City of Sioux City, Iowa

520 BOOSTER STATION
FACILITY IMPROVEMENTS

SPECIFICATIONS AND DOCUMENTS
BID ISSUE

City Project No. 519-132
B&V Project No. 192389.3100
2019
City of Sioux City, Iowa

520 BOOSTER STATION
FACILITY IMPROVEMENTS

SPECIFICATIONS AND DOCUMENTS

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR
UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY REGISTERED
PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.

SIGNATURE: [signature]
NAME: JOSEPH T. FORBES
MY LICENSE NUMBER IS: 14568
MY LICENSE RENEWAL DATE IS: December 31, 2019

PAGES OR SHEETS COVERED BY THIS SEAL:
DRAWING NOS. 3, 6, 7, 8, 9 & 10 AND TECHNICAL SPECIFICATIONS (DIVISION 16).

BLACK & VEATCH
Building a world of difference.

City Project No. 519-132

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2019
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INTRODUCTORY INFORMATION
NOTICE OF TAKING BIDS FOR THE CONSTRUCTION OF THE 520 BOOSTER STATION FACILITY IMPROVEMENTS PROJECT (PROJECT NO. 519-132), IN SIOUX CITY, IOWA.

Sealed bids will be received by the City of Sioux City City Clerk, at the Customer Service Center located on First Floor in City Hall, 405 Sixth Street, in Sioux City Iowa, until 1:00 P.M., Local Time, January 14, 2020, for the construction of the project, as described in the construction documents. The project is located at 3601 Southgate Drive, Sioux City, Iowa 51106 and includes replacement of two horizontal end split case centrifugal pumping units and associated piping, valves and appurtenances; electrical and instrumentation control work; and all other work indicated on the drawings and specified.

Bids received will be opened and tabulated at a public meeting, presided over by a City Engineer, in the 4th Floor Clock Tower Conference Room in the Public Works Department, City Hall, at 1:00 P.M., Local Time, on January 14, 2020. Thereafter, bids will be acted upon by the City Council at such time and place as may be fixed.

Each bid must be made on a form furnished by the City and must be accompanied by a bid bond, a cashier’s check or certified check of an Iowa bank or a bank chartered under the laws of the United States, or a certified share draft drawn on a credit union in Iowa or chartered under the laws of the United States, in an amount equal to ten percent (10%) of the amount of the bid, made payable to the City Treasurer of the City of Sioux City, Iowa. The check or draft may be cashed by the City Treasurer as liquidated damages in the event the successful bidder fails to enter into a contract within the ten (10) days after notice of award and post bond satisfactory to the City ensuring the faithful fulfillment of the contract.

The contract will be awarded to the lowest responsive, responsible bidder. However, the City reserves the right to reject any or all bids, readvertise for new bids and to waive informalities that may be in the best interest of the City. By virtue of statutory authority, a preference will be given to products and provisions grown and coal produced within the state of Iowa and to Iowa domestic labor.

The Notice of Public Hearing will be published in the Sioux City Journal on December 7, 2019 and December 14, 2019.

The work on this project shall begin upon receipt of the Notice to Proceed and be fully completed by January 15, 2021.

Specifications for this project shall be the latest version of the Iowa Statewide Urban Standard Specifications for Public Improvements modified in accordance with the latest edition of the City of Sioux City Supplement.

Copies of said construction documents are available at the office of the City Clerk of Sioux City for examination by the public. The documents are also available for viewing by the public, or subcontractors, or suppliers, on the City’s Engineering website, under the Projects Out to Bid tab www.sioux-city.org/engineering. Construction documents for private use, or potential prime contractors may be obtained from the Engineering Division, City Hall, upon deposit of twenty dollars ($20) for each set. The deposit will be returned to depositor if the construction documents are returned in good condition within fourteen (14) days from date of award.
intending to bid as the prime contractor must obtain a hard copy of the plans, specifications and form of contract from the Engineering Division. Failure to obtain a hard copy may result in the bid being deemed nonresponsive and rejected.

/s/ Lisa L. McCardle,
City Clerk of the City of Sioux City, Iowa

NOTICE OF PUBLIC HEARING ON PLANS, SPECIFICATIONS, FORM OF CONTRACT, AND ESTIMATED COSTS FOR THE CONSTRUCTION OF THE 520 BOOSTER STATION FACILITY IMPROVEMENTS PROJECT (PROJECT NO. 519-132), IN SIOUX CITY, IOWA.

A public hearing will be held before the Sioux City City Council in the Council Chambers, Room 504, City Hall, 405 Sixth Street, Sioux City, Iowa, on January 6, 2020 commencing at 4:00 P.M., Local Time, on the proposed plans, specifications, form of contract, and estimate of cost in the amount of $544,000.00, (the construction documents) for the construction of the 520 Booster Station Facility Improvements Project in Sioux City, Iowa. At said hearing, any interested person may appear and file objections to the proposed plans, specifications, contract, or estimated cost of the public improvement. The public improvement project is located at 3601 Southgate Drive, Sioux City, Iowa 51106 and includes replacement of two horizontal end split case centrifugal pumping units and associated piping, valves and appurtenances; electrical and instrumentation control work; and all other work indicated on the drawings and specified.

/s/ Lisa L. McCardle,
City Clerk of the City of Sioux City, Iowa

Publish in the Sioux City Journal December 7, 2019 and December 14, 2019.
Review Set Only - Not For Bidding
Instruction to Bidders

1. QUALIFICATION OF THE BIDDERS

   A. The bidder must be qualified by experience, financing, and equipment to do the work described in the contract documents.

   B. The City shall have the right to take such action as it may deem necessary in determining the ability of the bidder to perform the work satisfactorily. The City reserves the right to reject any bid that is not responsive to the proposal form or contract documents, or not submitted by a responsive, responsible bidder.

   C. Upon request of the Architect or Engineer, the bidder, whose bid is under consideration for award of a contract, shall submit evidence of its financial resources, construction experience, and organization available for performance of the proposed work. A bidder's inability to promptly secure the required bonds and insurance coverages for the proposed work, as well as the bidder's demonstrated inability to continuously maintain insurance coverages on past projects, may be considered an indication of financial responsibility and the bidder's qualification as a responsive, responsible bidder.

   D. Disqualification of Bidders – Any one or more of the following causes may be considered as sufficient for the disqualification of the bidder and the rejection of the bid or bids:

      1. More than one bid for the same work from an individual, firm, partnership or corporation under the same or different names.
      2. Evidence of collusion among bidders. Participants in such collusion may receive no recognition as bidders for any further work.
      3. Lack of responsibility as shown by past work judged from the standpoint of workmanship and progress, including projects with liquidated damages being assessed.
      4. Incomplete work which in the judgment of the City Council might hinder or prevent the prompt completion of additional work, if awarded.
      5. For being in arrears on existing contracts, in litigation with the City, or having defaulted on a previous contract.
      6. The attention of bidders is directed to Chapter 553, Code of Iowa, regarding unlawful combinations in making public contracts.

2. CONTENTS OF THE PROPOSAL FORMS

   A. Each prospective bidder will be furnished with a proposal form showing the location and description of the proposed work, the approximate quantities of work to be performed for which bid prices are requested, and the completion provisions. The contract documents will contain any special provisions that shall apply to the work to be performed.

   B. The purpose of the contract documents is to require the furnishing of highest quality equipment, material, and workmanship, and best accepted construction practice. The bidder is expected to base its bid on materials and equipment complying fully with the contract documents. Each bidder, in submitting its bid, acknowledges its willingness to comply with the terms of these contract documents.
3. QUANTITIES AND UNIT PRICES

A. Bidders shall submit a lump sum bid or unit bid price, as required by the proposal for the work covered by the contract documents. Prices shall cover complete work and include all costs incidental thereto.

B. When unit prices are requested in the proposal form, the quantities indicated on the proposal form are approximate only, and do not constitute a warranty or guarantee by the City as to the actual quantities involved in the work. Such quantities are to be used for the purpose of comparison of bids and determining the amount of bid security, contract, and performance, payment, and maintenance bond. In the event of discrepancies between unit prices and unit price extensions listed in a bidder’s proposal, unit prices shall govern and unit price extensions shall be corrected, as necessary, for agreement with unit prices. The City expressly reserves the right to increase or decrease the quantities during construction as outlined in General Conditions, Section 12.01 – Change in Contract Price, and to make reasonable changes in design, provided such changes do not materially change the intent of the contract. The amount of work to be paid for shall be based upon the actual quantities performed.

C. The proposal may have a lump sum item for mobilization. The bidder will indicate its bid price in dollars, and this will be the contract price for mobilization.

D. Materials, equipment, or labor essential for the proper completion of the work that are not specified as bid items in the contract documents and are incidental, and the cost of which shall be included in other bid items.

4. EXAMINATION OF THE CONTRACT DOCUMENTS AND SITE OF WORK

A. By submission of a proposal on the work, the bidder represents that it has carefully examined the site of the proposed work; the plans, specifications, and all other contract documents; and that the bidder is fully informed concerning the requirements of the contract, the physical conditions to be encountered in the work, and the character, quality, and the quantity of work to be performed, as well as materials to be furnished. The Contractor will not be entitled to additional compensation if it subsequently finds that conditions require methods or equipment other than that anticipated by the Contractor in making its proposal.

B. The attention of the bidder is directed to the fact that contracts for work, other than the proposed work, may have been awarded or may be awarded in the future. Completion of the proposed work may be contingent upon certain work by others or covered by other contracts being performed on the project in advance of this work; likewise, completion of work by others or covered by other contracts may be dependent upon completion of the proposed work. The bidder is expected to become familiar with work already in progress or previously let on this project, the contract periods, the progress being made, and any other conditions regarding work that may affect the bid or the bidder's performance under this contract.

C. The bidder on this work acknowledges the facts set out in the preceding paragraph and agrees it is in the public interest to have the work of other contracts and agencies performed concurrently rather than consecutively. The bidder further agrees to cooperate and coordinate the work with other contractors or agencies to the mutual interest of all parties doing work on the project.

D. By the submission of a bid on this work, the bidder acknowledges and agrees, investigation and inquiry has been made regarding the contracts for work with which this work must be coordinated. In the event disputes arise between contractors or other agencies doing work on the project as to their mutual rights or obligations, the Architect or Engineer will define the rights of all interested parties regarding the work.
E. The City does not warrant, impliedly or explicitly, the nature of the work, the conditions that will be encountered by the bidder, the adequacy of the contract documents for the Contractor to perform the work, or the conditions or structures to be encountered under any surface. Any such data supplied on the plans or other contract documents, or interpretation thereof by the Architect or Engineer, are merely for the convenience of the prospective bidders, who are to rely upon their own explorations of latent or subsurface site conditions, before completing and filing their proposal.

5. INTERPRETATION OF THE CONTRACT DOCUMENTS
All questions about the meaning or intent of the bidding documents shall be submitted to the Architect or Engineer in writing. Interpretations or clarifications considered necessary by the Architect or Engineer in response to such questions will be issued by Addenda, via the contact information provided on the plan holder’s list. Questions received less than seven (7) days prior to the date for opening bids may not be answered. Only answers issued by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6. ADDENDUM
Each bidder will receive a notice of addendum for any changes in the contract documents made prior to the time established for the receipt of bids. The notice will be delivered in the manner chosen by the City via the contact information provided on the plan holder’s list to the bidders with an acknowledgement of receipt required. Acknowledgement of the receipt of the addendum will be as provided in the proposal form.

7. PREFERENCE FOR LABOR AND MATERIALS
A. By virtue of statutory authority, preference will be given to products and provisions grown and coal produced within the State of Iowa, and to Iowa domestic labor, to the extent lawfully required under Iowa Code Chapter 73.

B. Such preferences will not be given where funding requirements, federal or otherwise, prohibit the giving of such preferences.

8. TAXES
A. Sales and Use Tax:
The bidder shall not include any form of sales or use tax in the bid. The City will facilitate the issuance of the tax certificates for the contractor and subcontractors. No materials shall be bought before obtaining this certificate.
All contractors and subcontractors shall submit the following information, on or prior to the pre-construction meeting, to the Public Works Department/Engineering Division to obtain the sales tax exemption certificate. The information required for this is:

- Company name
- Company contact
- Full address
- Phone number
- Fax number
- Tax ID number
- Email address

Materials cannot be purchased until this certificate is supplied to both the prime and subcontractors. The tax exemption certificate will be issued to the prime contractor along with all
subcontractors as soon as possible after the City Council approves the contracts, and the information is provided by the Contractor. The Notice to Proceed shall not be issued until the certificates are obtained. This does not apply to IDOT projects or material bought outside the state of Iowa.

B. Income Tax Deduction on Nonresident Contractors

The bidder who is awarded the contract will be subject to payment of Iowa income tax on income from this work in amounts prescribed by law. If such bidder is a non-Iowa partnership, individual or association, it shall furnish evidence, prior to execution of contract, that bond or securities have been posted with State of Iowa Tax Commission, as provided in Section 422.17, Code of Iowa, releasing City from withholding any and all sums required by provision of Section 422.17, Code of Iowa.

9. PREPARATION OF THE BID PROPOSAL

A. Bid Proposal: Bid proposals shall be legibly written in ink or typed on the forms provided by the City and shall be completely executed by the bidder with the requisite full signatures. The bidder must indicate in the proposal whether the proposal is submitted by an individual, partnership, joint venture, limited liability company, or a corporation. If the proposal is submitted by entity, it must be executed by an officer of such entity with authority to bind such bidder to perform the contract upon award. The business address of the bidder shall be typed or printed on the proposal. If the bidder does not qualify as a resident bidder, the nonresident bidder shall specify on the project proposal whether any preference to resident bidders, including but not limited to any preference to bidders, the imposition of any type of labor force preference, or any other form of preferential treatment to bidders or laborers from that state or foreign country is in effect in the nonresident bidder’s state or country of domicile at the time of a bid submittal.

B. Unit Price Attachment: The Architect or Engineer will allow the bidder to submit a computer-generated attachment, hereinafter referred to as unit price attachment, in lieu of completing that portion of the proposal identifying the bid items, description, unit, quantity, and unit prices.

1. If a unit price attachment is submitted, it shall be attached to the proposal and shall include the following minimum information at the top of each page: project title, letting date, bidder’s company name.
2. The unit price attachment shall have the same columns as the proposal; e.g. item number, description, unit, quantity, unit price, bid amount, etc. for each item. The bid item numbers and order on the unit price attachment shall follow that of the proposal.
3. The total amount bid shall be entered below the last bid item on the unit price attachment.
4. The unit price attachment page and print size shall be approximately the same as the proposal. Solid lines for separating the columns and lines need not be printed. Pages should be numbered by page number of the total pages (e.g. Page 1 of 4).
5. The bidder’s company name, as well as the authorized person signature, name, and title, shall be in ink and shall follow the total amount bid; and shall be the same person that signs the proposal.
6. In case of discrepancy in the item number, description, unit, or quantity between the unit price attachment and the proposal, the proposal shall govern. The unit price shown on the unit price attachment shall govern.
7. The bidder is solely responsible for the content, completeness, and accuracy of all the information contained in the unit price attachment. If the information in the unit price attachment is incomplete, the bid must be considered incomplete and be rejected.
8. When evaluating and tabulating the bids, the City shall utilize only the unit price as shown on the unit price attachment, and the item number, description, unit, and quantity as shown on the proposal.
C. When unit prices are requested, they shall be submitted on each and every item of work included for which bids are requested. The format for unit prices will be in dollars and whole cents only. In case of discrepancy, the unit price figures shall govern.

10. BIDDERS CERTIFICATION

By the submission of its proposal, the bidder certifies its bid is genuine and is not made in the interest of, or on behalf of, any undisclosed person, firm, or corporation; the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid; the bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and the bidder has not sought, by collusion or otherwise, to obtain for itself any advantage over any other bidder or over the City.

11. IRREGULAR AND NONRESPONSIVE PROPOSALS

A. Proposals will be considered irregular and may be rejected for any unauthorized changes in the proposal form or for any of the following reasons:

1. If submitted on a form other than that furnished by the City or the Unit Price Attachment, or if the form is altered or any part thereof is detached or missing;
2. If the bidder submits an obviously unbalanced bid. An unbalanced bid shall be defined as a bid containing lump sum prices or unit bid prices that do not reflect reasonable actual costs plus a reasonable proportionate share of the bidder’s anticipated profit, overhead costs, and other indirect costs to complete that item;
3. If the proposal does not contain a unit price for each pay item listed, except in the case of authorized alternate pay items; or
4. If the bidder submits more than one proposal for the same work under the same or different names.

B. Proposals will be considered nonresponsive and shall be rejected for any of the following reasons:

1. If there are unauthorized additions, conditional or alternate bids, or irregularities of any kind that may tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning;
2. If the bidder adds any provisions reserving the right to accept or reject an award or to enter into contract pursuant to an award;
3. If a bid on one project is tied to a bid on any other project, except as specifically authorized on the proposal form by the City;
4. If the bidder makes corrections or alterations to the unit prices it submits and such corrections or alterations are not initialed by the bidder. The City may require the bidder to identify any corrections or alteration so initialed;
5. If the bidder makes any omission of prices on items shown on the proposal forms, or any addition in writing to the form of the bid, or any condition or limitation on its proposal.
6. If the bid is accompanied by an unacceptable bid security.

C. If the bidder notes a requirement in the contract documents it believes will require a conditioned or unsolicited alternate bid, it shall immediately notify the Architect or Engineer in writing identifying such requirement. If the Architect or Engineer finds that such a requirement does exist in the contract documents, the City will make corrections thereto by an addendum.

D. Proposals will be evaluated by the City pursuant to the provisions of Approval for Award and Award of Contract, Section 1 - Acceptance or Rejection of Proposals.
12. SUBMISSION OF THE BID, IDENTITY OF BIDDER, AND BID SECURITY

A. The bid shall be sealed in an envelope, properly identified as the proposal with the project title and the name and address of the bidder, and deposited with the City at or before the time and at the place provided in the Notice of Public Hearing and Notice of Taking Bids. It is the sole responsibility of the bidder to see its proposal is delivered to the City prior to the time for opening bids, along with the appropriate bid security sealed in the separate envelope identified as bid security and attached to the outside of the bid proposal envelope. Any proposal received after the scheduled time for the receiving of proposals will be returned to the bidder unopened and will not be considered.

B. A corporation, limited liability company, or limited partnership shall bid in the name under which it is registered with the Iowa Secretary of State. A partnership shall bid in the name under which it is registered with the County recorder. An individual operating under a trade name shall bid using the trade name registered with the County recorder if such registration is required. The bidder's exact name as registered, if required, shall appear as the "principal" on any bid bond and shall appear on any cashier's check or share draft submitted to fulfill the bid security requirement. A bidder's failure to satisfy these requirements may be grounds for rejection of the bidder's proposal.

13. WITHDRAWAL OF BIDS

A. A bidder may request, without prejudice, to withdraw its proposal after it has been deposited with the City, provided such request is made in writing to the City prior to the time set for receiving proposals.

B. Modifications or corrections to proposals may be made on the withdrawn proposal, provided such modifications or corrections are initialed by the Bidder and are received by the City prior to the time set for receiving proposals. Modifications or corrections to a proposal will not be accepted if the modifications or corrections render the bid security inadequate or if not accompanied by sufficient additional bid security.

C. If a bidder has requested in writing to withdraw its proposal, said bidder may submit a different proposal and bid security at that time or any time prior to the time set for receiving proposals.

D. If, within 24 hours after bids are opened, any bidder files a duly signed written notice with the City and promptly thereafter demonstrates to the reasonable satisfaction of the City that there was a material and substantial mistake in the preparation of its bid, that bidder may withdraw its bid and the bid security will be returned. Thereafter, if the work is rebid, that bidder will be disqualified from further bidding on the work.

14. OPENING OF BIDS

At the time and place set forth in the Notice of Public Hearing and Notice of Taking Bids, proposals will be opened and read aloud. Proposals will be rejected if not accompanied by a bid security submitted in a separate, marked envelope. Submittals that do not include acknowledgement of each addendum to the contract documents will be rejected, except in those instances, in the opinion of the Architect or Engineer, where the addendum not acknowledged by a bidder will have no effect on the bid amount. Bid openings will be open to the public.

15. NONDISCRIMINATION AND AFFIRMATIVE ACTION

The bidder will be required to assure the City that the bidder will not in the performance of the work specified herein discriminate against any person based upon the person's age, race, creed, color, sex, nation origin, religion, sexual orientation, gender identity, pregnancy, mental disability, physical
disability, union or association membership or office therein. The bidder will also be required to submit to the City an affirmative action program.

16. BIDDER STATUS FORM

The bidder is required to complete the Bidder Status Form, and Worksheet: Authorization to Transact Business form, as provided in these documents. Failure to submit a fully completed Bidder Status Form and Worksheet with the bid may result in the bid being deemed nonresponsive and rejected.
APPROVAL FOR AWARD AND AWARD OF CONTRACT

1. ACCEPTANCE OR REJECTION OF PROPOSALS

A. The City reserves the right to accept the proposal that, in its judgment, is the lowest responsive, responsible bid; to award the contract by sections, if so specified in Special Provisions; to reject any or all proposals; to reject irregular or nonresponsive proposals as defined in Instruction to Bidder, Section 11 - Irregular and Nonresponsive Proposals; and to waive irregularities and/or technical deficiencies in the proposals to the extent allowed by law.

B. An individual, firm, partnership, corporation, or any association under the same or different names shall not submit more than one proposal. When reasonable evidence exists that indicates that a bidder has submitted more than one proposal at any letting for the same work under the same or different names, said proposals may be rejected.

C. Any or all proposals may be rejected if there is reason to believe collusion exists among bidders. Proposals received from participants in such collusion may not be considered for the same work if re-advertised.

D. Proposals may be rejected if the bidder has failed to promptly meet financial obligations undertaken in connection with other work under contract, or is in default on a previous contract with the City, or has an unsatisfactory record of performance and cooperation on any such previous contract with the City, or has failed to maintain satisfactory progress on work already under contract with the City.

E. In the event the bid specifies the use of materials, workmanship, methods, or equipment not in conformance with the contract documents, the bid will be rejected. In the event the bid was based on, but did not specify, the use of materials, workmanship, methods, or equipment not in conformance with the contract documents, the bidder will be held responsible for furnishing or using materials, workmanship, methods, and equipment in conformance with the contract documents at no change in the bid price.

F. When a contract for a public improvement is to be awarded to the lowest responsible bidder, a resident bidder shall be allowed a preference as against a nonresident bidder from a state or foreign country if that state or foreign country gives or requires any preference to bidders from that state or foreign country including but not limited to any preference to bidders, the imposition of any type of labor force preference, or any other form of preferential treatment to bidders or laborers from that state or foreign country. The preference allowed shall be equal to the preference given or required by the state or foreign country in which the nonresident bidder is a resident. In the instance of a resident labor force preference, a nonresident bidder shall apply the same resident labor force preference to a public improvement in this state as would be required in the construction of a public improvement by the state or foreign country in which the nonresident bidder is a resident.

G. Promptly after the proposals are opened and evaluated, the City shall give careful consideration to its needs, available funding, and other project considerations; and shall either designate the lowest responsive, responsible bidder and proceed with award of contract, or reject all bids and reconsider the project.

2. RELEASE OF BID SECURITY

A. After the City's approval of the contract executed by the lowest bidder, the City shall promptly release the bid security of all bidders, or within thirty days of the bid opening, whichever is sooner. If all bids are rejected, all bid security will be promptly released.
B. Bid security shall be released to bidders, either by making such bid security available for retrieval by bidders, or, if requested by a bidder, by mailing the bid security to the bidder.

3. AWARD OF CONTRACT

A. Contract Document Submittal: Within 10 calendar days after notification by the Architect or Engineer, unless otherwise provided in the contract documents, the Contractor shall sign, leaving all the dates blank, executed contract documents, including contract, performance, payment, and maintenance bond; certificate of insurance; and all other items required by the contract documents. The performance, payment, and maintenance bond and insurance certificate shall meet the requirements of Article 5 of the Standard General Conditions as required by the City. The City will thereupon receive and file such documents and award the contract.

B. Deferred Award: The City reserves the right to defer award of any contract for a period not to exceed 30 calendar days from the date of opening of proposals. No claims for compensable delay shall arise as the result of delay in the approval of award.

C. Failure to Execute the Contract: It is agreed by the bidder that upon its failure to enter into the contract and furnish the necessary insurance certificate and performance, payment and maintenance bond within 10 calendar days after notification by the City, the amount of the bidder's bid security may at the City's option be forfeited and shall become the property of the City, to be retained not as a penalty, but as liquidated damages. The award of the contract may then, at the discretion of the City, be made to the next lowest responsive, responsible bidder, or the work may be re-advertised or may be constructed by the City in any legal manner.
Title VI – Regulations Compliance

During the performance of this contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations: The contractor shall comply with the Regulations relative to nondiscrimination in Federally assisted programs of the Iowa Department of Transportation (hereinafter referred to as the Iowa DOT) 49 CFR 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, national origin, sex, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontracts, Including Procurement of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurement of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, national origin, sex, age, or disability.

4. Information and Reports: The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Iowa DOT or Federal Highway Administration (FHWA) to be pertinent to ascertain compliance with such Regulations, orders and instructions.

5. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the Iowa DOT or the FHWA as appropriate, and shall set forth what efforts it has made to obtain the information.

6. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the Iowa DOT shall impose such contract sanctions as it or the FHWA may determine to be appropriate, including, but not limited to:
   • withholding payments to the contractor under the contract until the contractor complies, and/or
   • cancellation, termination or suspension of the contract, in whole or in part.

7. Incorporation of Provisions: The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurement of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Iowa DOT or the FHWA may direct as a means of enforcing such provisions including sanctions for non-compliance, provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Iowa DOT to enter into such litigation to protect the interests of the Iowa DOT and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.
BIDDING REQUIREMENTS
BID FORM

BID OF ____________________________________________________________________, (Name of Bidder) (City) (State) herein called “Bidder”, for the construction of 520 Booster Station Facility Improvements in Sioux City, Woodbury County, Iowa.

Bidder proposes to furnish all necessary machinery, equipment, tools, labor, and other means of construction, and to furnish all materials specified in the manner and time prescribed and to do all the work at the prices herein set out. This Bid is filed with the understanding that payment will be made to Bidder in monthly estimates and one final payment. Bidder encloses herewith bid security in the amount of __________________________ Dollars ($________) as a Bid guarantee which it is understood will be retained in the event the formal contract and/or contractor’s bond and any other documents are not executed or provided if award is made to the undersigned bidder. It is understood that the City Council may retain the Bid for a period of thirty (30) days from and after the established date for receiving bids.

The Bidder hereby acknowledges that all addenda become a part of the contract documents when issued, and that each such addendum has been received and utilized in the preparation of this bid. The Bidder hereby acknowledges receipt of the following addenda by inserting the number of each addendum in the blanks below:

ADDENDUM NUMBER _________  ADDENDUM NUMBER __________
ADDENDUM NUMBER _________  ADDENDUM NUMBER __________

and certifies that said addenda were utilized in the preparation of this bid.

The Bidder hereby certifies:

1. That this bid is not affected by, contingent on, or dependent on any other bid submitted for any improvement with the Jurisdiction; and

2. That no individual employed by the Bidder has employed any person to solicit or procure the work on this project, nor will any employee of the bidder make any payment or agreement for payment of any compensation in connection with the procurement of this project; and

3. That no part of the bid price received by the Bidder was or will be paid to any person, corporation, firm, association, or other organization for soliciting the bid, other than the payment of their normal compensation to persons regularly employed by the Bidder whose services in connection with the construction of the project were in the regular course of their duties for the Bidder; and

4. That this bid is genuine and not collusive or sham; that the Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to submit a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought, by agreement or conclusion, or communication or conference, with any person, to fix the bid price of the Bidder or of any other bidder, and that all statements in this bid are true; and

5. That the Bidder does hereby certify to the City of Sioux City that in the performance of the work specified herein, no person shall in any way be favored or discriminated against because of the person's age, race, creed, color, sex, national origin, religion, sexual orientation, gender identity, pregnancy, mental disability, physical disability, union or association membership or office therein.

6. That the individual(s) executing this bid have the authority to execute this bid on behalf of the bidder.
Bidder agrees:

1. That the terms and provisions of the Notice of Taking Bids, the Instructions to Bidders and the Bid Bond are a part of this “Bid Form” as if fully set forth herein.

2. That, if the bid is accepted, to execute the contract and provide a bond and insurance and other documents as required by the bid documents.

3. To commence the work on this project on or before a date to be specified in a written notice to proceed by the jurisdiction, and to complete the project with a completion date of February 15, 2021; and to pay liquidated damages for noncompliance with said completion provisions at the rate of Five hundred dollars ($500) for each day thereafter that the work remains incomplete.

The Bidder shall indicate whether the bid is submitted by a/an:

☐ Individual, Sole Proprietorship

☐ Partnership

☐ Corporation

☐ Joint-venture: all parties must join in and execute all documents

☐ Other

By: __________________________

Name (Print/Type) __________________________

Title __________________________

Street Address __________________________

City, State, Zip Code __________________________

Telephone Number __________________________

The bidder shall enter its Public Registration Number - issued by the Iowa Commissioner of Labor pursuant to Section 91C.5 of the Iowa Code.

NOTE: The signature on this bid must be an original signature in ink; copies or facsimile of any signature will not be accepted.
BID FORM – LUMP SUM VERTICAL CONSTRUCTION BID

520 Booster Station Facility Improvements Project

The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by the Architect or Engineer, having visited the site and being familiar with all conditions and requirements of the work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. ________________________________________________________________

_____________________________ Dollars, ($____________________________)

BIDDER

By: ____________________________________________________________

Name: _________________________________________________________

Title: __________________________________________________________

Review Set Only-Not For Bidding
BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, ______________________ as Principal, and ______________________________ as Surety, are held and firmly bound unto the City of Sioux City, Iowa, hereinafter called the “JURISDICTION”, in the penal sum of _______________________________ Dollars ($____________________) lawful money of the United States, for the payment of which sum will and truly be made, we find ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents. The condition of this obligation is such that whereas the Principal has submitted the accompanying bid, dated __________________, for the construction of the 520 Booster Station Facility Improvement Project, in Sioux City, Iowa.

The Surety 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 jurisdiction may accept such bid or execute such Contract; and said surety does hereby waive notice of any such extension.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the venue thereof shall be Woodbury County, State of Iowa. If legal action is required by the Jurisdiction against the Surety or Principal to enforce the provisions of the bond or to collect the monetary obligation incurring to the benefit of the Jurisdiction, the Surety or Principal agrees to pay the Jurisdiction all damages, costs, and attorney fees incurred by enforcing any of the provisions of this Bond. All rights, powers, and remedies of the Jurisdiction hereunder shall be cumulative and not alternative and shall be in addition to all rights, powers, and remedies given to the Jurisdiction, by law. The Jurisdiction may proceed against Surety for any amount guaranteed hereunder whether action is brought against Principal or whether Principal is joined in any such action or actions or not.

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 specified 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 plus any court costs, attorney’s fees, and any other expenses of recovery.

By virtue of statutory authority, the full amount of this Bid Bond shall be forfeited to the Jurisdiction in liquidation of damages sustained in the event that the Principal fails to execute the contract and provide the bond as provided in the specifications or by law.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hand 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 on ______________________.
SURETY:

Surety Company

By: ______________________________
   Attorney-in-Fact/Officer           Signature

Name of Attorney-in-Fact/Officer

Company Name

Company Address

______________  City, State, Zip Code

Company Telephone Number

NOTE: All signatures on this bid bond must be original signatures in ink; copies or facsimile of any signature will not be accepted. This bond must be sealed with the Surety’s seal. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety’s seal.

PRINCIPAL:

Bidder

By: _____________________________
   Signature

Name (Print/Type)

Title

Address

______________  City, State, Zip Code

Telephone Number

Review Set Only-Not For Bidding
Bidder Status Form

To be completed by all bidders

Part A

Please answer "Yes" or "No" for each of the following:

[ ] Yes [ ] No My company is authorized to transact business in Iowa.
(To help you determine if your company is authorized, please review the worksheet on the next page).

[ ] Yes [ ] No My company has an office to transact business in Iowa.

[ ] Yes [ ] No My company's office in Iowa is suitable for more than receiving mail, telephone calls, and e-mail.

[ ] Yes [ ] No My company has been conducting business in Iowa for at least 3 years prior to the first request for bids on this project.

[ ] Yes [ ] No My company is not a subsidiary of another business entity or my company is a subsidiary of another business entity that would qualify as a resident bidder in Iowa.

If you answered "Yes" for each question above, your company qualifies as a resident bidder. Please complete Parts B and D of this form.

If you answered "No" to one or more questions above, your company is a nonresident bidder. Please complete Parts C and D of this form.

To be completed by resident bidders

Part B

My company has maintained offices in Iowa during the past 3 years at the following addresses:

Dates: ___ / ___ / ______ to ___ / ___ / ______ Address:

City, State, Zip:

Dates: ___ / ___ / ______ to ___ / ___ / ______ Address:

City, State, Zip:

Dates: ___ / ___ / ______ to ___ / ___ / ______ Address:

City, State, Zip:

You may attach additional sheet(s) if needed.

To be completed by non-resident bidders

Part C

1. Name of home state or foreign country reported to the Iowa Secretary of State:

2. Does your company's home state or foreign country offer preferences to bidders who are residents? [ ] Yes [ ] No

3. If you answered "Yes" to question 2, identify each preference offered by your company's home state or foreign country and the appropriate legal citation

You may attach additional sheet(s) if needed.

To be completed by all bidders

Part D

I certify that the statements made on this document are true and complete to the best of my knowledge and I know that my failure to provide accurate and truthful information may be a reason to reject my bid.

Firm Name:

Signature: ___________________________ 

Date: ___________________________

You must submit the completed form to the governmental body requesting bids per 875 Iowa Administrative Code Chapter 156.

This form has been approved by the Iowa Labor Commissioner.

309-6001 02-14
Worksheet: Authorization to Transact Business

This worksheet may be used to help complete Part A of the Resident Bidder Status form. If at least one of the following describes your business, you are authorized to transact business in Iowa.

☐ Yes ☐ No  My business is currently registered as a contractor with the Iowa Division of Labor.

☐ Yes ☐ No  My business is a sole proprietorship and I am an Iowa resident for Iowa income tax purposes.

☐ Yes ☐ No  My business is a general partnership or joint venture. More than 50 percent of the general partners or joint venture parties are residents of Iowa for Iowa income tax purposes.

☐ Yes ☐ No  My business is an active corporation with the Iowa Secretary of State and has paid all fees required by the Secretary of State, has filed its most recent biennial report, and has not filed articles of dissolution.

☐ Yes ☐ No  My business is a corporation whose articles of incorporation are filed in a state other than Iowa, the corporation has received a certificate of authority from the Iowa Secretary of State, has filed its most recent biennial report with the Secretary of State, and has neither received a certificate of withdrawal from the Secretary of State nor had its authority revoked.

☐ Yes ☐ No  My business is a limited liability partnership which has filed a statement of qualification in this state and the statement has not been canceled.

☐ Yes ☐ No  My business is a limited liability partnership which has filed a statement of qualification in a state other than Iowa, has filed a statement of foreign qualification in Iowa and a statement of cancellation has not been filed.

☐ Yes ☐ No  My business is a limited partnership or limited liability limited partnership which has filed a certificate of limited partnership in this state, and has not filed a statement of termination.

☐ Yes ☐ No  My business is a limited partnership or a limited liability limited partnership whose certificate of limited partnership is filed in a state other than Iowa, the limited partnership or limited liability limited partnership has received notification from the Iowa Secretary of State that the application for certificate of authority has been approved and no notice of cancellation has been filed by the limited partnership or the limited liability limited partnership.

☐ Yes ☐ No  My business is a limited liability company whose certificate of organization is filed in Iowa and has notified a statement of termination.

☐ Yes ☐ No  My business is a limited liability company whose certificate of organization is filed in a state other than Iowa, has received a certificate of authority to transact business in Iowa and the certificate has not been revoked or canceled.

300-6001 02-14
AFFIRMATIVE ACTION INFORMATION

The Contractor does hereby certify to the City of Sioux City, Iowa, that no person shall, in any way, be favored or discriminated against because of the person’s age, race, creed, color, sex, national origin, religion, sexual orientation, gender identity, pregnancy, mental disability, physical disability, union or association membership or office herein.

If selected as the successful bidder, this Contractor hereby agrees to file a nondiscrimination and equal opportunity statement and/or an Affirmative Action Program.

520 Booster Station Facility Improvements

COMPANY

EXECUTIVE OFFICER

AFFIRMATIVE ACTION OFFICER           SIGNATURE

ADDRESS OF THE AFFIRMATIVE ACTION OFFICER

PHONE NUMBER
SECTION 00450

QUESTIONNAIRE

Each Bidder shall also enter in the spaces provided the names of the manufacturers of equipment which Bidder proposes to furnish.

Upon award of a contract, the named manufacturers shall be furnished, unless changes are specifically authorized by Owner.

Equipment or material substitutions will be permitted only if equipment or materials by the named manufacturers do not meet the requirements of the Contract Documents or if the manufacturer is unable to meet the delivery requirements of the construction schedule or is dilatory in complying with the requirements of the Contract Documents.

Preliminary acceptance of equipment and materials listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment and materials; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Questionnaire may be cause for rejection of the Bid.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Equipment or Materials</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>11110</td>
<td>Horizontal Split Case Centrifugal Pumps</td>
<td></td>
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<tr>
<td>13562</td>
<td>Magnetic Flow Meters</td>
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</tr>
<tr>
<td>15093</td>
<td>Check Valves (Silent Check)</td>
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</tr>
<tr>
<td>15101</td>
<td>AWWA Butterfly Valves</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
FORM OF CONTRACT

THIS CONTRACT, made on __________________ by and between ________________________ (hereinafter called the “Contractor”) and the City of Sioux City, Woodbury County, Iowa, (hereinafter called the “Jurisdiction”).

WITNESSETH, that the Contractor and the Jurisdiction, for the consideration stated herein, agree as follows:

ARTICLE I.  SCOPE OF WORK – The Contractor shall perform everything required to be performed and shall provide and furnish all of the labor, materials, necessary tools, expendable equipment and complete in a workmanlike manner all the work required in connection with the construction of the 520 Booster Station Facility Improvements in Sioux City, Iowa, all in strict accordance with the contract documents; and in strict compliance with the Contractor’s bid and the other contract documents herein mentioned which are a part of this Contract; and the Contractor shall do everything required by this Contract and the other documents constituting a part thereof.

ARTICLE II.  THE CONTRACT PRICE – This contract is awarded and executed for completion of the work specified in the contract documents for the bid prices shown on the Contract Attachment.  Bid Items, Quantities, and Prices where were proposed by the Contractor in its bid submitted in accordance with the Notice to Bidders and Notice of Public Hearing.  The Contractor agrees to perform said work for and in consideration of the Jurisdiction’s payment of the bid amount of _________________________________ ($_________________), which amount shall constitute the required amount of the performance, maintenance, and payment bond.  The Contractor hereby agrees to commence work under this contract on or before a date to be specified in a written notice to proceed by the Jurisdiction and to complete the project on or before February 15, 2021 and to pay liquidated damages for noncompliance with said completion provisions at the rate of Five hundred and 00/00 dollars ($500.00) for each day thereafter that the work remains incomplete.

ARTICLE III.  PAYMENTS – Payments will be made to the Contractor in accordance with and subject to the provisions embodied in the documents made a part of this Contract.

ARTICLE IV.  COMPONENT PARTS OF THIS CONTRACT – This Contract consists of the following component parts, all of which are as fully a part of this Contract as if herein set out verbatim or, if not attached, as if hereto attached:

1. Change Orders
2. Addenda
3. Shop and Working Drawings submitted by the Contractor, when approved by the Architect or Engineer
4. This Instrument
5. Special Provisions
6. Plans
7. EJCDC – 2007 Standard General Conditions of the Construction Contract
8. Instruction to Bidders
9. Notice of Public Hearing  
10. Latest version of the Sioux City Supplement to SUDAS  
11. Latest version of the Iowa Statewide Urban Design and Specifications (SUDAS)  
12. Supplementary Conditions  
13. Contractor’s Performance, Maintenance & Payment Bond  
14. Contractor’s Bid  
15. Bidders Status Form  
16. Title VI – Regulation Compliance

In the event that any provision in any of the foregoing component parts of this Contract conflicts with any provision in any other of the component parts, the provision in the component part first enumerated shall govern over any other component part which follows it numerically, except as may be otherwise specifically stated.

IN WITNESS WHEREOF, the parties hereto have caused this Instrument to be executed in five original counterparts the day and year first above written.

This Contract, however, shall not be of any validity, force, or effect until it has been approved by the Jurisdiction Attorney, signed by the City Manager and City Clerk and delivered to the Contractor.

_________________________________  
Contractor  
By: _________________________________

_________________________________  
Title

CITY OF SIOUX CITY, IOWA

By: _________________________________  
City Manager

(SEAL)

ATTEST: ______________________________  
City Clerk

This Contract, the performance and payment bond and supporting insurance documents are approved as to form and content.

By: _________________________________  
Jurisdiction Attorney

Date: ________________________________

D-2
I hereby certify that the above Contract was authorized by the City Council of the City of Sioux City, Iowa, pursuant to Resolution No. _____________ on ________________.

By: ___________________________
City Clerk of Sioux City, Iowa
The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by the Architect, having visited the site and being familiar with all conditions and requirements of the work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. __________________________________________________________________________

__________________________________________________________________________ Dollars, ($_______________________________)

BIDDER

By: _________________________________

Name: _______________________________

Title: _______________________________
PERFORMANCE, PAYMENT, AND MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned, ________________________________________ as Principal (hereinafter called “Contractor” or “Principal”) and __________________________________________, as Surety are held and firmly bound unto the City of Sioux City, Iowa, as Obligee, (hereinafter called “Jurisdiction”) and to all persons who may be injured by any breach of any of the conditions of this Bond in the penal sum of __________________________________________ Dollars ($_______________________________), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, legal representatives and assigns, jointly or severally, firmly by these presents.

The conditions of the above obligations are such that whereas said Contractor entered into a contract with the Jurisdiction, bearing the date of ________________________ hereinafter the “Contract”) wherein said Contractor undertakes and agrees to construct the following described improvements: 520 Booster Station Facility Improvements and to faithfully perform all the terms and requirements of said Contract within the time therein specified, in a good and workmanlike manner, and in accordance with the Contract Documents.

It is expressly understood and agreed by the Contractor and Surety in this bond that the following provisions are a part of this Bond and are binding upon said Contractor and Surety, to-wit:

1. PERFORMANCE: The Contractor shall well and faithfully observe, perform, fulfill, and abide by each and every covenant, condition, and part of said Contract and Contract Documents, by reference made a part hereof, for the above referenced improvements, and shall indemnify and –save harmless the Jurisdiction from all outlay and expense incurred by the Jurisdiction by reason of the Contractor’s default of failure to perform as required. The Contractor shall also be responsible for the default or failure to perform as required under the Contract and Contract Documents by all its subcontractors, suppliers, agents, or employees furnishing materials or providing labor in the performance of the Contract.

2. PAYMENT: The Contractor and the Surety on this Bond hereby agree to pay all just claims submitted by persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the performance of the Contract on account of which this Bond is given, including but not limited to claims for all amounts due for labor, materials, lubricants, oil, gasoline, repairs on machinery, equipment, and tools, consumed or used by the Contractor or any subcontractor, wherein the same are not satisfied out of the portion of the contract price which the Jurisdiction is required to retain until completion of the improvement, but the Contractor and surety shall not be liable to said persons, firms, or corporations unless the claims of said claimants against said portion of the contract price shall have been established as provided by law. The Contractor and Surety hereby bind themselves to the obligations and conditions set forth in Chapter 573, Code of Iowa, which by this reference is made a part hereof as though fully set out herein.

3. MAINTENANCE: The Contractor and the Surety on this Bond hereby agree, at their own expense:

A. To remedy any and all defects that may develop in or result from work to be performed under the Contract within the period of two years.

B. To keep all work in continuous good repair; and

C. To pay the Jurisdiction’s reasonable costs of monitoring and inspection to assure that any defects are remedied, and to repay the Jurisdiction all outlay and expense incurred as a result of Contractor’s and Surety’s failure to remedy any defect as required by this section.

Contractor’s and Surety’s agreement herein made extends to defects in workmanship or materials not discovered or known to the Jurisdiction at the time such work was accepted.

4. GENERAL: Every Surety on this Bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:

A. To consent without notice to any extension of time to the Contractor in which to perform the Contract;
B. To consent without notice to any change in the Contract or Contract Documents, which thereby increases the total contract price and the penal sum of this bond, provided that all such changes do not, in the aggregate, involve an increase of more than twenty-five percent of the total contract price, and that this bond shall then be released as to such excess increase; and

C. To consent without notice that this Bond shall remain in full force and effect until the Contract is completed, whether completed within the specified contract period, within an extension thereof, or within a period of time after the contract period has elapsed and the liquidated damage penalty is being charged against the Contractor.

The Contractor and every Surety on the bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:

D. That no provision of this Bond or of any other contract shall be valid which limits to less than five years after the acceptance of the work under the Contract the right to sue on this Bond.

E. That as used herein, the phrase “all outlay and expense” is not to be limited in any way, but shall include the actual and reasonable costs and expenses incurred by the Jurisdiction including interest, benefits, and overhead where applicable. Accordingly, “all outlay and expense” would include but not be limited to all contract or employee expense, all equipment usage or rental, materials, testing, outside experts, attorneys’ fees (including overhead expenses of the Jurisdiction’s staff attorneys), and all costs and expenses of litigation as they are incurred by the Jurisdiction. It is intended that Contractor and Surety will defend and indemnify the Jurisdiction on all claims made against the Jurisdiction on account of Contractor’s failure to perform as required in the Contract and Contract Documents, that all agreements and promises set forth in the Contract and Contract Documents, in approved change orders, and in this Bond will be fulfilled, and that the Jurisdiction will be fully indemnified so that it will be put into the position it would have been in had the Contract been performed in the first stance as required.

In the event the Jurisdiction incurs any “outlay and expense” in defending itself with respect to any claim as to which the Contractor or Surety should have provided the defense, or in the enforcement of the promises given by the Contractor in the Contract, Contract Documents, or approved change orders, or in the enforcement of the promises given by the Contractor and Surety in this Bond, the Contractor and Surety agree that they will make the Jurisdiction whole for all such outlay and expense, provided that the Surety’s obligation under this bond shall not exceed 125% of the penal sum of this bond.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the venue thereof shall be Woodbury County District Court, State of Iowa. If legal action is required by the Jurisdiction to enforce the provisions of this Bond or to collect the monetary obligation incurring to the benefit of the Jurisdiction, the Contractor and the Surety agree, jointly and severally, to pay the Jurisdiction all outlay and expense incurred therefore by the Jurisdiction. All rights, powers, and remedies of the Jurisdiction hereunder shall be cumulative and not alternative and shall be in addition to Surety for any amount guaranteed hereunder whether action is brought against the Contractor or whether Contractor is joined in any such action or actions or not.

NOW, THEREFORE, the condition of this obligation is such that if said Principal shall faithfully perform all the promises of the Principal, as set forth and provided in the Contract, in the Contract Documents, and in this Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

When a work, term, or phrase is issued in this Bond, it shall be interpreted or construed first as defined in this Bond, the Contract, or the Contract Documents; second, if not defined in the Bond, Contract, or Contract Documents, it shall be interpreted or construed as defined in applicable provisions of the Iowa Code; third, if not defined in the Iowa Code, it shall be interpreted or construed according to its generally accepted meaning in the construction industry; and fourth, if it has no generally accepted meaning in the construction industry, it shall be interpreted or construed according to its common or customary usage.
Failure to specify or particularize shall not exclude terms or provisions not mentioned and shall not limit liability hereunder. The Contract and Contract Documents are hereby made a part of this Bond.

**SURETY:**

Surety Company

By: __________________________________________
Signature Attorney-in-Fact/Officer

Name of Attorney-in-Fact/Officer

Company Name

Company Address

City, State, Zip Code

Company Telephone Number

**PRINCIPAL:**

Contractor

By: ________________________________
Signature

Name (Print/Type)

Title

Address

City, State, Zip Code

Telephone Number

Note: All signatures on this bond must be original signatures in ink; copies of facsimile of any signature will not be accepted. This bond must be sealed with the Surety’s seal. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety’s seal.
CERTIFICATE OF LIABILITY INSURANCE

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFOSS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

Insured Information:

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<tr>
<th>INSURED</th>
<th>INSURED ADDRESS</th>
<th>INSURED PHONE</th>
<th>INSURED E-MAIL</th>
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Contractor Information:

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<th>CONTRACTOR NAME</th>
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Description of operations locations/activities (ACORD 311. Additional Remarks Schedule, may be attached if more space is required):

The City of Sioux City is listed as additional insured on General Liability & Automobile Liability. Umbrella Liability Policy will be Primary & Noncontributory.

Certificate Holder:

City of Sioux City
P.O. Box 447
Sioux City, IA 51102

Cancellation:

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

Authorized Representative:

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Review Set Only-Not For Bidding
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared by
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CONSTRUCTION SPECIFICATIONS INSTITUTE
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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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

2. **Agreement**—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. **Application for Payment**—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. **Asbestos**—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. **Bid**—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. **Bidder**—The individual or entity who submits a Bid directly to Owner.

7. **Bidding Documents**—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. **Bidding Requirements**—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. **Change Order**—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. **Claim**—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. **Contract**—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
12. Contract Documents—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. Contract Price—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. Contract Times—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer’s written recommendation of final payment.

15. Contractor—The individual or entity with whom Owner has entered into the Agreement.


17. Drawings—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

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

19. Engineer—The individual or entity named as such in the Agreement.

20. Field Order—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. General Requirements—Sections of Division 1 of the Specifications.

22. Hazardous Environmental Condition—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. Hazardous Waste—The term Hazardous Waste shall have the meaning provided in Section 1003 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. Laws and Regulations; Laws or Regulations—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. Liens—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. Milestone—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
27. **Notice of Award**—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. **Notice to Proceed**—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. **Owner**—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. **PCBs**—Polychlorinated biphenyls.

31. **Petroleum**—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. **Progress Schedule**—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.

33. **Project**—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. **Project Manual**—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. **Radioactive Material**—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. **Resident Project Representative**—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. **Samples**—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. **Schedule of Submittals**—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. **Schedule of Values**—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
40. **Shop Drawings**—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. **Site**—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. **Specifications**—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. **Subcontractor**—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. **Substantial Completion**—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.

45. **Successful Bidder**—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. **Supplementary Conditions**—That part of the Contract Documents which amends or supplements these General Conditions.

47. **Supplier**—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. **Underground Facilities**—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. **Unit Price Work**—Work to be paid for on the basis of unit prices.

50. **Work**—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. **Work Change Directive**—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an
addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. Intent of Certain Terms or Adjectives:

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. Day:

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. Defective:

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
   a. does not conform to the Contract Documents; or
   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
   c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).
E. **Furnish, Install, Perform, Provide:**

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

**ARTICLE 2 – PRELIMINARY MATTERS**

2.01 **Delivery of Bonds and Evidence of Insurance**

   A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

   B. **Evidence of Insurance:** Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 **Copies of Documents**

   A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 **Commencement of Contract Times; Notice to Proceed**

   A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.
2.04 **Starting the Work**

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 **Before Starting Construction**

A. **Preliminary Schedules:** Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 **Preconstruction Conference; Designation of Authorized Representatives**

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 **Initial Acceptance of Schedules**

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on
Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor’s full responsibility therefor.

2. Contractor’s Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor’s Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 Reference Standards

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.
3.03 **Reporting and Resolving Discrepancies**

A. **Reporting Discrepancies:**

1. **Contractor’s Review of Contract Documents Before Starting Work:** Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. **Contractor’s Review of Contract Documents During Performance of Work:** If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. **Resolving Discrepancies:**

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

   a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents), or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 **Amending and Supplementing Contract Documents**

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
1. A Field Order;

2. Engineer’s approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer’s written interpretation or clarification.

3.05 Reuse of Documents

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 Electronic Data

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user’s sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data’s creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data’s creator.
ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner’s furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner’s interest therein as necessary for giving notice of or filing a mechanic’s or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

A. Reports and Drawings: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Except for such reliance on such “technical data,” Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions, or information.
4.03 **Differing Subsurface or Physical Conditions**

A. **Notice:** If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any “technical data” on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. **Engineer’s Review:** After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner’s obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer’s findings and conclusions.

C. **Possible Price and Times Adjustments:**

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:
   
   a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
   
   b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
   
   a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
   
   b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and
contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor’s making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or 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) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 Underground Facilities

A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
   a. reviewing and checking all such information and data;
   b. locating all Underground Facilities shown or indicated in the Contract Documents;
   c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
   d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated:

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the
consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 **Reference Points**

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer’s judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 **Hazardous Environmental Condition at Site**

A. **Reports and Drawings:** The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. **Limited Reliance by Contractor on Technical Data Authorized:** Contractor may rely upon the accuracy of the “technical data” contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Except for such reliance on such “technical data,” Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions or information.
C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or, (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner’s own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.
H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor’s obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 Licensed Sureties and Insurers

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also
meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 Certificates of Insurance

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor’s full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.

5.04 Contractor’s Insurance

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

1. claims under workers’ compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor’s employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor’s indemnity obligations under Paragraphs 6.11 and 6.20;

4. 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 Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

   a. Such insurance shall remain in effect for two years after final payment.

   b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.
5.05 **Owner's Liability Insurance**

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner’s option, may purchase and maintain at Owner’s expense Owner’s own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 **Property Insurance**

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. 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, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors,
members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser’s own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 Waiver of Rights

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:
1. loss due to business interruption, loss of use, or other consequential loss extending beyond
direct physical loss or damage to Owner’s property or the Work caused by, arising out of, or
resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting
from fire or other insured peril or cause of loss covered by any property insurance maintained
on the completed Project or part thereof by Owner during partial utilization pursuant to
Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final
payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss
referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment
of any such loss, damage, or consequential loss, the insurers will have no rights of recovery
against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners,
employees, agents, consultants and subcontractors of each and any of them.

5.08 Receipt and Application of Insurance Proceeds

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with
Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear,
subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner
shall deposit in a separate account any money so received and shall distribute it in accordance
with such agreement as the parties in interest may reach. If no other special agreement is reached,
the damaged Work shall be repaired or replaced, the moneys so received applied on account
thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of
the parties in interest shall object in writing within 15 days after the occurrence of loss to
Owner’s exercise of this power. If such objection be made, Owner as fiduciary shall make
settlement with the insurers in accordance with such agreement as the parties in interest may
reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall
adjust and settle the loss with the insurers and, if required in writing by any party in interest,
Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 Acceptance of Bonds and Insurance; Option to Replace

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of
the bonds or insurance required to be purchased and maintained by the other party in accordance
with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party
shall so notify the other party in writing within 10 days after receipt of the certificates (or other
evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to
the other such additional information in respect of insurance provided as the other may
reasonably request. If either party does not purchase or maintain all of the bonds and insurance
required of such party by the Contract Documents, such party shall notify the other party in
writing of such failure to purchase prior to the start of the Work, or of such failure to maintain
prior to any change in the required coverage. Without prejudice to any other right or remedy, the
other party may elect to obtain equivalent bonds or insurance to protect such other party’s
interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 **Partial Utilization, Acknowledgment of Property Insurer**

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

**ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES**

6.01 **Supervision and Superintendence**

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 **Labor; Working Hours**

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 **Services, Materials, and Equipment**

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 Progress Schedule

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 Substitutes and “Or-Equals”

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. “Or-Equal” Items: If in Engineer’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment Engineer determines that:

      1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items:

a. If in Engineer’s sole discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

   a) perform adequately the functions and achieve the results called for by the general design,

   b) be similar in substance to that specified, and

   c) be suited to the same use as that specified;

2) will state:

   a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor’s achievement of Substantial Completion on time,

   b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer’s sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. Engineer’s Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No “or equal” or substitute will be ordered, installed or utilized until Engineer’s review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an “or equal.” Engineer will advise Contractor in writing of any negative determination.

D. Special Guarantee: Owner may require Contractor to furnish at Contractor’s expense a special performance guarantee or other surety with respect to any substitute.

E. Engineer’s Cost Reimbursement: Engineer will record Engineer’s costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. Contractor’s Expense: Contractor shall provide all data in support of any proposed substitute or “or-equal” at Contractor’s expense.
required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner’s acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor’s own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner,
Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 Patent Fees and Royalties

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, 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) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 Permits

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.
6.09 **Laws and Regulations**

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor’s compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, 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) arising out of or relating to such Work. However, it shall not be Contractor’s responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor’s obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 **Taxes**

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 **Use of Site and Other Areas**

A. **Limitation on Use of Site and Other Areas:**

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to any claim or action, legal or equitable, brought
by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor’s performance of the Work.

B. **Removal of Debris During Performance of the Work:** During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. **Cleaning:** Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

### 6.12 Record Documents

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

### 6.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

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

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and
shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner’s safety programs, if any. The Supplementary Conditions identify any Owner’s safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor’s safety program with which Owner’s and Engineer’s employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other 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 liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor’s duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 Safety Representative

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 Hazard Communication Programs

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is
required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 Shop Drawings and Samples

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. Shop Drawings:
   a. Submit number of copies specified in the General Requirements.
   b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. Samples:
   a. Submit number of Samples specified in the Specifications.
   b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer’s review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Submittal Procedures:

1. Before submitting each Shop Drawing or Sample, Contractor shall have:
   a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
   b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
   c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
   d. determined and verified all information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor’s obligations under the Contract Documents with respect to Contractor’s review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. **Engineer’s Review:**

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer’s review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer’s review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer’s review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer’s review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. **Resubmittal Procedures:**

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 **Continuing the Work**

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.
6.19 Contractor’s General Warranty and Guarantee

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor’s warranty and guarantee.

B. Contractor’s warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
2. normal wear and tear under normal usage.

C. Contractor’s obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor’s obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;
2. recommendation by Engineer or payment by Owner of any progress or final payment;
3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
4. use or occupancy of the Work or any part thereof by Owner;
5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
6. any inspection, test, or approval by others; or
7. any correction of defective Work by Owner.

6.20 Indemnification

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, 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 liable.
B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, 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 liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers’ compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer’s officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 Delegation of Professional Design Services

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor’s responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer’s review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer’s review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

**ARTICLE 7 – OTHER WORK AT THE SITE**

7.01 Related Work at Site

A. Owner may perform other work related to the Project at the Site with Owner’s employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner’s employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor’s Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor’s Work. Contractor’s failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor’s Work except for latent defects and deficiencies in such other work.

7.02 Coordination

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.
B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 Legal Relationships

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor’s wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor’s wrongful action or inactions.

ARTICLE 8 – OWNER’S RESPONSIBILITIES

8.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 Replacement of Engineer

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 Furnish Data

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 Pay When Due

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 Lands and Easements; Reports and Tests

A. Owner’s duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 Insurance

A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.
8.07 Change Orders
A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 Inspections, Tests, and Approvals
A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 Limitations on Owner’s Responsibilities
A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

8.10 Undisclosed Hazardous Environmental Condition
A. Owner’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 Evidence of Financial Arrangements
A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract Documents.

8.12 Compliance with Safety Program
A. While at the Site, Owner’s employees and representatives shall comply with the specific applicable requirements of Contractor’s safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER’S STATUS DURING CONSTRUCTION

9.01 Owner’s Representative
A. Engineer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner’s representative during construction are set forth in the Contract Documents.

9.02 Visits to Site
A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or
continuous inspections on the Site to check the quality or quantity of the Work. Engineer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer’s visits and observations are subject to all the limitations on Engineer’s authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 Project Representative

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer’s consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 Authorized Variations in Work

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 Rejecting Defective Work

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.
9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer’s authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer’s authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer’s authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer’s authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer’s written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer’s decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer’s written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer’s Authority and Responsibilities*

A. Neither Engineer’s authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not
exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer’s review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 Compliance with Safety Program

A. While at the Site, Engineer’s employees and representatives shall comply with the specific applicable requirements of Contractor’s safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.
10.02 Unauthorized Changes in the Work

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 Execution of Change Orders

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner’s correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 Notification to Surety

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor’s responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 Claims

A. Engineer’s Decision Required: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. Notice: Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data.
shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant’s written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant’s last submittal (unless Engineer allows additional time).

C. Engineer’s Action: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;
2. approve the Claim; or
3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer’s sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer’s written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 Cost of the Work

A. Costs Included: The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers’ compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

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

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor’s Cost of the Work and fee shall be determined in the same manner as Contractor’s Cost of the Work and fee as provided in this Paragraph 11.01.

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

5. Supplemental costs including the following:
   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor’s employees incurred in discharge of duties connected with the Work.
   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
   c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of
said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor’s fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. Costs Excluded: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor’s officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediers, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor’s principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor’s fee.

2. Expenses of Contractor’s principal and branch offices other than Contractor’s office at the Site.

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

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

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. Contractor’s Fee: When all the Work is performed on the basis of cost-plus, Contractor’s fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor’s fee shall be determined as set forth in Paragraph 12.01.C.

D. Documentation: Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. Cash Allowances:

1. Contractor agrees that:

   a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

   b. Contractor’s costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. Contingency Allowance:

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to
the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor’s overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor’s fee for overhead and profit (determined as provided in Paragraph 12.01.C).
C. **Contractor’s Fee:** The Contractor’s fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor’s fee shall be 15 percent;

   b. for costs incurred under Paragraph 11.01.A.3, the Contractor’s fee shall be five percent;

   c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

   d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

   e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor’s fee by an amount equal to five percent of such net decrease; and

   f. when both additions and credits are involved in any one change, the adjustment in Contractor’s fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 **Change of Contract Times**

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 **Delays**

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or
neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor’s entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor’s ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor’s ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor’s sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or 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) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor’s safety procedures and programs so that they may comply therewith as applicable.
13.03 Tests and Inspections

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner’s and Engineer’s acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor’s purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor’s expense unless Contractor has given Engineer timely notice of Contractor’s intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

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

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, 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) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 Owner May Stop the Work

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, 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) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner’s special warranty and guarantee, if any, on said Work.

13.07 Correction Period

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor’s use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions:
1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner’s written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, 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) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor’s obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer’s recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, 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) attributable to Owner’s evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer’s recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.
13.09 Owner May Correct Defective Work

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor’s services related thereto, take possession of Contractor’s tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner’s representatives, agents and employees, Owner’s other contractors, and Engineer and Engineer’s consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, 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) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor’s defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner’s rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 Progress Payments

A. Applications for Payments:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an
Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. 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 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 or other arrangements to protect Owner’s interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor’s legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer’s reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer’s recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer’s observations of the executed Work as an experienced and qualified design professional, and on Engineer’s review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer’s knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor’s being entitled to such payment appear to have been fulfilled in so far as it is Engineer’s responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or
involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer’s review of Contractor’s Work for the purposes of recommending payments nor Engineer’s recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor’s failure to comply with Laws and Regulations applicable to Contractor’s performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer’s opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer’s opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

1. Ten days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.
D. Reduction in Payment:

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

   a. claims have been made against Owner on account of Contractor’s performance or furnishing of the Work;

   b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   c. there are other items entitling Owner to a set-off against the amount recommended; or

   d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner’s refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 Contractor’s Warranty of Title

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 Substantial Completion

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor’s notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before
final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner’s objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer’s issuing the definitive certificate of Substantial Completion, Engineer’s aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 Partial Utilization

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor’s performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

A. Application for Payment:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
   b. consent of the surety, if any, to final payment;
   c. a list of all Claims against Owner that Contractor believes are unsettled; and
   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner’s property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. Engineer’s Review of Application and Acceptance:

1. If, on the basis of Engineer’s observation of the Work during construction and final inspection, and Engineer’s review of the final Application for Payment and accompanying
documentation as required by the Contract Documents, Engineer is satisfied that the Work
has been completed and Contractor’s other obligations under the Contract Documents have
been fulfilled, Engineer will, within ten days after receipt of the final Application for
Payment, indicate in writing Engineer’s recommendation of payment and present the
Application for Payment to Owner for payment. At the same time Engineer will also give
written notice to Owner and Contractor that the Work is acceptable subject to the provisions
of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to
Contractor, indicating in writing the reasons for refusing to recommend final payment, in
which case Contractor shall make the necessary corrections and resubmit the Application for
Payment.

C. Payment Becomes Due:

1. Thirty days after the presentation to Owner of the Application for Payment and
   accompanying documentation, the amount recommended by Engineer, less any sum Owner is
   entitled to set off against Engineer’s recommendation, including but not limited to liquidated
damages, will become due and will be paid by Owner to Contractor.

14.08 Final Completion Delayed

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if
   Engineer so confirms, Owner shall, upon receipt of Contractor’s final Application for Payment
   (for Work fully completed and accepted) and recommendation of Engineer, and without
   terminating the Contract, make payment of the balance due for that portion of the Work fully
   completed and accepted. If the remaining balance to be held by Owner for Work not fully
   completed or corrected is less than the retention stipulated in the Agreement, and if bonds have
   been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of
   the balance due for that portion of the Work fully completed and accepted shall be submitted by
   Contractor to Engineer with the Application for such payment. Such payment shall be made
   under the terms and conditions governing final payment, except that it shall not constitute a
   waiver of Claims.

14.09 Waiver of Claims

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled
   Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06,
   from failure to comply with the Contract Documents or the terms of any special guarantees
   specified therein, or from Contractor’s continuing obligations under the Contract Documents;
   and

2. a waiver of all Claims by Contractor against Owner other than those previously made in
   accordance with the requirements herein and expressly acknowledged by Owner in writing as
   still unsettled.
ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 Owner May Suspend Work

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 Owner May Terminate for Cause

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor’s persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor’s repeated disregard of the authority of Engineer; or


B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor’s tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, 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) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when
so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor’s services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

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

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 Owner May Terminate For Convenience

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, 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) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 Contractor May Stop Work or Terminate

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days
to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor’s stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 Methods and Procedures

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer’s action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
2. agrees with the other party to submit the Claim to another dispute resolution process; or
3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

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

17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.
SUPPLEMENTARY CONDITIONS TO STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

LIST OF SUBJECTS

SCOPE

SC-1 DEFINITIONS AND TERMINOLOGY
SC 1.01 Defined Terms

SC-2 PRELIMINARY MATTERS
SC 2.01 Copies of Documents

SC-3 CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE
SC-3.06 Electronic Data

SC-4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS
SC-4.02 Subsurface and Physical Conditions
SC-4.06 Hazardous Environmental Condition at Site

SC-5 BONDS AND INSURANCE

SC-6 CONTRACTOR'S RESPONSIBILITIES
SC-6.02 Labor; Working Hours
SC-6.07 Patent Fees and Royalties
SC-6.08 Permits
SC-6.09 Laws and Regulations
SC-6.10 Taxes
SC-6.17 Shop Drawings and Samples
SC-6.19 Contractor’s General Warranty and Guarantee
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SC-7 OTHER WORK AT THE SITE – No Modifications

SC-8 OWNER'S RESPONSIBILITIES
SC-8.01 Communications to Contractor
SC-8.02 Replacement of Engineer
SC-8.06 Insurance
SC-8.11 Evidence of Financial Arrangements

(City of Sioux City, Iowa ) 00800A
(520 Booster Station Improv. ) -1-
(Project 192389.3100 )
(7/15/2019 )
SC-9 ENGINEER’S STATUS DURING CONSTRUCTION
   SC-9.01 Owner’s Representative
   SC-9.03 Project Representative

SC-10 CHANGES IN THE WORK; CLAIMS
   SC-10.03 Execution of Change Orders
   SC-10.05 Claims

SC-11 COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK – NO MODIFICATIONS

SC-12 CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES
   SC-12.01 Change of Contract Price
   SC-12.03 Delays

SC-13 TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK
   SC-13.02 Access to Work
   SC-13.07 Correction Period

SC-14 PAYMENTS TO CONTRACTOR AND COMPLETION
   SC-14.02 Progress Payments
   SC-14.04 Substantial Completion
   SC-14.07 Final Payment

SC-15 SUSPENSION OF WORK AND TERMINATION - No Modifications
   SC-15.02 Owner May Terminate for Cause

SC-16 DISPUTE RESOLUTION – No Modifications

SC-17 MISCELLANEOUS
   SC-17.04 Survival of Obligations.
SCOPE. These Supplementary Conditions amend or supplement the General Conditions and other provisions of the Contract Documents as indicated herein. All provisions which are not so amended or supplemented remain in full force and effect.

SC-1. DEFINITIONS AND TERMINOLOGY.

SC-1.01. Defined Terms.

A. Delete and replace definitions 9, 15, 19, 29, and 51 in Paragraph 1.01.A of the General Conditions with the following:

9. Change Order – A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

15. Contractor--The individual or entity with whom Owner has entered into the Agreement. The terms Contractor and CONTRACTOR are interchangeable and shall have the same meaning in the Contract Documents.

19. Engineer--The individual or entity named as such in the Agreement. The terms Engineer and ENGINEER are interchangeable and shall have the same meaning in the Contract Documents.

29. Owner--The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed. The terms Owner and OWNER are interchangeable and shall have the same meaning in the Contract Documents.

51. Work Change Directive – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner ordering an addition, deletion or revision in the Work or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a
subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

SC-2. PRELIMINARY MATTERS.

SC-2.01. Copies of Documents. Delete Paragraph 2.02 of the General Conditions and replace with the following paragraph:

The Contractor to whom a contract is awarded will be furnished, one (1) hard copy and one (1) electronic copy of the Contract Documents.

SC-3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE.

SC-3.06. Electronic Data. Delete paragraph 3.06.A of the General Conditions and replace it with the following:

A. Except as permitted in the submittals section of Division 1, data furnished by Owner, Engineer, or to Contractor, or by Contractor to Owner, Engineer, or that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user’s sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

SC-4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS.

SC-4.02. Subsurface and Physical Conditions.

A. Reports and Drawings. Delete Paragraph 4.02.A of the General conditions and replace it with the following:

A. Reports and Drawings:

1. No reports of explorations and tests of subsurface conditions at or contiguous to the Site were relied upon.

2. The following drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) are known to the Owner:


B. Limited Reliance by Contractor on Technical Data Authorized. Add the following new paragraph immediately after Paragraph 4.02.B of the General Conditions:

It shall be understood that the information provided is not guaranteed by Owner or Engineer to be more than a general indication of the physical conditions likely to be found.

3. Generally, service connections are not indicated on the Drawings. Contractor shall be responsible for discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting.

SC-4.06. Hazardous Environmental Condition at Site.

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to the Owner.

B. Delete Paragraph 4.06.B of the General Conditions in its entirety.

G. Delete Paragraph 4.06.G and 4.06.H of the General Conditions and replace with the following:

G. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, 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) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

I. Renumber Paragraph 4.06.I of the General Conditions as Paragraph 4.06.H.
SC-5. **BONDS AND INSURANCE.** Delete Article 5 of the General Conditions in its entirety, and insert the following text in its place:

**ARTICLE 5 - BONDS AND INSURANCE**

**5.01. Performance, Payment, and Other Bonds.**

A. Contractor shall furnish a Performance, Payment, and Maintenance Bond in an amount at least equal to the Contract Price as security for the faithful performance, payment and maintenance of all Contractor’s obligations under the Contract Documents.

B. All Bonds shall be in the form prescribed by the Contract Documents.

C. If the surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

**5.02. Licensed Sureties and Insurers.**

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

**5.03. Certificates of Insurance.**

A. Contractor shall deliver to Owner, with copies to each additional insured or loss payee as identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
B. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

C. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

D. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner in the Contract Documents.

E. Certificates of insurance shall be submitted on the forms included in the Contract Documents.

5.04. Contractor's Liability Insurance.

A. The policies of insurance so required by this Paragraph 5.04 to be purchased and maintained shall:

1. include at least the specific coverages and be written for not less than the limits of liability specified or required by Laws or Regulations, whichever is greater;

2. include completed operations insurance;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.07, 6.11, and 6.20;

4. 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 Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 shall so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07;
6. include completed operations coverage;

   a. Such insurance shall remain in effect for two years after final payment.

   b. Contractor shall furnish Owner and each other additional insured to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

7. Contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance; and

8. With respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, and all other liability insurance specified herein to be provided by Contractor, Contractor shall require its insurance carriers to waive all rights of subrogation against Owner, Engineer, and their respective officers, directors, partners, employees, and agents.

B. Worker's Compensation and Employer's Liability Insurance. This insurance shall protect Contractor against all claims under applicable state workers' compensation laws, including coverage as necessary for the benefits provided under the United States Longshoremen's and Harbor Workers' Act and the Jones Act. Contractor shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workers' compensation law. This policy shall include an "all states" or "other states" endorsement.

The liability limits shall be not less than:

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<thead>
<tr>
<th>State:</th>
<th>Statutory</th>
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<tbody>
<tr>
<td>Applicable Federal statutory (e.g., Longshoreman’s):</td>
<td>Statutory</td>
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<tr>
<td>Employer’s Liability:</td>
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<tr>
<td>1) Each Accident</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>2) Aggregate</td>
<td>$2,000,000</td>
</tr>
</tbody>
</table>
C. Comprehensive Automobile Liability Insurance. This insurance shall be occurrence type, written in comprehensive form, and shall protect Contractor, and Owner Engineer's Consultants, and Engineer as additional insureds, against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, either on or off the project site whether they are owned, nonowned, or hired.

The liability limits shall be not less than:

Combined Single Limit of $1,000,000

D. Commercial General Liability Insurance. This insurance shall be occurrence type, written in comprehensive form, and shall protect Contractor, and Owner Engineer's Consultants, and Engineer as additional insureds, against claims arising from injuries, sickness, disease, or death of any person or damage to property arising out of performance of the Work. The policy shall also include a per project aggregate limit endorsement, personal injury liability coverage, contractual liability coverage, completed operations and products liability coverage, and coverage for blasting, explosion, collapse of buildings, and damage to underground property.

The liability limits shall be not less than:

General Aggregate $6,000,000
Products & Completed Operations
   1) Each Occurrence $2,000,000
   2) Aggregate $4,000,000
Personal and Advertising Injury
   1) Each Occurrence $2,000,000
   2) Aggregate $4,000,000
Excess or Umbrella Liability
   1) Each Occurrence $4,000,000
   2) Aggregate $8,000,000
Bodily Injury & Property Damage
   1) Each Occurrence $2,000,000
   2) Aggregate $4,000,000
   3) Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.
E. Pollution Liability Insurance. This insurance shall protect Contractor, and Owner Engineer’s Consultants, and Engineer as additional insureds, against claims arising out of pollution and excluded from the commercial general liability and comprehensive automobile liability policies. This insurance shall be coordinated with the commercial general liability policy and provide bodily injury and property damage coverage similar to and to the limits specified for the commercial general liability policy. Coverage shall include contractual liability.

F. Professional Liability Insurance: This insurance shall be required only in cases where the Contract Documents specifically require that Contractor provide for design services to be performed by a professional engineer with appropriate expertise in accordance with applicable laws and regulations, licensed or registered in the State of Iowa, and that the shop drawings or other evidence of design bear the seal and signature of that professional engineer. This insurance shall provide protection against claims arising out of performance of professional design services and caused by a negligent error, omission, or act for which the insured party is legally liable; such professional liability insurance shall provide coverage in the amount of $1,000,000 for each occurrence and $2,000,000 aggregate. Which shall be maintained throughout the duration of the Project and for one year after Substantial Completion.

In the event that the professional design services are performed by an independent consultant or Subcontractor engaged by Contractor, this insurance shall be furnished and maintained by the independent consultant or Subcontractor. In the event that the professional design services are performed by a member of Contractor’s organization, this insurance shall be furnished and maintained by Contractor.

A certificate of insurance for such professional liability insurance coverage, including the amount, duration, and name of the insured party, shall be delivered to Owner and Engineer.

SC-6. CONTRACTOR’S RESPONSIBILITIES.

SC-6.02. Labor; Working Hours. Add the following new paragraphs immediately after Paragraph 6.02.B of the General Conditions:

C. No work shall be done between 6 p.m. and 7 a.m. without permission of Owner. However, emergency work may be done without prior permission.
D. Night work may be undertaken as a regular procedure with the permission of Owner; such permission, however, may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for the proper execution and control of work at night.


SC-6.08. Permits. Modify the following paragraphs of the General Conditions and add the following paragraph immediately after Paragraph 6.08.A of the General Conditions:

A. Delete the last sentence of Paragraph 6.08.A of the General Conditions.

B. Owner will obtain and pay for the following permits:
   1. Iowa Department of Natural Resources Water Supply Section Construction Permit.

SC-6.09. Laws and Regulations. Modify the following paragraphs of the General Conditions and add the following new paragraphs immediately after Paragraph 6.09.C of the General Conditions:

C. At the end of Paragraph 6.09.C of the General Conditions, add the following new sentences:

The provisions of this Paragraph 6.09.C shall not apply to any changes to prevailing wage rates. Changes to wage rates during the life of the Contract shall be the responsibility of the Contractor, and shall not be eligible for Claims for changes to the Contract Price.

D. Safety and Health Regulations. OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR Part 1926, shall apply to Work under this Contract. The U.S. Department of Labor will be responsible for compliance review and enforcement of the regulations.

E. Employment Requirements. Employment requirements shall be as specified in the Contract Documents.

F. NSF Requirements. The following materials which will be in contact with water before or during the treatment process, water to be added or returned to the treatment process, or treated potable water, shall have been tested and certified to meet the requirements of ANSI/NSF 60 or ANSI/NSF 61. The materials shall be guaranteed by the
manufacturer to have the required certification and to be suitable for the intended service. Evidence of the certification shall be submitted to the Engineer with the appropriate drawings and data. Any materials which cannot be so guaranteed, whether or not specified by manufacturer and product designation, shall not be used.

- Chemical treatment additives
- Pipes and related products (including coated and uncoated pipes, fittings, small storage devices, tubing, and screens)
- Protective (barrier) materials (including paints, coatings, linings, and diaphragms)
- Joining and sealing materials (including gaskets, sealing materials, and lubricants)
- Process media (including media used in ion exchange, aeration, adsorption, oxidation, and filtration operations)
- Mechanical devices (including chemical feeders, pumps, valves, aeration equipment, clarifiers, mixers, strainers, and other water treatment process devices)
- Mechanical plumbing products

SC-6.10. Taxes. Add the following new paragraph immediately after Paragraph 6.10 of the General Conditions:

6.10.1. All taxes that are lawfully assessed against Owner or Contractor in connection with the Work shall be paid by the Contractor.

All Contractors and subcontractors shall submit the following information to the Public Works/Engineering Department at the award of the contract to obtain the sales tax exemption certificate. The information required for this is: Company name, Company contact, Full address, Phone number, Fax number, Tax ID number, and E-mail address.

Materials cannot be purchased until this certificate is supplied to both the prime and subcontractors. The tax exemption certificate will be issued to the prime contractor along with all subcontractors with the notice to proceed as soon as possible after the City Council approves the contracts, if all the needed information is obtained.
All other Federal, State, and local taxes, including any sales taxes assessed or levied against the Owner or Contractor in connection with the Work shall be included in the Bid Price and shall be paid by the Contractor to the appropriate taxing entities.

SC-6.17. Shop Drawings and Samples. Delete Paragraph 6.17 of the General Conditions in its entirety and replace it with the following:

6.17. Shop Drawings and Samples. Requirements for shop drawings, samples, and submittal procedures shall be as specified in Division 1 submittals sections. Fabrication that proceeds prior to acceptance of submittals by Engineer shall be at Contractor's risk.


6. an inspection, test, or approval by others;
7. any correction of defective Work by Owner, or
8. any expiration of a correction period.


D. Delete Paragraph 6.21.D of the General Conditions in its entirety, and replace with the following Paragraph 6.21.D:

D. Pursuant to this Paragraph 6.21, Engineer's review and acceptance of signed and sealed certifications of performance and design criteria used when designing systems, materials, or equipment and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and acceptance of Shop Drawings and other submittals (except performance and design criteria and design drawings) will be only for the purpose stated in Division 1 submittals section.

F. Add the following new Paragraph 6.21.F immediately after Paragraph 6.21.E of the General Conditions:

F. When professional design services are required by the Contract Documents, Contractor shall provide certification that the design has been performed by a design professional in accordance with
the Contact Documents and that the associated construction conforms to the design provided by the design professional.

SC-7. OTHER WORK AT THE SITE. No Modifications

SC-8. OWNER’S RESPONSIBILITIES.

SC-8.01. Communications to Contractor. Delete Paragraph 8.01.A of the General Conditions in its entirety, and replace it with the following:

A. Except as otherwise provided in these General Conditions, if Owner issues communications to Contractor a copy shall be provided to Engineer.


SC-8.06. Insurance. Delete paragraph 8.06 of the General Conditions.


SC-9. ENGINEER’S STATUS DURING CONSTRUCTION.

SC-9.01. Owner’s Representative. Add the following sentence at the end of Paragraph 9.01.A of the General Conditions:

The action of the Engineer in performance of these duties shall not be construed to make the Engineer the Agent for the Owner with respect to changes in the cost of the work or changes in the Contract Documents.

SC-9.03. Project Representative. Add the following new paragraph immediately after Paragraph 9.03.A of the General Conditions:

B. The duties, responsibilities, and limitation of authority of the Resident Project Representative (if provided by Engineer) will be furnished to the Contractor.

SC-10. CHANGES IN THE WORK; CLAIMS.

SC-10.03. Execution of Change Orders. Replace the first sentence of Paragraph 10.03.A of the General Conditions with the following:

A. Owner and Contractor shall execute appropriate Change Orders covering:
SC-10.05. Claims. Delete Paragraph 10.05.E. of the General Conditions in its entirety, and replace with the following:

E. Engineer’s written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in the Supplementary Conditions within 30 days of such action or denial.

SC-11. COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK. – No modifications.

SC-12. CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES.

SC-12.01. Delete Paragraph C in its entirety.

SC-12.03. Delays. Delete Paragraph 12.03.B of the General Conditions in its entirety, and replace with the following:

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times. Contractor’s entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor’s ability to complete the Work within the Contract Times.

SC-13. TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK.

SC-13.02. Access to Work. Add the following new paragraph immediately after Paragraph 13.02.A of the General Conditions:

B. Authorized representatives of the Environmental Protection Agency and of the Iowa Department of Natural Resources shall have access to the Work wherever it is in preparation or progress. Contractor shall provide proper facilities for such access and inspection.

SC-13.07. Correction Period. Add the following new paragraph paragraphs immediately after Paragraph 13.07.E of the General Conditions:

F. Nothing in this Article 13 concerning the correction period shall establish a period of limitation with respect to any other obligation which Contractor has under the Contract Documents. The establishment of time periods relates only to the specific obligations of
Contractor to correct the Work, and has no relationship to the time within which Contractor's obligations under the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than to specifically correct the Work.

G. The correction period set forth in Paragraph 13.07.A shall be as specified in the Performance, Payment, and Maintenance Bond in lieu of 1 year. All other provisions of Paragraph 13.07 shall remain unchanged.

SC-14. PAYMENTS TO CONTRACTOR AND COMPLETION.

SC-14.02. Progress Payments. Add the following new paragraphs immediately following Paragraph 14.02.A.3 of the General Conditions:

4. Materials and Equipment. Payments for stored materials and equipment shall be based only upon the actual cost to Contractor of the materials and equipment and shall not include any overhead or profit to Contractor.

Partial payments will not be made for undelivered materials or equipment.

5. Schedules and Data. During the progress of the Work, each application for Payment shall be accompanied by Contractor's updated schedule of operations or progress report, with such shop drawings schedules, procurement schedules, values of materials and equipment on hand included in application, and other data specified or reasonably required by Engineer.

SC-14.02. Progress Payments. Delete Paragraph 14.02.A.3 and replace with the following paragraph:

The City shall retain from each monthly progress payment five (5) percent of that amount which is determined to be due by the Representative. Five (5) percent of the contract sum shall be retained for thirty (30) days following formal acceptance of the work by the City Council under the provisions of Chapter 573, Code of Iowa.
SC-14.02. Progress Payments. Delete Paragraph 14.02.C.1 and replace with the following paragraph:

Within approximately 30 days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended will be subject to the provisions of Paragraph 14.01.D become due, and when due will be paid by Owner to Contractor.

SC-14.04. Substantial Completion. Add the following new paragraphs immediately after Paragraph 14.04.A of the General Conditions:

1. "Substantial Completion" means that the facilities are completed to the point that the new pumping units can be placed in continuous service with both local and remote monitoring and control in accordance with the Owner’s standard operating procedures and in the quality satisfactory to Owner, Engineer and Iowa Department of Natural Resources.

2. To be considered substantially complete, the following portions of the Work must be operational and ready for Owner’s continuous use as intended:

   - Horizontal Split Case Centrifugal Pumping Units
   - All Process Piping, Valves and Appurtenances
   - All Electrical and Instrumentation Work
   - All Testing including the Field System Operational Test
   - Receipt of Final Shop Drawings and O&M Manual
   - All other Work associated with the new facilities unless otherwise specified or acceptable to Owner and Engineer

3. Portions of the Work not essential to plant operation, which can be completed without interruption of plant operation, may be completed after the Work is accepted as substantially complete, and may include the following items:

   - Site Clean-up and Demobilization
   - Painting (Touch-up)
SC-14.07. Final Payment. Add the following new sentence at the end of Paragraph 14.07.A.2 of the General Conditions:

Consent of the surety, signed by an agent, must be accompanied by a certified copy of such agent's authority to act for the surety.


SC-15. SUSPENSION OF WORK AND TERMINATION.

SC-15.02 Owner May Terminate for Cause. Delete paragraph 15.02.A of the General Conditions in its entirety and replace with the following:

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor’s failure to perform Work in accordance with the Contract Documents (including, but limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor’s disregard of the authority of Engineer; or


SC-16. DISPUTE RESOLUTION. No modifications.

SC-17. MISCELLANEOUS.

SC-17.04. Survival of Obligations. Add the following new paragraph immediately after Paragraph 17.04.A of the General Conditions:

B. Contractor shall obtain from all Suppliers and manufacturers any and all warranties and guarantees of such Suppliers and manufacturers, whether or not specifically required by the Specifications, and shall assign such warranties and guarantees to Owner. With respect thereto, Contractor shall render reasonable assistance to Owner when requested, in order to enable Owner to
enforce such warranties and guarantees. The assignment of any warranties or guarantees shall not affect the correction period or any other provisions of these Contract Documents.

End of Section
SPECIAL PROVISIONS
520 Booster Station Facility Improvements

The specifications to be used on this project are the latest edition of the Iowa Statewide Urban Design and Specifications (SUDAS) in conjunction with the latest edition of the Sioux City Supplement to SUDAS. The following project special provisions take precedence over and revise the SUDAS and Sioux City Supplement to SUDAS.

A. Pre-Bid Meeting:
A pre-bid meeting will not be held for this project.

B. Pre-construction Conference
A pre-construction conference will be held at City Hall in the 4th Floor Clocktower Conference Room at a time to be determined by the City Project Manager. The contractor will receive the Notice to Proceed at the conclusion of the pre-construction meeting.

C. Notification to Property Owners
The Owner will provide an informational paper that is to be given to the property owners on the streets this project affects. The Contractor shall provide liaison between his activities and all businesses/residences and distribute this paper seven (7) days prior to the time when works begins and/or when their street will be closed for construction, in order to allow the affected businesses and residences to compensate for disruptions caused by the project. Property owners will be notified seventy-two (72) hours prior to any scheduled utility outage including water outages.

D. Section 1070 – Legal Relations and Responsibility to the Public
(the following is hereby added)

2.06 Traffic Control
C. The Contractor shall furnish, install, and maintain throughout the course of the construction all necessary construction signs, traffic control signs, barricades and other warning devices to inform the traveling public (including vehicular and pedestrians) of the construction within the project area. This shall include the removal or covering of existing traffic control signs, which are in conflict with the temporary construction signing. Existing traffic control signs which are removed shall be delivered to the City of Sioux City for storage during the duration of the construction. At the completion of the work, the Contractor shall remove all temporary signs and construction barricades and restore all permanent traffic control signs along the roadways (which were covered during the construction) as directed by the Engineer and the City of Sioux City.

D. Prior to the start of construction, the Contractor shall submit all phase revisions to the Engineer and a traffic control plan to implement. The City of Sioux City reserves the right to modify the proposed construction signing and barricade plan as necessary throughout the course of the work to assure the safety of the traveling public. The Contractor shall coordinate and schedule all street closures with the City of Sioux City. Please contact the Engineering Division 712-279-6324 to issue a press release: start date, duration, extent & location of closure, detour route, reason for closure. Additional notices may be required, depending on the project staging.

E. Payment for furnishing, installation, maintenance, and removal of all traffic control
devices including temporary pavement marking, construction signs and barricades for each phase of the project shall be paid for lump sum at the contract unit price bid for “Traffic Control.” This work shall also include submittal of all construction phase revisions, removal of existing and all temporary pavement markings, and all necessary removal, reinstallation or covering of existing traffic control signs which may conflict with the proposed construction signing and traffic control plan.

F. The Contractor must provide a 24-hour phone number to the City and the 911 Operator in the event of defective, missing or non-operational signing.

G. All open trenches and other excavations shall be protected with suitable barriers, signs and lights to the extent that adequate protection is provided to the public against accident by reason of such open construction. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.

H. All traffic control devices, procedures and layouts shall be as per part VI of the current addition of the MUTCD as adopted by the Iowa Department of Transportation. All sign shall utilize retroreflective sheeting material which meets the requirements of Article 4186.03 of the English Standard Specifications of Highway and Bridge Construction 2012 series as published by the Iowa Department of Transportation or shall be illuminated by means of acceptable warning lights from sunset to sunrise. Material stored upon or alongside public streets, roads and highways shall be so placed that the work at all times shall be so conducted as to cause minimum obstruction and inconvenience to the traveling public.

I. Where Type III barricades are shown as part of a full closure, the installation shall include an adequate number of Type III barricades to reach from edge of pavement to edge of pavement, as well as orange safety fence placed from right-of-way line to right-of-way line or as necessary to prevent vehicles from going around the barricades and entering the work area.

J. The Traffic Control bid item shall include all costs associated with furnishing, placing, maintaining, and removing all traffic control devices including the cost of flaggers.

K. The basis of payment shall be 50 percent of Lump Sum price paid on the first Certificate for Payment and 100 percent of Lump Sum price paid when 95 percent of the value of the work is completed.

E. Section 1080 – Prosecution and Progress
   (the following is hereby added)

1.17 Contact Personnel
   Contractor shall provide the city and 911 operator with the name and phone number of their representative to be contacted during working and non-working hours as necessary.
6. City’s Proposed Construction Schedule

The City anticipates the following timeline for this project. All dates are approximate.

- Council to Adopt Plans: December 2, 2019
- Bid Letting: January 13, 2020
- Council Award of Contract: January 27, 2020
- Council Approve (Execution of) Contract Documents: February 10, 2020
- Anticipated Pre-Construction Meeting: February 24, 2020
- Anticipated Date to Proceed: February 17, 2020
- Contract Completion Date: February 15, 2021

--END OF SPECIAL PROVISIONS--
SECTION 01015

PROJECT REQUIREMENTS

1. GENERAL DESCRIPTION OF WORK. The Work to be performed under these Contract Documents is generally described as follows:

   The work includes facility improvements at the 520 Booster Station consisting of the replacement of two horizontal split case centrifugal pumping units and associated piping, valves and appurtenances; electrical and instrumentation and control work; and all other work as indicated on the drawings and as specified.

   The site of the project is at 3601 Southgate Drive in Sioux City, Iowa.

2. OTHER CONSTRUCTION CONTRACTS. It is not anticipated that other work at the site will be occurring concurrently with the project.

3. WORK BY PUBLIC UTILITIES. Electric utility service is provided by Mid American Energy Company, 401 Douglas Street, Sioux City, Iowa. The contact representative with Mid American is Mr. Steve Fisher, (712-233-4834).

4. OFFSITE STORAGE. Offsite storage arrangements shall be approved by Owner for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such offsite storage arrangements shall be presented in writing and shall afford adequate and satisfactory security and protection. Offsite storage facilities shall be accessible to Owner and Engineer.

5. SUBSTITUTES AND "OR-EQUAL" ITEMS. Provisions for evaluation of substitutes and "or-equal" items of materials and equipment are covered in SUDAS. Requests for review of equivalency will not be accepted by Engineer from anyone except Contractor, and such requests will not be considered until after the Effective Date of the Agreement.

6. PREPARATION FOR SHIPMENT. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

   Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.
7. **SALVAGE OF MATERIALS AND EQUIPMENT.** Existing materials and equipment removed shall become Contractor's property.

Existing materials and equipment removed by Contractor shall not be reused in the Work.

8. **LAND FOR CONSTRUCTION PURPOSES.** Contractor will be permitted to use available land belonging to Owner, on or near the Site, for construction purposes and for storage of materials and equipment.

The locations and extent of the areas so used shall be as acceptable to the Owner.

Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by Owner, requiring access to the storage area. Materials or equipment shall not be placed on the property of Owner until Owner has agreed to the location to be used for storage.

9. **NOTICES TO OWNERS AND AUTHORITIES.** Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them.

When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

Utilities and other concerned agencies shall be notified at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

10. **OPERATION OF EXISTING FACILITIES.** Service interruptions shall be as specified in the Construction Progress Schedule section.

11. **LINES AND GRADES.** All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

Basic horizontal and vertical control points will be established or designated by Engineer to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to
complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in establishing or designating control points or in checking survey, layout, and measurement work performed by Contractor.

Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

Contractor shall remove and reconstruct work which is improperly located.

12. CONNECTIONS TO EXISTING FACILITIES. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

13. UNFAVORABLE CONSTRUCTION CONDITIONS. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

14. CUTTING AND PATCHING. As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.
Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:

- Removal of improperly timed Work.
- Removal of samples of installed materials for testing.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work without Engineer's concurrence.

Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

15. **CLEANING UP.** Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications.
16. **APPLICABLE CODES.** References in the Contract Documents to local codes mean the following:

- Great Lakes Upper Mississippi River Board of State Public Health & Environment Managers (Ten State Standards), Edition in compliance with the Iowa Administrative Code, Chapter 43
- Iowa Statewide Urban Designs and Specifications (SUDAS) as supplemented by the City of Sioux City
- Iowa Department of Natural Resources Standards
- 2009 International Building Code
- 2009 Uniform Plumbing Code
- 2009 International Mechanical Code
- 2009 International Fire Code
- 2008 National Electric Code
- 2009 International Energy Conservation Code

Other standard codes which apply to the Work are designated in the Specifications.

17. **PRECONSTRUCTION CONFERENCE.** Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

- Contractor and its superintendent.
- Principal Subcontractors.
- Representatives of principal Suppliers and manufacturers as appropriate.
- Engineer and its Resident Project Representative.
- Representatives of Owner.
- Government representatives as appropriate.
- Others as requested by Contractor, Owner, or Engineer.
Unless previously submitted to Engineer Contractor shall bring to the conference a preliminary schedule for each of the following:

Progress Schedule.

Procurement Schedule.

Schedule of Values for progress payment purposes.
Schedule of Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

Contractor's preliminary schedules.
Transmittal, review, and distribution of Contractor's submittals.
Processing Applications for Payment.
Maintaining record documents.
Critical Work sequencing.
Field decisions and Change Orders.
Use of premises, office and storage areas, security, housekeeping, and Owner's needs.
Major equipment deliveries and priorities.
Contractor's assignments for safety and first aid.

Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

18. PROGRESS MEETINGS. Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by Engineer or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

Contractor shall preside at the meetings. Meeting minutes shall be prepared and distributed by Contractor. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.
19. **SITE ADMINISTRATION.** Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner's employees) to observe the same regulations as Contractor requires of its employees.

End of Section
### ABBREVIATIONS OF TERMS AND ORGANIZATIONS

1. **LIST OF ABBREVIATIONS.** Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Organization</th>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
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<td>AABC</td>
<td>Associated Air Balance Council</td>
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<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
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<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<td>ABMA</td>
<td>American Boiler Manufacturers Association</td>
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<td>ACI</td>
<td>American Concrete Institute</td>
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<td>ACPA</td>
<td>American Concrete Pipe Association</td>
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<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
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<td>ABMA</td>
<td>Antifriction Bearing Manufacturers Association</td>
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<td>AFPA</td>
<td>American Forest &amp; Paper Association</td>
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<td>AGA</td>
<td>American Gas Association</td>
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<td>AGMA</td>
<td>American Gear Manufacturers Association</td>
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<td>AHA</td>
<td>American Hardboard Association</td>
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<td>AISC</td>
<td>American Institute of Steel Construction</td>
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<td>American Iron and Steel Institute</td>
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<td>AITC</td>
<td>American Institute of Timber Construction</td>
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<td>AMCA</td>
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<td>American National Standards Institute</td>
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<td>American Plywood Association</td>
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<td>American Petroleum Institute</td>
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<td>AREMA</td>
<td>American Railway Engineers and Maintenance-of-Way Association</td>
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<td>ARI</td>
<td>American Refrigeration Institute</td>
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<td>ASAHC</td>
<td>American Society of Architectural Hardware Consultants</td>
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<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
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<td>American Society of Sanitary Engineers</td>
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<td>American Society for Testing and Materials</td>
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<td>American Wire Gage</td>
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<td>Architectural Woodwork Institute</td>
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<td>American Wood-Preservers’ Association</td>
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<td>American Wood Preservers Bureau</td>
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(City of Sioux City, Iowa ) 01070
(520 Booster Station Improv. ) -1-
(Project 192389.3100 )
(8/20/2018 )
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<td>AWS</td>
<td>American Welding Society</td>
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<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
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<td>BIA</td>
<td>Brick Institute of America (formerly SCPI)</td>
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<td>CDA</td>
<td>Copper Development Association</td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
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<td>CMAA</td>
<td>Crane Manufacturers Association of America</td>
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<td>CRA</td>
<td>California Redwood Association</td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<td>CS</td>
<td>Commercial Standard (U.S. Department of Commerce)</td>
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<td>Ductile Iron Pipe Research Association</td>
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<td>EEI</td>
<td>Edison Electric Institute</td>
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<td>Environmental Protection Agency</td>
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<td>Federal Highway Administration</td>
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<td>FIA</td>
<td>Factory Insurance Association</td>
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<td>Factory Mutual</td>
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<tr>
<td>FSA</td>
<td>Fluid Sealing Association</td>
</tr>
<tr>
<td>FTI</td>
<td>Facing Tile Institute</td>
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<tr>
<td>HEI</td>
<td>Heat Exchange Institute</td>
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<tr>
<td>HMI</td>
<td>Hoist Manufacturers Institute</td>
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<tr>
<td>HPMA</td>
<td>Hardwood Plywood Manufacturers Association</td>
</tr>
<tr>
<td>HTI</td>
<td>Hand Tools Institute</td>
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<tr>
<td>I-B-R</td>
<td>Institute of Boiler and Radiator Manufacturers</td>
</tr>
<tr>
<td>IEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>IES</td>
<td>Illuminating Engineering Society</td>
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<tr>
<td>IFI</td>
<td>Industrial Fasteners Institute</td>
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<tr>
<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
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<tr>
<td>IRI</td>
<td>Industrial Risk Insurers</td>
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<tr>
<td>ISA</td>
<td>Instrumentation, Systems, and Automation Society</td>
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LEED Leadership in Energy and Environmental Design

MHI Materials Handling Institute
MIL Military Specification
MMA Monorail Manufacturers Association
MSS Manufacturers Standardization Society of Valve and Fitting Industry

NAAMM National Association of Architectural Metals Manufacturers
NACE NACE International
NBHA National Builders Hardware Association
NBBPVI National Board of Boiler and Pressure Vessel Inspectors
NBS See NIST
NCSPA National Corrugated Steel Pipe Association
NEBB National Environmental Balancing Bureau
NEC National Electrical Code
NECA National Electrical Contractors Association
NEMA National Electrical Manufacturers Association
NEMI National Elevator Manufacturing Industry
NFPA National Fire Protection Association
NIST National Institute of Standards and Technology (formerly NBS)
NLA National Lime Association
NPC National Plumbing Code
NPT National Pipe Thread
NRMCA National Ready Mixed Concrete Association
NSC National Safety Council
NSF NSF International (formerly National Sanitation Foundation)
NTMA National Terrazzo and Mosaic Association
NWMA National Woodwork Manufacturers Association

OSHA Occupational Safety and Health Administration

PCA Portland Cement Association
PCI Prestressed Concrete Institute
PS Product Standard

RIS Redwood Inspection Service
RTI Resilient Tile Institute (formerly AVATI)

SAE Society of Automotive Engineers

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Review Set Only - Not for Bidding
<table>
<thead>
<tr>
<th>Acronym</th>
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<tr>
<td>SCPRF</td>
<td>Structural Clay Products Research Foundation</td>
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<tr>
<td>SDI</td>
<td>Steel Door Institute</td>
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<tr>
<td>SFPA</td>
<td>Southern Forest Products Association</td>
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<tr>
<td>SI</td>
<td>Système International des Unités (International System of Units)</td>
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<td>SIGMA</td>
<td>Sealed Insulating Glass Manufacturers Association</td>
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<td>Steel Joist Institute</td>
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<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors National Association</td>
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<td>SPFA</td>
<td>Steel Plate Fabricators Association</td>
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<td>Society of the Plastics Industry</td>
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<td>Southern Pressure Treaters Association</td>
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<td>SSI</td>
<td>Scaffolding and Shoring Institute</td>
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<td>SSI</td>
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<td>U.S. Bureau of Reclamation</td>
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<td>USGBC</td>
<td>U.S. Green Building Council</td>
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<tr>
<td>WEF</td>
<td>Water Environment Federation</td>
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</tbody>
</table>

End of Section
1. SHOP DRAWINGS AND ENGINEERING DATA.

1.01. General. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor’s initial submittal shall be complete including all components.

All submittals, regardless of origin, shall be approved by Contractor and clearly identified with the name and number of this Contract, Contractor’s name, and references to applicable specification paragraphs and Contract Drawings. Each copy of all submittals, regardless of origin, shall be stamped or affixed with an approval statement of Contractor. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

Contractor shall be solely responsible for the completeness of each submittal. Contractor’s stamp or affixed approval statement of a submittal, per Figure 01300-1, is a representation to Owner and Engineer that Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that Contractor has reviewed and coordinated each submittal with the requirements of the Work and the Contract Documents.
All deviations from the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal using Figure 01300-2. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

Four copies of each drawing and the necessary data shall be submitted to Engineer. Engineer will return two marked copies (or one marked reproducible copy) to Contractor. Facsimile (fax) or electronic copies will not be acceptable. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

1.02. Engineer’s Review of Submittals. Engineer’s review of submittals covers only general conformity to the Drawings and Specifications, external connections, and dimensions that affect the layout; it does not indicate thorough review of all dimensions, quantities, and details of the material, equipment, device, or item covered. Engineer’s review shall not relieve Contractor of sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor’s sole responsibility for compliance with the Contract Documents.

Engineer’s submittal review period shall be 21 consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal in Engineer’s office. The time required to mail the submittal or resubmittal back to Contractor shall not be considered a part of the submittal review period.

When the drawings and data are returned with review status “NOT ACCEPTABLE” or “RETURNED FOR CORRECTION”, the corrections shall be made as instructed by Engineer. Five corrected copies shall be resubmitted. Resubmittals by facsimile or e-mail will not be accepted. When the drawings and data are returned with review status “EXCEPTIONS NOTED”, “NO EXCEPTIONS NOTED”, or “RECORD COPY”, no additional copies need be furnished unless specifically requested by Engineer.

1.03. Resubmittal of Drawings and Data. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal.

When corrected copies are resubmitted, Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the
number of the first submittal followed by a letter (A, B, etc.) or a unique identification that indicates the initial submittal and correct sequence of each resubmittal.

If more than one resubmittal is required because of failure of Contractor to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional resubmittals. This does not include initial submittal data such as shop tests and field tests that are submitted after initial submittal.

Resubmittals shall be made within 60 days of the date of the letter returning the material to be modified or corrected, unless within 30 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.

The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.

1.04. **Color Selection.** Contractor shall submit samples of colors and finishes for all accepted products before Engineer will coordinate the selection of colors and finishes with Owner. Engineer will prepare a schedule of finishes that include the colors and finishes selected for both manufactured products and for surfaces to be field painted or finished and will furnish this schedule to Contractor within 60 days after the date of acceptance of the last color or finish sample.

2. **OPERATION AND MAINTENANCE DATA AND MANUALS.** Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.

Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.

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Operation and maintenance manuals shall include the following:

a. Equipment function, normal operating characteristics, and limiting conditions.

b. Assembly, installation, alignment, adjustment, and checking instructions.

c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.

d. Lubrication and maintenance instructions.

e. Guide to troubleshooting.

f. Parts lists and predicted life of parts subject to wear.

g. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.

h. Test data and performance curves, where applicable.

The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by Contractor.

Two preliminary hard copies of each manual shall be submitted to Engineer prior to the date of shipment of the equipment. After review by Engineer is complete, two final hard copies and two electronic copies of each operation and maintenance manual shall be prepared and delivered to Engineer not later than 30 days prior to placing the equipment in operation.

All material shall be marked with project identification, and inapplicable information shall be marked out or deleted.

Shipment of equipment will not be considered complete until all required manuals and data have been received.
2.01. **Hard Copy Operation and Maintenance Manuals.** Preliminary hard copies submitted for review shall be temporarily bound in heavy paper covers bearing suitable identification. All manuals and other data shall be printed on heavy, first quality 8-1/2 x 11 inch paper, with standard three-hole punching. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall be suitably identified on the outside. Each volume containing data for three or more items of equipment shall include a table of contents and index tabs. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three “D”-ring binders with a table of contents and suitable index tabs.

2.02. **Electronic Operation and Maintenance Manuals.** Electronic manuals shall be in Adobe Acrobat’s Portable Document Format (PDF), and shall be prepared at a resolution between 300 and 600 dots per inch (dpi), depending on document type. Optical Character Recognition (OCR) capture shall be performed on these documents. OCR settings shall be performed with the “original image with hidden text” option in Adobe Acrobat Exchange.

File size shall be limited to 10 MB. When multiple files are required the least number of files possible shall be created. File names shall be in the format OMXXXXX-YYY-Z.pdf, where XXXXX is the five digit number corresponding to the specification section, YYY is a three digit O&M manual number, e.g. 001, Z is the letter signifying a resubmittal, A, B, C, etc, and V is a number used only when more than one 10 MB file is required for an O&M manual.

Documents prepared in PDF format shall be processed as follows:

1. Pages shall be searchable (processed for optical character recognition) and indexed when multiple files are required.
2. Pages shall be rotated for viewing in proper orientation.
3. A bookmark shall be provided in the navigation frame for each entry in the Table of Contents.
4. Embedded thumbnails shall be generated for each completed PDF file.
5. The opening view for PDF files shall be as follows:
   - Initial View: Bookmarks and Page
   - Page Number: Title Page (usually Page 1)
   - Magnification: Set to Fit in Window
   - Page: Single Page
6. Where the bookmark structure is longer than one page the bookmarks shall be collapsed to show the chapter headings only.
7. When multiple files are required, the first file of the series (the parent file) shall list every major topic in the Table of Contents. The parent file shall also include minor headings bookmarked based on the Table of Contents. Major headings, whose content is contained in subsequent files (children) shall be linked to be called from the parent to the specific location in the child file. The child file shall contain bookmark entries for both major and minor headings contained in the child file. The first bookmark of any child file shall link back to the parent file and shall read as follows "Return to the Equipment Name Table of Contents", e.g. Return to the Polymer Feed System Table of Contents.

8. Drawings shall be bookmarked individually.

9. Files shall be delivered without security settings to permit editing, insertion and deletion of material to update the manual provided by the manufacturer.

2.03. Labeling. As a minimum, the following information shall be included on all final O&M manual materials, including CD-ROM disks, jewel cases, and hard copy manuals:

- Equipment name and/or O&M title spelled out in complete words.
- Project Name.
- City Project/Contract Number.
- Specification Section Number. Example: “Section 15500”
- Manufacturer’s name.
- File Name and Date.

For example:

Backwash Pump Operation and Maintenance Manual
Somewhere Plant Expansion
Project/Contract No. _____
Specification Section 11110
Manufacturer
OM11110-001.pdf, 5/05/07

End of Section

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SUBMITTAL IDENTIFICATION & CONTRACTOR'S APPROVAL STATEMENT

DATE: ___________ COPIES ___________ DRAWING SHEET NO. __________

Description submittal contents: ___________________________________________
Location: __________________________________________________________________
Manufacturer: __________________________________________________________________
Subcontractor or Supplier (Optional): __________________________________________________________________

REMARKS: __________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

CONTRACTOR'S APPROVAL

(Construction Company) has reviewed and coordinated the submitted documentation and verifies that the equipment and material meet the requirements of the Work and the Contract Documents. We accept sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data contained in the submittal as required by the Contract Documents.

Deviations: □ None   □ Yes (See attached Figure 01300-2 for written description)

Approved By: ____________________ Date: ___________

This approval does not release subcontractor / vendor from the contractual responsibilities.
1. **CONSTRUCTION SCHEDULE.** Prior to the preconstruction conference, Contractor shall submit to Engineer for review a preliminary schedule of the proposed construction operations. The construction schedule shall be revised and resubmitted until acceptable to the Engineer, before the Work is started. Owner shall cooperate with Contractor in arrangements for continuity of service and operation of valves and other control facilities. The construction schedule shall indicate the sequence of the Work, the times (numbers of days or dates) for starting and completing the various stages of the Work, including the time for plant shutdowns for electrical tie-ins, and any milestones specified in the Contract Documents.

The 520 Booster Station shall remain in service until October 1, 2019. No construction work that will impact operation of the facility shall commence until October 1, 2019. The project Completion Date shall be as stipulated in the Bid Form.

The construction schedule shall also be revised and resubmitted with each monthly application for payment. The revised schedule shall indicate the original construction schedule, the schedule of actual progress made in previous months, and the schedule of future progress of the Work.

Owner may require Contractor, at Contractor’s expense, to add to his plant, equipment, or construction forces, as well as increase the working hours, if operations fall behind schedule at any time during the construction period.

The construction schedule shall account for delays resulting from inclement weather conditions. The following table identifies the specific number of work day delays which should be anticipated each month due to inclement weather conditions in the region based on a scheduled 5 day work week.

| Anticipated Monthly Delayed Work Days Resulting From Weather Conditions |
|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
| 13 | 11 | 7 | 7 | 8 | 7 | 8 | 6 | 6 | 5 | 6 | 13 |

The anticipated work day delays identified in the table will be used as the basis for evaluating abnormal weather delay claims. In particular, the number of anticipated work day delays each month will be subtracted from the actual number of work day delays. A Contract Time extension will be granted if the actual number of work day delays exceed the number of anticipated work day delays.
delays. The difference between these values will be multiplied by 7/5 to convert from work days to calendar days. A change order will subsequently be prepared to provide the Contract Time extension.

Documentation shall be submitted each month supporting any abnormal weather delay claims. The documentation shall identify the date the delay occurred, the weather conditions which caused the delay and the specific critical path work activity which was delayed.

Abnormal weather delay claims on Saturday or Sunday will not be considered. In addition, weather related delays in the performance of non-critical path work activities will not be considered.

Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing lighting, heating and security systems in operation during the construction period.

2. PROGRESS REPORTS. A progress report shall be submitted to Engineer with each application for progress payment. If the Work falls behind schedule, Contractor shall submit additional progress reports at such intervals as Engineer may request.

Each progress report shall include sufficient narrative to describe current and anticipated delaying factors, their effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.

End of Section
1. **SCHEDULE OF VALUES.** After review of the preliminary schedule at the preconstruction conference, and before submission of the first Application for Payment, Contractor shall prepare and submit to Engineer a Schedule of Values covering each lump sum item. The Schedule of Values, showing the value of each kind of work, shall be acceptable to Engineer before any Application for Payment is prepared.

The sum of the items listed in the Schedule of Values shall equal the Contract Price. Such items as Bond premium, temporary construction facilities, and plant may be listed separately in the Schedule of Values, provided the amounts can be substantiated. Overhead and profit shall not be listed as separate items.

The Schedule of Values shall have sufficient detail such that partial completion of separable items of work can easily be calculated. The Schedule of Values shall have separate lines for manufacturer's field services, O&M manuals, and performance testing for each item of equipment requiring such services.

An unbalanced Schedule of Values providing for overpayment of Contractor on items of Work which would be performed first will not be accepted. The Schedule of Values shall be revised and resubmitted until acceptable to Engineer. Final acceptance by Engineer shall indicate only consent to the Schedule of Values as a basis for preparation of applications for progress payments, and shall not constitute an agreement as to the value of each indicated item.

2. **SCHEDULE OF PAYMENTS.** Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

3. **SURVEY DATA.** All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout the construction period. All such data shall be submitted to Engineer with the other documentation required for final acceptance of the Work.
4. **LAYOUT DATA.** Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Resident Project Representative for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section
Section 01380

CONSTRUCTION PHOTOGRAPHS

1. CONSTRUCTION PHOTOGRAPHS BY CONTRACTOR. Contractor shall be responsible for the production of construction photographs as provided herein. Engineer shall designate the subject of each photograph.

Fifteen photographs of the entire site, or pertinent features thereof, shall be taken before the commencement of Work and promptly submitted to Engineer. The same views shall be rephotographed upon completion of all construction activities and submitted with Contractor's application for final payment. Ten additional photographs shall be made each month throughout the progress of the Work at such times as requested by Engineer, and submitted with Contractor's application for progress payment.

All photographs shall be color digital, produced by a competent professional photographer. Camera equipment shall have a minimum pixel capacity of 8.0 megapixels. Photographs shall be taken at a minimum resolution of 3264x2448 and at "Best" quality. Photographs shall be printed on photographic printer paper with a color printer capable of 4800 x 4800 dpi resolution or better, or shall be professionally printed.

Contractor shall submit the photographs electronically and two copies of 4 by 5 inch prints. Digital images shall be compiled on CD and provided with a descriptive index of the images. Prints shall be mounted on linen with flap for binding or enclosed in clear plastic binders, and marked with the name and number of the Contract, name of Contractor, description and location of view, and date photographed.

Engineer will transmit the digital files and one copy of the prints to Owner.

End of Section
Section 01400

QUALITY CONTROL

1. TESTING SERVICES. Testing services shall be provided in accordance with Paragraph 13.03 of the General Conditions. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards.

Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.01. Testing Services Provided by Contractor. Unless otherwise specified, Contractor shall provide all testing services in connection with the following:

   Concrete materials and design mixtures.

   All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

Contractor shall obtain Engineer's acceptance of the testing firm before having services performed, and shall pay all costs for these testing services.

1.02. Testing Services provided by Owner. Unless otherwise specified, Owner shall provide for tests made on the following materials and equipment:

   Concrete.

   Other materials and equipment at the discretion of Owner.

Testing, including sampling, will be performed by Engineer or the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Engineer shall determine the exact time, location, and number of tests, including samples.

Arrangements for delivery of samples and test specimens to the testing firm's laboratory will be made by Owner. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.
Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no Claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

1.03. Transmittal of Test Reports. Written reports of tests and engineering data furnished by Contractor for Engineer’s review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

The laboratory retained by Owner will furnish four copies of a written report of each test. One copy of each test report will be transmitted to the Resident Project Representative (if a RPR is provided), one copy to Engineer, one copy to Owner, and one copy to Contractor, within 3 days after each test is completed.

2. MANUFACTURER’S FIELD SERVICES. Manufacturer’s field services shall be as specified herein except as specifically specified in the respective equipment sections.

2.01. Services Furnished Under This Contract. An experienced, competent, and authorized representative of the manufacturer of each item of equipment for which field services are indicated in the respective equipment section or in the equipment schedule section shall visit the Site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer’s representative shall be present when the equipment is placed in operation. The manufacturer’s representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

Each manufacturer’s representative shall furnish to Owner, through Engineer, a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the Contract Price.

End of Section
TEMPORARY FACILITIES

1. **WATER.** All water required for and in connection with the Work to be performed will be furnished by Owner in the vicinity of the Site without charge to Contractor, provided:

   a. Contractor shall procure such water in the location and in the manner designated by Engineer

   b. Contractor at its own expense shall make authorized connections and provide means for delivering the water to the Site.

   c. Contractor shall provide adequately against waste and needless use of water.

2. **POWER.** Contractor shall provide all power for operation of Contractor's equipment, or for any other use by Contractor.

3. **SANITARY FACILITIES.** Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

   Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

4. **MAINTENANCE OF TRAFFIC.** Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

5. **FENCES.** All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is
obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original locations.

6. PROTECTION OF PUBLIC AND PRIVATE PROPERTY. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor or its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

7. DAMAGE TO EXISTING PROPERTY. Contractor will be held responsible for any damage to existing structures, Work, materials, or equipment because of his operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, Owner.

Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or workers to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

8. HAUL ROUTES. Contractor shall obtain all applicable permits from the City and County to allow use of city streets to transport equipment and materials to and from the site. At such time the Contractor shall request the governing department to approve the Contractor’s proposed haul routes or to establish the

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haul route. A copy of the permit and designated haul routes shall be provided to the Owner and Engineer prior to commencement of work in that area.

9. **SECURITY.** Contractor shall be responsible for protection of the Site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

No Claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall make good all damage to Owner's property resulting from Contractor's failure to provide security measures as specified.

Security measures shall be at least equal to those usually provided by Owner to protect Owner's facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the Site.

Contractor shall submit a list of all personnel that will access the site. The list shall be updated any time additional staff visit the site. Contractor shall maintain accurate records of all personnel that are on site each day and submit a written log to the City each week.

10. **ACCESS ROADS.** Contractor shall establish and maintain temporary access roads to various parts of the Site as required to complete the Project. Such roads shall be available for the use of all others performing work or furnishing services in connection with the Project.

11. **PARKING.** Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities. All vehicles shall park within the Contractors Staging Area indicated on the drawings.

12. **NOISE CONTROL.** Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building and shall conduct its operations to avoid unnecessary noise which might interfere with the activities of building occupants.
13. **DUST CONTROL.** Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

14. **TEMPORARY DRAINAGE PROVISIONS.** Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

15. **EROSION CONTROL.** Contractor shall prevent erosion of soil on the Site and adjacent property resulting from its construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.

Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

16. **POLLUTION CONTROL.** Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

End of Section
GENERAL EQUIPMENT STIPULATIONS

1. **SCOPE.** When an equipment specification section in this Contract references this section, the equipment shall conform to the general stipulations set forth in this section, except as otherwise specified in other sections.

2. **COORDINATION.** Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

3. **MANUFACTURER'S EXPERIENCE.** Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

4. **WORKMANSHIP AND MATERIALS.** Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

5. **LUBRICATION.** Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

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Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantities to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

6. ELEVATION. The elevation of the site shall be as indicated in the respective equipment specification sections. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at the specified elevation.

7. SAFETY GUARDS. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage thick or thicker galvanized, aluminum-clad sheet steel, or stainless sheet steel or from 1/2 inch mesh galvanized expanded metal, or poltrusion molded UV resistant materials. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

8. ANCHOR BOLTS. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall comply with the Anchorage in Concrete and Masonry section and, unless otherwise specified, shall be at least 3/4 inch in diameter.

Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

9. EQUIPMENT BASES. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components, and adequate grout holes. Baseplates for pumps shall have a
means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in the Grout section.

10. SPECIAL TOOLS AND ACCESSORIES. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

11. SHOP PAINTING. All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.

Surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer.

Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer.

12. PREPARATION FOR SHIPMENT. Equipment shall be prepared for shipment as specified in Section 01612, Shipping.

13. STORAGE. Handling and storage of equipment shall be as specified in Section 01614, Handling and Storage.

14. INSTALLATION AND OPERATION. Installation and operation shall be as specified in respective equipment sections and Section 01650 Startup Requirements.

15. OBSERVATION OF PERFORMANCE TESTS. Where the Specifications require the presence of Engineer, initial tests shall be observed or witnessed by Engineer. Owner shall be reimbursed by Contractor for all costs of subsequent visits by Engineer to witness or observe incomplete tests, retesting, or subsequent tests.
16. **PROGRAMMING SOFTWARE.** Programming software shall be provided for any equipment which includes a programmable logic controller (PLC) or other digital controller that is user-programmable. The software shall be suitable for loading and running on a laptop personal computer operating with a Windows-based operating system. A copy of the manufacturer's original operating logic program shall be provided for use in maintaining and troubleshooting the equipment. Where multiple pieces of equipment, from the same or different vendors, use the same programming software, only one copy of the software need be provided.

End of Section
Section 01611

METEOROLOGICAL AND SEISMIC DESIGN CRITERIA

1. **SCOPE.** Non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

2. **DESIGN CRITERIA.** Non-structural components and non-building structures shall be designed in accordance with the following criteria.

General Design Data:

- **Building code and references**: IBC 2009, ASCE 7-05
  - “Minimum Design Loads for Buildings and Other Structures”, AISC 360
  - “Specification for Structural Steel Buildings”, AISC 341
  - “Seismic Provisions for Structural Steel Buildings”

- **Site elevation, above mean sea level**: 1095.00 ft

Wind Design Data:

- **Basic wind speed, V**: 90 mph
- **Exposure category**: C
- **Importance factor (wind loads), I**: 1.15

Snow Design Data:

- **Ground snow load, Pg**: 35 psf
- **Importance factor (snow loads), I**: 1.10
- **Exposure factor (Ce)**: 1.0
- **Thermal factor (Ct)**: 1.0
Seismic Design Data for Non-structural Components:

- Design short period spectral response acceleration, $S_{DS}$: 0.113
- Component importance factor, $I_P$: 1.25
- Seismic Design Category: A

Seismic Design Data for Non-building Structures

- Occupancy Category: III
- Design short period spectral response acceleration, $S_{DS}$: 0.113
- Design one second period spectral response acceleration, $S_{D1}$: 0.058
- Mapped MCE one second period spectral response acceleration, $S_1$: 0.036
- Importance factor, $I$: 1.25

3. SEISMIC DESIGN.

3-1. General. Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.


3-3. Non-structural Components. Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of the ASCE 7.

Non-structural components shall have sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

Non-structural components shall be attached so that seismic forces are transferred to the structural system. These attachments shall be bolted, welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.
Non-structural components shall be designed to be operable during and following a seismic event, without collapsing or breaking away from supports, and remain intact to the extent that they do not create an ignition hazard or release hazardous materials. Components that contain contents that are hazardous (flammable, explosive, corrosive, acidic, caustic, toxic, or that otherwise present a danger to the general public if released) shall maintain containment of those contents following the design earthquake.

“\( W_p \)” shall include the total operating weight of the component or system, including, but not limited to, any insulation, fluids, and concentrated loads such as valves, condensate traps, and similar components.

Seismic effects that shall be analyzed in the design of piping systems include the dynamic effects of the piping system, contents, and, when appropriate, supports. The interaction between the piping system and the supporting structures, including other mechanical and electrical equipment, shall also be considered.

3-4. Non-building Structures. Non-building structures are the items described as such in Chapter 15 of ASCE 7.

Non-building structures shall provide sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

The seismic design of non-building structures shall provide sufficient stiffness, strength and ductility to resist the effects of seismic ground motions during the design earthquake.

"\( W \)" for non-building structures shall include the total dead load and shall also include all normal operating contents of tanks, vessels, bins, and piping.

End of Section
Section 01612

SHIPPING

1. **SCOPE.** This section covers packaging and shipping of materials and equipment.

2. **PREPARATION FOR SHIPMENT.** All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Grease and lubricating oil shall be applied to all bearings and similar items.

3. **SHIPPING.** Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

End of Section
Section 01614

HANDLING AND STORAGE

1. SCOPE. This section covers delivery, storage, and handling of materials and equipment.

2. DELIVERY. Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the jobsite.

Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

3. STORAGE. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Masonry products shall be handled and stored in a manner to hold breakage, chipping, cracking, and spalling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.
Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Electrical equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.

Equipment having moving parts, such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer. Manufacturer's storage instructions shall be carefully followed by Contractor.

When required by the equipment manufacturer, moving parts shall be rotated at least twice a month to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, Contractor shall, at the discretion of Engineer, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

When required by the equipment manufacturer, lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment by Contractor at the time of acceptance.

Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.

In addition to the protection specified for prolonged storage, the packaging of spare units and spare parts shall be for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.

4. HANDLING. Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

End of Section
1. **SCOPE.** This section consists of a schedule of the items of equipment for which manufacturer’s field services or operation and maintenance manuals are required, but not covered in other sections. When other sections indicate that manufacturer’s field services and operation and maintenance manuals are required, the requirements shall be as specified in the other sections.

Specific requirements for manufacturer’s field services are covered in the Quality Control section and the equipment specifications. The equipment testing and startup are covered in the Startup Requirements section. Specific requirements for operation and maintenance manuals are covered in the Submittals section and the equipment specifications.

2. **SCHEDULE.** Manufacturer’s field services and operation and maintenance manuals shall be provided for the items of equipment indicated in the following schedule:

<table>
<thead>
<tr>
<th>Spec Section</th>
<th>Type of Equipment</th>
<th>Mfr’s. Field Services</th>
<th>O&amp;M Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>11110</td>
<td>Horizontal Split Case Centrifugal Pumps</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13562</td>
<td>Flow Instruments</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13500</td>
<td>Instrumentation and Control</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>15010</td>
<td>AWWA Butterfly Valve</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>15093</td>
<td>Check Valves (Globe Style Silent Check)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>15180</td>
<td>Valve and Gate Actuators</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>16050</td>
<td>Electrical – Combination Solid State Starters</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>16220</td>
<td>General Purpose Induction Motors</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Manufacturer’s field services shall be as required to satisfy installation, testing, and startup requirements that are required by these contract documents. For each item of equipment indicated to have manufacturer’s field services, as a minimum, the following shall be provided:

- Initial site visit to inspect the initial installation.
- Two subsequent site visits (minimum) to respond to installation concerns and to assure the equipment is operating properly.
• One site visit at the completion of the project to explain the operation and maintenance procedures to the plant staff.

End of Section
STARTUP REQUIREMENTS

1. **SCOPE.** This section covers startup requirements for all items of equipment and systems including mechanical equipment. Additional requirements may be specified in specific equipment specifications. The requirements of this section shall be satisfactorily completed prior to any field tests specified in the specific equipment sections.

2. **GENERAL.** Equipment shall not be operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results. All items of equipment and systems shall be tested for proper operation, efficiency, and capacity. All required adjustments, tests, operation checks, and other startup activity shall be provided by qualified personnel. Contractor shall be responsible for planning, supervising, and executing the installation of Work.

2.01. **Coordination.** Contractor shall coordinate all tests related to startup of equipment and systems and shall report the results to Engineer in accordance with the submittals section. Contractor shall accept the equipment and the test results related to starting of equipment and systems before Engineer will accept the equipment and the test results.

When equipment is ready for a witness test, Contractor shall give written notice to Engineer at least 14 days before any offsite witness testing is performed or any field witnessed performance testing, unless otherwise specified.

3. **EQUIPMENT TESTS.**

3.01. **Factory Tests.** When specified in the specific equipment sections, the equipment will be test run at the point of manufacture and the test results will be delivered to Engineer. Such equipment will not be shipped until Engineer has reviewed the test results and advised the Contractor, in writing, that the equipment is acceptable for shipment. Such acceptance, however, will not be considered as final acceptance, which will only be made on the basis of the test results of the equipment after installation.

3.02. **Preliminary Field Tests.** All items of mechanical equipment shall be given a preliminary field test by Contractor after installation for proper operation, efficiency, and capacity. The preliminary field test shall consist of the requirements listed herein, unless exceptions or additions are indicated in the specific equipment sections.
Contractor's test operation of each piece of mechanical equipment shall continue for not less than 8 hours without interruption. All moving parts of equipment and machinery shall be carefully tested for operation, and adjusted so all parts move freely and function to secure satisfactory operation. All equipment shall be tested continuously under actual or simulated operating conditions. All parts shall operate satisfactorily in all respects, under continuous full load and in accordance with the specified requirements, for the full duration of the 8 hour test period. If any part of a unit shows evidence of unsatisfactory or improper operation during the 8 hour test period, correction or repairs shall be made and the full 8 hour test operation, as specified, shall be completed after all parts operate satisfactorily.

Tests of all process and pumping equipment, drive motors, including auxiliaries shall be made in accordance with the appropriate and approved test codes such as the American Society of Mechanical Engineers, Hydraulic Institute Standards, and IEEE.

Tests shall be conducted before the commencement of the Field System Operation Test so each item of equipment is ready for integrated operation with other equipment at the plant. Testing, measuring, and calibrating procedures shall be submitted to Engineer for review and acceptance prior to startup and testing of equipment.

The equipment shall be properly filled, by Contractor, with oil and grease, and Contractor shall furnish all power, personnel, water, chemicals, fuels, oil, grease, and auxiliaries necessary for conducting the testing of the equipment for proper operation, efficiency, and capacity.

The period of inspection, initial startup operation, and field adjustment shall be as needed to achieve satisfactory installation and operation of the items furnished. Any period required for instruction of Owner's personnel shall be as specified in the Contract Documents.

When the specific equipment sections indicate that an installation check is required by the equipment manufacturer, the manufacturer's representative will make all necessary field adjustments and correct defects in materials or workmanship during this test period.

All equipment installed under this Contract, including that furnished by others, shall be placed into successful operation according to the written instructions of the equipment manufacturer and the instructions of the manufacturer's field representative.
3.03. Field System Operation Test. After all equipment is installed and the entire plant or system is ready to operate, Contractor shall conduct a field system operation test. The test shall consist of the requirements listed herein, unless exceptions or additions are indicated in the specific equipment sections.

The test period shall be 3 days and each system shall operate under actual or simulated operating conditions before a certificate of Substantial Completion of the Work is issued. All defects of material, workmanship, or equipment which appear during this test period shall be corrected by Contractor. After such corrections are made, the 8 hour test shall be repeated before a certificate of Substantial Completion of Work is issued, unless waived by Engineer.

Contractor shall supply all power, water, oil, grease, auxiliaries, and operating personnel required for this operation test.

When necessary for certain items of equipment, the final adjustments and inspections will be made by factory trained service personnel (other than sales representatives), rather than by Contractor. The service personnel will also supervise the test operation. This requirement will be stated under the detailed specification for the particular piece or pieces of equipment. The manufacturer's service personnel will make adjustments and supervise testing by Contractor until such tests have been accepted by Engineer.

4. ACCEPTANCE. When no other field tests for acceptance are specified in the equipment sections, at the end of the field system operation testing, each system will be accepted if, in the opinion of Engineer, it has operated satisfactorily without excessive power use, wear, or need for lubrication, or requiring undue attention; and if all its rotating parts operate without excessive vibration or noise at any operating condition.

When other field tests for acceptance are specified in the equipment sections, acceptance shall be after all tests are satisfactorily conducted as specified in the appropriate equipment procurement specification.

When a field performance test for baseline is specified in the equipment sections, acceptance shall be after a completion of the baseline performance test that is conducted as specified in the pumping unit field testing - baseline performance section.

Acceptance of Work in connection with the installation of equipment furnished by others will be subject to approval of the manufacturer's field representative. Acceptance by Owner or approval of the manufacturer's field representative will not relieve Contractor of responsibility for defective Work.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the demolition of pumping units, concrete equipment bases, piping, pipe supports, valves, and electrical and instrumentation equipment, electrical conductors and appurtenances as indicated on the Drawings.

1-2. GENERAL. Contractor shall be responsible for all work under this section. Contractor shall provide 10 days written notice prior to beginning demolition activities.

Demolition work shall create minimum interference with Owner's operations and minimum inconvenience to Owner. Contractor shall provide protection and safety of all roadways, sidewalks, and all accessible areas during demolition activities.

Blasting will not be permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3-1. DEMOLITION. Removal of equipment or facilities shall include removal of all accessories, piping, wiring, supports, associated electrical starters and devices, concrete equipment bases, baseplates and frames, and all other appurtenances, unless otherwise directed. Existing materials and equipment removed, and not indicated to be reused as a part of the Work, shall become Contractor's property unless otherwise specified, and shall be removed from the Site.

Contractor shall conduct demolition activities in a manner that prevents damage to existing facilities which are indicated to remain and shall provide all necessary protection for existing facilities. Any remaining facilities damaged during demolition shall be repaired by Contractor to a condition equal to or better than the original condition.
When demolition is complete, all debris shall be removed from the Site and disposed of by Contractor.

3-1.01. **Structure Demolition.** Not used.

3-1.02. **Piping and Equipment Demolition.** The following piping and equipment shall be removed and shall become the property of Contractor. The limits of demolition are depicted on the Demolition Drawings. All such items shall be promptly removed from the jobsite.

- Pumping Unit Nos. 1 and 2 and associated concrete equipment bases.
- Suction and Discharge Lateral Piping, pipe supports, valves and appurtenances within the limits depicted on the drawings.
- Suction and Discharge Header Piping, pipe supports and appurtenances within the limits depicted on the drawings.
- Electrical Motor Control Center (internal components), concrete equipment base and Electrical conduit and conductors as indicated on the drawings.
- Instrumentation equipment and systems as indicated on the drawings.

3-1.03. **Sitework Demolition.** Not used.

3-2. **SALVAGE.**

3-2.01. **Items To Be Salvaged by Owner.** Not used.

3-2.02. **Items To Be Salvaged by Contractor.** Not used.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers cleaning of potable water pipelines and disinfection of all potable water pipelines installed under this Contract.

Pipeline pressure and leakage testing is covered in the Pipeline Pressure and Leakage section.

1-2. GENERAL.

1-2.01. Coordination. Contractor shall coordinate cleaning and disinfection work with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, flowmeters, sampling taps, pumps, disinfectant, neutralization agents, chlorine residual test apparatus, and all other items of equipment or facilities necessary to complete the cleaning and disinfection work.

Water for cleaning and disinfection work will be provided as stipulated in the Temporary Facilities section.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Project Requirements section.

Unless otherwise specified, final cleaning and disinfection work shall not be performed until after hydrostatic testing of the pipelines and any resulting repair work completed.

Contractor shall notify the Iowa Department of Natural Resources (IDNR) prior to the work to allow their representatives to be present during cleaning and/or disinfection of the pipelines.
1-2.02. Related Work. Other sections directly related to work covered in this section include the Pipeline Pressure and Leakage Testing section.

1-2.03. Governing Standard. All disinfection work shall conform to the requirements of ANSI/AWWA C651, and the requirements of the Iowa Department of Natural Resources (IDNR), except as modified herein. If any State or local requirements conflict with the provisions of this section, the State and local requirements shall govern.

Contractor shall notify Federal, State, and local regulatory agencies to determine if any special procedures or permits are required for disposal of neutralized or diluted chlorinated water from the final flushing of pipelines and to identify acceptable locations for disposal of the flushing water. All requirements and costs associated with notification and obtaining any discharge permits shall be the responsibility of the Contractor.

1-2.04. Experience. The disinfection work shall be performed by a subcontractor specialized in such work, or with the permission of Engineer, Contractor may provide the necessary equipment and do the work with his own personnel. In either case, all work shall be done under the direct supervision of a competent and experienced specialist in such work.

Personnel performing the disinfection shall demonstrate a minimum of 5 years experience in the chlorination and dechlorination of similar pipelines.

1-3. SUBMITTALS.

1-3.01. Cleaning and Disinfection Plan. Unless otherwise specified, Contractor shall submit a detailed cleaning and disinfection plan to Engineer 14 days prior to starting any cleaning and disinfection work. The plan shall cover the method and procedure proposed, necessary coordination, qualification of personnel performing the disinfection work, sequence of operations, the limits of the pipelines to be cleaned and disinfected, the positions of all valves, location of temporary bulkheads, materials and quantities of each to be used, equipment to be used, manner of filling and flushing the pipelines, chlorine injection points, sample points, bacteriological testing location and schedule, potable water source, method of metering the water if required, neutralization and disposal of wasted water, and all other methods and procedures to be followed in performing the cleaning and disinfection work.

1-3.02. Testing. Bacteriological testing shall be performed by an independent testing laboratory furnished by the Contractor. Contractor shall submit the qualifications of the proposed independent testing laboratory for Owner approval and for State (Iowa Department of Natural Resources) approval prior to
performing the specified bacteriological tests. Upon completion of each test, three copies of the test results shall be submitted to Engineer.

Contractor shall provide all items of equipment, piping, and other facilities necessary to assist with the collection of the samples as required. Locations for bacteriological sampling shall be in accordance with the governing standards or as acceptable to the Owner.

The chlorine residual tests shall be performed by Contractor. The test logbook shall be made available to Owner or Engineer upon request and shall be submitted to Engineer upon completion of all chlorine residual testing.

**1-4. QUALITY ASSURANCE.**

1-4.01. Chlorine Residual Tests. Contractor shall provide the necessary apparatus for making the chlorine residual tests by the drop dilution method in Appendix A of ANSI/AWWA C651. Test results shall be recorded in a logbook that includes for each test: the location, date, time, test results, and test kit manufacturer.

1-4.02. Bacteriological Tests. Sampling and testing of water in the piping shall be performed after final flushing in accordance with Section 5 of ANSI/AWWA C651. Two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected and standard heterotrophic plate counts measured for each sample.

1-4.03. Redisinfection. Should the bacteriological tests indicate the presence of coliform organisms at any sampling point, the piping shall be reflushed, resampled and retested in accordance with Section 5 of ANSI/AWWA C651. If check samples show the presence of coliform organisms, then the piping shall be rechlorinated until acceptable results are obtained.

**PART 2 - PRODUCTS**

2-1. MATERIALS. All materials furnished by Contractor shall conform to the requirements of ANSI/AWWA C651 and shall be clean and free of debris which could infer questionable test results.

2-1.01. Liquid Chlorine. Liquid chlorine shall conform to AWWA B301.

2-1.02. Calcium Hypochlorite (Dry). Calcium hypochlorite shall conform to AWWA B300.
2-1.03. Sodium Hypochlorite (Solution). Sodium hypochlorite shall conform to AWWA B300.

2-1.04. Chlorine Residual Test Kit. Chlorine residual concentration shall be measured using an appropriate range, drop count titration kit or an orthotolidine indicator comparator with wide range color discs. The color disc range shall be selected to match chlorine concentration limits. Test kits shall be maintained in good working order and available for immediate test of residuals at point of sampling. Test kits manufactured by Hach Chemical or Orbeco-Hellige are acceptable.

PART 3 - EXECUTION

3-1. APPLICATION.

3-1.01. Cleaning. Piping, including all associated valves and fittings, shall be cleaned to the satisfaction of Owner and Engineer.

Piping shall be cleaned by flushing with water at the maximum velocity which can be developed, but not less than 2.5 feet per second, unless otherwise permitted by Engineer. Flushing shall continue until the pipeline is free of dirt, debris, and other foreign materials. Cleaning shall precede disinfection.

Flushing shall be accomplished through the installed valves or fittings, blow-offs or through temporary flushing connections installed for that purpose.

3-1.02. Disinfection Procedure. The piping shall be disinfected by the tablet method or continuous feed method. Potable water shall be used in conjunction with the chlorination agent.

For the continuous feed method, the chlorination agent shall be injected into the line at the supply end of each new pipe.

Admission of disinfectant solution into or the flushing thereof through existing piping shall be held to the minimum possible, and then only after adequate measures have been taken to prevent any such solution of chlorinated wastewater from entering branch service connections to water customers or other piping systems.

During disinfection, all valves shall be operated to ensure that all appurtenances are disinfected. Valves shall be operated such that the chlorine solution in the pipeline being chlorinated will not flow back into the supply line. Check valves shall be used if needed.
Existing pipelines which may become contaminated during work requiring connections to the new pipeline, involving either tapping or cutting into operations, shall be flushed and disinfected in accordance with Section 4 of ANSI/AWWA C651.

3-1.03. Final Flushing. Upon completion of chlorination, but before sampling and bacteriological testing, all heavily chlorinated water shall be removed from the lines by flushing with potable water until the chlorine residual in the lines is not higher than that generally prevailing in the adjacent existing system or as acceptable to the Owner.

Final flushing shall be accomplished as specified for cleaning of pipelines.

3-1.04. Disposal of Chlorinated Wastewater. All chlorinated wastewater to be discharged shall be neutralized by chemical treatment and disposed in accordance with Section 4 and Appendix C of ANSI/AWWA C651 and the requirements of the governing agency specified herein. Schedule, rates of flow, and locations of discharge of disinfection and flushing water shall be coordinated with Engineer and in accordance with all applicable rules and regulations.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers field hydrostatic pressure and leakage testing of piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

Testing of other piping is covered in Miscellaneous Piping and Accessories Installation section. Cleaning and disinfection of piping is covered in the Cleaning and Disinfection of Water Distribution System section.

1-2. GENERAL. Contractor shall coordinate pressure and leakage testing with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, and all other items of equipment or facilities necessary to complete the pressure and leakage testing.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Project Requirements section.

Contractor shall notify Federal, State (Iowa Department of Natural Resources), and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of testing. All testing shall be performed to the satisfaction of Engineer, and in accordance with all governing standards and regulations.

1-2.01. Testing Schedule and Procedure. A testing schedule and procedure shall be submitted to Engineer for review and acceptance not less than 21 days
prior to commencement of testing. The schedule and procedure shall include, but not be limited to the following information for each pipe section to be tested:

- limits of each pipe test section;
- proposed time and sequence;
- physical locations and set positions of all valves;
- locations of temporary bulkheads, stops, caps, restraints, supports, and other temporary equipment needed;
- manner of filling and source of water;
- method and location of metering volumes;
- method and location of gauging pressures; and
- method and location of disposal of test water.

1-2.02 Special Testing Requirements. Not used.

1-2.03 Water. Treated water shall be used for testing. Unless otherwise permitted, the water shall be kept out of the remainder of the piping. Following completion of testing, the water shall be disposed of in accordance with the requirements of regulatory agencies and in a manner acceptable to Engineer.

PART 2 – PRODUCTS

2-1. TEST EQUIPMENT. All necessary connections between the piping to be tested and the water source, together with pumping equipment, water meter, pressure gauges, backflow prevention, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided. All required blind flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices shall also be provided. All temporary sectionalizing devices shall be removed upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested.

Test pressure shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by Engineer.

Permanent or temporary gauge connections shall be installed at each location where test gauges are connected to the piping during the required test. Drilling and tapping of pipe walls will not be permitted. Upon successful completion of testing, each permanent gauge connection shall be fitted with an isolation valve and a permanent gauge, and each temporary gauge connection, if used, shall be fitted with a permanent sealed plug or cap acceptable to the Engineer.
Permanent or temporary fill and vent connections shall be installed as needed for the required test. Drilling and tapping of pipe walls will not be permitted. Upon successful completion of testing, each permanent fill and vent connection shall be fitted with the permanent fill or vent piping, and each temporary fill and vent connection, if used, shall be fitted with a permanent sealed plug or cap acceptable to the Engineer.

PART 3 - EXECUTION

3-1. FILLING AND VENTING. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and operating properly. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3-2. BLOCKING AND BACKFILLING. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied.

3-3. PRESSURE TESTING. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials.

All process piping shall be subjected to a hydrostatic test gradient of Elev. 1,670 feet (250 psi).

The test pressure, expressed in feet of water, to be applied at any point in the piping shall be equivalent to the arithmetic difference between the specified test pressure plane elevation and the elevation of the horizontal center line of the piping at the selected location. The value obtained shall be multiplied by 0.433 to obtain psi.

3-4. PLANT PIPING LEAKAGE TESTING. All piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

End of Section

(City of Sioux City, Iowa )  02704
(520 Booster Station Improv. )  -3-
(Project 192389.3100 )
(8/20/2018 )
Section 03301
CONCRETE

PART 1 - GENERAL

1-1. **SCOPE.** This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work. All concrete shall be air-entrained.

1-2. **GENERAL.** All cast-in-place concrete shall be accurately formed and properly placed and finished as indicated on the drawings and as specified herein.

1-3. **SUBMITTALS.** All submittals of drawings and data shall be in accordance with the submittals section.

1-4. **STORAGE AND HANDLING.** Cement shall be stored in suitable moistureproof enclosures. Cement which has become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

Reinforcing steel shall be carefully handled and shall be stored on supports that will prevent the steel from touching the ground.

PART 2 - PRODUCTS

2-1. **LIMITING REQUIREMENTS.** Unless otherwise specified, concrete shall be controlled within the following limiting requirements.

2-1.01. **Cement Content.** The quantity of Portland cement in the concrete shall be not less than that indicated in the following table:
2-1.02. **Maximum Water-Cementitious Ratio.** The maximum water-cementitious ratio shall be 0.42 on a weight basis. If fly ash is used, the combined mass of cement plus fly ash shall be used to determine the water-cementitious materials ratio.

2-1.03. **Fly Ash Content.** At the option of Contractor, fly ash may be substituted for up to 25 percent of the portland cement, but not less than 15 percent, on the basis of 1.0 lbs of fly ash added for each lb [kilogram] of cement reduction.

2-1.04. **Coarse Aggregate.** The maximum nominal coarse aggregate size shall be not larger than 1 inch.

2-1.05. **Slump.** Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by Engineer, slump of concrete without a superplasticizer shall not exceed 4 inches]. Slump of concrete with a superplasticizer, or a midrange water reducer, shall not exceed 8 inches.

2-1.06. **Total Air Content.** The total volumetric air content of concrete after placement shall be 6 percent ±1 percent.

2-1.07. **Admixtures.** The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer’s recommendations. A water-reducing admixture and an air-entraining admixture shall be included in all concrete. A midrange water reducer or a superplasticizer may be used at Contractor’s option. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.

<table>
<thead>
<tr>
<th>Quantity of Cement (lb/yd$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse Aggregate Size</strong></td>
</tr>
<tr>
<td>from No. 4 Sieve to</td>
</tr>
<tr>
<td>3/8 in. 1/2 in. 3/4 in. 1 in.</td>
</tr>
<tr>
<td>600 580 560 535</td>
</tr>
</tbody>
</table>
2-1.10. **Strength.** The minimum acceptable compressive strengths, as determined by ASTM C39 with 6 inch diameter by 12 inch cylinders, shall be:

<table>
<thead>
<tr>
<th>Age</th>
<th>Minimum Compressive Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 days</td>
<td>3,375 psi</td>
</tr>
<tr>
<td>28 days</td>
<td>4,500 psi</td>
</tr>
</tbody>
</table>

2-2. **MATERIALS.**

- **Cement**
  ASTM C150, Type II or I/II, low alkali.

- **Fly Ash**
  ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.

- **Fine Aggregate**
  Clean natural sand, ASTM C33. Artificial or manufactured sand will not be acceptable.

- **Coarse Aggregate**
  Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.

- **Water**
  Potable.

- **Admixtures**
  - **Water-Reducing**
    ASTM C494, Type A or D.
  - **Air-Entraining**
    ASTM C260.
  - **Superplasticizing**
    ASTM C494, Type F or G.

- **Reinforcing Steel**
  - **Bars**
    ASTM A615, Grade 60, deformed.
  - **Welded Wire Fabric**
    ASTM A185 or A497.
  - **Bar Supports**
    CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connector (Couplers or Form Savers) Classified Type 2 per ACI 318. Use only where indicated on the drawings.

Forms

Plywood Product Standard PS1, waterproof, resin-bonded, exterior type, Douglas fir.

Lumber Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.

Form Coating Nonstaining and nontoxic after 30 days, VOC-compliant; Burke "Form Release (WB)", L&M Chemical "E-Z Strip", Nox-Crete "Form Coating", or Symons "Thrift Kote E".

Pre-Cure Finishing Aid Burke "Finishing Aid Concentrate", Euclid "Eucbar", L&M Chemical "E-Con", Master Builders "Confilm", or Sika "Sikafilm".

Polyethylene Film Product Standard PS17 or ASTM D 4397, 6 mils or thicker.


Membrane Curing Compound and Floor Sealer VOC – EPA ASTM C1315, Type I, Class A, maximum VOC 5.8 lb/gal, minimum 25 percent solids, acrylic, nonyellowing, unit moisture loss 0.40 kg/m² maximum in 72 hours.

2-3. PRELIMINARY REVIEW. The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to Engineer for review before concrete is placed.

2-4. FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be
substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.

Forms for pavement, curbs, or gutters shall be made of steel and shall be supported on thoroughly compacted earth. The top face of pavement forms shall not vary from a true plane more than 1/4 inch in 10 feet.

Forms shall be thoroughly cleaned and oiled before concrete is placed.

Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least 4 inches.

2-4.01. Form Ties. Form ties shall be of the removable end, permanently embedded body type, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders.

2-4.02. Edges and Corners. Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.

2-4.03. Form Removal. Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead, live, and construction loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

2-5. REINFORCEMENT. Reinforcement shall be accurately formed and positioned and shall be maintained in proper position while the concrete is being placed and compacted. Unless otherwise indicated on the drawings, the details of fabrication shall conform to ACI 315 and 318. In case of conflict, ACI 318 shall govern. Reinforcement shall be free from dirt, loose rust, scale, and contaminants. Mechanical connections shall be used only as indicated on the drawings.

2-6. BATCHING AND MIXING. Concrete shall conform to ASTM C94 and shall be furnished by an acceptable ready-mixed concrete supplier.

2-6.01. Consistency. The consistency of concrete shall be suitable for the placement conditions. Aggregates shall float uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.
2-6.02. **Delivery Tickets.** A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of the concrete supplier, the project name, the mix identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

**PART 3 - EXECUTION**

3-1. **PLACEMENT.** Contractor shall inform Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

Methods of conveying concrete to the point of final deposit and of placing shall prevent segregation or loss of ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Concrete shall be compacted by immersion-type vibrators, vibrating screeds, or other suitable mechanical compaction equipment. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3-2. **WATER STOPS.** Not used.

3-3. **FINISHING.** Recesses from form ties shall be filled flush with mortar. Fins and other surface projections shall be removed from all formed surfaces, except exterior surfaces that will be in contact with earth backfill.

Unless otherwise specified, unformed surfaces shall be screeded and given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.

Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color and the completed finish for unformed surfaces unless indicated otherwise.

**3-3.01. Troweling.** Exposed top surfaces of equipment bases and other surfaces designated on the drawings shall be steel trowel finished. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling
shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

3-3.02. Application of Pre-Cure Finishing Aid. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with a pre-cure finishing aid. The finishing aid shall form a monomolecular film on the surface of fresh, plastic concrete to retard evaporation.

Immediately following screeding, pre-cure finishing aid shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray finishing aid at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.

The sprayable solution shall be prepared as recommended by the manufacturer.

Under severe drying conditions, additional applications of finishing aid may be required following each floating or troweling, except the last finishing operation.

3-3.03. Sidewalks. Not used.

3-4. CURING. Concrete shall be protected from loss of moisture by water saturation or by membrane curing for at least 7 days after placement; however, when concrete is also being protected from low temperatures, the period of curing by saturation shall be 1 day less than the duration of the low temperature protection.

Water saturation shall be used on concrete which will be covered later with mortar or additional concrete. Water saturation or membrane curing compound may be used on all other concrete surfaces.

Water saturation of concrete surfaces shall begin as soon as possible after initial set. Unformed surfaces shall be covered with polyethylene film, tarpaulins, or sand to retain the water. Water shall be applied as often as necessary to keep the concrete saturated for the entire curing period. Acceptable methods of water curing are described in ACI 308.

Membrane curing compound shall be sprayed at a coverage rate of not more than 300 square feet per gallon. Unformed surfaces shall be covered with curing compound within 30 minutes after final finishing. If forms are removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces. Curing compound shall be suitably protected against abrasion during the curing period.
Concrete shall be protected against freezing for at least 8 days after placement.

3-5. **REPAIRING DEFECTIVE CONCRETE.** Defects in concrete surfaces shall be repaired to the satisfaction of Engineer. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges cut square to avoid feathering.

Concrete repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

3-6. **FIELD CONTROL TESTING.**

3-6.01. **Air Content.** An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Contractor shall provide all equipment and supplies necessary for the testing. Air content shall be determined in accordance with ASTM C231.

3-6.02. **Slump.** A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.

3-6.03. **Test Cylinders.** Compression test specimens shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and C39. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.

One set of 6 inch diameter by 12 inch concrete test cylinders shall be cast for each concrete pour. A set of test cylinders shall consist of four cylinders, two to be broken and to have compressive strengths averaged at 7 days, and two to be broken and to have compressive strengths averaged at 28 days. All concrete required for testing shall be furnished by, and at the expense of, Contractor.

The cured cylinders shall be tested by an independent testing laboratory at the expense of Owner.

End of Section
Section 03600

GROUT

PART 1 - GENERAL

1-1.  SCOPE.  This section covers procurement and installation of grout.  Unless otherwise specified, only nonshrink grout shall be furnished.

Epoxy grouting of anchor bolts, threaded rod anchors, and reinforcing bars is covered in the anchorage in concrete section.

1-2.  SUBMITTALS.  A letter of certification indicating the types of grout to be supplied and the intended use of each type shall be submitted in accordance with the Submittals Procedures section.

1-3.  DELIVERY, STORAGE, AND HANDLING.  Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2-1.  MATERIALS.

Nonshrink Grout

Precision cementitious grout with demonstrated non-shrinking properties, minimum 28 day compressive strength of 9000 psi; L&M "Crystex", BASF "Masterflow 928", Sika "SikaGrout 328", or Dayton Superior "Sure-Grip High Performance Grout".

Water

Clean and free from deleterious substances.

2-2.  CEMENTITIOUS GROUT.  Cementitious grout shall be furnished factory premixed so that only water is added at the jobsite.

2-3.  EPOXY GROUT.  Epoxy grout shall be used in lieu of cementitious grout when required by the equipment manufacturer for performance or warranty requirements. Epoxy grout products and installation procedures shall be submitted to Engineer for approval.
PART 3 - EXECUTION

3-1.  PREPARATION.  The concrete foundation to receive nonshrink grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.

3-2.  INSTALLATION.

3-2.01.  Mixing.  Grout shall be mixed in a mechanical mixer.  No more water shall be used than is necessary to produce a flowable grout.

3-2.02.  Placement.  Unless otherwise specified or indicated on the Drawings, grout under baseplates shall be 1-1/2 inches thick.  Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids.  Forms shall be provided where structural components of baseplates will not confine the grout.

3-2.03.  Edge Finishing.  In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set.  Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

3-2.04.  Curing.  Nonshrink grout shall be protected against rapid loss of moisture by covering with wet cloths or polyethylene sheets.  After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

End of Section
Section 05550

ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1-1. SCOPE. This section covers the procurement and installation of anchors in concrete. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods and reinforcing bars and expansion anchors.

1-2. GENERAL. Unless otherwise specified or indicated on the Drawings all anchors shall be cast-in-place anchor bolts or anchor rods, with forged heads or embedded nuts tack welded to the anchor rod and plate washers. Unless otherwise indicated, anchors in concrete for structural steel elements shall have a diameter of at least 3/4 inch and anchors for steel posts, as defined by AISC weighing less than 300 lbs, shall be not less than 5/8 inch.

Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials. Anchors in other locations and applications shall be as indicated on the Drawings.

Cast-In-Place Anchor Bolts and Anchor Rods

- Submerged locations: Stainless steel.
- Locations subject to splashing: Stainless steel.
- Buried locations: Stainless steel.
- Anchorage of structural steel columns: Galvanized steel.
- Other exterior locations: Galvanized steel.
- Other interior locations: Carbon steel.

Adhesive, Expansion, and Undercut Anchors

- Submerged locations: Stainless steel.
- Locations subject to splashing: Stainless steel.
- Buried locations: Stainless steel.
- Anchorage of structural steel columns: Stainless steel.
- Other exterior locations: Stainless steel.
Other interior locations Carbon steel.

Adhesive, expansion, and undercut anchors may be used instead of cast-in-place anchors only where specifically indicated or permitted on the Drawings or with the specific acceptance by Engineer.

1-3. SUBMITTALS. Data, catalog cuts, and International Code Council Evaluation Service (ICC-ES) reports indicating the manufacturer and types of adhesive anchors and expansion anchors to be supplied shall be submitted in accordance with the Submittals Procedures section.

If Contractor requests use of products other than those indicated herein, calculations prepared by a registered professional engineer using methods and procedures required by the building code will be required as part of the submittal package.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 - PRODUCTS

2-1. MATERIALS. Unless otherwise indicated on the drawings, materials shall be as indicated below.

Cast-In-Place Anchor Bolts and Anchor Rods

<table>
<thead>
<tr>
<th>Material</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon steel</td>
<td>ASTM F1554, Grade 36 with compatible nuts.</td>
</tr>
<tr>
<td>Galvanized steel</td>
<td>ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Bolts, ASTM F593, Alloy Group 1 or 2; nuts, ASTM F594, Alloy Group 1 or 2.</td>
</tr>
<tr>
<td>Flat Washers</td>
<td>ANSI B18.22.1; of the same material as anchor bolts and nuts.</td>
</tr>
</tbody>
</table>
Expansion Anchors in Concrete Products shall be single component anchors tested in accordance with ICC AC193, and shall have an ICC ES report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces. Hilti "Kwik-Bolt TZ", Powers Fasteners “Power-Stud+SD2”, Simpson “Strong-Bolt 2”.

Adhesive Anchors in Concrete Products shall be tested in accordance with ICC AC308, and shall have an ICC ES report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.

Threaded Rods and Nuts As recommended by the adhesive manufacturer; materials as indicated on the Drawings or in this specification.

Reinforcing Bars ASTM A615, Grade 60, deformed.

Reinforcing Bars, weldable ASTM A706, Grade 60, deformed.


2-2. ANCHORS.

2-2.01. Cast-in-Place Anchor Bolts and Anchor Rods. Cast-in-place anchor bolts and anchor rods shall be delivered in time to permit setting prior to the placing of structural concrete or masonry grout. Anchor sleeves shall not be used unless acceptable to Engineer. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.
2-2.02. **Adhesive and Expansion.** When adhesive or expansion anchors are indicated on the Drawings, only acceptable systems shall be used. Acceptable systems shall include only those systems and products specified or specifically indicated by product name on the Drawings. Alternative anchoring systems may be used only when specifically accepted by Engineer.

Unless otherwise required, single nuts and washers shall be furnished for adhesive and expansion anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

**PART 3 - EXECUTION**

3-1. **GENERAL.** Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before tightening of the nuts.

3-1.01. **Compliance With Manufacturer’s Instructions.** Post-installed anchors shall be installed in accordance with the manufacturer’s printed installation instructions and all applicable requirements of the ICC-ES report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer’s printed installation instructions, and the ICC-ES report installation requirements, Contractor shall notify Engineer for resolution.

3-1.02. **Special Inspection.** Special inspection requirements for cast-in-place and post-installed anchors shall be as indicated in the Structural Tests and Special Inspections section. Anchorage work shall be performed in a manner that allows the inspections to take place without adversely impacting the schedule.

3-2. **CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR RODS.** Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete. Contractor shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings. Threads, bolts, and nuts spattered with concrete or grout during placement shall be cleaned prior to final installation of the bolts and nuts.

Sleeves shall be filled with non-shrink grout.

3-3. **ADHESIVE ANCHORS.** Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer’s recommendations.
Anchors or bars shall be installed in holes hammer drilled into hardened concrete or masonry. Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

3-3.01. **Concrete Installation.** Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth that will develop the full tensile strength of the bar, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.

Adhesive anchors in concrete shall be installed under the following conditions.

- **Minimum Age of Concrete Prior to Anchor Installation:** 21 days.
- **Concrete Temperature Range:** Maximum short-term temperature 162 F, maximum long-term temperature 110 F.
- **Moisture Condition:** Dry concrete.
- **Type of Lightweight Concrete:** N/A
- **Hole Drilling and Preparation:** Hammer drill only.

Installation of adhesive anchors into concrete that are either horizontal or upwardly inclined shall be performed only by personnel certified by the ACI/CRSI Adhesive Anchor Installation Certification Program.

3-4. **EXPANSION ANCHORS.** Expansion anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

End of Section
Section 09940

PROTECTIVE COATINGS

PART 1 - GENERAL

1-1. SCOPE. This section covers field applied protective coatings, including surface preparation, protection of surfaces, inspection, and other appurtenant work for equipment and surfaces designated to be coated with heavy-duty maintenance coatings. Regardless of the number of coats previously applied, at least two field coats in addition to any shop coats or field prime coats shall be applied to all surfaces unless otherwise specified.

1-2. GENERAL. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this Specification and the coating manufacturer's recommendations.

1-2.01. Governing Standards. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following AWWA, ANSI, NACE, SSPC, NSF, and ASTM.

1-2.02. Delivery and Storage. All coating products shall be received and stored in accordance with the coating manufacturer's recommendations.

1-2.03. Coatings, Painting, and Linings Covered in Other Sections. Not used.

1-3. SUBMITTALS. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications, manufacturer's product data sheet and the completed Coating System Data Sheets, to Engineer for review and color selection. Each product data sheet shall include application temperature limits including recoat time requirements for the ambient conditions at the site, including temperatures up to 130°F. Requests for review submitted directly to Engineer by coating suppliers will not be considered.

When the proposed products will be in contact with treated or raw water in potable water treatment facilities, Contractor shall submit certifications that the proposed systems are in compliance with ANSI/NSF 61.

Contractor shall submit a Coating System Data Sheet for each separately identified surface in the Metal Surfaces Coating Schedule, Concrete and
Masonry Surfaces Coating Schedule, and the Miscellaneous Surfaces Coating Schedule that will be used in the Project, using the appropriate Coating System Data Sheet forms (Figures 1-09940 and 2-09940) at the end of this section. Each field coating system shall be acceptable to the coating material manufacturer.

Coating System Data Sheets shall be assigned a unique number with a prefix letter based on the following:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Surfaces</th>
<th>Fig.09940</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Iron and steel (coated entirely in field)</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>Iron and steel (shop primed)</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>Concrete and concrete block</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Equipment - submerged</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Equipment – nonsubmerged</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>Nonferrous metal</td>
<td>1</td>
</tr>
<tr>
<td>G</td>
<td>Galvanized</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>High temperature</td>
<td>1</td>
</tr>
<tr>
<td>P</td>
<td>PVC and FRP</td>
<td>1</td>
</tr>
</tbody>
</table>

Each coating system that will be applied entirely in the field shall be assigned only a prefix letter and no suffix letter. Figure1-09940 shall be submitted for each surface coated entirely in the field.

Each shop-applied coating system that includes one or more field applied coats shall be assigned both a prefix letter and suffix letter “F”. Figure 2-09940 shall be submitted for each surface having a shop applied coating and one or more field applied finish coats.

A separate Coating System Data Sheet shall be developed and submitted for each surface scheduled to be coated or variation or change in a coating system. The number identifying the surface and coating system shall be of the form A1₁ or A1₂-F. The subscript number shall be assigned by the Contractor so that each surface and coating system combination is uniquely identified. For example:

A1₁-F may be assigned to “Epoxy – one coat to metal curbs for skylights and power roof ventilators that have been shop primed.”

A2₁ may be assigned to “Epoxy – two coats to non-galvanized structural and miscellaneous steel exposed to view inside buildings.”
C2\textsubscript{1} may be assigned to “Epoxy – two coats to all concrete and concrete block in corrosive area (Except floors and surfaces scheduled to receive other coatings) which are exposed to view.”

C2\textsubscript{2} may be assigned to “Epoxy – two coats to walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment as indicated on the Drawings.”

For the epoxy and for aliphatic polyurethane, a total of not more than 15 custom colors (excluding deep tone or high-level colors) may be required. The manufacturer’s standard colors will be acceptable for all other coatings.

1-4. QUALITY ASSURANCE.

1-4.01. Coating System Data Sheet Certifications. The coating applicator and coating manufacturer shall review and approve in writing the coating manufacturer’s written recommendations for the coating system and the intended service. Any variations from the Specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer. The coating manufacturer shall observe the surface preparation, mixing, and application of the coating systems and submit a written report of his observations and any additional recommendations.

In addition to the requirements for all coating systems, the coating applicator and coating manufacturer shall develop and submit, in writing, the proposed detailed procedures for handling, storing, surface preparation, mixing, and application to verify compliance with this Specification and the coating manufacturer’s written recommendations. The procedures shall include copies of the coating manufacturer’s published recommendations and the proposed method for complying with these recommendations and these Specifications. Contractor, coating applicator, and coating manufacturer shall review and approve, in writing, the proposed detail procedures before they are submitted for review.

Contractor and coating manufacturer shall inspect coating application of the appropriate application methods.

PART 2 - PRODUCTS

2-1. ACCEPTABLE MANUFACTURERS.

2-1.01. Alternative Manufacturers. Universal primer, epoxy concrete filler and surface, epoxy enamel and aliphatic polyurethane coating systems shall be Tnemec, without exception. Alternative manufacturers will not be acceptable.
2-2. MATERIALS. All coatings shall be delivered to the job in original, unopened containers, with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.

All coatings shall conform to the air quality regulations applicable at the location of use. Coating materials that cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.

With the exception of heat resistant coatings, the coatings specified have been selected on the basis of the manufacturer's statement that the VOC content of the product is 2.8 lbs per gallon or less; however, it shall be the Contractor's responsibility to use only coating materials that are in compliance with the requirements of all regulatory agencies. Local regulations may require some coatings to have a lower VOC content than specified herein. The coatings specified may meet the VOC limits in the unthinned (as shipped) condition, but may exceed the limits if thinned according to the manufacturer's recommendations. In such case, the coatings shall not be thinned beyond the 2.8 lbs per gallon limit, and if the product cannot be thinned to suit the application method or temperature limits, another manufacturer's coating shall be used, subject to acceptance by Engineer.

Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with any previously applied coatings. Coatings used in successive field coats shall be produced by the same manufacturer. The first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats.

All coatings used on surfaces that will be in contact with potable or treated water shall be certified as being in compliance with ANSI/NSF 61. Coatings that cannot be so certified, whether or not specified by manufacturer and by product designation, shall not be used.

2-2.01 Primers.

Universal Primer (tie coat) Tnemec "Series 27 F.C. Typoxy".

2-2.02 Fillers and Surfacing. Not used.
2-2.03. **Intermediate and Finish Coatings.**

Epoxy (NSF certified systems)

- **Ferrous Metal Surfaces and Concrete Surfaces in Contact with Treated or Raw Water in Potable Water Facilities**
  - Tnemec "Series N140 Pota-Pox Plus "; immersion service.

- **Epoxy**
  - **Ferrous Metal Surfaces and Concrete Surfaces Other Than Floors**
    - Tnemec "Series N69 Hi-Build Epoxoline II".
  - **Aliphatic Polyurethane**
    - Tnemec "Series 1074 Endura-Shield II".

**PART 3 - EXECUTION**

3-1. **SURFACE PREPARATION.** All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss on previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.

Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic. When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer, and the edges of the repaired area shall be feathered by sanding or wire brushing to produce a smooth transition that will not be noticeable after the coating is applied. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.

3-1.01. **Galvanized Surfaces.** Galvanized surfaces shall be prepared for coating according to the instructions of the manufacturer of the epoxy. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.

3-1.02. **Ferrous Metal Surfaces.** Ungalvanized ferrous metal surfaces shall be prepared for coating by using one or more of the following cleaning procedures specified here-in: solvents (SSPC-SP1); abrasive blasting (SSPC-SP5, -SP10, -SP15).
SP6, or -SP7) power tools (SSPC-SP3 or -SP11); or hand tools (SSPC-SP2). Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other cleaning method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter. Tools which produce excessive roughness shall not be used.

All components of equipment that can be properly prepared and coated after installation shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation. Motors, drive trains, and bearings shall be protected during surface preparation in accordance with the equipment manufacturer’s recommendations.

All cut or sheared edges shall be ground smooth to a 1/8 inch minimum radius for all material 1/4 inch thickness and larger. For material thickness less than 1/4 inch all cut or sheared edges shall be ground smooth to a radius equal to 1/2 the material thickness. Grinding of rolled edges on standard shapes with a minimum radius of the 1/16 inch will not be required.

All ferrous metal surfaces shall have all welds ground smooth and free of all defects in accordance with NACE Standard SP0178, Appendix C, Designation C and sharp edges ground smooth, if not previously prepared in the shop. Instead of blending of the weld with the base metal as required by the NACE standard, it will be acceptable to furnish a welded joint that has a smooth transition of the weld to the base metal. All welds shall be ground smooth to ensure satisfactory adhesion of paint.

The cleaning methods and surface profiles specified herein are minimums, and if the requirements printed in the coating manufacturer’s data sheets exceed the limits specified, the value printed on the data sheets shall become the minimum requirement.

3-1.02.01. Ferrous Metal Surfaces – Non-immersion Service. Ferrous metal surfaces, including fabricated equipment, in non-immersion service shall be cleaned to the degree recommended by the coating manufacturer for surfaces to be coated with coal tar epoxy, epoxy, and heat-resistant coatings, except galvanized surfaces. Surface preparation of ferrous metal surfaces in non-immersion service shall consist of abrasive blast cleaning to SSPC-SP6, and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 2.0 mils.

3-1.02.02. Ferrous Metal Surfaces - Immersion Service. Surface preparation of ferrous metal surfaces in immersion service shall consist of abrasive blast
cleaning to at least SSPC-SP10 and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 3.5 mils.

3-1.03. **Concrete Surfaces**. Not used.

3-1.04. **Concrete Block Surfaces**. Not used.

3-1.05. **Copper Tubing**. All flux residue shall be removed from joints in copper tubing. Immediately before coating is started, tubing shall be wiped with a clean rag soaked in xylol.

3-1.06. **Plastic Surfaces**. All wax and oil shall be removed from plastic surfaces that are to be coated, including PVC and FRP, by wiping with a solvent compatible with the specified coating.

3-1.07. **Hardware**. Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

3-1.08. **Aluminum**. When a coating system is required, remove all oil or deleterious substance with neutral detergent or emulsion cleaner or blast lightly with fine abrasive.

3-1.09. **Stainless Steel**. When a coating system is required, surface preparation shall conform to the coating manufacturer's recommendations.

3-2. **MIXING AND THINNING**. Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.

Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3-3. **APPLICATION**. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be thoroughly dry and hard before the next coat is applied. Each coat shall be a different color, if available.
In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.

Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.

3-3.01. Priming. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of primer before application of the primer coat. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating.

Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the spot or touchup coating shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.

3-3.02. Epoxy. When used, epoxy shall be applied in accordance with the coating manufacturer’s recommendations, including temperature limitations and protection from sunlight until top-coated.

When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4-6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

3-3.03. Coal Tar Epoxy. Not used.

3-3.04. Film Thickness. The total coating film thickness including intermediate coats and finish coat, shall be not less than the following:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy</td>
<td></td>
</tr>
<tr>
<td>Surfaces with first coat of epoxy and final coat of aliphatic polyurethane</td>
<td>7 mils (5 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane).</td>
</tr>
</tbody>
</table>

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### Type of Coating

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surfaces with first and second coat of epoxy and final coat of aliphatic polyurethane</td>
<td>12 mils (10 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane)</td>
</tr>
<tr>
<td>Other surfaces (two coats)</td>
<td>10 mils</td>
</tr>
<tr>
<td>Immersion service (three coats)</td>
<td>15 mils</td>
</tr>
<tr>
<td>Other (one coat)</td>
<td>5 mils</td>
</tr>
<tr>
<td>Other (two coats)</td>
<td>10 mils</td>
</tr>
</tbody>
</table>

3-3.05. **Weather Conditions.** Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating.

Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer, or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

Coatings shall not be applied at temperatures higher than the maximum temperature recommended by the coating manufacturer. Where coatings are applied during periods of elevated ambient temperatures, Contractor and the coatings manufacturer shall be jointly responsible to ensure that proper application is performed including adherence to all re-coat window requirements. Precautions shall be taken to reduce the temperature of the surface application, especially for metal, at elevated temperatures above 100°F including shading application area from direct sunlight, applying coating in the evening or at night, and ventilating the area to reduce the humidity and temperature.

3-4. **REPAIRING FACTORY FINISHED SURFACES.** Factory finished surfaces damaged prior to acceptance by Owner shall be spot primed and recoated with materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.

3-5. **PROTECTION OF SURFACES.** Throughout the work Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors’ operations. Coatings spilled or spattered on adjacent surfaces which are not being coated at the time shall be immediately removed. Exposed concrete not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by Owner, coated with two coats of masonry coating.
3-6. **FIELD QUALITY CONTROL.** The following inspection and testing shall be performed: surface profile, visual inspection, and wet and dry film thickness testing. All inspection and testing shall be witnessed by Engineer.

3-6.01. **Surface Profile Testing.** The surface profile for ferrous metal surfaces shall be measured for compliance with the specified minimum profile. The surface profile for concrete shall comply with SSPC 13/NACE 6 Table 1 for severe service.

3-6.02. **Visual Inspection.** The surface of the protective coatings shall be visually inspected.

3.6.03. **Film Thickness.** Coating film thickness shall be verified by measuring the film thickness of each coat as it is applied and the dry film thickness of the entire system. Wet film thickness shall be measured with a gauge that will measure the wet film thickness within an accuracy of ±0.5 mil. Dry film thickness shall be measured in accordance with SSPC-PA 2.

3-6.04. **Spark Testing.** Not required.

3-6.05. **Adhesion Testing.** Not required.

3-7. **FIELD PRIMING SCHEDULE.** In general, steel and cast iron surfaces of equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field coated, including prime coat (if any). Galvanized, aluminum, stainless steel, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be:

<table>
<thead>
<tr>
<th>Surface To Be Primed</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment, surfaces to be coated with</td>
<td></td>
</tr>
<tr>
<td>Aliphatic polyurethane</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Epoxy</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Steel and cast iron, surfaces to be coated</td>
<td></td>
</tr>
<tr>
<td>with</td>
<td></td>
</tr>
<tr>
<td>Epoxy</td>
<td>Same as finish coats or</td>
</tr>
<tr>
<td></td>
<td>inorganic zinc.</td>
</tr>
<tr>
<td>Aluminum</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Galvanized</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Copper</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Plastic surfaces, including PVC and FRP</td>
<td>Same as finish coats.</td>
</tr>
</tbody>
</table>

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3-8. **FINISH COATING SYSTEMS.** The following schedule lists coatings systems and coating surface designations. See Article1-3 for a definition of the surface designations.

<table>
<thead>
<tr>
<th>No.</th>
<th>Finish Coating Systems</th>
<th>Coating Surface Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1.</td>
<td>Epoxy – One coat</td>
<td>X</td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy – Two coats</td>
<td>X</td>
</tr>
<tr>
<td>3.</td>
<td>Epoxy / NSF – Two coats</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Epoxy – Three coats</td>
<td>X</td>
</tr>
<tr>
<td>5.</td>
<td>Epoxy / NSF – Three coats</td>
<td>X</td>
</tr>
<tr>
<td>6.</td>
<td>Epoxy – First coat Aliphatic polyurethane – Finish coat</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Epoxy – First and second coat Aliphatic polyurethane – Finish coat</td>
<td>X</td>
</tr>
<tr>
<td>8.</td>
<td>Universal primer – First coat Aliphatic polyurethane – Finish coat</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Medium consistency coal tar – Two coats</td>
<td>X</td>
</tr>
<tr>
<td>10.</td>
<td>Coal tar epoxy – Two coats</td>
<td>X</td>
</tr>
</tbody>
</table>

3-8.01. **Surfaces Not To Be Coated.** Unless otherwise specified, the following surfaces shall be left uncoated:

- Exposed aluminum, except ductwork.
- Polished or finished stainless steel. Unfinished stainless steel, except flashings and counter flashings, shall be coated.
- Nickel or chromium.
- Galvanized surfaces, except items specifically noted.
- Rubber and plastics, except as specified.
- Exterior concrete.
- Surfaces specified to be factory finished.
3-8.02. **Shop Finishing.** Items to be shop finished include the following. Shop finishing shall be in accordance with the coating manufacturer’s recommendations.

a. Surfaces where blast cleaning cannot be or is not recommended to be performed in the field.
b. Other items as otherwise specified.

3-8.03. **Field Coating.** Items to be field coated include the following. Field coating shall be in accordance with the field priming schedule, the coating schedule, and the manufacturer’s recommendations.

a. Surfaces not indicated to be shop finished and surfaces where blast cleaning can be performed in the field.
b. Other items as otherwise specified.

3-9. **METAL SURFACES COATING SCHEDULE.**

<table>
<thead>
<tr>
<th>Surface To Be Coated</th>
<th>Finish Coating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-galvanized and galvanized structural and miscellaneous steel exposed to view</td>
<td>A2</td>
</tr>
<tr>
<td>inside buildings.</td>
<td></td>
</tr>
<tr>
<td>Unless otherwise specified, pumps, motors, speed reducers, and other machines and equipment exposed to view.</td>
<td>E8</td>
</tr>
<tr>
<td>Heating and air conditioning units, electrical equipment cabinets, and similar items and equipment (unless factory finished) exposed to view.</td>
<td>E8</td>
</tr>
<tr>
<td>Cast Iron and steel piping inside buildings, including piping to be insulated, valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.</td>
<td>A2</td>
</tr>
<tr>
<td>Copper pipe and tubing, including fittings and valves.</td>
<td>F1</td>
</tr>
<tr>
<td>Aluminum in contact with concrete.</td>
<td>F1</td>
</tr>
<tr>
<td>Aluminum and galvanized ductwork and conduit exposed to elements outdoors.</td>
<td>F6 or G6</td>
</tr>
</tbody>
</table>

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(8/20/2018 )
3-10. CONCRETE AND MASONRY SURFACES COATING SCHEDULE. Not used.

3-11. MISCELLANEOUS SURFACES COATING SCHEDULE. Not used.

3-12. PIPING IDENTIFICATION SCHEDULE. Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, marked with flow directional arrows, and color coded.

Piping scheduled to be color coded shall be completely coated with the indicated colors, except surfaces specified to remain uncoated shall include sufficiently long segments of the specified color to accommodate the lettering and arrows. All other piping shall be coated to match adjacent surfaces, unless otherwise directed by Engineer.

3-12.01. Location. Lettering and flow direction arrows shall be provided on pipe near the equipment served, adjacent to valves, on both sides of wall and floor penetrations, at each branch or tee, and at least every 50 feet in straight runs of pipe. If, in the opinion of Engineer, this requirement will result in an excessive number of labels or arrows, the number required shall be reduced as directed.

3-12.02. Metal Tags. Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, aluminum or stainless steel tags shall be provided instead of lettering. Tags shall be stamped as specified and shall be fastened to the pipe with suitable chains. Pipe identified with tags shall be color coded as specified.

3-12.03. Lettering. Lettering shall be painted or stenciled on piping or shall be applied as snap-on markers. Snap-on markers shall be plastic sleeves, Brady "Bradysnap-On B-915", Seton "Setmark", or equal. Letter size shall be as follows:

<table>
<thead>
<tr>
<th>Outside Diameter of Pipe or Covering</th>
<th>Minimum Height of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8 inch and smaller</td>
<td>Metal tags -1/4 inch</td>
</tr>
<tr>
<td>3/4 to 4 inches</td>
<td>3/4 inch</td>
</tr>
<tr>
<td>5 inches and larger</td>
<td>2 inches</td>
</tr>
</tbody>
</table>

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(Project 192389.3100 )          
(8/20/2018 )
3-12.04. **Color Coding and Lettering.** All piping shall be color coded. The color coating shall be the standard for the City of Sioux City or the Iowa Department of Natural Resources (IDNR).

Numerals at least 2 inches high shall be painted on or adjacent to all accessible valves, pumps, flowmeters, and other items of equipment which are identified on the Drawings or in the Specifications by number.

End of Section
<table>
<thead>
<tr>
<th>SURFACE DESCRIPTION</th>
<th>SYSTEM NO. -</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SURFACE PREPARATION DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Solvent SSPC-SP1</td>
</tr>
<tr>
<td>☐ Ferrous Metal Nonimmersion SSPC-SP6</td>
</tr>
<tr>
<td>☐ Ferrous Metal Immersion</td>
</tr>
<tr>
<td>☐ SSPC-SP10</td>
</tr>
<tr>
<td>☐ SSPC-SP-5</td>
</tr>
<tr>
<td>☐ Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COATING</th>
<th>DFT mils [µm]</th>
<th>MANUFACTURER AND PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Coat (Primer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total System</td>
<td></td>
<td>Not less than minimum thickness specified.</td>
</tr>
</tbody>
</table>

Notes: (Attached if needed.)

Project: City of Sioux City, Iowa
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Project 192389.3100

Coatings Manufacturer: Initials ____
Painting Applicator: Initials ____

BLACK & VEATCH | COATING SYSTEM DATA SHEET | Fig 1-09940
<table>
<thead>
<tr>
<th>COATING</th>
<th>DFT mils [µm]</th>
<th>MANUFACTURER AND PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shop (Primer)</td>
<td></td>
<td>(Identify Product/Type)</td>
</tr>
<tr>
<td>Touchup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finish Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total System</td>
<td></td>
<td>Not less than minimum thickness specified.</td>
</tr>
</tbody>
</table>

Notes: (Attached if needed.)

Project: City of Sioux City, Iowa  
520 Booster Station Facility Improvements  
Project 192389.3100

Coatings Manufacturer: Initials ______

Painting Applicator: Initials ______

BLACK & VEATCH  
COATING SYSTEM DATA SHEET  
Fig 2-09940
Section 11060

EQUIPMENT INSTALLATION

PART 1 - GENERAL

1-1. SCOPE. This section covers general installation requirements of new equipment that has been purchased by Contractor as part of this Work. Equipment specific installation requirements are covered in the equipment sections.

1-2. GENERAL. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. Coordination. When manufacturer's field services are provided by the equipment manufacturer, Contractor shall coordinate the services with the equipment manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer's field services furnished by others.

Flanged connections to equipment including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section.

1-3. DELIVERY, STORAGE, AND HANDLING.

1-3.01. Storage. Upon delivery, all equipment and materials shall immediately be stored and protected by Contractor in accordance with the Product Storage and Handling Requirements section until installed in the Work. Equipment shall be protected by Contractor against damage and exposure from the elements. At no time shall the equipment be stored on or come into contact with the ground, grass, or any other type of vegetation. Contractor shall keep the equipment dry at all times.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials shall be as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grout</td>
<td>As specified in the Grouting section.</td>
</tr>
<tr>
<td>Anti-Seize thread lubricant for SS bolts</td>
<td>As specified in the Anchorage in Concrete section.</td>
</tr>
</tbody>
</table>
PART 3 - EXECUTION

3-1. INSTALLATION. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results as specified in the Startup Requirements section.

Each equipment unit shall be leveled, aligned, and shimmed into position. Installation procedures shall be as recommended by the equipment manufacturer and as required herein. Shimming between machined surfaces will not be permitted.

Anti-seize thread lubricant shall be liberally applied to the threaded portion of all stainless steel bolts during assembly. For equipment installed in drinking water facilities, the anti-seize lubricant shall meet requirements of NSF-61.

When specified in the equipment sections, the equipment manufacturer will provide installation supervision and installation checks. For installation supervision, the manufacturer’s field representative will observe, instruct, guide, and direct Contractor's erection or installation procedures as specified in the equipment specifications. For installation checks, the manufacturer’s field representative will inspect the equipment installation immediately following installation by Contractor, and observe the tests indicated in the Startup Requirements section. The manufacturer’s representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

All equipment shall be protected after installation, prior to final acceptance by Owner. Protection provisions shall be as recommended by the manufacturer, and shall include provisions to prevent rust, mechanical damage, and foreign objects entering the equipment.

3-2. STARTUP AND TESTING. Startup requirements, and tests associated with startup shall be as indicated in the Startup Requirements section. Other field tests shall be as indicated in the specific equipment sections. Startup and tests required shall occur in the order listed in the following paragraphs. Tests shall not begin until any installation supervision and installation checks by the equipment manufacturer have been completed, except where noted below.

3-2.01. Preliminary Field Tests. Preliminary field tests shall be conducted on all equipment by Contractor as indicated in the Startup Requirements section. When an installation check is specified in the equipment sections, the equipment manufacturer's representative will participate in these tests to the extent described in the Startup Requirements section and in the equipment sections.
3-2.02. **Field System Operation Tests.** Field system operation tests shall be conducted on all equipment by Contractor as indicated in the Startup Requirements section. When an installation check is specified in the equipment sections, the equipment manufacturer’s service personnel will participate in these tests to the extent described in the Startup Requirements section and in the equipment sections.

3-2.03. **Field Demonstration Tests.** Field demonstration tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

3-2.04. **Field Performance Tests & Distribution Tests.** Field performance tests or distribution tests will be conducted by the equipment manufacturer on equipment as indicated and as specified in the equipment sections.

3-2.05. **Field Baseline Performance Tests.** Field baseline performance tests shall be conducted by Contractor on the equipment indicated in the equipment sections, and the tests shall be performed as indicated. When indicated in the equipment sections, the equipment manufacturer will participate in these tests. This test shall not be considered an acceptance test, but rather a test to determine initial performance curves and efficiency just prior to the equipment entering service.

End of Section
HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of single-stage, horizontal, split case, double suction centrifugal pumping units.

Pump designation. Booster Pumps
Number of pumps. 2
Pump tag numbers. P-1, P-2
Pump location. 520 Booster Station

Each pumping unit shall be complete with a pump, electric motor, coupling, coupling guard, anchor bolts, and other appurtenances specified or otherwise required for proper operation, all mounted on a common baseplate.

1-2. GENERAL. Equipment furnished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer. Hydraulic considerations and definition of terms shall be as set forth in the Hydraulic Institute Standards.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Tagging. Each item of equipment and each part shipped separately shall be tagged and identified with indelible markings for the intended service. Tag number shall be clearly marked on all shipping labels and on the outside of all containers.

1-2.03. Power Supply. Unless otherwise indicated, power supply to the equipment shall be 480 volts, 60 Hz, 3 phase.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete fabrication and assembly drawings, together with detailed specifications and data covering materials, drive unit, parts, devices, and accessories forming a part of the equipment furnished, shall
be submitted in accordance with the Submittals section. The data and specifications for each unit shall include, but shall not be limited to, the following:

**Pumps**
- Name of manufacturer.
- Type and model.
- Tag number.
- Pump location.
- Rotative speed.
- Size of suction nozzle.
- Size of discharge nozzle.
- Net weight of pump only.
- Net weight with baseplate and couplings.
- Complete performance curves showing capacity versus head, NPSH required, pump efficiency, wire-to-water efficiency, and pump input power.
- Data on coupling.
- Data on shop painting.

**Complete Pumping Unit**
- Max overall dimensions.
- Total weight.
- Detailed fabrication drawings
- Base and anchor bolt details.

**Motors**
- As specified in the General Purpose Induction Motors section.

1-3.02. **Operation and Maintenance Data and Manuals.** Adequate operation and maintenance information shall be supplied as required in the Submittals section. Operation and maintenance manuals shall be submitted in accordance with the Submittals section. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1-4. **QUALITY ASSURANCE.**

1-4.01. **Balance.** All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the unfiltered vibration velocity, as measured at any point on the machine including the motor, shall not exceed the maximum vibration limits of the governing standard unless otherwise required.

At any operating speed, the ratio of rotative speed to the critical speed of a unit or its components shall be less than 0.8 or more than 1.3.
1-4.02. **Efficiency Evaluation.** If the efficiency, as determined by the shop test, is below the specified minimum efficiency, Owner may, at his option, reject the unit.

1-5. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

1-6. **SPARE PARTS AND ACCESSORIES.** The following spare parts and accessories shall be furnished in substantial wooden boxes with identifying labels and delivered to the vicinity of the project site or the Owner as directed:

<table>
<thead>
<tr>
<th>Spare Parts</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical seals.</td>
<td>One set</td>
</tr>
<tr>
<td>Complete sets of pump bearings.</td>
<td>One set</td>
</tr>
<tr>
<td>Complete sets of wearing rings.</td>
<td>One set</td>
</tr>
<tr>
<td>Complete sets of shaft sleeves</td>
<td>One set</td>
</tr>
<tr>
<td>Complete sets of gaskets and seals.</td>
<td>One set</td>
</tr>
<tr>
<td>Flexible coupling.</td>
<td>One</td>
</tr>
<tr>
<td>Bearings and seals of drive motor.</td>
<td>One set</td>
</tr>
</tbody>
</table>

1-7. **ACCEPTABLE MANUFACTURERS.** The pumps shall be the product of Pentair (Fairbanks Nijhuis), Flowserve, ITT/Goulds or Patterson, without exception.

**PART 2 - PRODUCTS**

2-1. **SERVICE CONDITIONS.** All pumping units will be installed in the lower level of the 520 Booster Station as indicated on the Drawings and will pump potable water from the Grandview Service Level to the Morningside Service Level. All pumps will operate singly or in combination with other pumping units as operating conditions dictate. Pump operation will be locally controlled or remotely controlled through the Control System.

Each pump unit is to be designed for installation and disassembly within the structure utilizing the existing 1 ton monorail.

The pumping units shall be constant speed.
The pumping units shall be suitable for the following service conditions:

<table>
<thead>
<tr>
<th>Seismic Zone</th>
<th>See Meteorological and Seismic Design Criteria section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of environmental exposure.</td>
<td>Indoor</td>
</tr>
<tr>
<td>Pumps start and stop against a closed valve.</td>
<td>No</td>
</tr>
<tr>
<td>Site elevation.</td>
<td>1095 ft</td>
</tr>
</tbody>
</table>

Parts shall be interchangeable between units of similar size and capacity to extent practical.

All equipment furnished shall be designed to meet all specified conditions and to operate satisfactorily at this elevation.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. Pumping units shall be designed for the operating conditions as follows:

<table>
<thead>
<tr>
<th>Pump tag numbers.</th>
<th>P-1, P-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated head.</td>
<td>200 ft</td>
</tr>
<tr>
<td>Capacity at rated head.</td>
<td>2,085 gpm</td>
</tr>
<tr>
<td>Operating head range for full speed continuous operation.</td>
<td>125 to 220 ft</td>
</tr>
<tr>
<td>Minimum shutoff head.</td>
<td>223 Ft</td>
</tr>
<tr>
<td>Maximum nominal pump speed.</td>
<td>1800 rpm</td>
</tr>
<tr>
<td>Maximum power required at pump input shaft at any point from minimum operating head to shutoff head.</td>
<td>170 bhp</td>
</tr>
<tr>
<td>Efficiency.</td>
<td>70 %</td>
</tr>
<tr>
<td>Type of efficiency indicated.</td>
<td>Wire-to-Water</td>
</tr>
<tr>
<td>Efficiency calculated at.</td>
<td>Rated head</td>
</tr>
</tbody>
</table>
### Pump Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump tag numbers.</td>
<td>P-1, P-2</td>
</tr>
<tr>
<td>Pump designed for reverse rotation.</td>
<td>No</td>
</tr>
<tr>
<td>Minimum NPSHA at rated head.</td>
<td>268 ft</td>
</tr>
<tr>
<td>Maximum suction pressure.</td>
<td>116 psi</td>
</tr>
<tr>
<td>Maximum “A” rated weighted noise at 3 ft.</td>
<td>89 dBa</td>
</tr>
<tr>
<td>Maximum unfiltered vibration velocity.</td>
<td>HIS in/s</td>
</tr>
<tr>
<td>Pump rotation as viewed from driven end.</td>
<td>See drawings</td>
</tr>
<tr>
<td>Minimum pump suction nozzle size.</td>
<td>10 in</td>
</tr>
<tr>
<td>Minimum pump discharge nozzle size.</td>
<td>6 in</td>
</tr>
</tbody>
</table>

All specified conditions shall be at rated speed, unless otherwise indicated.

Overall (wire-to-water) efficiency for constant speed pumps shall include losses in the pump and motor.

The minimum hydrostatic test pressure shall be 1.5 times shutoff head plus max suction pressure.

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at design suction submergences. The design performance shall be based on a wearing ring diametral clearance of not less than 1 mil per inch of wearing ring diameter, or 12 mils total, whichever is greater.

2-3. MATERIALS. Each pump shall be cast iron, bronze fitted, using the following materials:

- **Casing:** Cast iron, ASTM A48.
- **Wearing Ring:** Bronze, ASTM B505-952.

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Impeller Bronze, ASTM B148.
Impeller Wearing Ring Bronze, ASTM B505-954.
Shaft Carbon steel, AISI 1045.
Shaft Sleeve Bronze, ASTM B505-954.
Stuffing Box Hardware Corrosion-resistant metal.
Mechanical Seal Durametallc "Type RO" or John Crane "Type 1".
Bearings Antifriction.
Drive Shaft Coupling Gear Type; All metal, oil or grease filled; gear type.
Baseplate Cast iron or fabricated steel.
Rust-preventive compound As recommended by manufacturer.

2-4. PUMP CONSTRUCTION.

2-4.01. Casing. The upper and lower casing halves shall be flange-bolted and doweled together with tapered dowels. The upper half casing flange shall have tapped holes for jacking screws and lifting lugs or eyebolts. Supporting feet, bearing arms, and nozzles shall be either cast integrally with or bolted and doweled to the lower half casing. Pipe tapped openings shall be provided for draining, priming, and venting the casing and for draining stuffing box leakage. A nipple with an isolation ball valve shall be provided on the casing vent tap. The vent shall be directed towards the floor outside the limits of the pumping unit.

For pumping units driven by 100 hp or larger motors, pump feet shall be provided for bolting and doweling to a baseplate.

For stuffing box lubrication water connections, suitably valved connecting lines or passages shall be provided on the upper half casing leading from the discharge volute to the stuffing box for lubricating the stuffing boxes with the liquid being pumped.

2-4.02. Impeller. The impeller shall be a one-piece casting completely machined on all exterior surfaces and statically balanced. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity.

The impeller shall be keyed to the shaft and positively held in the center of the discharge volute.
2-4.03. **Shaft and Shaft Sleeves.** The shaft shall be completely machined. If the shaft is more than 2-1/2 inches in diameter, it shall be tapered at the coupling end. Deflection at the stuffing box shall not exceed 0.002 inch at any operating head.

The shaft shall be provided with sleeves extending from the impeller through each stuffing box. Each sleeve shall be positively secured to the shaft and shall be sealed to prevent leakage between the shaft and the sleeve. After assembly on the shaft, total runout shall not exceed 0.002 inch.

2-4.04. **Wearing Rings.** Renewable wearing rings shall be provided in the casing and on the impeller. The casing ring shall be positively locked against rotation in the lower half casing. The impeller ring shall be locked against rotation.

2-4.05. **Stuffing Box.** The stuffing boxes shall each contain a single mechanical seal. A lubrication water connection shall be provided at each stuffing box.

2-4.06. **Seal Water Station.** Not Used.

2-4.07. **Bearings.** Bearings may be either grease or oil lubricated antifriction type. The outboard bearing shall carry both radial and axial loads imposed by the pump. The inboard bearing shall carry the radial loads imposed by the pump and drive unit.

Antifriction bearings shall have an AFBMA L_{10} Life Rating of 40,000 hours at specified operating conditions. The pump shaft speed shall not exceed the limits specified by the bearing manufacturer.

Bearing housings shall be designed to maintain shaft alignment and ensure long bearing and lubricant life. Housings shall have labyrinth type running clearance designed to effectively retain the lubricant and keep out contaminants. Ample clearance for stuffing box maintenance shall be provided between the bearing housings and the stuffing box glands.

2-4.08. **Flexible Coupling.** The pump coupling shall be sized for continuous operation at full load and at maximum rpm when the misalignment is within the manufacturer’s tolerance limit. Coupling design shall permit removal of the pump rotating element without disconnecting the piping, moving the drive unit, or causing axial movement of the coupling halves on the shafts.

Couplings for motors with sleeve type bearings shall have a limited end float feature. A suitable service factor shall be used when the pump is driven by an internal combustion engine.
Flexible couplings shall be gear type.

2-4.09. Equipment Bases. Each unit and its drive assembly shall be supported on a single baseplate of neat design. When the motor weight exceeds 1,000 lbs; baseplates shall be provided with adequate openings to facilitate grouting. Other equipment base requirements are specified in the General Equipment Stipulations.

2-5. ACCESSORIES. Each pump shall be provided with lifting eyebolts or lugs, plugged gauge cock connections at the suction and discharge flanges, tapped and plugged openings for casing and bearing housing vents and drains, and appropriate fittings for adding bearing lubricant. Grease lubricated units shall be provided with a means of venting the casing. Oil lubricated units shall be provided with constant level oilers or with sight glasses arranged to indicate operating and static oil levels.

2-5.01. Bearing Temperature Gauge. Not Used.


2-5.03. Resistive Temperature Devices (RTDs). Not Used.

2-6. DRIVE UNITS.

2-6.01. Electric Motors. The electric motors shall be designed as specified in General Purpose Induction Motors section.

2-7. SHOP TESTS. Each pump shall be tested at the factory for capacity, power requirements, and efficiency at specified rated head, evaluated head, shutoff head, operating head extremes, and at as many other points as necessary for accurate performance curve plotting. All tests and test reports shall be made in conformity with the requirements and recommendations of the Hydraulic Institute Standards. Acceptance testing shall be Level A, with no minus tolerance or margin allowed.

The pumping unit shall be shop tested with the motor to be installed in the work.

For pumping units 100 horsepower and larger, a certified test report shall be prepared. Five certified copies of a report covering each test shall be prepared by the pump manufacturer and delivered to Engineer not less than 10 days prior to the shipment of the equipment from the factory. The report shall include data and test information as stipulated in the Hydraulic Institute Standards, copies of the test log originals, test reading to curve conversion equations, and certified performance curves. The curves shall include head, pump input power, pump efficiency, and wire-to-water efficiency (when specified), rpm, and shop test.
NPSH available, plotted against capacity. The curves shall be easily read and plotted to scales consistent with performance requirements, with all test points clearly shown.

PART 3 - EXECUTION

3-1. INSTALLATION. Each pumping unit shall be installed in accordance with the Equipment Installation section.

Couplings shall be realigned after grouting. Final coupling misalignment shall be within one-half of the coupling manufacturer's allowable tolerance.

3-2. FIELD QUALITY CONTROL.

3-2.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the contract price.

3-2.02. Installation Supervision. The equipment manufacturer shall furnish a qualified field installation supervisor during the equipment installation.

All costs for these services shall be included in the contract price.

Manufacturers' installation supervisor shall observe, instruct, guide, and direct the installing contractor's erection or installation procedures. The equipment manufacturer will be provided with written notification 10 days prior to the need for such services.

End of Section
DIVISION 13
SPECIAL CONSTRUCTION
PART 1 – GENERAL

1-1. SCOPE. This section covers the furnishing and installation of an instrumentation system designated as the Facility Control System.

The system shall be furnished as specified, complete with all software, input/output hardware, instrumentation, and all devices, accessories, appurtenances, testing, and training necessary for proper operation.

The system shall include the installation of new two new pumps at 520 Booster Station. The existing PLC enclosures shall remain in place. New input/output wiring shall be routed from new starters to be installed in existing MCC buckets at the 520 Booster Station. The existing wiring shall be pulled and replaced for the new suction and discharge pressure transmitters and flow metering transmitters to be installed at the facility. The existing conduit shall be extended and/or replaced to accommodate the I/O signal wiring for the new instrumentation. The I/O for the new pumps and instrumentation shall be landed on the existing point assignments for the signals they are replacing. New current transformers shall be provided for each pump. Transducers shall be provided and installed in the existing PLC enclosure and MCC buckets as necessary to provide a 4-20 mA signal input for each pump. An additional digital input shall be wired and configured for the flow switch to be installed in the new pressure relief piping.

In addition, the System Supplier shall coordinate, modify and configure the existing HMI screens to accommodate the facility upgrades.

1-1.02. Associated Sections. This section also includes the equipment and services specified in the following sections.

Section 13561   PANEL MOUNTED INSTRUMENTS
Section 13562   FLOW INSTRUMENTS
Section 13563   PRESSURE AND LEVEL INSTRUMENTS
Section 13566   MISCELLANEOUS INSTRUMENTS
1-2. **GENERAL.** Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. **General Equipment Stipulations.** The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. **Drawings.** The Drawings indicate locations and arrangements of equipment and may include installation details and block and one-line diagrams showing connections and interfaces with other equipment. The input/output (I/O) lists are attached as an appendix to this section.

Principal components of the instrumentation systems shall be as indicated on the P&ID drawings and instrument device schedule attached to this section.

1-2.03. **Codes, Permits and Agency Approvals.** All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Where mandated by codes, panels, assemblies, materials, and equipment shall be listed by Underwriters’ Laboratories. Contractor shall, as part of their work, arrange for and obtain all necessary permits, inspections, and approvals by the authorities having local jurisdiction of such work. This shall include any third-party inspections and testing of panels and equipment.

1-2.04. **Supplier’s Qualifications.** Equipment and software furnished under this section and under other related sections listed in the Scope paragraph above shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Supplier. The System Supplier shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Contractor shall utilize the services of the System Supplier to coordinate all control system related items, to check-out and calibrate instruments, and to perform all testing, training, and startup activities specified to be provided.

The System Supplier shall have the following minimum qualifications:

- The supplier shall maintain a design office staffed with qualified technical design personnel.
• The supplier shall maintain competent and experienced service personnel to service the hardware and software furnished for this project.
• The supplier shall have as a minimum 5 years of experience in the design, coordination and supply of computer-based monitoring, control, and data acquisition systems.

1-2.05. Coordination. Systems supplied under this section shall be designed and coordinated by System Supplier for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications, under other contracts, and, where applicable, with related existing equipment. All equipment shall be designed and installed in full conformity with the Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, and the manufacturer of the related equipment.

1-2.06. Related Equipment and Materials. Related equipment and materials may include, but will not be limited to, instrumentation, motor controllers, valve actuators, chemical feeders, analytical measuring devices, conduit, cable, and piping as described in other sections or furnished under other contracts.

1-2.07. Device Tag Numbering System. All devices shall be provided with permanent identification tags. The tag numbers shall agree with System Supplier’s equipment drawings and shall be as close as practical to the tag numbers used on the Drawings and device schedules. All field-mounted transmitters and devices shall have stamped stainless steel identification tags. Panel, subpanel, and rack-mounted devices shall have laminated phenolic identification tags securely fastened to the device. Hand-lettered or tape labels will not be acceptable.

1-3. GENERAL REQUIREMENTS. The drawings and specifications indicate the extent and general arrangement of the systems. If any departures from the Drawings or Specifications are deemed necessary by System Supplier, details of such departures and the reasons shall be submitted to Engineer for review with or before the first stage submittal. No departures shall be made without prior written acceptance.

The specifications describe the minimum requirements for hardware and software. Where System Supplier’s standard configuration includes additional items of equipment or software features not specifically described herein, such equipment or features shall be furnished as a part of the system and shall be warranted as specified herein.
1-3.01. **Governing Standards.** Equipment furnished under this section shall be designed, constructed, and tested in accordance with IEEE 519, ANSI C37.90, FCC Part 15 - Class A, and NEMA ICS-1-109.60.

1-3.02. **Dimensional Restrictions.** Layout dimensions will vary between manufacturers and the layout area indicated on the Drawings is based on typical values. The System Supplier shall review the Drawings, the manufacturer’s layout drawings and installation requirements, and make any modifications requisite for proper installation subject to acceptance by Engineer. At least three feet of clear access space shall be provided in front of all instrumentation and control system components.

1-3.03. **Workmanship and Materials.** System Supplier shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except for testing.

1-3.04. **Corrosive Fluids.** All parts which are exposed to corrosive conditions shall be made from corrosion resistant materials. System Supplier shall submit certification that the instrument manufacturer approves the selection of materials of primary elements that are in contact with the specified process fluid to be inert to the effects of the process fluid.

1-3.05. **Appurtenances.** Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, and isolation devices shall be furnished as needed for proper performance of the equipment.

1-3.06. **Programming Devices.** A programming or system-configuring device shall be provided for systems that contain any equipment that requires such a device for routine calibration, maintenance, and troubleshooting. The programming device shall be complete, newly purchased for this project, and shall be in like-new condition when turned over to Owner at completion of startup.

1-4. **SUBMITTALS.** Complete dimensional, assembly, and installation drawings, wiring and schematic diagrams; and details, specifications, and data
covering the materials used and the parts, devices and accessories forming a part of the system furnished, shall be submitted in accordance with the submittals section. Submittal data shall be grouped and submitted in three separate stages. The submittal for each stage shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Equipment tag numbers or identifications used on the Drawings shall be referenced where applicable.

1-4.01. **First Stage Submittal.** The first stage submittal shall include the following items.

   a. A detailed list of any exceptions, functional differences, or discrepancies between the system proposed by System Supplier and this specification.

   b. Product catalog cut sheets on all hardware and software items, clearly marked to show the model number, optional features, and intended service of each device.

   c. A brief, concise description of the proposed system, including major hardware and software components and personnel training.

   d. A block diagram or schematic drawing showing the principal items of equipment furnished, including model numbers, and their interrelationships.

   e. Drawings showing floor and wall space or desktop area requirements for all equipment items, including allowances for door swings and maintenance access.

   f. Environmental and power requirements, including heat release information for each equipment item.

   g. Standard field termination drawings for all process input/output equipment, showing typical terminations for each type of point available in the system.

   h. A copy of the proposed software licenses for all software associated with the system.

   i. Outline for training classes.

   j. Additional Requirements identified in other Division 13 sections.

1-4.02. **Second Stage Submittal.** Before any equipment is released for shipment to the site and before factory testing is scheduled, the following data shall be submitted.
At System Supplier’s option, the first and second stage submittals may be combined.

a. Detailed functional descriptions of all software modules specified and furnished as part of System Supplier’s standard system. The descriptions shall be identified with the applicable specification paragraph.

b. Complete panel fabrication drawings and details of panel wiring, piping, and painting. Panel and subpanel drawings shall be to scale and shall include overall dimensions, metal thickness, door swing, mounting details, weight, and front of panel arrangement to show general appearance, with spacing and mounting height of instruments and control devices.

c. Wiring and installation drawings for all interconnecting wiring between components of the system and between related equipment and the equipment furnished under this section. Wiring diagrams shall show complete circuits and indicate all connections. If panel terminal designations, inter-device connections, device features and options, or other features are modified during the fabrication or factory testing, revised drawings shall be submitted before shipment of the equipment to the site.

d. Review of drawings submitted prior to the final determination of related equipment shall not relieve System Supplier from supplying systems in full compliance with the specific requirements of the related equipment.

e. Input/output listings showing point names, numbers, and addresses. Input/output identification numbers from the contract documents shall be cross-referenced in this submittal.

f. Proposed lesson plans or outlines for all training courses specified herein, including schedule, instructors' qualifications and experience, and recommended prerequisites.

g. Standard system engineering and user manuals describing the use of the system and application programming techniques for modifying the existing operator interface terminal (OIT) graphics, database, and adding new process I/O nodes to the system.

h. Additional Requirements identified in other Division 13 sections.

1-4.03. Third Stage Submittal. Complete system documentation, in the form of Operation and Maintenance Manuals, shall be submitted before the commencement of field acceptance testing. Operation and Maintenance Manuals shall include complete instruction books for each item of equipment and software
furnished. Where instruction booklets cover more than one specific model or range of device, product data sheets shall be included which indicate the device model number and other special features. A complete set of “as-built” wiring, fabrication, and interconnection drawings shall be included with the manuals. If field-wiring modifications are made after these drawings are submitted, the affected drawings shall be revised and resubmitted. Additional requirements are identified in other Division 13 specification sections.

1-5. PREPARATION FOR SHIPMENT. All electronic equipment and instruments shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements, shall be kept dry at all times, and shall not be exposed to adverse ambient conditions.

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted surfaces that are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Each shipment shall include an appropriate shipping list that indicates the contents of the package, including the specific instrument tags. The shipping list shall be accessible without exposing the instruments to the atmosphere. The shipping list shall also contain any cautionary notes regarding storage of the instruments, including requirements to protect the instrument from static discharge, desensitizing chemicals (solvents, paints, etc.), or ambient atmospheric conditions.

Individual instruments shall be appropriately tagged or labeled to positively identify the device. All identification shall be visible without the need to unpack the instrument from its protective packaging.

Instrument shipment and storage requirements shall be coordinated with Engineer or Owner prior to shipment. System Supplier shall provide adequate storage and be ready to accept the shipment before shipping any equipment to the site. Additional shipping and storage requirements shall be as detailed in the individual instrument specifications.

Components which are shipped loose due to transportation limitations shall be assembled and disassembled by the manufacturer prior to shipment to assure that all components fit together and are adequately supported.
1-6. **DELIVERY, STORAGE, AND SHIPPING.** Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

1-7. **SPARE PARTS.** Spare parts and consumable items are specified in other sections.

1-7.01. **Packaging.** All spare parts shall be delivered to Owner before final acceptance of the system. Packaging of spare parts shall provide protection against dust and moisture and shall be suitable for storage. Circuit boards and other electronic parts shall be enclosed in anti-static material. All packages shall be clearly marked with the manufacturer’s name, part number or other identification, date of manufacture, and approximate shelf life.

1-7.02. **Replacement.** System Supplier may utilize spare parts and supplies during system installation, debugging, startup, or training, but shall restore all such materials and supplies to the specified quantities before final acceptance of the systems.

**PART 2 - PRODUCTS**

2-1. **GENERAL REQUIREMENTS.** All equipment furnished under each section referenced in SCOPE is a part of this section and shall be selected by System Supplier for its superior quality and intended performance. Equipment and materials used shall be subject to review.

2-1.01. **Standard Products.** The systems furnished shall be standard products. Where two or more units of the same type of equipment are supplied, they shall be the products of the same manufacturer; however, all components of the systems furnished hereunder need not be the products of one manufacturer unless specified herein.

To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished.

2-2. **PERFORMANCE AND DESIGN REQUIREMENTS.** The design of the systems furnished hereunder shall utilize concepts, techniques and features that provide maximum reliability and ease of maintenance and repair. The systems shall include board-level devices such as light emitting diodes or other indicators.

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to facilitate quick diagnosis and repair. Diagnostic software shall be furnished to facilitate system-level troubleshooting.

Where redundant hardware is provided, the system shall be capable of performing all specified functions, without reconfiguring hardware or software, with only one device of each category in service.

2-2.01. Factory Assembly. Equipment shall be shipped completely factory assembled, except where its physical size, arrangement, configuration, or shipping and handling limitations make the shipment of completely assembled units impracticable.

2-3. POWER SUPPLY AND INSTRUMENT SIGNAL. Power supply to all control system equipment will be 120 volts, 60 Hz, single phase. System Supplier shall be responsible for distribution of power among enclosures, consoles, peripherals, and other components of the system from the power supply receptacles and junction boxes indicated on the Drawings. Power distribution hardware shall include cables and branch circuit overcurrent protection installed in accordance with the electrical section.

Unless otherwise indicated, power supply to the instrumentation will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.

2-3.01. Facility Distribution System. Equipment not indicated to be powered from an uninterruptible power source shall be suitable for being supplied from the facility distribution system and shall be capable of withstanding voltage variations of ±10 percent and harmonics up to the limits of IEEE 519 without affecting operation. System Supplier shall provide voltage conditioning or filtering equipment if necessary to meet the requirements specified.

2-3.02. Power Supplies. Power supplies for voltages other than those listed above shall be an integral part of the equipment furnished. Internal power supplies shall be regulated, current limiting, and self-protected.

2-3.03. Surge Withstand. All equipment shall meet all surge withstand capability tests as defined in ANSI C37.90 without damage to the equipment.

2-3.04. Uninterruptible Power Supply. An uninterruptible power supply (UPS) shall be furnished hereunder to power the equipment indicated on the Drawings or will be furnished under another section. System Supplier shall be responsible
for coordinating the size of the UPS unit with the equipment furnished hereunder, and shall advise Engineer if a unit of higher capacity is necessary.

2-4. SERVICE CONDITIONS AND ENVIRONMENTAL REQUIREMENTS. The equipment provided for the instrumentation and control system shall be suitable for the service conditions specified in the attached equipment sections.

All equipment shall be designed and selected to operate without degradation in performance throughout the environmental extremes specified. Equipment shall be designed to prevent the generation of electromagnetic and radio frequency interference and shall be in compliance with FCC Rules and Regulations, Part 15, for Class A computing devices.

2-4.01. Ambient Temperature and Elevation. All system equipment located in air conditioned rooms shall be suitable for operation in ambient temperatures from 10°C to 35°C and a relative humidity of 10 to 80 percent, noncondensing. All equipment located in non air conditioned indoor areas shall be suitable for an ambient temperature range of 0°C to 50°C and a relative humidity of 10 to 95 percent, noncondensing. All equipment located outdoors shall be suitable for operation in an ambient temperature range -20°C to 60°C and a relative humidity of 5 to 100 percent. Heaters and air conditioning/cooling equipment shall be provided where essential to maintain equipment within its manufacturer-recommended operating ranges.

All equipment and instruments shall be designed to operate at the site elevation of 1095 ft.

2-4.02. Deleterious Effects. All system equipment will be installed in areas without anti-static floor construction and without any provisions for control of particulates or corrosive gases other than ordinary office-type HVAC filtering. System Supplier shall furnish any additional air cleaning equipment, anti-static chair pads, or other protective measures necessary for proper operation of the system.

All input/output hardware shall meet or exceed, without false operation, all requirements of NEMA ICS-1-109.60, Electrical Noise Tests.

2-4.03. Noise Level. The equivalent "A" weighted sound level for any system equipment located in the control room, except printers, shall not exceed 35 dBA. The sound level for printers shall not exceed 65 dBA. Sound reduction enclosures shall be provided where necessary to comply with these limits.
2-4.04. **Lightning Protection.** In addition to other environmental protection specified herein, the entire system shall be provided with lightning protection. Lightning protection measures shall include the following.

2-4.04.01. **Grounding.** All major components of the system shall have a low resistance ground connection. Grounding system provisions indicated on the Drawings shall be modified as recommended by System Supplier.

2-4.04.02. **Surge Suppressors.** Surge and lightning suppressors shall be non-faulting, non-interrupting, and shall protect against line-to-line and line-to-ground surges. Devices shall be solid-state metal oxide varistor (MOV) or silicon junction type, with a response time of less than 50 nanoseconds. Surge protective devices shall be applied for the following:

   a. All 120 VAC power connections to RTUs, PLCs, DCUs, instruments and control room equipment. Surge arresters shall be Transtector "ACP-100-HW Series", Power Integrity Corporation “ZTA Series”, Phoenix Contact “Mains PlugTrab”, or MCG Surge Protection “400 Series”.

   b. All analog signal circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Surge protection devices shall not impede or interfere with the use of smart transmitter calibration/communication. Protection devices located near the transmitter shall be Telematic “TP48.” Protection devices in control panels shall be Transtector “PDS Series or FSP Series”, Telematic “SD Series”, Phoenix Contact “PipeTrab Series”, or Citel "BP1-24."

2-5. **SOFTWARE DOCUMENTATION.** System Supplier shall furnish complete documentation on all software supplied with the systems specified herein. Operating systems, compilers, assemblers, and utility and diagnostic programs that are standard commercial products of third parties need not be included in the optical media backup. Software documentation shall consist of the following principal items:

   a. One backup set of any integrated circuit or solid-state memory-based plug-in firmware used.

   b. Two complete back-up copies of system and application software in executable format on optical media compatible with the system furnished.

   c. Three sets of user reference manuals for all standard system and
application software.

d. One set of user reference manuals for all operating system software.

e. Three sets of printed as-built reference documentation for any special software provided specifically for this contract.

f. For each licensed software product, all documentation provided by the product manufacturer shall be provided. This includes all reference manuals and any other documents that were provided by the manufacturer. One set of this documentation shall be supplied for each and every piece of equipment provided. Multiple pieces of similar equipment or software require multiple copies of this documentation.

2-6. SOFTWARE LICENSE. All software programs supplied as a standard part of System Supplier’s products for this project shall be licensed to Owner for use on the system specified herein. Such license shall not restrict Owner from using the software on the system provided hereunder or its replacement. Owner shall have the right to make copies of the software for use on the system provided. Specific requirements of System Supplier’s software license are subject to review and approval by Owner and Engineer.

2-7. INSTALLATION TEST EQUIPMENT. All necessary testing equipment for calibration and checking of system components shall be provided by System Supplier. System Supplier shall also furnish calibration and maintenance records for all testing and calibration equipment used on the site if requested by Engineer.

2-8. PROGRAMMING DEVICES. The following programming devices shall be provided for the instruments specified in other sections:

<table>
<thead>
<tr>
<th>Instruments Requiring Programming Devices</th>
<th>Quantity of Programming Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow instruments</td>
<td>1</td>
</tr>
<tr>
<td>Pressure and level instruments</td>
<td>1</td>
</tr>
</tbody>
</table>

2-8. PROGRAMMING SOFTWARE. The following programming software shall be provided for the instruments specified in other sections:

<table>
<thead>
<tr>
<th>Instruments Requiring Programming Software</th>
<th>Number of Copies of Programming Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow instruments</td>
<td>1</td>
</tr>
</tbody>
</table>
PART 3 – EXECUTION

3-1. INSTALLATION REQUIREMENTS. The installation of equipment furnished hereunder shall be by the Contractor or their assigned subcontractors.

3-1.01. Field Wiring. Field wiring materials and installation shall be in accordance with the electrical section.

3-1.02. Instrument Installation. Instruments shall be mounted so that they can be easily read and serviced and so that all appurtenant devices can be easily operated. Installation details for some instruments are indicated on the Drawings.

All outdoor instrumentation shall be protected from direct sun exposure. Instruments shall be placed in locations to limit south and west sun exposure. Sunshades shall be provided on instruments that are subject to the direct sun exposure. Sunshades shall be located so the opening faces north or east where possible. Sunshades shall be provided as shown on the Drawings.

3-1.03. Salvage of Existing Equipment. Existing equipment and materials removed or replaced under this contract shall be delivered to Owner at a location designated by Owner, or shall be properly disposed of at Owner’s discretion. Care shall be taken to avoid damage to equipment delivered to Owner.

Any mounting brackets, enclosures, stilling wells, piping, conduits, wiring, or openings that remain after removal of equipment and support hardware shall be removed or repaired in a manner acceptable to Owner and Engineer. Transmitters or switches containing mercury shall be removed and disposed of by personnel trained in the handling of hazardous materials and using approved procedures.

3-2. SYSTEM SOFTWARE CONFIGURATION. System software shall be configured by the System Supplier. Configuration services shall consist of the creation of the system database, report formats, operator interface graphic and tabular display screen formats, password and security implementation, and programming of control units to provide a fully functioning system. The System Supplier shall fully configure the system using data provided herein or supplied by the Engineer and/or the Owner after award of the contract.
The system that is delivered to the field for installation, checkout, and startup shall have all files, or databases, that are configurable in size, sized in a manner in which there will be 50% space available for future work after the completion of this project. This sizing should include the addition of memory modules, disk drives, or any other device to insure the 50% spare space availability. All "tuning" of software that is dependent on space requirements shall be done prior to the completion of this project.

Tuning of software programs shall be accomplished in such a manner that the program operates at its highest performance level. These programs include, but are not limited to Microsoft SQL Server, all PLC ladder logic, and others.

3-2.01. **Control System Database.** The control system database shall be developed and configured by the System Supplier. The System Supplier shall enter information obtainable from the Contract Documents into the database prior to soliciting input from the Engineer and the Owner. The System Supplier shall determine the need for any "pseudo" database points and shall ascertain and enter all information needed to define these points. The System Supplier is responsible for entering all information associated with each point. This includes but is not limited to, descriptions, engineering units, associated displays, areas, security, etc. All fields associated with each database point must be completely filled out accurately.

3-2.02. **Graphic Screen Displays.** The System Supplier shall be responsible for developing and configuring the custom graphic displays. Each piece of major process equipment that is monitored by the control system shall be displayed on one or more graphic screen. Graphic screens shall be representations of the equipment and piping. The screens must accurately show all devices and equipment that is part of the control loops. These items must be done in accordance to the Configuration Standards and Conventions as described later in this section. Alarm and/or event displays shall also be provided and proven functional prior to acceptance of the system. A means of capturing and printing all graphic screens shall also be included. The software program provided must be capable of printing the screen in a black and white (using gray scale) or color format. This program must be accessible from all terminals provided under this contract. The black and white printing shall be done in a manner in which the use of the black background is not represented in the printout. This is done to keep the utilization of ink cartridge and toner cartridge to a minimum. All graphic screens shall be animated to indicate the current state of the piece of equipment. The following graphic screens shall be modified, as a minimum.

- Main Overview of the Booster Station
- Alarm Summary

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• Event Summary
• Overview of each major process area (with vectoring to sub-areas)
• Summary screen to vector to all video trends

A minimum of 10 custom graphic displays shall be modified and/or reconfigured by the System Supplier.

3-2.02. Configuration Standards and Conventions. The Owner’s existing “Software Configuration Standards and Conventions” shall be reviewed by the System Supplier. The System Supplier shall provide a document to be submitted for review and approval before software configuration commences. The document shall describe and define such items as proposed graphic display process line colors/representations; symbology; color standards for “on”, “off”, “opened”, “closed”, “warning” and “alarm” conditions; alarm handling conventions; how items will be selected for control; methods for navigation between displays; address usage/naming conventions; and security setup. Before submitting the initial draft document, the System Supplier shall meet with the Engineer and/or Owner to review any of the Owner’s existing standards and conventions. All copies of this submittal shall be provided in color to insure the accuracy of each item. No black and white copies will be accepted. The colors used in the printed submittal shall accurately depict the colors and shapes proposed for use on the final system.

In addition to submitting the document for review, an updated version of the document shall be submitted as part of the O&M Manuals. The document shall be revised to document any additional standards that are established throughout the configuration process.

3-2.05. Configuration Review Meetings. Proposed HMI graphic screens shall be reviewed with the Owner and Engineer throughout the configuration process. The System Supplier’s programming personnel shall attend all meetings. A second review meeting shall be held at approximately 50 percent completion. Both meetings shall be held at the Owner’s facilities.

3-2.06. Software Functional Requirements. General functional requirements for system configuration are indicated on the Drawings and described in the specifications. The information presented herein and indicated on the Drawings illustrates the general functional intent of the system, and may not be sufficient to fully configure the system. The System Supplier shall be responsible for determining what additional information may be required to complete the configuration tasks, and for obtaining this information from the Engineer or the Owner.
3-3. **SYSTEMS CHECK.** System Supplier shall provide the services of a trained and experienced field supervisor to assist the installation contractor during installation, and to calibrate, test, and advise others of the procedures for installation, adjustment, and operation.

3-3.01. **Field Manager.** System Supplier shall appoint a field services manager who shall be responsible for the coordination of all system check-out and startup activities, and who shall be immediately available to Engineer and Owner by phone or on site for the duration of this project.

3-3.02. **Field Inspection at Delivery.** The field supervisor shall inspect major equipment items within five working days of delivery, to assure that the equipment was not damaged during shipment and shall supervise or assist with unpacking, initial placement, and initial wiring of the system.

3-3.03. **Field Calibration of Instruments.** After each instrument has been installed, a technical representative of System Supplier shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration report is attached to the end of this section.

3-3.04. **Training for Installation Personnel.** The field supervisor shall train the installation personnel in reading and understanding submittal drawings, and in the correct installation and wiring procedures for the equipment.

3-3.05. **Field Inspection Prior to Start Up.** After installation and wiring connections are complete, the field supervisor, with additional System Supplier’s personnel shall verify that each external connection to the system is correctly wired and field process components and devices are functioning as intended. A minimum of 2 working days shall be included for this task, but System Supplier shall be responsible for completing the following scope of work.

3-3.05.01. **Discrete Signals.** Discrete input and output signals shall be simulated and verified that they are received at the respective receiving device, and at the proper voltage.

3-3.05.02. **Devices by Other Suppliers.** If interrelated devices furnished by other suppliers, under other contracts, or by Owner, such as valve actuators, motor controls, chemical feeders, and instruments, do not perform properly at the time of system checkout, the field supervisor shall use suitable test equipment to...
introduce simulated signals to and/or measure signals from these devices to locate the sources of trouble or malfunction.

3-3.05.04  System Check Out Report. The System Supplier shall submit a written report on the results of such tests to Engineer. Additional documentation shall be furnished as requested by Engineer to establish responsibility for corrective measures. System Supplier shall verify, in writing, to Engineer or Owner that System Supplier has successfully completed the external connection check before beginning system startup or field acceptance testing.

3-3.06  Start Up Assistance. After the field supervisor has completed the system check and submitted his report, System Supplier shall supply a factory-trained engineer and programmer to provide on-site start up assistance. During the startup period, these personnel shall thoroughly check all equipment, correct any deficiencies, and verify the proper operation of all components. 5 working days shall be included for this task for two separate startup periods associated with each wetwell.

3-4  TESTING.
Testing shall include all instrumentation, controlled equipment, monitored equipment, software, firmware, control wiring, and communication equipment furnished, installed, or modified under this Contract.

The Contractor shall assume all risk for failure during the testing procedure. The equipment shall be delivered in operating condition by the Contractor, and the Contractor shall repair any defects which may be present or may be caused by the testing procedure.

The Engineer shall have the final authority on test or retest all specified functions whether or not explicitly stated in the Test Procedures until the functional requirements of the overall system are met. No additional compensation shall be provided for any required extended testing. The Engineer’s decision shall be final regarding the acceptability and completeness of all testing.

Testing and start-up procedures for the various equipment shall include detailed check-out of all electrical, mechanical, communications, and instrumentation prior to turning the equipment over to the City for permanent operations. Electrical circuits and control devices shall be considered in testing procedures and a specific step by step sequence shall be implemented to insure that the equipment is properly operational and adjusted prior to operation. The System Supplier/Contractor shall follow all lockout tag-out procedures established for the project.
3-4.01. Basic Testing Concepts.
The System Supplier shall provide tests for all equipment furnished and/or installed. Even if equipment does not have specific tests defined in the Contract Documents, the System Supplier shall develop a Testing Plan, Test Procedures, and Test Forms for all equipment provided under this Contract. For equipment that is not specifically included in the tests specified in these documents, the System Supplier shall incorporate manufacturer recommended testing or industry best practices into the Test Plan, Test Procedures, and Test Forms.

Before the start of any test that will be witnessed by the Engineer and/or the City, the System Supplier shall have conducted all prerequisite testing as well as a dry-run of the entire witnessed test to ensure the success of the test.

The System Supplier may use its own in-place programs, plans, and test procedures to implement the requirements as specified herein provided that such programs, plans, and test procedures provide the level of detail and meet the intent of the requirements specified herein and are submitted to and successfully reviewed by the Engineer. Each test and verification procedure must verify that the item, subsystem, or system tested meets the specific requirements of these Specifications.

The System Supplier shall be prepared for the scheduled testing and shall have all available tools and equipment necessary to perform the testing. Test instruments shall be suitable for the purpose of measurement, with a rated accuracy commensurate to the measurement value of the equipment being tested or calibrated. Each test instrument shall be certified by an established calibration laboratory prior to the commencement of testing and recertified, without adjustment, after completion of testing to verify accuracy throughout the testing period. If recertification without adjustment is not demonstrated, the calibration instrument must be adjusted and certified, the field calibration repeated, and the recertification without further adjustment verified. Certified calibration reports traceable to the National Bureau of Standards shall be included with the test report.

Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of simulation at the instrument or device. Define these simulation techniques in the test plan and procedures.

3-4.02 Control System Test Plan.
The System Supplier shall prepare and submit for favorable review a Control System Test Plan. The plan shall include the following basic elements:

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The elements of the plan are described in further detail below. The plan shall be submitted for review by the Engineer in phases as described below.

The Phase 1 Test Plan shall include:

• Updated schedule focusing on installation of controls related equipment up to and through Loop testing.
• Test Procedures and Test Forms
• Test Procedures and Test Forms for Loop testing.

The Phase 2 Test Plan shall include:

• Updated schedule focusing on end-to-end testing, commissioning, and startup related equipment control related testing.
• Test Procedures and Test Forms from Phase 1
• Test Procedures and Test Forms for Site Demonstration Testing (SDT)
• Test Procedures and Test Forms for System Availability Testing (SAT)

Prior to executing any testing at each phase of the testing identified above, the Engineer shall favorably review the Test Plan before the start of each phase of testing. Successive reviews of the Test Plan may delay the testing schedule at no additional cost to the City. The schedule shall not be finalized until favorably reviewed by the Engineer. The System Supplier shall submit the Testing Plan 30 days (1 Month) prior to any proposed schedule testing at each phase of the testing identified above.

After completing all control system testing on the project the System Supplier shall submit the Test Plan with an Appendix of all Test Reports as final documentation of all control system testing performed.

3-4.02.01 Control System Testing Activities. The following is a list of testing activities that shall be included in the testing plan.

• Loop Testing
• Site Demonstration Test (SDT) - Witnessed Test
• System Availability Test (SAT)

Refer to this specification section for additional requirements associated with each of the testing activities identified above. The Test Plan shall summarize the
requirements identified in these specification along with any propose improvements to the testing requirements.

3-4.02.02. Schedule. The System Supplier shall be responsible for developing a schedule of control system testing activities to support overall construction, commissioning, and startup. The schedule shall be developed in coordination with the Contractor and Engineer and it shall include interdependencies and prerequisites of other construction related tasks to meet the overall construction schedule. The System Supplier shall be responsible for coordinating testing requirements described in this section with other Contract required testing including mechanical, electrical, and process related testing. Refer to additional restrictions in this section, Division 01, and other requirements in the Contract documents. The schedule shall be updated fortnightly throughout the project or more frequently during the initial schedule development. System Supplier shall develop the schedule to identify construction activities that must be completed prior to conducting any testing. The schedule shall be submitted as part of the Testing Plan and submitted separately to the City and Engineer upon request.

Testing and startup shall be scheduled to account for time to train operations staff prior to putting equipment into continual operation. Testing and startup activities must be scheduled around operational needs. Testing and startup activities will require coordination with plant staff and scheduling around facility operational constraints. Startup restrictions and requirements in this Section are minimums other restrictions my include availability of power, or other construction related activities.

The Contractor shall not start any testing activity that cannot be completed by the end of the work week if so doing would disrupt treatment operations as determined by the City staff. Testing and startup activities shall not be conducted on Fridays or working days immediately prior to an Owner staff holiday unless permission from the Owner, and Engineer is received in writing.

3-4.02.03. Test Procedures and Test Forms. The System Supplier shall develop detailed Test Procedures to bring order to the testing process. Procedures shall be developed for each phase of the Test Plan identified above. A separate Test Procedure shall be created for testing unique type of control related equipment and/or functionality. For example, one test procedure shall be created for pump remote manual control, which will be referred to for every pump furnished, installed, or modified in the Contract. Test Procedures shall comprehensively test to ensure proper indication, control, and response to failure conditions as identified in the Contract documents.
Test Procedures for each test shall clearly describe the test steps to be performed and the results expected after each step. The System Supplier shall determine the expected results of the test and list them on the testing form next to the actual results to be entered during the test. This allows the tester to easily determine the success or failure of the test.

Any assumptions to be used in evaluating the test results shall be defined in the Test Procedure. As a minimum, the following information shall be included in each Test Procedure:

- A test identification number and name.
- A statement of test objective and scope.
- A test description.
- A list of the make and model of all test equipment required to perform the test.
- A description of the required test setup including diagrams illustrating test equipment connections and identifying test points, where applicable.
- Step-by-step instructions for performing the test, identifying where data are to be recorded and the limits for acceptable data.
- Associated test forms or ledgers to document the testing. The forms or ledgers shall include as a minimum the following fields:
  - Equipment and/or Function
  - Expected Test Results
  - Actual Test Results
  - Testing Date
  - Pass/Fail
  - Space for handwritten notes and comments

Test Forms shall be produce separate from the testing procedures. Separate Test Forms shall be provided for each phase of the Test Plan required above. The Test Forms shall list all equipment and/or associated control function identified in the specification for the given for Control System Testing Activity and shall include the following columns:

- Procedure Number - reference to the numbered testing procedure
- Expected Results - list of desired results of the test
- Actual Results - space for the tester to document the results of the test
- Pass/Fail - determine if the test passed or failed.
- Test Date
- Tester Initials
Test Procedures and Test Forms shall be submitted to the City and favorably reviewed before scheduling or starting the corresponding test. System Supplier shall submit Test Procedures for review and approval by the Owner and Engineer at least 60 days prior to the anticipated start of the associated test.

While performance of a test, if it is determined that, the equipment in order to perform properly requires replacement, adjustment, or modification then testing shall be repeated following such modification. If a modification to the Test Procedure is made in the field by the Engineer or City, the System Supply shall update the Testing Procedures and Testing Form to reflect that actual test performed on the system delivered to the City.

3-4.03. Test Reports. The System Supplier shall document testing in weekly reports after any control system testing is conducted. The reports shall be submitted to the City. Each report shall describe the scope of the testing activity conducted during the week and include the following attachments:

- Updated Control System Action Item Log
- Updated Control System Testing Progress Log
- Scanned Images of Testing Forms

At the completion of each test, a Test Form shall be filled out documenting the results of the test, which shall be used to ensure that equipment has been successfully validated prior to start-up and/or operation of equipment or process.

3-4.03.01. Control System Action Item Log. The System Supplier shall maintain a Control System Action Item Log for the purpose of systematically documenting corrections, fixes, and/or retesting requirements noticed by the tester or test witnessing personnel. The log will be sorted first by completion and second by date showing most recent items first. The log will include the following fields as a minimum:

- Item Number, unique
- Completed, yes or no (blank)
- Date Completed
- Description of Action Required
- Identified by initials
- Corrected by initials

3-4.03.02. Control System Testing Progress Log. The System Supplier shall maintain a Control System Testing Progress Log for the purpose of monitoring and tracking testing progress. The log will be broken into separate section for each of the Control System Testing Activities and shall include a comprehensive...
list of all Control System equipment and/or Control System Functionality identified in the Contract Documents. The log will calculate the percent complete based on the completion of each test associated with an identified Control System Testing Activity.

3-4.04. **Test Procedures and Test Forms.** Test Procedures and associated Test Forms shall be created to comprehensively validate all Input/Output (I/O) points from field terminals to PLC I/O hardware. System Supplier shall test every I/O point for proper operation, including wired spares. Jumper cables and multifunction multimeters shall be used to verify the operation of each Analog Input (AI), Discrete Input (DI), Analog Output (AO), and Discrete Output (DO) point. The procedures and forms shall include the following provisions:

- For each analog input point:
  - Value at 0%, 25%, 50%, & 100% of full scale (ramped in both directions)
  - HiHi, High, Low, LoLo Alarm Limits
  - Rate of Change limit
  - Alarm Deadband.

- For each analog output point:
  - Milliamp reading at 0%, 25%, 50%, & 100% of full scale (ramped in both directions).

- For each discrete input point:
  - Status points - proper indication
  - Alarm points, proper alarm notification.

- For each discrete output point:
  - Proper operation (latching or momentary)

The System Supplier shall create Test Procedures and associate Test Forms for each unique device that transmits information to or from the PLC using some form of a communication protocol. Examples include Modbus RTU/TCP, Ethernet/IP, DeviceNet, Foundation Fieldbus H1, Profibus DP, Profibus PA, etc.

The System Supplier shall create Test Procedures and Test Forms for PLC, and HMI functionality. At a minimum, the PLC, and HMI shall be programmed to simulate remote manual operation of all controlled equipment identified in the
Control Descriptions section of the contract documents. The System Supplier will not be required to demonstrate simulated PID controls or complex sequential logic such as gravity filter controls. The System Supplier shall create Test Procedures and associated Test Forms the following:

- All equipment wired to the PLC panel that has a unique control schematic
- All equipment wired to the PLC panel that has a unique multiple monitoring points
- HMI display functions for all equipment wired to the PLC panel
- Power-Fail and Restart logic for all equipment controlled from the PLC.
- Backup generator Auto Restart logic for equipment indicated to be added to the essential loads lists.
- Calculation of Totalizers, Run Timers and Count Starts

3-4.05. Loop Tests. The purpose of Loop Testing is to ensure that all monitored and/or controlled equipment is functioning as required and is properly communicating to the PLC as required. Prerequisites for this testing shall include the following:

- The System Supplier shall have a favorably reviewed Phase 1 Test Plan
- All equipment to be tested shall be permanently installed including permanently powered, configured, calibrated, wired, and capable of performing all monitoring and control functions identified in the Contract Documents.

The Test Procedures and Test Forms requirements described in Loop Tests paragraphs shall be incorporated into the Phase 1 Test Plan.

The System Supplier shall create comprehensive Test Procedures and Test Forms to validate the following:

- HMI Servers, HMI Workstation, and Related Devices
- Monitored and unmonitored instrumentation including gauges, switches, sensors, and transmitters.
- Motor Control Center (MCC) controlled and/or monitored equipment

Unique Test Procedures shall be created for all re-configured HMI Servers and HMI Workstation equipment. The Test Procedures shall validate only basic operation and functionality of the equipment. The Site Demonstration Testing shall comprehensively validate all HMI functionality.

Unique Test Procedures shall be created for each type of instrument and application. The Test Procedures shall validate the calibration and functionality.
Unique Test Procedures shall be created for each electrical schematic associated with MCC, and/or control panel equipment. The procedures shall cover at a minimum the following:

- Local control of the equipment
- Local indication of the equipment
- Correct remote monitoring of the equipment at a minimum to the PLC or through the PLC to the HMI

3-4.06. Site Demonstration Test (SDT). The purpose of the SDT is to demonstrate all aspects of the control system from field controls and monitoring to remote control and automation. This testing shall comprehensively test all aspects of the control system. Successful completion of testing defined in the SDT paragraphs shall be a requirement of Substantial Completion as defined in these Contract Documents. Prerequisites for this testing shall include the following:

- The System Supplier shall submit all weekly testing reports covering the Loop Tests to date
- The System Supplier shall have a favorably reviewed Test Plan
- All equipment to be tested shall be permanently installed including permanently powered, configured, calibrated, wired, and capable of performing all monitoring and control functions identified in the Contract Documents.

The Test Procedures and Test Forms requirements described in SDT paragraphs shall be incorporated into the Test Plan.

The System Supplier shall coordinate the SDT testing schedule with the startup schedule. The goal of the coordination shall be to schedule as much equipment and systems testing as practical to minimize startup complications while controlling a given process or system. With these required goals in mind, the System Supplier shall work with the Contractor, City, and Engineer to develop the testing schedule. It is understood that some remote automatic controls, mainly PID control loops, may have to wait until the process or system is in startup before tuning can take place; however, to the extent practical, all local control, remote manual controls, automatic complex sequential logic, and remote automatic controls for each given system shall be tested prior to startup. After startup the remainder of the automatic controls shall be tested.

The System Supplier shall create and/or expand on Loop Tests procedures and test forms. The Test Procedures and Test Forms shall cover all aspects of
control and/or monitoring from the field to the HMI graphics, historian, trending, and alarm systems.

The System Supplier shall conduct an unwitnessed and witnessed version of SDT using favorably reviewed Test Procedures and Test Forms. The unwitnessed version of the test shall comprehensive and include everything that the witnessed version of the test. The intent is to ensure a successful witnessed test and to correct known deficiencies prior to witnessed testing. After successfully completing the unwitnessed test and submitting the testing report to the Engineer for a favorable review, the witnessed version of the SDT shall be conducted onsite with the Engineer and/or City as the witnessing personnel. Prerequisites for conducting the witnessed SDT include, favorably reviewed Phase 3 Test Plan with all required test procedures required herein.

3-4.07. System Availability Test (SAT). The purpose of this SAT is to validate the availability of the control system to perform all operations control operation over a wide range of operating conditions and scenarios. Prerequisites for this testing shall include the following:

- The System Supplier shall submit all weekly testing reports covering the SDT unwitnessed and witness testing.
- All items listed in the Control System Action Item Log shall be completed.
- All startup system shall be completed and tested according to the Phase 3 Test Plan.
- All Owner Training associated with the control system shall be completed.
- The control system shall be handed over to the Owner for permanent operation.

The duration of the System Availability Test shall be not less than 30 calendar days (1 month). During the SAT, no downtime shall be permissible as determined by the Engineer. If, at any time during the SAT, a failure occurs which results in downtime being assessed, the test shall restart at day 1. Note: minor PID re-tuning may be necessary during the SAT; however, this will not constitute downtime. Major PID re-tuning efforts or other significant failures will constitute control system downtime. This demonstration shall continue until it is completed successfully.

During the SAT the System Supplier shall be available by phone to aid the Owner’s operations and maintenance staff 24 hours a day in troubleshooting and repairing any control system failure. If the repair cannot be resolved over the phone the System supplier shall be available to respond onsite within eight (8) hours of the phone call to troubleshoot and repair the control system failure.

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The SAT may be suspended by mutual agreement between Owner and System Supplier.

Failure of redundant equipment shall not be considered downtime provided that automatic failover occurs as specified and, in the opinion of Engineer, the failure was not caused by deficiency in design or installation. In the event of repeated failure of any hardware component or software module, the acceptance test shall be terminated and re-started.

Successful completion of the site acceptance test, including the operational demonstration, is prerequisite to Substantial Completion as specified in the Supplementary Conditions.

3-6. TRAINING. System Supplier shall conduct training courses for personnel selected by Owner. Training shall be provided in the following categories: instrument, control system maintenance, operator (pre-installation), operator (post-installation), programmer (HMI software), programmer (PLC software), networking, and supplemental shall be provided. Training shall be conducted by experienced instructors who are familiar with the specific system supplied.

3-6.01. General Training Requirements. In general, System Supplier’s standard training courses may be used to meet the training objectives specified. Where standard courses do not meet these objectives, additional coursework shall be developed. Clock hour requirements for each level of training are shall be as listed. A “clock hour” is defined as one hour of instruction or supervised training exercise. Training hour requirements are the number of hours of training to be provided for each student. Additional training time shall be provided if considered necessary to meet the training objectives.

3-6.01.01. Training Costs. All costs associated with the training program; excluding travel, lodging, and per diem expenses for Owner’s and Engineer’s personnel to attend off-site training programs; shall be the responsibility of System Supplier and shall be included in the contract price.

3-6.01.02. Lessons. Training lesson plans and other information for the second stage submittal as defined herein shall be submitted at least 30 days prior to the start of training.

3-6.01.03. Video Recording. Not used.

3-6.02. Instrument Training. Training on the calibration, maintenance, troubleshooting, and repair for the instrument devices provided under this project shall be provided. Training shall also be provided for any hand-held or computer-
based calibration devices and their associated software. 4 hours of training for 4 students shall be provided at the Owner’s facility.

3-6.03. Control System Maintenance Training. Not used.

3-6.04. Operator Training. Owner’s personnel will utilize the system for day-to-day monitoring and/or control of the facilities. The training program shall provide operators with sufficient knowledge to move from screen to screen within the system, understand the contents of group and detailed point displays, react to and acknowledge alarms, adjust control setpoints and alarm limits, configure and print shift reports, print preconfigured reports on demand, control equipment connected to the system, and react to and resolve minor system errors.

3-6.04.01. Classes. Operator training shall include sessions as specified below.

3-6.04.01.01. Pre-installation Session. Not used.

3-6.04.01.02. Post-installation Session. The post-installation training shall include three separate, but identical, sessions for three shifts of personnel and shall be conducted at Owner’s facilities. Each class shall consist of 4 hours of instruction using the lesson plan submitted and approved for use. The post-installation sessions may have to be conducted outside normal working hours to accommodate the working schedule of Owner’s personnel. The post-installation training sessions shall be conducted for 4 of the Owner’s operating personnel.

3-6.04.02. Content of Classes. Each session shall cover at least the following topics.

a. Power-up, "bootstrapping", and shutdown of all hardware devices.

b. Logging on and off the system and the use of passwords.

c. Access and interpretation of standard displays and diagnostics.

d. Use and care of operator workstations, servers, video displays, printers, and other control room hardware, including replenishment of supplies and replacement of ribbons and ink cartridges.

e. Moving from screen to screen within the graphic display environment.

f. Interpretation of preconfigured group and detailed point or database displays.

g. Response to and acknowledgment of alarms.

h. Adjustment of control set points and alarm limits.
i. Configuration and printing of shift and other reports by schedule or on demand.

j. Control of field equipment and devices connected to the system.

k. Manual entries to database points.

l. Generation of current (real-time) and historical custom and predefined reports and trend displays.

m. Appropriate responses to software and hardware errors.

n. Enabling and disabling individual inputs and outputs.

The operator-training program shall be developed for personnel with no prior experience with the hardware and software provided as part of the project.

3-6.05. **Programmer Training (HMI Software).** Not used.

3-6.06. **Programmer Training (PLC Software).** Not used.

3-6.07. **Network Training.** Not used.

3-6.08. **Supplemental Training.** System Supplier shall provide additional training to Owner’s personnel on topics of Owner’s choosing. Supplemental training shall be conducted in one session at Owner’s facilities using the hardware and software installed for this project. The training shall consist of 4 hours of instruction for 4 students.

End of Section
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<tr>
<th>INPUT</th>
<th>ACTUAL OUTPUT</th>
<th>DESIRED OUTPUT</th>
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PROPORTIONAL BAND:

RESET:

POSITION OF SWITCHES, JUMPERS, ETC.

COMMENTS:

DATE OF CALIBRATION: 
CALIBRATED BY: 

Black & Veatch

INSTRUMENT CALIBRATION REPORT

Figure 1-13500
<table>
<thead>
<tr>
<th>Item</th>
<th>Tag</th>
<th>Loop</th>
<th>Service Description</th>
<th>Device Type</th>
<th>Remarks</th>
<th>Size</th>
<th>Output Type</th>
<th>Output Range</th>
<th>Power</th>
<th>PID DRAWING</th>
<th>Specification</th>
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<td>520 Booster Station Suction Header Pressure Indication</td>
<td>Pressure Gauge</td>
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<td>0-200 psi</td>
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## Input/Output Listing

### Input/Output List - Legend/Description Sheet

**Item**  This is an arbitrary sequential number which is for reference only.

**Type**  This is the type of I/O signal, as follows:

- **AI** = Analog Input
- **AO** = Analog Output
- **DI** = Discrete Input
- **DO** = Discrete Output
- **PI** = Pulse Input (totalizer or accumulator type input)

**Controller ID or Remote I/O**  This is the identification for the PLC/RTU responsible for controlling this I/O point or the RIO rack where the I/O point is terminated.

**Analog Data (Signal Type)**  This will typically be 4-20mA, but could also be 1-5Vdc, serial, HART, DeviceNet, ControlNet, or similar to indicate the signal type of the associated input or output.

**Analog Data (Calibrated Range)**  This will be the scaled value of the input in engineering units.

**PI** = Pulse Input (totalizer or accumulator type input)

**Number**  This is a sequential number for a given type within a specific controller (PLC, RTU, or DCU).

**Service Description**  This is the description or the function (i.e. Fuel Storage Tank Level).

**Field Device**  This is the tag number of equipment identifier associated with the I/O point.

**Controller ID or Remote I/O**  This is the identification for the PLC/RTU responsible for controlling this I/O point or the RIO rack where the I/O point is terminated.

**Analog Data (Signal Type)**  This will typically be 4-20mA, but could also be 1-5Vdc, serial, HART, DeviceNet, ControlNet, or similar to indicate the signal type of the associated input or output.

**Analog Data (Calibrated Range)**  This will be the scaled value of the input in engineering units.

**Analog Data (Power)**  This will typically be '2-wire' for devices which are loop powered from the PLC enclosure, or '4-wire' for devices which are powered from external power supplies, unless

**Discrete Data (Signal Type)**  This will be 120VAC, 24VDC, or similar to indicate the signal type of the associated input or output.

**Discrete Data (Closed State)**  This will indicate the state of the input or output when it is considered to be closed or energized (normal, alarm, running, failed, etc.).

**Discrete Data (Power Source)**  This will indicate the location of the power source for the wetting voltage on the contacts, as follows:

- **Field** = External field power source. (May require interposing relays or isolated I/O module type.)
- **Local** = Power originates from within the PLC or I/O enclosure.

**Discrete Data (Interp Relay)**  This will be either 'Yes' or 'No' to indicate whether the input or output requires an interposing relay. Relays are typically required to isolate external voltage sources. See

**Remarks**  This column may include a cross reference to another specification section where applicable, or to a note which provides additional information.
<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
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<th>Description</th>
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PART 1 - GENERAL.

1-1. SCOPE. The Panel Mounted Instruments section covers the furnishing of all panel mounted instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1-2. DESIGN CRITERIA. The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or the Instrument Device Schedule.

Where possible, each instrument shall be factory calibrated to the calibration ranges indicated on the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. For "smart" devices, calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings and/or Instrument Device Schedule.

1-3. SUBMITTALS. Submittals shall be as specified in the Instrumentation and Control System section.
PART 2 - PRODUCTS

2-1. GENERAL. The following paragraphs describe minimum device stipulations. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01 Programming Device. For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training stipulations. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.02 Configuration Software/Serial Interface. Devices indicated as requiring a serial interface shall be provided with all accessories to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under the Windows 8.1 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.

2-2. PANEL FRONT MOUNTED DEVICES.

2-2.02 Totalizers. Not used.

2-2.03 Digital Panel Indicators. Not used.

2-2.04 Electronic Bar Graph Indicators. Not used.

2-2.05 Edgewise Panel Indicators. Not used.

2-2.06 Manual Loading Stations. Not used.

2-2.07 Ratio Stations. Not used.

2-2.08 1/4 DIN Single-Loop Control Stations. Not used.


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2-2.10. Large Case Recorders. Not used.

2-2.11. Strip Chart Recorders. Not used.


2-2.15. Alarm Horns. Not used.

2-3. PANEL INTERIOR MOUNTED DEVICES.
   2-3.01. Integrators. Not used.

2-3.02. Power Supplies. Regulated dc power supplies for instrument loops shall be designed and arranged so that loss of one supply does not affect more than one instrument loop or system. Power supplies shall be suitable for an input voltage variation of ±10 percent, and the supply output shall be fused or short circuit protected. Output voltage regulation shall be by the instrumentation equipment supplied. Multiloop or multisystem power supplies will be acceptable if backup power supply units are provided which will automatically supply the load upon failure of the primary supply. The backup supply systems shall be designed so either the primary or the backup supply can be removed, repaired, and returned to service without disrupting the instrument system operation. Multiloop power supply connections shall be individually fused so a fault in one instrument loop will be isolated from the other loops being fed from the same supply. Fuses shall be clearly labeled and shall be located for easy access. Multiloop supply systems shall be oversized for an additional 10 percent future load. Failure of a multiloop supply shall be indicated on the respective instrument panel or enclosure.

Power supplies shall be Allen Bradley, Phoenix Contact, PULS, or equal.

2-3.03. Relays. Relays indicated to be provided in panels, enclosures, or systems furnished under this section shall be of the plug-in socket base type with
dustproof plastic enclosures unless noted otherwise. Relays shall be UL recognized and shall have not less than double-pole, double-throw contacts. Control circuit relays shall have silver cadmium oxide contacts rated 10 amperes at 120 V ac. Electronic switching-duty relays shall have gold-plated or gold alloy contacts suitable for use with low-level signals. Relays used for computer input, alarm input, or indicating light service shall have contacts rated at least 3 amperes. Time delay relays shall have dials or switch settings engraved in seconds and shall have timing repeatability of ±2 percent of setting. Latching and special purpose relays shall be for the specific application. Unless otherwise indicated, all relays shall have an integral pilot light that illuminates to indicate an energized condition. Relays shall be IDEC "Series RR"; Potter & Brumfield "Series KRP, CB"; or Struthers-Dunn "Series 219, 246".


2-3.05. Electronic Signal Booster/Isolators. Not used.

2-3.06. Electronic Signal Selectors. Not used.


PART 3 – EXECUTION

3-1 FIELD SERVICES. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section. Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section

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(8/20/2018)
Part 1 - General

1-1. Scope. The Flow Instrument Section covers the furnishing of flow instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1-2. Design Criteria. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by Contractor.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

Where possible, each instrument shall be factory wet flow calibrated to the full scale flow range of the sensors or calibration ranges indicated on the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration and configuration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings or Instrument Device Schedule.
1-3. **SUBMITTALS.** Submittals shall be made as specified in the Instrumentation and Control System section.

1-4. **SHIPMENT, PROTECTION, AND STORAGE.** Equipment provided under this section shall be shipped, protected, and stored as specified in the Instrumentation and Control System section. Identification of packaging shall be as specified in the Instrumentation and Control System section.

**PART 2 - PRODUCTS**

2-1. **GENERAL.** The following paragraphs provide minimum device requirements. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. **Interconnecting Cable.** For instruments where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated on the Drawings or in the Instrument Device Schedule. The interconnecting cable shall be provided in the length necessary for installation. Splices shall not be allowed in the installed cable.

2-1.02. **Programming Device.** For instruments that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. **Configuration Software/Serial Interface.** Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. As a minimum, an appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under the Windows 8.1 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.
2-2. FLOW INSTRUMENTATION.

2-2.01. Differential Pressure Flow Transmitters. Not used.

2-2.02. Magnetic Flowmeters, Signal Converters, and Accessories.

2-2.02.01. Magnetic Flowmeter. The magnetic flowmeter shall be a completely obstructionless, in-line flowmeter with no constrictions in the flow of fluid through the meter. The meter shall consist of a metallic tube with flanged ends and with grounding rings or grounding electrodes as required by the application. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5 for line sizes from one-half inch to 24 inches or AWWA C207 for line sizes larger than 24 inches. Flange class ratings and meter maximum pressure ratings shall be compatible with the adjoining piping. Self-cleaning electrodes shall be provided for all meters used for sludge metering. Electrode and liner materials shall be fully compatible with the process fluid as approved by the Engineer and shall comply with the requirements specified in the instrument device schedules. Each meter shall be factory wet flow calibrated to the sensors full flow capacity, at a facility, which is traceable to NIST or other standard acceptable to Engineer, and a copy of the calibration, report shall be submitted as part of the operation and maintenance manual submittal.

The meter shall be capable of standing empty for extended periods of time without damage to any components.

The meter housing shall be of a splash-proof and drip-proof design, unless indicated on the Drawings or in the Instrument Device Schedule to be submersible. Where required to be submersible, the meter housing shall withstand submergence in 30 feet of water for 48 hours without damage.

Meters shall be manufactured by ABB or Badger.

2-2.02.02. Magnetic Flowmeter Signal Converters. Separately mounted, microprocessor-based signal converters shall be provided for the magnetic flowmeters. The signal converters shall include output damping, self-testing, built-in calibration capability, and an "empty pipe zero" contact input. The overall accuracy of the magnetic flowmeter transmitter and signal converter shall be ±0.5 percent of actual flow rate for full-scale settings of 3 to 30 fps. The meter manufacturer shall furnish the signal cable between the converter and the magnetic flowmeter. Signal cable shall be continuous and not spliced between the meter and the signal converter. The signal converter shall be housed in a corrosion-resistant, weatherproof NEMA Type 4X housing and shall be suitable for operation over an ambient temperature range of -30 to +140°F, and relative humidity of 10 to 100 percent. The converter shall have an analog output of
4-20 mA dc. Transmitters tagged on the Drawings or specified to be of the indicating type shall contain a local indicator with a minimum four digit LCD type display, scaled to read in engineering units of flow.

Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC excited metering circuit. Converters shall be capable of bi-directional flow measurement. Signal converters shall be of the same brand as the magnetic flowmeters.

The signal converter shall be diagnosed and recalibrated with the use of a hand-held communicator/calibrator device. One device shall be furnished for all converters provided by a single manufacturer.

2-2.03. **Open Channel Ultrasonic Flowmeters.** Not used.
2-2.04. **Open Channel Admittance Probe Flowmeters.** Not used.
2-2.05. **Doppler Ultrasonic Flowmeters.** Not used.
2-2.06. **In-Line Type Ultrasonic Flowmeters (Single Path).** Not used.
2-2.07. **In-Line Type Ultrasonic Flowmeters (Multi-Path).** Not used.
2-2.08. **Averaging Pitot Type Flow Elements.** Not used.
2-2.09. **Thermal Dispersion Flowmeters.** Not used.
2-2.10. **Propeller Flowmeters.** Not used.
2-2.11. **Turbine Flowmeters.** Not used.
2-2.12. **Orifice Plates.** Not used.
2-2.13. **Differential Pressure Flow Indicators.** Not used.
2-2.15. **Liquid Service Rotameters.** Not used.
2-2.16. **Target-Type Flow Switches.** Not used.
2-2.17. **Coriolis Mass Flowmeters.** Not used.
PART 3 - EXECUTION

3-1. FIELD SERVICES. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of pressure instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple instruments of a particular type are specified, and each requires different features, the required features are described on the Drawings or the Instrument Device Schedule.

1-2. DESIGN CRITERIA. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by the Contractor.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or in the Instrument Device Schedule.

Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the Drawings or in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Drawings and/or Instrument Device Schedule.
1-3. **SUBMITTALS.** Submittals shall be made as specified in the Instrumentation and Control System section.

1-4. **SHIPMENT, PROTECTION, AND STORAGE.** Equipment provided under this section shall be shipped, protected, and stored in accordance with the requirements of the Instrumentation and Control System section. Identification of packaging shall be as described in the Instrumentation and Control System section.

**PART 2 - PRODUCTS**

2-1. **GENERAL.** The following paragraphs provide minimum device stipulations. The Drawings or Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. **Interconnecting Cable.** For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Drawings or Instrument Device Schedule.

2-1.02. **Programming Device.** For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section.) The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. **Configuration Software/Serial Interface.** Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under Microsoft’s Windows 8.1 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.
2-2. **PRESSURE INSTRUMENTATION.**

2-2.01. **Pressure Transmitters.** Transmitters shall be an all solid state electronic two-wire device that does not require a direct power connection to the transmitter. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, Hastelloy-C, ceramic, or cobalt-chromium-nickel alloy diaphragms, and the transducer may use a silicone oil fluid fill. Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping. Transmitters shall be enclosed in a NEMA Type 4X housing and shall be suitable for operation at temperatures from 0° to 180°F, and relative humidity of 5 to 100 percent. All parts shall be cadmium-plated carbon steel, stainless steel, or other corrosion-resistant materials. Transmitters shall have over-range protection to maximum line pressure. Accuracy of the transmitter shall be 0.075 percent of span, and transmitter output shall be 4-20 mA dc without the need for external load adjustment. Transmitters shall not be damaged by reverse polarity. Transmitters shall have an elevated or suppressed zero. For calibrated spans of less than 8 psig a differential pressure type transmitter with side vents shall be utilized. Transmitters shall be provided with brackets for wall and pipe-stand mounting.

Transmitters shall be factory calibrated to the required range and provided with the manufacturer's standard hand-held communications/calibration device. One device shall be furnished for all transmitters provided by a single manufacturer.

Transmitters tagged on the Drawings or specified to be indicating type shall be furnished with LCD type digital indicators.

Transmitters will have a turndown ratio of 30:1, or more.

Transmitters shall be ABB “Model 264GS”, Endress+Hauser “Cerabar S”, or “Deltabar S Series”, Foxboro "Model IGP10", Rosemount “Model 2051”, or Siemens “SITRANS P”.

2-2.02. **Premium Accuracy Pressure and Pressure Sensing Level Transmitters.** Not used.

2-2.03. **Differential Pressure Transmitters.** Not used.

2-2.04. **Premium Accuracy Differential Pressure Transmitters.** Not used.

2-2.05. **Flange-Mounted Pressure Sensing Level Transmitters.** Not used.

2-2.06. **Ultrasonic Level Transmitters.** Not used.
2-2.07. **Admittance Probe Level Transmitters.** Not used.

2-2.08. **Submersible Pressure Sensing Level Transmitters.** Not used.

2-2.09. **Bubbler System Components.** Not used.

2-2.10. **Fixed-Mount Float Type Level Switches.** Not used.

2-2.11. **Weighted Float Type Level Switches.** Not used.

2-2.12. **Adjustable Deadband Float Type Level Switches.** Not used.

2-2.13. **Electrode/Conductance Relay Level Switches.** Not used.

2-2.14. **Flange-Mounted Displacement Float Type Level Switches.** Not used.

2-2.15. **Flood Level Switches.** Not used.

2-2.16. **Ultrasonic Level Switches.** Not used.

2-2.17. **Pressure Switches.** Not used.

2-2.18. **Field-Mount Pressure Gauges.** Pressure gauges shall be of the indicating dial type, with C-type phosphor bronze Bourdon tube; stainless steel rotary geared movement; phenolic or polypropylene open front turret case; adjustable pointer; stainless steel, phenolic, or polypropylene ring; and acrylic plastic or shatterproof glass window.

Gauge dial shall be 4-1/2 inch size, with white background and black markings. The units of measurement shall be indicated on the dial face. Subdivisions of the scale shall conform to the requirements of the governing standard. Pointer travel shall be not less than 200 degrees or more than 270 degrees of arc.

Surface-mounted gauges shall be provided with 1/4 inch NPT connections. All stem-mounted gauges shall be provided with 1/2 inch NPT connections. Where indicated in the Drawings or on the Instrument Device Schedule, stem mounted gauges shall have an adjustable viewing angle to allow the gauge to be positioned for optimum viewing.

All pressure gauges shall measure in psi and all vacuum gauges in inches water. All gauges shall have a suitable range to give mid-scale readings under normal conditions. Gauge accuracy shall be 0.5 percent of scale range.
Each gauge shall be provided with a threaded end, ball-type gauge valve. Gauge valve materials shall be compatible with the measured process. Where the process is not defined, gauge valves shall have AISI Type 316 stainless steel wetted parts and Teflon seals. Multi-port gauge valves shall have all unused ports plugged. Gauge valve construction shall be as detailed in the Miscellaneous Instruments section.

Gauges shall be installed at the locations indicated on the Drawings, with installation conforming to the installation details. All gauges, snubbers, and diaphragm seals shall be installed in the vertical, upright position. Thread sealer, suitable for use with the associated process, shall be used in the assembly of threaded connections. All connections shall be free from leaks. Lines shall be purged of trapped air at gauge locations prior to installation of the gauge or diaphragm seal.

Each gauge shall be provided with all required mounting hardware to securely mount the unit according to the mounting requirements indicated in the Drawings or the Instrument Device Schedule.

Unless otherwise indicated, mounting and installation hardware shall be Type 316L stainless steel.

Pressure gauges shall be Ashcroft "1279 Duragauge", or equal.

2-2.19. Annular Type Pressure Sensors. Not used.

PART 3 - EXECUTION

3-1. FIELD SERVICES. Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of all miscellaneous instruments and accessories required for the Instrumentation and Control System as specified herein or as indicated on the Drawings.

Equipment and services provided under this section shall be subject to the Instrumentation and Control System section. This section shall be used and referenced only in conjunction with the Instrumentation and Control System section. Supplementing the Instrumentation and Control System section, instrument data, special requirements, and options are indicated on the Drawings or the Instrument Device Schedule.

When multiple miscellaneous instruments of a particular type are indicated, and each requires different selectable features, the required features are described on the Drawings or in Instrument Device Schedule.

1-2. DESIGN CRITERIA. Each device shall be a pre-assembled, packaged unit. Upon delivery to the work site, each device or system shall be ready for installation with only minor piping and electrical connections required by System Supplier.

Primary elements shall derive any required power from the transmitter, unless otherwise indicated.

The instruments shall be installed to measure, monitor, or display the specified process at the ranges and service conditions indicated on the Drawings or as indicated in the Instrument Device Schedule. The instruments shall be installed at the locations indicated on the Drawings or the Instrument Device Schedule.

Where possible, each instrument shall be factory calibrated to the calibration ranges indicated in the Instrument Device Schedule. Transmitters or similar measurement instruments shall be calibrated using National Institute of Standards and Technology (NIST) approved bench calibration procedures, when such procedures exist for the instrument type. Calibration data shall be stored digitally in each device, including the instrument tag designation indicated on the Instrument Device Schedule.
1-3 **SUBMITTALS.** Submittals shall be made as specified in Instrumentation and Control System section.

1-4 **SHIPMENT, PROTECTION, AND STORAGE.** Equipment provided under this section shall be shipped, protected, and stored as specified in the Instrumentation and Control System section. Identification of packaging shall be as described in the Instrumentation and Control System section.

**PART 2 - PRODUCTS**

2-1. **GENERAL.** The following paragraphs provide minimum device stipulations. The Instrument Device Schedule shall be used to determine any additional instrument options, requirements, or service conditions.

2-1.01. **Interconnecting Cable.** For systems where the primary element and transmitter are physically separated, interconnecting cable from the element to the transmitter shall be provided. The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter. Length of cable shall be a minimum of three meters or as indicated in the Instrument Device Schedule.

2-1.02. **Programming Device.** For instruments that require a dedicated programming device for calibration, maintenance, or troubleshooting, one such programming device shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). The programming device shall include appropriate operation manuals and shall be included in the training requirements. For systems that allow the programming device functions to be implemented in software, running on a laptop computer, the software shall be provided instead of the programming device.

2-1.03. **Configuration Software/Serial Interface.** Devices indicated as requiring a serial interface shall be provided with all accessories required to properly communicate over the serial link. An appropriate cable shall be provided to allow the transmitter serial interface to be connected to a personal computer. One licensed copy of the diagnostic/interface software shall be provided for each Owner facility (quantity required shall be as indicated in the Instrumentation and Control System section). Software shall be capable of running under Microsoft’s Windows 8.1 operating system. If the software furnished performs the same functions as the programming device, specified elsewhere, then the programming device shall not be furnished.
2-2. **MISCELLANEOUS INSTRUMENTS.**

2-2.01. **Field-Mounted Process Indicators.** Not used.

2-2.02. **Milliamp Calibrator.** Not used.

2-2.03. **Pressure Calibrator.** Not used.

2-2.04. **Multi-function Instrument Calibrator.** The calibrator shall be completely portable and shall be capable of measuring and generating milliamperees, millivolts and volts. The calibrator shall have one 4-1/2 digit display capable of indicating either calibrator input or output. The display indication (output or input) shall be switch selectable. The input display shall be bipolar, complete with a minus (-) sign.

Inputs shall range from -50 to +50 volts; -100 to +100 mV; and -50 to +50 mA dc. Outputs ranges shall cover 0 to 110 mV, 0 to 11 volts and 0 to 22 mA dc. Input and output accuracy shall be ± 0.1 percent of full scale and shall be traceable to the National Institute of Standards and Technology. The calibrator shall be capable of simulating a two-wire transmitter operating from an external supply voltage of 12 to 65 V dc, or driving an external load of 0 to 400 ohms at 20 mA dc from the calibrator's internal 24 V dc supply. The calibrator shall have input-output isolation and shall be protected against misconnection and overvoltage.

The calibrator shall be powered from a snap-in battery pack capable of operating the calibrator for 8 hours at 20 mA continuous output. The calibrator shall be supplied with two battery packs, a separate battery charger, a carrying case, an instruction manual, and test leads. The calibrator shall be Transmation "1091PLUS".

The calibrator shall be capable of measuring pressure in inches of water or psig. Accuracy of pressure measurement shall be 0.07 percent of full scale and shall be traceable to the National Institute of Standards and Technology. The pressure modules shall have over pressure relief that protects calibration and shall be compatible with nonconductive, noncorrosive, instrument-grade clean air or clean inert gas. Pressure ranges and modules shall be provided as follows:

**Pressure Ranges**

- Dual Scale: 0-10 PSIG; 0-280" H$_2$O
- Dual Scale: 0-33 PSIG; 0 to 830 inches H$_2$O
- Single Scale: 0 to 100 psig

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The calibrator shall be provided with fittings, connecting tubing and a portable air supply pump. The air supply pump shall be Transmation "P".

2-2.05. **Manometer.** Not used.

2-2.06. **Proximity (Door) Switches.** Not used.

2-2.07. **Vibration Switches.** Not used.

2-2.08. **Instrument Shutoff Valves.** Instrument shutoff valves shall be provided for instruments as indicated on the Drawings and as detailed in the specifications. The indicated shutoff valves shall be provided by System Supplier for all instruments furnished under the Panel Mounted Instruments section, Flow Instruments section, Pressure and Level Instruments section, Analytical Instruments section, and the Miscellaneous Instruments section. Shutoff valves shall be compatible with the measured process and shall be selected in accordance with the manufacturer’s recommendations for the specified process. Unused ports of multi-port gauge valves shall be plugged. An instrument shutoff valve schedule shall be submitted indicating the quantity, material, size, and associated instrument. Permanent tagging of the instrument valves is not required. However, temporary hand-written tags or other means of identification shall be provided to ensure that the appropriate valve is installed for a given instrument.

Instrument shutoff valves shall be D/A Manufacturing, Anderson-Greenwood, or equal.

2-2.09. **Limit Switches.** The existing pressure relief valve indicated on the drawings as having limit switches shall be provided with limit switches mounted on the valve operating mechanism housing cover plate. A stainless steel actuating stem with adapter shall be fastened directly to the main valve stem. The main stem shall move through an adapter and gland with two O-Ring seals allowing the stop collar to actuate a micro switch bracket to be mounted on the exterior of the adapter.

Each switch shall be a single pole, double-throw micro switch. Each switch shall be adjustable to operate at any point of the valve’s travel by raising or lowering the collar on the actuating stem. The electrical switch shall be in a weatherproof NEMA 4 enclosure. All assemblies shall be capable of accommodating up to three switches. Standard materials in contact with operating fluid are brass, stainless steel, monel and Buna-N.

The switches shall be Cla-Val Co. Model No. X105LCW Limit Switch Assemblies, as manufactured by Cla-ValCo.
2-2.10. **Modulating Valve Positioners.** Not used.

2-2.11. **Current-to-Pressure Transducers.** Not used.

2-2.12. **Valve Position Transmitters.** Not used.

**PART 3 - EXECUTION**

3-1. **FIELD SERVICES.** Manufacturer's field services shall be provided for installation, field calibration, startup, and training as specified in the Instrumentation and Control System section.

Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

End of Section
Section 15010
VALVE INSTALLATION

PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of new valves and actuators purchased by Contractor as part of this Work.

Cleaning, disinfection, pressure and leakage testing and pipe supports are covered in other sections.

The following specification sections are applicable to valves to be installed:

Title
Miscellaneous Ball Valves
Check Valves
AWWA Butterfly Valves

1-2. GENERAL. Equipment installed under this section shall be erected and placed in proper operating condition in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Any valves and actuators that are identified as being provided by others will be furnished complete for installation by Contractor. Technical specifications under which the equipment will be purchased are available.

1-2.01. Coordination. When manufacturer’s field services or installation check services are provided by the valve manufacturer, Contractor shall coordinate the services with the valve manufacturer. Contractor shall give Engineer written notice at least 30 days prior to the need for manufacturer’s field services.

Flanged connections to valves including the bolts, nuts, and gaskets are covered in the appropriate pipe specification section. Valve ends shall match piping.

PART 2 - PRODUCTS

Not Applicable.
PART 3 - EXECUTION

3-1. INSPECTION. All valves and accessories shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and re-cleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2. INSTALLATION.

3-2.01. General. Valves shall be installed with sufficient clearance for proper operation of any external mechanisms, and with sufficient clearance to dismantle the valve for in-place maintenance. Installation shall be in accordance with the valve manufacturer’s recommendations.

Unless otherwise indicated on the Drawings or specified, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation, as reviewed by Engineer.

3-2.02. Installation Checks. When specified in the valve sections, the valve manufacturer will provide installation checks. For installation checks, the manufacturer’s field representative will inspect the valve installation immediately following installation by Contractor. The manufacturer’s representatives will revisit the site as often as necessary to ensure installation satisfactory to Owner.

3-2.03. AWWA Butterfly Valves. Butterfly valves shall be installed with the shaft horizontal unless otherwise necessary for proper operation or as acceptable to Engineer.

Whenever an actuator must be removed to permit installation of a valve, the actuator shall be promptly reinstalled and shall be inspected and readjusted by a representative of the valve manufacturer.

3-2.04. Check Valves. Check valves shall be installed in accordance with the manufacturers’ recommendations.

3-2.04.01. Lift Check Valves. Not used.

3-2.04.02. Swing Check Valves. Not used.
3-2.04.03. **Low Pressure Air Service Check Valves.** Not used.

3-2.05. **Plug Valves.** Not used.

3-2.05.01. **Eccentric Plug Valves.** Not used.

3-2.05.02. **Plug Valves.** Not used.

3-2.06. **Resilient Seated Gate Valves.** Not used.

3-2.06.02. **Double Disc Gate Valves.** Not used.

3-2.07. **Air Release and Combination Air Valves.** Not used

3-2.08. **Hydrants.** Not used.

3-2.08.01. **Yard Hydrants.** Not used.

3-2.08.02. **Fire Hydrants.** Not used.

3-2.09. **Valve Boxes.** Not used.

3-3. **VALVE ACTUATORS.** Valve actuators and accessories shall be factory mounted on the valve, calibrated, and tested by the valve or actuator manufacturer.

3-4. **FIELD QUALITY CONTROL.**

3-4.01. **Field Testing.** After installation, all valves shall be tested in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.01. **Pressure Tests.** Pressure testing shall be in accordance with the Pipeline Pressure and Leakage Testing section.

3-4.01.02. **Leakage Tests.** All valves shall be free from leaks. Each leak that is discovered within the correction period shall be repaired by and at the expense of Contractor. This requirement applies whether pressure testing is required or not.

3-5. **ADJUSTING.** After installation, the opening and closing time shall be adjusted as needed for each pneumatic, hydraulic and electric actuated valve.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the installation of piping and accessories as indicated on the Drawings for the following piping sections:

<table>
<thead>
<tr>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscellaneous Piping and Pipe Accessories</td>
</tr>
<tr>
<td>Miscellaneous Steel Pipe, Tubing, and Accessories</td>
</tr>
<tr>
<td>Copper Tubing and Accessories</td>
</tr>
</tbody>
</table>

Contractor shall furnish all necessary jointing materials, coatings, and accessories that are specified herein.

Pipe supports and anchors shall be furnished by Contractor, and are covered in the Pipe Supports section.

1-2. GENERAL.

1-2.01. Coordination. Materials installed under this section shall be installed in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by Engineer.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals Procedures section. Items requiring submittals shall include, but not be limited to, the following:

- Materials as specified herein.

1-3.02. Welder Certification. Prior to the start of the work, Contractor shall submit a list of the welders he proposes using and the type of welding for which each has been qualified. Copy of certification and identification stamp shall be submitted for each welder. Qualification tests may be waived if evidence of prior qualification is deemed suitable by Engineer.
1-3.03. **Spool Drawings.** Not used.

1-4. **QUALITY ASSURANCE.**

1-4.01. **Welding and Brazing Qualifications.** All welding and brazing procedures and operators shall be qualified by an independent testing laboratory in accordance with the applicable provisions of Section IX of the ASME Code. All procedure and operator qualifications shall be submitted to the Engineer for review.

1-4.02. **Tolerances.** These tolerances apply to in-line items and connections for other lines.

The general dimension, such as face-to-face, face or end-to-end, face- or end-to-center, and center-to-center shall be 1/8 inch.

The inclination of flange face from true in any direction shall not exceed 3/64 inch per foot.

Rotation of flange bolt holes shall not exceed 1/16 inch.

1-5. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

1-5.01. **Coated Pipe.** Handling methods and equipment used shall prevent damage to the protective coating and shall include the use of end hooks, padded calipers, and nylon or similar fabric slings with spreader bars. Bare cables, chains, or metal bars shall not be used. Coated pipe shall be stored off the ground on wide, padded skids. Plastic-coated pipe shall be covered or otherwise protected from exposure to sunlight.

**PART 2 - PRODUCTS**

2-1. **SERVICE CONDITIONS.** Pipe, tubing, and fittings covered herein shall be installed in the services indicated in the various pipe sections.
2-2. **MATERIALS.**

**Threaded Fittings**

- **Anti-Seize Thread Lubricant**: Jet-Lube "Nikal", John Crane "Thread Gard Nickel", Never-Seez "Pure Nickel Special", or Permatex "Nickel Anti-Seize".

- **Teflon Thread Sealer**: Paste type; Hercules "Real-tuff", John Crane "JC-30", or Permatex "Thread Sealant with Teflon".

- **Teflon Thread Tape**: Hercules "Tape Dope" or John Crane "Thread-Tape".

**Solder or Brazed Fittings**

- **Solder**: Solid wire, ASTM B32, ANSI/NSF 61 certified, Alloy Grade Sb5, (95-5).

- **Soldering Flux**: Paste type, ASTM B813.

- **Brazing Filler Metal**: AWS A5.8, BCuP-5; Engelhard "Silvaloy 15", Goldsmith "GB-15", or Handy & Harman "Sil-Fos".

- **Brazing Flux**: Paste type, Fed Spec O-F-499, Type B.

**Insulating Fittings**

- **Threaded**: Dielectric steel pipe nipple, ASTM A53, Schedule 40, polypropylene lined, zinc plated; Perfection Corp. "Clearflow Fittings".

- **Flanged**: Epco "Dielectric Flange Unions" or Central Plastics "Insulating Flange Unions".

**Protective Coatings**

- **Primer**: As recommended by the tape manufacturer.
PART 3 - EXECUTION

3-1.  INSPECTION.  All piping components shall be inspected for damage and cleanliness before being installed. Any material damaged or contaminated in handling on the job shall not be used unless it is repaired and recleaned to the original requirements by Contractor. Such material shall be segregated from the clean material and shall be inspected and approved by Owner or his representative before its use.

3-2.  PREPARATION.

3-2.01.  Field Measurement.  Pipe shall be cut to measurements taken at the site, not from the Drawings. All necessary provisions shall be made in laying out piping to allow for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction to avoid transmission of noise resulting from expansion.

3-3.  INSTALLATION.

3-3.01.  General.  All instruments and specialty items shall be installed according to the manufacturer’s instructions and with sufficient clearance and access for ease of operation and maintenance.

Flat faced wrenches and vises shall be used for copper tubing systems. Pipe wrenches and vises with toothed jaws will damage copper materials and shall not be used. Bends in soft temper tubing shall be shaped with bending tools.

3-3.02.  Pipe Sleeves.  Not used.

3-3.03.  Pipe Joints.  Pipe joints shall be carefully and neatly made in accordance with the indicated requirements.

3-3.03.01.  Threaded.  Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be fully and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed after threading and before assembly to remove all burrs. Unless otherwise indicated, threaded joints shall be made up with teflon thread tape, thread sealer, or a suitable joint compound.

Threaded joints in plastic piping shall be made up with teflon thread tape applied to all male threads. Threaded joints in stainless steel piping shall be made up with teflon thread sealer and teflon thread tape applied to all male threads. Threaded joints in steel piping for chlorine service shall be made up with teflon thread tape or litharge and glycerine paste applied to all male threads.
3-3.03.02. **Compression.** Ends of tubing shall be cut square and all burrs shall be removed. The tubing end shall be fully inserted into the compression fitting and the nut shall be tightened not less than 1-1/4 turns and not more than 1-1/2 turns past fingertight, or as recommended by the fitting manufacturer, to produce a leaktight, torque-free connection.

3-3.03.03. **Flared.** Ends of annealed copper tubing shall be cut square, and all burrs shall be removed prior to flaring. Ends shall be uniformly flared without scratches or grooves. Fittings shall be tightened as needed to produce leaktight connections.

3-3.03.04. **Soldered and Brazed.** Where solder fittings are specified for lines smaller than 2 inches, joints may be soldered or brazed at the option of Contractor. Brazing alloy shall contain no tin.

Surfaces to be joined shall be thoroughly cleaned with flint paper and coated with a thin film of flux. At each joint, tubing shall enter to the full depth of the fitting socket.

Care shall be taken to avoid overheating the metal or flux. Each joint shall be uniformly heated to the extent that filler metal will melt on contact. While the joint is still hot, surplus filler metal and flux shall be removed with a rag or brush.

3-3.03.05. **Solvent Welded.** Not used.

3-3.03.06. **Epoxy and Adhesive Bonded.** Not used.

3-3.03.07. **Heat Fusion Bonded.** Not used.

3-3.03.08. **Flanged.** Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but shall not be torqued less than the minimum value required by the gasket manufacturer. Flange bolts shall not be so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly.

Flange bolt holes shall be oriented as follows, unless otherwise indicated on the spool drawings:

Vertical flange face: Bolt holes to straddle the vertical centerlines.

Horizontal flange face: Bolt holes shall be aligned with connecting pipe.
Pipe sealants, thread compounds, or other coatings shall not be applied to flange gaskets unless recommended by the gasket manufacturer for the specified service and approved by Engineer.

Welds at orifice flanges shall have internal surfaces ground smooth to the pipe wall.

Slip-on flanges shall be welded inside and outside. There shall be a distance of approximately 1/16 to 1/8 inch between the edge of the fillet weld and the face of the flange. The seal weld shall be applied so that the flange face shall be free of weld spatter and does not require refacing.

Flat-faced flanges shall be used when mating to Class 125 flanges. Full-face gaskets shall be used with flat-faced flanges and ring gaskets shall be used with raised faced flanges.

Weld neck flanges shall be used with butt-weld fittings. The bore of weld neck flanges shall match the pipe wall thickness.

Insulating joints connecting submerged (buried) piping to exposed piping shall be installed above the maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged (buried) metallic piping shall be isolated from the concrete reinforcement. Insulating flanges shall be tested for electrical isolation after installation and bolt-up but prior to introduction of conducting fluid.

3-3.03.09. Welded. Welding shall conform to the specifications and recommendations contained in the "Code for Pressure Piping", ANSI B31.1.

Weld cross-sections shall be equal to or greater than the pipe wall thickness. Welds shall be smooth and continuous and shall have interior projections no greater than 1/16 inch. Backing strips or rings shall not be used except with specific prior review by Engineer as to use, material, and design. Root gap inserts that are completely melted and consumed in the weld bead are acceptable only when reviewed in advance by Engineer.

Stainless steel welding shall be inert gas tungsten arc (TIG) or the direct current, straight polarity, inert gas metal arc process (MIG).

Carbon steel welding shall be made by the shielded metal arc process.

For socket weld joints, fully engage the two pipe ends, then separate them by 1/16 inch prior to welding to all space for shrinkage.
3-3.03.10. **Grooved Couplings.** Not used.

3-3.03.11. **Push-on.** Not used.

3-3.03.12. **Rubber-Gasketed.** Not used.

3-3.03.13. **Other Pipe Joints.** Not used.

3-3.04. **Pipe.** Pipe shall be installed as specified, as indicated on the Drawings, or, in the absence of detail piping arrangement, in a manner acceptable to the Engineer.

Piping shall be installed without springing or forcing the pipe in a manner which would induce stresses in the pipe, valves, or connecting equipment.

Piping shall be supported in conformance with the Pipe Supports section.

Piping shall be connected to equipment by flanges or unions as specified in the various piping sections. Piping connecting to equipment shall be supported by a pipe support and not by the equipment.

Water, gas, and air supply piping shall be provided with a shutoff valve and union at each fixture or unit of equipment, whether or not indicated on the Drawings, to permit isolation and disconnection of each item without disturbing the remainder of the system. Air supply piping shall be provided with sectionalizing valves and valved air inlet connections as needed for isolation of portions of the system for periodic testing. Gas supply lines to buildings shall be provided with a shutoff valve and union located above grade immediately outside the building. A capped drip leg shall be provided at the bottom of the vertical riser of gas supply piping adjacent to gas-fired appliances.

A union shall be provided within 2 feet of each threaded-end valve unless there are other connections which will permit easy removal of the valve. Unions shall also be provided in piping adjacent to devices or equipment which may require removal in the future and where required by the Drawings or the Specifications.

Water supply piping within structures shall be arranged, and facilities provided, for complete drainage. All piping serving metering equipment shall be uniformly graded so that air traps are eliminated and complete venting is provided.

Stuffing box leakage from water sealed pumps shall be piped to the nearest point of drainage collection.

Taps for pressure gauge connections on the suction and discharge of pumping units shall be provided with a nipple and a ball type shutoff valve.
Drilling and tapping of pipe walls for installation of pressure gauges or switches will not be permitted.

In all piping, insulating fittings shall be provided to prevent contact of dissimilar metals, including but not limited to, contact of copper, brass, or bronze pipe, tubing, fittings, valves, or appurtenances, or stainless steel pipe, tubing, fittings, valves, or appurtenances with iron or steel pipe, fittings, valves, or appurtenances. Insulating fittings shall also be provided to prevent contact of copper, brass, or bronze pipe, tubing, fittings, valves or appurtenances with stainless steel pipe, tubing, fittings, valves, or appurtenances.

Piping adjacent to flow sensors shall be installed in accordance with the requirements of the manufacturer of the flow sensor and commonly accepted design practices of the appropriate straight pipe runs both upstream and downstream.

Drains required for operation are shown on the Drawings. However, vents at all high points and drains at all low points in the piping that are required for complete draining for pressure test may not be shown on these Drawings. Contractor shall add such items as found to be necessary during detail piping design and/or piping installation.

3-3.05. Reducers. Eccentric reducers shall be installed flat on the bottom for steam, condensate return and digester gas services.

3-3.06. Valves. Isolation valves provided with equipment and instruments shall be located in a manner which will allow ease of access and removal of the items to be isolated. Prior to soldering or brazing valves, teflon and elastomer seats and seals shall be removed to prevent damage.

3-4. PIPING ASSEMBLY.

3-4.01. General. Contractor shall only use labor that has been qualified by training and experience to capably perform the specified activities required to accomplish the work in a satisfactory manner.

Any deviations from the Specifications or piping locations shown on the Drawings require prior review and approval by Engineer.

3-4.02. Buttwelded Piping. Not used.
3-5. **PROTECTIVE COATING.** Piping shall be coated in accordance with Section 09940 – Protective Coatings.

3-6. **PRESSURE AND LEAKAGE TESTING.** All specified tests shall be made by and at the expense of Contractor in the presence, and to the satisfaction of Engineer. Each piping system shall be tested for at least 1 hour with no loss of pressure. The Contractor shall coordinate this section with the Pipeline Pressure and Leakage Testing section. Piping shall be tested at the indicated pressures:

<table>
<thead>
<tr>
<th>Service</th>
<th>Test Pressure</th>
<th>Test Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply</td>
<td>1-1/2 times working pressure but not less than 120 psi</td>
<td>Water</td>
</tr>
<tr>
<td>Air supply and signal</td>
<td>1-1/2 times working pressure but not less than 50 psi</td>
<td>Compressed air with 100 percent of all oil 0.025 micron and larger removed</td>
</tr>
<tr>
<td>Other piping</td>
<td>1-1/2 times working pressure but not less than 50 psi</td>
<td>Suitable fluid or gas; for distilled water piping, distilled water or filtered oil-free compressed air may be used</td>
</tr>
</tbody>
</table>

Compressed air or pressurized gas shall not be used for testing plastic piping unless specifically recommended by the pipe manufacturer.

Leakage may be determined by loss-of-pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to Engineer. All fixtures, devices, or accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped as needed during the testing.

Unless otherwise required by the applicable codes, drainage and venting systems shall be water tested. For water testing, the drainage and venting system shall be filled with water to the level of the highest vent stack. For air testing, the system shall be charged with air to a minimum pressure of 5 psig. Openings shall be plugged as necessary for either type of test. To be considered free of leaks, the system shall hold the water or air for 30 minutes without any drop in the water level or air pressure.

All necessary testing equipment and materials, including tools, appliances and devices, shall be furnished and all tests shall be made by and at the expense of Contractor. Contractor shall give Engineer five (5) working days advanced notice of scheduled testing.
All joints in piping shall be tight and free of leaks. All joints which are found to leak, by observation or during any specified test, shall be repaired, and the tests repeated.

3-6.01. Air Pressure Tests. Not used.

3-7. CLEANING. The interior of all pipe, valves, and fittings shall be smooth, clean, and free of blisters, loose mill scale, sand, dirt, and other foreign matter when installed. Before being placed in service, the interior of all lines shall be thoroughly cleaned, to the satisfaction of Engineer.

3-8. ACCEPTANCE. Owner reserves the right to have any section of the piping system which he suspects may be faulty cut out of the system by Contractor for inspection and testing. Should the joint prove to be sound, Owner will reimburse Contractor on a time-and-material basis as specified in the Contract. Should the joint prove to be faulty, the destructive test will continue joint by joint in all directions until sound joints are found. Costs for replacement of faulty work and/or materials shall be the responsibility of Contractor.
Section 15060

MISCELLANEOUS PIPING AND PIPE ACCESSORIES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of miscellaneous piping and pipe accessories. Miscellaneous piping shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

1-2. SUBMITTALS.

1-2.01. Drawings and Data. Complete specifications, data and catalog cuts or drawings shall be submitted in accordance with the Submittals Procedures section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

Name of Manufacturer
Type and model
Construction materials, thickness, and finishes
Pressure and temperature ratings

Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-3. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.

PART 2 - PRODUCTS

2-1. MATERIALS. Miscellaneous piping materials shall be as specified herein.
2-1.01. **Material Classification BR-1.**

- **Pipe:** BR-1 – Regular Weight Brass Pipe
- **Fittings:** Gauge piping for hot/cold water.

**ASTM B43, red brass, seamless, regular weight.**

**ANSI/ASME B16.15, Class 125.**

2-1.02. **Material Classification BR-2.** Not used.

2-1.03. **Material Classification HS-1.** Not used.

2-1.04. **Material Classification HS-2.** Not used.

2-1.05. **Material Classification TG-1.** Not used.

2-1.06. **Material Classification CRP-1.** Not used.

2-1.07. **Accessories.** Accessories for the miscellaneous piping systems shall be as indicated:

- Unions for brass pipe

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section
Section 15062

STEEL PIPE

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of steel pipe 6 inches in diameter and larger. Steel pipe shall be furnished and installed complete with all fittings, specials, adapters, closure pieces, blowoffs, outlets, caps and plugs, temporary bulkheads, access manholes, jointing materials, pipe hangers and supports, anchors, blocking, encasements, cathodic protection, appurtenances, and accessories specified and indicated on the Drawings, and as required for proper installation and functioning of the piping.

Steel pipe smaller than 6 inches in diameter, light wall steel pipe, miscellaneous small piping, pipe hangers and supports, pressure and leakage tests, and cleaning and disinfection are covered in other sections.

The size, service, and location of steel pipelines are covered in the Steel Pipe Schedule.

Piping furnished hereunder shall be complete with all joint gaskets, bolts, nuts and other jointing materials required for installation of any valves and equipment, including any valves and equipment furnished by Owner or others for installation under this Contract.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all steel pipe, fittings, and specials shall conform to the applicable requirements of the following standards:

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<th>ANSI/AWWA Standards</th>
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<td>C207</td>
<td>Steel Pipe Flanges for Waterworks Service – Sizes 4 In. through 144 In.</td>
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**ANSI/ASME Standards**

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<tr>
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<td>B36.10</td>
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1-3. QUALIFICATIONS. Pipe manufacturer shall be ISO-9001 or SPFA certified with 5 years’ experience in the manufacture of steel pipe, fittings, coatings, and linings specified. All pipe, fittings, specials, coatings, linings, and appurtenances shall be fabricated at one company facility for quality control purposes, unless otherwise acceptable to the Engineer.

1-3.01. Pipe Manufacturer’s Experience and Services. All steel pipe, fittings, specials, bolts, gaskets, other jointing materials and appurtenances shall be fabricated, lined, coated, and furnished under the direction and management of one pipe manufacturer. The pipe manufacturer’s responsibilities, shall include, at a minimum; coordinating and furnishing all pipe materials, gaskets, bolts, and other jointing materials and pipe appurtenances (except for furnishing coupled joints and other similar products by a specified manufacturer) for a complete piping system that meets the specified pipe test pressure and service conditions; certifying that all pipe, fittings, specials, and other pipe materials, gaskets, and bolts specified herein are being manufactured in full accordance with the Contract Documents; preparing and submitting all submittal information and shop drawings; and making any corrections that may be required to submittal information and shop drawings.

The pipe manufacturer’s minimum required experience qualifications shall include manufacture of interior and buried steel plant piping of similar diameters for at least two water or wastewater plants with the same type joints, linings, and coatings and suitable for the same or higher pressure rating, which has performed satisfactorily for the past 5 years.

All steel pipe shall be installed as specified herein and indicated on the drawings, in accordance with the pipe manufacturer’s recommendations.

1-4. SUBMITTALS. Drawings, details, specifications, installation schedules, welding procedures and welder qualifications, and other data showing complete details of the fabrication, construction, weld locations, joint details and certification, and installation of pipe, fittings, specials, and connections, together with complete data covering all materials proposed for use, shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

a. Certifications and Affidavits of Compliance: Contractor shall submit all certifications and affidavits of compliance. Performing and paying for sampling and testing as necessary shall be the Contractor's responsibility. The following certifications and affidavits of compliance are required for all pipe and other products or materials furnished, as specified in ANSI/AWWA C200 and herein.
1. Mill Certificates. Material lists and steel reinforcement schedules which describe all materials to be utilized. Metallurgical test reports for steel proposed for use on the project. Chemical and physical test reports from each heat of steel that indicate the steel conforms to the Contract Documents. Records shall indicate heat of steel for each pipe joint listed in the pipe laying schedule.

2. List cross-referencing pipe mark numbers with pipe sequence numbers, heat numbers, and can numbers.

3. Hydrostatic test reports.

4. Results of production weld tests.

5. Sand, cement and mortar tests.

6. Rubber gasket tests and gaskets certification by pipe manufacturer, including a written statement from the gasket material manufacturer, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions.

7. All materials in contact with treated or potable water are ANSI/NSF 61 approved.

8. Certification of the proof-of-design tests for rubber gasketed bell and spigot joints (stab joints), or field experience documentation, as specified.

9. Pipe temperature complies with Contract Documents prior to placing backfill material and prior to and during welding.

10. All welds were performed in conformance with these Contract Documents.

11. Affidavit of compliance for each ANSI/AWWA standard covering materials and work furnished for the project.

12. Certification of pipe manufacturer’s minimum experience requirements. Certification to be submitted prior to award of contract if required in the bidding documents or requested by Engineer.
b. Shop Drawings: The Contractor shall submit Shop Drawings of piping in accordance with the requirements of ANSI/AWWA C200 and the following supplemental requirements:

1. Certified dimensional drawings of all pipe, fittings, specials, and appurtenances. The ASTM designation for the material from which each class of pipe is fabricated.

2. Production schedule for manufacturing/fabricating pipe for the work as part of Contractor's Progress Schedule. Steel pipe production schedule shall be included in all versions of the Contractor's Progress Schedule beginning with the first Progress Scheduled submittal.

3. Joint and pipe wall construction details which indicate the type and thickness of cylinder; the position, type, size and area of wire or other reinforcement; coatings and linings including holdbacks; manufacturing tolerances; maximum angular joint deflection limitations; and all other pertinent information required for the manufacture and installation of the product. Joint details and design criteria shall be submitted for all welded joint types, including beveled ends for alignment conformance and any deep butt strap joints required for control of temperature stresses.

4. Pipe design criteria sufficient to ascertain conformance of pipe and fittings with the Contract Documents. Pipe design criteria shall include, but shall not be limited to, minimum pipe diameter, minimum pipe wall thickness, pressures, external loads, yield strength, allowable fiber stress, longitudinal stress for restraint, temperature changes, lining and coating materials, and other factors used for pipe design.

5. Pipe Laying Schedule Information:
   a. Pipe laying schedule and marking diagrams compatible with the requirements of AWWA Manual 11 (M11) which indicate the specific number of each pipe, fitting, and special and the location and direction of each pipe fitting, and special in the completed pipeline. In addition, the pipe laying schedule shall include: the station and centerline or invert elevation coordinated with the Drawings to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment; and the limits within each reach of restrained and/or welded joints or of concrete encasement. The location of all mitered pipe sections,
beveled ends for alignment conformance, and any deep butt strap joints for temperature stress control shall be clearly indicated on the diagrams.

The pipe laying schedule shall have a sequence of laying and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the pipe laying schedule shall list the pipeline station and either the pipe centerline or invert elevation coordinated with the Drawings at least every 100 feet.

b. Drawings showing the location and details of bulkheads for hydrostatic testing of the pipeline including details for removal of test bulkheads and repair of the lining.

c. Details and locations of closures and cutoffs for length adjustment, temporary access manholes, vents and weld lead pass holes as specified or indicated on the Drawings, and as required for construction convenience.

d. The method that the Contractor proposes to use for measuring deflection of pipe joints.

e. Annotated laying schedule showing all changes made during the progress of the Work.

6. Detail drawings indicating the type, number and other pertinent details of slings, strutting, and other methods proposed for pipe support and handling during manufacturing, transport, and installation. The recommended methods of handling and placement of the pipe shall be submitted as a record copy prior to transporting any pipe to the Site. All pipe handling equipment and methods shall be acceptable to the Engineer.

7. For record copy, detailed drawings indicating loading and shipping procedures that are designed to minimize damage to coating.

8. Pipe manufacturer's written Quality Assurance/Control Program.


1-5. SHIPPING, HANDLING, AND STORAGE. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section, and as specified herein.
Pipe, fittings, and accessories shall be handled and stored as recommended by the pipe manufacturer and shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Forks and other lifting devices shall have broad, well-padded contact surfaces.

Contractor-furnished pipe and fittings in which the lining has been damaged shall be replaced by and at the expense of Contractor. With the concurrence of Engineer, small and readily accessible damaged areas may be repaired as recommended by the pipe manufacturer.

If the lining of Owner-furnished pipe or fittings is damaged by Contractor during unloading or handling, the damaged pipe or fittings shall be replaced by and at the expense of Contractor. Where the damaged areas are small and readily accessible, Contractor may be permitted to repair the lining as recommended by the pipe manufacturer.

Contractor shall repair any damage to pipe coatings and linings before the pipe is installed.

PART 2 - PRODUCTS

2-1. BASIS OF DESIGN. Steel pipe, fittings, and specials shall be fabricated type for pipe 14 inches and larger, and may be either fabricated or mill type for pipe 12 inches and smaller. All items shall be the sizes, dimensions, and shapes indicated on the Drawings or specified herein.

The specified size of fabricated pipe, fittings, and specials shall be the nominal inside diameter, in inches, where 12 inches and smaller, and the actual inside diameter of pipe lining, where 14 inches and larger. Where stab joint pipe is permitted and two or more wall thicknesses are required for pipe of the same size, pipe size may be adjusted slightly to allow the different classes of pipe to be stabbed together.

The specified size of mill pipe, fittings, and specials shall be the nominal pipe size as set forth in ANSI/ASME B36.10.

Pipe ellipticity (out-of-roundness) shall not exceed one percent.

Pipe design shall be performed by the pipe manufacturer. Minimum design criteria shall be as specified.
2-1.01. **Pipe Wall Thickness.** Pipe shall be designed for all conditions indicated in the Steel Pipe Schedule and on the drawings.

The wall thickness for internal pressure due to hoop stress shall be determined by the following formula:

\[ t = \frac{(PD)}{(2s)}, \]

where

- \( t \) = the pipe wall thickness in inches.
- \( s \) = the allowable fiber stress in psi, shall not exceed 50 percent of the minimum yield strength of the steel plate at working pressure or 75 percent of the minimum yield strength at the larger of field test pressure or working pressure plus surge pressure. The yield strength used in the calculation for cement mortar coated pipe shall not exceed 36,000 psi. The yield strength used in the calculation for cement mortar lined pipe shall not exceed 45,000 psi.

- \( P \) = the pipe working pressure or the larger of field test pressure or working pressure plus surge pressure in psi.

- \( D \) = the pipe outside diameter, in inches, of straight pipe sections or the larger outside diameter of tapered sections.

Unless otherwise indicated, the working pressure and the working pressure plus surge pressure shall be as indicated in the Steel Pipe Schedule.

The pipe wall thickness shall be in accordance with ANSI/AWWA M11, except that all pipe shall have a wall thickness of at least 1/4 inch, and a diameter to wall thickness ratio not to exceed 165.

Pipe wall thickness shall be constant for the entire length of pipe for each pipe class, location, or service indicated in the Steel Pipe Schedule unless otherwise indicated on the drawings or specified.

2-1.02. **Fitting Dimensions.** The dimensions of steel pipe fittings shall be as indicated on Figures 1-15062(A) and 1-15062(B) and shall be designed by the pipe manufacturer.
2-1.03. Reinforcement of Fittings and Specials. Whether or not shown on the drawings, all bends, fittings, branch connections, reducers, and special sections shall be reinforced, or the pipe wall thickness shall be increased, so that the combined stresses due to internal pressure (circumferential and longitudinal) and bending will not exceed the allowable stresses specified in the Pipe Wall Thickness paragraph. Where external piping reinforcement interferes with other construction the pipe wall thickness shall be increased and external reinforcement eliminated as necessary for acceptable clearances.

Where suspended, the design of reinforcement or wall thickness shall also take into consideration the weight of the piping and appurtenances full of water.

Wall thicknesses of reducing sections shall be not less than the required thicknesses for the larger ends.

2-1.04. Joints. Acceptable joints of the type indicated on the Drawings and as specified herein shall be provided for all pipe installations in the locations indicated or accepted by Engineer. To facilitate installation, additional field-welded or mechanically coupled joints may be provided, but shall be kept to a minimum, and their locations shall be acceptable to Engineer. Field-welded joints shall not be used in pipe smaller than 30 inches, except in locations where the interior coating can be satisfactorily repaired and inspected.

2-2. MATERIALS.

Pipe, Fittings, and Specials
ANSI/AWWA C200. All steel shall be fully killed, with a maximum carbon content of 0.25 percent, made to a fine austenitic grain size practice, and manufactured from continuous cast steel. Maximum yield strength shall be limited to 42,000 psi.

Gaskets – All Joint Types
Synthetic rubber unless otherwise specified; natural rubber will not be acceptable. All gaskets shall be furnished by the pipe manufacturer, unless another manufacturer’s product is specified. Pipe manufacturer shall submit certificates of gasket suitability, certifying that the gasket materials are compatible with the joints specified and are recommended for the specified field test pressure and service conditions. Gaskets for treated or potable water service shall also be certified for chlorinated and chloraminated potable
Joint Lubricant

Vegetable-based lubricant recommended by the pipe manufacturer. Petroleum or animal-based lubricants will not be acceptable. Lubricants that will be in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.

Flanged Joints

Flanges

ANSI/AWWA C207, slip-on, except where otherwise specified or indicated on the Drawings.

Dimensions and Drilling

ANSI/AWWA C207, Class E except as otherwise indicated on the Drawings or specified to match connections to existing flanges.

Blind Flanges

ANSI/AWWA C207, Class E except as otherwise indicated on the Drawings or specified to match connections to existing flanges.

Gaskets

ANSI/AWWA C207. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.

Insulated Flanges

Flanges

As specified herein, except bolt holes shall be enlarged as needed to accept bolt insulating sleeves.

Insulation Kits

As manufactured by Advanced Products or Pipeline Seal and Insulator, Inc.

Insulating Gaskets

Type E, G10, 1/8 inch thick, with Nitrile or EPDM sealing element unless otherwise required by pipe manufacturer and acceptable by Engineer. Pipe manufacturer shall submit certification of gaskets furnished as indicated above under Gaskets – All Joint Types.
Bolt Insulating Sleeves

- Bolt: G-10, 1/32 inch thick.
- Insulating Sleeves: G-10, 1/8 inch thick.

Insulating Washers
- Insulating Washers: G-10, 1/8 inch thick, two for each flange bolt.

Backing Washers
- Backing Washers: Steel, 1/8 inch thick, two for each flange bolt.

Flange Bolting

- Material: ANSI/AWWA C207, unless otherwise required by the pipe manufacturer, including higher strength and accepted by the Engineer.
- Type: Bolt and nut; bolt-stud and two nuts permitted for 1 inch and larger.

Bolts and Bolt-Studs

- Length: As required for ends to project 1/4 to 1 inch beyond outer face of nut.
- Ends: Chamfered or rounded.
- Threading: ANSI/ASME B1.1, coarse thread series, Class 2A fit. Bolt-studs may be threaded full length.
- Bolt Head Dimensions: ANSI/ASME B18.2.1; regular pattern for square, heavy pattern for hexagonal.
- Nuts: Hexagonal.
- Dimensions: ANSI/ASME B18.2.2, heavy, semi-finished pattern.

Coupled Joints
Mechanical Couplings

Gaskets
- Gaskets shall be as recommended by the coupling manufacturer. Coupling manufacturer shall submit certification of gaskets furnished as indicated above under

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Gaskets – All Joint Types.

Full Ring Type


All Others Baker "Series 200", Dresser "Style 38", or Smith-Blair "411 Steel Coupling"; without pipe stop.

Dismantling Joints

Restrained 3 inch and larger. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.

Romac "DJ400", Dresser "Style 131 Dismantling Joint", or Viking Johnson. For use in potable water systems, coating to be in accordance with NSF-61.

Restrained Joints

Welded ANSI/AWWA C200 and C206.

Lugs or Collars ASTM A283, Grade B or C; or ASTM A36.

Tie Bolts ASTM A193, Grade B7.

Threading ANSI/ASME B1.1, Class 2A fit, coarse thread series for 7/8 inch and smaller, and 8-thread series for 1 inch and larger.

Ends Chamfered or rounded.

Nuts Hexagonal, ASTM A194, Grade 2H or better.

Threading As specified for tie bolts, except Class 2B fit.

Dimensions ANSI/ASME B18.2.2, heavy semifinished pattern.

Flat Washers Hardened steel, ASTM A325.
Small Branch Connections

Pipe Nipples Seamless black steel pipe, ASTM A53, standard weight (Schedule 40).

Welding Fittings
- Threaded Outlets Bonney Forge "Thredolets" or Flowserve/Vogt "Weld Couplets".
- Welded Outlets Bonney Forge "Weldolets" or Flowserve/Vogt "Weld Couplets".

Coatings and Linings All materials in contact with treated or potable water shall be certified as being in compliance with ANSI/NSF 61.

Cement Mortar ANSI/AWWA C205 and C602.
- Cement ASTM C150, Type II.
- Sand ANSI/AWWA C205, Section 4.2.3, except sand for field-applied lining shall pass a No. 16 sieve.

Epoxy Bonding Agent ASTM C881, Type II, moisture insensitive and suitable for service conditions.
- Latex Admixture Euclid "Flex-Con" or Sika "SikaLatex".

Universal Primer Pipe manufacturer's standard.

Watertight/Dusttight Pipe Sleeves "PSI Thunderline/Link-Seal", insulating type with modular rubber sealing elements, nonmetallic pressure plates, and stainless steel bolts and nuts.

Anti-Seize Thread Lubricant Jet-Lube "Nikal", John Crane "Thred Gard Nickel", Bostik/Never-Seez "Pure Nickel Special" or Permatex "Nickel Anti-Seize".

Anchor Bolts ASTM A307.

2-3. ENDS OF SECTIONS.

2-3.01. For Field Welding. Not used.

2-3.02. For Fitting with Flanges. Ends to be fitted with slip-on flanges shall be prepared to accommodate the flanges in accordance with the governing standards.
2-3.03. **For Stab Joints.** Not used.

2-3.04. **For Mechanical Couplings.** Ends to be joined by mechanical couplings shall be plain end type. Pipe seam welds on ends to be joined by mechanical couplings without pipe stops shall be ground flush to permit slipping the coupling in at least one direction to clear the pipe joint. The welds on ends to be joined by split ring type couplings shall be ground flush to allow uniform contact of the shoulder and pipe wall. Outside diameter and out-of-round tolerances shall be within the limits specified by the coupling manufacturer.

Where retainer rings for split ring mechanical couplings are required to be fixed to the ends of pipe to provide restraint within a mechanical coupling, at least one of the restraint rings shall be welded in place in the field to assure the coupling is installed with the pipe in a fully-extended position.

2-3.05. **For Grooved Couplings.** Not used.

2-3.06. **For Flanged Coupling Adapters.** Not used.

2-3.07. **For Connection to Dissimilar Pipe Materials.** Steel pipe connections to cast or ductile iron pipe shall be made with insulated flanges.

2-4. **SEAMS.** Except for seamless mill-type pipe, all piping shall be made from steel plates rolled into cylinders or sections thereof with the longitudinal seams butt-welded, or shall be spirally formed and butt-welded. There shall be not more than two longitudinal seams. Girth seams shall be butt-welded and shall be spaced not closer than 10 feet apart except in specials and fittings.

2-5. **PIPE LENGTHS.** Straight pipe section lengths shall be pipe manufacturer's standard lengths, unless otherwise indicated on the Drawings.

All pipe to be connected with mechanical couplings shall be fabricated so that the space between pipe ends within the couplings will not exceed the amount recommended by the coupling manufacturer, but shall be at least 1/2 inch.

2-6. **SMALL BRANCH CONNECTIONS.** Branch connections 2-1/2 inches and smaller shall be made with welding fittings with threaded outlets. Where the exact outlet size desired is in doubt, but is known to be less than 1 inch, a 1 inch outlet shall be provided and reducing bushings used as needed.

Branch connections sized 3 through 12 inches shall be made with pipe nipples or with welding fittings with welded outlets. Pipe nipples and welding fittings shall be welded to the pipe shell and reinforced as needed to meet design and testing requirements.

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Small branch connections shall be so located that they will not interfere with joints, supports, or other details, and shall be provided with caps or plugs to protect the threads during shipping and handling.

2-7. **ACCESS MANHOLES.** Not used.

2-8. **DRAINS AND VENTS.** Pipe used for drain and vent piping shall be ASTM A53, standard weight, black steel pipe. Drain and vent valves shall be ball valves. Drain and vent valves shall comply with the requirements of the valves section.

2-9. **FLANGED JOINTS.** Flange faces of flanged joints shall be normal to the pipe axis. Angular deflection (layback) of the flange faces shall not exceed the allowable set forth in ANSI/AWWA C207. All flanges shall be refaced after welding to the pipe, if necessary to prevent distortion of connecting valve bodies from excessive flange bolt tightening and to prevent leakage at the joint.

Pipe lengths and dimensions and drillings of flanges shall be coordinated with the lengths and flanges for valves, pumps, and other equipment to be installed in the piping. All mating flanges shall have the same diameter and drilling and shall be suitable for the pressures to which they will be subjected.

Flanges shall be of the slip-on type, except that welding-neck or slip-on flanges welded to short lengths of pipe shall be used where installation of flanges in the field is permitted or required.

For welding neck flanges, the pipe shall be concentrically reduced as necessary for proper alignment of the pipe wall with the welding neck flange for butt welding. The interior of the weld joint and flange shall be cement lined in the shop as specified in ANSI/AWWA C205.

2-10. **STAB JOINTS.** Not used.

2-11. **MECHANICAL COUPLINGS.** The middle ring of mechanical couplings shall have a thickness at least equal to the wall thickness specified herein for the size of pipe on which the coupling is to be used. If the coupling manufacturer’s standard thickness is less, that thickness may be used unless allowable pressures are exceeded. The length of each middle ring shall be not less than 10 inches for 36 inches and larger pipe and not less than 7 inches for pipe smaller than 36 inches.

All surfaces, including the interior surfaces of the middle rings, shall be prepared for coating in accordance with the coating manufacturer’s instructions and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210.
Factory pipe spacers shall be provided where indicated on the drawings. The spacers shall be factory coated and lined with 16 mils of liquid epoxy.

2-12. **GROOVED COUPLINGS.** Not used.

2-13. **FLANGED COUPLING ADAPTERS.** Not used.

2-14. **DISMANTLING JOINTS.** Dismantling joints shall be provided for restrained couplings 6 inches and larger. Dismantling joints shall comply with AWWA C219 and shall be restrained flange by flange couplings manufactured as a single unit. Unless otherwise indicated on the Drawings, dismantling joints shall be restrained.

The inner and outer surfaces of dismantling joints, except flange mating surfaces, shall be prepared for coating in accordance with instructions of the coating manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The flange mating surfaces shall be cleaned and shop primed with universal primer.

2-15. **RESTRAINED JOINTS.** Restrained joints shall be flanged, welded or harnessed mechanical couplings as specified or as indicated on the Drawings. All steel pipe shall be restrained.

Where indicated on the Drawings, mechanically coupled joints shall be restrained with harness bolts and lugs or collars. Lugs or collars shall be shop welded to the pipe and coated as specified for the adjacent pipe.

2-16. **PROTECTIVE COATINGS AND LININGS.** All steel pipe, fittings, specials, wall fittings, and accessories shall be lined, coated, or wrapped as specified herein.

2-16.01. **Type of Coating and Lining.** Surface preparation shall be in accordance with the pipe manufacturer’s and coating and lining manufacturer’s instructions. Types of protective coating and lining shall be as follows:

- **Exterior Surfaces in Interior Locations**
  - Shop-applied universal primer.
- **Interior Surfaces**
  - Cement mortar - shop applied, ANSI/AWWA C205. The governing standards shall be as modified herein.
- **Pipe Joints**
  - **Couplings**
    - Shop coating as specified for each type of coupling.
Ends of Sections  
As specified herein.

Machined Surfaces  
Rust-preventive compound.

2-16.02. Modifications to the Governing Standards.

2-16.02.01. Cement Mortar Lining. Cement mortar lining for all pipe shall be shop applied. Except as modified herein, shop-applied mortar linings shall comply with ANSI/AWWA C205.

Specials. Wire fabric reinforcement shall be used in the lining of fittings and specials in accordance with ANSI/AWWA C205.

Adjacent to Valves. If the specified nominal pipe size is the actual outside diameter, cement mortar lining installed in steel pipe adjacent to butterfly valves shall be tapered so that the lining material will not interfere with the valve disc during valve operation.

2-16.02.02. Tape Coating. Not used.

2-17. MARKING. In addition to the pipe markings required by ANSI/AWWA C200, each pipe section, fitting, and special shall be clearly marked to indicate the service, the wall thickness, and the minimum yield strength of the pipe material. Pipe piece identification shall be shown on both the inside and outside of each pipe section, fitting, and special.

2-18. SHOP INSPECTION AND TESTING. Except as otherwise indicated or acceptable to Engineer, all materials and work shall be inspected and tested by the pipe manufacturer in accordance with ANSI/AWWA C200. All costs in connection with such inspection and testing shall be borne by Contractor.

Copies of all test reports shall be submitted in accordance with the Submittals Procedures section.

Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to comply with the specified requirements.

Steel greater than or equal to 1/4 inch thickness used in production manufacturing of pipe and specials shall be tested for notch toughness using Charpy V-Notch tests in accordance with ASTM A370 – Test Methods and Definitions for Mechanical Testing of Steel Products. The test acceptance for full
size specimens (0.394 in. by 0.394 in. size) shall be 25 foot-pounds at a test temperature of 32 degrees F; tests shall include three impact specimens and shall be conducted in the direction transverse to the final direction of rolling. Filler material shall meet the same toughness properties as the base metal. Tests shall be conducted in accordance with ASTM A20 for two coils of each heat.

2-18.01. **Owner's Inspection at the Shop.** If Owner elects to inspect any work or materials, as permitted under Section 5.1 of ANSI/AWWA C200, all costs in connection with the services of Owner's inspector will be paid for by Owner.

A fabrication schedule shall be submitted to Owner at least 30 days prior to fabrication activities. Each time the schedule is changed, the Contractor shall revise and resubmit the schedule. The Contractor shall notify the Engineer at least 5 days prior to any change in the revised and current schedule. If the Owner's representatives make an inspection and the manufacturer is not performing the work as indicated in the revised and current schedule for that date, the expense shall be the sole responsibility of the Contractor.

Additional weld test specimens shall be furnished to Owner's inspector for testing by an independent testing laboratory whenever, in the judgment of Owner's inspector, a satisfactory weld is not being made. Test specimens shall also be furnished when Owner's inspector desires. The entire cost of obtaining, inspecting, and testing of such additional specimen plates, welds, or materials will be borne by Owner. If any specimen is found not to conform to the specified requirements, the materials represented by the specimen will be rejected. The expense of all subsequent tests due to failure of original specimens to comply with the specifications shall be the responsibility of Contractor.

In addition to making or witnessing specified tests and submitting any required reports to Engineer and Owner, Owner's inspector will submit written reports to Contractor concerning all materials rejected, noting the reason for each rejection.

Inspection by Owner's inspector, or Owner's option not to provide inspections, shall not relieve Contractor of his responsibility to provide materials and to perform the work in accordance with the Contract Documents.

The Owner reserves the right to sample and test any pipe after delivery and to reject all pipe represented by any sample which fails to meet with the specified requirements.

**PART 3 - EXECUTION**

3-1. **INSPECTION.** Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Pipe ends shall be examined with particular care. All defective pipe and fittings shall be removed from the Site.
All shop-applied exterior tape or other dielectric coatings on pipe, fittings, or specials shall be electrically inspected for holidays and other defects, and repaired if necessary. All electrical inspection shall be made in accordance with the standard to which the coating was applied.

Inspection and repair of linings and coatings shall be performed by and at the expense of Contractor, after receipt of the pipe, fittings, or specials on the Site and before installation. Electrical inspection of exterior tape or other dielectric coatings after installation of the pipe, fitting, or special in the trench shall be made where, in the opinion of Engineer, the coating may have been damaged by handling during installation.

3-1.01. Confined Space Entry Supervision. Not used.

3-2. PROTECTION AND CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign material prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wiped clean.

Precautions shall be taken to prevent foreign material from entering the pipe during installation and until the work has been accepted.

3-3. ALIGNMENT AND GRADE. Not used.

3-4. INSTALLATION.

3-4.01. Buried Piping. Not used.

3-4.02. Pipe Deflection. Not used.

3-4.03. Flanged Joints. Flange faces shall be flat and perpendicular to the pipe centerline. The rust-preventive coating on the flange faces shall be soluble and shall be removed before the joint is made.

Care shall be taken in bolting flanged joints to avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or would cause unnecessary stress in the flanges. The pipe or fitting shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually in a crisscross pattern at a uniform rate, to ensure uniform compression of the gasket around the entire flange. All flange joint bolting procedures shall be in accordance with the pipe manufacturer’s recommendations.

Care shall be taken when connecting piping to pumping equipment to ensure that piping stresses are not transmitted to the pump flanges. All connecting piping

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shall be permanently supported to obtain accurate matching of bolt holes and uniform contact over the entire surface of flanges is obtained before any bolts are installed in the flanges.

Pump connection piping shall be free to move parallel to its longitudinal center line while the bolts are being tightened. Each pump shall be leveled, aligned, and wedged into position which will fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe so that the pump may be shifted on its foundation if necessary to properly install the connecting piping. Each pump shall, however, be grouted before final bolting of the connecting piping.

After final alignment and bolting, the pump connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as needed and then the flanges bolted back together. The flange bolts then shall be loosened and the process repeated until no movement is observed.

3-4.04. Insulated Flanged Joints. Insulated flanged joints shall be installed where indicated on the Drawings. In addition to one full-faced insulating gasket, each flange insulating assembly shall consist of one full-length sleeve, two insulating washers, and two backing washers for each flange bolt. The insulating gasket ID shall be 1/8 inch less than the ID of the flange in which it is installed. The insulated flanged joint accessories shall be installed in accordance with the instructions and recommendations of the insulating kit manufacturer.

3-4.05. Stab Joints. Not used.

3-4.06. Welded Joints. Not used.

3-4.07. Couplings. Surfaces of pipe ends and couplings in contact with the sealing gasket shall be clean and free from foreign material when the coupling is installed on the pipe. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. All bolts shall be tightened by approximately the same amount, with all parts of the coupling square and symmetrical with the pipe. Following installation, the exterior coating of each coupling shall be touched up or re-primed.

Where restraint is required, Contractor shall verify that tie bolts have been stressed to assure the pipe will not creep when pressurized. When split ring, fixed type couplings are installed, piping shall be in a fully-extended position to engage the restraint rings at the pipe ends.
3-4.07.01. **Flanged Coupling Adapters.** Not used.

3-4.07.02. **Dismantling Joints.** Dismantling joints shall be installed in accordance with the coupling manufacturer’s recommendations. All dismantling joints shall be restrained.

3-4.07.03. **Mechanical Couplings.** Mechanical couplings shall be installed in accordance with the coupling manufacturer’s recommendations. A space of at least 1/4 inch, but not more than 1 inch, shall be left between the pipe ends. Pipe and coupling surfaces in contact with gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks, and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of Engineer.

3-4.07.04. **Grooved-End Joints.** Not used.

3-5. **WALL SLEEVES AND WALL PIPES.** Not used.

3-6. **REDUCERS.** Reducers shall be eccentric or concentric as indicated on the Drawings. Reducers of eccentric pattern shall be installed with the straight side on top, so that no air traps are formed.

3-7. **BLOWOFFS.** Not used.

3.8. **ACCESS MANHOLES.** Not used.

3-9. **PIPE ANCHORS, BLOCKING, CONCRETE ENCASEMENT, HANGERS, AND SUPPORTS.** Pipe anchors, blocking, hangers, and supports shall be installed where and as specified and indicated on Drawings and shall be fabricated in accordance with the Pipe Supports section and the details indicated on the Drawings, and shall be furnished and installed complete with all concrete bases, anchor bolts and nuts, plates, rods, and other accessories required for proper support of the piping. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports. Where the details must be modified to fit the piping and structures, all such modifications shall be subject to acceptance by Engineer. Unless otherwise permitted, lugs for lateral or longitudinal anchorage shall be shop welded to the pipe.

Reaction blocking, anchorages, or other supports for fittings exposed within structures, shall be provided as indicated on the Drawings.

3-10. **JOINT HOLDBACKS AND COATINGS AND LININGS.**
3-10.01. Shop Holdbacks and Coatings and Linings and Field Repair. Entry into the pipe or pipeline for application of interior linings to unlined ends shall be from open ends or through access manholes, except as otherwise permitted by Engineer. Pour holes will not be permitted.

Holdbacks, coatings and linings for pipe ends at joints shall conform to the following:

For Flanged Joints

Extend lining to ends of pipe.

For Mechanically Coupled Joints

Cement Mortar

Hold back coating 16 inches (or greater if required to clear harness lugs) from joints. Shop coat exposed surfaces with liquid epoxy to end of pipe in accordance with ANSI/AWWA C210 Epoxy. Lining shall extend to end of pipe.

Liquid Epoxy

Epoxy shop coating shall extend to ends of pipe; epoxy shop lining shall extend to ends of pipe; in accordance with ANSI/AWWA C210.

For Other Type of Joints

Other types of joints that cannot be shop coated with the primary coating and lining system shall be shop coated and lined with 20 mil dry film thickness of liquid epoxy in accordance with ANSI/AWWA C210 Epoxy.

3-10.02. Modifications to the Governing Standards.

3-10.02.01. Field Repair of Cement Mortar Lining. Field repair of interior joint surfaces shall be done in accordance with ANSI/AWWA C205, except that an epoxy bonding agent and latex admixture shall be used in conjunction with the sand and cement mortar. The addition of lime or pozzolan will not be permitted.

The exposed steel shall be thoroughly cleaned and all grease shall be removed. A coat of epoxy bonding agent shall be applied over the area to be lined in accordance with the coating manufacturer's recommendations. A soupy mixture of cement and water shall be applied over the epoxy after it becomes tacky. Cement mortar to which the latex admixture has been added shall then be
packed into the area to be patched and screeded off level with the adjacent cement mortar lining. The patched area shall be given an initial floating with a wood float, followed by a steel trowel finish.

Defective or damaged cement mortar linings shall be removed, the surfaces cleaned, and the lining repaired as specified above for joint repair. Wire fabric reinforcement shall be used in the lining of fittings and specials in conformance with ANSI/AWWA C205.

3-11. **CORROSION PROTECTION.** Not used.

3-13. **PROVISIONS FOR CATHODIC PROTECTION.** Not used.

3-14. **PRESSURE AND LEAKAGE TESTS.** After installation, pipe and fittings shall be subjected to a pressure test and a leakage test in accordance with the Pipeline Pressure and Leakage Testing section.

3-15. **DISINFECTION.** After installation, all potable water pipelines shall be disinfected as specified in the Cleaning and Disinfection of Water Pipelines section.

End of Section
Schedule 15062-S01
Steel Pipe Schedule

<table>
<thead>
<tr>
<th>Service</th>
<th>Size (inches)</th>
<th>Min. Wall Thickness (inches)</th>
<th>Maximum D/T ratio</th>
<th>Working Pressure (psi)</th>
<th>Working + Surge Pressure (psi)</th>
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<tr>
<td>Pump Suction Lateral</td>
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<td>¼</td>
<td>165</td>
<td>115</td>
<td>215</td>
</tr>
<tr>
<td>Pump Suction Header</td>
<td>20</td>
<td>¼</td>
<td>165</td>
<td>115</td>
<td>215</td>
</tr>
<tr>
<td>Pump Discharge Lateral</td>
<td>12</td>
<td>¼</td>
<td>165</td>
<td>205</td>
<td>250</td>
</tr>
<tr>
<td>Pump Discharge Header</td>
<td>16</td>
<td>¼</td>
<td>165</td>
<td>206</td>
<td>250</td>
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</tbody>
</table>

End of Schedule
MISCELLANEOUS STEEL PIPE, TUBING, AND ACCESSORIES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of miscellaneous steel pipe, tubing and accessories for pipe diameters 24 inches and smaller. Pipe and tubing shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

Steel pipe for potable and non-potable water conveyance are covered in the Steel Pipe section.

1-2. GENERAL.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals Procedures section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

- Name of Manufacturer
- Type and model
- Construction materials, thickness, and finishes
- Pressure and temperature ratings

Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.
1-4.01. **Coated Pipe.** Handling methods and equipment used shall prevent damage to the protective coating and shall include the use of end hooks, padded calipers, and nylon or similar fabric slings with spreader bars. Bare cables, chains, or metal bars shall not be used. Coated pipe shall be stored off the ground on wide, padded skids. Plastic coated pipe shall be covered or otherwise protected from exposure to sunlight.

PART 2 - PRODUCTS

2-1. **GALVANIZED STEEL PIPE.** Galvanized steel pipe materials and service shall be as specified herein.

2-1.01. **Material Classification CSG-1.** Not used.

2-1.02. **Material Classification CSG-2.**

- **CSG-2 – Standard Weight Galvanized Steel with Threaded Fittings**
  - Drain piping from equipment.
  - Pipe: ASTM A53, Type E, standard weight, Grade A or B; or ASTM A106, of equivalent thickness, galvanized.
  - Malleable iron threaded, galvanized. Fittings shall conform to ANSI/ASME B16.3, Class 150, or Fed Spec WW-P-521, Type II.

2-1.03. **Material Classification CSG-3.** Not used.

2-1.04. **Accessory Materials.** Accessory materials for galvanized steel pipe shall be as indicated in the Steel Pipe section of the specification.

2-2. **STEEL PIPE.** Steel pipe materials and service shall be as specified herein.

2-2.01. **Material Classification CS-1.** Not used.

2-2.02. **Material Classification CS-2.** Not used.

2-2.03. **Material Classification CS-3.** Not used.

2-2.04. **Material Classification CS-4.** Not used.
2-2.05. **Material Classification CS-5.** Not used.

2-2.06. **Material Classification CS-6.** Not used.

2-2.07. **Material Classification CS-7.** Not used.

2-2.08. **Material Classification CS-8.** Not used.

2-2.09. **Material Classification CS-9.** Not used.

2-2.10. **Material Classification CS-10.** Not used.

2-2.11. **Material Classification CS-11.** Not used.

2-2.12. **Material Classification CS-12.** Not used.

2-2.13. **Material Classification CS-13.** Not used.

2-2.14. **Material Classification CS-14.** Not used.

2-2.15. **Accessory Materials.** Accessory materials for the miscellaneous steel pipe and tubing systems shall be as indicated.

**Nipples**

ASTM A733, seamless, extra strong (Schedule 80); "close" nipples will be permitted only by special authorization in each case.

**Unions (Malleable Iron)**

Fed Spec WW-U-53l, Class 2; Type B (galvanized) for galvanized pipe or Type A (black) for ungalvanized pipe.

**Flanges**

Standard Weight Pipe

ANSI/ASME B16.5, Class 150, flat faced when connected to flat faced flanges; otherwise, raised face.

Flange Bolts and Nuts

ASTM A193, Grade B7 with ASTM A194 Grade 2H nuts. Length such that, after installation, the bolts will project 1/8 to 3/8 inch beyond outer face of the nut.

**Flange Gaskets**
For Water Service  
ASTM D1330, Grade I, red rubber, ring type, 1/8 inch thick.

For Other Services  
Flat Faced Flanges  
Non-asbestos filler with neoprene or nitrile binder; dimensions to suit flange contact face; 1/16 inch minimum thickness for plain finished surfaces, 3/32 inch minimum thickness for serrated surfaces.

Raised Face Flanges  
Continuous stainless steel ribbon wound into a spiral with non-asbestos filler between adjacent coils with a carbon steel gauge ring. Compressed gasket thickness shall be 0.095 inch ±0.005 inch.

2-3. COATINGS. Standard weight steel pipe in buried locations shall have exterior surfaces protected with a shop applied plastic coating.

All surfaces to be tape-wrapped in the shop shall be thoroughly cleaned and primed in accordance with the tape manufacturer's recommendations immediately before wrapping. The tape shall be applied by two-ply (half-lap) wrapping or as needed to provide a total installed tape thickness of at least 60 mils.

Shop applied coatings shall be as follows:

External Coatings  
Plastic  
Liberty Coating Company “Pritec” or Bredero-Shaw “Entec”. The products of other manufacturers will not be acceptable.

Tape Wrap  
ANSI/AWWA C209, except single ply tape thickness shall not be less than 30 mils; Protecto Wrap “200” or Tapecoat “CT”.

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PART 3 - EXECUTION

3-1. INSTALLATION. Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section
Section 15070

COPPER TUBING AND ACCESSORIES

PART 1 - GENERAL

1-1. **SCOPE.** This section covers the furnishing of copper tubing and accessories. Copper tubing shall be furnished complete with all fittings, flanges, unions, and other accessories specified herein.

1-2. **SUBMITTALS.**

1-2.01. **Drawings and Data.** Complete specifications, data, and catalog cuts or drawings shall be submitted in accordance with the Submittals Procedures section. Submittals are required for all piping, fittings, gaskets, sleeves, and accessories, and shall include the following data:

- Name of Manufacturer
- Type and model
- Construction materials, thickness, and finishes
- Pressure and temperature ratings

Contractor shall obtain and submit a written statement from the gasket material manufacturer certifying that the gasket materials are compatible with the joints specified herein and are recommended for the specified field test pressures and service conditions.

1-3. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section. All materials shall be stored in a sheltered location above the ground, separated by type, and shall be supported to prevent sagging or bending.
PART 2 - PRODUCTS

2-1. MATERIALS. Copper tubing materials and service shall be as specified herein.

2-1.01. Material Classification CU-1.

CU-1 – Water Tubing with Flared Fittings

- Tubing: Soft annealed copper tubing, ASTM B88, Type K.

All instrument tubing not otherwise specified.

2-1.02. Material Classification CU-2. Not used.

2-1.03. Material Classification CU-3.

CU-3 – Water Tubing with Solder and Brazed Joints

- Tubing: Hard drawn copper tubing, ASTM B88, Type L.
- Fittings: Solder joint (smaller than 2 inch), brazed joint (2 inch and larger), material to match tubing. Fittings shall conform to ANSI B16.18, or ANSI/ASME B16.22.

Potable, non-potable water supply, 3 inch and smaller.

Where required for connection to equipment, valves, and accessories, ANSI B16.24, class 150, cast bronze, brazed joint.

2-1.04. Material Classification CU-4. Not used.

2-1.05. Material Classification CU-5. Not used.

2-1.06. Material Classification CU-6. Not used.

2-1.07. Material Classification CU-7. Not used.

2-1.08. Material Classification CU-8. Not used.
2-1.09. **Accessory Materials.** Accessory materials for the copper tubing systems shall be as indicated:

<table>
<thead>
<tr>
<th>Accessory Materials</th>
<th>Specification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange Bolts and Nuts</td>
<td>ASTM A307, Grade B, length such that, after installation, the bolts will project 1/8 to 3/8 inch beyond outer face of the nut.</td>
</tr>
<tr>
<td>Flange Gaskets</td>
<td>ASTM D1330, Grade I, red rubber, ring type, 1/8 inch thick.</td>
</tr>
<tr>
<td>Expansion Joints</td>
<td>Tempflex &quot;Model HB Expansion Compensators&quot; with copper tube ends.</td>
</tr>
<tr>
<td>Insulating Fittings</td>
<td></td>
</tr>
<tr>
<td>Threaded</td>
<td>Dielectric steel pipe nipple, ASTM A53, Schedule 40, poly-propylene lined, zinc plated; Perfection Corp. &quot;Clearflow Fittings&quot;.</td>
</tr>
<tr>
<td>Flanged</td>
<td>Epco &quot;Dielectric Flange Unions&quot; or Central Plastics &quot;Insulating Flange Unions&quot;.</td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Materials furnished under this section will be installed in accordance with the Miscellaneous Piping and Accessories Installation section.

End of Section
Section 15091
MISCELLANEOUS BALL VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of manually operated or remote activated two position (open-close) ball valves as specified herein.

Miscellaneous ball valves shall be provided where AWWA type ball valves are not required.

Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1-2. GENERAL.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment and materials furnished under this section. If the requirements in this section are different from those in the General Equipment Stipulations, the requirements in the section shall take precedence.

1-2.02. Identification. Valves specified herein shall be tagged in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

PART 2 - PRODUCTS

2-1. CONSTRUCTION. Ball valves shown on the drawing, but not specified herein, shall be selected to match piping material they are installed in.
2-1.01. **Valves Type VB-1.**

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<thead>
<tr>
<th>VB-1</th>
<th>Rating</th>
<th>500 psi nonshock cold. WOG.</th>
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</thead>
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<tr>
<td></td>
<td>Water service in Code</td>
<td>MSS SP-110.</td>
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<tr>
<td></td>
<td>metallic piping Type</td>
<td>In-line, two piece, end entry, full port. ASTM B584–C84400 bronze.</td>
</tr>
<tr>
<td></td>
<td>systems.</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Body/Bonnet</th>
<th>2 inch &amp; smaller</th>
<th>500 psi nonshock cold. WOG.</th>
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<tbody>
<tr>
<td>Trims</td>
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<td></td>
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<tr>
<td>Seat</td>
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<td>Thrust Washer</td>
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<td>Temp. Limitations</td>
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</tbody>
</table>

2-1.02. **Valves Type VB-2.** Not used.

2-1.03. **Valves Type VB-3.** Not used.

2-1.04. **Valves Type VB-4.** Not used.

2-1.05. **Valves Type VB-5.** Not used.

2-1.06. **Valves Type VB-6.** Not used.

2-1.07. **Valves Type VB-7.** Not used.

2-1.08. **Valves Type VB-8.** Not used.

2-1.09. **Valves Type VB-9.** Not used.

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2-1.10. **Valves Type VB-10.** Not used.

2-1.11. **Valves Type VB-11.** Not used.

2-1.12. **Valves Type VB-12.** Not used.

2-1.13. **Valves Type VB-13.** Not used.

2-1.14. **Valves Type VB-14.** Not used.

2-1.15. **Valves Type VB-15.** Not used.

2-1.16. **Valves Type VB-16.** Not used.

2-1.17. **Valves Type VB-17.** Not used.

2-1.18. **Length Tolerance.** Unless otherwise specified, the actual length of valves shall be within plus or minus 1/16 inch of the specified or theoretical length.

2-1.19. **Shop Coatings.** All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

**Coating Materials**

- Epoxy Enamel (for liquid service) Ameron "Amerlock 400 High-Solids Epoxy Coating", Carboline "Carboguard 891", or Tnemec "Series N140 Pota-Pox Plus".
- Rust-Preventive Compound As recommended by the manufacturer.

**Surfaces To Be Coated**

Unfinished Surfaces
- Interior Surfaces (Liquid Service)
- Exterior Surfaces of all other valves

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2-2. **VALVE ACTUATORS.** Ball valves, except those which are equipped with power actuators or are designed for automatic operation, shall be provided with manual actuators. Unless otherwise specified or indicated on the drawings, each manual actuator shall be equipped with a lever operator. Ball valves with center lines more than 7'-6” above the floor shall be provided with chain levers.

2-3. **ACCESSORIES.** If the drawings indicate the need for extension stems, stem guides; position indicator; floor boxes; valve boxes; or operating stands, refer to the Valve Actuator section.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Materials furnished under this section shall be installed in accordance with the Valve Installation section.

End of Section
SECTION 15093
CHECK VALVES

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of check valves as specified herein.

Piping, pipe supports, insulation, and accessories that are not an integral part of the valves or are not specified herein are covered in other sections.

1-2. GENERAL. Equipment furnished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the drawings, specified, otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.
2-1. CONSTRUCTION.

2-1.02. Valves VC-2.

<table>
<thead>
<tr>
<th>VC-2</th>
<th>Rating</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>Compatible with the working pressure</td>
<td>AWWA C508</td>
</tr>
<tr>
<td>discharge</td>
<td>(205 psi) and the test pressure</td>
<td></td>
</tr>
<tr>
<td>4 inch or</td>
<td>(250 psi)</td>
<td></td>
</tr>
<tr>
<td>larger</td>
<td>Code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>ASTM A126</td>
</tr>
<tr>
<td></td>
<td>Body</td>
<td>Class B</td>
</tr>
<tr>
<td></td>
<td>Globe Style Silent Check</td>
<td>Cast Iron</td>
</tr>
<tr>
<td></td>
<td>Plus &amp; Sent</td>
<td>Bronze</td>
</tr>
<tr>
<td></td>
<td>Spring</td>
<td>Stainless</td>
</tr>
<tr>
<td></td>
<td>End Connection</td>
<td>Steel, ASTM</td>
</tr>
<tr>
<td></td>
<td>Manuf acturers</td>
<td>A276, T316</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flanged, ASME</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B16.1 Class</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125, flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>faced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>APCO “Series 600” or equal.</td>
</tr>
</tbody>
</table>

2-1.03. Shop Coatings. All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop coated for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating.

Coating Materials

Epoxy Enamel (for liquid service) Ameron "Amerlock 400 High-Solids Epoxy Coating", Carboline "Carboguard°891", or Tnemec "Series N140 Pota-Pox Plus".

Rust-Preventive Compound As recommended by the manufacturer.

Surfaces To Be Coated

Unfinished Surfaces

Interior Surfaces

Liquid Service Epoxy enamel.

Exterior Surfaces Universal primer.

Polished or Machined Surfaces Rust-preventive compound.
PART 3 - EXECUTION

3-1. INSTALLATION. Materials furnished under this section will be installed in accordance with Valve Installation section.

END OF SECTION
PART 1 – GENERAL

1-1. SCOPE. This section covers furnishing of AWWA butterfly valves for cold water service as indicated in the AWWA Butterfly Valve Schedule.

AWWA butterfly valves shall be furnished complete with actuators and accessories as specified herein, as indicated in the schedule, and as specified in the Valve Actuators section.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Valves shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of valves.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standard. Except as modified or supplemented herein, all butterfly valves and manual actuators shall conform to the applicable requirements of ANSI/AWWA C504.

1-2.03. Marking. Supplementing the requirements of Section 6.1 of the governing standard, the country of origin of all castings and an identifying serial number shall be stamped on a corrosion-resistant plate attached to the valve body.

1-2.04. Temporary Number Plates. Each butterfly valve shall be tagged or marked in the factory with the identifying listed in the AWWA Butterfly Valve Schedule.
1-2.05. Identification. AWWA butterfly valves shall be tagged in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the valves and their appurtenances shall be submitted in accordance with the Submittals Procedures section. Included in the submittal shall be drawings by the valve manufacturer to indicate the position of the valve actuator and valve shaft.

Certified copies of test results for tests described in Section 5 of the governing standard shall be submitted to Engineer before the valves are shipped. An affidavit of compliance shall be provided as indicated in Section 6.3 of ANSI/AWWA C504.

PART 2 – PRODUCTS

2-1. ACCEPTABLE PRODUCTS. Butterfly valves shall be manufactured by DeZurik or Pratt (Mueller), without exception.

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of butterfly valves shall conform to the requirements of the governing standard.

Acceptable shop coatings are listed in the following table.

<table>
<thead>
<tr>
<th>Epoxy</th>
<th>PPG Amercoat “Amerlock 400 High Solids Epoxy”, Carboline “Carboguard 891”, Sherwin-Williams &quot;Macropoxy 646NSF&quot; or Tnemec “Series N140 Pota-Pox Plus”.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rust-Preventive</td>
<td>As recommended by manufacturer.</td>
</tr>
<tr>
<td>Compound</td>
<td></td>
</tr>
</tbody>
</table>

2-3. VALVE CONSTRUCTION.

2-3.01. Valve Bodies. Valves shall be short-body type unless otherwise specified in the AWWA Butterfly Valve Schedule. The use of a stop or lug cast integrally with or mechanically secured to the body for the purpose of limiting disc
travel by means of direct contact or interference with the valve disc (in either the open or closed position) will not be acceptable.

2-3.02. **Flanges.** Flanges shall be finished to true plane surfaces within a tolerance limit of 0.005 inch. The finished face shall be normal to the longitudinal valve axis within a maximum angular variation tolerance of 0.002 inch per foot (0.017 percent) of flange diameter.

2-3.03. **Mechanical Joint Ends.** Not used.

2-3.04. **Valve Shafts.** Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts having a hexagonal cross section will not be acceptable. The connection between shaft and disc shall be in accordance with the governing standard.

The connection between the shaft and the disc shall be mechanically secured by means of solid, smooth sided, stainless steel or monel taper pins or dowel pins. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the pins specified herein will not be acceptable.

2-3.05. **Valve Seats.** Acceptable seating surfaces mating with rubber are AISI Type 304 or 316 stainless steel, monel, or plasma-applied nickel-chrome overlay for all valves; bronze for 20 inch and smaller valves; and alloy cast iron for 20 inch and smaller manually operated valves.

Seats shall be located on the valve body. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable.

2-3.06. **Shaft Seals.** Shaft seals shall be of the chevron type.

2-3.07. **Thrust Bearings.** Each valve shall be provided with one or more thrust bearings in accordance with the governing standard. Thrust bearings which are directly exposed to line liquid and which consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface will not be acceptable.

2-4. **VALVE ACTUATORS.** Requirements for valve actuators shall be as specified herein, as indicated in the AWWA Butterfly Valve Schedule, and as specified in the Valve Actuators section.
All 8 inch and larger valves shall have geared actuators.

If valves with an AWWA class designation higher than specified are furnished, actuator torque capabilities shall be increased accordingly and shall be acceptable to Engineer.

2-4.01. **Actuator Sizing.** The valve manufacturer shall size the actuator in accordance with the governing standard, the operating conditions and requirements indicated in the AWWA Butterfly Valve Schedule, and the valve manufacturer’s requirements.

Unless otherwise indicated or specified, actuator torque requirements shall be based on a maximum differential pressure across the valve equal to the maximum pressure associated with the valve class and a maximum velocity through the valve of 16 feet per second.

Valves with operating stands shall have actuator torques increased by 25 percent. Actuator torques determined by the above requirements shall be increased by any design factors required by paragraph 4.2.8 of ANSI/AWWA C504 or as specified herein.

2-5. **SHOP PAINTING.** All interior and exterior ferrous metal surfaces, except finished surfaces, bearing surfaces, and stainless steel components, of valves and accessories shall be shop painted for corrosion protection. The valve manufacturer’s standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

Surfaces shall be painted as follows:

<table>
<thead>
<tr>
<th>Unfinished Surfaces</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Surfaces</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Exterior Surfaces</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Polished or Machined Surfaces</td>
<td></td>
</tr>
<tr>
<td>Flange Faces</td>
<td>Rust-preventive compound.</td>
</tr>
<tr>
<td>Other Surfaces</td>
<td>Epoxy.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>(City of Sioux City, Iowa)</td>
<td>15101</td>
</tr>
<tr>
<td>(520 Booster Station Improv.)</td>
<td>-4-</td>
</tr>
<tr>
<td>(Project 192389.3100)</td>
<td></td>
</tr>
<tr>
<td>(8/20/2018)</td>
<td></td>
</tr>
</tbody>
</table>
Epoxy 10 mils.
Universal Primer 3 mils.

2-6. **ACCESSORIES.** Requirements for extension stems and stem guides, position indicators, floor boxes, operating stands, torque tubes, valve boxes, and extension bonnets shall be as indicated in the AWWA Butterfly Valve Schedule and as specified in the Valve Actuators section.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Valves shall be installed in accordance with the Valve Installation section.

3-1.01. **Installation Check.** An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until any problems are corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping and appurtenances; and has been operated under full load conditions and that it has operated satisfactorily.

All costs for these services shall be included in the contract price.

End of Section
## AWWA Butterfly Valves Schedule
### Manual Actuators

<table>
<thead>
<tr>
<th>Tag Number</th>
<th>Size</th>
<th>Application</th>
<th>Type of Installation(2)</th>
<th>AWWA Class(3)</th>
<th>Maximum Non-Shock Shutoff Pressure</th>
<th>Maximum Differential Pressure</th>
<th>Maximum Velocity</th>
<th>Type of Manual Actuator(4)</th>
<th>Limit Switches(6)</th>
<th>Extensions Stems</th>
<th>Position Indicator for Buried Valve Actuators</th>
<th>Cast Iron Operating Stands</th>
<th>Fabricated Steel Operating Stands</th>
<th>Torque Tubes</th>
<th>Extension bonnet</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFV-1</td>
<td>12</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BFV-2</td>
<td>12</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BFV-3</td>
<td>12</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BFV-4</td>
<td>12</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BFV-5</td>
<td>20</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BFV-6</td>
<td>20</td>
<td>Treated Water O-C</td>
<td>IP</td>
<td>250B-F</td>
<td>250</td>
<td>16</td>
<td>HW</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Section 15140

PIPE SUPPORTS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of pipe hangers, brackets, supports, bracing, anchorage, and the design for the pipe support system for pipes 12 inches and smaller. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories. This section also covers the spacing of expansion joints in pipes 12 inches in diameter and smaller. Expansion joint products and materials are covered in the respective piping sections.

This section covers pipe supports for the following pipe materials:

Steel
Copper

1-2. GENERAL. Contractor shall provide pipe supports, anchors, flexible couplings, and expansion joints for all piping systems. The Drawings indicate pipe supports, anchors, flexible couplings, and expansion joints for pipes larger than 12 inches in diameter, and in special cases for pipes that are 12 inches and smaller. Contractor shall design anchors, pipe supports, expansion joints, and flexible couplings not already shown on the Drawings, in accordance with the requirements specified herein.

Contractor’s design shall include pipe supports, bracing, and anchorage adjacent to expansion joints, couplings, valves, in-line devices, equipment, wyes and tees, or changes in direction as required for dismantling piping, removing valves or other in-line devices, disconnecting piping from equipment, and pipe support, in addition to supports in accordance with the maximum spacing specified herein. The pipe support system design by Contractor shall rigidly support pipe so there is no visible movement or visible sagging between supports. The system shall comply with specified piping code requirements.

Contractor shall not delete or relocate the supports, expansion joints, or couplings indicated on the Drawings without written approval of Engineer.

Pipe supports and expansion joints are not required in buried piping, but concrete blocking or other suitable anchorage shall be provided as indicated on the Drawings or specified in other sections.
1-2.01. **General Equipment Stipulations.** The General Equipment Stipulations shall apply to all supports furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-3. **SUBMITTALS.** Complete data, catalog information, and drawings covering fabricated pipe supports, fabricated inserts, and stainless steel, galvanized, and copper-plated and plastic-coated pipe supports shall be submitted in accordance with the Submittals Procedures section.

Data shall include a listing of the intended use and general location of each item submitted.

When a wind and/or seismic design is required, Contractor shall submit confirmation of compliance with the Meteorological and Seismic Design Criteria section.

**PART 2 - PRODUCTS**

2-1. **MATERIALS.** Unless otherwise indicated, all pipe supports shall comply with ANSI/MSS SP-58 and MSS SP-69. All pipe support materials shall be packaged as necessary to ensure delivery in satisfactory condition.

Pipe supports shall be fabricated of galvanized steel materials.

Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.

Pipe supports shall be manufactured for the sizes and types of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item. Continuously threaded rod is not acceptable for hanger rods over 12 inches in length.

Unless accepted by Engineer, the use of supports which rely on stressed thermoplastic components to support the pipe will not be permitted. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Portions of pipe supports which come into contact with other metals that are dissimilar shall be rubber or vinyl coated. Supports for brass or copper pipe or tubing shall be copper plated or plastic coated.

Unless otherwise noted, all supports shall be hot-dip galvanized in accordance with ASTM A153 and A385.
2-2. **WIND AND SEISMIC LOADS.** Wind and seismic loads for worst case conditions of either full, partially full, or empty pipes shall be considered in the design. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

**PART 3 - EXECUTION**

3-1. **APPLICATION.** Concrete inserts or anchor bolts shall be used to support piping from new cast-in-place concrete. Fastening of supports to existing concrete and masonry shall be in accordance with the Anchorage in Concrete and Masonry section.

Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as specified to force expansion and contraction movement to occur at expansion joints, loops, or elbows, and as needed to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

When expansion joints are required, pipe guides shall be provided adjacent to bellows type expansion joints. Guides will not be required where mechanical couplings are permitted as expansion joints. Guides shall be located on both sides of expansion joints, except where anchors are adjacent to the joint. Unless otherwise indicated on the Drawings, one guide shall be within four pipe diameters from the joint and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for anchoring pipe against longitudinal forces. Pipe guides shall be provided at locations as recommended by the manufacturer.

Pipe supports for insulated cold piping systems shall be sized for the outside diameter of the insulated pipe, and an insulation protection shield shall be installed between the support and the insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields for piping larger than 2 inches or when needed to prevent crushing of the insulation. Inserts shall be of the same thickness as the adjacent insulation and shall be vapor sealed.

Insulated hot piping systems shall be supported by clevises, clamps, support saddles, or rollers. Pipe clamps shall be attached directly to the pipe. Support saddles and rollers shall be sized for the outside diameter of the insulated pipe, and an insulation protection saddle shall be installed at the support.
3-2. **TYPES OF SUPPORTS.** The products for pipe supports shall be as indicated in Table 1 for the specified type and size of support. Where stainless steel is specified for pipe supports but is not available from the name suppliers for the model specified in Table 1, Contractor shall provide a heavier duty support that is available in stainless steel.

**TABLE 1 - TYPES OF SUPPORTS**

<table>
<thead>
<tr>
<th>Description and Service</th>
<th>MSS SP 69 Type (Note 1)</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hangers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-1/2 inch and smaller pipe</td>
<td>1</td>
<td>B-Line &quot;B3100&quot;, Anvil &quot;260&quot; Piping Technology &amp; Products Fig. 83.</td>
</tr>
<tr>
<td>For hot and cold insulated piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clevis</td>
<td>1</td>
<td>B-Line &quot;B3100&quot;, Anvil &quot;260&quot; Piping Technology &amp; Products Fig. 83.</td>
</tr>
<tr>
<td><strong>Other services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J-style</td>
<td>5</td>
<td>B-Line &quot;B3690&quot;, Anvil &quot;67&quot;, Unistrut &quot;J Hanger&quot;, or Piping Technology &amp; Products Fig. 67.</td>
</tr>
<tr>
<td>Clevis</td>
<td>1</td>
<td>B-Line &quot;B3104&quot;, Anvil &quot;260&quot;, or Piping Technology &amp; Products Fig 83.</td>
</tr>
<tr>
<td><strong>3 Through 12 inch pipe (Note 3)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For hot insulated piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double bolt</td>
<td>3</td>
<td>B-Line &quot;B3144&quot;, Anvil &quot;295&quot;, or Piping Technology &amp; Products Fig. 70.</td>
</tr>
<tr>
<td>For cold insulated piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clevis</td>
<td>1</td>
<td>B-Line &quot;B3100&quot;, Anvil &quot;260&quot;, or Piping Technology &amp; Products Fig 83.</td>
</tr>
<tr>
<td>For uninsulated cold piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clamp</td>
<td>4</td>
<td>B-Line &quot;3140&quot;, Anvil &quot;212&quot;, or Piping Technology &amp; Products Fig. 50.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Description and Service</th>
<th>MSS SP 69 Type (Note 1)</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clevis</td>
<td>1</td>
<td>B-Line &quot;B3100&quot;, Anvil &quot;260&quot;, or Piping Technology &amp; Products Fig 83.</td>
</tr>
<tr>
<td>Other services Clevis</td>
<td>1</td>
<td>B-Line &quot;B3100&quot; or Anvil &quot;260&quot; for steel pipe; B-Line &quot;B3102&quot;, Anvil &quot;590&quot;, or Piping Technology &amp; Products Fig. 83 C. L. for cast iron pipe.</td>
</tr>
<tr>
<td>Concrete Inserts, Steel 12 inch and smaller pipe</td>
<td>18</td>
<td>Channel 12 ga, galv, 1-5/8 by 1-3/8 inches, min. 8 inches long, anchor lugs on 4 inch centers, at least three lugs, end caps, and filler strip.</td>
</tr>
<tr>
<td>Beam Clamps, Malleable Iron or Steel, 12 inch and smaller pipe</td>
<td>21, 28, 29</td>
<td>B-Line &quot;3050&quot; and &quot;3055&quot;, Anvil &quot;133&quot; and &quot;134&quot;, or Piping Technology &amp; Products Fig. 130 and Fig. 130 (SP). Anvil &quot;292&quot; or Piping Technology &amp; Products Fig. 140.</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>B-Line &quot;3054&quot;, Anvil &quot;228&quot;, or Piping Technology &amp; Products Fig. 140.</td>
</tr>
<tr>
<td>Side Beam Bracket</td>
<td>34</td>
<td>B-Line &quot;B3062&quot;, Anvil &quot;202&quot;, or Piping Technology &amp; Products Fig. 20L.</td>
</tr>
</tbody>
</table>
### Wall Supports and Frames

#### Steel, 12 inch and smaller pipe (Note 2)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brackets</td>
<td>32</td>
<td>B-Line &quot;B3066&quot;, Anvil &quot;195&quot;, or Piping Technology &amp; Products Fig. 76.</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>B-Line &quot;B3067&quot;, Anvil &quot;199&quot;, or Piping Technology &amp; Products Fig. 76.</td>
</tr>
</tbody>
</table>

#### Prefabricated channels

<table>
<thead>
<tr>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 ga, galv, 1-5/8 inches, with suitable brackets and pipe clamps.</td>
<td></td>
</tr>
</tbody>
</table>

#### Offset pipe clamp, 1-1/2 inch and smaller pipe

<table>
<thead>
<tr>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galv, 1-1/4 by 3/16 steel, with 3/8 inch bolts.</td>
<td></td>
</tr>
</tbody>
</table>

#### Offset pipe clamp, 2 to 3-1/2 inch pipe

<table>
<thead>
<tr>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galv, 1-1/4 by 1/4 steel, with 3/8 inch bolts.</td>
<td></td>
</tr>
</tbody>
</table>

### Floor Supports, Steel or Cast Iron

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>37 (with base) B-Line &quot;B3090&quot;, Anvil &quot;259&quot; or Piping Technology &amp; Products Fig. 48.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>B-Line &quot;B3093&quot;, Anvil &quot;264&quot; or Piping Technology &amp; Products Fig. 46.</td>
<td></td>
</tr>
</tbody>
</table>

### Pipe Alignment Guides

<table>
<thead>
<tr>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3281&quot; through &quot;B3287&quot;, Anvil &quot;255&quot;, or Piping Technology &amp; Products Fig. 6.</td>
<td></td>
</tr>
</tbody>
</table>

### Turnbuckles Steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3202&quot;, Anvil &quot;230&quot;, or Piping Technology &amp; Products Fig. 30.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hanger Rods, Carbon Steel, Threaded Both Ends, 3/8 inch minimum size

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3205&quot;, Anvil &quot;140&quot;, or Piping Technology &amp; Products Fig. 128.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Weldless Eye Nut, steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3200&quot;, Anvil &quot;290&quot;, or Piping Technology &amp; Products Fig. 40.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Insulation Protection Saddle

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3160 Series&quot;, Anvil &quot;160 Series&quot;, or Piping Technology &amp; Products Fig. 184.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Insulation Protection Shield

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Line &quot;B3151&quot;, Anvil &quot;167&quot;, or Piping Technology &amp; Products Fig. 183.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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(City of Sioux City, Iowa ) 15140
(520 Booster Station Improv. ) -6-
(Project 192389.3100 )
(8/20/2018 )
Table 1 Notes:

1. MSS SP-69 supports and hangers are illustrated on Figure 1-15140.
2. Pipe clamps or other devices which rely on the application of a clamping force to the supported pipe in order to maintain the clamp position or location in a prefabricated channel or track will not be acceptable for use with nonmetallic pipe or tubing.
3. Alternatively, pipe hangers for 12 inch pipe may be saddle type as indicated on the Drawings.

3-3. SUPPORT SPACINGS. Pipe supports and expansion joints shall be spaced in accordance with Table 2. The types of pipes to be supported are as specified herein. Table 2 covers spacings for the standard operating conditions specified for each pipe material. Spacing in the tables is the maximum spacing considering gravity loads. Where Contractor’s design includes lateral and longitudinal forces due to seismic loads, wind loads, and other forces, the spacing requirement may be less than that indicated in the tables.

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Pipe Support Max Spacing</th>
<th>Max Run Without Expansion Joint, Loop, or Bend (Note 1)</th>
<th>Expansion Joint Max Spacing (Note 2)</th>
<th>Type of Expansion Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel, for other services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-1/4 inch and smaller</td>
<td>7</td>
<td>30</td>
<td>100</td>
<td>Note 3</td>
</tr>
<tr>
<td>1-1/2 to 4 inch</td>
<td>10</td>
<td>30</td>
<td>100</td>
<td>Note 3</td>
</tr>
<tr>
<td>Over 4 inch</td>
<td>15</td>
<td>80</td>
<td>80</td>
<td>Note 6</td>
</tr>
<tr>
<td>Copper, for hot water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 inch and smaller</td>
<td>5</td>
<td>20</td>
<td>100</td>
<td>Note 3</td>
</tr>
<tr>
<td>Over 1 inch</td>
<td>7</td>
<td>20</td>
<td>100</td>
<td>Note 3</td>
</tr>
<tr>
<td>Copper, for services other than hot water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 inch and smaller</td>
<td>5</td>
<td>--</td>
<td>--</td>
<td>Note 7</td>
</tr>
<tr>
<td>Over 1 inch</td>
<td>7</td>
<td>50</td>
<td>100</td>
<td>Note 3</td>
</tr>
</tbody>
</table>
Table 2 Notes:

1. Unless otherwise acceptable to Engineer, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.

2. Unless otherwise acceptable to Engineer, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.

3. Expansion joint fittings are specified in the respective piping sections.

4. At least two properly padded supports for each pipe section.

5. At least one support for each pipe section.

6. Expansion joints shall be mechanical couplings.

3-4. INSTALLATION.

3-4.01. General. All piping shall be supported in a manner which will prevent undue stress on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, and adjacent to flexible couplings. Pipe supports and hangers shall not be installed in equipment access areas.

Where horizontal piping is arranged with two or more parallel lines, trapeze hangers may be used in lieu of individual hangers. Trapeze assembly shall consist of structure attachments as previously specified with rod size dependent upon total weight supported. Spacing of assemblies shall be determined by the minimum pipe size included in the group supported. Trapeze horizontal assemblies shall be structural angle or channel section of sufficient size to prevent measurable sag between rods when pipes are full. All lines shall be attached to the horizontal with intermediate pipe guides and U-bolts or one-hole clamps. Pre-engineered support equipment may be used when selected and installed in accordance with the manufacturer's recommendations.

Where copper pipe is installed on a support system of dissimilar metal with other pipes, the copper pipe shall be galvanically isolated from the support using Neoprene strips or other material acceptable to Engineer.

No piping shall be supported from the pipe above.

Horizontal piping hanger support rods shall attach to steel beams with center-loading I-clamps, or welded beam clips. Hanger support rods shall attach to concrete slabs or beams with inserts.

Anchorage shall be provided to resist both lateral and longitudinal seismic forces.
3-4.02. **Inserts.** Reference building structural concrete Drawings for concrete inserts. When not provided as part of the building concrete structure, provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

Where concrete slabs form finished ceilings, provide inserts flush with the slab surface.

Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. NDE (Non-Destructive Evaluation) shall be used to locate existing reinforcing before drilling.

3-4.03. **Pipe Hangers and Supports.** Hanger rod sizes for copper pipe and plastic pipe shall be the size of hanger rods for steel pipe. Install hangers to provide a minimum 1/2 inch space between finished covering and adjacent work.

A hanger shall be placed within 18 inches of each horizontal elbow, and on both sides of all piping accessories and valves weighing 20 lbs or more.

Hangers shall have 1-1/2 inches minimum vertical adjustment.

Support horizontal cast iron, ductile iron and no-hub piping systems adjacent to each joint.

Support vertical piping at every floor using riser clamps.

Support riser piping independently of connected horizontal piping.

Hanger and hanger components shall be sized specifically for the pipe size it is to be used on.

3-5. **PLACEMENT.** The maximum spacing for pipe supports and expansion joints shall be as indicated in Table 2.

Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

Unless otherwise indicated on the Drawings or acceptable to Engineer, piping shall be supported approximately 1-1/2 inches out from the face of walls and at least 3 inches below ceilings.

End of Section
Section 15180

VALVE ACTUATORS

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing manual actuators and accessories as specified herein.

1-2. GENERAL. Equipment provided under this section shall be fabricated and assembled in full conformity with Drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

Actuators shall be furnished with all necessary parts and accessories indicated on the Drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Governing Standards. Except as modified or supplemented herein, actuators for resilient-seated gate valves shall conform to the applicable requirements of ANSI/AWWA C509.

Except as modified or supplemented herein, actuators for butterfly valves shall conform to the applicable requirements of ANSI/AWWA C504.

1-2.03. Power Supply. Not used.

1-2.04. Marking. Each actuator shall be marked with the manufacturer's name, model number, and the country of origin. An identifying serial number shall be stamped on a corrosion-resistant plate attached to the actuator.

1-2.05. Temporary Number Plates. Each actuator shall be factory tagged or marked to identify the actuator and the applicable valve by number or service as indicated in the valve schedule.

1-3. SUBMITTALS. Complete drawings, details, and specifications covering the actuators and their appurtenances shall be submitted in accordance with the
Submittal Procedures section. Submittal drawings shall clearly indicate the country of origin of each actuator and its components.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. General. Actuators and appurtenances shall be designed for the conditions and requirements as indicated in the respective valve sections.

Liberal factors of safety shall be used throughout the design, especially in the design of parts subject to intermittent or alternating stresses. In general, working stresses shall not exceed one-third of the yield point or one-fifth of the ultimate strength of each material.

2-1.02. Valve Actuators. Each actuator shall be designed to open or close the valve under all operating conditions. Actuators shall be designed for the maximum pressure differential across the valve and maximum velocities through the valve where indicated in the respective valve schedules.

Valve actuators shall be provided and adjusted by the valve manufacturer. Actuator mounting arrangements and positions shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by Engineer.

When valves are to be buried, submerged, or installed in vaults; the actuators and accessories shall be sealed to prevent the entrance of water. The design water depth shall be as indicated in the respective valve schedules but not less than 20 feet.

2-1.03. Limit Switches. Not used.

2-2. MATERIALS. Except as modified or supplemented herein, materials used in the manufacture of actuators shall conform to the requirements of the applicable governing standard(s).

2-3. VALVE MANUAL ACTUATORS.

2-3.01. General. Manual actuators of the types listed in the valve specifications or schedules shall be provided by the valve manufacturer.

Unless otherwise indicated or specified, each geared manual actuator shall be equipped with an operating handwheel. The direction of rotation of the wheel, wrench nut, or lever to open the valve shall be to the left (counterclockwise).
Each valve body or actuator shall have cast thereon the word "Open" and an arrow indicating the direction to open.

The housing of traveling-nut type actuators shall be fitted with a removable cover which shall permit inspection and maintenance of the operating mechanism without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. The use of stop nuts or adjustable shaft collars which rely on clamping force or setscrews to prevent rotation of the nut or collar on the reach rod will not be acceptable.

Each actuator shall be designed so that shaft seal leakage cannot enter the actuator housing.

Valves for throttling service shall be equipped with an infinitely variable locking device or a totally enclosed gear actuator.

Actuators shall produce the required torque with a maximum pull of 80 lbs on the lever, handwheel, or chain. Actuator components shall withstand, without damage, a pull of 200 lbs on the handwheel or chainwheel or an input of 300 foot-lbs on the operating nut.

2-3.02. Handwheels. Handwheel diameters shall be at least 8 inches but not more than 24 inches for 30 inch and smaller valves and not more than 30 inches for 36 inch and larger valves. All handwheels shall be furnished with integral spinner knobs; clamp-on style spinner knobs will not be acceptable.

2-3.03. Chainwheels. Not used.


2-3.05. Chain Levers. Not used.

2-3.06. Wrench Nuts. Not used.


2-3.08. Wall Brackets. Not used.

2-4. ACTUATOR ACCESSORIES.

2-4.01. Extension Stems. Not used.
2-4.02. **Position Indicators.** Unless otherwise specified, each valve actuator shall be provided with a position indicator to display the position of the plug or disc relative to the body seat opening.

Each actuator for butterfly valves, except where located in manholes, buried, or submerged, shall have a valve disc position indicator mounted on the end of the valve shaft. A disc position indicator shall also be provided on each operating stand or the actuator mounted thereon.

2-4.02.01. **Position Indicators for Buried Actuators.** Not used.

2-4.03. **Floor Boxes.** Not used.

2-4.04. **Torque Tubes.** Not used.

2-4.05. **Valve Boxes.** Not used.

2-5. **SHOP PAINTING.** All ferrous metal surfaces, except bearing and finished surfaces and stainless steel components of valve actuators and accessories, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable, provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.

The following surfaces shall be painted:

- Polished or Machined Surfaces: Rust-preventive compound.
- Other Surfaces: Epoxy.
- Actuators and Accessories: Universal primer.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Actuators will be installed on the valves in accordance with the Valve Installation section.

End of Section
PART 1 - GENERAL

1-1. **SCOPE.** This section covers the furnishing and installation of all equipment and materials needed for the electrical requirements of this Contract. It also covers conduit, wiring, and terminations for electrical equipment installed under Electrical Equipment Installation section.

This section covers the installation and interconnection of electrical equipment furnished under other sections, except electrical items designated to be installed under those sections.

1-2. **GENERAL.** Electrical apparatus on all equipment shall be installed complete and placed in readiness for proper operation.

Electrical materials furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer.

1-2.01. **General Equipment Stipulations.** The General Equipment Stipulations section shall apply to all equipment provided under this section. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence.

1-2.02. **Seismic Design Requirements.** Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

1-2.03. **Coordination.** Electrical work shall conform to the construction schedule and the progress of other trades.

1-2.04. **Anchor Bolts and Expansion Anchors.** All anchor bolts, nuts, washers, and expansion anchors shall comply with Anchorage in Concrete and Masonry section, except smaller than 3/4 inch will be permitted to match NEMA standard size bolt holes on motors and electrical equipment.
1-2.05. **Drawings.** Supplementing this section, the Drawings indicate locations of equipment and enclosures and provide one-line and schematic diagrams regarding the connection and interaction with other equipment.

1-3. **CODES AND PERMITS.** All work shall be performed and materials shall be furnished in accordance with the NEC - National Electrical Code, the NESC - National Electrical Safety Code, and the following standards where applicable:

- ANSI American National Standards Institute.
- AWG American Wire Gauge.
- ICEA Insulated Cable Engineers Association.
- IEEE Institute of Electrical and Electronics Engineers.
- IESNA Illuminating Engineering Society of North America.
- NEIS National Electrical Installation Standards
- NEMA National Electrical Manufacturers Association.
- UL Underwriters' Laboratories.

Equipment covered by this section shall be listed by UL, or by a nationally recognized third party testing laboratory. All costs associated with obtaining the listing shall be the responsibility of Contractor. If no third-party testing laboratory provides the required listing, an independent test shall be performed at Contractor's expense. Before the test is conducted, Contractor shall submit a copy of the testing procedure to be used.

1-4. **SEISMIC DESIGN REQUIREMENT.**

1-4.01. **Seismic Design Requirements.** Submit confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1-5. **IDENTIFICATION.**

1-5.01. **Conduit.** Conduits in manholes, handholes, building entrance pull boxes, junction boxes, and equipment shall be provided with identification tags. Identification tags shall be 19 gage stainless steel, with 1/2 inch stamped letters and numbers as indicated on the Drawings. Identification tags shall be attached to conduits with nylon tie wraps and shall be positioned to be readily visible.
1-5.02. **Conductors.** All conductors in power, control, and instrumentation circuits shall be identified and color coded as described herein.

1-5.02.01. **Conductor Identification Number.** Except for lighting and receptacle circuits, each individual conductor in power, control, and instrumentation circuits shall be provided with wire identification markers at the point of termination.

The wire markers shall be of the heat-shrinkable tube type, with custom typed identification numbers.

The wire numbers shall be as indicated on the equipment manufacturer’s drawings.

The wire markers shall be positioned to be readily visible for inspection.

1-5.02.02. **Conductor Color Coding.** Power conductors shall be color coded as indicated below. For conductors 6 AWG and smaller, the color coding shall be the insulation finish color. For sizes larger than 6 AWG, the color coding may be by marking tape. The equipment grounding conductor shall be green or green with one or more yellow stripes if the conductor is insulated.

The following color coding system shall be used:

- 120/240V single-phase — black, red, and white
- 120/208V, three-phase — black, red, blue, and white
- 120/240V, three-phase — black, orange, blue, and white
- 277/480V, three-phase — brown, orange, yellow, and gray

Where 120/240 and 120/208 volt systems share the same conduit or enclosure, the neutral for either the 120/240 volt system or the 208 volt system shall be white with a permanent identifiable violet stripe.

Control and instrumentation circuit conductors shall be color coded as indicated in the Cable Data Figures at the end of this section.

1-5.03. **Motor Starters.** Not used.

1-5.04. **Control Stations.** Not used.

1-5.05. **Circuit Breakers.** Not used.

1-5.06. **Disconnect Switches.** All switches shall have front cover-mounted permanent nameplates that include switch type, manufacturer's name and catalog number, and horsepower rating. An additional nameplate, engraved or
etched, laminated black-over-white plastic, with 1/8 inch letters, shall be provided to identify the associated equipment. Both nameplates shall be securely fastened to the enclosure.

1-5.07. Arc Flash Hazard Labels. Lighting panels, power panels, power centers, and meter socket enclosures shall be provided with permanent labels warning the risk of arc flash and shock hazard. Labels shall be designed in accordance with ANSI Z535.4-1998 and shall include the following:

WARNING
Arc Flash and Shock Hazard

Appropriate personal protection equipment (PPE) required. SEE NFPA 70E.
Equipment must be accessed by qualified personnel only.
Turn off all power sources prior to working on or inside equipment.

Additional information shall be provided on the labels where specified in the Arc Flash Hazard Analysis section of this section.

1-6. SUBMITTALS. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the work performed by the Contractor, shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

Drawings and data.
Operating manuals.
Samples.

1-6.01. Submittal Identification. Information covering all materials and equipment shall be submitted for review in accordance with the Submittals Procedures section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment as follows:

a. Lamp fixture descriptive sheets shall show the fixture schedule letter, number, or symbol for which the sheet applies.

b. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies.

c. Sheets or drawings covering more than the item being considered shall have all inapplicable information crossed out.

d. A suitable notation shall identify equipment and materials descriptive literature not readily cross-referenced with the Drawings or Specifications.
e. Schematics and connection diagrams for all electrical equipment shall be submitted for review. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted, unless it is clearly marked to show the intended connections.

Contractor shall submit the name and qualifications of the Engineering and Testing Services firm proposed to perform the coordination study and the on site testing.

Within 90 days after the Notice to Proceed, Contractor shall furnish a submittal for all types of cable and conduit to be provided. The submittal shall include the cable manufacturer and type, and sufficient data to indicate that the cable and conduit meet the specified requirements.

In addition to the complete specifications and descriptive literature, a sample of the largest size of each type of cable shall be submitted for review before installation. Each sample shall include legible and complete surface printing of the cable identification.

1-6.02. Seismic Design Requirements. Submitted confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1-7. PROTECTION AND STORAGE. During construction, the insulation on all electrical equipment shall be protected against absorption of moisture, and metallic components shall be protected against corrosion by strip heaters, lamps, or other suitable means. This protection shall be provided immediately upon receipt of the equipment and shall be maintained continuously.

PART 2 - PRODUCTS

2-1. POWER SERVICE ENTRANCE. Not used.

2-2. TELEPHONE SERVICE ENTRANCE. Not used.

2-3. CABLE. All cables of each type (such as lighting cable or 600 volt power cable) shall be from the same manufacturer.

All types of cable shall conform to the Cable Data Figures at the end of this section and as described herein.

2-3.01. Lighting Cable. Not used.
2-3.02. **600 Volt Power Cable.** Cable in power, control, indication, and alarm circuits operating at 600 volts or less, except where lighting, multiconductor control, and instrument cables are required, shall be 600 volt (Figure 2-16050 XHHW-2) power cable.

2-3.03. **Instrument Cable.** Cable for electronic circuits to instrumentation, metering, and other signaling and control equipment shall be two- or three-conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield. Types of instrument cables shall be (Figure 4-16050 single pair).

2-3.04. **Multiconductor Control Cable.** Not used.

2-3.05. **Medium Voltage Power Cable.** Not used.

2-3.06. **Tray Cable.** Not used.

2-4. **CONDUIT.** Conduit and raceways shall be as described in the following paragraphs:

2-4.01. **Rigid Steel Conduit.** Rigid steel conduit shall be heavy wall, hot-dip galvanized, shall conform to ANSI C80.1, and shall be manufactured in accordance with UL 6.

2-4.02. **Intermediate Metal Conduit (IMC).** Not used.

2-4.03. **Liquidtight Flexible Metal Conduit.** Liquidtight flexible metal conduit shall be hot-dip galvanized steel, shall be covered with a moistureproof polyvinyl chloride jacket, and shall be UL labeled.

2-4.04. **Utility (PVC) Duct.** Not used.

2-4.05. **Rigid Nonmetallic (PVC) Conduit.** Not used.

2-4.06. **PVC-Coated Rigid Steel Conduit.** Not used.

2-4.07. **Electrical Metallic Tubing (EMT).** Not used.

2-4.08. **Rigid Aluminum Conduit (RAC).** Not used.

2-5. **WIRING DEVICES, BOXES, AND FITTINGS.** Concealed conduit systems shall have flush-mounted switches and convenience outlets. Exposed conduit systems shall have surface-mounted switches and convenience outlets.
2-5.01. **Conduit Boxes and Fittings.**

a. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be manufactured by Crouse-Hinds, Appleton, or O Z Gedney. In applications utilizing aluminum conduit systems, aluminum boxes and fittings manufactured by Crouse-Hinds, Appleton, or O Z Gedney shall be installed.

b. Rigid PVC device boxes and fittings shall be manufactured by Carlon or Cantex.

c. Sheet steel device boxes shall be manufactured by Appleton, Raco, or Steel City.

d. PVC coated device boxes shall be manufactured by Ocal, Perma-Cote, or Robroy Industries.

e. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement to avoid unnecessary bends and fittings.

2-5.02. **Device Plates.**

a. Galvanized or cadmium-plated device plates shall be used on surface mounted outlet boxes where weatherproof plates are not required.

b. Device plates on flush mounted outlet boxes where weatherproof plates are not required shall be AISI Type 302 stainless steel, Eagle "93nnn series", Hubbell "S series", or Leviton "840nn-40 series"; nylon or polycarbonate, Eagle "513nV series", Hubbell "Pn series", or Leviton "807nn-1 series".

c. Device plate mounting hardware shall be countersunk and finished to match the plate.

d. Device plates for switches outdoors or indicated as weatherproof shall have provisions for padlocking switches "On" and "Off", and shall be Appleton "FSK-1VS", Crouse-Hinds "DS185" or O Z Gedney "FS-1-WSCA".

e. Device plates for receptacles indicated as weatherproof shall be Appleton "FSK-WRD", Crouse-Hinds "WLRD1", or O Z Gedney "FS-1-WDCA.

f. Flush-mounted, weatherproof plates shall be provided with adapter plates, Appleton "FSK-SBA" or Crouse-Hinds "FS031".
g. Device plates for ground fault interrupter receptacles indicated to be weatherproof shall be Appleton "FSK-WGFI", Eagle "966", or O Z Gedney "FS-1-GFCA".

h. Receptacle covers outdoors or otherwise indicated to be weatherproof while in-use shall be die cast aluminum and shall include a padlock eye. Covers for standard convenience outlets shall be Hubbell “WP8M” or Thomas and Betts Red Dot “CKMUV”. Covers for ground fault interrupter receptacles shall be Hubbell “WP26M” or Thomas and Betts Red Dot “CKMUV”.

i. Engraved device plates, where required, shall be manufactured by Leviton, or equal.

j. Device plates on PVC conduit fittings shall be Carlon "E98 Series" or Cantex "513300 Series".

2-5.03. **Wall Switches.**

a. Switches on ac lighting panel load circuits through 277 volts shall be 20 amperes, 120/277 volts, Eagle "2221V" through "2224V", Hubbell "HBL 1221I" through "HBL 1224I", or Leviton "1221-2I" through "1224-2I".

b. Switches for pulse control of lighting contactors shall be 20 amperes, 120/277 volts, momentary, double-throw, center "Off", Eagle "2220V", Hubbell "1557I" or Leviton "1257-I".

c. Switches on ac lighting panel load circuits through 277 volts in Class I, Division 1 and Division 2, Group D hazardous areas indicated on the Drawings shall be 20 ampere, 120/277 volts. Hazardous area switches shall be factory sealed tumbler switches, Appleton “EDS” or Killark “FXS”.

2-5.04. **Receptacles.** Not used.

2-5.05. **Special Outlets.** Not used.

2-6. **JUNCTION BOXES, PULL BOXES, AND WIRING GUTTERS.** Indoor boxes (larger than switch, receptacle, or fixture type) and gutters shall be constructed of sheet steel, shall be galvanized after fabrication, and shall be rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.

Indoor boxes and gutters in corrosive areas indicated on the Drawings and outdoor boxes and gutters shall be NEMA Type 4X, ABS or stainless steel and shall be rigidly supported by PVC-coated or stainless steel framing materials.
Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer’s instructions.

Bolt-on junction box covers 3 feet square or larger, or heavier than 25 lbs, shall have rigid handles. Covers larger than 3 by 4 feet shall be split.

Where indicated on the Drawings, junction and pull boxes with a removable side opposite the underground conduits shall be provided over building ends of underground conduit banks. Boxes shall be sized in accordance with the National Electrical Code, including space for full size continuations of all underground conduits not originally continued. Conduit arrangement shall leave maximum space for future conduits.

2-7. **LIGHTING FIXTURES.** Not used.

2-8. **LIGHTING PANELS.** Not used.

2-9. **POWER PANELS.** Not used

2-10. **SURGE PROTECTIVE DEVICES.** Not used.

2-11. **SEPARATELY ENCLOSED MOTOR STARTERS.** Not used.

2-12. **SEPARATELY ENCLOSED MANUAL STARTERS.** Not used.

2-13. **CONTROL STATIONS.** Not used.

2-14. **SEPARATELY ENCLOSED CIRCUIT BREAKERS.** Not used.

2-15. **DISCONNECT SWITCHES.** Unless otherwise specified, each disconnect switch shall be 3 pole, nonfusible, 600 volts, with a continuous current rating as indicated on the Drawings.

Switches located indoors shall have NEMA type enclosure designations as required by the locations where they will be installed. Switches located outdoors shall have NEMA Type 4X enclosures. Switches in chlorine rooms, or in other areas where contact with caustic substances may occur, shall have NEMA Type 4X enclosures of molded reinforced polyester.

Switches shall have high conductivity copper, visible blades; nonteasible, positive, quick-make, quick-break mechanisms; and switch assembly plus operating handle as an integral part of the enclosure base. Each switch shall have a handle whose position is easily recognizable and which can be locked in
the "Off" position with three padlocks. The "On" and "Off" positions shall be clearly marked.

All switches shall be UL listed and horsepower rated, and shall meet the latest edition of NEMA KS1. Switches shall have defeatable door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

2-16. **LIGHTING AND AUXILIARY POWER TRANSFORMERS.** Not used.

2-17. **POWER CENTERS.** Not used.

2-18. **POWER FACTOR CORRECTION CAPACITORS.** Capacitors shall be rated 3 phase delta and for the voltage of the system to which they will be connected. The capacitors shall not contain PCBs. Enclosures shall be suitable for the areas in which they are installed and as indicated by the area designations on the Drawings.

The kVAR sizes indicated on the Drawings are only approximate and shall be as recommended by the motor manufacturer to improve the power factor to 95 percent at full load. Contractor shall modify cable and conduit sizes to match. Capacitors shall be complete with discharge resistors and fuses.

2-19. **LIGHTING CONTACTORS.** Not used.

2-20. **PHOTOELECTRIC CONTROLS.** Not used.

2-21. **RELAY ENCLOSURES.** Not used.

2-22. **ALARMS HORN AND BEACON.** Not used.

2-23. **HEAT-TRACED PIPING.** Not used.

2-24. **MOTOR CONTROL CENTER MODIFICATIONS.** Existing autotransformer starters shall be replaced with solid-state starters as shown on the Drawings. Existing MCC is a 15" deep Allen-Bradley Centerline, Bulletin 2100 lineup. Interior components shall be replaced as necessary within the existing starter vertical sections. Providing new vertical sections will not be acceptable. A qualified field installation representative of Rockwell/Allen-Bradley shall perform all MCC modifications. Upon completion, certification of a UL listed installation shall be provided.

2-24.01. **Combination Solid-State Starters.** As indicated on the Drawings, control center starters shall be breaker combination, solid-state, reduced voltage...
type. Six back-to-back silicon controlled rectifiers shall be used to provide smooth, stepless motor acceleration. When the motor reaches full speed, a bypass contactor shall close and carry the continuous duty motor current.

a. Starters shall be 3 phase, 60 Hz, with overloads, a 120 volts ac bypass contactor coil, a dry-type control transformer, and a molded-case circuit breaker. Control transformers shall be mounted with the removable starters and shall have capacity for all simultaneous loads. Control transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded.

b. The bypass contactor shall have an 8 hour current rating in accordance with the latest NEMA standards.

c. One NO and one NC spare interlock contacts, whether on the starter or on a relay, shall be wired separately to the unit terminal board.

d. Starters shall include smooth starting and stopping, adjustable starting torque, adjustable ramp time, inverse time overload current trip, current limit, phase loss protection, and adjustable electronic overloads.

e. An external manual breaker operating handle with provisions for up to three padlocks shall be provided on each starter. The access door shall be interlocked with the circuit breaker so that the door cannot be opened, except by an interlock override, while the breaker is closed.

f. Contractor shall match control transformers, overloads, and the minimum sizes of starters to equipment furnished, which may differ from the estimated values indicated on the Drawings. Overload relay devices shall be adjusted to reflect reduced motor current caused by load-side power factor correction capacitors.

g. Unless otherwise specified, spare starters shall have breakers and overloads sized for the largest rated motor and 100 watts extra transformer capacity.

h. Starters shall include an auxiliary contactor for connection to a line-side power factor correction capacitor. The contactor shall be interlocked to prevent the capacitor from being connected before the bypass contactor has energized.

i. Starters shall provide a 4-20 mA analog output for remote indication of current to the plant control system. Range shall be coordinated with the motor. Starter shall include any CTs or additional modules required to provide this output signal.
2-24.02. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Startup Requirements section, and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer. The manufacturer’s representative shall work with the pump manufacturer, motor manufacturer, Contractor, Engineer, and Owner to set and field adjust solid-state starter settings during startup for proper pump operation.

The manufacturer’s representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily. The report shall include final settings for each solid-state starter.

All costs for these services shall be included in the Contract price.

PART 3 - EXECUTION

3-1. INSTALLATION, TESTING, AND COMMISSIONING. All material, equipment, and components specified herein shall be installed, tested, and commissioned for operation in compliance with NECA 1000 – NEIS Specification System. Where required in NECA 1000, testing and commissioning procedures shall be followed prior to energizing equipment.

3-2. ARC FLASH HAZARD ANALYSIS. Contractor shall commission an Arc Flash Hazard Analysis for each piece of electrical equipment in accordance with OSHA 29 CFR Part 1910, NEC, NFPA 70E, and IEEE 1584 and shall submit an Arc Flash Hazard Analysis report as specified herein.

The Arc Flash Hazard Analysis shall be performed in association with, or as a continuation of, the short circuit study and protective-device coordination study.

Arc Flash Hazard Analysis calculations shall lead to a selection of a level of Personal Protective Equipment (PPE) that is a balance between the calculated incident energy exposure and the work activity being performed, while meeting the following concerns:

Provide adequate protection.
Avoid the need for more protection than is warranted.
Results of the Arc Flash Hazard Analysis shall be used to identify the flash-protection boundary and the incident energy at assigned working distances throughout any position or level in the overall electrical generation, transmission, distribution, or utilization system.

The analysis shall include, but shall not be limited to, the following:

- A tabulation of the symmetrical RMS bolted fault current available and X/R ratio at each piece of electrical equipment.
- A tabulation of the arc fault current available at each piece of electrical equipment.
- A list containing the incident energy and the flash-protection boundary for all electrical equipment.
- A list containing each piece of electrical equipment, its corresponding incident energy, hazard rating, and the required Personal Protective Equipment.

An Engineering and Testing Services firm acceptable to Engineer shall conduct the Arc Flash Hazard Analysis.

3-2.01. Arc Flash Analysis Software. The Arc Flash Hazard Analysis shall be performed using the latest version of SKM Power*Tools for Windows software, without exception. After the final version of the study and analysis are completed and accepted, Contractor shall provide two (2) copies of the SKM electronic file to Owner.

3-2.02. Arc Flash Hazard Report. Contractor shall be responsible for submitting complete and accurate arc flash analysis information in the Arc Flash Hazard Report. The report shall be submitted to Engineer for review before the final report is prepared. Contractor shall ensure that calculated values for flash-protection boundary, working distance, incident energy, and required Personal Protective Equipment is submitted and provide substantiation that the information will be prominently displayed on electrical equipment.

The Arc Flash Hazard Analysis report shall be bound in a standard 8-1/2 by 11 inch three-ring binder and shall be submitted in accordance with the Submittals section. Final selection of required Personal Protective Equipment shall be subject to review and acceptance by Engineer.

3-2.03. Arc Flash Labeling. After approval of the Arc Flash Hazard Report, Contractor shall furnish and install arc flash warning labels on the applicable electrical equipment. All electrical equipment shall be provided with the appropriate ANSI compliant arc flash labeling. Labels shall include the flash
protection boundary distance, incident energy, and minimum required Personal Protective Equipment.

3-3. **COORDINATION STUDY.** Contractor shall commission a short circuit study and protective-device coordination study of relays, fuses, circuit breakers, and all other protective devices and shall submit a coordination report as specified herein. The study shall include the entire distribution system, or the portion of the system indicated as required, starting with the smallest – 480 volt, 3 phase, 60 Hz – circuit protective device on the load end, to the nearest protective device on the power company’s line side.

Contractor shall be responsible for and shall ensure that all relays and circuit breakers are set according to the study results.

The study shall include, but shall not be limited to, the following:

- Color-coded printouts of coordination curves prepared with calculation software.
- A tabulation of all protective relay and circuit breaker trip settings and recommended sizes and types of medium-voltage fuses.
- Motor starting profiles for all 50 horsepower and larger motors.
- Transformer damage curves and protection, evaluated in accordance with ANSI/IEEE C57.109.
- Coordination curve(s) from the power company, if available.
- Calculated short-circuit values at all nodes in the distribution system included within the scope of the coordination study.

An Engineering and Testing Services firm acceptable to Engineer shall conduct the coordination study.

Contractor shall be responsible for obtaining the following:

- The coordination curves for relays, fuses, and circuit breakers.
- Transformer damage curves.
- Motor data.
- Other applicable information for all new and existing electrical equipment.

Contractor shall coordinate with the power company to obtain the required protective device curves and shall be responsible for all the field work associated with obtaining the necessary data on existing relays, circuit breakers, fuses, and transformers to be included in the coordination study.
The available 3 phase, symmetrical fault current at the point of service shall be obtained from the Power Company.

The coordination report shall be bound in a standard 8-1/2 by 11 inch three-ring binder and shall be submitted in accordance with the Submittals section. Final selection of all protective device settings or sizes shall be subject to review and acceptance by Engineer.

3-4. POWER AND SERVICE ENTRANCE INSTALLATION. Not used.

3-5. TELEPHONE SERVICE ENTRANCE INSTALLATION. Not used.

3-6. CABLE INSTALLATION.

3-6.01. General. Except as otherwise specified or indicated on the Drawings, cable shall be installed according to the following procedures, taking care to protect the cable and to avoid kinking the conductors, cutting or puncturing the jacket, contamination by oil or grease, or any other damage. Circuits to supply electric power and control to equipment and devices, communication and signal circuits as indicated on the one-line diagrams shall be installed continuous and may not be spliced unless approved by the Engineer.

a. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.

b. Stranded conductor cable shall be spliced by crimp type connectors. Twist-on wire connectors may be used for splicing solid cable and for terminations at lighting fixtures.

c. Splices may be made only at readily accessible locations.

d. Cable terminations and splices shall be made as recommended by the cable manufacturer for the particular cable and service conditions. All shielded cable stress cone terminations shall be IEEE Class 1 molded rubber type. Shielded cable splices shall be tape or molded rubber type as required. Shielded cable splices and stress cone terminations shall be made by qualified splicers. Materials shall be by 3M Company, Plymouth/Bishop, or Raychem Electric Power Products.

e. Cable shall not be pulled tight against bushings nor pressed heavily against enclosures.
f. Cable-pulling lubricant shall be compatible with all cable jackets; shall not contain wax, grease, or silicone; and shall be Polywater "Type J".

g. Cables operating at more than 2000 volts shall be fireproofed in all cable vaults, manholes, and handholes. Fireproofing shall be applied with a half-lapped layer of 3M "Scotch 77 Arc-Proofing Tape", anchored at each end with a double wrap of 3M "Scotch 69 Glass Cloth Tape" or with equivalent tape by Anixter or Plymouth/Bishop.

h. Where necessary to prevent heavy loading on cable connections, in vertical risers, the cable shall be supported by Kellems, or equal, woven grips.

i. Spare cable ends shall be taped, coiled, and identified.

j. Cables shall not be bent to a radius less than the minimum recommended by the manufacturer. For cables rated higher than 600 volts, the minimum radius shall be 8 diameters for nonshielded cable and 12 diameters for shielded cable.

k. All cables in one conduit, over 1 foot long, or with any bends, shall be pulled in or out simultaneously.

l. Circuits to supply electric power and control to equipment and devices are indicated on the one-line diagrams. Conductors in designated numbers and sizes shall be installed in conduit of designated size. Circuits shall not be combined to reduce conduit requirements unless acceptable to Engineer.

3-6.02. Underground Cable Pulling Procedure. Not used.

3-6.03. Cable Insulation Test. Not used.

3-7. CONDUIT INSTALLATION. Contractor shall be responsible for routing all conduits. This shall include all conduits indicated on the one-lines, riser diagrams, and home-runs shown on the plan Drawings. Conduits shall be routed as defined in these Specifications. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.

Except as otherwise specified or indicated on the Drawings, conduit installation and identification shall be completed according to the following procedures.

3-7.01. Installation of Interior and Exposed Exterior Conduit. This section covers the installation of conduit inside structures, above and below grade, and in exposed outdoor locations. In general, conduit inside structures shall be
concealed. Large conduit and conduit stubs may be exposed unless otherwise specified or indicated on the Drawings. No conduit shall be exposed in water chambers unless so indicated on the Drawings.

Unless otherwise indicated on the Drawings, Contractor shall be responsible for routing the conduit to meet the following installation requirements:

a. Conduit installed in all exposed indoor locations, except corrosive areas indicated on the Drawings, and in floor slabs, walls, and ceilings of hazardous (classified) locations, shall be rigid steel. Exposed conduit shall be rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.

b. Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 40 PVC.

c. Conduit installed in all exposed outdoor locations shall be PVC-coated rigid steel, rigidly supported by PVC-coated framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer’s instructions.

d. Final connections to dry type transformers, to motors without flexible cords, and to other equipment with rotating or moving parts shall be liquid tight flexible metal conduit with watertight connectors installed without sharp bends and in the minimum lengths required for the application, but not longer than 6 feet unless otherwise acceptable to Engineer.

e. Terminations and connections of rigid steel and intermediate metal conduit shall be taper threaded. Conduits shall be reamed free of burrs and shall be terminated with conduit bushings.

f. Exposed conduit shall be installed either parallel or perpendicular to structural members and surfaces.

g. Two or more conduits in the same general routing shall be parallel, with symmetrical bends.

h. Conduits shall be at least 6 inches from high temperature piping, ducts, and flues.

i. Conduit installed in corrosive chemical feed and storage areas as indicated by Area Type on the Drawings shall be rigid Schedule 40 PVC.

j. Rigid Schedule 40 PVC conduit shall have supports and provisions for expansion as required by NEC Article 352.

k. Metallic conduit connections to sheet metal enclosures shall be...
securely fastened by locknuts inside and outside.

l. Rigid Schedule 40 PVC conduit shall be secured to sheet metal device boxes using a male terminal adapter with a locknut inside or by using a box adapter inserted through the knockout and cemented into a coupling.

m. Conduits in walls or slabs, which have reinforcement in both faces, shall be installed between the reinforcing steel. In slabs with only a single layer of reinforcing steel, conduits shall be placed under the reinforcement. Conduits larger than 1/3 of the slab thickness shall be concrete encased under the slab.

n. Conduits that cross structural joints where structural movement is allowed shall be fitted with concretetight and watertight expansion/deflection couplings, suitable for use with metallic conduits and rigid Schedule 40 PVC conduits. The couplings shall be Appleton Type DF, Crouse-Hinds Type XD, or O-Z Type DX.

o. Conduit shall be clear of structural openings and indicated future openings.

p. Conduits through roofs or metal walls shall be flashed and sealed watertight.

q. Conduit installed through any openings cut into non-fire rated concrete or masonry structure elements shall be neatly grouted. Conduit penetrations of fire rated structure elements shall be sealed in a manner that maintains the fire rating as indicated on the Architectural Drawings.

r. Conduits shall be capped during construction to prevent entrance of dirt, trash, and water.

s. Exposed conduit stubs for future use shall be terminated with galvanized pipe caps.

t. Concealed conduit for future use shall be terminated in equipment or fitted with couplings plugged flush with structural surfaces.

u. Where the Drawings indicate future duplication of equipment wired hereunder, concealed portions of conduits for future equipment shall be provided.

v. Horizontal conduit shall be installed to allow at least 7 feet of headroom, except along structures, piping, and equipment or in other areas where headroom cannot be maintained.

w. Conduit shall not be routed across the surface of a floor, roof, or
walkway unless approved by Engineer.

x. PVC-coated rigid steel conduit shall be threaded and installed as recommended by the conduit manufacturer’s installation procedure using appropriate tools.

y. All conduits that enter enclosures shall be terminated with acceptable fittings that will not affect the NEMA rating of the enclosure.

z. Nonmetallic conduit, which turns out of concrete slabs or walls, shall be connected to a 90 degree elbow of PVC-coated rigid steel conduit before it emerges. Conduits shall have PVC-coated rigid steel coupling embedded a minimum of 3 inches when emerging from slabs or walls and the coupling shall extend 2 inches from the wall.

ab. Power conductors to and from adjustable frequency drives shall be installed in steel conduit.


3-7.03. Sealing of Conduits. Not used.

3-7.04. Reuse of Existing Conduits. Existing conduits may be reused subject to the concurrence of Engineer and compliance with the following requirements:

a. A wire brush shall be pulled through the conduit to remove any loose debris.

b. A mandrel shall be pulled through the conduit to remove sharp edges and burrs.

3-8. WIRING DEVICES, BOXES, AND FITTINGS INSTALLATION. Metallic and nonmetallic conduit boxes and fittings shall be installed in the following locations:

3-8.01. Conduit Boxes and Fittings.

a. Galvanized or cadmium plated, threaded, malleable iron boxes and fittings shall be installed in concrete walls, ceilings, and floors; in the outdoor faces of masonry walls; and in all locations where weatherproof device covers are required. These boxes and fittings shall also be installed in exposed rigid steel and intermediate metal conduit systems.

b. Galvanized or cadmium plated sheet steel boxes shall be installed in the indoor faces of masonry walls, in interior partition
walls, and in joist supported ceilings.

c. Rigid PVC device boxes shall be installed in exposed nonmetallic conduit systems.

d. PVC coated boxes and fittings shall be installed in PVC coated conduit systems.

e. Telephone conduit shall be provided with separate junction boxes and pull fittings.

3-8.02. Device Plates. Oversized plates shall be installed where standard-sized plates do not fully cover the wall opening.

3-8.03. Wall Switches.

a. Wall switches shall be mounted 3'-6" above floor or grade.

b. After circuits are energized, all wall switches shall be tested for proper operation.

3-8.04. Receptacles.

a. Convenience outlets shall be 18 inches above the floor unless otherwise required.

b. Convenience outlets outdoors and in garages; in basements, shops, storerooms, and rooms where equipment may be hosed down; shall be 4 feet above floor or grade.

c. Welding receptacles shall be surface-mounted 4 feet above the floor.

d. After circuits are energized, each receptacle shall be tested for correct polarity and each GFCI receptacle shall be tested for proper operation.

e. Conduit and wire for convenience outlet installation is not shown on the Drawings and shall be sized, furnished, and installed by Contractor. Conductors shall be minimum 12 AWG and conduit shall be minimum 3/4 inch for convenience outlet installation.

3-8.05. Special Outlets.

a. Wall thermostats shall be 4'-6" above the floor unless otherwise required. Thermostats on exterior walls shall be suitably insulated from wall temperature.
b. Telephone outlets shall be 18 inches above the floor unless otherwise required. Telephone outlets outdoors and in garages; in basements, shops, storerooms, and rooms where equipment may be hosed down; shall be 4 feet above floor or grade.

c. Clock outlets shall be located 7 feet above the floor.

d. Horns and strobe lights for audio/visual alarms shall be mounted a minimum of 8 feet above finished floor and shall be positioned to provide maximum penetration of the surrounding area.

3-9. **EQUIPMENT INSTALLATION.** Except as otherwise specified or indicated on the Drawings, the following procedures shall be used in performing electrical work.

3-9.01. **Setting of Equipment.** All equipment, boxes, and gutters shall be installed level and plumb. Boxes, equipment enclosures, metal raceways, and similar items mounted on water- or earth-bearing walls shall be separated from the wall by at least 1/4 inch thick corrosion-resistant spacers. Where boxes, enclosures, and raceways are installed at locations where walls are not suitable or available for mounting, concrete equipment pads, framing material, and associated hardware shall be provided.

3-9.02. **Sealing of Equipment.** All outdoor substation, switchgear, motor control center, and similar equipment shall be permanently sealed at the base, and all openings into equipment shall be screened or sealed with concrete grout to keep out rodents and insects the size of wasps and mud daubers. Small cracks and openings shall be sealed from inside with silicone sealant, Dow-Corning "795" or General Electric "SCS1200".

3-10. **GROUNDING.**

3-10.01. **General.** The electrical system and equipment shall be grounded in compliance with the National Electrical Code and the following requirements:

a. All ground conductors shall be at least 12 AWG soft drawn copper cable or bar, bare or green-insulated in accordance with the National Electrical Code.

b. Ground cable splices and joints, ground rod connections, and equipment bonding connections shall meet the requirements of IEEE 837, and shall be exothermic weld connections or irreversible high-compression connections, Cadweld "Exothermic" or Burndy "Hyground". Mechanical connectors will not be acceptable. Cable connections to bus bars shall be made with high-compression two-hole lugs.
c. Ground cable through exterior building walls shall enter within 3 feet below finished grade and shall be provided with a water stop. Unless otherwise indicated, installation of the water stop shall include filling the space between the strands with solder and soldering a 12 inch copper disc over the cable.

d. Ground cable near the base of a structure shall be installed in earth and as far from the structure as the excavation permits, but not closer than 24 inches. The tops of ground rods and ground cable interconnecting ground rods shall be buried a minimum of 30 inches below grade, or below the frost line, whichever is deeper.

e. All powered equipment, including lighting fixtures and receptacles, shall be grounded by a copper ground conductor in addition to the conduit connection.

f. Ground connections to equipment and ground buses shall be made with copper or high conductivity copper alloy ground lugs or clamps. Connections to enclosures not provided with ground buses or ground terminals shall be made with irreversible high-compression type lugs inserted under permanent assembly bolts or under new bolts drilled and inserted through enclosures, other than explosion proof enclosures, or by grounding locknuts or bushings. Ground cable connections to anchor bolts; against gaskets, paint, or varnish; or on bolts holding removable access covers will not be acceptable.

g. The grounding system shall be bonded to the station piping by connecting to the first flange inside the building, on either a suction or discharge pipe, with a copper bar or strap. The flange shall be drilled and tapped to provide a bolted connection.

h. Ground conductors shall be routed as directly as possible, avoiding unnecessary bends. Ground conductor installations for equipment ground connections to the grounding system shall have turns with minimum bend radii of 12 inches.

i. Ground rods not described elsewhere shall be a minimum of 3/4 inch in diameter by 10 feet long, with a copper jacket bonded to a steel core.

j. Test wells and covers for non-traffic areas shall be molded high density polyethylene. Test wells for traffic areas shall be precast concrete construction rated for traffic duty with concrete or cast iron covers.

3-10.02. Grounding System Resistance. The ground system resistance shall comply with National Electrical Code.
3-10.03. **Grounding System Testing.** Not used.

3-11. **LIGHTING FIXTURE INSTALLATION.** Not used.

3-12. **POWER FACTOR CORRECTION CAPACITOR INSTALLATION.** Capacitors shall be furnished and installed for the motors indicated on the Drawings. Capacitors shall not be connected to the load side of solid-state starters, reduced-voltage autotransformer starters with open transition, multispeed starters, or adjustable frequency drives. Galvanized angle iron mounting stands shall be furnished for mounting the capacitors at least 4 inches above the mounting surface.

3-13. **MODIFICATIONS TO EXISTING EQUIPMENT.** Modifications to existing equipment shall be completed as specified herein and indicated on the Drawings. All existing facilities shall be kept in service during construction. Temporary power or relocation of existing power and control wiring, equipment, and devices shall be provided as required during construction. Coordination and timing of outages shall be as specified in other sections of these Specifications. Electrical power interruptions will only be allowed where agreed upon in advance with Owner, and scheduling at times of low demand may be required.

3-13.01. **Demolition.** Unless otherwise specified or indicated on the Drawings, all cable and all exposed conduit for power and control signals of equipment indicated to be removed shall be demolished. Conduit supports and electrical equipment mounting hardware shall be removed, and holes or damage remaining shall be grouted or sealed flush. Conduit partially concealed shall be removed where exposed, and plugged with expanding grout flush with the floor or wall. Repairs shall be refinished to match the existing surrounding surfaces. Demolished equipment shall be discarded or salvaged as indicated on the Drawings and as specified in other sections of these Specifications.

End of Section
**STANDARD SPECIFICATIONS**

**REFERENCE:** ICEA S-95-658 (NEMA WC 70).

**CONDUCTOR:** Concentric-lay, uncoated copper; strand Class B. Wet/dry maximum operating temperature 90°C.

**INSULATION:** Cross-linked thermosetting polyethylene, ICEA S-95-658, Paragraph 3.6.

**SHIELD:** None.

**JACKET:** None.

**FACTORY TESTS:** Cable shall meet the requirements of ICEA S-95-658.

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**Cable Details**

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<td>1140</td>
</tr>
<tr>
<td>4</td>
<td>25.0</td>
<td>7</td>
<td>0.045</td>
<td>1140</td>
</tr>
<tr>
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<td>7</td>
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<td>1140</td>
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</tr>
<tr>
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<td>19</td>
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<td>1400</td>
</tr>
<tr>
<td>4/0</td>
<td>95.0</td>
<td>19</td>
<td>0.055</td>
<td>1400</td>
</tr>
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</tr>
<tr>
<td>750</td>
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<td>61</td>
<td>0.080</td>
<td>2030</td>
</tr>
<tr>
<td>1,000</td>
<td>500.0</td>
<td>61</td>
<td>0.080</td>
<td>2030</td>
</tr>
</tbody>
</table>

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 90 percent of the values indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer's name, XLP, XHHW-2, conductor size, and voltage class.

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**600 Volt, Single Conductor Lighting/Power Cable (600-1-XLP-NONE-XHHW-2)**
### STANDARD SPECIFICATIONS

**REFERENCE:** UL 62, UL 1277.

**CONDUCTOR:** 16 AWG (1.5 mm²), 7-strand, concentric-lay, uncoated copper. Maximum operating temperature 90°C dry, 75°C wet.

**INSULATION:** Polyvinyl chloride, not less than 15 mils (380 µm) average thickness; 13 mils (330 µm) minimum thickness, UL 62, Type TFN.

**LAY:** Twisted pair with 1-1/2 inch to 2-1/2 inch (38.10 mm - 63.5 mm) lay.

**SHIELD:** Cable assembly, combination aluminum-polyester tape and 7-strand, 20 AWG (0.5 mm²) minimum size, tinned copper drain wire, shield applied to achieve 100 percent cover over insulated conductors.

**JACKET:**
- **Conductor:** Nylon, 4 mils (100 µm) minimum thickness, UL 62.
- **Cable assembly:** Black, flame-retardant polyvinyl chloride, UL 1277, applied over tape-wrapped cable core.

**CONDUCTOR IDENTIFICATION:** One conductor black, one conductor white.

**FACTORY TESTS:** Insulated conductors shall meet the requirements of UL 62 for Type TFN. Assembly jacket shall meet the requirements of UL 1277. Cable shall meet the vertical-tray flame test requirements of UL 1277.

#### Cable Details

<table>
<thead>
<tr>
<th>Assembly Jacket Thickness*</th>
<th>Maximum Outside Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>µm</td>
</tr>
<tr>
<td>Single Pair</td>
<td>0.045</td>
</tr>
</tbody>
</table>

*The average thickness shall be not less than that indicated above. The minimum thickness shall be not less than 80 percent of the value indicated above.

A durable marking shall be provided on the surface of the cable at intervals not exceeding 24 inches (600 mm). Marking shall include manufacturer’s name, Type TC, Type TFN, conductor size, single pair, and voltage class.
PART 1 – GENERAL

1-1. SCOPE. This section covers single and three-phase, small (fractional) and medium (integral) horsepower, alternating current motors rated 500 horsepower and less (NEMA MG1).

Motors shall be designated and coordinated with the driven equipment and shall be located as indicated on the Drawings.

1-2. GENERAL. Motors furnished under driven equipment Specification sections shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

Where applicable, individual motor data sheets have been developed which specify additional requirements for specific motors.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations section shall apply to all motors, unless otherwise specified. If requirements in this section differ from those in the General Equipment Stipulations section, the requirements specified herein shall take precedence.

1-2.02. Seismic Design Requirements. Seismic design requirements for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

1-2.03. Governing Standards. Motors furnished under this section shall be designed, constructed, and tested in accordance with the latest version of NEMA MG 1, NEMA MG 10, and IEEE 112, Test Method B.

1-2.04. Nameplates. All motor nameplate data shall conform to NEMA MG 1 requirements.

1-3. SUBMITTALS. Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the motor shall be submitted in accordance with the Submittals Procedures section. The drawings and data shall include, but shall not be limited to, the following:

Motors

(City of Sioux City, Iowa ) 16220
(520 Booster Station Improv. ) -1-
(Project 192389.3100 )
(8/20/2018 )
Name of manufacturer.
Type and model.
Type of bearing and method of lubrication.
Rated size of motor, hp, and service factor.
Temperature rise and insulation rating.
Full load rotative speed.
Net weight.
Efficiency at full, 3/4, and 1/2 load.
Full load current.
Locked rotor current.
Space heater wattage, where applicable.
Motor temperature switch data, where applicable.
Motor Shaft Grounding Ring data, where applicable.
Recommended PFCC rating to correct to 95%.

Seismic Design Requirements
Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1-4. OPERATION AND MAINTENANCE DATA AND MANUALS. Adequate operation and maintenance information shall be supplied. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section.

Operation and maintenance manuals shall include the following:

a. Assembly, installation, alignment, adjustment, and checking instructions.

b. Lubrication and maintenance instructions.


d. Parts lists and predicted life of parts subject to wear.

e. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.

f. Test data and performance curves, where applicable.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. Service conditions for motors shall be as specified in the driven equipment Specification sections. Motors shall be designed for special conditions such as area classification, altitude, frequent starting, intermittent overload, high inertia, mounting configuration, or service environment. Where site elevation and ambient temperature is not specified in
the driven equipment Specification sections, the motors shall be designed for the following.

   Site elevation       Below 3,300 ft
   Ambient temperature  40 °C

Unless specified otherwise, all motors shall be designed for full voltage starting and to operate from an electrical system that may have a maximum of 5 percent voltage distortion according to IEEE 519.

Motors utilizing a reduced-voltage, autotransformer starter shall be capable of reduced-voltage starting at a 65 percent tap setting.

Motors utilizing a reduced voltage solid state starter shall be capable of starting at 50% of the specified voltage.

When powered from an adjustable frequency drive (AFD), motors shall be inverter duty and specifically selected for service with an adjustable frequency type speed controller and shall be derated as required to compensate for harmonic heating effects and reduced self-cooling capability at low speed operation. Each motor shall not exceed a Class B temperature rise when operating in the installed condition at load with power received from the adjustable frequency drive. All motors driven by AFDs shall be supplied with full phase insulation on the end turns and shall meet the requirements of NEMA MG 1, Part 31. In addition to the requirements of NEMA MG 1, Part 31, motors shall be designed to be continually pulsed at the motor terminals with a voltage of 1600 volts ac.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. Unless otherwise specified in the attached motor data sheet(s), design and construction of each general-purpose motor shall be as specified herein. Motor voltage, frequency, speed, service factor, and insulation class shall be as follows.

<table>
<thead>
<tr>
<th>Motor voltage.</th>
<th>460, 3 phase for ½ horsepower and larger, 120, single phase for smaller than ½ horsepower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency.</td>
<td>60 Hz</td>
</tr>
<tr>
<td>Speed.</td>
<td>Constant speed</td>
</tr>
<tr>
<td>Service factor.</td>
<td>1.0, except for AFD driven motors which shall be 1.15</td>
</tr>
<tr>
<td>Insulation class and temperature rise above 40°C design ambient (by resistance method. Enclosure.</td>
<td>Class F with 80°C rise at 1.0 SF Totally enclosed fan cooled</td>
</tr>
</tbody>
</table>

(City of Sioux City, Iowa) 16220
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(Project 192389.3100
(8/20/2018)
Main conduit box sized to include. Main motor leads and space heater leads where space heaters are specified.

2-2.01. **Nameplate Horsepower.** Motor nameplate horsepower shall be equal to or greater than the maximum load imposed by the driven equipment.

2-2.02. **Enclosures.** All motors shall be self-ventilated. All self-ventilated open type motors, including those with dripproof, splashproof, and weather protected enclosures, and the fan covers of totally enclosed fan cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine.

2-2.02.01. **Totally Enclosed Motors.** Totally enclosed motors shall be furnished with drain holes and rotating shaft seals. Frames, bearing brackets, external terminal housings, and fan covers for fan cooled motors shall be cast iron. External cooling fans for fan cooled motors shall be fabricated of brass, bronze, aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic and shall be UL approved.

2-2.02.02. **Outdoor Motors.** Outdoor motors shall have NEMA weather protected enclosures. All exposed metal surfaces shall be protected, where practical, with a corrosion resistant polyester coating. Exposed uncoated surfaces shall be of a corrosion resistant metal. Enclosure exterior and interior surfaces, air gap surfaces, and windings shall be protected with a corrosion resistant polyester, polyurethane or epoxy coating.

2-2.02.03. **Motors for Hazardous Locations.** Motors for hazardous locations shall be in accordance with the NEC and of the correct type enclosures for the particular service as specified in NEMA MG 1. Motors shall meet the requirements of UL 674.

2-2.02.04. **Encapsulated Windings.** Not used.

2-2.02.05. **Severe Duty Chemical Service Motors.** Not used.

2-2.03. **Main Conduit Boxes.** The main conduit box shall be in accordance with NEMA MG 1. The main conduit boxes shall be diagonally split for easy access to the motor leads, and designed for rotation in 90-degree increments. A gasket shall be furnished between the halves of the box. Conduit openings in the main conduit box shall match the size and quantity of conduits indicated on the one line Drawings.
The main conduit box shall be oversized at least one size larger than NEMA standard. The main conduit box shall be sized for all indicated accessory leads.

Motors furnished in NEMA 320 frame series and larger shall have conduit boxes designed and constructed to permit motor removal after installation without disconnecting raceways.

2-2.04. Leads. Motor power leads shall be wired into the main conduit box. Unless otherwise specified, space heater leads shall be wired into the main conduit box. All motor leads and their terminals shall be permanently marked in accordance with the requirements of NEMA MG 1, Part 2. Each lead marking shall be visible after taping of the terminals.

All motors rated 100 horsepower and larger, and all vertical motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing, or on the nameplate, and the leads marked for phase sequence T1, T2, T3, to correspond to the direction of rotation and supply voltage sequence.

Leads for dual-voltage rated or for multispeed motors shall be easily connected or reconnected in the main conduit box for the operating voltage or for the specified speeds. Permanent instructions for making these connections shall be furnished inside the main conduit box or on the motor frame or nameplate.

2-2.05. Terminals. Cable type leads shall be provided with Burndy Type YA or acceptable equal compression type connectors.

2-2.06. Grounding Connections. All motors shall be furnished with a ground connection.

2-2.07. Bearings. All bearings shall be self-lubricating, shall have provisions for relubrication, and shall be designed to operate in any position or at any angle.

Motor bearings shall be antifriction type with \(L_{10}\) life rating of 40,000 hours in accordance with ABMA Standards.

All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings, and shall be fitted with pipes, drain plugs, and fittings arranged for safe, easy relubrication from the outside of the motor while the motor is in service, as necessary.

2-2.07.01. Insulated Bearings. Motors over 100 horsepower controlled by an adjustable frequency drive shall be furnished with one insulated bearing. The insulated bearing shall be installed on the non-drive end of the motor.
2-2.08. **Rotors.** All induction motors shall have squirrel-cage rotors adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors shall be dynamically balanced to 0.08 in./sec or less.

2-2.09. **Shafts.** Shafts shall be furnished with corrosion resistant treatment or shall be of a corrosion resistant material.

2-2.10. **Torque Characteristics.** Motors rated 200 horsepower and less shall have torques and locked-rotor current in accordance with NEMA MG 1, Part 12.

2-2.11. **Motor Space Heaters.** Unless otherwise specified, motors 1 horsepower and larger shall be provided with a space heater element sized to prevent condensation on the core and windings. The space heaters shall be isolated or so located as to prevent heat damage to adjacent painted surfaces and shall be suitable for 120 volt, 60 Hz, single phase power supply.

2-2.12. **Temperature Sensing Devices.** Not used.

2-2.13. **Motor Shaft Grounding Ring.** Not used.

2-2.14. **Assembly.** All motors shall be completely assembled with the driven equipment, lubricated, and ready for operation.

2-2.15. **Efficiency.** Unless otherwise specified in the attached motor data sheet(s), motors shall be premium efficiency type and shall have a NEMA nominal efficiency nameplate value equal to or greater than values indicated in the following table. Efficiency shall be determined in accordance with IEEE 112, Test Method B.

Vertical motors shall have efficiency values equal to or greater than those indicated in the following table minus 0.50.

<table>
<thead>
<tr>
<th>Motor Nominal Efficiency Values Nominal Efficiency Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>3600 rpm</td>
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<tr>
<td>0.7</td>
</tr>
<tr>
<td>82.5</td>
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<td>82.5</td>
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<td>kW</td>
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</table>

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(8/20/2018 )
### Motor Nominal Efficiency Values

<table>
<thead>
<tr>
<th>kW hp</th>
<th>Open Drip Enclosure</th>
<th>TEFC Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3600 rpm</td>
<td>3600 rpm</td>
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<tr>
<td>336</td>
<td>450</td>
<td>95.8</td>
</tr>
<tr>
<td>373</td>
<td>500</td>
<td>96.2</td>
</tr>
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</table>

2-3. **ACCESSORIES.**

2-3.01. **Special Tools and Accessories.** Motors requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Each motor shall be provided with lifting eyebolts or lugs and appropriate fittings for adding bearing lubricant. Grease lubricated units shall be provided with a means of venting the casing. Oil lubricated units shall be provided with constant level oilers or with sight glasses arranged to indicate operating and static oil levels.

2-4. **ANCHORS.** Contractor shall furnish suitable anchors for each item of equipment as required for driven equipment.

2-5. **BALANCE.** All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the unfiltered vibration displacement (peak-to-peak), as measured at any point on the machine, shall not exceed the limits as required. At any operating speed, the ratio of rotative speed to the critical speed of a unit or its components shall be less than 0.8 or more than 1.3.

### PART 3 - EXECUTION

3-1. **INSTALLATION.** Each motor shall be installed in accordance with the Equipment Installation section.

End of Section