NOTICE TO CONTRACTORS
CARSON CITY PUCHASING AND CONTRACTS
201 NORTH CARSON STREET, SUITE 3
CARSON CITY, NEVADA 89701
775-283-7137 / FAX 775-887-2107
http://www.carson.org/Index.aspx?page=998

ADVERTISED BID #1213-180
BID TITLE "Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"
Labor Commissioner PWP# CC-2013-238
Engineer's Estimate: $625,000.00

PLEASE NOTE: Carson City has extensively revised these Contract Documents and all Bidders are advised to read these documents thoroughly before submitting a bid.

SUMMARY

Carson City is accepting sealed bids for all labor, materials, tools and equipment necessary for the above referenced Wastewater Reclamation Plant Digester Rehabilitation Project – Phase 1. The project consists of digester cleaning and preparation including the removal of the digester contents, screening and mechanical dewatering, hauling and disposal, odor control and wash-down; demolition of existing piping and appurtenances on top of the digester; demolition of the digester dome; possible repair of the interior digester walls; construction of a new digester dome; installation of new piping and appurtenances at the top of the digester; and repair the concrete masonry unit wall. Sealed bids must be submitted in accordance with the bid documents, drawings and specification relate hereto.

CONTRACTOR'S LICENSE: Carson City has determined that the responsive bidder must possess a minimum of a Class A General Engineering license with appropriate sub-classifications or subcontractors . All Contractor's license shall be in good standing and issued by the Nevada State Contractor's Board at the time of the bid.

BID DOCUMENTS may be obtained as follows and the cost is non-refundable.

You may download this Bid Document, excluding the drawings, and a pdf version of the Bid Bond and Bid Proposal to prepare your bid from the Carson City website http://www.carson.org/Index.aspx?page=998. ***Downloading this bid document from the website does not put you on the plan holders list, you must click the link at the bottom of the page and provide your information to add your company name to the plan holders list.***

You may purchase the drawings separately from the following businesses, please call ahead to place your order.

Nevada Blue, 3246 North Carson Street, Carson City, NV 89706 (775) 883-6011www.nvblue.com

OSI, Inc., 4750 Longley Lane, Suite 103, Reno, NV 89502 (775) 827-4343 www.osireno.com

Nevada Builder's Exchange, 634 Ryland Street, Suite E, Reno, NV 89502 (775)786-4468 www.nevadabuildersx.com

Sierra Contractor's Source, 860 Maestro Dr., Suite B, Reno NV 89511 (775) 329-7222 www.scsplanroom.com

INSPECTION OF BID DOCUMENTS: All documents related hereto may be viewed at the following locations:

CARSON CITY PUBLIC WORKS DEPARTMENT, 3505 Butti Way, Carson City, Nevada 89701.

ADDENDA: All addenda are posted on Carson City's website http://www.carson.org/Index.aspx?page=998. It is each bidder's responsibility to ensure that they have received all addenda prior to submission of their sealed bid.

QUESTIONS regarding this bid must be received a minimum of four (4) days prior to bid opening.

SEALED BIDS must be submitted in a sealed envelope which shall be clearly marked with title and number of this Bid Document to Carson City Purchasing and Contracts Department, 201 North Carson Street, Suite 3, Carson City, Nevada 89701, by not later than 11:00 a.m. on July 1, 2013. Bids received after the date and time set for receipt will be **REJECTED** and returned to the bidder unopened.

BID OPENING will be held publicly at 11:10 a.m. on July 1, 2013, at 201 North Carson Street, Suite 3, Carson City, Nevada 89701. Bidders, their representatives, and all other interested persons may be present during the bid opening.

A tabulation of the **BID PROPOSAL** will be posted on Carson City's website within 48 hours.

AWARD RECOMMENDATION will be made by the Carson City Purchasing and Contracts Department. You are encouraged to visit the City's website for that recommendation or contact Kim Belt at KBelt@carson.org for the recommendation.

NOTICE OF PROTEST OF AWARD OF CONTRACT must be submitted in writing to Carson City Purchasing and Contract within five (5) working days of the **BID OPENING** and must be in compliance with Nevada Revised Statute (NRS) 338.

BID AWARD will be made by the Carson City Board of Supervisors and is scheduled for July 18, 2013 and their decision is final. The Carson City Board of Supervisors meeting will be held in the Sierra Room of the Carson City Community Center, 851 East William Street, Carson City, Nevada 89701 beginning at 8:30 a.m.

PRICES must be quoted FOB Carson City, Nevada and are valid for sixty (60) calendar days after the **BID OPENING**.

Signature in Project File

Kim Belt, CPM
Purchasing and Contracts Manager

Signature in Project File

Andrew Burnham, Public Works Director

Signature in Project File

Darren Schulz, Deputy Public Works Director

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INSTRUCTIONS TO BIDDERS

CORRESPONDENCE AND/OR COMMUNICATIONS:

The provisions of this contract shall be approved by the governing body of the City, and the normal lines of communications shall be between the following persons and the authorized representative of the Contractor:

A. Contract Administrator
Kim Belt, CPM - Purchasing and Contracts Manager
Carson City Purchasing and Contracts
201 North Carson Street, Suite 3
Carson City, Nevada 89701
775-283-7137
FAX 775-887-2107
KBelt@carson.org

B. Owner's Representative
Andrew Burnham, Public Works Director
Carson City Public Works Department
3505 Butti Way
Carson City, Nevada 89701
775-887-2355 x 30367
FAX No. 775-887-2112
ABurnham@carson.org

C. Construction Manager
Rick Cooley, P.E., Public Works Construction Manager
3505 Butti Way
Carson City, Nevada 89701
775-283-7302
FAX No. 775-887-21132
Rcooley@carson.org

D. Design Consultant
Chris Machado
Carollo Engineers
376 East Warm Springs Road, Suite #250
Las Vegas, Nevada
702-792-3711
FAX No. 702-792-4533
CMachado@carollo.com

NOTE: The City reserves the right to appoint a substitute designee for these positions at the City's discretion.

END OF DOCUMENT

INSTRUCTIONS TO BIDDERS

B.1 BIDDING PROCEDURES

A. Pre-bid Conference

If required, a Pre-bid Conference will be held at the time and place indicated on the Notice to Contractors. The purpose of this conference is to discuss the Project, prospective Bidders concerns, and key issues of the Project. Attendance is not mandatory unless otherwise indicated.

B. Designated Contacts

The designated contact for questions pertaining to the Contract Documents, Specifications and/or Drawings is the designated Contract Administrator. All questions should be submitted in writing, and will receive a written response from the Contract Administrator.

C. Contract Drawings

The Contract Drawings used for Bidding shall have the following title:

CONTRACT DRAWING TITLE: **"Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"**

The Contract Drawings do not purport to show all the details of the Work. They are intended to illustrate the character and extent of the performance desired under the Contract; therefore, they may be supplemented or revised from time to time, as the Work progresses, by the Construction Manager. Drawing revisions and/or additional drawings or sketches will be made and furnished to the Contractor if they are deemed necessary to adequately illustrate the Work.

D. Interpretations and Addenda

Bidder shall take no advantage of any apparent error or omission in this Bid Document. In the event the Bidder discovers such an error or omission, he/she shall immediately notify the City's Contract Administrator in writing or by email. Carson City will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of this Bid Document through the issuance of an Addendum. Any Addendum or clarification supplementing this Bid Document, the Drawings, and the Specifications, issued prior to the date and time set for the submittal of Bid Proposal shall be made part of the Contract.

If it becomes necessary to revise any part of this Bid Document, a written addendum will be provided to all plan holders. The City is not bound by any oral representations, clarifications, or changes made by Carson City employees, or representatives, unless such clarification or change is provided to all Bidders in written addendum form.

Addenda shall be sent by fax, e-mail or posted on the City's website to all who are known by the City to have received a complete set of Bid Documents (plan holders). No Addendum shall be issued by Carson City less than two (2) working days prior to the advertised date and time for Bid submittal. **Note:** Bidders are requested to submit questions four (4) working days prior to the advertised date and time for Bid submittal.

Prior to submission of the Bid Proposal, each Bidder shall ascertain that he/she has received all Addenda issued. The Bidder shall acknowledge receipt of all Addenda by completing the acknowledgment space provided on the Bid Proposal.

E. Bid Preparation and Submission

1. Bid proposals are to be submitted on the Bid Proposal provided and must be manually signed by pen by an officer or authorized agent (with attached power of attorney) of the Bidder. All figures must be written in ink or typewritten. Figures written in pencil or erasures are not acceptable. Any interlineation or alteration must be initialed in ink by a person authorized to bind the Bidder to a Contract. If the person making said interlineation or alteration is not the same person who signs the Bid Proposal, such person must write his/her signature and print his/her name and title on each page of the Bid Proposal where initials appear. Written delegation of signature authority to an agent acting on behalf of the Bidder must accompany the sealed Bid and cannot contain any

language which states the Bidder retains final approval of acceptance of any of the terms, conditions, specifications and/or finalized Contract.

2. Each Bid shall be submitted in a sealed envelope and the envelope must be prominently marked on the lower left corner as follows:

   SEALED BID
   BID NO.: 1213-180
   OPENING: July 1, 2013 at 11:10 am
   COMPANY NAME:

3. Carson City will not consider a Bid that fails to comply with the above stated requirements. Carson City will not be responsible for the premature opening of a Bid not properly addressed or identified. All Bids must be received prior to the date and time specified in the Notice to Contractors at the following address:

Carson City will not consider a Bid that fails to comply with the above stated requirements. Carson City will not be responsible for the premature opening of a Bid not properly addressed or identified. All Bids must be received prior to the date and time specified in the Notice to Contractors at the following address:

   Carson City Purchasing and Contracts Department
   201 North Carson Street, Suite 3
   Carson City, Nevada 89701

4. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed as specified. Mailed Bids must be received by the Purchasing and Contracts Department prior to the closing date and time for receipt of Bids in order to receive consideration. Bids submitted by facsimile or email will not be accepted or considered.

F. Documents Necessary for Submittal

The Bid Bond, Bid Proposal Summary, Bidder's Preference Certificate of Eligibility (if applicable) and any other documents required as defined in the Special Conditions all shall be included in the sealed envelope. **Do not return the entire spec book with the Bid.** Carson City will not consider a Bid received if there is an omission of or failure to complete any portion of the required documents at the time of the Bid Opening.

G. Bid Security

1. Each Bid Proposal must be accompanied by a Cashier's check, Certified Check, or Bid Bond acceptable to Carson City in an amount equal to at least five percent (5%) of the Bidder's "Base Bid" Proposal. Said Bid Security shall be payable without condition to Carson City as a guarantee that the Bidder, if awarded the Contract, will promptly execute such Contract in accordance with the Bid Proposal and, in the manner and form required by the Bid Document, and will furnish the required PERFORMANCE and PAYMENT bonds. (Refer to Documents # 2151 and 2152). Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, the amount of the Bid Security may be forfeited to the City as liquidated damages, not as penalty. All checks must indicate the Payee as "Carson City, Nevada" and reflect the Bid Title and Number. Failure to enclose a Bid guarantee with the sealed Bid will cause the Bid to be rejected and not considered.

2. Surety companies issuing bonds must be licensed to issue surety by the State of Nevada Insurance Division pursuant to NRS 683A.090 and issued by an appointed agent pursuant to NRS 683A.280. Bonds issued by an individual surety are not acceptable to the City.

3. The City will have the right to hold the Bid Security of Bidders to whom an award is being considered until either: (a) the Contract has been executed and bonds have been furnished, (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

H. Quantities

The quantities given in the Bid Document or indicated by the unit Bid items are approximate quantities and are intended to illustrate the Scope of Work. The Bidder shall be responsible for verifying the exact quantities involved each month through the measurement and payment provisions of the Bid Document.

I. Compensation

The Total Bid Price shall cover all Work required by the Bid Document. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment, tools and temporary utilities; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices Bid. All work not specifically set forth as a pay item in the Bid Proposal shall be considered a subsidiary obligation of the Bidder, and all costs in connection therewith shall be included in the prices Bid.

J. Schedule of Values

The purpose of the Schedule of Values shall serve the City in two (2) distinct areas:

1. **PRIOR TO AWARD OF BID:** Carson City may request a Schedule of Values for any or all item(s) included in the Bid Proposal for the purpose of determining an unbalanced Bid. The analysis shall be conducted by the City.

2. **AFTER AWARD OF BID** Carson City will request a Schedule of Values for any or all item(s) included in the Bid Proposal for the purpose of making partial payments to the Contractor.

Under no circumstances may any Bid item reflected as LUMP SUM or otherwise be increased or decreased as a result of the Lump Sum Bid breakdown analysis.

All prospective Bidders may be required to prepare a Schedule of Values, and it shall be the Bidder's responsibility to verify the quantities as shown on the Drawings before preparing his/her Bid. The schedule as shown on the Contract Drawings does not constitute a complete outline of the Work to be performed by the Contractor in accordance with the Contract Drawings and Specifications. This list is intended to include all major items, and the Bid computed therefrom will be the maximum compensation for all work and materials furnished by the Contractor in order to comply with the Contract Drawings and Specifications, whether or not indicated in the approximate quantities or pertaining to the items of Work listed therein.

K. Validity of Bid

Carson City reserves the right to withhold award of the Contract for a period of sixty (60) days from the date of the Bid opening. The Bidder acknowledges in submitting his/her Bid that all prices listed in the Bid Proposal are valid for a period of not less than sixty (60) days from the date of the Bid Opening.

L. Bidders Preference

Bidders submitting a proposal to a public body for a Public Work shall bear the responsibility to ascertain the relevancy of the "preference for certain contractors" referenced in NRS 338.147. Bidders claiming preference shall submit with their Bid Proposal the "Certificate of Eligibility" issued by the State of Nevada Contractor's Board as proof of Contractor's compliance with the provisions of NRS 338.147. Failure to submit the Certificate of Eligibility with your Bid shall result in a waiver of any Bidder preference.

Note: Pursuant to Subsection 8 of NRS 338.147, the provisions of Subsection 2 of NRS 338.147 do not apply to any Contract for a Public Work which is expected to cost less than $250,000.

M. Bidders Representation

Each Bidder by submitting its Bid represents that:

1. The Bidder, signing the Proposal summary and submitting the bid represents that he/she has familiarized himself with the Notice to Contractors, Contract Drawings, Specifications, and Contract Documents and has found them fit and sufficient for the purpose of preparing his/her Bid. By submission of his/her Bid, he/she agrees to all the terms and conditions of the Bid Document and further agrees that no claim will be made against the City, the Construction

Manager, or the Design Consultant for any damage that he/she or his/her subcontractors may have suffered due to the inadequacy of his/her Bid on account of any alleged errors, omissions, or other deficiencies in the Notice to Contractors, Drawings, Specifications, or Contract Documents supplied to him/her by the City.

2. The submission of a Bid shall constitute an acknowledgment upon which the City may rely that the Bidder has thoroughly examined and is familiar with the Bid Documents. The Bidder shall in no way be relieved from any obligation with respect to its proposal or to the Contract. No claim for additional compensation will be allowed which is based upon a lack of knowledge of the Contract Documents.

3. The Bidder has inspected the site(s) of the Work and is satisfied, by personal examination or by other means, of the locations of the proposed Work, of the actual conditions, including subsurface conditions, of and at the site(s) of the Work. If, during the course of its examinations, a Bidder finds facts or conditions which appear to be in conflict with the letter or spirit of the Bid Documents before submitting his/her bid, the Bidder shall request the City, in writing, to provide additional information and explanation.

4. Submission of a Bid by a Bidder shall constitute conclusive evidence that the Bidder has relied on his/her own examination of (1) the site of the Work, (2) access to the site, (3) all other data and matters requisite to the fulfillment of the Work and on its own knowledge of existing facilities on and in the vicinity of the site of the Work to be constructed under the Contract, (4) the conditions to be encountered, (5) the character, quality and scope of the proposed Work, (6) the quality and quantity of the materials to be furnished, and (7) the requirements of the Bid, the Drawings and Specifications. The Bidder is aware that soil classifications do not represent any particular stability or drainability characteristics, and are aware that water table levels can vary.

5. The information provided by the City is not intended to be a substitute for, or a supplement to, the independent verification by the Bidder to the extent such independent investigation of site conditions is deemed necessary or desirable by the Bidder.

6. The Bidder, by signing the Bid Proposal, agrees that all material and workmanship on this Project shall meet or exceed OSHA standards and NOSHA standards.

   Bidder must be duly qualified and possess the classification(s) of contractor's license stipulated by the City for this particular Work and issued by the Nevada State Contractor's Board. Nevada Contractor's License type, number, expiration date and dollar limit must be indicated on the Bid Proposal. The Bidders and the successful Contractors and their subcontractors shall comply with all provisions of NRS Chapter 624 and Nevada Administrative Code, Chapter 624. Carson City will not consider any Bid that fails to comply with these requirements.

   The successful Bidder must obtain a valid Carson City Business License within ten (10) days after the award of the Contract, or the Contractor will be declared in default of the contract.

N. Fair Employment Practices

Pursuant to NRS 338.125, it is unlawful for any Contractor in connection with the performance of work under a contract with a public body, when payment of the contract price, or any part of such payment, is to be made from public money, to refuse to employ or to discharge from employment any person because of race, creed, color, national origin, sex, sexual preference, or age to discriminate against person with respect to hire, tenure, advancement, compensation or other terms, conditions, privileges of employment because of race, creed, color, national origin, sex, sexual preference or age.

O. Preferential Employment

Pursuant to NRS 338.130, Preferential Employment in Construction of Public Works, "In all cases where persons are employed in the construction of public works, preference shall be given, the qualifications of the applicants being equal: First: To honorably discharged Army, Navy, Air Force, Marine Corps or Coast Guard soldiers of the United States who are citizens of the State of Nevada; Second: To citizens of the State of Nevada". If the provisions of NRS 338.130 are not complied with by the Contractor, this Contract

shall be void, and any failure or refusal to comply with any of the provision of NRS 338.130 shall render this Contract void.

P. Subcontracting

The Bidder agrees that he/she will perform work totaling at least Fifty per cent (50%) of the Bid amount and will not subcontract work totaling more than Fifty per cent (50%) of the Bid amount.
The Bidder shall be bound by and comply with NRS 338.141 to limit the practice of shopping for Bids and shall provide a Subcontractors Listing with the submission of their Bid. The form must have the spaces filled in for each subcontractor who will be paid an amount exceeding five percent (5%) of the Bid amount. Within two (2) hours after the opening of Bids, the bidders who submitted the three lowest Bids must submit a list of names of each subcontractor who will provide labor or a portion of the Work or improvement to the Contractor for which he/she will be paid an amount exceeding one percent (1%) of the Bid amount or Fifty Thousand Dollars ($50,000), whichever is greater. Within twenty-four (24) hours of the Bid opening the Bidder who submitted the lowest Bid must submit a list of all subcontractors who will perform any work on the Contract, including their name, license number and classification, items of work to be performed and anticipated amount of the subcontract. If a bidder fails to submit such lists within the required time, his/her Bid shall be deemed non-responsive.

The bidder shall verify prior to submitting their Bid that all subcontractors specified are properly licensed. Substitutions of subcontractors specified in the Bid shall comply with the requirements of NRS 338.141.

Bidder agrees that if awarded the Contract, he/she will assume responsibility for acts or omissions of subcontractors and of persons either directly or indirectly employed by them, as they are responsible for the acts or omissions of persons directly employed by the Bidder. Nothing contained in the Bid Document shall create any contractual relationship between any subcontractor and the City.

Each Contractor engaged on a public works project shall report to the Labor Commissioner the name and address of each Subcontractor whom he/she engages for work on the project within ten (10) days after the Subcontractor commences work on the contract.

Substitutions for subcontractors listed in the Bid Proposal shall comply with the requirements of NRS 338.141.

Q. Site Information

Where investigations of surface or subsurface conditions have been made by the City, in respect to foundations or other structural design for design purposes only, said information is available only for the convenience of bidders but are not a part of the Bid Documents. The City, Construction Manager, and Design Consultant assume no responsibility whatsoever as to the sufficiency of borings, or of the log of test borings or other investigations, or tests, or of the interpretations thereof; there is no guarantee, warranty, or representation, expressed or implied, that the conditions indicated thereby, in fact, exist or are representative of those existing throughout the work. Such information available to bidders is not to be construed in any way as a waiver of the other provisions of this paragraph and bidders must satisfy themselves through their own investigations as to the surface and subsurface conditions to be encountered at the Site.

IB.2. OPENING OF BIDS

All Bids received at the designated time and place that comply with these requirements will be opened, publicly read aloud at the date, time and place set forth in the Notice to Contractors. Bidders, their representatives, and all other interested persons may be present at the opening and reading of Bids.

Any Bids received after the date and time set for receiving and opening Bids, as set forth in the Notice to Contractors and any Addendum, will not be considered. Any such Bids will be returned unopened to the Bidder.

A. Mistake in Bid

A request for withdrawal of a Bid due to a purported error shall not be considered unless it is given in writing to the Contract Administrator by the Bidder within forty-eight (48) hours after opening of the bid. Any such request shall contain a full explanation of any purported error and shall be supported by the original calculations on which the Bid was computed, together with a certification and notarization thereon that such calculation is the original as prepared by the Bidder or his/her agent.

In the case of a difference between written words and figures, the amount stated in written words shall govern for a Lump Sum Bid.

In the case of a difference between Unit Price and the Extended Price, the Unit Price shall govern.

B. Withdrawal of Bid

1. **Before Bid Opening** - A Bidder may request withdrawal of his/her, sealed Bid prior to the scheduled date and time of the scheduled Bid opening provided the request is submitted to the Contract Administrator's Office in writing or an authorized representative must present himself with proper identification to the Contract Administrator's Office and verbally request that the Bid be withdrawn.

2. **After Bid Opening** - No Bids may be withdrawn for a period of sixty (60) calendar days after the date and time of Bid opening, except as set forth in A above. All responsive and responsible Bids received are considered firm offers for the time period specified above and may be considered for award. The Bidder's offer will expire at the time specified above or upon acceptance by City, which occurs when the successful Bidder provides the bonds, insurance, and submits the signed Contract to the City for execution and the City executes the Contract.

IB.3 AWARD OF CONTRACT/REJECTION OF BIDS/DISQUALIFICATION OF BIDDERS

A. Award of Contract

Carson City will award the Contract pursuant to the provisions of Nevada State law including but not limited to:

(a) Chapter 332 (Purchasing: Local Governments)

(b) Chapter 338 (Public Works Projects)

(c) Chapter 339 (Contractor's Bonds on Public Works)

(d) Chapter 624 (Contractors).

B. Rejection of Bids

The City reserves the right to waive any informality or irregularity in any Bid received, and to reject any or all Bids. In the case of rejection of all Bids, the City reserves the right to advertise for new Bids or to proceed to do the Work otherwise if, in the judgment of the Carson City Board of Supervisors or Carson City Regional Transportation Commission, it is in the best interest of the City.

C. Irregular Bid

A Bid shall be considered irregular for the following reasons, any one or more of which may be cause for rejection:

1. If the Bid Proposal furnished by the City is not used or is altered.

2. If there are unauthorized additions, conditional or alternate Bids, or omissions or irregularities of any kind, which may tend to make the Bid incomplete, indefinite or ambiguous as to its meaning, or give the Bidder submitting the same a competitive advantage over other Bidders.

3. If the Bid submitted contains any erasures, interlineations, or other corrections unless each such correction is prepared and authenticated in acceptance with the provisions of Paragraph IB.1.E (1).

D. Unbalanced Bid

If the Unit Bid Item prices and/or schedule of values of a prospective Bidder's Bid are obviously unbalanced, either in excess or below the reasonable cost analysis values, in the opinion of the Owner's Representative, the Bid may be rejected. All Bids with separately priced line items shall be analyzed to determine if the prices are unbalanced. A bid may be rejected if the City determines that the lack of balance poses an unacceptable risk to the City.

A Bid with unbalanced pricing may increase performance risk and could result in payment of unreasonably high prices. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more bid items is significantly over or understated as indicated by the application of cost or price analysis techniques. The greatest risks associated with unbalanced pricing occur when:

1. Over pricing of startup work, mobilization, or early items of work (front end loading) would cause a bidder to receive substantial up-front payment;

2. Base quantities and option quantities are separate line items;

3. The quantities as bid are incorrect and the contract cost will be increased when quantities are corrected;

4. On items where the quantities may vary, if the anticipated variation in quantity would result in the lower Bidder not remaining as the low Bidder;

E. Disqualification of Bidders

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

1. The Bidder is not responsive or responsible;

2. The quality of the services, materials, equipment or labor offered does not conform to the approved Contract Drawings and specifications;

3. Evidence of collusion among prospective Bidders; (Participants in such collusion will receive no recognition as Bidders)

4. Lack of the contractor's license classification stipulated by Carson City for this Work;

5. More than one Bid for the same work from an individual, firm, or corporation under the same or different name;

6. Lack of competency, understanding of the scope of the Work, adequate machinery, plant and/or equipment as revealed by the requested experience or subcontractor information;

7. Unsatisfactory performance record as shown by past work for the City, judged from the standpoint of workmanship, progress, and quality of services/goods provided;

8. Uncompleted work which, in the judgment of the City, might hinder or prevent the prompt completion of additional work, if awarded;

9. Failure to pay or satisfactorily settle all bills due for labor and material on any contract(s);

10. Failure to comply with any requirements of the City;

11. Failure to list, as required, all subcontractors who will be employed by the Bidder;

12. Negative actions against the Contractor's license by the Nevada State Contractor's Board;

13. Any other reason determined, in good faith, to be in the best interest of the City.

IB.4 BID PROTESTS

A Bidder may file a Notice of Protest regarding the awarding of the contract with the authorized representative designated by the public body within five (5) working days after the date the bids were opened by the public body or its authorized representative pursuant to the provisions of NRS 338.142.

INSTRUCTIONS TO BIDDERS

IB.5 BID PREPARATION EXPENSES

By accepting the Bid Proposal of the Bidder, the City assumes no obligation to reimburse the Bidder for Bid preparation expenses. No Bidder shall have any right or claim against the City for reimbursement of Bid preparation expenses.

IB.6 COLLUSION, DISCRIMINATION, AND/OR PRICE FIXING

The Bidder certifies that any and all prices which he/she may charge under the terms of the Contract do not, and will not, violate any existing federal, state or municipal laws or regulations concerning discrimination and/or price fixing. The Bidder agrees to indemnify, exonerate and hold Carson City harmless from liability for any such violation now and throughout the term of the Contract.

END OF INSTRUCTIONS TO BIDDERS

BID PROPOSAL

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that I/We _____

as Principal, hereinafter called Contractor, and _____

a corporation duly organized under the laws of the State of Nevada, as Surety, hereinafter called the Surety, are held and firmly bound unto Carson City, Nevada a consolidated municipality of the State of Nevada, hereinafter called City, for the sum of $ _____Dollars

(state sum in words)_____
for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid, identified as **BID # 1213-180** and titled **"Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid".**

NOW, THEREFORE if the City shall accept the bid of the Principal and the Principal shall enter into a contract with the City in Accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Bid Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the City the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the City may in good faith contract with another party to perform work covered by said bid or an appropriate liquidated amount as specified in the Invitation for Bids then this obligation shall be null and void, otherwise to remain in full force and effect.

Executed on this _____ day of _____2013

Signature of Principal: _____

Title: _____

(Seal)

Firm: _____

Address: _____

City/State/Zip Code: _____

Written Name of Principal: _____

ATTEST NAME

Signature of Notary: _____

Subscribed and sworn before me this _____day of _____ 2013
(printed name of notary) _____Notary Public for the State of _____

Claims Under this Bond May be Addressed to:	Nevada Resident Agent Information Complete for out of state bonding companies
Name of Surety	Name of Local Agent
Address	Address
City	City
State/Zip Code	State/Zip Code
Name	Agent's Name
Title	Agent's Title
Phone	Agents Phone

Surety's Acknowledgement

NOTICE: No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for services of process in the State of Nevada. Certified copy of Power of Attorney must be attached.

BID PROPOSAL

BID # 1213-180
BID TITLE: "Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"

NOTICE: No substitution or revision to this Bid Proposal form will be accepted. Carson City will reject any Bid that is received that has changes or alterations to this document. Although the Prevailing Wages are provided in this bid document, the bidder is responsible to verify with the Labor Commissioner if any addendums have been issued. The successful bidder will be required to provide the current Prevailing Wages used in preparation of their bid within 24 hours of bid submission.

PRICES will be valid for sixty (60) calendar days after the bid opening which is indicated in the Notice to Contractors.

A COPY OF CONTRACTOR'S "CERTIFICATE" of eligibility issued by the State of Nevada Contractors' Board as proof of Bidder's compliance with the provisions of N.R.S. 338.147 must be submitted with his/her bid for the preference to be considered. This Statute does not apply to projects expected to cost less than $250,000.

COMPLETION of this project is expected **PURSUANT TO THE BID DOCUMENTS**.

BIDDER acknowledges receipt of _____ Addendums.

SUMMARY

Description		Scheduled Value	Unit	Unit Price	Total Price
	Base Bid Items - Schedule A				
BP. 1	Mobilization, Demobilization and Clean-up	1	LS		
BP. 2	Digester Cleaning	1	LS		
BP. 3	Demolition	1	LS		
BP.4	Digester Interior Walls Structural Inspection and Repair (Allowances)	1	LS	$50,000	$50,000
BP. 5	Digester Dome Replacement	1	LS		
BP. 6	Digester CMU Wall Repair	100	CMU		
BP.7	Digester Gas Piping	1	LS		
BP.8	Electrical and Instrumentation	1	LS		
BP. 9	**SUBTOTAL SCHEDULE A**				
BP. 10	**Total Base Bid Price(SCHEDULE A)**				

BP.11 Total Base (SCHEDULE A) Bid Price Written in Words:

_____

BID PROPOSAL

BP.12 BIDDER INFORMATION:

Company Name:

Federal ID No.:
Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
Complete Fax Number:
Fax Number including area code:
E-mail:

Contact Person / Title:

Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
Complete Fax Number:
E-mail Address:

BP.13 LICENSING INFORMATION:

Nevada State Contractor's License Number:
License Classification(s):
Limitation(s) of License:
Date Issued:
Date of Expiration:
Name of Licensee:
Carson City Business License Number:
Date Issued:
Date of Expiration:
Name of Licensee:

BID PROPOSAL

BP.14 DISCLOSURE OF PRINCIPALS:

Individual and/or Partnership:

Owner 1) Name:
Address:
City, State, Zip Code:
Telephone Number:
Owner 2) Name:
Address:
City, State, Zip Code:
Telephone Number:
Other 1) Title:
Name
Other 2) Title:
Name:

Corporation:

State in which Company is Incorporated:
Date Incorporated:
Name of Corporation:
Mailing Address
City, State, Zip Code:
Telephone Number:
President's Name:
Vice-President's Name:
Other 1) Name & Title:

BID PROPOSAL

BP.15 MANAGEMENT AND SUPERVISORY PERSONNEL:

Persons and Positions	Years With Firm
Name 1)	

Title 1)

Name 2)	

Title 2)

Name 3)	

Title 3)

Name 4)	

Title 4)

Name 5)	

Title 5)

Name 6)	

Title 6)

(If additional space is needed, attach a separate page)

BID PROPOSAL

BP.16 REFERENCES:

Instructions:
List at least three (3) contracts of a similar nature performed by your firm in the last three (3) years. If **NONE**, use your Company's letterhead (and submit with your bid proposal) to list what your qualifications are for this contract. Carson City reserves the right to contact and verify, with any and all references listed, the quality of and the degree of satisfaction for such performance.

Clients: (if additional space is needed attach a separate page)

Company Name 1):
Contract Person:
Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
E-Mail Address:
Project Title:
Amount of Contract:
Scope of Work:
Company Name 2):
Contract Person:
Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
E-Mail Address:
Project Title:
Amount of Contract:
Scope of Work:

BID PROPOSAL

Company Name 3):
Contract Person:
Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
E-Mail Address:
Project Title:
Amount of Contract
Scope of Work:
Company Name 4):
Contract Person:
Mailing Address:
City, State, Zip Code:
Complete Telephone Number:
E-Mail Address:
Project Title:
Amount of Contract:
Scope of Work:

BID PROPOSAL

BP. 17 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS PRIMARY COVERED TRANSACTIONS

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal, State or Local department or agency.

b) Have not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

d) Have not within a three-year period preceding this bid had one or more public transactions (Federal, State or Local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this bid.

_____ _____
Signature of Authorized Certifying Official Title

_____ _____
Printed Name Date

I am unable to certify to the above statement. My explanation is attached.

_____ _____
Signature Date

BIDDER'S SAFETY INFORMATION

Bidder's Safety Factors:

Year	"E-Mod" Factor[1]	OSHA Incident Rate[2]
2011		
2010		

[1] E-Mod (Experience Modification) Factors are issued by the Employer's Insurance Company of Nevada.
[2] OSHA Incident Rate is the number of OSHA Recordable Accidents per 100 employees and is calculated as the number of accidents divided by 208,000.

BID PROPOSAL

SUBCONTRACTORS

BP.18 INSTRUCTIONS: for Subcontractors and **General Contractors who self-perform** in amounts **exceeding five (5) percent of bid amount.** This information must be submitted with your bid proposal. The bidder shall enter **NONE** under **Name of Subcontractor** if not utilizing subcontractors exceeding this amount and **per revised NRS 338.141 (as amended by SB268), the prime contractor shall list itself on the subcontractor's list if it will be providing any of the work on the project.** (This form must be complete in all respects. If, additional space is needed, attach a separate page).

Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		

BID PROPOSAL

SUBCONTRACTORS

BP.19 **INSTRUCTIONS:** for Subcontractors **exceeding one (1) percent of bid amount or $50,000 whichever is greater.** This information must be submitted by the three lowest bidders within two (2) hours after the completion of the opening of the bids. The bidder may elect to submit this information with the bid proposal and, in that case, the bidder will be considered as having submitted this information within the above two hours.

Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		

BID PROPOSAL

SUBCONTRACTORS

BP. 20 **INSTRUCTIONS:** for **all Subcontractors** **not previously listed** on the 5% and 1% pages. This information must be submitted by the three lowest bidders within twenty four (24) hours after the completion of the opening of the bids. The bidder may elect to submit this information with the bid proposal and, in that case, the bidder will be considered as having submitted this information within the above twenty four hours.

Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of work		

BID PROPOSAL

BP. 21

WORKERS EMPLOYED REPORT
INSTRUCTIONS FOR COMPLETION

Effective April 27, 2011, contractors who receive a preference in bidding on a public work must submit an affidavit to the public body certifying that at least 50 percent of all workers employed on the public work, including any employees of the contractor and of any subcontractor, will hold a valid driver's license or identification card issued by the Nevada Department of Motor Vehicles. Pursuant to NRS 338.070(4), a contractor and each subcontractor engaged on a public work shall keep an accurate record showing, for each worker employed by the contractor or subcontractor in connection with the public work who has a driver's license or identification card, the name of the worker, the driver's license number or identification card number of the worker, and the state or other jurisdiction that issued the license or card. A copy of this record must be received by the public body no later than 15 days after the end of the month. Additionally, the contractor and any subcontractor will maintain and make available for inspection within Nevada his or her records concerning payroll relating to the public work.

- EACH contractor and subcontractor must complete the Workers Employed Report.
- You may make additional copies of the report as necessary.
- A copy of this report must be submitted with the monthly certified payroll report.
- For the first report submitted, each contractor and subcontractor should list every worker employed in connection with the public work. The workers listed should be the same as those reported on the certified payroll report.
- For each subsequent month, add only those workers not previously reported to the Workers Employed Report and submit the newly-revised report. If no additional workers have been added, you may submit the previous month's report.
- If a worker has been reported on a previous month's report, but does not work during a subsequent month or is no longer employed by the contractor, his or her name should remain on the report. DO NOT DELETE ANY NAMES. This report is intended to serve as a cumulative list of all workers employed by the contractor and subcontractor over the duration of the project to verify compliance with the minimum requirements of the affidavit.

BID PROPOSAL

WORKERS EMPLOYED REPORT

Project Name: _____ Contract Number : _____
General Contractor:_____ PWP #_____
Subcontractor: _____ Date:_____
Address at which payroll records are maintained:
_____

Contact Person and Phone Number: _____

Employee Name	Driver License Number or ID Card Number	Issuing State or Jurisdiction

BID PROPOSAL

BP. 22

MATERIAL SUPPLIER REPORT
INSTRUCTIONS FOR COMPLETION

Effective April 27, 2011, contractors who receive a preference in bidding on a public work must submit an affidavit to the public body certifying that at least 25 percent of the suppliers of the materials used for the public work will be located in Nevada. In order to ensure compliance the prime contractor shall submit with its monthly application for progress payment a Material Supplier Report completed by each contractor engaged on the public work.

- EACH contractor and subcontractor must complete the Material Supplier Report.
- You may make additional copies of the report as necessary.
- A copy of this report must be submitted with the monthly application for progress payment.
- For the first report submitted, each contractor and subcontractor should list every supplier of materials used in connection with the public work. Include a brief list or description of the materials supplied in the space provided on the report.
- For each subsequent month, add only those suppliers not previously reported to the Material Supplier Report and submit the newly-revised report. If no additional suppliers have been added, you may submit the previous month's report.
- DO NOT DELETE ANY NAMES. This report is intended to serve as a cumulative list of all suppliers of materials over the duration of the project to verify compliance with the minimum requirements of the affidavit.

BID PROPOSAL

MATERIAL SUPPLIER REPORT

Project Name: _____ Contract Number : _____
General Contractor:_____ PWP #_____
Subcontractor: _____ Date:_____

Material Supplier Name	Address	Material Supplied

BID PROPOSAL

Local Preference Affidavit

(This form is required to receive a preference in bidding)

I, _____, on behalf of the Contractor, _____, swear and affirm that in order to be in compliance with NRS 338.XXX* and be eligible to receive a preference in bidding on Project No._____, Project Name _____, certify that the following requirement will be adhered to, documented and attained on completion of the contract. Upon submission of this affidavit on behalf of _____, I recognize and accept that failure to comply with any requirements is a material breach of the contract and entitles the City to damages. In addition, the Contractor may lose their preference designation and/or lose their ability to bid on public works for one year, pursuant to NRS 338. XXX*:

1. The Contractor shall ensure at least 50 percent of the workers possess a Nevada driver's license or identification card;

2. The Contractor shall ensure all vehicles used primarily for the public work will be registered and (where applicable) partially apportioned to Nevada;

3. The Contractor shall ensure at least 50 percent of the design professionals who work on the project (including sub-contractors) have a Nevada driver's license or identification card.

4. The Contractor shall ensure at least 25 percent of the material suppliers used for the public work are located in Nevada and;

5. The Contractor shall ensure payroll records related to this project are maintained and available within the State of Nevada.

***Note that specific sections of NRS 338 detailing the continued procedures associated with the use of the "bidder's preference" have been amended by the passage of Assembly Bill 144 on April 27, 2011, requiring this affidavit and subsequent record keeping and reporting by the General Contractor using the preference program and awarded this project . These requirements are not applicable to Contractors who do not use the "Bidder's Preference" eligibility certificate in their bid.**

By:_____ Title:_____

Signature:_____ Date:_____

Signed and sworn to (or affirmed) before me on this _____ day of _____, 20_____,
by_____ (name of person making statement).

State of _____)
)ss.
County of _____)

_____ STAMP AND SEAL
Notary Signature

BID PROPOSAL

BP.23 ACKNOWLEDGMENT AND EXECUTION:

STATE OF _____)
) SS
COUNTY OF _____)

I _____ (Name of party signing this Bid Proposal), do depose and say: That I am the Bidder or authorized agent of the Bidder; and that I have read and agree to abide by this Bid which includes, but is not limited to the following documents: Notice to Contractors, Table of Contents, Project Coordination, Instructions to Bidders, Bid Bond, Proposal Summary, Contract Award Instructions and Information, Sample Contract, Sample Performance Bond, Sample Labor and Material Payment Bond, General Conditions, Special Conditions, Standard Specifications, Prevailing Wage Rates, Technical Specifications, Geotechnical Report (if any), Contract Drawings, Permits (if any), and any addenda issued and understands the terms, conditions, and requirements thereof; that if his/her bid is accepted that he/she agrees to furnish and deliver all materials except those specified to be furnished by the City (Owner) and to do and perform all work for the "**Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid**", contract number **1213-180**, together with incidental items necessary to complete the work to be constructed in accordance with the Contract Documents, Contract Drawings, and Specifications annexed hereto.

BIDDER:

PRINTED NAME OF BIDDER: _____

TITLE: _____

FIRM: _____

Address: _____

City, State, Zip: _____

Telephone: _____

Fax: _____

E-mail Address: _____

_____
(Signature of Bidder)

DATED: _____

Signed and sworn (or affirmed) before me on this _____day of _____, 2013, by _____.

_____
(Signature of Notary)

(Notary Stamp)

END OF BID PROPOSAL

CONTRACT AWARD

CA.1 METHOD OF AWARD

The Bid, if awarded, will be awarded to the lowest responsive and responsible Bidder based on the Total Base Bid amount, plus or minus any or all Additive or Deductive Alternates, in any combination that is most advantageous to the City. Bidder must bid all items to be responsive and considered for award.

CA.2 TIME OF AWARD

The award, if made, will be within sixty (60) calendar days after the opening of Bids. The City reserves the right to accept or reject any or all Bids received.

CA.3 BONDS

A. Bonds Required

The Contractor agrees that any bonding or guarantee required by this bid shall not be considered as the exclusive remedy of the City for any default in any respect by the Contractor, but such bonding or guarantee shall be considered to be in addition to any right or remedy hereunder or allowed by law, equity, or statute.

A Performance Bond and a Payment Bond, pursuant to the requirements of NRS 339.025, if not otherwise excluded under the threshold stated in NRS 339.025, in the amount of one hundred percent (100%) of the Contract Amount shall be required of the Contractor prior to execution of the Contract and not later than ten (10) calendar days after receipt of the Notice of Award. Said bonds shall remain in full force and effect for a period of not less than one (1) year from the date of Final Acceptance of this Project by the City (Carson City Board of Supervisors or Carson City Regional Transportation Commission). Each of the bonds required must be executed by one or more surety companies authorized to do business in the State of Nevada. Note that individual surety bonds are not acceptable to the City.

B. Bond Forms

The referenced bonds shall be written on the Performance Bond, and Labor and Material Payment Bond forms provided by the City, as shown in the following Construction Contract forms.

The Bidder shall require any resident agent who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her power of attorney.

Any Labor and Material Payment Bond or Performance Bond prepared by a licensed non-resident agent must be countersigned by a resident agent in accordance with the provisions of NRS 680A.300.

The referenced Bonds must be issued by a certified surety listed in the Department of the Treasury, Fiscal Service (Department Circular 570, Current Revision); companies holding certificates of authority as acceptable sureties on federal bonds and as acceptable reinsuring companies.

CA.4 INSURANCE REQUIREMENTS

A. General

Contractor, as an independent contractor and not an employee of the City, must carry policies of insurance in amounts specified and pay all taxes and fees incidental hereto. City shall have no liability except as specified in this Contract.

Contractor shall not commence work before: (1) Contractor has provided the required evidence of insurance to Carson City Purchasing and Contracts, (2) City has approved the insurance policies provided by Contractor, and (3) City has issued the Notice to Proceed.

Contractor shall not allow any subcontractors to commence work on its subcontract until all similar insurance required of the subcontractor has been obtained and verified by Contractor.

Prior approval of the insurance policies by City shall be a condition precedent to any payment of consideration under this Contract and City's approval of any changes to insurance coverage during the

course of performance shall constitute an ongoing condition subsequent to this Contract. Any failure of City to timely approve shall not constitute a waiver of the condition.

The insurance requirements specified herein do not relieve Contractor of his/her responsibility or limit the amount of his/her liability to the City or other person, and Contractor is encouraged to purchase such additional insurance as he/she deems necessary.

Contractor is responsible for and must remedy all damage or loss to any property, including property of City, caused in whole or in part by Contractor, any subcontractor or anyone employed, directed or supervised by Contractor**.** Contractor is responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

City reserves the right to occupy existing facilities under construction or to use or occupy parts of the Work. Insurance policies shall not restrict or limit such use.

Certificate Holder: Each liability insurance policy shall list Carson City c/o Carson City Purchasing and Contracts, 201 North Carson Street, Suite 3, Carson City, Nevada 89701 as a certificate holder.

A. Insurance Coverage

Contractor shall, at Contractor's sole expense, procure, maintain and keep in force for the duration of this Contract the following insurance conforming to the minimum requirements specified below. Unless specifically specified herein or otherwise agreed to by the City, the required insurance shall be in effect prior to the commencement of work by the Contractor and shall continue in force as appropriate until the latter of:

1. Final acceptance by the City of the completion of this Contract; or

2. Such time as the insurance is no longer required by the City under the terms of this Contract

3. Any insurance or self-insured available to the City shall be in excess of and non-contributing with any insurance required from the Contractor. Contractor's insurance policies shall apply on a primary basis. Until such time as the insurance is no longer required by the City, Contractor shall provide the City with renewal or replacement evidence of insurance no less than thirty (30) calendar days before the expiration or replacement of the required insurance. If at any time during the period when insurance is required by this Contract, an insurer or surety fail to comply with the requirements of this Contract, as soon as **CONTRACTOR** has knowledge of any such failure, Contractor shall immediately notify the City and immediately replace such insurance or bond with an insurer meeting the requirements.

B. General Requirements

Certificate Holder: Each liability insurance policy shall list Carson City c/o Carson City Purchasing and Contracts, 201 North Carson Street, Suite 3, Carson City, Nevada 89701, as a certificate holder.

Additionally Insured: By Endorsement to the general liability insurance policy evidence by Contractor, the City and County of Carson City, Nevada, its officers, employees and immune Contractors shall be named as additionally insured's for all liability arising from this contract.

Waiver of Subrogation: Each liability insurance policy shall provide for a waiver of subrogation as to additionally insured's.

Cross Liability: All required liability policies shall provide cross-liability coverage as would be achieved under the standard ISO separation of insured's clause.

Deductibles and Self-Insured Retentions: Insurance maintained by the Contractor shall apply on a first dollar basis without application of a deductible or self-insured retention unless otherwise specifically

agreed to by the City. Such approval shall not relieve Contractor from the obligation to pay any deductible or self-insured retention. Any deductible or self-insured retention shall not exceed $5,000.00 per occurrence, unless otherwise approved by the City**.**

Policy Cancellation: Except for ten (10) calendar days notice for non-payment of premium, each insurance policy shall be endorsed to state that: without thirty (30) calendar days prior written notice to Carson City Purchasing and Contracts, the policy shall not be cancelled, non-renewed or coverage and/or limits reduced or materially altered, and shall provide that notices required by this paragraph shall be sent by certified mail to Carson City Purchasing and Contracts, 201 North Carson Street, Suite 3, Carson City, Nevada 89701.

Approved Insurer: Each insurance policy shall be issued by insurance companies authorized to do business in the State of Nevada or eligible surplus line insurers acceptable to the State and having agents in Nevada upon whom service of process may be made, and currently rated by A.M. Best as "A-VII" or better.

Evidence of Insurance: Prior to commencement of work, the Contractor must provide the following documents to Carson City Purchasing and Contracts, 201 North Carson Street, Suite 3, Carson City, Nevada 89701.

Certificate of Insurance: The Acord 25 Certificate of Insurance form or a form substantially similar must be submitted to Carson City Purchasing and Contracts to evidence the insurance policies and coverages required of Contractor.

Additional Insured Endorsement: An additional Insured Endorsement (CG20 10 or CG 20 26), signed by an authorized insurance company representative, must be submitted to Carson City Purchasing and Contracts to evidence the endorsement of **CITY** as an additional insured.

Schedule of Underlying Insurance Policies: If Umbrellas or Excess policy is evidenced to comply with the minimum limits, a copy of the Underlyer Schedule from the Umbrella or Excess insurance policy may be required.

Review and Approval: Documents specified above must be submitted for review and approval by Carson City Purchasing and Contracts prior to the commencement of work by Contractor. Neither approval by the City nor failure to disapprove the insurance furnished by the Contractor shall relieve Contractor or Contractor's full responsibility to provide the insurance required by this Contract. Compliance with the insurance requirements of this Contract shall not limit the liability of Contractor or its subcontractors, employees or agents to City or others, and shall be in addition to and not in lieu of any other remedy available to the City under this Contract or otherwise. Carson City reserves the right to request and review a copy of any required insurance policy or endorsement to assure compliance with these requirements.

C. Commercial General Liability Insurance

Minimum Limits required:

Two Million Dollars ($2,000,000.00) – General Aggregate

Two Million Dollars ($2,000,000.00) – Products and Completed Operations Aggregate

One Million Dollars ($1,000,000.00) – Each Occurrence

Coverage shall be on an occurrence basis and shall be at least as broad as ISO 1996 from CG 00 01 (or a substitute form providing equivalent coverage); and shall cover liability arising from premises, operations, independent Contractors, completed operations, person injury, products, civil lawsuits, Title VII actions and liability assumed under an insured contract (including the tort liability or another assumed in a business contact).

D. Business Automobile Liability

Minimum Limit required:

On Million Dollars ($1,000,000.00) per occurrence for bodily injury and property damage

Coverage shall be for "any auto" including owned, non-owned and hired vehicles. The policy shall be written on ISO form CA 00 01 or a substitute providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.

F. Worker's Compensation and Employer's Liability Insurance

CONTRACTOR shall provide workers' compensation insurance as required by Nevada Revised Statutes Chapters 616A through 616D inclusive and Employer's Liability insurance with a minimum limit of $500,000.00 each employee per accident for bodily injury by accident or disease.

CA.5 PENALTY FOR COLLUSION

If at any time, it is found that the Contractor has, in presenting any bid or bids, colluded with any other party or parties, then the Contract shall be null and void, and the Contractor and its sureties shall be liable for loss or damage which the City may suffer thereby, and the City may advertise for new bids for said Work. The Contractor further certifies that any and all prices which he/she may charge under the terms of the Contract do not, and will not; violate any existing Federal, State or Municipal laws or regulations concerning discrimination and/or price fixing.

CA.6 SUCCESSORS AND ASSIGNS

The performance of the Contract may not be assigned. Consent will not be given to any proposed assignment which would relieve the surety of the original Contractor of their responsibilities under the Contract, nor will the City consent to any assignment of a part of the Work under the Contract.

CA.7 RIGHTS AND REMEDIES

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to, and not a limitation of, any duties, obligations, rights, and remedies otherwise imposed or available by law.

No action or failure to act by the City, the Design Consultant, or the Construction Manager shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

CA.8 COPELAND ANTI-KICKBACK LAW

The Contractor shall comply with the Copeland Anti-Kickback Act (19 U.S.C. 874) as supplemented in the Department of Labor Regulations (29 CFR Part 3). This act provides that each Contractor or subcontractor shall be prohibited from inducing by any means, any person employed in the construction, completion or repair of public work, to give up any part of the compensation to which he/she is otherwise entitled.

CA.9 NOTICE TO PROCEED

Within ten (10) calendar days of receipt of all required post-bid information, including bonds, insurances, and executed Contract, the City will issue the Notice to Proceed.

CA.10 TIME: COMPLETION OF PROJECT

A. Time

The successful Bidder, upon becoming the Contractor after having entered into a Contract with the City, shall commence the Work to be performed under the Contract on the date set by the City in the written Notice to Proceed, continuing the Work in accordance with the approved schedule and shall complete the entire Work within the number of calendar days stated in the Special Conditions after the date of the Notice to Proceed. Further, separable portions of the Work may be subject to milestone or specific dates as established in the Special Conditions.

The time specified above represents no overtime requirement. Any scheduling of overtime for this Project is solely that of the Contractor, unless specifically directed in writing by the City. The City will not be responsible for any costs related to overtime work performed unless it is specifically directed in writing by the City.

B. Liquidated Damages

In case of failure on the part of the Contractor to complete the Work within the time(s) specified in the Contract, or within such additional time(s) as may be granted by formal action of the City, or the Contractor fails to prosecute the Work, or any separable part thereof, with such diligence as will insure its completion within the time(s) specified in the Contract or any extensions thereof, the Contractor shall pay to the City, as liquidated damages, the sum specified in the Special Conditions for each calendar day for delay until such reasonable time as may be required for final completion of the Work, together with any increased costs incurred by the City in completing the Work.

Time stated for completion shall include the final cleanup and demobilization.

The signing of the Bid Proposal by the Bidder shall be prima facie evidence that the Contractor agrees that the amount of liquidated damages is fair and reasonable.

CA. 11 LIQUIDATED DAMAGES FOR LATE SUBMITTALS AND LAPSE OF INSURANCE

The Contractor shall provide all submittals required by this Contract within fifteen (15) calendar days of the Notice to Proceed. If the Contractor does not provide the submittals on or before the fifteenth (15th) calendar day, he/she will pay to the City the amount of Two Hundred Fifty Dollars ($250) per day as liquidated damages. If the Contractor does not keep the bonds or insurance policies in effect or allows them to lapse, the Contractor will pay to the City the amount of Two Hundred Fifty Dollars ($250) per day as liquidated damages, and will be in breach of Contract.

END OF CONTRACT AWARD

SAMPLE CONTRACT

THIS **CONTRACT** made and entered into this 18th day of July, 2013, by and between Carson City, a consolidated municipality, a political subdivision of the State of Nevada, hereinafter referred to as the "**OWNER"**, and ???? hereinafter referred to as **"CONTRACTOR".**

WITNESSETH:

WHEREAS, the Purchasing and Contracts Administrator for the City and County of Carson City is authorized pursuant to Nevada Revised Statutes 338 and Carson City Purchasing Resolution #1990-R71, to approve and accept this Contract as set forth in and by the following provisions; and

WHEREAS, it is deemed necessary that the services of **CONTRACTOR** for **CONTRACT No. 1213-180, titled "Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"** are both necessary and in the best interest of **CITY**; and

NOW, THEREFORE, in consideration of the aforesaid premises, the parties mutually agree as follows:

REQUIRED APPROVAL

This Contract shall not become effective until and unless approved by the Carson City Board of Supervisors or the Carson City Regional Transportation Commission.

CONTRACT TERM AND LIQUIDATED DAMAGES

CONTRACTOR agrees to complete the Work on or before the date specified in the Notice to Proceed or any executed Change Orders to the entire satisfaction of the **OWNER** before final payment is made, unless sooner termination by either party as specified in the General Conditions, section GC 3.18.

Pursuant to the provisions under Time for Completion and Liquidated Damages in the Contract Documents of said Specifications; the **CONTRACTOR** will complete the work within the Contract time. Since **OWNER** and **CONTRACTOR** agree it is difficult to ascertain the actual amount of damages incurred due to delay of the Project, it is agreed that **OWNER** will be paid the liquidated damages as specified in the Contract Special Conditions for each and every calendar day of delay in the completion of the work, in addition to any direct charges incurred by the **OWNER** as a result of delay of the Project, including engineering fees and additional damages due to late construction. The **OWNER** also reserves the right to deduct any amounts due the **OWNER** from any moneys earned by the **CONTRACTOR** under this Contract.

That in the performance of this Contract, an employer shall pay 1 ½ times an employee's regular wage rate whenever an employee who received compensation for employment at a rate less than 1 ½ time the minimum wage who works more than forty (40) hours in any scheduled work week, more than eight (8) hours in a day, unless by mutual agreement the employee works a scheduled ten (10) hours per day for four (4) calendar days with an work week. Employers should refer to NRS 608.018 for further details on overtime requirements.

NOTICE

Unless otherwise specified, termination shall not be effective until seven (7) calendar days after a party has served written notice of default, or without cause upon the other party. All notices or other communications required or permitted to be given under this Contract shall be in writing and shall be deemed to have been duly given if delivered personally in hand, by e-mail with simultaneous regular mail, by telephonic facsimile with simultaneous regular mail, or by certified mail, return receipt requested, postage prepaid on the date posted, and addressed to the other party at the address specified below.

For P&C Use Only	
CCBL expires	_____
NVCL expires	_____
GL expires	_____
AL expires	_____
WC expires	_____

SAMPLE CONTRACT

Notice to CONTRACTOR shall be addressed to:

Notice to CITY shall be addressed to:

Carson City Purchasing and Contracts
Kim Belt, CPM Purchasing and Contracts Manager
201 North Carson Street Suite 3
Carson City, NV 89701
775-283-7137 / FAX 775-887-2107
KBelt@carson.org

COMPENSATION

The parties agree that **CONTRACTOR** will provide the Work specified in these Contract Documents for the Contract Amount of "amount in word" (amount in figures).

OWNER will pay **CONTRACTOR** progress payments and the final payment computed from the actual quantities of work performed and accepted and the materials furnished at the Unit and Lump Sum prices shown on the **CONTRACTOR'S** Bid Proposal and any executed Change Orders.

Contract Amount represents full and adequate compensation for the complete Work, and includes the furnishing of all materials; all labor, equipment, tools, transportation, services, appliances; and all expenses, direct or indirect connected with the proper execution of the work.

OWNER does not agree to reimburse **CONTRACTOR** for expenses unless otherwise specified.

CONTRACT TERMINATION

Termination Without Cause:
Any discretionary or vested right of renewal notwithstanding, this Contract may be terminated upon written notice by mutual consent of both parties or unilaterally by either party without cause.

CITY reserves the right to terminate this Contract for convenience whenever it considers termination, in its sole and unfettered discretion, to be in the public interest. In the event that the Contract is terminated in this manner, payment will be made for work actually completed. In no event if termination occurs under this provision shall **CONTRACTOR** be entitled to anticipated profits on items of work not performed as of the effective date of the termination or compensation for any other item, including but not limited to, unabsorbed overhead. **CONTRACTOR** shall assure that all subcontracts which he/she enters related to this Contract likewise contain a termination for convenience clause which precludes the ability of any subcontractor to make claims against **CONTRACTOR** for damages, due to breach of contract, of lost profit on items of work not performed or of unabsorbed overhead, in the event of a convenience termination.

Termination for Nonappropriation:
The continuation of this Contract beyond June 30, 2013 is subject to and contingent upon sufficient funds being appropriated, budgeted, and otherwise made available by the Carson City Board of Supervisors. **CITY** may terminate this Contract, and **CONTRACTOR** waives any and all claim(s) for damages, effective immediately upon receipt of written notice (or any date specified therein) if for any reason the funding is not appropriated or is withdrawn, limited, or impaired.

Cause Termination for Default or Breach:

A default or breach may be declared with or without termination.

SAMPLE CONTRACT

This Contract may be terminated by either party upon written notice of default or breach to the other party as follows:

If **CONTRACTOR** fails to provide or satisfactorily perform any of the conditions, work, deliverables, goods, or services called for by this Contract within the time requirements specified in this Contract or within any granted extension of those time requirements; or

If any state, county, city or federal license, authorization, waiver, permit, qualification or certification required by statute, ordinance, law, or regulation to be held by **CONTRACTOR** to provide the goods or services required by this Contract is for any reason denied, revoked, debarred, excluded, terminated, suspended, lapsed, or not renewed; or

If **CONTRACTOR** becomes insolvent, subject to receivership, or becomes voluntarily or involuntarily subject to the jurisdiction of the bankruptcy court; or

If **CITY** materially breaches any material duty under this Contract and any such breach impairs **CONTRACTOR'S** ability to perform; or

If it is found by **CITY** that any quid pro quo or gratuities in the form of money, services, entertainment, gifts, or otherwise were offered or given by **CONTRACTOR**, or any agent or representative of **CONTRACTOR**, to any officer or employee of **CITY** with a view toward securing a contract or securing favorable treatment with respect to awarding, extending, amending, or making any determination with respect to the performing of such contract; or

If it is found by **CITY** that **CONTRACTOR** has failed to disclose any material conflict of interest relative to the performance of this Contract.

CITY may terminate this Contract if **CONTRACTOR**:

Fails to maintain bonding, Nevada State Contractors' Board License, State Industrial Insurance requirements or insurance policies for limits as defined in this Contract;

Persistently or repeatedly refuses or fails to supply properly skilled workers or proper materials;

Fails to make payment to subcontractors for materials or labor in accordance with the respective agreements between **CONTRACTOR** and the subcontractors;

Persistently disregards laws, ordinances, or rules, regulations or order of a public authority having jurisdiction;
Otherwise makes a material breach of a provision of this Contract; or

CONTRACTOR fails to maintain safe working conditions.

When any of the above reasons exist, **CITY** may provide, without prejudice to any other rights or remedies of **CITY** and after giving **CONTRACTOR** and **CONTRACTOR'S** Surety, seven (7) calendar days written notice, terminate employment of **CONTRACTOR** and may, subject to any prior rights of the surety:

Take possession of the site and of all materials, equipment, tools and construction equipment and machinery thereon owned by **CONTRACTOR**;

Accept assignment of subcontractors pursuant to this Contract (Contingent Assignment of Subcontracts to Carson City if this Contract is terminated); and,

Finish the Work by whatever reasonable method **CITY** may deem expedient.

If **CITY** terminates this Contract for one of the reasons stated above, **CONTRACTOR** shall not be entitled to receive further payment until the Work is finished.

If the unpaid balance of the Contract Amount exceeds the cost of finishing the Work including expenses made necessary thereby, such excess shall be paid to **CONTRACTOR**. If the costs of finishing the Work exceed the

unpaid balance, **CONTRACTOR** shall pay the difference to **CITY**. The amount to be paid to **CONTRACTOR** or **CITY**, as the case may be, shall survive termination of this Contract.

In the event of such termination, all monies due **CONTRACTOR** or retained under the terms of this Contract shall be held by **CITY**; however, such holdings will not release **CONTRACTOR** or its sureties from liability for failure to fulfill this Contract. Any excess cost over and above the Contract Amount incurred by **CITY** arising from the termination of the operations of this Contract and the completion of the Work by **CITY** as provided above shall be paid for by any available funds held by **CITY**. **CONTRACTOR** will be so credited with any surplus remaining after all just claims for such completion have been paid.

If at any time before completion of the Work under this Contract, the Work shall be stopped by an injunction of a court of competent jurisdiction or by order of any competent authority, **CITY** may give notice to **CONTRACTOR** to discontinue the Work and terminate this Contract. **CONTRACTOR** shall discontinue the Work in such manner, sequence, and at such times as **CITY** may direct. **CONTRACTOR** shall have no claim for damages for such discontinuance or termination, nor any claim for anticipated profits on the Work thus dispensed with, nor for any claim for penalty, nor for any other claim such as unabsorbed overhead, except for the work actually performed up to the time of discontinuance, including any extra work ordered by **CITY** to be done.
Time to Correct:

Termination upon a declared default or breach may be exercised only after service of formal written notice as previously specified, and the subsequent failure of the defaulting party within five (5) calendar days of that notice to provide evidence, satisfactory to the aggrieved party, showing that the declared default or breach has been corrected.

Winding Up Affairs Upon Termination:
In the event of termination of this Contract for any reason, the parties agree that the provisions of this paragraph survive termination:

The parties shall account for and properly present to each other all claims for fees and expenses and pay those which are undisputed and otherwise not subject to set off under this Contract. Neither party may withhold performance of winding up provisions solely based on nonpayment of fees or expenses accrued up to the time of termination;

CONTRACTOR shall satisfactorily complete work in progress at the agreed rate (or a pro rata basis if necessary) if so requested by **CITY**;

CONTRACTOR shall execute any documents and take any actions necessary to effectuate an assignment of this Contract if so requested by **CITY**;

CONTRACTOR shall preserve, protect, and promptly deliver into **CITY** possession all proprietary information in accordance with City Ownership of Proprietary Information.

SCOPE OF WORK

The parties agree that the scope of work will be specifically described and hereinafter referred to as the **WORK**. This Contract incorporates the following attachments, a **CONTRACTOR'S** attachment shall not contradict or supersede any **OWNER** specifications and/or terms or conditions without written evidence of mutual assent to such change appearing in this Contract.

CONTRACTOR agrees that the Contract Documents for Bid No. 1213-180 include, but not limited to, the Notice to Contractors, Table of Contents, Project Coordination, Instructions to Bidders, Contract Award Information, General Conditions, Special Conditions, Technical Specification, Prevailing Wages, Contract Drawings, and Addenda, if any, herein after referred to as Exhibit A, are intended to be complete and complementary and are intended to describe a complete work. These documents are incorporated herein by reference and made a part whereof.

CONTRACTOR additionally agrees **CONTRACTOR'S** Bid Bond, Proposal Summary, Executed Contract, Performance Bond, Labor and Material Bond, Certificate of Eligibility, Insurance Certificates, Permits, Notice of

Award, Notice to Proceed and Executed Change Orders, referred to as Exhibit B, are incorporated herein and made a part whereof.

DAVIS BACON & RELATED ACTS 29CFR PARTS 1,3,5,6,&7 AND NRS 338.070(5)

Each covered contractor or subcontractor must provide a weekly statement of the wages paid to each of its employees engaged in covered work. The statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages and shall be on the "Statement of Compliance" form on the back of WH-347 "Payroll (For Contractors Optional Use") or on any form with identical wording (Page BP-17). **Within seven days after the regular pay date for the pay period the statement shall be delivered to a representative of the federal or state agency in charge.**

NRS 338.070(5) " The record maintained pursuant to subsection 4 must be open at all reasonable hours to the inspection of the public body awarding the contract. The contractor engaged on the public work or subcontractor engaged on the public work shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month."

CERTIFIED PAYROLLS FOR DAVIS BACON AND PREVAILING WAGE PROJECTS

The higher of the Federal or local prevailing wage rates for Carson City, as established by the Nevada Labor Commission and the Davis-Bacon Act, shall be paid for all classifications of labor on this Project. Also, in accordance with NRS 338, the hourly and daily wage rates must be posted at the work site by the Contractor. The Contractor shall ensure that a copy of the Contractor's and Subcontractor's certified payrolls for each calendar week is received by Carson City.

The Contractor and each subcontractor shall keep an accurate payroll record, showing the name, address, work classification, straight time, and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed in connection with the Project.

The payroll records shall be certified and shall be submitted weekly to the Construction Manager. Submission of the certified payrolls shall be a condition precedent for processing the monthly progress payment. The General Contractor shall collect the wage reports from the Sub-Contractors and ensure the receipt of a certified copy of each weekly payroll for submission to the City as one complete package.

Pursuant to NRS 338.060 and 338.070, the Contractor hereby agrees to forfeit, as a penalty to the City, not less than Twenty Dollars ($20) nor more than Fifty Dollars ($50) for each calendar day or portion thereof that each worker employed on the Contract is paid less than the designated rate for any work done under the Contract, by the Contractor or any subcontractor under him/her, or is not reported to the City as required by NRS 338.070.

FAIR EMPLOYMENT PRACTICES

Pursuant to NRS 338.125, Fair Employment Practices, the following provisions must be included in any contract between **CONTRACTORS** and Public Bodies;

In connection with the performance of work under this Contract, the CONTRACTOR agrees not to discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex sexual orientation or age, including, without limitation, with regard to employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including without limitation, apprenticeship.

In connection with the performance of work under this Contract, **CONTRACTOR** agrees not to discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, sexual orientation or age, including without limitation, with regard to employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including, without limitation, apprenticeship.

SAMPLE CONTRACT

CONTRACTOR further agrees to insert this provision in all subcontracts hereunder, except subcontracts for standard commercial supplies or raw materials.

PREFERENTIAL EMPLOYMENT

Pursuant to Nevada Revised Statute 338.130, in all cases where persons are employed in the construction of public works, preference must be given, the qualifications of the applicants being equal: (1) First: To persons who have been honorably discharged from the Army, Navy, Air Force, Marine Corps or Coast Guard of the United States, a reserve component thereof or the National Guard; and are citizens of the State of Nevada. (2) Second: To other citizens of the State of Nevada.

In connection with the performance of work under this Contract, **CONTRACTOR** agrees to comply with the provisions of Nevada Revised Statute 338.130 requiring certain preferences to be given to which persons are employed in the construction of a public work. If **CONTRACTOR** fails to comply with the provisions of Nevada Revised Statute 338.130, pursuant to the terms of Nevada Revised Statute 338.130(3), this Contract is void, and any failure or refusal to comply with any of the provisions of this section renders this Contract void.

ALTERNATIVE DISPUTE RESOLUTION

Pursuant to Nevada Revised Statute 338.150, public body charged with the drafting of specifications for a public work shall include in the specifications a clause requiring the use of a method of alternative dispute resolution before initiation of a judicial action if a dispute arising between the public body and the **CONTRACTOR** engaged on the public work if the dispute cannot otherwise be settled. Therefore, in the event that a dispute arising between **OWNER** and **CONTRACTOR** cannot otherwise be settled, **OWNER** and **CONTRACTOR** agree that, before judicial may be initiated, **OWNER** and **CONTRACTOR** will submit the dispute to non-binding mediation. **OWNER** shall present **CONTRACTOR** with a list of three potential mediators. **CONTRACTOR** shall select one person to serve as the mediator from the list of potential mediators presented by **OWNER**. The person selected as mediator shall determine the rules governing the mediation.

LIMITED LIABILITY

OWNER will not waive and intends to assert available NRS Chapter 41 liability limitations in all cases. Contract liability of both parties shall not be subject to punitive damages. Liquidated damages shall not apply unless otherwise specified in the incorporated attachments. Damages for any **OWNER** breach shall never exceed the amount of funds appropriated for payment under this Contract, but not yet paid to **CONTRACTOR,** for the fiscal year budget in existence at the time of the breach. **CONTRACTOR'S** tort liability shall not be limited.

FORCE MAJEURE

NEITHER party shall be deemed to be in violation of this Contract if it is prevented from performing any of its obligations hereunder due to strikes, failure of public transportation, civil or military authority, act of public enemy, accidents, fires, explosions, or acts of God, including, without limitation, earthquakes, floods, winds, or storms. In such an event, the intervening cause must not be through the fault of the party asserting such an excuse, and the excused party is obligated to promptly perform in accordance with the terms of this Contract after the intervening cause ceases.

INDEMNIFICATION

To the extent permitted by law, including but not limited to, the provisions of NRS Chapter 41, each party shall indemnify, hold harmless and defend, not excluding the other's right to participate, the other party from and against all liability, claims, actions, damages, losses, and expenses, including but not limited to reasonable attorney's fees and costs arising out of any alleged negligent or willful acts or omissions of the indemnifying party, its officers, employees and agents. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of the indemnity which would otherwise exist as to any party or person described in this paragraph.

Except as otherwise provided below, the indemnifying party shall not be obligated to provide a legal defense to the indemnifying party, nor reimburse the indemnified party for the same, for any period occurring

before the indemnified party provides written notice of the pending claim(s) or cause(s) of action to the indemnifying party, along with:

1) a written request for a legal defense for such pending claim(s) or cause(s) of action; and

2) a detailed explanation of the basis upon which the indemnified party believed that the claim or cause of action asserted against the indemnified party implicated the culpable conduct of the indemnifying party, its officers, employees, and/or agents.

After the indemnifying party has begun to provide a legal defense for the indemnified party, the indemnifying party shall not be obligated to fund or reimburse any fees or costs provided by any additional counsel for the indemnified party, including counsel through which the indemnified party might voluntarily choose to participate in its defense of the same matter.

After the indemnifying party has begun to provide legal defense for the indemnified party, the indemnifying party shall not be obligated to reimburse the reasonable attorney's fees and costs incurred by the indemnified party during the initial thirty (30) day period of the claim or cause of action, if any, incurred by separate counsel.

INDEPENDENT CONTRACTOR

An independent contractor is a natural person, firm or corporation who agrees to perform services for a fixed price according to his/her or its own methods and without subjection to the supervision or control of the other contracting party, except as to the results of the work, and not as to the means by which the services are accomplished.

It is mutually agreed that **CONTRACTOR** is associated with **CITY** only for the purposes and to the extent specified in this Contract, and in respect to performance of the contracted services pursuant to this Contract. **CONTRACTOR** is and shall be an independent contractor and, subject only to the terms of this Contract, shall have the sole right to supervise, manage, operate, control, and direct performance of the details incident to its duties under this Contract.

Nothing contained in this Contract shall be deemed or construed to create a partnership or joint venture, to create relationships of an employer-employee or principal-agent, or to otherwise create any liability for **CITY** whatsoever with respect to the indebtedness, liabilities, and obligations of **CONTRACTOR** or any other party.

CONTRACTOR shall indemnify and hold **CITY** harmless from, and defend **CITY** against, any and all losses, damages, claims, costs, penalties, liabilities, expenses arising out of or incurred in any way because of, but not limited to, **CONTRACTOR'S** obligations or legal duties regarding any taxes, fees, assessments, benefits, entitlements, notice of benefits, employee's eligibility to work, to any third party, subcontractor, employee, state, local or federal governmental entity.

Neither **CONTRACTOR** nor its employees, agents, or representatives shall be considered employees, agents, or representatives of **CITY**.

COMPLIANCE WITH LEGAL OBLIGATIONS

Pursuant to NRS 338.153, a public body shall include in each contract for a public work a clause requiring each Contractor, subcontractor and other person who provide labor, equipment, materials, supplies and services for the public work to comply with the requirements of all applicable state and local laws, including without limitation, any applicable licensing requirements and requirements for the payment of sales and use taxes on equipment, materials and supplies provided for the public work.

CONTRACTOR shall procure and maintain for the duration of this Contract any state, county, city, or federal license, authorization, waiver, permit, qualification or certification required by statute, ordinance, law, or regulation to be held by **CONTRACTOR** to provide the goods or services of this Contract. **CONTRACTOR** will be responsible to pay <u>all government obligations, including, but not limited to,</u> all taxes, assessments, fees, <u>fines, judgments,</u> premiums, permits, and licenses required <u>or imposed</u> by law <u>or a court</u>. Real property and personal

property taxes are the responsibility of **CONTRACTOR** in accordance with Nevada Revised Statutes 361.157 and 361.159. **CONTRACTOR** agrees to be responsible for payment of any such government obligations not paid by its subcontractors during performance of this Contract. CITY may set-off against consideration due any delinquent government obligation.

WAIVER OF BREACH

Failure to declare a breach or the actual waiver of any particular breach of this Contract or its material or nonmaterial terms by either party shall not operate as a waiver by such party of any of its rights or remedies as to any other breach.

SEVERABILITY

If any provision contained in this Contract is held to be unenforceable by a court of law or equity, this Contract shall be construed as if such provision does not exist and the nonenforceability of such provision shall not be held to render any other provision or provisions of this Contract unenforceable.

ASSIGNMENT/DELEGATION

To the extent that any assignment of any right under this Contract changes the duty of either party, increases the burden or risk involved, impairs the chances of obtaining the performance of this Contract, attempts to operate as a novation, or includes a waiver or abrogation of any defense to payment by **OWNER**, such offending portion of the assignment shall be void, and shall be a breach of this Contract. **CONTRACTOR** shall neither assign, transfer nor delegate any rights, obligations or duties under this Contract without the prior written approval of **OWNER.**

CITY OWNERSHIP OF PROPRIETARY INFORMATION

Any files, reports, histories, studies, test, manuals, instruction, photographs, negatives, blue prints, plans, maps, data, system designs, computer programs, computer codes, and computer records (which are intended to be consideration under this Contract), or any other documents or drawings, prepared or in the course of preparation by **CONTRACTOR** (or its subcontractors) in performance of its obligations under this Contract shall be exclusive property of the City of Carson City, Nevada, and such materials shall be delivered into **OWNER'S** possession by **CONTRACTOR** upon completion, termination, or cancellation of this Contract. **CONTRACTOR** shall not use, willingly allow, or cause to have such materials used for any purpose other than the performance of **CONTRACTOR'S** obligations under this Contract without the prior written consent of **OWNER**. Notwithstanding the foregoing, **OWNER** shall have no proprietary interest in any materials license for use by **OWNER** that are subject to patent, trademark or copyright protection.

OWNER shall be permitted to retain copies, including reproducible copies, of **CONTRACTOR'S** drawings, specifications, and other documents for information and reference in connection with this Contract.

CONTRACTOR'S drawings, specification and other documents shall not be used by **OWNER** or others without expressed permission of **CONTRACTOR.**

PUBLIC RECORDS

Pursuant to NRS 239.010, information or documents received from **CONTRACTOR** may be opened to public inspection and copying. **OWER** will have duty to disclose unless a particular record is made confidential by law or a common law balancing of interests. **CONTRACTOR** may clearly label specific parts of an individual document as a "trade secret" or "confidential" in accordance with NRS 332,061, provided that **CONTRACTOR** thereby agrees to indemnify and defend **OWNER** for honoring such a designation. The failure to so label any document that is released by **OWNER** shall constitute a complete waiver of any and all claims for damages caused by any release of the records.

SAMPLE CONTRACT

CONFIDENTIALITY

CONTRACTOR shall keep confidential all information, in whatever form, produced, prepared, observed or received by **CONTRACTOR** to the extent that such information is confidential by law or otherwise required by this Contract.

FEDERAL FUNDING

In the event federal funds are used for payment of all or part of this Contract:

CONTRACTOR certified, by signing this Contract, that neither it not its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency. This certification if made pursuant to the regulations implementing Executive Order 12549, Debarment and Suspension, 28 C.F.R. pt. 67, § 67.510, as published as pt. VII of the May 26, 1988, Federal Register (pp.19160-19211), and any relevant program-specific regulations. This provision shall be required of every subcontractor receiving any payment in whole or in part from federal funds.

CONTRACTOR and its subcontractors shall comply with all terms, conditions, and requirements of the Americans with Disabilities Act of 1990 (P.L. 101-136), 42 U.S.C. 12101, as amended, and regulations adopted thereunder contained in 28 C.F.R. 26.101.36.999, inclusive, and any relevant program-specific regulations.

CONTRACTOR and its subcontractors shall comply with the requirements of the Civil Rights Act of 1964, as amended, the Rehabilitation Act of 1973, P.L. 93-112, as amended, and any relevant program-specific regulation, and shall not discriminate against any employee or offeror for employment because of race, national origin, creed, color, sex, religion, age, disability or handicap conditions (including AIDS and AIDS-related conditions).

LOBBYING

The parties agree, whether expressly prohibited by federal law, or otherwise, that no funding associated with this Contract will be used for any purpose associated with or related to lobbying or influencing or attempting to lobby or influence for any purpose the following:

Any federal, state, county or local agency, legislature, commission, counsel or board;

Any federal, state, county or local legislator, commission member, counsel member, board member, or any other elected official; or

Any officer or employee of any federal, state, county or local agency, legislature, commission, counsel, or board.

PROPER AUTHORITY

The parties hereto represent and warrant that the person executing this Contract on behalf of each party has full power and authority to enter into this Contract. **CONTRACTOR** acknowledges that this Contract is effective only after approval by the Carson City Board of Supervisors and only for the period of time specified in this Contact. Any services performed by **CONTRACTOR** before this Contract is effective or after it ceases to be effective are performed at the sole risk of **CONTRACTOR.**

GOVERNING LAW: JURISDICTION

This Contract and the rights and obligations of the parties hereto shall be governed by, and construed according to, the laws of the State of Nevada, without giving effect to any principal of conflict-of-law that would require the application of the law any other jurisdiction. **CONTRACTOR** consents and agrees to the jurisdiction of the courts of the State of Nevada located in Carson City, Nevada for enforcement of this Contract.

SAMPLE CONTRACT

ENTIRE CONTRACT AND MODIFICATION

This Contract and its integrated attachment(s) constitute the entire contract of the parties and such are intended as a complete and exclusive statement of the promises, representations, negotiations, discussions, and other Contracts that may have been made in connection with the subject matter hereof. Unless an integrated attachment to this Contract specifically displays a mutual intent to amend a particular part of this Contract general conflicts in language between any such attachment and this Contract shall be construed consistent with the terms of this Contract. Unless otherwise expressly authorized by the terms of this Contract, no modification or amendment to this Contract shall be binding upon the parties unless the same is in writing and signed by the respective parties hereto and approved by the Carson City Board of Supervisors. The parties agree that each has had their respective counsel review this Contract which shall be construed as if it was jointly drafted.

SAMPLE CONTRACT

AND ALL SUPPLEMENTAL AGREEMENTS AMENDING OR EXTENDING THE WORK CONTEMPLATED.

ACKNOWLEDGMENT AND EXECUTION:

In witness whereof, the parties hereto have caused this Contract to be signed and intend to be legally bound thereby.

CARSON CITY
Finance Director

Attn: Kim Belt, CPM - Purchasing and Contracts Manager
201 North Carson Street, Suite 3
Carson City, Nevada 89701
Telephone: 775-283-7137
Fax: 775-887-2107
KBelt@carson.org

By:_____
Kim Belt, CPM

Dated _____

CITY'S LEGAL COUNSEL
Neil A. Rombardo, District Attorney

I have reviewed this Contract and approve as to its legal form.

By: _____
Deputy District Attorney

Dated _____

CITY'S ORIGINATING DEPARTMENT
BY: Andrew Burnham, Director
Carson City Public Works Department
3505 Butti Way
Carson City, Nevada 89701
Telephone: 775-887-2355 Ext. 7367
Fax: 775-887-2164
ABurnham@carson.org

By: _____

Dated _____

SAMPLE CONTRACT

"name of signer" deposes and says: That he/she is Contractor or authorized agent of Contractor; the he/she has read the foregoing Contractor; and that he/she understands the terms, conditions and requirements thereof.

CONTRACTOR
BY:
TITLE:
FIRM:
CARSON CITY BUSINESS LICENSE #:
NEVADA CONTRACTOR'S LICENSE #:
Address:
City: State: Zip Code:
Telephone: /Fax:
E-mail Address:

_____
(Signature of Contractor)

DATED _____

STATE OF_____)
)ss
County of _____)

Signed and sworn (or affirmed before me on this _____day of _____,2013, by "name of Contractor".

_____
(Signature of Notary)

(Notary Stamp)

SAMPLE CONTRACT

CONTRACT ACCEPTANCE AND EXECUTION:

The Board of Supervisors for Carson City, Nevada at their publicly noticed meeting of July 18, 2013 approved the acceptance of the attached contract hereinbefore identified as **CONTRACT No. 1213-180** and titled **"Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"**. Further, the Board of Supervisors authorizes the Mayor of Carson City, Nevada to set his hand to this document and record his signature for the execution of this contract in accordance with the action taken.

CARSON CITY, NEVADA

_____

ROBERT L CROWELL, MAYOR

DATED this 18th day of July, 2013.

ATTEST:

_____

ALAN GLOVER, CLERK-RECORDER

DATED this 18th day of July, 2013

PERFORMANCE BOND

Doc. No. 2151
(Rev. 11-17-99)

KNOW ALL MEN BY THESE PRESENTS, that I/we_____
_____as Principal, hereinafter called Contractor, and
_____
a corporation duly organized under the laws of the State of Nevada, as Surety, hereinafter called the Surety, are held and firmly bound unto Carson City, Nevada a consolidated municipality of the State of Nevada, hereinafter called City, for the sum of $_____Dollars(state sum in Words)_____
_____
for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____, 2013, entered into a contract with the City for **BID # 1213-180** and titled **"Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid"** in accordance with drawings and specifications prepared by Carson City and which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract then this obligation shall be null and void; otherwise it shall remain in full force and effect. The Surety hereby waives notice of any alteration or extension of time made by the City and its obligation is not affected by any such alteration or extension provided the same is within the scope of the contract. Whenever Contractor shall be, and is declared by City to be in default under the Contract, the City having performed City's obligations thereunder, the Surety may promptly remedy the default or shall promptly:

1) Complete the Contract in accordance with its terms and conditions; or

2) Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the City and the Surety jointly of the lowest responsive, responsible bidder, arrange for a contract between such bidder and the City, and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price, but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price", as used in this paragraph, shall mean the total amount payable by City to Contractor under the Contract and any amendments thereto, less the amount properly paid by City to Contractor. No right of action shall accrue on this bond to or for the use of any person or corporation other than the City or successors of the City.

PERFORMANCE BOND

Continued for **BID # 1213-180** and titled "**Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid**"

BY:	**(Signature of Principal)**
TITLE:	
FIRM:	
Address:	**L.S.**
City, State, Zip	
Phone:	
Printed Name of Principal	
Attest By	**(Signature of Notary)**
Subscribed and Sworn before me this day of	**,2013**

CLAIMS UNDER THIS BOND MAY BE ADDRESSED TO:	**Nevada Resident Agent Information (complete for out of state bonding companies)**
Name of Surety	**Name of Local Agent**
Address	**Address**
City	**City**
State/Zip Code	**State/Zip Code**
Name	**Agent's Name**
Title	**Agent's Title**
Telephone	**Agent's Telephone**
Surety's Acknowledgment:	**Nevada Resident Agent's Acknowledgment:**
By:	**By:**

NOTICE:

No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in the State of Nevada. Certified copy of Power of Attorney must be attached.

LABOR AND MATERIAL PAYMENT BOND

Doc. No. 2152
(Rev. 11-17-99)

KNOW ALL MEN BY THESE PRESENTS, that I/we _____ _____as Principal, hereinafter called Contractor, and _____ a corporation duly organized under the laws of the State of Nevada, as Surety, hereinafter called the Surety, are held and firmly bound unto Carson City, Nevada a consolidated municipality of the State of Nevada, hereinafter called City, for the $_____Dollars (state sum in words)_____ _____f or the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____, 2013 entered into a contract with the City for **BID # 1213-180** and titled "**Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid**" in accordance with drawings and specifications prepared by Carson City and which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1) A claimant is defined as one having a direct contract with the Contractor or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental of equipment directly applicable to the Contract.

2) The above-named Principal and Surety hereby jointly and severally agree with the City that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The City shall not be liable for the payment of any costs or expenses of any such suit.

3) No suit or action shall be commenced hereunder by any claimant:

   a) Unless claimant, other than one having a direct contract with the Contractor, shall have given written notice to any two of the following: the Contractor, the City, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be personally served or served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal at any place the Principal maintains an office or conducts its business.

   b) After the expiration of one (1) year following the date on which the last of the labor was performed or material was supplied by the party bringing suit.

   c) Other than in a court of competent jurisdiction for the county or district in which the construction contract was to be performed.

LABOR AND MATERIAL PAYMENT BOND

Continued for **BID #1213-180** and titled "**Wastewater Reclamation Plant Digester Rehabilitation Project – Phase I Rebid**"

4) The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

BY:	**(signature of Principal)**
TITLE:	
FIRM:	
Address:	**L.S.**
City, State, Zip	
Phone:	
Printed Name of Principal:	
Attest by:	**(signature of notary)**
Subscribed and Sworn before me this day of	**, 2013**

CLAIMS UNDER THIS BOND MAY BE ADDRESSED TO:	**Nevada Resident Agent Information (complete for out of state bonding companies)**
Name of Surety	**Name of Local Agent**
Address	**Address**
City	**City**
State/Zip Code	**State/Zip Code**
Name	**Agent's Name**
Title	**Agent's Title**
Telephone	**Agent's Telephone**
Surety's Acknowledgment:	**Nevada Resident Agent's Acknowledgment:**
By:	**By:**

NOTICE:

No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in the State of Nevada. Certified copy of Power of Attorney must be attached.

GENERAL CONDITIONS

SECTION 1.0 INTENT, DEFINITIONS, ABBREVIATIONS

GC 1.1 INTENT OF CONTRACT DOCUMENTS

The intent of the Contract Drawings and Specifications is to describe the details for the construction and completion of the Work which the Contractor undertakes to perform in accordance with the terms of the Contract. Contract Drawings and Specifications are divided into groups for the convenience of the City Engineer, and Construction Manager. These divisions are not for apportioning Work or responsibility for Work among subcontractors, suppliers, and manufacturers. The Contractor shall provide the City with a complete and operable Work or improvement, even though the Contract Drawing and Specifications may not specifically call out all items or items of work required of the Contractor to complete his/her tasks, incidental appurtenances, materials and the like and without additional compensation.

Where the Contract Drawings or Specifications describe portions of the Work in general terms but not in complete detail, it is understood that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. The Contractor shall furnish tools, equipment, and incidentals, and do all the Work involved in executing the Contract in a satisfactory and complete manner.

The Instructions to Bidders, General Conditions, Special Conditions, Technical Specifications, Standard Specifications, Drawings and all supplementary documents are intended to be complete and complementary and to prescribe a complete work. If any omissions are made of information necessary to carry out the full intent and meaning of the Contract Documents, the Contractor shall immediately call the matter to the attention of the Engineer for furnishing of detail instructions. If specific lines, grades, and dimensions are not shown on the Drawings, those furnished by the Engineer shall govern.

Anything mentioned in these Specifications and not indicated on the Contract Drawing, or anything indicated on the Contract Drawing and not mentioned in these Specifications, shall be in the same force and effect as if indicated or mentioned in both.

In the event the materials and/or equipment are to be furnished by the City, as designated in the Special Conditions, this shall not relieve the Contractor of the above requirements to furnish all other labor, materials, and equipment to complete the Contract.

GC 1.2 PARTIAL INVALIDITY

If any provision of this Contract is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remaining provisions shall nevertheless continue in full force without being impaired or invalidated in any way.

GC 1.3 GOVERNING ORDER OF BIDDING AND CONTRACT DOCUMENTS

The Bidding and Contract Documents include various divisions, sections, and conditions which are essential parts for the Work to be provided by the successful Bidder. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete Work. In case of discrepancy, the following precedence will govern:

a. Permits from City Departments and other Agencies as may be required by law
b. Change Orders
c. Contract
d. Addenda
e. Special Conditions
f. Technical Specifications
g. General Conditions
h. Contract Drawing s
i. Standard Specifications for Public Works Construction (Orange Book specifications) sponsored and distributed by R.T.C. of Washoe County, Washoe County, City of Sparks, City of Reno, Carson City, and City of Yerington; 1996 Edition with Revision No. 1 dated 12-15-1998, Revision No. 2 dated 5-1-2000, Revision No. 3 dated 11-08-2001, Revision No. 4 dated 2-27-2004,and Revision No. 5 dated 2-14-2007.
j. Reference Specifications

GENERAL CONDITIONS

With reference to Contract Drawing, the order of precedence is as follows:

1) Addenda/Change Order Drawings govern over any other Drawing
2) Figures govern over scaled dimensions
3) Contract Detail Drawings govern over Contract General Drawings
4) Contract Drawing govern over Standard Details

GC 1.4 HEADINGS

Headings to parts, divisions, sections, articles, paragraphs, subparagraphs, and forms are inserted for convenience of reference only and shall not affect the interpretation of the Contract Documents.

GC 1.5 DEFINITIONS

The words directed, required, permitted, ordered, instructed, designated, applicable, appropriate, sufficient, proper, desirable, necessary, prescribed, approved, acceptable, satisfactory or words of like import refer to actions, expressions, and prerogatives of the City, Design Consultant, or Construction Manager.

Each gender work includes the masculine, feminine and neuter genders. References to gender, such as "workman" and "flagman" and the pronouns "he" or "his" referring to such titles, are abstract in the specifications, are used for the sake of brevity, and are intended to refer to persons of either sex and, if applicable, to the neuter gender.

Singular words include the plural and "person" includes firms, companies, and corporations.

Where used in the Contract Documents, the following words and terms shall have the meanings indicated. The meanings shall be applicable to the singular, plural, masculine, and feminine of the words and terms.

Acceptance - The formal action by the Carson City Board of Supervisors or the Carson City Regional Transportation Commissions accepting the work as being complete. See Final Acceptance.

Act of God - An earthquake, flood, cyclone, or other cataclysmic phenomenon of nature. A rain, windstorm, high water, or other natural phenomenon which might reasonably have been anticipated from historical records of the general locality of the Work, shall not be construed as an Act of God.

Addenda - Written or graphic instruments issued prior to the Bid Opening which modify or interpret the Contract Documents, Drawings, and specifications by additions, deletions, clarifications, or corrections. All addenda become part of the Contract Documents.

Additive Alternative Bid - The amount stated in the Bid Schedule - Additive Schedule to be added to the amount of the Base Bid if the corresponding change in the Work, as described in the Bid Documents, is accepted by the City with the Award of the Project, subject to the availability of funds. Bidder must quote all items to be responsive and considered for Award.

Agreement - The written Contract covering the performance of the Work as more fully described in the Contract Documents.

As Shown, As Indicated, As Detailed - Where these words or words of similar import are used, it shall be understood that reference to the Drawings is made unless stated otherwise.

As Directed, As Permitted, As Approved - Where these words or words of similar import are used, it shall be understood that written direction, requirements, permission, approval or acceptance of the Construction Manager is intended unless otherwise stated.

Bid - The offer or proposal of the Bidder submitted on the prescribed forms setting forth the price for the Work to be performed.

GENERAL CONDITIONS

Bidder - Any properly licensed and qualified individual, firm, partnership, corporation, joint venture, or combination thereof, submitting a proposal for the Work contemplated, acting directly or through a duly authorized representative.

Bond(s) - Bid, Performance, or Payment Bonds and Guarantee and other instruments of surety, furnished by the Contractor and Contractor's surety in accordance with the Contract Documents.

Calendar Day - Every day shown on the calendar.

Cardinal Change - A change required by the City which requires the Contractor to build a fundamentally different Project than originally planned.

City - Consolidated City/County of Carson City, Nevada. Under this Contract, the City is usually identified by name.

Change Order - A written order to the Contractor authorizing an addition, deletion, or revision of the work within the general scope of the Contract, or an adjustment in the contract price or time. Also referred to as a Contract Change Order.

Construction Completion or Completion of Work - Construction completion is when all work is complete, including punch list items, final cleanup, demobilization and submittal of final documentation, in accordance with the contract documents.

Construction Conflicts - Conflicts which may occur whenever corrections, alterations, or modifications of the Work under this Contract are ordered and approved by the City and change the character of the Work, the amount of the Work or the period of time in which to complete said Work.

Construction Inspector - The person designated by the City to act as its representative at the construction site, or remote locations, to perform construction inspection services.

Construction Manager - The person designated in writing by the City to act as its representative at the construction site and to perform construction inspection services and administrative functions relating to this Contract. Initial contact by the Contractor with the City shall be through the Construction Manager.

Construction Schedule - A graphic document that is computer generated which utilizes “critical path method” or “bar chart method” for scheduling projects. The construction schedule is supported by reports that can be generated to demonstrate relationships and logic.

Contract - The written agreement between Carson City and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to the performance of the work, the furnishing of labor and materials, and the basis of payment.

Contract Completion Date - The date set forth in the Contract documents for the completion of all Contract work, including all punch list work, final cleanup and demobilization.

Contract Documents - The words "Contract Documents" shall mean any or all of, but not limited to, the following items, as applicable: Notice to Contractors, Instructions to Bidders, Bid Bond, Bid Proposal Summary, Contract Award Instructions, Contract, Performance Bond, Labor and Material Payment Bond, General Conditions, Prevailing Wage Rates, Permits, Special Conditions, Standard Specifications, Technical Specifications, Drawings, Addenda, if any, Executed Change Orders, if any, Notice of Award, and Notice to Proceed

Each of these items is to be considered by reference as part of the Contract Documents. Also referred to as the Contract.

GENERAL CONDITIONS

Contract Price - The total amount payable to the Contractor under the terms and conditions of the Contract based on the price given on the Bid Proposal, with adjustments made in accordance with the Contract. Said total amount shall include all sales, use, and other consumer taxes related to the work. The base amount given in the Bid Proposal shall be either a lump sum Bid or the summation of the unit price Bids multiplied by the estimated quantities set forth in the Bid form. Also referred to as the Contract Amount.

Contract Time - Number of calendar days stated in the Contract Documents for the completion of the Work, including all authorized time adjustments.

Contractor - The person or persons, firms, partnership, corporation, joint venture, or combination thereof, who have entered into the Contract with the City. "Contractor" shall mean the principal Contractor as defined by NRS 624.020 or his/her authorized representative.

Contractor's Plant and Equipment - Equipment, material, supplies, tools and all other items, except labor, brought onto the site by the Contractor to carry out the Work, but not to be incorporated in the Work.

Day(s) - See Calendar Day(s). A twenty-four hour time period beginning at 12 midnight of day one and terminating at 12 midnight of the same day.

Design Consultant - The engineer, architect or other licensed professional designated by the City to have design control over the Work or a specified portion of the Work, acting either directly or through duly authorized representatives. Such representatives shall act within the scope of the particular duties delegated to them.

Drawings - Refers to the Contract Drawing, profiles, cross sections, elevations, details, and other working Drawings and supplementary Drawings, or reproductions thereof, signed by the Design Consultant and bearing the appropriate Professional seal, approved by the City, and are referred to in the Contract Documents. Drawings show the location, character, dimensions, and details of the Work to be performed. The term "plans" has the same meaning as the term Drawings.

Engineer- The City Engineer of Carson City, or other person or firm designated by the City Engineer as his/her duly authorized representative.

Extra Work - An item of work not provided for in the Contract as awarded but found essential by the Engineer to the satisfactory completion of the Contract within its intended scope.

Field Directive - Written documentation of the actions of the City or Construction Manager in directing the Contractor. Also referred to as a Work Directive.

Field Order - A written instruction given to the Contractor by the City or Construction Manager, authorizing Work that is a change to the scope of Work, to be carried out on a time and materials basis, or a negotiated lump sum. Also referred to as a Work Directive.

Final Acceptance - The formal acceptance by the City of the Work for an entire Contract, which has been completed in all respects (including submittal of the operation and maintenance manuals, equipment start-up and testing, warranty of title, and submittal of record drawings, lien and claims releases, and warranty), in accordance with the Contract Documents and any modifications thereof previously approved.

Final Completion - Final completion is when construction is complete, the City has accepted the work, and the Notice of Completion has been recorded in the Office of the County Recorder. This is based on acceptance by the Carson City Board of Supervisors or the Carson City Regional Transportation Commission of the completed work embraced by the Contract.

GENERAL CONDITIONS

Float - Float or "total float" shall be defined as provided in the Associated General Contractors of America "CPM in Construction, A Manual for General Contractors".

General Conditions - Part of the Contract Documents representing the general clauses that establishes how the Contract is to be administered.

Holidays - Legal holidays observed by the City.

Inspector- The authorized representative of the Engineer assigned to observe the work or materials therefor.

Intermediate Completion- Intermediate Completion is the stage in the progress of the work when an element, section, or division of the Work is sufficiently complete in accordance with the contract documents so that the City can occupy or utilize the essential component(s) of the contractually defined element, section or division of the Work for its intended purpose.

Laboratory - The designated materials testing laboratory authorized by the City to test materials and Work involved in the Contract.

Liquidated Damages - Money to be paid to the City or to be deducted from any payments due to the Contractor for each day's delay in completing the whole, any specified portion of the Work beyond the time allowed in the Contract Documents, submitting award documentation, or technical submittals.

Major Bid Item - Any bid item whose unit bid item price extension is 5 percent or more of the total Contract Price.

Notice of Award - A written notice by the City to the Contractor informing it that the Contract has been awarded to the Contractor.

Notice of Completion - The City will cause to be recorded in the Office of the County Recorder, a notice of completion, which is based on acceptance by the Carson City Board of Supervisors or the Carson City Regional Transportation Commission of the completed work embraced in the Contract.

Notice to Proceed - A) The written notice by the City to the Contractor authorizing the Contractor to proceed with the Work and establishing the date of commencement of the Work. B) Material Only Notice to Proceed - Written notice by the City to the Contractor authorizing the Contractor to proceed with ordering materials, preparing shop Drawings, and acquiring permits only.

Owner – Carson City, which has contracted for the performance of the Work.

Owner's Representative - The person designated in writing by the City to act as its agent on specified matters relating to this Contract. The Owner's Representative may or may not be the Engineer, the Construction Manager, or the Design Consultant.

Plans - All drawings or reproductions thereof pertaining to details of the Work and which are made a part of the Contract Documents. The term “Plans” has the same meaning as “Drawings”. See Drawings

Project - The undertaking to be performed under the provisions of the Contract.

Provide - Shall be understood to mean furnish and install, complete in place.

Punch List - List of incomplete items of work and of items of work which are not in conformance with the Contract.

Reference Documents - Bulletins, Standards, Rules, Methods of Analysis or Test, Codes and Specifications of public or private agencies, Engineering Societies, or Industrial Associations. Reference

shall be to the latest edition thereof, including Amendments, which are in effect and published at the time the Invitation for Bids is issued, unless a specific edition is identified, in which case reference shall be to such specific edition.

Right-of-Way - The area provided by the City for use in constructing the work covered by the Contract, including appurtenances thereto. The right-of-way so designated may be either temporary or permanent.

Schedule of Values - A list of all major items, or those requested by the City, including their respective quantities and unit prices for all Work and materials furnished by the Contractor in order to comply with the contract drawings and specifications, whether or not indicated in the approximate quantities or pertaining to the items of work listed therein.

Service Connection - All or any portion of a pipeline including sewer laterals, conduit, wire, cable or duct, including meters between a utility main distribution line and an individual customer or customers when served by a single connection.

Service Provider - A service provider is an organization, company, or business that provides a service for the Work, but does not perform the Work at the Project site.

Shall - Refers to actions by either the Contractor or the City and means the Contractor or City has entered into a covenant with the other party to do or perform the action.

Shop Drawings - All diagrams, drawings, illustrations, brochures, schedules, and all other data or submittals required by the Contract to be furnished by the Contractor illustrating fabrication, installation, dimensions, and other aspects of the Work.

Site - The property as described in the Special Conditions or as shown on the Drawings where the Project is to be constructed. See Work Area.

Special Conditions - Part of the Contract Documents that establishes special requirements peculiar to the Work and supplementary to the General Conditions.

Specifications - That part of the Contract Documents consisting of the General Conditions, Special Conditions, applicable Standard Specifications, Technical Specifications, other named standard specifications.

Standard Plans - The Standard Details for Public Works Construction, (Orange Book Details) sponsored and distributed by RTC of Washoe County, Washoe County, City of Reno, City of Sparks, Carson City and City of Yerington.

Standard Specifications - The Standard Specifications for Public Works Construction, (Orange Book Specifications) sponsored and distributed by RTC of Washoe County, Washoe County, City of Reno, City of Sparks, Carson City and City of Yerington; 1996 Edition with Revision No. 1 dated 12-15-1998, Revision No. 2 dated 5-1-2000, Revision No. 3 dated 11-08-2001, Revision No. 4 dated 2-27-2004, and Revision No. 5 dated 2-14-2007.

Subcontractor - A subcontractor is a person or entity who has a direct Contract with the Contractor to perform Work at the Site. The term subcontractor means a subcontractor or subcontractor's authorized representative.

Submittals - The information which is specified for submission to the Construction Manager in accordance with the specifications.

Substantial Completion - Substantial Completion is the stage in the progress of the Work when all Work is sufficiently complete in accordance with the Contract Documents so the City can occupy or utilize the essential components of the Project for its intended use.

Sub-subcontractor - A sub-subcontractor is a person or entity who has a Contract with a subcontractor to perform any of the Work at the Site. The term sub-subcontractor means a sub-subcontractor or an authorized representative thereof.

Superintendent - the Contractor's authorized representative in responsible charge of the Work.

Supplier - Any person, firm, corporation, or organization who supplies materials or equipment for the Work, including that fabricated to a special design, and may also be a subcontractor or a sub-subcontractor, also referred to as Vendor.

Surety - The person, firm, corporation, or organization that joins with the Contractor in assuming the liability for the faithful performance of the Work and for the payment of all obligations pertaining to the Work in accordance with the Contract Documents by issuing the Bonds required by the Contract Documents or by law.

Technical Specifications- The specialized directions, provisions, and requirements of the Contract Documents for materials, equipment, construction systems, standards, and workmanship.

Title and Headings - The titles or headings of the section and subsections in the Contract Documents are intended for convenience of reference and shall not be considered as having bearing on their interpretation.

Total Base Bid - The base amount given in the Bid Schedule as either a lump sum bid, or the summation of the unit price bids multiplied by the estimated quantities as set forth in the bid form.

Utility- Public or private fixed improvement for the transportation of fluids, gases, power, signals, or communications and shall be understood to include tracks, overhead and underground wires, cables, pipelines, conduits, ducts, sewers or storm drains.

Work - The labor, materials, equipment, supplies, and other items necessary for the execution, completion, and fulfillment of the Contract.

Work Area - That area which is defined on the Contract Drawings as the City's Right-of-Way and/or temporary easement available to the Contractor for construction purposes. See Site.

Work Directive - A written directive to the Contractor issued after the effective date of the Contract and signed by the City's Construction Manager ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen conditions under which the Work is to be performed, or to emergencies. A Work Directive may not change the Contract Price or Contract Time, but is the basis and evidence that the parties expect that the change directed or documented by the Work Directive will be incorporated in a subsequently issued Change Order following negotiations of the parties as to its effect, if any, on the Contract Price or Contract Time.

Working Day - A calendar day on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed for at least 5 hours of the day with at least seventy-five (75) percent of the normal working force engaged in performing the current critical item(s) of work on the latest favorably reviewed Construction Schedule, exclusive, however, of Saturdays, Sundays, City recognized holidays, and any day that is incumbent upon the Contractor, by means of a Master Labor Agreement, to observe as a holiday. However, if the Contractor elects to work on such days, those days will be considered as a working day.

GC 1.6 ABBREVIATIONS

Whenever the following terms are used, the intent and meaning shall be as follows:

GENERAL CONDITIONS

Abbreviations Stand For

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute (formerly USASI, USAS, ASA)
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASLA	American Association of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American Wire Gauge
AWPA	American Wood-Preserver's Association
AWS	American Welding Society
AWWA	American Water Works Association
CBR	California Bearing Ratio
COE	Department of the Army Corps of Engineers
CRSI	Concrete Reinforcing Steel Institute
DFPA	Douglas Fir Plywood Association
DIPRA	Ductile Iron Pipe Research Association
EIA	Electronic Industries Association
EPA	U.S. Environmental Protection Agency
ETL	Electronic Testing Laboratory
FHWA	Federal Highway Administration
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPCE	International Power Cable Engineers Association
ISA	Instrument Society of America
MUTCD	Manual on Uniform Traffic Control Devices
NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NOSHA	Nevada Occupational Safety and Health Act
NRS	Nevada Revised Statutes
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Act

GENERAL CONDITIONS

PCA	Portland Cement Association
RTC	Regional Transportation Commission
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
TCA	Tile Council of America
UBC	Uniform Building Code
UPC	Uniform Plumbing Code
U/L or UL	Underwriters Laboratories
WCLIB	West Coast Lumber Inspection Bureau

GENERAL CONDITIONS

SECTION 2.0 CONTRACT ADMINISTRATION AND RESPONSIBILITIES: OWNER'S REPRESENTATIVE, CONSTRUCTION MANAGER, DESIGN CONSULTANT AND CONTRACTOR

GC 2.1 ADMINISTRATION

The Owner's Representative, the Construction Manager, and the Design Consultant will provide administration of the Contract as hereinafter discussed. The duties, responsibilities and limitations of authority of the Design Consultant and the Construction Manager as the representatives of the City during construction, as set forth in the Contract Documents, will not be modified or extended without approval of the City.

In case of the termination of the employment of the Design Consultant or the Construction Manager, the City shall appoint a Design Consultant or a Construction Manager whose status under the Contract Documents shall be that of the former Design Consultant or Construction Manager, respectively.

GC 2.2 OWNER'S REPRESENTATIVE

2.2.1 GENERAL

The Owner's Representative has the authority to act on behalf of the City on change orders, progress payments, Contract decisions, acceptability of the Contractor's work, and early possession.

2.2.2 CHANGE ORDERS

The Owner's Representative has the authority to accept or reject change orders and cost proposals submitted by the Contractor or as recommended by the Construction Manager.

2.2.3 PROGRESS PAYMENTS

The Owner's Representative has the authority to accept or reject requests for progress payments which have been submitted by the Contractor and recommended by the Construction Manager.

2.2.4 CONTRACT DECISIONS

Should the Contractor disagree with the Construction Manager's decision with respect to the Contract, the Contractor may appeal to the Owner's Representative in accordance with the provisions of the Contract.

2.2.5 ACCEPTABILITY OF WORK

The Owner's Representative has the authority to make the final determination of the acceptability of the Work. The Owner's Representative also has the authority to accept or reject the Design Consultant's recommendations regarding retention of non-conforming work as provided.

GC 2.3 CONSTRUCTION MANAGER

2.3.1 GENERAL

The Construction Manager is a representative of the City employed to act as advisor and consultant to the City in construction matters related to the Contract.

All instructions to the Contractor and all communications from the Contractor to the City or the Design Consultant shall be forwarded through the Construction Manager. The Construction Manager will have authority to act on behalf of the City only to the extent provided in the Contract Documents. The City has delegated its authority to the Construction Manager to make initial decisions regarding questions which may arise as to the quality or acceptability of materials furnished and work performed, and as to the manner of performance and rate of progress of the Work under the Contract. The Construction Manager shall interpret the intent and meaning of the Contract and shall make initial decisions with respect to the Contractor's fulfillment of the Contract and the Contractor's entitlement to compensation. The Contractor shall look initially to the Construction Manager in matters relating to the Contract.

2.3.2 REPRESENTATIVE

The Construction Manager will generally be represented at the site by a resident Construction Manager, a resident engineer, or a resident inspector who will observe the progress, quality, and quantity of the Work to determine, in general, if the Work is proceeding in accordance with the intent of the Contract Documents. The

Construction Manager shall not be responsible for the Contractor's construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work.

In accordance with the provisions detailed elsewhere in these General Conditions, the Construction Manager will make decisions relative to all matters of interpretation or execution of the Contract Documents.

2.3.3 INSPECTION OF CONSTRUCTION

The Construction Manager shall have the authority to reject Work and materials which do not conform to the Contract Documents, and to require special inspection or testing.

The Construction Manager may employ one or more inspectors to observe the Work and to act in matters of construction under this Contract. An inspector is not authorized to revoke, alter, or waive any requirements of the Contract Documents. The inspector is authorized to call to the attention of the Contractor any failure of the Work, materials or workmanship to conform to the Contract Documents. The inspector shall have the authority to reject materials or, in any emergency, suspend the Work. The Contractor may appeal any such issue which it disagrees with to the Construction Manager for decision.

2.3.4 ACCEPTABILITY OF THE WORK

The Construction Manager shall make a recommendation to the City as to the acceptability of the Work.

2.3.5 CHANGE ORDERS

The Construction Manager has the authority to initiate change orders; to reject change orders proposed by the Contractor or Design Consultant; to negotiate and recommend acceptance of change orders; or to order minor changes in the Work at no cost or time extension to the City.

2.3.6 CONSTRUCTION SCHEDULE

The Construction Manager has the authority to review and recommend acceptance of the Progress Schedule submitted by the Contractor at the start of the Work and subsequent revisions for conformance to the specified sequence of work and logic.

2.3.7 PROGRESS PAYMENTS

The Construction Manager has the authority to recommend acceptance or rejection of requests for progress payments which have been submitted by the Contractor.

2.3.8 FINAL ACCEPTANCE

The Construction Manager, with the assistance of the Design Consultant, will conduct inspections to determine substantial completion and final construction completion of the Work, and will receive and forward to the City, for the City's acceptance, written warranties, and related documents required by the Contract and assembled by the Contractor. The Construction Manager will recommend acceptance of the work by the City.

GC 2.4 DESIGN CONSULTANT

2.4.1 GENERAL

The Design Consultant will have the authority to act on behalf of the City to the extent provided in the Contract Documents.

2.4.2 INTERPRETATIONS

The Design Consultant has the authority to be the initial interpreter of the technical requirements of the Contract Documents. Either party to the Contract may make written request to the Construction Manager for interpretations necessary for the proper execution or progress of the Work. The Construction Manager shall refer such written requests of the Contractor to the Design Consultant, who will render such interpretations. Where the Contractor has requested an interpretation from the Construction Manager, or been notified by the Construction Manager that such interpretation has been requested by the City, any Work done before receipt of such interpretations, if not in accordance with same, is subject to being removed and replaced or adjusted as directed by the Construction Manager without additional expense to the City.

2.4.3 ACCEPTABILITY OF THE WORK

The Design Consultant has the authority to make a recommendation as to the acceptability of the Work. The Design Consultant has the authority to recommend acceptance regarding the retention of defective work.

2.4.4 SITE OBSERVATIONS

The Design Consultant may visit the site at intervals appropriate to the stage of construction to become familiar with the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents. However, the Design Consultant will not be required to make extensive or continuous on-site inspections to check the quality or quantity of the Work.

2.4.5 SUBMITTALS

The Design Consultant has the authority to review and take other appropriate action upon the Contractor's submittals of shop drawings, product data, and samples for conformance with the design concept of the Work and the Contract Documents.

GC 2.5 CITY

2.5.1 GENERAL

The City, acting through the Owner's Representative or the Construction Manager, shall have the authority to act as the sole judge of the Work and materials with respect to both quantity and quality as set forth in the Contract.

2.5.2 ATTENTION TO WORK

The City shall notify the Contractor of the name of the individual designated as the Owner's Representative and the name of the individual designated by the Construction Manager to act as the Construction Manager’s representative with the City’s authority. The Construction Manager's designated representative will regularly be at the site of the Work.

2.5.3 INSPECTION

In addition to the Construction Manager, the City may employ one or more inspectors to observe the Work and to act in matters of construction under this Contract. An inspector is not authorized to revoke, alter, or waive any requirements of the specifications. The inspector is authorized to call to the attention of the Contractor any failure of the Work or materials to conform to the Contract Documents. The inspector shall have the authority to reject materials or, in any emergency, suspend the Work. The Contractor may appeal any such issue which it disagrees with to the Construction Manager for its decision.

Separate and independent from the inspection above, the Project may be inspected by Building Officials or other agency officials (i.e. Fire Officials, Nevada Department of Transportation) for code compliance. Such inspectors shall have the authority provided to them by local jurisdiction.

If upon routine inspection by the City a problem is found that creates a safety hazard for either City employees or the general public and the General Contractor or subcontractor is not on site, the City employees will correct the safety hazard and the General Contractor will be charged for the City’s labor, materials and equipment for making the correction plus a fixed penalty fee of $500 per occurrence.

2.5.4 CITY'S RIGHT TO CARRY OUT THE WORK

If the Contractor and/or his/her surety defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within seven (7) days after receipt of written notice from the City to commence correction of such default or neglect with diligence and promptness, the City may make good such deficiencies.

Whenever, in the opinion of the Construction Manager, the Contractor has not taken sufficient precautions for the safety of the public or the protection of the Work to be constructed under this contract, or of adjacent structures or property which may be injured by processes of construction on account of such negligence, and whenever in the opinion of the Construction Manager, an emergency shall arise and immediate action shall be considered necessary in order to protect public or private, personal or property interest, then and in that event the Construction Manager, with or without notice or prior legal process to the Contractor, may provide suitable protection to the said interests by causing such work to be done and such material to be furnished as shall provide such protection as the Construction Manager may consider necessary and adequate.

In either case an appropriate Change Order shall be issued unilaterally deducting from the payments due the Contractor the cost of correcting such deficiencies and/or for performing such work, including compensation for the Design Consultant's, the Construction Manager's, and City's additional services made necessary by such default, neglect, failure or emergency.

The performance of such emergency work under the direction of the Construction Manager shall in no way relieve the Contractor from any damages which may occur during or after such precaution has been taken by the Construction Manager.

2.5.5 CITY'S RIGHT TO USE OR OCCUPY

The City reserves the right to use the sewer, water, reclaimed water, storm drains and roadway systems as well as the right to occupy and use any completed part or parts of the Work, providing these parts and facilities have been approved for use or occupancy by the City. The City anticipates to use the sewer, water, reclaimed water, storm drains and roadway systems throughout the construction contract, with no increase in the contract amount. Use of the systems will not change the contractual obligations of the Contractor regarding security, damage to the Work, insurance, the period for corrections to the Work, and the commencement of Warranties. The exercise of this right shall in no way constitute an acceptance of the total Work of this Contract, or any other part of the Work, nor shall it in any way prejudice the City's rights in the Contract, or any bonds guaranteeing the same. The Contract shall be deemed completed only when all the Work Contracted has been duly and properly performed and accepted by the City.

Prior to such occupancy or use, the City and Contractor shall agree in writing regarding the responsibilities assigned to each of them for payments, security, maintenance, heat, utilities, damage to the Work, insurance, the period for correction of the Work, and the commencement of warranties required by the Contract Documents.

In exercising the right to occupy or use completed parts of the Work, the City shall not make any use which will materially increase the cost to the Contractor without increasing the Contract Amount, nor materially delay the completion of the Contract without extending the time for completion.

The part or parts of the Work, if any, which the City anticipates to use or occupy during construction are generally noted in the Special Conditions. Failure to note a part or parts of the Work for use or occupancy shall not limit the City's right to use or occupy part or parts of the Work not noted.

2.5.6 CITY'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

The City reserves the right to perform the Work related to the Project with the City's own forces, and to award separate Contracts in connection with the Project or other Work on the site under these or similar Conditions of the Contract. If the Contractor claims that delay, damage, or additional cost is involved

because of such action by the City, the Contractor shall make such claim as provided elsewhere in the Contract Documents.

When separate contracts are awarded for different portions of the Project or other Work on the Site, the term "Contractor" in the Contract Documents in each case shall mean the contractor who executes each separate agreement. The City will provide for the coordination of the Work of the City's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate therewith.

2.5.7 PROPERTY RIGHTS IN MATERIALS

Nothing in this Contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the work or the soil, or after payment has been made for materials delivered to the Site of the Work, or stored subject to or under the control of the City. All such materials shall become the property of the City upon being so attached or affixed or upon payment for materials delivered to the Site of the Work or stored subject to or under the control of the City.

Soil, stone, gravel, and other materials found at the Site of the Work and which conform to the plans and specifications for incorporation into the Work may be used in the Work. No other use shall be made of such materials except as may be otherwise described in the plans and specifications.

2.5.8 CITY OBSERVED HOLIDAYS

The following are the legal Holidays observed by the City. The Contractor shall not perform any Work on a City observed Holiday. When the holiday falls on a Saturday, it is observed the prior Friday; when the holiday falls on a Sunday it is observed on the following Monday:

New Years Day - January 1st
Martin Luther King Day - 3rd Monday of January
Presidents Day - 3rd Monday of February
Memorial Day - last Monday of May
Independence Day - July 4th
Labor Day - 1st Monday of September
Nevada day - last Friday of October
Veterans Day - November 11th
Thanksgiving Day - 4th Thursday of November
Family Day - 4th Friday of November
Christmas Day - December 25th

Any other legal holiday declared by the President of the United States, the Governor of Nevada, or the Carson City Board of Supervisors.

2.5.9 AUDIT OF RECORDS

The City, acting through its Internal Auditor or an outside appointed auditor, may audit or direct the audit of any and all records of the Contractor pertaining to this Contract. In case any portion of this Contract is funded through NDOT, FHWA, or other agencies, they, too, shall have the right to audit any and all records of the Contractor pertaining to this Contract. Contractor agrees by entering this Contract to provide access to any and all records of Contractor pertaining to this Contract for a period of three (3) years after Contract acceptance.

2.5.10 ATTORNEY'S FEES

In the event the Contractor files a complaint or writ naming the City as a party and the Contractor fails to obtain all the relief requested in the complaint or writ, the Contractor shall pay the City reasonable attorney fees and the costs for participating in the litigation. It is specifically agreed that reasonable attorney fees shall be $150.00 per hour for City-employed attorneys or the usual per hour fee charged by any other attorney retained by the City to participate in the litigation.

GC 2.6 CONTRACTOR

2.6.1 OFFICE

The Contractor's office at the Project Site is hereby designated as the legal address of the Contractor for the receipt of documents, samples, notices, letters, and other articles of communication. Should the Contractor not maintain an office at the Project site, the Contractor shall notify the Construction Manager regarding the Contractor's legal address for its receipt of Project documents.

2.6.2 CONTRACTOR'S REPRESENTATIVE

At the pre-construction conference (see GC 3.9) the Contractor shall notify the City in writing of the name of the person and an alternate, if applicable, who will act as the Contractor's Representative(s) and shall have the authority to act in matters relating to this Contract. Such notification shall include the Representative's list of projects for which he/she held the position of Contractor's Representative for a three (3) year period. The list shall include the type of construction, the cost of construction, and the name of the owner(s) or agency(ies) including telephone numbers of contact persons. The Contractor's Representative shall have at least three (3) years of experience related to similar Work as described in the Contract Documents.

The Engineer and/or the City may reject the request for Contractor's Representative if, in the opinion of the Engineer and/or the City, the Contractor's Representative is not qualified to perform the Work. No additional payment or compensation will be considered for the rejection and subsequent hiring of Contractor's Representative. A replacement Contractor's Representative for a previously approved Contractor's Representative shall meet the same qualifications as listed above. Contractor shall submit the information requested above to demonstrate that the replacement Contractor's Representative meets the qualifications listed above.

The Contractor, acting through its Representative, shall give personal attention to, and shall manage the Work, so that it shall be prosecuted faithfully. The Contractor's Representative shall be an employee of the Contractor. Upon written request of the Contractor, this requirement may be waived by the City.

At all times during the progress of the Work, the Contractor's representative shall be personally present at the Project site, or a designated alternate shall be at the Project site who has the authority to act in matters relating to the Contract. The Contractor's representative or designated alternate shall have the authority to carry out the provisions of the Contract and to supply materials, equipment, tools, and labor without delay for the performance of the Work. If neither the Contractor's representative nor a designated alternate is at the Project site, the City acting through the Construction Manager shall have the authority to suspend the work until such a representative is at the Project site.

Before initial work is begun on the Contract, the Contractor shall file with the Construction Manager, and City, addresses and telephone numbers where the Contractor's and all subcontractors' representatives can be reached for emergency call outs during all hours, including nights and weekends, when work is not in progress.

2.6.3 CONSTRUCTION PROCEDURES

The Contractor will supervise and direct the Work. The Contractor shall determine the means, methods, techniques, sequences, and procedures of construction, except in those instances where the City, to define the quality of an item of work, specifies in the Contract a means, method, technique, sequence, or procedure for construction of that item of Work.

2.6.4 CONTRACTOR'S EMPLOYEES

The Contractor shall be responsible for the safety, adequacy, efficiency, and sufficiency of its employees.

If any person employed by the Contractor or its subcontractors, appear to the Construction Manager to be disorderly, disrespectful, rude, or intoxicated, such person shall be discharged from the site immediately by the Contractor.

2.6.5 SUBCONTRACTORS

Subcontractors will not have a direct relationship with the City. The persons engaged in the Work, including employees of subcontractors, suppliers and service providers, will be considered employees of the Contractor. The Contractor will be responsible for their work and their work shall be subject to the provisions of the Contract. The Contractor is as fully responsible to the City for the acts and omissions of its subcontractors and of persons either directly or indirectly employed by them as the Contractor is for the acts and omissions of persons directly employed by the Contractor. Nothing contained in the Contract Documents shall create any Contractual relationship between any subcontractor and the City. References in the Contract Document to actions required of subcontractors, manufacturers, suppliers, or any party other than the Contractor, the City, the Construction Manager, or the Design Consultant shall be interpreted as requiring that the Contractor shall require such subcontractor, manufacturer, supplier, or party to perform the specified action, unless the Contract Documents specifically state that the Work is not included in the Contract.

The Contractor shall employ only subcontractors who are properly licensed in accordance with Nevada State Law. Changes to subcontractors listed in the Bid shall be made only with the approval of the City.

2.6.6 CONTRACTOR'S EQUIPMENT AND FACILITIES

The Contractor shall furnish and maintain in good condition all equipment and facilities as required for the proper execution and inspection of the Work. Such equipment and facilities shall meet all requirements of applicable ordinances and laws.

2.6.7 CITY-CONTRACTOR COORDINATION

A. Service of Notice

Notice, order, direction, request, or other communication given by the Construction Manager or City to the Contractor shall be deemed to be well and sufficiently given to the Contractor if delivered to the Contractor's Representative, or to the Contractor's address provided in the Bid Proposal.

B. Suggestions to Contractor

Plans or methods of work suggested by the City, the Construction Manager, or the Design Consultant to the Contractor, but not specified or required, if adopted or followed by the Contractor in whole or in part, shall be used at the risk and responsibility of the Contractor. The City, Construction Manager, or the Design Consultant assume no responsibility therefore, and in no way will be held liable for any defects in the Work which may result from or be caused by use of such suggested plan or method of work.

C. Cooperation

The Contractor shall conduct its operations so as to interfere as little as possible with those of other contractors or subcontractors on or near the Work. It is expressly understood that the City has the right and may award other contracts in connection with the Work so long as it does not unreasonably interfere with the Work under this Contract.

The Contractor shall afford the City, the Construction Manager and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall connect and coordinate the Work with the others as required by the Contract Documents.

If any part of the Contractor's Work depends for proper execution or results upon the Work of the City or any separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the Construction Manager any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results. Failure of the Contractor to so report shall constitute an acceptance of the City's or separate contractor's work as fit and proper to

receive the Work, except as to latent defects which subsequently become apparent in such work by others.

If requested by the Contractor, the City shall arrange meetings with other contractors performing work on behalf of the City to plan coordination of construction activities. The City shall keep the Contractor informed of the planned activities of other contractors.

Where one contractor's operations are within the limits or adjoin the operations of another contractor, each shall be responsible to the other for any damage, injury, loss, or expense which may be suffered on account of interference of operations, neglect or failure to finish work at the proper time, or of any other cause.

Differences and conflicts arising between the Contractor and other contractors employed by the City or between the Contractor and the workers of the City with regard to their work shall be submitted to the Construction Manager for his/her decision in the matter. If such separate contractor files a claim against the City on account of any delay or damage alleged to have been caused by the Contractor, the City shall notify the Contractor who shall, at the City's election, defend such claims at the Contractor's expense. If any judgment or award against the City arises from any such claim whether defended by City or by Contractor, the Contractor shall pay or satisfy said judgment or award and shall reimburse the City for all fees, including attorneys' fees, and costs which the City has incurred or for which it is liable.

2.6.8 PERMITS

Unless specifically stated in the Special Conditions to be provided by the City, the Contractor shall apply for, obtain, and comply with all terms, conditions and requirements attached to all permits, licenses, and agreements required by federal, state, or local agencies to perform work, construct, erect, test and start up any equipment or facility for this Contract. The City will provide, at no cost to the Contractor, the City "Building Permit" and/or the City "Engineering Permit". Where operating permits are required, the Contractor shall apply for and obtain such operating permits in the name of the City and provide the permit in an appropriate file folder when the City accepts substantial completion of the equipment or facility. The Contractor shall give all notices necessary or incidental to the due and lawful prosecution of the Work.

The Contractor shall apply for and obtain in its name all necessary permits and shall be responsible for satisfying all code requirements, calling for inspections, and obtaining final approvals. Code inspections will be coordinated with the Construction Manager. The Contractor shall comply with all conditions stipulated in the permits. The Contractor shall include in its Bid the fees for any permits and inspections that are required.

The Contractor shall also apply for and obtain all safety permits for excavations, tunneling, trenches, construction (building structure, scaffolding, or false work) and demolition required by OSHA. Any permits, licenses, agreements, and fees therefore required for the performance of work under this Contract and not specifically mentioned herein as having been obtained and paid by the City shall be included in the Contractor's Bid price. The cost of inspections associated with complying with permits, licenses, and agreements are to be included in the bid price. No time extensions shall be granted for time lost due to violations of permits.

The Contractor shall submit copies of all required Permits to the Construction Manager prior to proceeding with the Work covered by the respective Permits. If copies of all required Permits are not submitted to the Construction Manager prior to proceeding with the Work covered by the respective Permits, the Construction Manager may suspend the Work on the entire project, without any additional time or compensation to the Contractor, until the copies of the Permits are received.

2.6.9 CONTRACTOR'S RESPONSIBILITY FOR THE WORK AND MATERIALS

Until final acceptance of the Work, the Contractor shall have the charge and care of the Work and of the materials to be used therein, the Contractor shall bear the risk of injury, loss, or damage to any part

thereof (regardless of whether partial payments have been made on such damaged portions of the Work) by the action of the elements or from any other cause, whether or not arising from the non-execution of the Work. The Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work or the materials occasioned by any cause, before its completion and acceptance, and shall bear the expense thereof, except for such injuries, losses, or damages as are directly and proximately caused by acts of the City. Where necessary to protect the work or materials from damage, the Contractor shall, at his/her expense, provide suitable drainage and erect such temporary structures as are necessary to protect the work or materials from damage. The suspension of work or the granting of an extension of time from any cause whatever shall not relieve the Contractor of his/her responsibility for the work and materials as herein specified.

In an emergency affecting the safety of life or property, including adjoining property, the Contractor, without special instruction or authorization, is authorized to act at his/her discretion to prevent such threatened loss or injury.

2.6.10 SURVEYS, LINES AND GRADES

The Contractor shall be responsible for all construction surveying and the setting of all construction control stakes. All construction surveying must be performed by the designated Project Surveyor who shall be a Nevada Licensed Professional Land Surveyor, or the Surveyor's subordinates. Contractor shall provide the name, license number and contact information of the Project Surveyor to the Construction Manager prior to the start of Work.

The Contractor shall be responsible for directing the Project Surveyor to establish all the survey control staking to accomplish the Work within the tolerances established in the Technical Specifications and per the requirements of the Nevada Administrative Code, for Construction Surveys, Sections 625.760 through 625.780.

2.6.11 LAWS TO BE OBSERVED

The Contractor shall keep fully informed of existing and pending county, state, and national laws and regulations and all municipal ordinances and regulations of the City which in any manner affect those engaged or employed in the Work and of all such orders and decrees of bodies having any jurisdiction or authority over the same. The Contractor shall protect and indemnify the City and its officers, agents, employees, and volunteers against any claim or liability arising from or based on the violation of any such laws, ordinances, regulations or orders, whether by the Contractor or its employees. If any discrepancy or inconsistency is discovered in the drawings, specifications or Contract for the Work in relation to any such law, ordinance, regulations, order or decree, the Contractor shall immediately report the same to the Construction Manager in writing.

The Contractor shall comply with all Federal, State and local laws relative to conducting business in Carson City including, but not limited to, licensing, labor and health laws, and applicable NRS. The laws of the State of Nevada will govern as to the interpretation, validity and effect of the Bid, its award, and the Contract.

A. Certified Payrolls - If Prevailing Wage Rates are Required

The Contractor and each subcontractor shall keep an accurate payroll record, showing the name, address, work classification, straight time, and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed in connection with the Project.

The payroll records shall be certified and shall be submitted weekly to the Construction Manager. Submission of the certified payrolls shall be a condition precedent for processing the monthly progress payment. The General Contractor shall collect the wage reports from the Sub-Contractors and ensure the receipt of a certified copy of each weekly payroll for submission to the City as one complete package.

Pursuant to NRS 338.060 and 338.070, the Contractor hereby agrees to forfeit, as a penalty to the City, not less than Twenty Dollars ($20) nor more than Fifty Dollars ($50) for each calendar day or portion thereof that each worker employed on the Contract is paid less than the designated rate for any work done under the Contract, by the Contractor or any subcontractor under him/her, or is not reported to the City as required by NRS 338.070.

2.6.12 SAFETY

A. Contractor's Safety Responsibility

The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor (OSHA) Standards, the Nevada Occupational Safety and Health Act, and all other applicable Federal, State, County, and local laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed in other parts of these Contract Documents. Where any of these are in conflict, the more stringent requirement shall be followed.

No provision of the Contract Documents shall act to make the City, the Construction Manager or any party other than the Contractor responsible for safety. The Construction Manager shall not have authority for safety on the Project. The Contractor shall indemnify, defend (not excluding the City's right to participate) and hold harmless the City, Construction Manager, or other authorized representatives of the City, from and against any and all actions, damages, fines, suits, and losses arising from the Contractor's failure to meet all safety requirements and/or provide a safe work site.

If death or serious injuries or serious damages are caused, the accident shall be reported immediately to the Construction Manager, the City and OSHA. In addition, the Contractor must promptly report in writing to the Construction Manager all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the site giving full details and statements of witnesses. The Contractor shall make all reports as are, or may be, required by any authority having jurisdiction, and permit all safety inspections of the Work being performed under this Contract.

If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Construction Manager, giving full details of the claim.

B. Safety Program

The Contractor shall establish, implement, and maintain a written injury prevention program. Before beginning the Work, the Contractor shall prepare and submit to the Construction Manager a Safety Program that provides for the implementation of all of the Contractor's safety responsibilities in connection with the Work at the site and the coordination of that program and its associated procedures and precautions with safety precautions and procedures of each of its subcontractors. The Contractor shall be solely responsible for initiating, maintaining, monitoring, coordinating, and supervising all safety programs, precautions, and procedures in connection with the Work and for coordinating its programs, precautions, and procedures of any other prime Contractors and subcontractors performing work at the site.

C. Safety Supervisor

The Contractor shall appoint an employee as Safety Supervisor who is qualified and authorized to supervise and enforce compliance with the Safety Program. The Contractor shall notify the Construction Manager in writing prior to the commencement of work of the name of the person who will act as the Contractor's Safety Supervisor.

D. Excavation Safety

The Contractor shall submit, in advance of excavation five feet or more in depth, detailed plans showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from hazard of caving ground during such excavation, and protection to adjacent structures during such excavation. Design calculations and plans must be sealed by a Civil or Structural Engineer registered in the State of Nevada.

Prior to commencing any excavation, the Contractor shall designate in writing to the Construction Manager the "Competent Person(s)" with the authority and responsibilities designated in the Construction Safety Orders.

E. Emergencies

In emergencies affecting the safety or protection of persons, the Work, or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Construction Manager, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Construction Manager prompt notice if the Contractor believes that any changes in the Work or variations from the Contract Documents have been caused thereby. The Contractor shall not resume construction during an emergency, or after an emergency until directed to by the Construction Manager.

F. Safety Violations

The City shall have the authority to require the removal from the Project of any employee in responsible charge of the Work where safety violations occur.

2.6.13 FIRE PREVENTION AND CONTROL

Before setting any fires whatsoever, the Contractor shall notify the responsible Federal, State, or local agency having jurisdiction for the area concerned. The Contractor shall abide by such rules and instructions as to fire prevention and control and as to the place for burning as the Federal, State, or local agency having jurisdiction may prescribe. The Contractor shall take all necessary steps to prevent his/her employees from setting fires not required in the prosecution of the work. The Contractor shall be responsible for preventing the escape of fires set in connection with the work and shall under the direction of the appropriate agency, or, in the absence of an officer from any such agency, acting independently, extinguish all fires which may escape the work, whether or not set directly or indirectly as a result of his/her operations.

The Contractor shall be fully responsible for any damage caused to public and/or private property as a result of his/her burning operations, and shall leave no fires unattended at any time during these operations. He/She shall have available at the site at all times when burning is in progress, adequate equipment to extinguish the fires set by him/her, and to control the spread of fire outside of the burning areas. Burning during high wind conditions shall be expressly prohibited in order to prevent fire hazard, regardless of the prevailing season.

2.6.14 ERRORS OR DISCREPANCIES NOTED BY CONTRACTOR

It is the duty of the Contractor to promptly notify the Construction Manager in writing of any design, materials, or specified method that the Contractor believes may prove defective or insufficient. If the Contractor believes that a defect or insufficiency exists in design, materials, or specified method and fails to promptly notify the Construction Manager in writing of this belief, the Contractor waives any right to assert that defect or insufficiency in design, materials, or specified method at any later date in any legal or equitable proceeding against the City, or in any subsequent arbitration or settlement conference between the City and the Contractor.

The Construction Manager, on receipt of any such notice, will promptly investigate the circumstances and give appropriate instructions to the Contractor. Until such instructions are given, any work done by the Contractor after he/she comes to the belief that a defect or insufficiency exists in materials, or specified method which is directly or indirectly affected by such alleged defect or insufficiency in design, materials, or specified method will be at his/her own risk and he/she shall bear all costs arising therefrom.

If the Contractor, either before commencing work or in the course of the work, finds any discrepancy between the specifications and the plans or between either of them and the physical conditions at the site of the work or finds any error or omission in any of the plans or in any survey, he/she shall promptly notify the Construction Manager of such discrepancy, error, or omission. If the Contractor observes that any plans or specifications are at variance with any applicable law, ordinance, regulation, order, or decree, he/she shall promptly notify the Construction Manager in writing of such conflict. The Construction Manager, on receipt of any such notice, will promptly investigate the circumstances and give appropriate instructions to the Contractor. Until such instructions are given, any work done by the Contractor after his/her discovery of such error, discrepancy, or conflict will be at his/her own risk and he/she shall bear all costs arising therefrom.

2.6.15 INDEMNIFICATION

The Contractor hereby agrees to indemnify, hold harmless, and defend, not excluding the City's right to participate, the Construction Manager, the City and its elected officials, officers, employees, agents, volunteers, other retained consultants and representatives, from and against any and all liability, claims, actions, damages, legal or administrative proceedings, losses and expenses, including without limitations, reasonable attorney's fees and costs (including attorney's fees in establishing indemnification of whatsoever nature), litigation costs, penalties, fines, judgments, or decrees by reason of any death, injury or disability to or of any person and/or damages to any property or business, including loss of use, arising out of any alleged negligent or willful acts, errors or omissions of the Contractor, Contractor's employees, agents, or subcontractors arising out of or suffered, directly or indirectly, by reason of or in connection with the performance of the Work under this Contract.

The Contractor guarantees the payment of all claims for materials, supplies and labor, and all other claims against it or any subcontractor, made in connection with this Agreement.

2.6.16 INSPECTIONS

The right of inspection and acceptance or rejection of contracted work by the City shall not make the Contractor an agent of the City, and the liability of the Contractor for all damages to persons or to public or private property, arising from the Contractor's execution of the work, shall not be lessened because of such inspections.

2.6.17 CONTRACTOR IS AN INDEPENDENT CONTRACTOR

This Contract does not create an employee/employer relationship between the parties. It is the parties' intention that the Contractor will be an independent contractor and not Carson City's employee for all purposes, including but not limited to the application of the Fair Labor Standards Act, the Federal Unemployment Tax Act, the provisions of the Internal Revenue Code, and Nevada State revenue and taxation laws. The Contractor will retain sole and absolute discretion in the judgment of the manner and means of carrying out the Contractor's activities and responsibilities hereunder. The Contractor agrees that it is a separate and independent enterprise from the public employer, that it has full opportunity to find other business, that it has made its own investment in its business and that it will utilize industry standard of care necessary to perform the Work. This Contract shall not be construed as creating any joint employment relationship between the Contractor and the City, and the City will not be liable for any obligation incurred by the Contractor, including but not limited to unpaid minimum wages and/or overtime premiums.

2.6.18 VALUE ENGINEERING PROPOSALS

Value Engineering Proposals (VEP) may be submitted by the Contractor in writing for modifying the plans, specifications or other requirements of the Contract for the purpose of reducing the total cost of construction without reducing design capacity or quality of the finished product. If accepted, net savings resulting from a VEP will be shared by the City and the Contractor on a 50%-50% basis.

The requirements herein apply to all VEP's initiated and developed by the Contractor and which are identified as such at the time of submission. Nothing herein shall be construed as requiring consideration or approval of a VEP submitted hereunder.

Each VEP shall result in a net savings over the Contract costs without impairing essential functions and characteristics of the item(s) or of any other part of the project, including but not limited to environmental considerations, service life, reliability, economy of operation, ease of maintenance, desired aesthetics and safety.

Submit the following information with each VEP:

5) A statement that the proposal is submitted as a VEP;

6) A statement concerning the basis for the VEP and benefits to the City together with an itemization of the Contract requirements affected by the VEP;

7) A detailed estimate of the cost under the existing Contract and under the VEP;

8) Proposed specifications and recommendations as to how such VEP changes are to be accomplished; and

9) A statement as to the time by which a Contract Change Order adopting the VEP must be issued so as to obtain the maximum cost effectiveness.

The VEP will be processed in the same manner as prescribed for any other proposal which would necessitate issuance of a Contract Change Order. The City may accept in whole or in part any VEP by issuing a Contract Change Order which will identify the VEP on which it is based. The City will not be liable for failure to accept or act upon any VEP submitted pursuant to these requirements nor for any delays to the work attributable to any such proposal. Until a proposal is effected by Contract Change Order, Contractor remains obligated to perform under the terms and conditions of the Contract. If an executed Contract Change Order has not been issued by the date upon which the proposal specifies that a decision thereon should be made, or such date as the Contractor may have subsequently specified in writing, such proposal shall be deemed rejected.

The Contract Change Order effecting the necessary Contract modification will establish the net savings agreed upon, will provide for adjustment in the Contract prices and will indicate the new savings to be equally divided between the City and the Contractor. Contractor shall absorb all costs incurred in preparing a VEP for submission. All reasonably incurred costs of reviewing and administering the VEP will be borne by the City. The City reserves the right to include in the agreement any conditions it deems appropriate for consideration, approval, and implementation of the proposal. The Contractor's 50% share of the net savings shall constitute full compensation to him/her for effecting all changes pursuant to the agreement.

Acceptance of the VEP and performance of the work thereunder will not change the Contract time limit as a result of the VEP, unless specifically provided for in the Contract Change Order authorizing the VEP.

Proposed changes in the basic design of a bridge or pavement type, traffic control plan, or changes which require different right-of-way limits, will not normally be considered as an acceptable VEP.

The Construction Manager shall be the sole judge of the acceptability of a VEP.

Subject to the provisions contained herein, the City or any other public agency shall have the right to use all or part of any accepted VEP without obligation or compensation of any kind to the Contractor.

In the event a VEP is accepted by the City, the provisions of General Conditions Section 6.4.4, Unit Price Adjustments Due to Increased or Decreased Quantities, which pertain to adjustment of Contract unit

prices due to alterations of Contract quantities, will not apply to items adjusted or deleted as a result of effecting the VEP by Contract Change Order.

SECTION 3.0 PROGRESS OF WORK, MEETINGS, SCHEDULES

GC 3.1 BEGINNING OF WORK

The Contractor shall begin work within ten (10) calendar days of the effective date of the Notice to Proceed and shall diligently prosecute the same to completion within the Contract Time.

GC 3.2 PERFORMANCE OF THE WORK

Unless otherwise specified in the Special Conditions, the Contractor shall furnish all materials, labor, permits, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and incidentals, including but not limited to, dust and traffic control measures, and to perform all work involved in executing the Contract in a satisfactory and workmanlike manner within the time specified.

GC 3.3 PLANS AND SPECIFICATIONS FURNISHED BY THE CITY

The City will furnish to the Contractor, free of charge, up to five (5) copies of the contract drawing and specifications. Additional sets shall be provided by the City at cost of the City's standard billing rate for labor of reproduction and the cost of reproduction itself. The five (5) sets of plans and specifications shall be available to the Contractor at the time he/she takes out the Carson City permit at the City's One Stop Permit Center located at the Building Department, 2621 Northgate Lane, Suite 6.

The location of the Work, its general nature and extent, and the form and detail of the various features are shown on the Contract Drawings accompanying and made a part of these Contract Documents.

GC 3.4 ORDER OF WORK

When required by the Contract Documents, the Contractor shall follow the sequence of operations as set forth therein. Full compensation for conforming with such requirements will be considered as included in the prices paid for the various Contract items of work and no additional compensation will be allowed therefore.

GC 3.5 TIME OF COMPLETION

Time shall be of the essence of the Contract. The Contractor shall diligently prosecute the Work so that the various portions of the Project shall be complete and ready for use within the time specified. It is expressly understood and agreed by and between the Contractor and the City that the Contract Time for completion of the Work described herein is a reasonable time taking into consideration the average climatic and economic conditions and other factors prevailing in the locality and the nature of the Work.

Failure of the Contractor to perform any covenant or condition contained in the Contract Documents within the time period specified shall constitute a material breach of this Contract entitling the City to terminate the Contract unless the Contractor applies for, and receives, an extension of time in accordance with the procedures set forth in GC 3.15, EXTENSION OF TIME.

Failure of the City to insist upon performance of any covenant or condition within the time period specified in the Contract Documents shall not constitute a waiver of the Contractor's duty to complete the performance within the designated periods unless the City has given a waiver in writing.

The City's agreement to waive a specific time provision or to extend the time for performance shall not constitute a waiver of any other time provision contained in the Contract Documents. Failure of the Contractor to complete the performance promptly within any additional time authorized or in any waiver or extension of time shall constitute a material breach of this Contract entitling the City to terminate.

GC 3.6 MEANS AND METHODS

It is expressly stipulated that the drawings, specifications, and other contract documents set forth the requirements as to the nature of the completed Work and do not purport to control the method of performing work except in those instances where the nature of the completed Work is dependent upon the method of performance.

Neither the City, Design Consultant, nor the Construction Manager will be responsible for or have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work. Neither the City, Design Consultant nor the Construction Manager will be responsible for or have control or charge over the acts or omissions of the Contractor, or any of their subcontractors, agents or employees, or any other persons performing any of the Work. Any general control of the Work exercised by the City or its authorized representatives shall not make the Contractor an agent of the City, and the liability of the Contractor for all damages to persons and/or to public or private property arising from the Contractor's execution of the Work shall not be lessened because of such general control.

Neither the inspection by the City, Design Consultant, or Construction Manager, nor any order, measurement, approved modification, or payment of monies, nor acceptance of any part or whole of the Work by the City, Design Consultant, Construction Manager, or their agents shall operate as a waiver of any provision of the Contract.

GC 3.7 CITY-FURNISHED MATERIALS

Only materials and equipment specifically indicated in the Contract Documents shall be furnished by the City and such materials and equipment will be made available as designated in the Special Conditions. The Contractor shall be prepared to load or unload and to properly protect all such material and equipment from damage or loss. The cost of loading, unloading, hauling, handling, demurrage and storage, and placing City-furnished materials into the Work shall be considered as included in the price bid for the Contract item involving such City-furnished material.

Contractor shall inspect and assure itself of the amount and soundness of such material or equipment at the time of receiving such materials. Any City-furnished material or equipment lost or damaged from any cause after the Contractor has taken control of said material or equipment, shall be replaced by the Contractor at his/her expense.

GC 3.8 DEFECTIVE AND UNAUTHORIZED WORK

Any materials or workmanship which does not conform to the requirements of the Contract Documents shall be considered defective and shall be remedied or removed and replaced by the Contractor, together with any other work which may be displaced in so doing, and no additional compensation will be allowed to the Contractor for such removal, replacement, or remedial work. All nonconforming materials shall be immediately removed from the Site.

Any work done beyond the limits of work, lines, and grades shown on any approved plans or established by the Construction Manager, or any changes in, additions to, or deductions from the work done without written authority, will be considered as unauthorized and will not be paid. Work so done may be ordered remedied, removed, or replaced at the Contractor’s expense.

Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this Section, the Engineer shall have authority to cause nonconforming materials, rejected work, or unauthorized work to be remedied, removed, or replaced at the Contractor’s expense and to deduct the costs from any monies due or to become due the Contractor.

These provisions shall have full effect regardless of the fact that the defective work may have been done or the defective materials used with the full knowledge of the Engineer or his/her representative. The fact that the Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it. Nothing stated herein shall be deemed to shorten the term of any statute of limitations applicable to claims which the City may have against the Contractor.

GC 3.9 PRE-CONSTRUCTION CONFERENCE

The Construction Manager will schedule a Pre-Construction Conference at the Project site or other established location at the time of Notice to Proceed and/or execution of the Contract and prior to commencement of construction activities.

3.9.1 ATTENDEES

The City, Design Consultant, Construction Manager, Contractor and its superintendent, subcontractors, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

3.9.2 AGENDA

The Construction Manager will prepare an agenda for discussion of significant items relative to Contract requirements, procedures, coordination and construction. Minutes shall be kept by the Construction Manager and distributed to all attendees.

GC 3.10 PROGRESS MEETINGS

The Construction Manager will conduct progress meetings at the Project site or other established location at regularly scheduled intervals which may be as frequent as weekly. Frequency of meetings shall be determined at the Pre-Construction Conference. Meeting minutes will be taken and distributed by the Construction Manager.

3.10.1 ATTENDEES

The City, Design Consultant, Construction Manager, Contractor, and its superintendent may each be represented at these meetings. Attendance by subcontractors, suppliers, utilities and other entities is subject to issues and/or items of the agenda which may require attendance.

3.10.2 AGENDA

Agenda may include, but not necessarily be limited to: review, correct or approve minutes of the previous progress meeting, review of items of significance that could affect progress, review/discuss topics as appropriate to the current and future status and/or needs of the Project, review the progress of the Work in the preceding week and in the subsequent week, coordinate the Work with public agencies and/or other Contractors as required, and allow the Construction Manager to plan his/her activities for testing, inspection, etc.

GC 3.11 CONSTRUCTION SCHEDULES

Construction schedules are required for all Contracts. The type of construction schedule required, that is, Construction Schedule (A) or Construction Schedule (B) will be specified in the Special Conditions. Compensation for the Work under this item will be included within the other bid items.

3.11.1 CONSTRUCTION SCHEDULE (A)

A. General

The schedule shall be submitted at the Pre-Construction Conference and must be favorably reviewed by the Construction Manager and the City before the first partial payment can be made. NOTE: The Construction Schedule must include and account for the total contract time specified in the Contract Documents.

B. Base Schedule

The Contractor shall submit the schedule based on either the bar chart method or the Critical Path Method (CPM). The schedule shall indicate preceding activity relationships and/or restraints where applicable and a controlling path shall be indicated. The schedule shall be time-scaled and shall be drafted to show a continuous flow from left to right. The construction schedule shall clearly show the sequence of construction operations and specifically list:

1. The start and completion dates of primary work items or components.

2. The dates of submittals, procurement, delivery, installation and completion of each major equipment and material requirement.

3. Progress milestone events or other significant stages of completion.

4. The lead time required for testing, inspection and other procedures required prior to acceptance of the Work.

5. All activities, other than procurement activities, shall be cost-loaded. Activities shall be no longer than 14 calendar days, except for submittals and delivery items. If an activity takes longer, it shall be broken into appropriate segments of work for measurement of progress. This limitation may be waived, upon approval of the Construction Manager, for repetitious activities of longer durations for which progress can be easily monitored.

C. Reports

The Bar Charts or CPM Schedules shall be prepared as follows:

1. Bar Chart: A manually generated report which lists each primary activity description, early start and finish dates, and all preceding and succeeding activities. Report shall indicate all critical activities. A report with the above information shall be provided with each monthly update.

2. CPM Schedule: A CPM network report sorted by I-J or activity number which lists each activity description, early start and finish dates, preceding and succeeding activities and restraints, including lead/lag durations. The report shall show the critical path.

- CPM network report sorted by total float.
- CPM network report sorted by early start.

3.11.2 CONSTRUCTION SCHEDULE (B)

A. General

The Construction Schedule under this requirement will also be referred to as the CPM Schedule.

The Contractor shall designate, in writing, an authorized representative in its firm who will be responsible for the preparation, revising, and updating of the CPM Schedule. The Contractor's representative shall have direct Project control and complete authority to act on behalf of the Contractor in fulfilling the construction scheduling requirements set forth herein, and such authority will not be interrupted throughout the duration of the Project. The requirements for the CPM Schedule are included to assure adequate planning and execution of the Work and to assist the Construction Manager and the City in appraising the reasonableness of the proposed schedule and evaluating progress of the Work.

Within seven (7) days from award of the Contract, the Contractor shall submit to the Construction Manager demonstration of competence in the use of CPM Scheduling, including evidence of the use of CPM Scheduling on a project of similar value and complexity. In the event of the failure of the Contractor to satisfy the Construction Manager of its CPM Scheduling competence, the Contractor will be required to employ a qualified CPM consultant who regularly performs these services and who in the opinion of the Construction Manager possesses the qualifications required to perform CPM Scheduling for this Project.

B. Preliminary Construction Schedule

At the Pre-Construction Conference, the Contractor shall submit copies of a Preliminary Construction Schedule in the form of a precedence diagram covering the following Project phases and activities:

1. Procurement and Submittals, including shop drawings, fabrication, and delivery of key and long lead time procurement activities.

a. The Contractor's submittal information shall show intended submittal dates and shall be incorporated into the base project schedule.

b. The delivery information shall include realistic delivery dates for the procurement activities.

2. The activities planned for the first 90 days in the execution of the Work.

3. The approach to scheduling the remaining activities or phases of the Work. The Work for each phase or activity shall be represented by at least one summary activity and the sum of the summary activities shall equal the Contract Time.

4. Approximate cost and duration for each summary activity representing the Contractor's best estimate for the Work the summary activity represents.

5. Projected monthly cash flow.

C. <u>Base Schedule Submittal</u>

The Contractor shall submit an acceptable Critical Path Method (CPM) Schedule to the Construction Manager within thirty (30) days after the receipt of the Notice to Proceed. Subsequent revisions to said schedule shall be submitted as set forth hereinafter.

The Construction Manager shall review the schedule and provide any comments, its favorable review of the schedule, or request a meeting to review the schedule with the Contractor within fifteen (15) days of receipt of the schedule. If requested, the Contractor shall participate in a review and evaluation of the proposed network diagrams and analysis by the Construction Manager. Any revisions necessary as a result of this review shall be resubmitted for review by the Construction Manager within ten (10) days. When completed, the favorably reviewed schedule shall then be the schedule to be used by the Contractor for planning, organizing, and directing the Work, and for reporting progress. If the Contractor thereafter desires to make significant changes in its method of operating and scheduling, the Contractor shall notify the Construction Manager in writing stating the reasons for the change. Only one progress payment will be made prior to acceptance of the CPM Schedule. Neither the Contractor nor the City shall own the "float".

To the extent that the favorably reviewed initial Construction Schedule, or revisions thereto, indicate anything not jointly agreed upon, it shall be deemed to be not favorably reviewed by the Construction Manager. Any omission of work from the detailed schedule, otherwise required for Contract compliance, will not excuse the Contractor from completing such work within any applicable completion date.

The CPM Schedule shall utilize a (CPM) format using either the precedence or arrow diagramming method. The schedule shall show completion of the Project at the Contract Completion Date or before.

The schedule shall be computer generated utilizing a scheduling program identified in the Special Conditions. The Contractor shall provide a compact disk or other electronic means approved by the Construction Manager for the initial base schedule and all monthly updates with the network diagram and mathematical analyses. The program shall be capable of accepting revised completion dates as modified by approved time adjustments and re-computations of all tabulation date and float accordingly. The CPM schedule system shall consist of diagrams and accompanying mathematical analyses network diagram. See Special Conditions for further details regarding scheduling requirements.

D. Cash Flow Projection

A cash flow projection shall be submitted with the Construction Schedule. This cash flow projection shall be revised and resubmitted when revisions of the Construction Schedule will result in significant changes to the projected cash flow.

GC 3.12 NOTICE OF DELAYS

When the Contractor foresees a delay in the prosecution of the Work and, in any event, within seventy-two (72) hours of a delay, the Contractor shall notify the Construction Manager in writing of the probability of the occurrence, the estimated or actual extent of the delay, and its cause. The Contractor shall take immediate steps to prevent, if possible, the occurrence or continuance of the delay. The Contractor agrees that no claim shall be made for delays which are not called to the attention of the Construction Manager within the time specified above.

Except for Standby Time for City utilities as provided for in GC 7.10, COORDINATION/COOPERATION WITH UTILITIES, the Contractor's sole remedy for any delay in the Work, regardless of the alleged cause of the delay, shall be an extension of the contract time; the Contractor shall not be entitled to any delay damages, wage escalation, material escalation, extended job site or home office overhead or supervision, or additional compensation of any kind.

3.12.1 NON-EXCUSABLE DELAYS

Non-excusable delays in the prosecution of the Work shall include delays which could have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its subcontractors, at any tier level, or suppliers. Time lost due to violations of permit requirements shall be non-excusable delays. No time extension or other compensation shall be granted for time lost due to non-excusable delays.

3.12.2 EXCUSABLE DELAYS

Excusable delays in the prosecution or completion of the Work shall include delays which result from causes beyond the control of the Contractor and which could not have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its subcontractors, at any tier level, or suppliers.

Delays caused by acts of God, fire, unusual storms, floods, earthquakes, strikes, labor disputes, freight embargoes, and shortages of materials shall be considered as excusable delays insofar as they prevent the Contractor from proceeding with at least seventy-five (75) percent of the normal labor and equipment force for at least five (5) hours per day toward completion of the current critical activity item(s) on the latest favorably reviewed Construction Schedule.

Excusable delays shall not entitle the Contractor to any additional compensation. The sole remedy of the Contractor shall be to seek an extension of time.

3.12.3 STANDBY TIME

As provided in GC 7.10, COORDINATION/COOPERATION WITH UTILITIES, if the Contractor is delayed due to the City's non-marking, mis-marking or mis-locating the City's main line water mains, reclaimed water mains, sanitary sewer main lines and storm drains, the City will be responsible for repairs, damages and standby time caused the Contractor. Compensation to the Contractor for such repairs, damages or standby time shall be calculated on the basis of GC 6.4.3, FORCE ACCOUNT PAYMENT. Note: this provision does not apply to service laterals/connections.

Also Note: per NRS 455.082, the approximate location of a subsurface installation marked in response to a request of USA means a strip of land not more than 24 inches on either side of the exterior surface of a subsurface installation.

3.12.4 WEATHER DELAYS

Should inclement weather conditions or the conditions resulting from weather prevent the Contractor from proceeding with seventy-five (75) percent of the normal labor and equipment force engaged in the current critical activity item(s) on the latest favorably reviewed Construction Schedule for a period of at least five

(5) hours per day toward completion of such operation or operations, and the crew is dismissed as a result thereof, it shall be a weather delay day. The Contractor may be granted a non-compensable time extension should the critical path activities be affected by the weather delay.

3.12.5 CONCURRENT DELAYS

Concurrent delays are those delay periods when the prosecution of the Work is delayed during the same period of time due to causes from a combination of the delays, City-caused and Contractor-caused. Time extensions will be granted on the basis of a time impact analysis from the CPM Schedule.

GC 3.13 LIQUIDATED DAMAGES

It is agreed by the parties to the Contract that time is of the essence in the completion of this Work, and that in case all the Work called for under the Contract is not completed before or upon the expiration of the time limit as set forth in these Contract Documents, or as modified by extensions of time granted by the City, damage will be sustained by the City. As it may be impracticable to determine the actual delay damage; it is, therefore, agreed that the Contractor shall pay liquidated damages to the City in the amount set forth in the Construction Contract, per calendar day for each and every calendar day's delay beyond the time prescribed to complete the Work. The Contractor agrees to pay such liquidated damages and in case the same are not paid, agrees that the City may deduct the amount thereof from any monies due or that may become due the Contractor under the Contract.

The Contractor shall not be deemed in breach of this Contract nor shall liquidated damages be collected because of any delays in the completion of the Work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor provided the Contractor requests an extension of time in accordance with the procedures set forth in GC 3.15, EXTENSION OF TIME. Unforeseeable causes of delay beyond the control of the Contractor shall include Acts of God, acts of a public enemy, acts of government, or acts of the City, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and weather, or delays of subcontractors due to such causes, or delays caused by failure of the City or the facilities.

GC 3.14 RIGHTS BEYOND LIQUIDATED DAMAGES

Liquidated damages shall not preclude the City from claiming and collecting damages on account of delay, price changes, loss of other contracts, loss of income, and or any inability of the City to fulfill other obligations, if such damages are direct or consequential arising out of the failure of the Contractor to perform under the terms, conditions and requirements of this Contract.

GC 3.15 EXTENSION OF TIME

The time specified for completion of all of the Work or any part of the Work may be extended only by a written change order executed by the City. The Construction Manager may, at his/her discretion, recommend that the City extend the time for completion of the Work without invalidating any of the provisions of the contract and without releasing the surety.

Extensions of time, when recommended by the Construction Manager, will be based upon the effect of delays to the project as a whole and will not be recommended for non-controlling delays to minor portions of the Work, unless it can be shown that such delays did, in fact, delay progress of the project as a whole. Excusable delays may justify an extension of time.

No extension of time for completion will be allowed for non-excusable delays.

Written requests for an extension of time must be delivered to the Construction Manager within seventy-two (72) hours following the date of the occurrence which caused the delay. The request must state the cause of the delay, the date of the occurrence causing the delay, and the amount of additional time requested. The delay causing condition must affect an activity on the critical path of the latest favorably reviewed Construction Schedule. Requests for extensions of time shall be supported by all evidence reasonably available or known to the Contractor which would support the extension of time requested. Requests for extension of time failing to include the information specified in this Section, and requests for extensions of time which are not received within

the time specified above, shall result in the forfeiture of the Contractor's right to receive any extension of time requested.

If the Contractor is requesting an extension of time because of a weather delay, Contractor shall supply daily reports to the Construction Manager describing such weather and the work which could not be performed that day because of such weather or conditions resulting therefrom and which Contractor otherwise would have performed. The City's acceptance of the daily reports shall not be deemed an admission of the Contractor's right to receive an extension of time or a waiver of the City's right to strictly enforce the time provisions contained in the Contract Documents.

When the Contractor has submitted a request for an extension of time in accordance with the procedures of this Section, the City will ascertain the facts and extent of the delay and extend the time for completing the Work if, in its judgment, the findings of fact justify such an extension, and its findings of fact thereon shall be final and conclusive. An extension of time may be granted by the City after the expiration of the time originally fixed in the Contract or as previously extended, and the extension so granted shall be deemed to commence and be effective from the date of such expiration.

GC 3.16 TEMPORARY SUSPENSION OF WORK

The City may order suspension of all or any part of the Work if:

(1) Unsuitable weather and such other conditions beyond the control of the Contractor prevent satisfactory and timely performance of the Work; or

(2) The contractor does not comply with the Contract or the Engineer's orders.

If the Work is suspended for reason (1) above, the period of work stoppage will be counted as non-working days. However, if the Construction Manager believes the Contractor should have completed the suspended work before the suspension, all or part of the suspension period may be counted as working days. The Construction Manager will set the number of non-working days (or parts of days) by deciding how long the suspension delayed the entire project. An extension of time may be granted. Also, the Contractor will be compensated for its actual costs plus the standard markup for overhead and profit for performing all work necessary to provide a safe, smooth, unobstructed passageway through the Site for use by the public, pedestrian and vehicular traffic during the period of such a suspension of work.

If the Work is suspended for reason (2) above, the period of work stoppage will be counted as working days and no extension of time will be granted. The lost work time, however, shall not relieve the Contractor from any contract responsibility.

If the Contractor fails to correct defective work as required, or fails to carry out the Work in accordance with the Contract Documents or any other applicable rules and regulations, the City, in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the City to stop the Work shall not give rise to any duty on the part of the City to exercise this right for the benefit of the Contractor or any other person or entity. All delays in the Work occasioned by such stoppage shall not relieve the Contractor of any duty to perform the Work or serve to extend the time for the Work completion. Any and all necessary corrective work done in order to comply with the Contract Documents shall be performed at no cost to the City. When ordered by the City to suspend or resume work, the Contractor shall do so immediately. In all cases of suspension of construction operations, the work shall not again be resumed until permitted by written order of the City.

In the event that a suspension of Work is ordered for reason (2) above, as provided in this Section, the Contractor shall perform all work necessary to provide a safe, smooth, and unobstructed passageway through the Site for use by public, pedestrian and vehicular traffic, during the period of such a suspension. Should the Contractor fail to perform the Work as specified, the City may perform such work and the cost thereof may be deducted from monies due the Contractor under the Contract. The Contractor will be responsible for all damage to the Work that may occur during suspensions of work. The Contractor will not be entitled to any additional compensation nor allowance for overhead or profit incurred in connection with this type of suspension.

GC 3.17 PROTECTION OF ANTIQUITIES

State and Federal laws pertaining to the protection and preservation of sites or objects of archeological, paleontological or historic interest shall be observed by the Contractor performing this Work.

When features of archeological, paleontological or historic interest are encountered or unearthed in material pits, the roadway prism, or other excavation, the Contractor shall stop work in the immediate vicinity of such feature, protect it from damage or disturbance, and report promptly to the State Historic Preservation Office at (775) 684-3448 and the Construction Manager.

Work shall not be resumed in the immediate area until the Contractor is advised by the authorities having jurisdiction that study or removal of the feature or features has been completed. The Contractor may be allowed an appropriate contract extension of time, as provided for in these General Conditions, for construction time lost.

GC 3.18 CONTRACT TERMINATION

If at any time the Contractor is determined to be in material breach of the Contract, notice thereof in writing will be served upon the Contractor and its sureties, and should the Contractor neglect or refuse to promptly provide means for satisfactory compliance with the Contract, within the time specified in such notice, the City in such case shall have the authority to terminate the operation of the Contract.

A. The City may terminate the Contract if the Contractor:

1. Fails to maintain bonding, Nevada State Contractor's Board License, State Industrial Insurance requirements or insurance policies for limits as defined in the Contract Documents;

2. Persistently or repeatedly refuses or fails to supply properly skilled workers or proper materials;

3. Fails to make payment to subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the subcontractors;

4. Persistently disregards laws, ordinances, or rules, regulations or order of a public authority having jurisdiction;

5. Otherwise makes a material breach of a provision of the Contract Documents; or

6. Contractor fails to maintain safe working conditions.

B. When any of the above reasons exist, the City may provide, without prejudice to any other rights or remedies of the City and after giving the Contractor and the Contractor's Surety, seven (7) days written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

1. Take possession of the site and of all materials, equipment, tools and construction equipment and machinery thereon owned by the Contractor;

2. Accept assignment of subcontractors pursuant to this Contract for Construction (Contingent Assignment of Subcontracts to City if Contract is terminated); and,

3. Finish the Work by whatever reasonable method the City may deem expedient.

C. If the City terminates the Contract for one of the reasons stated in Termination by the City for Cause, the Contractor shall not be entitled to receive further payment until the Work is finished.

D. If the unpaid balance of the Contract Amount exceeds the cost of finishing the Work including expenses made necessary thereby, such excess shall be paid to the Contractor. If the costs of

finishing the Work exceed the unpaid balance, the Contractor shall pay the difference to the City. The amount to be paid to the Contractor or City, as the case may be, shall survive termination of the Contract for Construction.

In the event of such termination, all monies due the Contractor or retained under the terms of this Contract shall be held by the City; however, such holdings will not release the Contractor or its sureties from liability for failure to fulfill the Contract. Any excess cost over and above the Contract Amount incurred by the City arising from the termination of the operations of the Contract and the completion of the Work by the City as provided above shall be paid for by any available funds held by the City. The Contractor will be so credited with any surplus remaining after all just claims for such completion have been paid.

If at any time before completion of the Work under the Contract, the Work shall be stopped by an injunction of a court of competent jurisdiction or by order of any competent authority, the City may give notice to the Contractor to discontinue the Work and terminate the Contract. The Contractor shall discontinue the Work in such manner, sequence, and at such times as the Construction Manager may direct. The Contractor shall have no claim for damages for such discontinuance or termination, nor any claim for anticipated profits on the Work thus dispensed with, nor for any claim for penalty, nor for any other claim such as unabsorbed overhead, except for the work actually performed up to the time of discontinuance, including any extra work ordered by the Construction Manager to be done.

GC 3.19 CITY'S RIGHT TO TERMINATE FOR CONVENIENCE

The City reserves the right to terminate this contract for convenience whenever it considers termination, in its sole and unfettered discretion, to be in the public interest. In the event that the Contract is terminated in this manner, payment will be made for work actually completed. In no event if termination occurs under this provision shall the Contractor be entitled to anticipated profits on items of work not performed as of the effective date of the termination or compensation for any other item, including but not limited to, unabsorbed overhead. The Contractor shall assure that all subcontracts which he/she enters related to this Contract likewise contain a termination for convenience clause which precludes the ability of any subcontractor to make claims against the Contractor for damages, due to breach of contract, of lost profit on items of work not performed or of unabsorbed overhead, in the event of a convenience termination.

GC 3.20 WORK DURING DISPUTES AND LITIGATION

In the event of a dispute between the parties hereto as to performance of the Work, the interpretation of this Contract, or payment or nonpayment for work performed, the parties shall attempt to resolve the dispute. If the dispute is not resolved, Contractor agrees to continue the Work diligently to completion and will neither rescind this Contract nor stop the progress of the Work but will submit such controversy to determination in accordance with the terms of the Contract Documents. In the event any litigation is commenced with respect to this Contract, such litigation shall not serve to suspend Contractor's obligation to continue performance of the Work hereunder.

GC 3.21 LANDS AND RIGHTS-OF-WAY

The lands and rights-of-way for the project to be constructed will be provided by the City. The Contractor shall make his/her own arrangements and pay all expenses for additional area required by him/her outside the limits of the City's land and right-of-way. Work in the public right-of-way shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the work is located in addition to conforming to the plans and specifications.

GC 3.22 WAIVER OF RIGHTS

Except as otherwise specifically provided in the Contract Documents, no action or failure to act by the City, Owner's Representative, Construction Manager or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract Documents, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder.

SECTION 4.0 SHOP DRAWINGS AND QUALITY CONTROL/INSPECTIONS

GC 4.1 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall submit, at its own expense, submittals and details of structural and reinforcing steel, concrete mix designs, coatings, equipment, material, electrical controls, architectural fabrications, pipe, pipe joints, special pipe sections, and other appurtenances as required in the Technical Specifications and Special Conditions of the Contract Documents. The contract Unit Bid Price for the various items requiring submittals shall include the cost of furnishing all shop drawings, product data, and samples, and the Contractor will be allowed no extra compensation for such drawings, product data or samples.

All submittals and supporting drawings, designs, calculation, data, catalogs, schedules, etc., shall be submitted as the instruments of the Contractor, who shall be responsible for their accuracy, completeness, and coordination. Such responsibility shall not be delegated in whole or part to subcontractors or suppliers. These submittals may be prepared by the Contractor, subcontractors, or suppliers, but the Contractor shall ascertain that submittals meet all of the requirements of the Contract Documents while conforming to structural, space, and access conditions at the point of installation. Designation of work "by others," if shown in submittals, shall mean that the work will be the responsibility of the Contractor rather than the subcontractor or supplier who prepared the submittals. The Contractor shall insure that there is no conflict with other submittals and notify the Construction Manager in each case where its submittal may affect the work of another Contractor or the City. The Contractor shall insure coordination of submittals among the related crafts and subcontractors.

Submittals shall be prepared in such form that data can be identified with the applicable Specification paragraph. The data shall clearly demonstrate compliance with the Contract Drawings and specifications and shall relate to the specific equipment to be furnished. Where manufacturer's standard drawings are employed, they shall be marked clearly to show what portion of the data is applicable to this Project.

GC 4.2 SOURCE OF MATERIALS

Unless otherwise approved in writing by the Construction Manager, only unmanufactured materials produced in the United States, and only manufactured materials made in the United States, shall be used in the performance of this contract.

GC 4.3 TRANSMITTAL PROCEDURES

4.3.1 TRANSMITTAL FORM

A separate transmittal form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections for which the submittal is required. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole. The specification section to which the submittal is related shall be indicated on the transmittal form.

A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.

4.3.2 DEVIATIONS FROM THE CONTRACT

If the submittals show any deviations from the Contract requirements, the Contractor shall submit with the submittal submission a written description of such deviations and the reasons therefore. If the City accepts such deviation, the City shall issue an appropriate Contract Change Order, except that, if the deviation is minor, or does not involve a change in price or in time of performance, a Change Order may

not be issued. If deviations from the Contract requirements are not noted on the submittal by the Contractor, the review of the shop drawing shall not constitute acceptance of such deviations.

4.3.3 SUBMITTAL COMPLETENESS

The Contractor shall check all submittals before submitting them to the Construction Manager and shall certify on the transmittal letter and on each shop drawing that they have been checked, are in compliance with the drawings and specifications, and all deviations from the Contract requirements are noted.

If the Contractor submits an incomplete submittal, the submittal may be returned to the Contractor without review. A complete submittal shall contain sufficient data to demonstrate that the items comply with the specifications, shall meet the minimum requirements for submissions cited in the Technical Specifications, shall include materials and equipment data and certifications where required, and shall include any necessary revisions required for equipment other than first named.

The City reserves the right to deduct monies from payments due the Contractor to cover additional actual costs of review beyond the second submission.

4.3.4 SUBMITTAL PERIOD

All submittals shall be submitted to the Construction Manager within fifteen (15) calendar days after the date of the Notice to Proceed by the City, unless the Construction Manager accepts an alternate schedule for submission of submittals proposed by the Contractor or unless provided for differently in the Special Conditions.

4.3.5 MATERIAL AND EQUIPMENT SUBSTITUTIONS

In preparing these specifications, the Design Consultant has named those products which to its knowledge meet the specifications and are equivalent in construction, functional efficiency, and durability.

Wherever catalog numbers and specific brands or trade names preceded by "similar and equal" or followed by the designation "or equal" are used in conjunction with a designated material, product, installation, or service mentioned in these specifications, they are used to establish the standards of quality and utility required. The Contractor may request, in writing, approval of any material, process or article which he/she believes to be equal. The written request shall state how the material, process, or article proposed for substitution compares with or differs from the designated material, process, or article in composition, size, arrangement, performance, and in addition, the request shall be accompanied by documentary evidence of equality in price and delivery or evidence of difference in price and delivery. Data on price shall be in the form of certified quotations from suppliers of both the designated and proposed material, process or article. If any material, process or article offered by the Contractor is not, in the opinion of the Engineer, equal or better in every respect to that specified, then the Contractor must furnish the material, process or article specified or one that, in the opinion of the Engineer, is the equal or better in every respect. In the event the Contractor furnishes material, process, or article more expensive than that specified, the difference in cost of such material, process, or article so furnished shall be borne by the Contractor. Pursuant to NRS, Chapter 338.140, data substantiating a request for substitution of “an equal” item shall be submitted within seven (7) days after Award of the Contract.

GC 4.4 REVIEW PROCEDURE

Submittals shall be submitted to the Construction Manager for review and will be returned to the Contractor within fifteen (15) working days after receipt, unless otherwise provided for in the Special Conditions. The primary objective of review of submittals by the City is the completion of the Project in full conformance with the Contract, unmarred by field corrections, and within the time provided. In addition to this primary objective, submittal review as a secondary objective will assist the Contractor in its procurement of equipment that will meet all requirements of the Project Drawings and specifications, will fit the structures detailed on the drawings, will be completed with respect to piping, electrical, and control connections, will have the proper functional characteristics, and will become an integral part of a complete operating facility.

After review by the City of each of the Contractor's submissions, the material will be returned to the Contractor with actions defined as follows:

A. <u>No Exceptions Noted (Resubmittal Not Required)</u>
Accepted subject to its compatibility with future submissions and additional partial submissions for portions of the work not covered in this submission. Does not constitute approval or deletion of specified or required items not shown in the partial submission.

B. <u>Make Corrections Noted (Resubmittal Not Required)</u>
Same as A, except that minor corrections as noted shall be made by the Contractor.

C. <u>Make Corrections Noted (Resubmittal)</u>
Rejected because of inconsistencies or errors which shall be resolved or corrected by the Contractor prior to subsequent review by the City.

D. <u>Not Acceptable (Resubmit)</u>
Submitted material does not conform to drawings and specifications in major respects, i.e.: wrong size, model, capacity, or material.

It shall be the Contractor's responsibility to copy and/or conform reviewed submittals in sufficient numbers for its files, subcontractors, and vendors.

The Contractor shall submit a minimum of six (6) copies for each submittal. The Construction Manager will retain a minimum of four (4) copies for its use and record and return two (2) copies to the Contractor.

The City's favorable review of submittals shall be obtained prior to the fabrication, delivery and construction of items requiring submittal review.

Favorable review of submittals does not constitute a change order to the Contract requirements. The favorable review of all submittals by the City shall apply in general design only and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein. Favorable review by the City shall not relieve the Contractor of its obligation to meet safety requirements and all other requirements of law. Favorable review by the City shall not constitute acceptance by the City of any responsibility for the accuracy, coordination, and completeness of any items or equipment represented on the submittals.

GC 4.5 QUALITY CONTROL - GENERAL

All materials and equipment to be incorporated into the Work, unless otherwise specified, shall be new and of the specified quality and equal to the samples found to be acceptable by the Design Consultant if samples have been submitted. All materials, equipment, and supplies provided shall, without additional charge to the City, fully conform with all applicable state and federal safety laws, rules, regulations, and orders, and it shall be the Contractor's responsibility to provide only such materials, equipment, and supplies. It shall be the duty of the Contractor to call the Construction Manager's attention to apparent errors or omissions and request instructions before proceeding with the Work. The Construction Manager may, by appropriate instructions, correct errors and supply omissions not involving extra cost, which instructions shall be as binding upon the Contractor as though contained in the original Contract Documents.

At the option of the Construction Manager, materials and equipment to be supplied under this Contract will be tested and inspected either at their place of origin, laboratory, or at the site of the Work. The Contractor shall give the Construction Manager written notification at least 30 days prior to the shipment of materials and major equipment to be tested and inspected at point of origin. Prior to shipping any precast concrete products, a meeting shall be held at the manufacturer's site to discuss and agree on uniform acceptability standards for the precast products. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the materials and equipment, nor shall such tests and inspections preclude retesting or re-inspection at the site of the Work.

Inspection of the Work by the City, Construction Manager and/or Design Consultant shall not relieve the Contractor of its obligations to conduct comprehensive inspections of the Work, to furnish materials and perform acceptable Work, and to provide adequate safety precautions in conformance with the intent of the Contract.

4.5.1 QUALITY ASSURANCE INSPECTION

All work and materials are subject to the inspection of the Construction Manager. The Contractor shall prosecute work only in the presence of the Construction Manager or a City inspector appointed by the Construction Manager, and any work done in the absence of said Construction Manager or inspector may be subject to rejection. Furthermore, failure to call for the Construction Manager or inspector to inspect as the work progresses shall be considered as a major breach of the Contract and may constitute grounds for the City to terminate. The Contractor shall make a request to the Construction Manager or inspector at least twenty-four (24) hours in advance before inspection services are required for the work. If the specifications, the Construction Manager's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give timely notice of its readiness for inspection. The City, Construction Manager, Design Consultant and authorized agents and their representatives shall at all times be provided safe access to the Work wherever it is in preparation or progress and to all warehouses and storage yards wherein materials and equipment are stored, and the Contractor shall provide facilities for such access and for inspection, including maintenance of temporary and permanent access. Inspection of the Work shall not relieve the Contractor of the obligation to fulfill all conditions of the Contract, and improper work will be subject to rejection. Work and materials not meeting such requirements shall be made good, and unsuitable work or materials may be rejected; notwithstanding that such work or materials have been previously inspected by the Construction Manager or that payment therefore has been included in a progress estimate.

No work or any portion thereof shall be deemed acceptable by reason of the presence of the Engineer. While the Engineer will endeavor to point out to the Contractor any defective work which comes to the Engineer’s attention during these observations, the Engineer’s failure to do so shall not constitute the basis of any claim, suit, or cause of action by the Contractor or any party against the Engineer or City and shall not excuse nonconforming or defective work by the Contractor.

No portion of any work or installed materials shall be covered or concealed in any manner without first being inspected by the Construction Manager. If any work should be covered up without the approval or consent of the Construction Manager, the Construction Manager shall have the authority to require, at any time before acceptance of the Work, that such work be uncovered for examination. After examination, the Contractor shall restore said portions of the Work to the standards required by the Specifications. Should the work thus exposed or examined prove acceptable, the uncovering or removing of the covering and the replacing of the covering or making good of the parts removed, will be paid for as provided in GC 6.0, CHANGE ORDERS, but should the work so exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed shall be at the Contractor’s expense.

4.5.2 PERMIT AND CODE COMPLIANCE INSPECTIONS

Separate and independent from the inspections above, the Work may require the inspections of Building Officials or other agencies. The Contractor shall make arrangements with the Carson City Building Department to schedule appropriate Building Permit compliance inspections and with other agencies (i.e. Fire Officials, NDOT, NDEP, etc.) to schedule their required permit and code inspections. Such inspectors shall have the authority provided them by their agencies and jurisdictions.

4.5.3 SAMPLES AND TESTS

The source of supply of materials for the Work shall be subject to tests and inspection before the delivery is started and before such materials are used in the Work. Representative preliminary samples of the character and quality prescribed shall be submitted to the Construction Manager by the Contractor in sufficient quantities or amounts for testing or examination.

All tests of materials furnished by the Contractor shall be made in accordance with the commonly recognized standards of national technical organizations, and such special methods and tests as are prescribed in the Technical Specifications. Certificates of Compliance shall be provided by the Contractor as required in the Technical Specifications.

A. Sampling

The Contractor shall furnish such samples of materials as are requested by the Construction Manager. No material shall be used until the Construction Manager has had the opportunity to test or examine such materials. Samples shall be secured and tested whenever necessary to determine the quality of the material. Samples and test specimens prepared at the site, such as concrete test cylinders, shall be taken or prepared by the Construction Manager in the presence and with the assistance of the Contractor.

B. Testing

All initial testing including, but not limited to, concrete, soils, and asphalt/concrete pavement shall be at no expense to the Contractor and shall be performed in the City's laboratory or in a laboratory designated by the City. When required by the Contract or the Construction Manager, the Contractor shall furnish certificates of tests of materials and equipment made at the point of manufacture by a recognized testing laboratory.

The Contractor is responsible for all system and equipment testing as provided for in these Contract Documents.

C. Retesting Costs

The costs of any retesting required due to failed test or defective material or sample shall be at the Contractor's expense. The City will deduct such retesting costs from the progress payments through a deductive change order.

D. Test Standards

All sampling, specimen preparation, and testing of materials shall be in accordance with the requirements of the Standard Specifications, or any permits, and the standards of nationally recognized technical organizations. The physical characteristics of all materials not particularly specified shall conform to the latest standards published by the American Society for Testing Materials, where applicable.

E. Testing Disputes

In the event that the Contractor disputes the results of the City's materials testing and retains his/her own testing laboratory for comparison testing, only a laboratory and personnel certified under the Nevada Alliance for Quality Transportation Construction (NAQTC) will be considered.

SECTION 5.0 PAYMENT

GC 5.1 GENERAL

The Contractor shall accept the compensation, as herein provided, as full payment for furnishing all labor, materials, tools, equipment, and incidentals appurtenant to the various items of the Proposal Summary, as further specified herein, necessary for completing the Work, all in accordance with the requirements of the Contract Documents, including all costs of permits and compliance with the regulations of the Occupational Safety and Health Administration of the U. S. Department of Labor (OSHA), and no additional compensation will be allowed therefore. No separate payment will be made for any item that is not specifically set forth in the Proposal Summary, and all costs therefore shall be included in the prices named in the Proposal Summary for the various items of Work. Prior to the City processing the pay estimate, if prevailing wage rates are required, the Contractor shall submit to the City a copy of its certified payroll reports for each week within the pay estimate period.

GC 5.2 PAYMENT FOR PATENTS AND PATENT INFRINGEMENT

All fees or claims for any patented invention, article, or arrangement that may be used upon or in the work, or is in any manner connected with the performance of the Work, shall be included in the price bid for doing the work. The Contractor and its sureties shall defend, protect, and hold the City, the Construction Manager, and Design Consultant, and their officers, agents, employees, and volunteers harmless against liability of any nature or kind for any and all costs, legal expenses, and damages made for such fees or claims and against any and all suits and claims brought or made by the holder of any invention or patent, or on account of any patented or unpatented invention, process, article, or appliance manufactured for or used in the performance of the Contract, including its use by the City. Before final payment is made on the Contract, the Contractor shall furnish an affidavit to the City regarding patent rights for the Project. The affidavit shall state that all fees and payments due as a result of the Work incorporated into the Project or methods utilized during construction have been paid in full. The Contractor shall certify in the affidavit that no other fees or claims exist in this Project.

GC 5.3 PAYMENT OF TAXES

The Contractor shall pay and shall assume exclusive liability for all taxes levied or assessed on or in connection with the Contractor's performance of this Contract, including, but not limited to, state and local sales and use taxes, federal and state payroll taxes or assessments, and excise taxes. No separate allowance will be made therefore, and all costs in connection therewith shall be included in the total amount of the Contract Amount.

GC 5.4 PAYMENT FOR LABOR AND MATERIALS

In accordance with the provision of NRS 338.550, the Contractor shall pay and require its subcontractors to pay all accounts for labor including workers' compensation premiums, state unemployment and federal social security payments and other wage and salary deductions required by law. The Contractor also shall pay and cause its subcontractors to pay all accounts for services, equipment, and materials used by the Contractor and its subcontractors during the performance of Work under this Contract. Such accounts shall be paid as they become due and payable.

GC 5.5 PARTIAL PAYMENTS

In consideration of the faithful performance of the Work prosecuted in accordance with the provisions of the Contract Documents, the City will pay the Contractor for all such work installed on the basis of percentage completion. Amounts earned will be based on the accepted Schedule of Values.

Payments will be made by the City to the Contractor on estimates approved by the Construction Manager, based on the value of equipment installed and tested, labor and materials incorporated into said permanent Work by the Contractor during the preceding month, and acceptable materials and equipment on hand (materials and equipment furnished and delivered to the site by the Contractor and not yet incorporated into the work accompanied by an approved paid invoice) per GC 5.5.1, below.

Partial payments will be made monthly based on work accomplished as of the last day of each calendar month.

The Contractor and Construction Manager shall meet within five (5) days after the end of each calendar month to review and agree on the Work completed within the past month. The Contractor shall then submit its progress

billing of the Work completed during the prior month and the Work completed to date on the City's approved form corresponding to the accepted Schedule of Values. Upon receipt of Contractor's progress billing, the City shall act in accordance with the following:

a. The Construction Manager shall review the submitted progress billing to verify that it corresponds with the agreement reached at the above mentioned review meeting. If the progress billing is satisfactory, the Construction Manager will process it for payment.

b. If the Construction Manager determines that the progress billing is not satisfactory, then pursuant to NRS 338.525, the City shall, within twenty (20) days of receipt of said progress billing, give written notification to the Contractor of any amount that will be withheld and a detailed explanation of the reason for the withholding. The remainder will be processed for payment.

If requested, the Contractor shall provide such additional data as may be reasonably required to support the partial payment request. Payment will be made by the City to the Contractor in accordance with City's normal accounts payable procedures. The City shall retain amounts in accordance with Sections GC 5.6, RETENTION, and GC 5.7, OTHER WITHHOLDS.

Per NRS 338.515, the City shall pay the Contractor within thirty (30) days after receipt of its progress billing.

5.5.1 PARTIAL PAYMENTS - INCLUSION OF MATERIALS ON HAND

Except as otherwise provided in NRS 338.515(1), GC 5.6 "RETENTION", NRS 338.525, and GC 5.7 "OTHER WITHHOLDS", pursuant to NRS 338.515(2), the City will pay or cause to be paid to the Contractor the actual cost of the supplies, materials and equipment that have been identified in the Special Conditions as eligible for such payment. To be eligible for such payment the supplies, materials, or equipment must:

(A) be identified in the Special Conditions:

(B) have been delivered and stored at a location, and in the time and manner, specified in this Contract by the Contractor or a subcontractor or supplier for use in the Work; and,

(C) be in short supply or were made specifically for this Contract.

Materials, as used herein, shall be considered to be those items which are fabricated and manufactured goods and equipment. Only those materials for which the Contractor can transfer clear title to the City will be qualified for partial payment.

To receive payment for materials and equipment delivered to the site, but not incorporated in the Work, it shall be necessary for the Contractor to submit to the Construction Manager a list of such materials at least seven (7) days prior to submitting the monthly progress billing for work completed. At the Construction Manager's discretion, the Construction Manager will approve items for which partial payment is to be made subject to the following:

a. Only equipment or materials which have received favorable review of shop drawings will qualify.

b. Eligible equipment or materials must be delivered and properly stored, protected, and maintained at the job site in a manner favorably reviewed by the Construction Manager.

c. The Contractor's actual net cost for the materials must be supported by paid invoices of suppliers or other documentation requested by the Construction Manager.

GC 5.6 RETENTION

From each progress payment estimate, ten (10) percent of the "total completed to date" sum will be deducted and retained by the City, and the remainder, less the amount of all previous payment, will be paid to the Contractor. After fifty (50) percent of the Work has been completed and if progress on the Work remaining is satisfactory, the

deduction to be made from the remaining progress payments and from the final payment may be reduced to five (5) percent of the adjusted Contract Price at the discretion of the City.

GC 5.7 OTHER WITHHOLDS

In addition to the amount which the City may otherwise retain under the Contract, the City may withhold a sufficient amount of any payment otherwise due the Contractor, as in its judgment may be necessary to cover:

a. Defective work not remedied;

b. A reasonable doubt that the Contract can be completed for the balance then unpaid;

c. Damage to another contractor, third party, or to property;

d. Failure to submit, revise, resubmit, or otherwise conform to the requirements herein for preparing and maintaining a construction schedule;

e. Failure of the Contractor to keep the Work progressing in accordance with its Progress Schedule;

f. Failure to maintain current “As-Built” record drawings;

g. Failure of the Contractor to make proper submissions, as herein specified;

h. Payments due the City from the Contractor;

i. Reduction of Contract Amount because of modifications; or

j. The Contractor's neglect or unsatisfactory prosecution of the Work, including failure to clean up.

When the above reasons for withhold amounts are removed, payment will be made to the Contractor for amounts withheld.

SECTION 6.0 CHANGE ORDERS

GC 6.1 GENERAL

Without invalidating the Contract and without notice to sureties or insurers, the City through the Construction Manager, may at any time order additions, deletions, or revisions in the Work. These will be authorized by Work Directive, Field Order, or Change Order. A Change Order will not be issued for a Work Directive unless the Construction Manager concurs with an appeal by the Contractor that such Work Directive is a change in the scope of the Contract. The Contractor shall comply promptly with the requirements of all Change Orders, Field Orders, or Work Directives. The work involved in Change Orders shall be executed under the applicable conditions and requirements of the Contract Documents. If any Field Order or Work Directive causes an increase or decrease in the Contract Amount or an extension or shortening of the Contract Time, an equitable adjustment will be made by issuing a Change Order. If the Contractor accepts a Change Order that does not include a time extension, the Contractor waives any claim for additional time for the work covered by that Change Order. Additional or extra work performed by the Contractor without written authorization of a Work Directive, Field Order or Change Order will not entitle the Contractor to an increase in the Contract Amount or an extension of the Contract Time.

Extra work shall be that work neither shown on the Contract Drawings nor specified. Such work shall be governed by all applicable provisions of the Contract Documents. In giving instructions, the Construction Manager shall have authority to make minor changes in the Work, not involving extra cost, or extra time, and not inconsistent with the intent of the Work. With the exception of an emergency which would endanger life or property, no extra work or change shall be made unless in pursuance of a written order by the City through the Construction Manager, and no claim for an addition to the total amount or total time of the Contract shall be valid unless so ordered in writing.

In case any change increases or decreases the Work shown, the Contractor shall be paid for the work actually done at a mutually agreed upon adjustment to the Contract Amount.

If the Contractor refuses to accept a Change Order, the City may issue it unilaterally. The Contractor shall comply with the requirements of the Change Order. The City shall provide for an equitable adjustment to the Contract, and compensate the Contractor accordingly. If the Contractor does not agree that the adjustment is equitable, it may submit a claim in accordance with the requirements herein stated.

GC 6.2 DIFFERING SITE CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Construction Manager in writing, of any:

a. Material that the Contractor believes may be hazardous waste that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of law.

b. Subsurface or latent physical conditions at the site differing from those indicated.

c. Unknown physical conditions at the site of any unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

The Construction Manager shall promptly investigate the conditions, and if it finds that the conditions do materially differ, or do involve hazardous waste, and cause an increase or decrease in the Contractor's cost of, or the time required for performance of any part of the Work, the City shall cause to be issued a change order under the procedures provided herein.

In the event that a dispute arises between the City and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the Work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. The Contractor

shall retain any and all rights provided either by Contract or by law which pertain to the resolution of disputes and protests between the parties.

No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required.

GC 6.3 RESOLUTION OF DISPUTES

6.3.1 CONTRACT INTERPRETATION BY THE CONSTRUCTION MANAGER

Questions regarding the meaning and intent of the Contract Documents shall be referred in writing by the Contractor to the Construction Manager. Where practical, the Construction Manager shall respond to the Contractor in writing with a decision within seven (7) working days of receipt of the request.

6.3.2 CLAIMS

A. Notice

If the Contractor disagrees with the Construction Manager's decision, or in any case where the Contractor deems additional compensation or a time extension to the Contract period is due the Contractor for work or materials not covered in the Contract or which the Construction Manager has not recognized as extra work, the Contractor shall notify the Construction Manager, in writing, of its intention to make claim. Claims pertaining to decisions based on Contract interpretation or such other determinations by the Construction Manager shall be filed in writing to the Construction Manager within five (5) days of receipt of such decision. All other claims or notices for extra work shall be filed in writing to the Construction Manager prior to the commencement of such work. Written notice shall use the words "Notice of Potential Claim". Such Notice of Potential Claim shall state the circumstances and all reasons for the claim, but need not state the amount.

It is agreed that unless notice is properly given, the Contractor shall not recover costs incurred by it as a result of the alleged extra work, changed work or other situation which, had proper notice been given, would have given rise to a right for additional compensation. The Contractor should understand that timely Notice of Potential Claim is of great importance to the Construction Manager and City, and is not merely a formality. Such notice allows the City to consider preventative action, to monitor the Contractor's increased costs resulting from the situation, to marshal facts, and to plan its affairs. Such notice by the Contractor, and the fact that the Construction Manager has kept account of the cost as aforesaid, shall not in any way be construed as proving the validity of the claim.

B. Records of Disputed Work

In proceeding with a disputed portion of the Work, the Contractor shall keep accurate and complete records of its costs and shall make available to the Construction Manager a daily summary of the hours and classifications of equipment and labor utilized on the disputed work, as well as a summary of any materials or any specialized services which are used which shall be signed by the Construction Manager and Contractor daily. Such information shall be submitted to the Construction Manager on a weekly or daily basis as determined by the Construction Manager, receipt of which shall not be construed as an authorization for or acceptance of the disputed work.

C. Submission of Claim Costs

Within thirty (30) days after the last cost of work for which the Contractor contends it is due additional compensation is incurred, but if costs are incurred over a span of more than thirty (30) days, then within fifteen (15) days after the thirtieth day and every month thereafter, the Contractor shall submit to the Construction Manager, as best the Contractor is able, its costs incurred for the claimed matter. Claims shall be made in itemized detail. Should the Construction Manager be dissatisfied with format or detail of presentation, and upon request for more or different information, the Contractor will promptly comply to the satisfaction of the Construction Manager. If the additional costs are in any respect not known with certainty, they shall be estimated as best as can be done. In case the claim is found to be just, it shall be allowed and

paid for as provided in GC 6.4, MODIFICATION PROCEDURES and GC 5.5, PARTIAL PAYMENTS.

D. Claim Meetings

The Construction Manager may call special meetings to discuss outstanding claims. The Contractor shall cooperate and attend such meetings prepared to discuss its claims, making available the personnel necessary for resolution, and all documents which may reasonably be requested by the Construction Manager.

GC 6.4 MODIFICATION PROCEDURES

6.4.1 CHANGES IN CONTRACT PRICE

Whenever corrections, alterations, or modifications of the Work under this Contract are ordered by the Construction Manager, approved by the City, and increase the amount of work to be done, such added work shall be known as extra work. When such corrections, alterations, or modifications decrease the amount of work to be done, such subtracted work shall be known as work omitted.

The difference in cost of the work affected by such change will be added to or deducted from the amount of said Contract Amount, as the case may be, by a fair and reasonable valuation, which shall be determined in one or more of the following ways as directed by the Construction Manager:

a. By unit prices accepted by the City and stated in the Contract Documents or Schedule of Values;

b. By unit prices subsequently fixed by agreement between the parties;

c. By an acceptable lump sum proposal from the Contractor; or

d. By Force Account (as described in GC 6.4.3, Force Account Payment, when directed and administered by the City or Construction Manager.

When required by the Construction Manager, the Contractor shall submit, in the form prescribed by the Construction Manager, an itemized breakdown with supporting data of the quantities and prices used in computing the value of any change that may be ordered.

The Construction Manager will review the Contractor's proposal for the change and negotiate an equitable adjustment with the Contractor. When there is an agreement, the Construction Manager will prepare and process the Change Order and make a recommendation for action by the City. All Change Orders must be signed by the Contractor and approved by the City unless unilaterally issued per GC 6.1, above.

The prices agreed upon and any agreed upon adjustment in Contract Time shall be incorporated in the written order issued by the City, which shall be written so as to indicate an acceptance on the part of the Contractor as evidenced by its signature. By signature of the Change Order, the Contractor acknowledges that the adjustments to cost and time contained in the Change Order are in full satisfaction and accord, payment in full, and so waives any right to claim any further cost and time impacts at any time during and after completion of the Contract for the changes encompassed by the Change Order.

When any Extra Work is performed by a Subcontractor, the markups established in GC 6.4.2 and GC 6.4.3 shall be applied to the Subcontractor’s costs as determined under GC 6.4.2 and GC 6.4.3. The Contractor’s markup on subcontracted work shall be limited to five percent (5%) of the total of the Subcontractor’s costs, which amount shall constitute the markup for all overhead and profit for the Contractor on work by the Subcontractor. On any item(s) of Extra Work, there shall only be one markup allowed to the Subcontractor even if there are multiple tiers of subcontractors, and only one markup allowed to the Contractor for subcontracted work.

6.4.2 NEGOTIATED CHANGE ORDERS

Under the methods described in GC 6.4.1.b and 6.4.1.c above, the Contractor shall submit substantiating documentation with an itemized breakdown of Contractor and subcontractor direct costs, including labor, material, equipment, rentals, and approved services pertaining to such ordered work in the form and detail acceptable to the Construction Manager. The direct costs shall include only the payroll cost for workers and foremen including wages, fringe benefits as established by negotiated labor agreements or state prevailing wages, workers' compensation and labor insurance, and labor taxes as established by law. No other fixed labor burdens will be considered. The cost of materials used and equipment delivered and installed in the Work shall be as substantiated by appropriate documents. The cost of construction machinery and equipment shall be based on fair rental or ownership values acceptable to the Construction Manager as described in GC 6.4.3, Force Account Payment, and the cost of incidentals directly related to such work. The direct costs shall not include any labor or office costs pertaining to the Contractor's managers or superintendents, its office and office facilities, or anyone not directly employed on such work, nor the cost of small tools, as all such indirect costs form a part of the Contractor's overhead expense.

Under the method described in GC 6.4.1.b and 6.4.1.c, the maximum percentage which will be allowed for the Contractor's combined overhead and profit will be:

Direct Labor	fifteen percent (15%)
Materials	fifteen percent (15%)
Equipment (owned or rented)	fifteen percent (15%)

The above fees represent the maximum limits which will be allowed, and they include the Contractor's indirect home office expenses and all costs for cost proposal preparation.

The amount of credit to be allowed by the Contractor to the City for any such change which results in a decrease in cost will be the amount of the actual net decrease plus a credit in accordance with the markups allowed above.

The Contractor shall not claim for anticipated profits on work that may be omitted unless the deleted amount of work is determined to constitute a cardinal change to the Project.

6.4.3 FORCE ACCOUNT PAYMENT

If either the amount of Work or payment for a Change Order cannot be determined or agreed upon beforehand, the City may direct by written Change Order, Work Directive, or Field Order that the Work be done on a force account basis. The term "force account" shall be understood to mean that payment for the Work will be done on a time and expense basis, that is, on an accounting of the Contractor's forces, materials, equipment, and other items of cost as required and actually used to do the work. In order to have a valid claim for Force Account payment, the Contractor must submit on a daily basis the City’s Daily Extra Work Report signed by both the Contractor’s representative and the City’s Construction Manager or inspector. For the work performed, payment will be made for the documented actual cost of the following:

a. Direct labor cost for workers, including foremen, who are directly assigned to the force account Work. Direct labor cost is the actual payroll cost including wages, fringe benefits as established by negotiated labor agreements or state prevailing wages, workers' compensation and labor insurance, and labor taxes as established by law. No other fixed labor burdens will be considered.

b. Material delivered and used on the designated work, including sales tax, if paid for by the Contractor or its subcontractor. Material wasted or disposed of in a manor not called for under the contract, material not unloaded from the transporting vehicle, material placed outside the limits indicated or given plans; or material remaining on hand after completion of the work will not be paid for except as otherwise provided.

GENERAL CONDITIONS

a. Equipment rental: For any machinery or equipment, the use of which has been authorized by the Construction Manager, the Contractor will be paid for the use of such machinery or equipment in the manner hereinafter specified, regardless of ownership and any rental or other agreement, if such may exist, for the use of such equipment entered into by the contractor.

Rental rates will be determined as follows:

1.1 The base rates shall be those established in publications and revisions thereto entitled "Rental Rate Blue Book for Construction Equipment" or the "Rental Rate Blue Book for Older Construction Equipment" available from Equipment Watch, 1735 Technology Drive, Suite 410, San Jose, CA 95110-1313, phone (408) 467-6700.

The hourly rate to be paid shall be the monthly rate divided by 176, multiplied by the regional adjustment factor, and multiplied by the appropriate rate adjustment factor, then plus the estimated operating cost per hour shown therein, and then rounded to the nearest $0.10.

2. Attachments (e.g. tractor with ripper and dozer or tractor with loader and backhoe) will be included in the hourly rental rate only when deemed essential to the work as determined by the Construction Manager. When multiple attachments are approved for use and are being used interchangeably, the attachment having the highest rental rate shall be the only on included for payment.

3. No direct payment will be made for necessary accessories (including replenishing blades, augers, teeth, hoses, bits, etc.) if not listed in the Rental Rate Blue Book.

4. No compensation will be allowed for shop tools having a daily rental rate of less than $10 as set forth in Section 18 of the Rental Rate Book.

If ordered to use equipment not listed in the aforementioned publications, a suitable rental rate for such equipment will be established. Contractor shall furnish any cost data which might assist in the establishment of such rental rate.

Except as provided below, payment will be made for the actual time that such equipment is in operation on the work. Time will be measured in 0.5 hours increments of actual working time and necessary traveling time of the equipment within the limits of the project.

Authorized standby time for idle equipment will be paid for at 50% of the "monthly rate divided by 176, multiplied by the regional adjustment factor, and multiplied by the rate adjustment factor", and rounded to the nearest $0.10. <u>No operating cost, markup, overhead or profit will be added</u>.

The rental rates paid as above provided shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciating, storage, insurance and all incidentals.

When special equipment has been ordered in connection with force account work, travel time and transportation to the project will be measured as hereinafter outlined. For the use of special equipment moved in on the work and used exclusively for extra work paid for on a force account basis, the rental rates as determined above and the cost of transporting the equipment to the location of the work and its return to its original location will be paid, all according to the following provisions:

(a) The original location of the equipment to be hauled to the location of the work will be agreed to in advance.

(b) The City will pay the costs of loading and unloading such equipment.

(c) The cost of transporting equipment on low bed trailers shall not exceed the hourly rates charged by established haulers.

(d) The rental period shall begin at the time the equipment is unloaded at the site of the extra work, shall include each day that the equipment is at the site of the extra work, excluding Saturdays, Sundays and legal holidays unless the extra work is performed on such days, and shall terminate at the end of the day on which the Construction Manager directs the Contractor to discontinue the use of such equipment.

(e) Should the Contractor desire the return of the equipment to a location other than its original location, the City will pay the cost of transportation by the above provisions, provided such payment shall not exceed the cost of moving the equipment to the work.

(f) Payment for transporting and loading and unloading equipment as above provided will not be made if the equipment is used on the work in any other way than upon extra work paid for on a force account basis.

To the preceding costs, there shall be added the following fees as the combined overhead and profit for the Contractor:

a. A fixed fee not-to-exceed fifteen (15) percent of the costs of Item a, labor, above.

b. A fixed fee not-to-exceed fifteen (15) percent of the costs of Item b, materials, above.

c. A fixed fee not-to-exceed fifteen (15) percent of the costs of Item c, equipment, above.

The added fixed fees shall be considered to be full compensation covering the cost of general supervision, overhead, profit, and all other expenses. The above fixed fees represent the maximum limits which will be allowed, and they include the Contractor's indirect home office expenses and all costs for cost proposal preparation and record keeping.

6.4.4 UNIT PRICE ADJUSTMENTS DUE TO INCREASED OR DECREASED QUANTITIES

The unit prices as stated in the Bid and as negotiated in Change Orders shall apply to one hundred (100) percent of the quantity indicated to be estimated quantity for the Bid item, plus or minus twenty-five (25) percent. Either party to the Contract will be entitled to an equitable adjustment in unit prices for that portion of the actual quantity less than seventy-five (75) percent or more than one hundred twenty-five (125) percent of the original Bid quantity. Such equitable adjustment shall be determined in one or more of the following ways:

A. If the parties are able to agree, the price will be determined by using:
1. Unit prices; or
2. Other agreed upon prices.

B. If the parties cannot agree, the price will be determined by the Engineer using:
1. Unit prices, or
2. Other means to establish costs.

The following limitations shall apply in determining the amount of the equitable adjustment:

A. No claim for loss of anticipated profits on deleted or uncompleted work or consequential damages of any kind will be allowed.

B. If the actual quantity of work performed is less than seventy-five (75) percent of the original Bid quantity, the total payment for the item will be limited to not more than seventy-five (75) percent of the amount originally Bid.

C. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the extent that there is an unbalanced allocation of such expenses among the contract Bid items.

D. No adjustment in the unit contract bid price will be made for any item unless the increase or decrease in quantity results in a change of $10,000 or more as measured by the original bid quantity and unit price for the item.

The City will not adjust for increases or decreases if the City has entered the amount for the Bid item in the proposal form only to provide a common basis for bidders.

6.4.5 TIME EXTENSIONS FOR CHANGE ORDERS

If the Contractor requests a time extension for the extra work necessitated by a proposed Change Order, the request must be accompanied by a time impact analysis, based on the latest Construction Schedule update, or other method acceptable to the Construction Manager.

GC 6.5 DISPUTES

Any dispute relating to this Contract after award shall be resolved through good faith efforts by the Contractor and City. The Contractor shall have the right to appeal any decision by any inspector to the Construction Manager; and, by the Construction Manager to the Owner's Representative. Initial notice of any dispute must be filed with the Construction Manager per GC 6.3.2.A, Claims - Notice.

If the Contractor considers the determination of the Construction Manager to be unfair he/she shall, within ten (10) days after receipt of the Construction Managers decision, file a written protest with the Owner's Representative stating clearly and in detail his/her objections and the reasons therefore. The Owner's Representative shall review the issue in dispute and shall promptly advise the Contractor in writing of his/her final decision. At all times, the Contractor shall carry on the Work and maintain its Construction Schedule in accordance with the requirements of the Contract and the determination of the City, pending resolution of any dispute.

If review by the Owner's Representative does not result in a resolution of the dispute, the parties shall proceed to non-binding mediation. Non-binding mediation shall be conducted under the auspices of the American Arbitration Association acting under its Construction Industry Mediation Procedures. Mediation conducted in accordance with this provision shall take place in Carson City, Nevada. Mediation shall be conducted by a single mediator, approved by both the City and the Contractor from a list provided by the American Arbitration Association. Each party shall pay one-half of the mediator's compensation and the administration fees. Each party shall bear its own expenses associated with the mediation, including but not limited to its own attorney and expert consultant fees. Each party shall have at least one individual attend the mediation proceeding who has full authority to settle the dispute on their behalf, provided however, that any agreement reached will have to be put before the Carson City Board of Supervisors or Carson City Regional Transportation Commission for final approval.

GC 6.6 ARBITRATION

Any controversy or claim arising out of or relating to the performance of these Contract Documents, which cannot be resolved by mutual agreement or mediation, shall be submitted to binding arbitration by the claiming party by filing a Notice of Intent to Arbitrate (demand) within fifteen (15) days of the conclusion of mediation, specified above in GC 6.5, DISPUTES, with the other party and three (3) copies to the American Arbitration Association or the Nevada Arbitration Association. Either party to the Contract Documents may request that any dispute or difference be arbitrated by filing a demand to arbitrate. Said demand shall contain a statement of the disputes,

the amount involved, if any, and the remedy sought. Through written mutual consent, the parties may agree to combine all disputes for a single arbitration proceeding during or after substantial completion of the Project. Such arbitration shall be conducted in accordance with the Construction Industry Arbitration Rules (which can be found at www.adr.org) administered by the American Arbitration Association or the Nevada Arbitration Association. Failure to give such notice in the time specified shall preclude the party desiring arbitration from subsequently arbitrating that particular claim, dispute, or other matter. Judgment on the award rendered by the arbitrators may be entered in the First Judicial District Court of the State of Nevada.

In the event that any controversy or claim arising out of or relating to the performance of this Contract becomes the subject of arbitration, Carson City shall have the right to join or bring an additional party to the arbitration proceeding, and the Contractor hereby irrevocably consents and agrees to such joinder.

In the event that Carson City is named as a party to any arbitration action arising out of, or resulting from the design or construction of the Project, the Contractor hereby agrees, at the request of Carson City, to be joined as a party to that arbitration proceeding and to be bound by any decision resulting from arbitration.

In the event of arbitration, it is agreed by the parties that all means of discovery, including but not limited to depositions and interrogatories, will be afforded to the parties involved in the arbitration, and the appointed arbitrator shall have all authority to impose sanctions against either party for failing to comply with the rules for discovery provided under the Nevada Rules of Civil Procedure.

Any arbitration carried out under the provisions of GC 6.6, ARBITRATION, shall be heard and determined by a three (3) member panel. From a list of arbitrators provided by the American Arbitration Association, Carson City shall select one (1) member of the panel and the Contractor shall select one (1) member of the panel. The third member of the panel shall be selected from said list by the first two (2) members and shall be approved by both Carson City and the Contractor. The third (3rd) member shall function as the Chairperson of the arbitration panel.

The Contractor shall carry on the Work and maintain progress during any arbitration or any other disputes unless otherwise mutually agreed upon in writing.

Arbitration conducted in accordance with this provision shall take place in Carson City, Nevada.

SECTION 7.0 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

GC 7.1 GENERAL

The Contractor shall provide all temporary facilities and utilities required for prosecution of the Work, protection of employees and the public, protection of the Work from damage by fire, weather or vandalism, and such other facilities as may be specified or required by any legally applicable law, ordinance, rule, or regulation.

GC 7.2 TEMPORARY UTILITIES AND CONSTRUCTION FACILITIES

7.2.1 ELECTRICAL SERVICE

The Contractor shall arrange with the local utility to provide adequate temporary electrical service at a mutually agreeable location. The Contractor shall then provide adequate jobsite distribution facilities conforming to applicable codes and safety regulations. The Contractor shall provide, at its own cost, all electric power required for construction, testing, general and security lighting, and all other purposes whether supplied through temporary or permanent facilities.

7.2.2 WATER

The Contractor shall pay for and shall provide for all facilities necessary to furnish water for its use during construction. Water used for human consumption shall be kept free from contamination and shall conform to the requirements of the state and local authorities for potable water. The Contractor shall pay for all water used for the Contractor's operations prior to final acceptance. The Contractor shall be responsible for obtaining a City water meter and paying all associated charges, including monthly water usage.

The Contractor is hereby informed that Carson City does not allow use of potable water for dust control on unpaved areas and/or earthwork compaction except for health safety concerns as determined by NDEP. The Contractor must obtain a “Treated Wastewater Effluent for Construction Purposes Permit” from the Carson City Wastewater Treatment Plant located at 3320 E. Fifth Street, Carson City. Special arrangements must be made with the Carson City Water Utility located at 3505 Butti Way, Carson City, for use of potable water for dust control on paved areas.

7.2.3 TEMPORARY LIGHTING

The Contractor shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by OSHA standards. As permanent lighting facilities are completed they may be used in lieu of temporary facilities, provided however, that bulbs, lamps, or tubes of such facilities used by the Contractor shall be replaced prior to final acceptance of the Work.

7.2.4 HEATING AND VENTILATION

The Contractor shall provide means for heating and ventilating all work areas as may be required to protect the Work from damage by freezing, high temperatures, weather, or to provide a safe environment for workers. Unvented direct fired heaters shall not be used in areas where freshly placed concrete will be exposed to the combustion gases until at least two hours after the concrete has attained its initial set.

7.2.5 SANITARY CONVENIENCES

The Contractor shall provide suitable and adequate sanitary conveniences for the use of all persons at the site of the Work. Such conveniences shall include chemical toilets or water closets and shall be located at an appropriate location at the site of the Work. All sanitary conveniences shall conform to the regulations of the public authority having jurisdiction over such matters. At the completion of the Work, all such sanitary conveniences shall be removed and the site left in a sanitary condition.

7.2.6 COMMUNICATIONS

The Contractor shall provide, at its own cost, telephone communications to the Project Site either through ground lines or cellular equipment.

7.2.7 CONSTRUCTION FACILITIES

Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and move the loads to which they will be subjected. Railings, enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided**.**

A. Staging and Falsework

Temporary supports shall be designed by a professional registered engineer with an adequate safety factor to assure adequate load bearing capability. If requested by the Construction Manager, the Contractor shall submit design calculations for staging and shoring prior to application of loads.

Excavation support shall be in accordance with GC 2.6.12 (D), Excavation Safety.

B. Temporary Enclosures

When sandblasting, spray painting, spraying of insulation, or other activities inconvenient or dangerous to property or the health of employees or the public are in progress, the area of activity shall be enclosed adequately to contain the dust, over-spray, or other hazard. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the Contractor shall provide suitable temporary enclosures.

C. Warning Devices and Barricades

The Contractor shall adequately identify and guard all hazardous areas and conditions by visual warning devices and, where necessary, physical barriers. Such devices shall, as a minimum, conform to the requirements of OSHA and MUTCD**.**

D. Use of Explosives

All persons engaged in the activities of receiving, storing, using, handling or transporting any explosives must obtain a permit from the Carson City Fire Department; and all work shall be governed by Title 14, Fire, of the Carson City Municipal Code. The Contractor must notify the Construction Manager at least 14 days prior to the use of explosives.

GC 7.3 CONSTRUCTION CONTROLS

7.3.1 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS

The Contractor shall not trespass upon private property and shall be responsible for the protection of public and private property at and adjacent to the Work and shall exercise due caution to avoid damage to such property.

The Contractor shall not infringe upon wetland areas at the Site, whether identified or not, without the written approval of the Construction Manager. Infringement on wetlands will give cause for suspension of all work being conducted on or adjacent to the wetland area.

In addition to any requirements imposed by law, the Contractor shall shore up, brace, underpin, and protect as may be necessary, all foundations and other parts of all existing structures adjacent to and adjoining the Site of the Work which are in any way affected by the excavations or other operations connected with the performance of the Work. Whenever any notice is required to be given to any adjacent or adjoining landowner or other party before commencement of any work, such notice shall be given in writing by the Contractor.

The Contractor shall repair or replace all existing improvements which are not designated for removal (e.g., curbs, sidewalks, survey points, fences, walls, signs, utility installations, pavements, structures, irrigation lines and facilities, etc.) and are damaged or removed as a result of its operations. Repairs and replacements shall be at least equal to existing improvements and shall match them in finish and dimension.

Land survey monuments and property marks shall not be moved or otherwise disturbed by the Contractor until the Contractor arranges for a Nevada licensed Land Surveyor to witness or otherwise reference their locations in accordance with the requirements of the agency having jurisdiction. Any survey monument or property mark so moved or disturbed must be re-established and re-set by a Nevada licensed Land Surveyor in accordance with the requirements of the agency having jurisdiction.

Trees, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original conditions and location as is reasonably possible or better. Where existing turf areas are damaged, they must be replaced with fresh sod of matching grass.

The Contractor shall give reasonable notice, as determined by the Construction Manager, to occupants or owners of adjacent property to permit them to salvage or relocate plants, trees, fences, sprinklers, and other improvements within the right-of-way which are designated for removal or would be destroyed because of the Work.

A. Flood Protection

During the construction period, the Contractor shall be responsible for any damage which may result from flooding, including any earthwork re-excavation or replacement that may be a result of flooding. The Contractor shall submit to the Construction Manager a flood control plan for trenching operations associated with the Work. The flood control plan shall describe the Contractor's plan for control and diversion of surface runoff and flood flows around trench and structure excavations, and the Contractor's action plan for protection of the work and Contractor's plant and equipment during flood events**.**

7.3.2 PROJECT SECURITY

The Contractor shall make adequate provision for the protection of the Work area against fire, theft, and vandalism, and for the protection of the public against exposure to injury. Contractor shall call the Carson City Sheriff's Department at 887-2008 or call 911 in the event of any public harassment or violence to any of the Contractor's or subcontractor's employees.

A. Fire Extinguisher

Sufficient number of fire extinguishers of the type and capacity required to protect the Work and ancillary facilities, shall be provided and maintained in readily accessible locations.

B. Temporary Fences

The Contractor shall enclose the site of the Work other than roadways with a fence or barricades adequate to protect the Work and temporary facilities against acts of theft, violence, or vandalism. Work within the roadway right-of-way shall be protected as provided for in the "Manual on Uniform Traffic Control Devices."

In the event all or a part of the site is to be permanently fenced, this permanent fence or a portion thereof may be built to serve for protection of the Work site, provided however, that any portions damaged or defaced shall be replaced prior to final acceptance.

Temporary openings in existing fences shall be protected to prevent intrusion by unauthorized persons. During night hours, weekends, holidays, and other times when no work is performed at the site, the Contractor shall provide temporary closures or guard service to protect such openings. Temporary openings shall be fenced when no longer necessary.

C. Graffiti Removal

The Contractor shall at all times keep all equipment, traffic control devices, materials, office trailers, storage facilities, the Work and the site free from graffiti. The Contractor shall remove all graffiti within 24 hours of notification by the Construction Manager. All expenses associated with graffiti removal shall be the responsibility of the Contractor.

7.3.3 ACCESS ROADS

Access roads shall be maintained to all storage areas and other areas to which frequent access is required. Similar roads shall be maintained to all existing facilities on the site of the Work to provide access for delivery of material and for maintenance and operation. Where such temporary roads cross buried utilities that might be injured by the loads likely to be imposed, such utilities shall be adequately protected by steel plates or wood planking, or bridges shall be provided so that no loads shall discharge on such buried utilities.

7.3.4 NOISE ABATEMENT

Operations at the site shall be performed to minimize unnecessary noise. Special measures shall be taken to suppress noise during night hours. Noise levels due to construction activity shall not exceed the following levels:

Allowable Daytime Noise Levels as measured at the exterior of any given site shall be a noise level of not more than 75 dba Leq from the hours of 7:00 AM to 8:00 PM daily.
Allowable Nighttime Noise Levels as measured at the exterior of any site shall be a noise level of not more than 55 dba Leq from the hours of 8:00 PM to 7:00 AM daily.

Internal combustion engines used on the Work shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated without said muffler.

7.3.5 WORKING HOURS

Construction shall be allowed only between the hours of seven (7:00) AM and four (4:00) PM Monday thru Friday (Normal Working Hours) unless otherwise specified in the Special Conditions.

The starting, fueling, maintenance of equipment, and delivery of equipment and materials, and placement or removal of traffic control devices is considered Construction and shall not be allowed outside of the Normal Working Hours. Requests for exceptions to these limitations shall be made in writing to the Construction Manager for consideration in non-sensitive, non-residential areas.

The Contractor may request to work outside the Normal Working Hours by submitting a written request to the Construction Manager at least seventy-two (72) hours in advance of the start of work outside the Normal Working Hours. Permission may or may not be granted by the Construction Manager, with hours noted by the Construction Manager. The Contractor shall be responsible for the costs of any inspection, testing, and additional administration incurred by the City, or its agents and representatives, for work by the Contractor outside the Normal Working Hours defined above, on weekdays in excess of eight (8) hours, or any work on weekends or holidays recognized by the City. Such costs shall be withheld from the succeeding monthly progress payment. Any work specifically required to be performed outside the Normal Working Hours as may be indicated in the Special Conditions, or work required by the Construction Manager, in writing, to be performed outside the Normal Working Hours, is excluded from withholding of payment.

7.3.6 DRAINAGE CONTROL / STORM WATER POLLUTION PREVENTION PLAN

In all construction operations, care shall be taken not to disturb existing drainage patterns whenever possible. Particular care shall be taken not to direct drainage water onto private property. Drainage water shall not be diverted to streets or drainage ways inadequate for the increased flow. Drainage means shall be provided to protect the Work and adjacent facilities from damage due to water from the site or due to altered drainage patterns from construction operations. Temporary provisions shall be made by the Contractor to insure the proper functioning of gutters, storm drain inlets, drainage ditches, culverts, irrigation ditches, and natural water courses. The Contractor shall provide water quality and erosion controls in accordance with the NDEP “Handbook of Best Management Practices” to prevent sedimentation runoff from the Site.

The Contractor shall comply with the National Pollutant Discharge Elimination System (NPDES) regulations for storm water discharges from a construction site and the Stormwater General Permit NVR100000, State of Nevada, Division of Environmental Protection, General Permit. Preparation of a Storm Water Pollution Prevention Plan (SWPPP) and compliance with the permitting requirements shall be the Contractor's responsibility. The Contractor shall submit the required Notice of Intent (NOI) to the NDEP and comply with the SWPPP referenced above. The Contractor shall obtain any required Temporary Permits prior to any discharges. The Contractor shall submit any required Notification of Termination to the NDEP upon completion of construction and final site stabilization, and shall submit to the City copies of all records associated with the permitting requirements. Contractor must submit a copy of the SWPPP permit and plan to the Construction Manager prior to the start of work.

The Contractor shall be responsible for all costs associated with complying with the permit requirements, submitting any required NOI, preparing and complying with the SWPPP, revising the SWPPP, any required submittal of the Notification of Termination, any required discharge permit and any other related costs.

7.3.7 CONSTRUCTION CLEANING

The Contractor shall, at all times, keep property on which work is in progress and the adjacent property free from accumulations of waste material, rubbish, caused by his/her operations. All surplus material shall be removed from the site immediately after completion of the work causing the surplus materials. Spillage resulting from hauling operations along or across existing streets or roads shall be removed immediately by the Contractor. All gutters and roadside ditches shall be kept clean and free from obstructions. Daily cleanup of trash, paper, and small debris subject to movement with winds shall be required**. The Contractor shall reasonably clean the immediate Work Area on a daily basis to reduce risk of personal injury as well as fire hazard.**

7.3.8 DISPOSAL OF MATERIAL

Unless otherwise specified in the Special Conditions, the Contractor shall make his/her own arrangements for disposing of construction waste materials outside the Project Site and the Contractor shall pay any and all dump fees required, except as provided below. If the Contractor arranges to dispose of construction waste materials on private property, he/she shall first obtain written permission from the property owner on whose property the disposal is to be made in which the City is absolved from any and all liability and responsibility in connection with the disposal of such material on said property. A copy of said written permission must be delivered to the Construction Manager prior to starting disposal operations. When construction waste material is disposed of as above provided, the Contractor shall conform to all required codes and permits pertaining to grading, hauling, and filling of earth or other materials. The Contractor shall contact the City's Community Development Department and the Health Department concerning such codes and permits.

Disposal of all construction waste including but not limited to all pipe, concrete, manholes, pavement, building and excavated materials, and all other appurtenances shall be disposed of in a manner consistent with all local, State and Federal laws and guidelines. Any hazardous waste shall be disposed of at hazardous waste disposal sites that are permitted to accept such wastes. All disposal site locations shall be approved in writing by the Construction Manager. A copy of the disposal plans and any required permits must be delivered to the Construction Manager prior to starting disposal operations.

Asbestos Cement Pipe (ACP) removed from the Project shall be separated from other material, manifested and delivered to the Carson City Landfill. For manifest and disposal requirements prior to removal of any ACP the Contractor shall contact:

Mr. David Bruketta
Operations Manager- Environmental
Cellular phone at (775) 230-2782

ACP Manifests are valid for ten (10) days from date of issuance.

Construction waste including but not limited to all pipe, concrete, manholes, pavement, building and excavated material, and all other appurtenances removed from the Project may be accepted free of charge at the Carson City Landfill if approved under the direction of the Construction Manager. A Landfill Disposal Form will be provided by the Carson City Inspector upon request by the Contractor. The Contractor or Contractor's agent will provide a Landfill Disposal Form, which must be signed, dated and timed by a Carson City Inspector, to the Landfill Attendant for a waiver of disposal fees for each separate load. The Contractor will pay the full disposal fee if no Landfill Disposal Form from Carson City is presented to the Landfill Attendant. Carson City will not reimburse the Contractor for disposal fees due to failure to comply with these conditions.

7.3.9 PARKING AND STORAGE AREAS

All stockpiled materials and parked equipment at the job site shall be located to avoid interference with private property and to prevent hazards to the public. Locations of stockpiles, parking areas, and equipment storage must be approved by the Construction Manager. Material and equipment may not be stored in public right-of-way unless prior approval by the Construction Manager.

GC 7.4 PUBLIC SAFETY/CONVENIENCE AND TRAFFIC CONTROL

The Contractor shall so conduct his/her operations as to offer the least possible obstruction and inconvenience to the general public, including the residents, businesses and any other contractors working in the vicinity of the Work, and he/she shall have under construction no greater length or amount of work than he/she can prosecute properly with due regard to the rights of the public. Convenient access to driveways, houses, and buildings along the line of work shall be maintained and temporary crossings shall be provided and maintained in good condition. Traffic shall not be prevented from accessing business. Maintain a minimum of one (1) access to each business property at all times. Business Access signs shall be used to direct business traffic. Not more than one (1) crossing or intersecting street or road shall be closed at any one time. Safe access must be maintained for pedestrian traffic through or around the work area at all times.

Inconvenience caused by digging across driveways and sidewalks shall be kept to a minimum by restoring the serviceability of the driveway or sidewalk as soon as possible. Contractor shall provide and identify to the Construction Manager a person to act as a community liaison person, who must be fluent in English with good communication skills, to personally contact each resident and business at least three (3) working days prior to performing any Work which effects their sewer or water service, restricts on street parking, restricts access to their property, or blocks a driveway or sidewalk. Said community liaison person shall provide written notices, pre-approved by the Construction Manager, to all such residents and businesses and must be available and able to answer their questions. Copies of notices to all properties other than single family residences provided to the Construction Manager shall include a name and signature of the person accepting the notice for those properties. The Contractor shall make every effort to provide alternate access to the property during such closure, if at all possible. The Contractor shall replace or repair any damage done to driveways or sidewalks and shall provide temporary relief in the form of steel plates and supports of adequate strength over the excavation. Access to properties must be restored during all non-working hours.

Direct access shall be provided at all times to fire stations, fire hydrants, hospitals, police stations and at all other agencies or services where emergencies may require immediate access to same.

Temporary paving replacement in front of business establishments shall be placed immediately following backfill and shall remain in place until the condition of the backfill is suitable for permanent pavement replacement.

No streets or roads shall be blocked or made inaccessible, due to the Contractor's work, without approval of the City. No open excavations shall be allowed during non-working hours. Excavations shall be backfilled to grade and, if in a pavement area, temporarily paved level with adjacent pavement or, with the prior approval of the Construction Manager, covered with steel plates during non-working hours. <u>If temporary paving and/or maintenance of temporary paving of all disturbed streets, driveways and sidewalks is not completed prior to the end of each work day, the Construction Manager may suspend the Work on the entire project, without any additional costs to the City, until the temporary paving is completed and/or properly maintained.</u> The Construction Manager shall be the judge of proper maintenance of the temporary paving.

If needed, the City will provide the Contractor with "Temporary No Parking" signs to be posted in the construction area by the Contractor to accommodate each day's work. The Contractor must post the “Temporary No Parking” signs in the construction area no less than seventy-two (72) hours prior to the effective start of such parking restrictions. Temporary No Parking hours are to conform to the Contractor’s Working hours, but in no instance shall they exceed the Working Hours as specified in GC 7.3.5 or as amended in the Special Conditions. Contractor must keep a log of day, date, time and location that the signs are posted. If, when work starts, vehicles are parked in violation of the posted restrictions, the Contractor shall call the Carson City Sheriff's Office Dispatch Center at 887-2008 to request that the violating vehicle(s) be towed. Contractor shall identify expected no parking areas on the Traffic Control Plan and shall notify the Construction Manager at least one (1) week prior to the need for the “Temporary No Parking” signs.

7.4.1 HAUL ROUTES

Prior to hauling, the Contractor shall submit for approval the proposed route(s) for all construction traffic on the Project. This shall include any designated routes, if any, shown on the Contract Drawings. Upon approval, the Contractor shall adhere to approved routes only.

7.4.2 TRAFFIC CONTROL

During construction within traffic roadways the Contractor shall maintain no less than one (1) lane of traffic during working hours and two (2) lanes at all other times. When one-way traffic is in effect, the Contractor shall employ no less than two (2) flaggers to facilitate the safe flow of traffic. No streets or roads shall be blocked, closed or made inaccessible due to the Contractor’s work, without the prior approval of the Construction Manager.

The Contractor shall provide and maintain traffic control devices such as signs, warning lights, reflectors, barriers, fences, flaggers, steel plates, barricades, light signs and other necessary safety devices and measures on all sides of the construction zone, the number, size, message and spacing of which shall be governed by the Traffic Control Plans, local ordinance, or permit requirements. Traffic control shall be in accordance with the MUTCD. Any Traffic Control for work within NDOT right-of-way shall be in accordance with the NDOT permit requirements. The Contractor shall submit for approval by the City and any other applicable agency, its traffic control plans at least two (2) weeks prior to beginning work on public streets in accordance with GC 4.0, SHOP DRAWINGS AND QUALITY CONTROL.

The Contractor shall designate a Traffic Control Supervisor who shall be responsible for preparing and signing all Traffic Control Plans, and for installing and maintaining all traffic control devices as shown on the approved Traffic Control Plans. Said Traffic Control Plans must be per the provisions of the MUTCD and any Special Conditions. The Traffic Control Supervisor shall be available to be contacted by the Construction Manager twenty-four (24) hours per day for the duration of the Contract. The Traffic Control supervisor must be certified as a worksite traffic supervisor by ATSSA. As a minimum, the Traffic Control Supervisor shall check all traffic control devices at the start, mid-day, and end of each work day and at least once on every non-working day.

In addition to the flaggers required above, the Contractor shall employ flaggers at places designated by the Construction Manager for the safe movement of the public through the Work area. Flaggers shall possess a valid flagger card attesting that they have satisfactorily completed an instructional course in flagger procedures conducted by NDOT or some other approved course given by another entity of government within the State of Nevada.

No material or equipment shall be stored or parked where it will interfere with the free and safe passage of public traffic, and at the end of each day's work, and at other times when construction operations are suspended for any reason, the Contractor shall remove all materials, equipment and other obstructions from the public right-of-way. With the prior approval of the Construction Manager, the Contractor may shield the public traffic from materials or equipment within the public right-of-way by the use of temporary concrete or water filled barrier rails.

The Contractor shall notify the Carson City Fire Department and Sheriff Department dispatch center at (775) 887-2008 at least twenty-four (24) hours in advance of rerouting public traffic when traffic patterns

are to be altered due to construction operations. Said notification shall set forth the specific traffic patterns to be provided in lieu of the normal routing and the estimated duration of such change(s).

Should the Contractor appear to be negligent in furnishing or maintaining warning and protective measures, as above provided, the Construction Manager may direct attention to the existence of the hazard, and the necessary warning and protective measures shall be immediately furnished and installed by the Contractor at its expense. Failure to do so will be cause to suspend the Work until the deficiency is corrected. If the Contractor does not correct a Traffic Control deficiency by the end of the work day and the Construction Manager determines that the public safety is endangered, then the Construction Manager may take the necessary action to correct the deficiency pursuant to GC 2.5.4, City's Right to Carry Out the Work.

7.4.3 TRAFFIC DETOURS

Detouring traffic to private streets shall not be allowed. Advance warning/detour signs shall be used to direct through-traffic, and shall be placed to notify traffic to avoid all possible situations that require individual motorists to turn around to avoid the closure. The advanced warning signs shall be placed in accordance with the approved Traffic Control Plan. No detour or street closure signing shall be placed on any street prior to the start of Work hours and shall be removed prior to the end of Work hours unless otherwise provided in the approved Traffic Control Plan.

7.4.4 PEDESTRIAN AND BICYCLE DETOURS

Advanced warning/detour signs shall be placed to notify pedestrian and bicycle traffic of any closure and to avoid all possible situations that may require individuals to turn around to avoid the closure.

GC 7.5 PROJECT SIGNS

If required by Contract Special Conditions, the Contractor shall provide, install and maintain for the duration of the Project, Project sign(s). Two (2) signs shall be required for pipeline projects. The sign(s) shall be installed within fifteen (15) days of the Notice to Proceed and shall be installed where directed by the Construction Manager. The Project Sign(s) shall conform to the requirements listed in the Special Conditions.

GC 7.6 PROJECT OFFICE

Unless the Contractor has an office in the Carson City/Reno/Sparks area, the Contractor shall maintain a suitable office on the Project site. The Contractor shall maintain at the Project site copies of the Contract Documents, record drawings, Project schedule, submittals, permits, Material Safety Data Sheets, approved Traffic Control Plans, and other relevant documents which shall be accessible to the Construction Manager and other City representatives during normal working hours. Said site office shall be the headquarters of the Contractor's representative authorized to receive Drawings, instructions, or other communications or articles from the City or its agents unless the Contractor notifies the City otherwise per GC 2.6.1, Office.

GC 7.7 STORAGE OF MATERIALS

Materials shall be stored in such a manner as to ensure the preservation of their quality and fitness for the Work. When required by the Construction Manager, materials shall be placed on platforms or other hard, clean surfaces and covered.

Materials shall be stored so as to facilitate inspection. Storage areas shall be suitably fenced if necessary to protect the public or the material.

Locations and arrangements for storage sites for materials and equipment outside the limits of work, shall be selected and maintained by the Contractor at the Contractor's expense. Prior to occupying a storage site on private property, the Contractor shall submit a letter or agreement signed by the private property owner that authorizes the Contractor to occupy the private property. The City shall be specifically exempted in any agreement from any liability incurred from the use of private property for construction purposes. Use of portions of the City's area at the site for materials and equipment storage shall be permitted upon the approval of the Construction Manager.

GC 7.8 HAZARDOUS MATERIALS

The storage and handling of potential pollution-causing and hazardous materials, including but not necessarily limited to: gasoline, oil, and paint shall be in accordance with all local, state, and federal requirements. All hazardous materials shall be stored and handled in accordance with the Material Safety Data Sheets for the products. Material Safety Data Sheets shall be submitted to the Construction Manager prior to the delivery of materials to the Project site. Copies of the Material Safety Data Sheets shall be maintained at the Project Site in a readily accessible location.

GC 7.9 SYSTEM TESTING

The Contractor shall test the facilities as specified in the Technical Specifications. The Contractor shall provide all other necessary facilities for conducting the tests including but not limited to: personnel, power, water, equipment, and chemicals. The Contractor shall provide a minimum of forty-eight (48) hours notice to the Construction Manager of its readiness and intent prior to each test.

GC 7.10 COORDINATION/COOPERATION WITH UTILITIES

Within the construction limits of this Project may be various utility systems including water, reclaimed water, sanitary sewers, storm drains, gas, telephone, cable television, and electric power. The approximate location of known main line utilities, as taken from existing records, is shown on the Drawings. The service connections to these facilities may not be shown on the Drawings, however, the Contractor shall field locate and protect all service connections from damage during the course of the Work. The full costs for locating and protecting such service connections shall be included in the various items of work and no additional compensation shall be allowed. Where underground main utility distribution lines are shown on the plans or marked in the field, the Contractor shall assume that every property parcel is served by service connections for each type of utility. The City and Engineer do not guarantee that all existing utilities and facilities are shown on the Drawings or that they are shown in their actual position. The Contractor shall consider it normal and expected that the elevation and alignment of said utilities may vary from that shown on the Drawings, and also that utilities may be encountered that are not shown on the Drawings. Also consider it normal and expected that utilities will prove to be an impediment to the operations and that use of other than the usual equipment and construction methods in accomplishing the necessary work over, around or under such utility installations may be necessary. Should a discrepancy be found on the Drawings, it shall not be construed to relieve the Contractor from his/her responsibility to protect any such utility or facility.

The City has notified all utility companies, all pipeline owners, or other parties known to be affected by the Project and has endeavored to have all necessary adjustments of their facilities and other appurtenances made as soon as possible to eliminate conflicts within or adjacent to the limits of construction. The Contractor shall be responsible to protect and/or support all utilities which do not have to be relocated, but which do affect the Work. Where the City has made arrangements with utility owners to relocate or adjust their facilities, the City's responsibility for such adjustments are shown on and called out at the specific locations on the plans.

Any delays to the Contractor’s operations performing the current critical item(s) of work on the latest favorably reviewed Construction Schedules as a direct result of utility or other facilities not being rearranged as herein provided (other than delays in connection with rearrangements made to facilitate Contractor’s construction operations) will be considered excusable delays within the meaning of GC 3.12.2, Excusable Delays.

It shall be the Contractor’s full responsibility to call Underground Service Alert (USA) at (1-800-227-2600) not less than two (2) working days, but not more than fourteen (14) calendar days, prior to performing any excavation, for location mark-out of any underground utilities and obtaining an inquiry identification number. Contractor must comply with all instructions received from USA.

Note: Per NRS 455.082, the approximate location of a subsurface installation marked in response to a notice to USA means a strip of land not more than twenty-four (24) inches on either side of the exterior surface of a subsurface installation.

If a private underground utility such as gas, electric, telephone or cable television facility must be located or adjusted for construction operations and its location differs by more than twenty-four (24) inches on either side of the exterior surface of the subsurface facility from that shown on the plans or marked in the field, the City shall

reimburse the Contractor, as extra work, for the difference between the costs incurred in finding the actual location of the facility and the costs of finding the reputed location of the facility.

Contractor shall pothole all indicated, shown, or marked utilities and points of connection to verify their exact location. The Contractor shall have the proposed Work laid out in the filed by a Nevada Licensed Professional Land Surveyor or the Surveyor's subordinates prior to commencing with the potholing. The Contractor shall then pothole prior to performing any other Work including saw cutting for the work. The Contractor shall obtain date (on a form provided by the Construction Manager) to include type, size, and dimensions, material, location and elevation of the underground utilities, referenced to the Surveyor's lay out stakes for each pothole. The Contractor shall provide to the Construction Manager, all data, and shall identify to the Construction Manager any facilities which conflict with the Work on the day the pothole is performed. Carson City will not be responsible for any damages, delays or standby time caused by the Contractor's failure to perform potholing prior to commencement of the Work, failure to provide the data or identify the conflicts when specified, or failure to locate services, laterals or points of connections.

Carson City will be responsible for repairs, damages and standby time caused the Contractor due to non-marking, mis-marking or mis-locating, as defined in NRS 455.082, of the City's main line water mains, reclaimed water mains, sanitary sewer main lines and storm drains. Compensation to the Contractor for such repairs, damages or standby time shall be calculated on the basis of GC 6.4.3, Force Account Payment. NOTE: This provision does not apply to service laterals/connections unless the Contractor can show he/she used diligence in trying to locate each service.

The Contractor shall not interrupt the service function or disturb the support of any utility without authority from the utility owner. All valves, switches, manholes, vaults, and meters shall be maintained readily accessible for emergency shutoff or access. In case it should be necessary to move or temporarily maintain the property of any utility, the cost of which is not required to be borne by the owner thereof, the Contractor shall bear all time required and all expenses incidental to the removal or temporary maintenance of such property in a manner satisfactory to the owner thereof. The work necessary to the raising, lowering, or relocating of a utility may be done by the owner of the utility or by the Contractor, at the option of the utility owner. All work shall be in accordance with the utility owner's standards, and shall be at the Contractor's time and expense unless otherwise expressly provided for in the Special Conditions.

The Contractor shall repair or replace all utilities damaged or destroyed due to his/her operations, even in the event such damage or destruction occurs after backfilling or is not discovered until after completion of backfilling. The Contractor shall resolve all crossing and clearance problems with the utility company concerned and the Construction Manager. The right is reserved to the State, County, City, and owners of private utilities and franchises to enter at any time upon any street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work and for the purpose of maintaining and making repairs to their property.

In cases where water or sewer mains, or service connections thereto, are accidentally broken or, with the prior approval of the Construction Manager, are intentionally cut by the Contractor, they shall be fully repaired to City specifications and returned to service within four (4) hours, or sooner if deemed necessary by the Construction Manager. The Contractor is to make these repairs a priority over other portions of the Work.

At all times allow the Fire Department access to fire hydrants. Do not place materials or other obstructions closer to a fire hydrant than permitted by ordinance, rules, or regulations or within fifteen (15) feet of the fire hydrant in the absence of such ordinances, rules, or regulations.

GC 7.11 CONTAMINATED GROUNDWATER and/or SOIL

Contaminated groundwater and/or soil may exist anywhere within the Project limits. If contaminated groundwater and/or soil are encountered during construction, the Contractor must act in accordance with all applicable Federal, State, and local laws and Nevada Administrative Code 445A.347, which requires the Nevada Department of Environmental Protection be notified within twenty-four (24) hours of the encounter at (775) 687-4670.

GC 7.12 DUST CONTROL

The Contractor is responsible for the control of dust originating from any and all of the Contractor's construction operations either within or outside of the Work Area at all times in accordance with Federal, State and local laws, at the Contractor's expense. In areas where fugitive dust is a nuisance, the Contractor shall, as often as necessary, wet down the area to prevent dusty conditions. This includes weekends and holidays. The Contractor shall contact NDEP to determine if a Ground Disturbance Permit is required.

GC 7.13 BY-PASS PUMPING OF SANITARY SEWER

The Contractor shall prepare and submit to the Construction Manager a plan for by-pass pumping of sanitary sewers which will provide for adequate size pumps and hoses to carry the flows from one manhole to another. Hoses must be rated for traffic if traffic is allowed on the roadway where the hose is placed. Provide a backup pump, replacement hose sections and a backup power source at the work site prior to commencing any by-pass pumping operations. Contractor must test the by-pass pumping system, including the backup pump, in the presence of the Construction Manager or his/her representative prior to effecting the flow in the existing sanitary sewer to be diverted. Contractor must identify and have available during pumping operations a person capable and qualified to make emergency repairs in case of a failure of any part of the by-pass pumping operation. The Contractor shall ensure that no spillage of raw sewage will occur on or in the ground. The by-pass pumping plan shall also address how an accidental spill of raw sewage would be contained and mitigated.

SECTION 8.0 CONTRACT COMPLETION, O&M MANUALS

GC 8.1 INTERMEDIATE COMPLETION

When an intermediate milestone is specified in the Contract Documents, and the Contractor considers that a Work element, section, or division has met the intermediate completion stage requirements, the Contractor shall notify the Construction Manager in writing. Upon receipt of the notification, the Construction Manager and the City will make inspection to determine if the Work element, section or division is sufficiently complete in accordance with the Contract Documents to determine its acceptability for Intermediate Completion and for determination of any other items which do not meet the terms of the Contract so the City can occupy or utilize the Work for its intended use. Upon verification that the Work element, section, or division meets the contractual requirements for Intermediate Completion, the Construction Manager shall prepare a Notice of Intermediate Completion letter for the City's signature. The notice shall establish the date of Intermediate Completion, the responsibilities of the City and Contractor for maintenance, utilities, and damage to the subject Work. If items are found which prevent such use or occupancy, the Construction Manager shall notify the Contractor of such items.

Upon the completion of such corrective work, the Contractor shall so notify the Construction Manager in writing. The Contractor agrees to pay the City's actual costs including, but not limited to, charges for engineering, inspection and administration incurred due to the Contractor's failure to complete the punch list work within the time period specified.

Unless otherwise specified under Special Conditions, no partial acceptance of any portion of the Work will be made and no acceptance other than the final acceptance of the overall completed Project will be made. No review pertaining to specific parts of the Project shall be construed as final acceptance of any part until the overall final acceptance by the City is made. Final payment for completed portions of Work will not be made until final acceptance of the total Work.

GC 8.2 SUBSTANTIAL COMPLETION

When the Contractor considers that all Work required by this Contract including equipment start-up and testing is substantially complete, the Contractor shall notify the Construction Manager in writing. Upon receipt of the notification, the Construction Manager and the City will make inspection to determine if the Work is sufficiently complete in accordance with the Contract Documents to determine its acceptability for Substantial Completion and for determination of any other items which do not meet the terms of the Contract so the City can occupy or utilize the Work for its intended use. If items are found which prevent such use or occupancy, the Construction Manager shall notify the Contractor of such items. Upon verification that the Project is substantially complete, the Construction Manager shall prepare a Notice of Substantial Completion letter for the City's signature. The notice shall establish the date of Substantial Completion and the responsibilities of the City and Contractor for maintenance, utilities, and damage to the Work.

GC 8.3 CONSTRUCTION COMPLETION, FINAL INSPECTION, PAYMENT, AND ACCEPTANCE

When the Contractor considers that all Work including record drawings, operation and maintenance manuals, and cleanup has been completed in accordance with the terms of the Contract, the Contractor shall notify the Construction Manager. Upon notification, the Construction Manager and the City will make the pre-final inspection to determine the actual status of the Work in accordance with the terms of the Contract. If materials, equipment, or workmanship are found which do not meet the terms of the Contract, the Construction Manager shall prepare a final punch list of such items and submit it to the Contractor. Following completion by the Contractor of the corrective work, required by the punch list, the Construction Manager shall notify the City that the Work has been completed in accordance with the Contract. A final inspection will be made to determine the acceptability of the Work. After completion of the Work, but prior to its acceptance by the City, the last partial payment will be made to the Contractor.

After receipt of the last partial payment, but prior to acceptance of the Work by the Carson City Board of Supervisors or Carson City Regional Transportation Commission, the Contractor shall send a letter to the Construction Manager submitting lien releases for all material, or labor for any work covered by this Contract. The letter shall state that acceptance of the final payment described below shall operate as and shall be, a release to the City, the Construction Manager, the Design Consultant, and their duly authorized agents, from all claims

and/or liability to the Contract arising by virtue of the Contract related to those amounts. Disputed Contract claims in stated amounts previously filed as provided in GC 6.3.2, Claims, may be specifically excluded by the Contractor from the operation of the release.
Following receipt of all required submittals, the Construction Manager's written statement that construction is complete, and recommendation from the City's representative to accept the Project, the Construction Manager shall prepare an agenda item for the Carson City Board of Supervisor's or Carson City Regional Transportation Commission's acceptance of the completed Work and a Notice of Completion.

Following the acceptance by the Carson City Board of Supervisors or the Carson City Regional Transportation Commission of the completed Work embraced in the Contract, the City will cause to be recorded in the office of the County Recorder a Notice of Completion.

Thirty (30) days after recording the Notice of Completion of the Work involved in the Contract, the City will pay the Contractor such sums of money as may be due the Contractor including all sums retained but excluding such sums as have previously been paid the Contractor. This payment will constitute the final payment to the Contractor under this Contract.

GC 8.4 OPERATION AND MAINTENANCE MANUALS

Prior to the delivery and installation of any item of machinery or equipment, the Contractor shall submit one (1) copy of the Operation and Maintenance Manual(s) as required by the Technical Specifications. The manual(s) will be reviewed by the Construction Manager and/or Design Consultant for content and the Construction Manager will advise the Contractor within five (5) working days of receipt if the manual is acceptable for the delivery and installation of the equipment or machinery. No equipment or machinery shall be tested or installed if the general content of the manual is found to be deficient. The final Operation and Maintenance Manuals, three (3) copies, must be submitted and favorably reviewed prior to final acceptance.

GC 8.5 EQUIPMENT START-UP

After all acceptance tests have been completed by the Contractor, but prior to final acceptance, the Contractor shall recheck all equipment for proper alignment and adjustment, check oil levels, relubricate all bearing and wearing points, and assure that all equipment is in proper condition for regular continuous operation. Final start-up of equipment requires forty-eight (48) hours advance notice to the Construction Manager and coordination with the user department of the City. Start-ups shall only occur Monday through Thursday.

GC 8.6 FINAL CLEAN UP

At the completion of the Work and before final inspection, the Contractor shall clean the Work Area, material sites, adjacent property and streets and all grounds occupied by the Contractor in connection with the Work of all rubbish, excess and waste materials, as well as all his/her tools, construction equipment, machinery and temporary facilities. All parts of the Work shall be left in a neat and clean condition. If the Contractor fails to clean up at the completion of the Work, the City may do so and the cost shall be charged to the Contractor.

GC 8.7 WARRANTY OF TITLE

No material, supplies, or equipment for the Work under this Contract shall be purchased subject to any chattel mortgage, security agreement, or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants clear title to all material, supplies, and equipment installed or incorporated in the Work and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by the Contractor, to the City free from any claim, liens, security interest, or charges, and further agrees that neither the Contractor nor any person, firm, or corporation furnishing any materials or labor for any work covered by this Contract shall have any claims, liens, security interests or charges against this Project, provided that this shall not preclude the Contractor from installing metering devices or other equipment of utility companies, the title of which is commonly retained by the utility company. Nothing contained in this Section, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection or any right under any law permitting such persons to look to funds due the Contractor in the hands of the City. The provisions of this Section shall be inserted in all subcontracts and material contracts, and notices of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

GC 8.8 RECORD DRAWINGS

The Contractor shall keep at the Site a copy of the Contract drawings and specifications, including addenda and change orders, to which the Design Consultant, Construction Manager, and City shall have access at all times.

The Contractor shall maintain one (1) set of specifications and full size drawing prints and mark thereon in red any and all deviations from plan dimensions, elevations, or orientations, and all changes from addenda, change orders, and clarifications. Marked prints shall be updated at least weekly and shall be available to the City for review. Prior to Final
Acceptance by the City, the Contractor shall submit the record Drawings to the Construction Manager in the manner and format specified in the Special Conditions.

GC 8.9 WARRANTY

The Contractor hereby agrees to make, at its own expense, all repairs or removals and replacements necessitated by defects in materials or workmanship supplied under the terms of this Contract, and to pay for any damage to other works resulting from repairs or removals and replacements of such defects which become evident within one (1) year after the date of Substantial Completion of the Project by Carson City or within such longer period of time as may be prescribed by law or by the terms of any applicable technical specification. The Contractor further assumes responsibility for a similar guarantee for all work and materials provided by subcontractors or manufacturers of packaged equipment components. The Contractor also agrees to indemnify, defend, and hold the City, and it's officers, agents, employees, and volunteers harmless from liability of any kind arising from damage due to said defects.

The Contractor shall execute and submit a completed Warranty Form in the format as appended to this section for the Work. The Warranty Form shall be submitted prior to the final acceptance of the Project or within five (5) days of the occupancy or use of a portion of the Work, whichever is applicable.

The Contractor shall, upon the receipt of written notice from the City, promptly make all repairs or removals and replacements arising out of defective materials, workmanship, or equipment. The City is hereby authorized to make such repairs or removals and replacements, and the Contractor and its Surety shall be liable for the cost thereof, if five (5) days after receipt of such written notice to the Contractor, the Contractor has failed to make or undertake the repairs or removals and replacements with due diligence. In case of emergency, where in the opinion of the City delay could cause serious loss or damage, repairs or removals and replacements may be made without notice being sent to the Contractor, and the expense in connection therewith shall be charged to the Contractor, and its Surety shall be liable for the cost thereof. Such action by the City shall not relieve the Contractor of the guarantees required by this Section or elsewhere in the Contract Documents.

This Section does not in any way limit the warranty on any items for which a longer warranty is specified or on any items for which a manufacturer or supplier gives a warranty for a longer period. The Contractor agrees to act as a co-guarantor with such manufacturer or supplier and shall furnish the City all appropriate guarantee or warranty certificates upon completion of the Work. No warranty period, whether provided for in this Section or elsewhere, shall in any way limit the liability of the Contractor or his/her sureties or insurers under the indemnity or insurance provisions of these General Conditions.

Prior to the expiration of the Warranty period, the City reserves the right to hold a meeting with the Contractor. The purpose of the meeting would be to review warranties, bonds, and maintenance requirements and determine required repair or replacement requirements of defective items.

For the purpose of this paragraph, acceptance of the Work or a portion of the Work by the City, shall not extinguish any covenant or agreement on the part of the Contractor to be performed or fulfilled under this Contract which has not, in fact, been performed or fulfilled at the time of such acceptance. All covenants and agreements shall continue to be binding on the Contractor until they have been fulfilled.

GENERAL CONDITIONS

WARRANTY FORM

Warranty For

_____(Project/Component)

_____(Location)

We hereby guarantee the _____(Project/Component)_____ that we have constructed for a period of one (1) year from _____(Date)_____ the date of Substantial Completion of the Work set by Carson City.

The following items are excluded from the provisions of this warranty:

We agree that if any of the material or equipment should fail due to any reason other than improper maintenance or improper operation, if any pipe or appurtenances should develop leakage, or if any settlement of fill or backfill occurs, or should any portion of the Work fail to fulfill any of the requirements of the Contract Documents, we will, within five (5) days of receipt of written notice of such defects, commence to repair or replace the same together with any other work which may be damaged or displaced in so doing.

In the event of our failure to comply with the above mentioned conditions within a reasonable time after being notified, or should the urgency of the case require repairs or replacements to be made before we can be notified or respond to notification, we do hereby authorize Carson City, to proceed to have the defect repaired and made good at our expense, and we will pay the cost therefor upon demand.

The warranty provided herein shall not be in lieu of, but shall be in addition to any warranties or other obligations otherwise imposed by the Contract Documents and by law.

Contractor:

Signed:

Title:

Date:

SECTION 9.0 PREVAILING WAGE

GC 9.1 PREVAILING WAGE RATES

A. The Contractor and subcontractors shall be bound by and comply with all federal, state and local laws with regard to minimum wages, overtime work, hiring and discrimination, including Chapter 338 of the NRS, which is entitled, "Public Works Projects." The Contractor shall ensure that all employees on the work site are paid in accordance with the CURRENT PREVAILING WAGE RATES AS APPROVED BY THE STATE LABOR COMMISSIONER, whenever the actual value of the Contract totals One Hundred Thousand Dollars ($100,000) or more, or when required by the Special Conditions. A copy of the rates are attached hereto and included herein. If a Change Order causes a Contract to exceed One Hundred Thousand Dollars ($100,000), the State Labor Commissioner may audit the entire Contract period.

When federal money is associated with the project making the Contract subject to both state and federal wage rates, the Contractor shall not pay less than the higher rate when the two rates differ for similar kinds of labor.

Questions involving the Prevailing Wage Rates for Carson City should be referred to the Labor Commissioner, State of Nevada, at (775)687-4850.

B. Posting of Minimum Wage Rates - In accordance with NRS, Chapter 338, Section 338.020, the Contractor shall post the hourly and daily rate of wages to be paid to each of the classes of mechanics and workers on the site of Work of this Contract in a place generally visible to the workers.

C. Pursuant to NRS 338.060 and 338.070, the Contractor hereby agrees to forfeit, as a penalty to the City, not less than Twenty Dollars ($20) nor more than Fifty Dollars ($50) for each calendar day or portion thereof that each worker employed on the Contract is paid less than the designated rate for any work done under the Contract, by the Contractor or any subcontractor under him/her, or is not reported to the City as required by NRS 338.070.

D. The Contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name, the occupation and the actual per diem, wages and benefits paid to each worker employed by him/her in connection with the public Work. The General Contractor shall collect the wage reports from the Sub-Contractors and ensure the receipt of a certified copy of each weekly payroll for submission to the City as one complete package.

E. The record must be open at all reasonable hours to the inspection of the City, and its officers and agents. A copy of the record for each calendar week for the General Contractor and all Sub-Contractors must be sent to the City by the General Contractor no later than one (1) week after the end of the week. The copy must be open to public inspection as provided in NRS 239.010.

F. The Contractor and all subcontractors hereby agree not to hinder on-site interviews of the Contractor's or subcontractor's workers by the Construction Manager or his/her representative to verify that the workers are being paid the prevailing wage rates.

G. It is unlawful for any Contractor in connection with the performance of work under a contract with the state, or any of its political subdivisions, when payment of the Contract Price, or any part of such payment, is to be made from public funds, to refuse to employ or to discharge from employment any person because of his/her race, color, creed, national origin, sex, sexual preference or age, or to discriminate against a person with respect to hire, tenure, advancement, compensation or other terms, conditions or privileges of employment because of his/her race, creed, color, national origin, sex, sexual preference or age. The Contractor agrees to insert this

provision in all subcontracts hereunder except subcontracts for standard commercial supplies or raw materials.

GC 9.2 NO EXTRA COMPENSATION

All work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the City. In case of extra work under the provisions of GC 6.4, MODIFICATION PROCEDURES, no additional payment will be made to the Contractor because of the payment by him/her of overtime wage rates for such work unless the use of overtime work in connection with such extra work is specifically ordered in writing by the City.

END OF GENERAL CONDITIONS

SPECIAL CONDITIONS

These Special Conditions amend or supplement the Standard Terms and Conditions and General Conditions of the Contract and add other Special Conditions to the contract document as indicated below, and amend or supplement the Technical Specifications. All provisions of the Contract which are not so amended or supplemented remain in full force and effect.

SC.1 EXPLOSION, COLLAPSE AND UNDERGROUND INSURANCE

The CONTRACTOR shall carry insurance coverage for explosion, collapse, and underground hazards with limits of not less than One Million Dollars ($1,000,000) per occurrence combined single limit “per accident” for bodily injury and property damage and as specified in CA.4.G.

SC.2 BUILDER’S RISK INSURANCE

The CONTRACTOR shall carry builder’s risk insurance coverage as specified in CA.4.H.

SC.3 GC 3.4, ORDER OF WORK

Reference Section 01_14_00, Work Restrictions. This Section shall be considered as SC.3, Order of Work:

SC.4. GC 3.5, TIME OF PERFORMANCE

The CONTRACTOR shall complete the Work within 153 days from the Notice to Proceed. The specific milestones for portions of the Work are as follows:

1. **Milestone 1:** Digester cleaning, preparation, and wall repairs.
2. **Milestone 2:** Construction of new Digester Number 1 dome with associated mechanical and electrical appurtenances.
3. **Milestone 3:** Start-up and commissioning.

SC.5 GC3.23, PRE-INSTALLATION MEETINGS

1 General: Meet with manufacturers and installers of major units of construction which require coordination between subcontractors.
2 Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
3 Schedule meeting at least 7 days in advance of installation.
4 Conduct meetings in CONTRACTOR's field office or other mutually agreed upon place.
5 Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.
6 Invite OWNER and ENGINEER.
7 Preside at meetings.
8 Record minutes of meeting and distribute copies of minutes within 3 days of meeting to participants and interested parties.

SC.6 GC 3.11, CONSTRUCITON SCHEDULES

A Type “A” Construction Schedule is required. The schedule must be accepted by the OWNER prior to the beginning of work.

SPECIAL CONDITIONS

SC.7 GC 3.13, LIQUIDATED DAMAGES

Add the following:

Liquidated damages shall be $1,000 per calendar day for failure to complete the Work within the time specified under SC.4, Time of Performance, above.

SC.8 GC 4.0, SHOP DRAWINGS AND QUALITY CONTROL/INSPECTIONS

The CONTRACTOR shall provide submittals as indicated in the Technical Specifications.

SC.9 GC 4.5.2, PERMIT AND CODE COMPLIANCE INSPECTIONS

CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE

	Verification and Inspection	Continuous	Periodic
1.	Inspection of reinforcing steel, including prestressing tendons, and placement.	–	X
2.	Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5B.	–	–
3.	Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased.	X	–
4.	Verifying use of required design mix.	–	X
5.	At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	–
6.	Inspection of concrete and shotcrete placement for proper application techniques.	X	–
7.	Inspection for maintenance of specified curing temperature and techniques.	–	X
8.	Inspection of prestressed concrete:		
	a. Application of prestressing forces.	X	–
	b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.	X	–
9.	Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	–	X

MASONRY SPECIAL INSPECTION SCHEDULE

		Frequency of Inspection	
	Verification and Inspection	Continuous During Task Listed	Periodic During Task Listed
1.	As masonry construction begins, the following shall be verified for compliance:	–	X
	a. Proportions of site-prepared mortar.		X
	b. Construction of mortar joints.	–	X
	c. Location of reinforcement and connectors.		X

Verification and Inspection	Frequency of Inspection: Continuous During Task Listed	Frequency of Inspection: Periodic During Task Listed
d. Prestressing technique.	–	X
e. Grade and size of prestressing tendons and anchorages.	–	X
2. The inspection program shall verify:		
a. Size and location of structural elements.	–	X
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	–	X
c. Specified size, grade, and type of reinforcement.	–	X
d. Welding of reinforcing bars.	X	–
e. Protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F).	–	X
f. Application and measurement of prestressing force.	–	X
3. Prior to grouting, the following shall be verified for compliance:		
a. Grout space is clean.		X
b. Placement of reinforcement and connectors and prestressing tendons and anchorages.	–	X
c. Proportions of site-prepared grout and prestressing grout for bonded tendons.		X
d. Construction of mortar joints.		X
4. Grout placement shall be verified for compliance with code and construction document provisions.	X	–
a. Grouting of prestressing bonded tendons.	X	–
5. Preparation of any required grout specimens, mortar specimens, and/or prisms shall be observed.	X	–
6. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	–	X

SC.10 GC 4.6, CUTTING AND PATCHING

Reference Section 01_73_29, Cutting and patching, Paragraph 3.02. This section shall be considered as SC.10, Cutting and Patching.

SC.11 GC 4.7, SELECTIVE DEMOLITION

Reference Section 01_35_21, Selective Demolition. This section hall be considered as SC.11 Selective Demolition.

SC.12 GC 8.5.1, TESTING, TRAINING, AND FACILITY START-UP

Reference Section 01_75_17 Testing, Training, and Facility Start-Up. This section should be considered as SC.12, Testing, Training and Facility Start-Up.

SC.13 GC 5.5, PARTIAL PAYMENTS

Add the following:
Divide the Work into the following Schedule of Values:

1. General:
    a. Mobilization (not more than 5% of the Total Contract Price (TCP).
    b. General Requirements (Not more than 0.5% of TCP).
    c. Record Drawings (Not less than 0.5% of TCP).
    d. Operation and Maintenance Manuals (Not less than 0.5% of TCP).
    e. Demobilization and Site Maintenance (Not less than 3% of TCP).
    f. Other (Provide breakdown).
2. Digester cleaning and preparation (Provide breakdown).
3. Demolition (Provide breakdown).
4. Construction of new digester dome (Provide breakdown).
5. Piping (Provide breakdown).
6. General Electrical (Provide breakdown).
7. General Instrumentation and Controls (Provide breakdown).
8. Other (Provide breakdown.

SC.14 GC 7.5, Project Signs

Delete the requirements

SC.15 GC 7.6, Project Office

Delete the requirements

SC.16 GC 5.4.1, Partial Payments

Bid Proposal item BP.4 proposes an allowance of $50,000 to provide for anticipated but unknown repairs to the interior walls of the Digester. After the digester wall surfaces are cleaned by the Contractor, the Engineer will inspect the walls for damage and will give direction to the Contractor for repair of the damaged areas. Payment for repair of the damaged areas will be by negotiated change order with payment coming from the Allowance Funds designated in BP.4. When the work is complete, the Engineer will prepare a balancing change order to account for the difference between the allowance funds and the ultimate required amount.

SC.17 <u>Bid Items Clarifications</u>

SCOPE

This section provides a general description of the items of Work covered under this contract. It is not meant to be all-inclusive and does not in anyway supersede the entirety of the Work as defined by the Contract Documents. It is the responsibility of the Bidder to ensure that the costs for all aspects of the Work as defined by the Contract Documents is accounted for in the total bid amount for the Work identified in the Bid Form.

CONTRACTOR'S COSTS AND OVERHEADS

Contractor shall include in each Bid Item, all costs required to complete the Work, including General Conditions costs, covering a period of time not less than from Notice to Proceed through the entire length of the allowable contract time specified in the Contract Documents.

PAYMENTS

Payments shall be as described in the General Conditions.

BP.1 MOBILIZATION, DEMOBILIZATION AND CLEAN-UP

Bidder shall include all costs for Work associated with Mobilization, Demobilization, and Cleanup in Bid Item No. BP. 1 as specified in the General and Special Conditions sections. The following summary of Work is intended to give the bidder a general sense of the Work included in this bid item. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Mobilization shall include the obtaining of all permits (the City will pay for the Building Permit, the Contractor shall sign for it); moving onto the site of all plant and equipment; furnishing, erecting, and removal of construction facilities; and implementing security requirements; all as required for the proper performance and completion of the Work.

BP.2 DIGESTER CLEANING

Bidder shall include all costs for Work associated with Digester Cleaning in Bid Item No. BP. 2 as specified is sections 01_14_00 and 46_01_72. The following summary of Work is intended to give the bidder a general sense of the Work included in this bid item. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Remove, dewater, and dispose of liquids, solids, grit and all material contained in the existing digester. The City will remove approximately 2/3 of the digester contents through their solids dewatering process at no cost to the Contractor. The remainder, approximately 1/3 of the volume of the digester, shall be removed and disposed by the Contractor.

B. Haul solids to the Carson City Landfill for final disposal. The City will waive the tipping fees for disposal of the solids.

C. Prepare digester for construction and interior inspection. Digester must be clean and accessible for Work and inspection. Effluent reuse water will be provided by the City for wash down. Wash down water can be returned to the process in coordination with process operation procedures and City's Process Operation Staff.

BP.3 DEMOLITION

Bidder shall include all costs for Work associated with Demolition in Bid Item No. BP. 3 as depicted in drawings, D-01 and D-02 and supplemented by the technical specifications. The following summary of Work is intended to give the bidder a general sense of the Work included in this bid item. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Demolish and dispose of existing digester reinforced concrete dome, including all digester accessories encased in the concrete (e.g. dome plates, manholes, sample ports, sight glass). Concrete debris shall be hauled to the Carson City Landfill for final disposal. The City will waive the tipping fees for disposal of the debris.

B. Demolish and dispose of existing portions of the CMU veneer that are damaged and portions required to remove and reconstruct dome. Debris shall be hauled to the Carson City Landfill for final disposal. The City will waive the tipping fees for disposal of the debris.

C. Demolish and dispose of existing guardrail and handrail.

D. Demolish and dispose of existing digester piping and accessories at the top of the digester dome. Contractor shall coordinate with Plant maintenance supervisor to identify items that might be salvaged and reused by the City as spare parts.

E. Temporarily remove the metal stairway that gives access to the dome. The stairway shall be stored and protected for reinstallation after the new dome is constructed.

F. Demolish and dispose of existing light poles, including, conduits, and conductors.

G. Clean and prepare damage surfaces of the digester walls.

H. Shore and protect in place digester overflow box.

BP.4 DIGESTER INTERIOR WALLS STRUCTURAL INSPECTION AND REPAIR (ALLOWANCE)

This allowance shall cover the negotiated change order for repair of the digester interior walls. After cleaning by Contractor and inspection by Engineer, Engineer will give contractor instructions for repair. Contractor will provide a cost estimate for the Work, which will be negotiated using this allowance. Allowance funds that have not been disbursed at the completion of the project will be credited to the City by Contractor by a deductive Change Order.

BP.5 DIGESTER DOME REPLACEMENT

Bidder shall include all costs for Work associated with Digester Dome Replacement in Bid Item No. BP. 5 as depicted in drawings, S-01, S-02, S-03, and S-04 and supplemented by the technical specifications. The following summary of Work is intended to give the bidder a general sense of the Work included in this bid item. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Furnish and place reinforced concrete structure wall and dome.

B. Furnish and install guardrails and handrails and all its components.

C. Furnish and install new CMU veneer.

D. Reinstall the metal stairway that gives access to the dome.

E. Design, furnish and install post-tensioning system for the new concrete dome structure.

F. Furnish and install digester accessories (e.g. dome plate, manholes, foam control ports, sight glass).

G. There will be no interior lining of the digester.

BP.6 DIGESTER CMU WALL REPAIR

Bidder shall include all costs for Work associated with Digester CMU Wall Repair in Bid Item No. BP. 6 as depicted in drawings S-02 and S-04 and supplemented by the technical specifications.

BP.7 DIGESTER GAS PIPING AND ACCESSORIES

Bidder shall include all costs for Work associated with Digester Gas Piping and Accessories in Bid Item No. BP. 7 as depicted in drawings P-01 and P-02 and supplemented by the technical specifications. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Furnish and install digester gas pipes, supports, fittings, pipe insulation, valves, sediment trap, pressure/vacuum relief system, multiport plug-valve, flame arrestors and accessories.

B. Furnish and install drain pipes, supports, fittings, pipe insulation, and valves.

C. Furnish and install pipe connection for differential pressure transmitter inside digester room including pipe, fittings, valve, wall thimble, and applicable coatings. Provide pipe penetration and related structural modifications.

D. Furnish and install connections for all instrumentation equipment.

BP.8 ELECTRICAL AND INSTRUMENTATION

Bidder shall include all costs for Work associated with Electrical and Instrumentation in Bid Item No. BP. 8 as depicted in drawings P-01, P-02, E-01, and E-02 and supplemented by the technical specifications. The following summary of Work is intended to give the bidder a general sense of the Work included in this bid item. It is not intended to be an exhaustive listing of all Work required to complete the Work as depicted by the Contract Documents.

A. Furnish and install new light poles, including, conduits, conductors, supports, hangers, luminaries, light fixtures, lamps, boxes, identification, grounding, bonding, and all accessories.

B. Design, furnish, and install lightning protection system as specified in section 26_41_01.

C. Furnish and install differential pressure transmitter, pressure indicating transmitter, and radar level transmitter including equipment, conductors, conduits, supports, hangers, boxes, identification, and all accessories.

D. All the system SCADA programming will be performed by the City.

END OF SPECIAL CONDITIONS

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TECHNICAL SPECIFICATIONS

SECTION 01_11_00

SUMMARY OF WORK

GENERAL

SUMMARY

Section Includes: Identification and summary description of the Work, location, OWNER furnished products, activities by others, and coordination.

THE WORK

The Work consists of construction of the following:

Demolition of exiting Digester Number 1 dome with associated mechanical and electrical appurtenances as indicated on the contract documents.

Construction of new Digester Number 1 dome with associated mechanical and electrical appurtenances as indicated on the contract documents.

Milestone portions of the Work have Substantial Completion contract times and liquidated damages as specified in the Special Conditions. Milestones are described as follows:

Milestone 1: Digester cleaning, preparation, and wall repairs.

Milestone 2: Construction of new Digester Number 1 dome with associated mechanical and electrical appurtenances.

Milestone 3: Start-up and commissioning.

Except as specifically noted otherwise, provide and pay for:

Insurance and bonds.

Labor, materials, and equipment.

Tools, equipment, and machinery required for construction.

Utilities required for construction.

Temporary facilities.

Safety provisions.

Other facilities and services necessary for proper execution and completion of the Work.

Secure and pay for all permits including Carson City Building Department, government fees and licenses.

Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

LOCATION OF PROJECT

The Work is located at 3320 East Fifth Street, Carson City, Nevada.

TECHNICAL SPECIFICATIONS

OWNER ASSIGNED SUBCONTRACTORS

Assignment of Subcontractors by OWNER is not anticipated.

ACTIVITIES BY OTHERS

OWNER will provide SCADA and PLC programming.

OWNER, utilities, and others may perform activities within Project area while the Work is in progress. Schedule the Work with OWNER, utilities, and others to minimize mutual interference.

Cooperate with others to minimize interference and delays.
When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.

When the Work depends on proper execution or results upon work performed by others, inspect and promptly report apparent discrepancies or defects in work performed by others.
Assume responsibility for work performed by others, except for defects reported as specified in this paragraph and defects which may become apparent in work performed by others after execution of the Work.

COORDINATION OF WORK

Maintain overall coordination of the Work.

Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.

EARLY OCCUPANCY OF PORTIONS OF WORK

Substantially Complete following portions of Work for OWNER's occupancy including specified testing, training of OWNER's personnel, and other preparations necessary for OWNER's occupancy or use, by the date specified:
Milestone 3.

Certificates of Substantial Completion will be executed for each designated portion of Work prior to OWNER occupancy.
Such certificate of Substantial Completion will describe the portion of the Work to be occupied by OWNER, items that may be incomplete or defective, date of occupancy by OWNER, and other information required by OWNER and CONTRACTOR.

After OWNER occupancy, allow access for OWNER's personnel, access for others authorized by OWNER, and OWNER operation of equipment and systems.

Following Occupancy, OWNER will:
Provide power to operate equipment and systems.
Repair damage caused by OWNER's occupancy.

Guarantee period for portions of the Work occupied or partially utilized by OWNER shall commence with date of Substantial Completion for that portion of the Work and acceptance for use by OWNER.
However, progress payment withholdings for portions of the Work occupied by OWNER will not be released until final acceptance of the total Work.

Prior to such occupancy or use, enter into agreement with OWNER indicating work that remains to be performed in occupied areas.

When OWNER's use of occupied facilities reveal defective work, correct defects.

No partial acceptance of the Work will be made and no acceptance other than the final acceptance of the completed Work will be made except for those portions of Work designated for early occupancy by OWNER.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_11_02

PROJECT MANUAL LANGUAGE

GENERAL

SUMMARY

Section Includes: Explanation of arrangement, language, reference standards, and method of resolving conflicts between Contract Documents.

Related Documents and Sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

REFERENCES

Construction Specifications Institute (CSI):
MasterFormat™.
SectionFormat™.
PageFormat™.

PROJECT MANUAL ARRANGEMENT

Document and Section numbers used in Project Manual, and Project Manual arrangement are in accordance with CSI MasterFormat™, except where departures have been deemed necessary.

Sections are written in CSI SectionFormat™, Three-Part Section Format, except where departures have been deemed necessary.

Page format for Sections in the Project Manual is in PageFormat™, except where departures have been deemed necessary.

PROJECT MANUAL LANGUAGE

Specification Section Paragraphs entitled "Section Includes" summarizes briefly what is generally included in the section. Requirements of Contract Documents are not limited by "Section Includes" paragraphs. Specifications have been partially streamlined by intentionally omitting words and phrases, such as "the CONTRACTOR shall," "in conformity therewith," "shall be" following "as indicated," "a," "an," "the" and "all". Assume missing portions by inference.

Phrase "by ENGINEER" modifies words such as "accepted," "directed," "selected," "inspected," and "permitted," when they are unmodified.

Phrase "to ENGINEER" modifies words such as "submit," "report," and "satisfactory," when they are unmodified.

Colons (:) are used to introduce a list of particulars, an appositive, an amplification, or an illustrative quotation.
When used as an appositive after designation of product, colons are used in place of words "shall be."

Word "provide" means to manufacture, fabricate, deliver, furnish, install, complete, assemble, erect in place, test, render ready for use or operation, including necessary related material, labor, appurtenances, services, and incidentals.

Words "CONTRACTOR shall" are implied when direction is stated in imperative mood.

Term "products" includes materials and equipment as specified in Section 01_60_00.

REFERENCE STANDARDS

Use edition or amendment of referenced standards in effect on date stipulated in General Conditions.

Use only applicable portions of referenced standards, ignoring payment stipulations and other provisions which change the duties of the ENGINEER or OWNER as described in the General Conditions.

Equate terms relating to designer to "ENGINEER."

Notify ENGINEER when referenced standard, code, or specification conflicts with Contract Documents.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_11_02

PROJECT MANUAL LANGUAGE

GENERAL

SUMMARY

Section Includes: Explanation of arrangement, language, reference standards, and method of resolving conflicts between Contract Documents.

Related Documents and Sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

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Colons (:) are used to introduce a list of particulars, an appositive, an amplification, or an illustrative quotation.
When used as an appositive after designation of product, colons are used in place of words "shall be."

Word "provide" means to manufacture, fabricate, deliver, furnish, install, complete, assemble, erect in place, test, render ready for use or operation, including necessary related material, labor, appurtenances, services, and incidentals.

Words "CONTRACTOR shall" are implied when direction is stated in imperative mood.

Term "products" includes materials and equipment as specified in Section 01_60_00.

REFERENCE STANDARDS

Use edition or amendment of referenced standards in effect on date stipulated in General Conditions.

Use only applicable portions of referenced standards, ignoring payment stipulations and other provisions which change the duties of the ENGINEER or OWNER as described in the General Conditions.

Equate terms relating to designer to "ENGINEER."

Notify ENGINEER when referenced standard, code, or specification conflicts with Contract Documents.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_14_00

WORK RESTRICTIONS

GENERAL

SUMMARY

Section Includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions and coordination between construction operations and plant operations, including:

Access to site.
Use of site.
Use of premises.

SUBMITTALS

Plan that details all proposed cleaning and shutdown procedures and schedules.

Submit qualifications of digester cleaning subcontractor.

GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

The Carson City Wastewater Reclamation Plant is the City's only means of treating domestic and industrial wastewater prior to discharge. Impairing the operational capabilities of this treatment plant will result in serious environmental damage and monetary fines.

Conduct work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.

CONTRACTOR shall be responsible for all areas of the Site used by CONTRACTOR, by other contractors, and by all Subcontractors in the performance of the Work.

CONTRACTOR will 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 has 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 CONTRACTOR's employees.

The status of the treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit.

Work Sequence and Constraints:
Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with National Pollutant Discharge Elimination System permit requirements. It is CONTRACTOR's responsibility to identify any additional constraints for completion of the Work, and keep the existing systems and plant fully operational.

Include costs for compliance with the specific sequencing limitations and constraints as well as for the general factors pertaining to such compliance including:
Reduced construction efficiency and productivity.
Overtime costs for performing work outside of normal work hours.
Escalation of costs.
Work related to cleaning and preparation of Digester Number 1 needed to maintain plant operations.
Preparation and revision of schedule and planned sequence of work.
Numerous requests for clarification of details related to compliance with this Section.
Cleaning and preparation of Digester Number 1.
Coordination of temporary power with utility.
Providing temporary power.
Hiring staff or consultants to assist with defining and refining the work sequence.
Use of plant potable or service water.

The Carson City Wastewater Reclamation Plant working hours are Monday through Friday from 7:00 am to 5:30 pm. Work must be performed within the Wastewater Reclamation Plant working hours. Deviations must be approved by the City. CONTRACTOR shall note that this schedule is not the same for the City's Landfill. CONTRACTOR must coordinate with the City for the Landfill Operation Schedule.

INTERRUPTION OF TREATMENT PROCESSES

Execute the Work while the existing facility is in operation as specified in Section 01_35_16.

Indicate required shutdowns of existing facilities or interruptions of existing operations on Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the plant will not be jeopardized and identified constraints are satisfied.

Submit notification of required shutdowns of existing facilities at least 15 days prior to the planned date of shutdown and again at 7 days prior to the planned shutdown.

The OWNER and the ENGINEER will evaluate the feasibility of the requested date based on the plant's ability to reliably meet capacity demands.

Do not begin alterations until ENGINEER's written permission has been received.

Minimize shutdown times by thorough advanced planning. Have required equipment, materials, in place and labor on hand at time of shutdown.

Shutdown of utility power at the Sludge Dewatering Building is limited to no more than 4 hours per day at a frequency of no more than 4 days per 7-day week unless temporary sludge dewatering and dewatered solids transportation facilities are provided by the CONTRACTOR.

Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide power, temporary pumping, temporary piping, lighting, controls, instrumentation, and safety devices.

COMPLIANCE WITH NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

The existing facility is operating under the terms of a National Pollutant Discharge Elimination System permit issued by the Nevada Division of Environmental Protection. This permit specifies the water quality limits that the plant must meet prior to discharge of effluent. The NPDES permit limits that apply regardless of construction activities are as follows:

Parameter	Units	Discharge Limits	
		30 Day Average	Daily Maximum
Flow	Million gallons per day	6.9	--
BOD_5	mg/L	30	45
TSS	mg/L	30	45
Fecal coliform	Cfu/100 mL	2.2	23
pH	--	6.0 - 9.0	

The CONTRACTOR shall perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.

The CONTRACTOR shall bear the cost of penalties imposed on the OWNER for discharge violations caused by actions of the CONTRACTOR.

REQUIREMENTS FOR OPERATION OF PLANT

Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
Raw wastewater influent piping for conveyance of raw sewage from the collection system to the Headworks from the North Lift Pump Station, North Influent Box and from the South Influent Box.

Primary and secondary treatment processes, which include but are not limited to the Headworks, Primary Clarifier, Trickling Filters, primary effluent pumping from the Intermediate Pump Station to the Trickling Filters and Aerated Pond No. 1, RAS pumping from the RAS Pumping Station to the Aerated Pond No. 1, Aerated Pond No. 1, Equalization Basin, Secondary Clarifier Nos. 1, 2, and 3, Filter Pump Station, Tertiary Filters, Chlorine Contact Basin, Effluent Pump Station, DAF Thickeners, Anaerobic Digesters, Sludge Dewatering Building.
Maintaining safe, continuous access to all process facilities for operations and maintenance personnel at all times.

WORK SEQUENCE AND SHUTDOWN CONSTRAINTS

Comply with shutdown constraints to keep the existing facilities operational as required by the OWNER.

Prior to any pipe fabrication or construction, the CONTRACTOR shall field verify all dimensions and pipe connections. If necessary, the CONTRACTOR shall revise the plans or dimensions in order to meet the tie-in time constraint without violating the intent of the design. All CONTRACTOR revisions shall be approved by the ENGINEER prior to any Work.

The CONTRACTOR shall complete all possible portions of new construction and/or modifications to existing facilities including testing prior to making any connection to existing facilities. All parts, fabrications, and other components necessary to complete the work during the shutdown and startup must be on the job site prior to final scheduling of the shutdown unless otherwise authorized herein or by the OWNER.

The CONTRACTOR shall include in his lump sum bid the cost for makeup piping necessary to connect to the exact location of existing pipe joints and fittings. The exact location of each existing joint is not shown on the Drawings.

The CONTRACTOR must submit a detailed work plan/sequence for each shutdown of any facility and receive the ENGINEER's approval, unless specified otherwise, at least 15 days prior to the planned date of shutdown. Alternative equivalent construction methods and sequences must be submitted to the ENGINEER in a timely manner to allow review, revisions, and approval prior to scheduling of the shutdown. Many of the connections will require shutdowns. Unless specifically indicated otherwise, no more than 4 hours of shutdown of any existing item shall be allowed. The shutdowns shall only be allowed during low flow period between the hours of 1:00 a.m. and 5:00 a.m. for the months indicated, unless noted otherwise. All shutdowns shall be coordinated with plant staff.

DIGESTER CLEANING AND PREPARATION

The CONTRACTOR shall provide cleaning and preparation accordance with Section 46_01_72 for portions of the Work that require facilities to be taken out of service.

Construction work in Digester Number 1 requires shutdown, cleaning, and preparation of Digester. Procedures for shutdown, cleaning, and preparation of Digester must be approved in writing by the ENGINEER and the OWNER.

Shutdown of the Digester Number 1 is limited to the period between May 01 and October 31, unless specifically approved in writing by the OWNER.

CONTRACTOR is responsible for all dewatering, handling, hauling, and disposal of all biosolids contained in the Digester Number 1. The CITY may remove approximately one third (1/3) of the digester solids and dewater them through its regular dewatering process. CONTRACTOR must coordinate all cleaning and dewatering procedures with the CITY.

CONTRACTOR is responsible for all handling, hauling, and disposal of washwater generated from the cleaning procedures.

CONTRACTOR must meet all NDEP requirements for handling, hauling, and disposal of biosolids and washwater.

UTILITIES

Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.

WORK BY OTHERS

Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

Locate temporary facilities in a manner that minimizes interference to OWNER's operation and maintenance personnel.

Provide submittals on proposed temporary electrical and instrumentation components necessary to maintain existing facilities.

Dewater and promptly clean wet wells, tanks, and channels temporarily removed from service.

Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The CONTRACTOR shall field verify all dimensions and conditions and report any discrepancies to the ENGINEER a minimum of 14 days in advance of any construction in the area.

Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:
Coordinates.
Bearings and lengths.
Stationing.

TECHNICAL SPECIFICATIONS

PRODUCTS

Not Used.

EXECUTION

COORDINATION OF WORK

Maintain overall coordination of execution of work.

Obtain schedules from subcontractors and suppliers and assume responsibility for correctness.

Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

WORK BY OTHERS

Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

WORK SEQUENCE

The sequence of work described herein represents one possible sequence, which is based on the information provided in the Contract Documents. The sequence is provided for informational purposes only, and may be modified as necessary, subject to the work restrictions described herein.

Proposed Digester Rehabilitation Project – Phase I Sequence:
Shutdown Digester Number 1 following OWNER's standard operation procedure and safety provisions.
Clean Digester No. 1 by removing and disposing the sludge and grit accumulated within the tank. The sludge contained in the digester is a biohazard and must be handled following the OWNER's, State, and Federal safety provisions as described in Sections 01_35_44 and 46_01_72. Digester must be completely clean and free of debris and sludge for the construction work to commence.
Demolish exiting piping and appurtenances on top of the digester.
Demolish digester dome.
Repair digester interior walls upon inspection and direction of the CITY and the ENGINEER.
Construct new Digester dome.
Repair CMU wall.
Install new piping and appurtenances at the top of the Digester.
Perform Start up in coordination with Plant operations and the OWNER.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_29_00

PAYMENT PROCEDURES

GENERAL

SUMMARY

Section Includes: Procedures for submitting applications for payment and means used as a basis for Progress Payments, including:
Cost Summaries.
Payment for Mobilization.
Start-up.
Demobilization.

BASIS FOR PROGRESS PAYMENTS

Base Application for Payment on the breakdown of costs for each scheduled activity in the Progress Schedule and the Percentage of Completion for each activity.

Generate Application for Payment by downloading cost data from the Progress Schedule to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost of each activity, the estimated Percent Complete for each activity, and the Value of Work Completed for both the payment period and job to date.

PAYMENT REQUESTS

Refer to Section 01_29_77 - Applications for Payment.

COST SUMMARIES

Prepare Summary of Cost Information for each Major Item of Work listed in the Schedule of Values. Identify the Value of Work Completed for both the payment period and job to date.

Cash Flow Summary: Prepare cash flow summary, indicating total dollar amount of work planned for each month of the project. Equate sum of monthly amounts to Lump Sum contract price.

PAYMENT FOR MOBILIZATION

Limit amounts included under Mobilization to the following items:
Moving on the site any equipment required for first month operations.
Installing temporary construction power and wiring.
Establishing fire protection system.
Developing construction water supply.
Providing field office trailers for the CONTRACTOR and the ENGINEER, complete with all specified furnishings and utility services including telephones.

Providing on-site sanitary facilities and potable water facilities as specified.
Arranging for and erection of CONTRACTOR's work and storage yard.
Subcontractor insurance and bonds.
Obtaining all required permits, licenses, and fees.
Developing construction schedule.
Provide and erect the project sign.
CONTRACTOR bonds and insurance.

Furnish data and documentation to substantiate the amounts claimed under mobilization.

Limit price for mobilization to no more than 5 percent of Contract Price.

PAYMENT FOR START-UP AND DEMOBILIZATION

Total Price for start-up and demobilization shall not be less than 3 percent of Contract Price.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_29_73

SCHEDULE OF VALUES

GENERAL

SUMMARY

Section Includes: Requirements for preparation, format, and submittal of Schedule of Values.

PREPARATION

1. Print out Schedule of Values from accepted Preliminary or Baseline Schedule submitted and accepted under Section 01_32_16, Progress Schedules and Reports.

2. Schedule of Values shall be a listing of all cost loaded, on-site construction activities from the progress schedule, listed in numerical order, showing that the sum total of all cost loaded activities equals the value of Contract.

3. Whenever the schedule is changed or revised to include added or deleted work, the Schedule of Values shall also be revised such that the sum total of all cost loaded activities continuously equals the current Contract value.

Divide the Work into following Major Items of Work:

General:

Mobilization (Not more than 5% of the Total Contract Price (TCP).
General Requirements (Not more than 0.5% of TCP).
Record Drawings (Not less than 0.5% of TCP).
Operation and Maintenance Manuals (Not less than 0.5% of TCP).
Demobilization and Site Maintenance (Not less than 3% of TCP).
Other (Provide breakdown).

Digester cleaning and preparation (Provide breakdown).
Demolition (Provide breakdown).
Construction of new digester dome (Provide breakdown).
Piping (Provide breakdown).
General Electrical (Provide breakdown).
General Instrumentation and Controls (Provide breakdown).
Other (Provide breakdown).

Assign prices to Major Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Major Item of Work.

SUBMITTALS

Submit Schedule of Values for the Preliminary Schedule in accordance with the requirements in Article "Preliminary Schedule," Section 01_32_16.

Submit Schedule of Values for the Baseline Schedule in accordance with the requirements in Article "Baseline Schedule," Section 01_32_16.

Submittal of the Schedule of Values is a condition precedent to the issuance of any payment under this Contract.

SAMPLE SCHEDULE OF VALUES

Following is an acceptable form for Schedule of Values.

SCHEDULE OF VALUES		
NO.	**DESCRIPTION OF ITEM**	**LUMP SUM COST**
1.	General:	
a.	Mobilization (Not more than 5% of the Total Contract Price (TCP).	
b.	General Requirements (Not more than 0.5% of TCP).	
c.	Record Drawings (Not less than 0.5% of TCP).	
d.	Operation and Maintenance Manuals (Not less than 0.5% of TCP).	
e.	Demobilization and Site Maintenance (Not less than% of TCP).	
f.	Other (Provide breakdown).	
2.	Digester cleaning and preparation (Provide breakdown).	
3.	Demolition (Provide breakdown)	
4.	Digester interior wall repairs (Provide breakdown)	
5.	Construction of new digester dome (Provide breakdown).	
6.	Block wall repair (Provide breakdown)	
7.	Piping (Provide breakdown).	
8.	General electrical work not included on Major Items of Work (Provide breakdown).	
9.	General instrumentation and controls work not included on Major Items of Work.	
10.	Miscellaneous work items and other prices not included in previous items and necessary to complete the Work (Provide breakdown).	
	TOTAL LUMP SUM BID	

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_29_77

APPLICATIONS FOR PAYMENT

GENERAL

SUMMARY

Section Includes: Procedures for preparation and submittal of Applications for Payment.

FORMAT

Develop satisfactory spreadsheet-type form generated by downloading cost data from the Progress Schedule.

Fill in information required on form.

When Change Orders are executed, add Change Orders at end of listing of scheduled activities.
Identify change order by number and description.
Provide cost of change order in appropriate column.

After completing, submit Application for Payment.

ENGINEER will review application for accuracy. When accurate, ENGINEER will transmit application to OWNER for processing of payment.

Execute application with signature of responsible officer of CONTRACTOR.

SUBSTANTIATING DATA

Provide Substantiating Data with cover letter identifying:
Project.
Application number and date.
Detailed list of enclosures.
For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products.
Submit “certified” payroll.

SUBMITTALS

Submit 3 copies of Application for Payment and Substantiating Data with cover letter.

Coordinate requirements with Section 5.0 Payment of the General Conditions.

TECHNICAL SPECIFICATIONS

PAYMENT REQUESTS

Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity.

Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.

Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, and the value of work completed for both the payment period and job to date.

Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.

Submit progress payment requests at progress meetings.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_32_16

PROGRESS SCHEDULES AND REPORTS

GENERAL

SUMMARY

Section Includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, contract time adjustments, and payment requests, including the following:

- Preliminary Schedule.
- Baseline Schedule.
- Summary Schedule.
- Weekly Schedule.
- Schedule Updates.
- Schedule Revisions.
- Time Impact Analyses.
- Final Schedule Submittal.

RESPONSIBLE PERSON

Designate, in writing and within 5 calendar days after Notice of Award, person responsible for preparation, maintenance, updating and revision of all schedules.

Qualifications of Responsible Person:
Authority to act on behalf of CONTRACTOR.
Five (5) years verifiable experience in preparation of complex construction schedules for projects of similar value, size and complexity.
Knowledge of CPM scheduling utilizing Primavera P6 Professional Project Management software.

References: Submit written reference of 3 project OWNERS who have personal experience with this scheduler on previous projects. Identify name, address, telephone number, project name, and cost.

Scheduler shall be dedicated full time to this project, located on-site. All scheduling software and hardware shall be located on-site. Scheduler shall attend all project meetings called for under Section 01_31_19, Project Meetings.

ENGINEER reserves the right to disapprove scheduler when submitted by CONTRACTOR if not qualified. ENGINEER reserves the right to remove scheduler from the project if found to be incompetent.

SCHEDULING FORMAT AND SOFTWARE

Schedule Format: Utilize critical path method (CPM) format.

Prepare computerized schedule utilizing Primavera Project Planner, most current version. The CONTRACTOR shall provide one licensed copy of the scheduling software to the ENGINEER, registered in the ENGINEER's name, for the duration of the project.

PRECONSTRUCTION SCHEDULING MEETING

ENGINEER will conduct Preconstruction Scheduling Meeting with CONTRACTOR's Project Manager, General Superintendent, and Scheduler within 7 calendar days after Notice to Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.

At the meeting, scheduling requirements shall be reviewed with CONTRACTOR. These include schedule preparation, reporting requirements, manpower and equipment loading, updates, revisions, and schedule delay analysis. CONTRACTOR shall present their schedule methodology, planned sequence of operations, resource loading methodology, and present their proposed activity coding structure.

Coding Structure: CONTRACTOR shall submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule. The coding structure shall, at a minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/ Construction and Responsibility/Subcontractor. Refer to paragraph 1.09H for listing of activity categories to be included in the schedule.

PREPARATION

Preparation and submittal of Progress Schedule represents CONTRACTOR's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause.

CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.

During preparation of the preliminary Progress Schedule, ENGINEER will facilitate CONTRACTOR's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.

Prepare schedule utilizing Precedence Diagramming Method (PDM).

Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work. CONTRACTOR shall coordinate holidays to be observed with the OWNER and incorporate them into the schedule as non-working days.

Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the Work and portions thereof within specified

times and at price specified in Agreement. Failure of CONTRACTOR to include required schedule constraints, sequences or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the OWNER.

Reference schedule to working days with beginning of Contract Time as Day “1.”

Baseline Schedule and Project Completion: Should CONTRACTOR submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date, OWNER may issue Change Order, at no cost to OWNER, revising time of performance of Work and Contract completion date to match CONTRACTOR’s schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.

Contract float is for the mutual benefit of both OWNER and CONTRACTOR. Changes to the project that can be accomplished within this available period of float may be made by OWNER without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, CONTRACTOR may utilize float to offset delays other than delays caused by OWNER. Mutual use of float shall continue until all available float shown by schedule has been utilized by either OWNER or CONTRACTOR, or both. At that time, extensions of the Contract time will be granted by OWNER for valid OWNER-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by CONTRACTOR.

Resource Loading and Leveling: CONTRACTOR shall input manpower and equipment data on each schedule activity. Manpower data shall consist of the manhours estimated to perform each task, categorized by trade. Equipment data shall consist of equipment hours estimated to perform each task, categorized by piece of equipment. CONTRACTOR shall optimize and level manpower and equipment requirements. Resource leveling shall reflect a reasonable plan for accomplishing Work. Individual activities may be sequenced within limits of available float. Critical or near critical paths resulting from use of manpower or equipment restraints shall be kept to a minimum. Near critical path identified as path with 15 or less working days of float.

Schedule Logic: Schedule shall be assembled to show order in which CONTRACTOR proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials and equipment. The following criteria shall form basis for assembly of schedule logic.
Which activities must be completed before subsequent activities can be started?
Which activities can be performed concurrently?
Which activities must be started immediately following completed activities?
What major facility, equipment or manpower restrictions are required for sequencing these activities?

Non-sequestering of Float: Pursuant to float sharing requirements of Contract, use of float suppression techniques such as preferential sequencing or logic, special

lead or lag logic restraints, extended activity durations or imposed dates shall be cause for rejection of any schedule submittal.

Major Subcontractor, Parallel Prime Contractor Sign Off: CONTRACTOR shall provide written confirmation of concurrence from all major subcontractors and independent prime CONTRACTORS on site with all schedule submittals. Term “major subcontractor” as used in this Section means any subcontractor, at any tier, with a subcontract worth 5% or more of the total cost of the Work.

Imposed Dates, Hidden Logic Prohibited: CONTRACTOR shall not use imposed dates or hidden logic in preparation of schedule.

Interim Milestone Dates, Operational Constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, CONTRACTOR shall show them on schedule as specified in Contract. CONTRACTOR shall not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements. Schedule Windows for Owner-furnished, Contractor-installed Equipment or Materials: Immediately after Award of Contract, CONTRACTOR shall obtain from ENGINEER anticipated delivery dates of OWNER furnished equipment or materials. These dates shall be shown on schedule in same manner indicated by ENGINEER.

Cost Loading: All schedules shall be cost loaded. Only on-site construction activities shall be cost loaded. The sum total of all cost loaded activities shall equal the current value of the Contract, including change orders, at all times. Upon acceptance by OWNER, the Baseline Schedule shall also be the Schedule of Values required under Section 01_29_73. The monthly Schedule Updates shall be the monthly Payment Application required under Section 01_29_77. Submittal and acceptance of these schedules shall be a condition precedent to the making of any payments under this Contract.

SUBMITTAL OF PROGRESS SCHEDULES

Submit preliminary and baseline schedule in accordance with the Conditions of the Contract as modified by this Section.

Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.

Submit revised schedules and time impact analyses as specified.

Submit schedules in the media and number of copies as follows.

Three (3) sets of the CPM network and/or barchart (as specified by the OWNER) on D-size sheets. Color-coding to be specified by the OWNER.
Three (3) sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
Two (2) CDs/DVDs containing the computerized CPM Schedule data.
Three (3) prints of the Summary Schedule.

TECHNICAL SPECIFICATIONS

PRELIMINARY SCHEDULE

CONTRACTOR shall submit Preliminary Schedule within 10 calendar days after Notice to Proceed. Preliminary Schedule shall contain detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.

ENGINEER and CONTRACTOR shall meet within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. CONTRACTOR shall submit revised preliminary schedule within 5 calendar days after meeting.

CONTRACTOR shall submit schedule of manpower and costs for all activities on revised Preliminary Schedule with revised Preliminary Schedule. Schedule of manpower and costs shall be realistic and level so as not to have unusual manpower requirements.

Schedule of costs shall be Schedule of Values required under Section 01_29_73 for first 90 calendar days of Work. Submittal and acceptance of Preliminary Schedule is condition precedent to making of progress payments under Section 01_29_77 and payments for mobilization costs otherwise provided for in the Contract. No pay item Work shall commence until Preliminary Schedule and schedule of costs have been accepted by OWNER.

Accepted Preliminary Schedule shall be incorporated unchanged, as first ninety (90) calendar days of activity in CONTRACTOR's Baseline Schedule.

Preliminary Schedule shall be updated monthly during first 90 calendar days after Notice to Proceed. Updated Preliminary Schedule shall be the payment application required under Section 01_29_77.

BASELINE SCHEDULE

No more than 45 calendar days after Notice of Award, CONTRACTOR shall submit the Baseline Schedule for all Work of the project. Baseline Schedule shall show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.

Baseline Schedule shall conform to requirements of the following Article, "Network Details and Graphical Output."

Acceptance of the Baseline Schedule by the OWNER is a condition precedent to making payments under Section 01_29_77 after the first 90 calendar days after Notice to Proceed.

NETWORK DETAILS AND GRAPHICAL OUTPUT

Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.

Include for each activity, the description, activity number, estimated duration in working days, total float and all activity relationship lines.

Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.

Indicate the critical path for the project.

Delineate the specified contract duration and identify the planned completion of the Work as a milestone. The time period between the planned and Contract completion dates, if any, shall be shown on the schedule as an activity identified as project float unless a Change Order is issued pursuant to paragraph 1.05H.

Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones. Include, in addition to Construction Activities:

Submission dates and review periods for major equipment submittals, shoring submittals, and indicator pile program.
Shoring Reviews: Allow 4 week review period for each shoring submittal.
Pile Indicator Program: Allow 3 week review period for analysis of program.
Any activity by the OWNER or the ENGINEER that may affect progress or required completion dates.
Equipment and long-lead material deliveries over 8 weeks.
Approvals required by regulatory agencies or other third parties.

Produce network diagram on 22 inch by 34 inch sheets with grid coordinate system on the border of all sheets utilizing alpha and numeric designations.

Identify the Execution of the following, omitting items not applicable to the Work:
Mobilization.

All required submittals and submittal review times showing 30 calendar day duration for such activities and equal amount of time for re-submittal reviews.
Equipment and materials procurement/fabrication/delivery.
Cleaning and preparation.
Demolition.
Excavation.
Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
Shoring review, shoring materials procurement, shoring installation, and shoring removal.
Backfill and compaction.
Dewatering.
Grading, subbase, base, paving, and curb and gutters.
Fencing and landscaping.
Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing, and patching.
Tests for leakage of concrete structures intended to hold water.
Masonry.

Metal fastenings, framing, structures, and fabrications.
Wood structures, finish carpentry, architectural woodwork, and plastic fabrications.
Waterproofing and dampproofing, insulation, roofing and flashing, and sealants.
Doors and windows, including hardware and glazing.
Finishes including coating and painting, flooring, ceiling, and wall covering.
Process equipment, including identification of ordering lead time, factory testing and installation.
Pumps and drives, including identification of ordering lead time, factory testing, and installation.
Conveying equipment including hoists and cranes, conveyor systems, and materials handling equipment, including identification of ordering lead time and installation.
Other mechanical equipment including fans and heating, ventilating, and air conditioning equipment.
Trenching, pipe laying, and trench backfill and compaction.
Piping, fittings and appurtenances, including identification of ordering and fabrication lead time, layout, installation, and testing.
Valves, gates, and operators, including identification of order lead time, installation, and testing.
Plumbing specialties.
Electric transmission, service, and distribution equipment, including identification of ordering lead time, and factory testing.
Other electrical work including lighting, heating and cooling, and special systems, including identification of ordering lead time.
Instrumentation and controls, including identification of ordering lead time.
Preliminary testing of equipment, instrumentation, and controls.
Final testing, including preparation time.
Seven-day operational test.
Substantial Completion: Substantial completion activity shall meet all requirements set forth in Document 00_73_00, Supplementary Conditions.
Punch list work.
Operation and maintenance training.
Demobilization.

SUMMARY SCHEDULE

Provide Summary Schedule which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.

Summary Schedule shall be updated and submitted monthly and after each Schedule Update or Schedule Revision.

SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS

After Preliminary Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a list of all shop drawings and sample submittals anticipated in first 60 calendar days after Notice to Proceed using early start dates.

Submittal of this preliminary list shall be a condition precedent to making of progress payments during the first 60 calendar days after Notice to Proceed.

After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall print out and submit list of all shop drawings and sample submittals for all Work using early start dates. This listing will contain all submittals required for the entire Work including those listed above.

Submittal of final list shall be a condition precedent to making of progress payments after the first 60 calendar days after Notice to Proceed.

These schedules shall conform to the requirements of the General Conditions, Article 2.05.

MANPOWER SCHEDULES

After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a schedule histogram depicting total craft manpower and craft manpower for CONTRACTOR's own labor forces and those of each subcontractor. This manpower schedule shall be submitted electronically on a CD in Excel format, with 1 paper copy.

Submittal of this manpower data shall be a condition precedent to making of progress payments after the first 60 calendar days after Notice to Proceed.

EQUIPMENT SCHEDULE

After Baseline Schedule has been submitted and accepted by OWNER, CONTRACTOR shall submit a tabular report listing each major piece of construction equipment to be used in performing the Work. This report will list major equipment for CONTRACTOR and each subcontractor. This tabular report of equipment shall be submitted electronically on a CD in Excel format with 1 paper copy.

Submittal of this equipment data shall be a condition precedent to making of progress payments after the first 60 calendar days after Notice to Proceed.

WEATHER DAY ALLOWANCE

Include as a separate identifiable activity on the critical path, an activity labeled "Weather Days Allowance." Insert this activity at the end of the schedule.

Duration of Weather Days Allowance is specified in Conditions of the Contract.

Insert an activity in critical path to reflect weather day occurrences when weather days are experienced and accepted by ENGINEER. Identify this activity as a weather delay.

Reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the Schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float.

ALLOWANCE FOR OWNER-CAUSED DELAY

Include as a separate identifiable activity on the critical path, an activity labeled "Allowance for OWNER-Caused Delay." Insert this activity at the end of the schedule, following the Project Completion Milestone.

Duration of this activity is specified in Bid Form. The duration of this OWNER-Caused Delay Allowance is in addition to the contractual time frame.

Insert an activity in critical path to reflect OWNER-caused delay occurrences when OWNER-caused delay days are experienced and accepted by ENGINEER. Identify this activity as an OWNER-caused delay.

Reduce duration of OWNER-Caused Delay Allowance activity as OWNER-caused delays are experienced and inserted into the schedule. Remaining days in OWNER-Caused Delay Allowance at completion of project is considered float.

REVIEW AND ACCEPTANCE OF SCHEDULES

ENGINEER will review Baseline Schedules, Schedule Updates, Schedule Revisions and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships and completeness.

ENGINEER and OWNER will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to CONTRACTOR within 14 calendar days after receipt by ENGINEER.

Revise and resubmit schedule in accordance with ENGINEER’s comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections. If a meeting is requested the CONTRACTOR and all major subcontractors shall participate in the meeting with ENGINEER. Revise and resubmit schedule within 7 calendar days after meeting.

When schedule reflects OWNER's and CONTRACTOR's agreement of project approach and sequence, schedule will be accepted by OWNER. Use accepted schedule for planning, organizing, and directing the work and for reporting progress. Provide all items specified in Article, "Submittal of Project Schedules."

UPDATING THE SCHEDULE

Update the schedule prior to monthly progress meeting. Submit a written report of significant changes in progress meeting. A detailed written list of all changes to the previous schedule submittal contained in the Schedule Update shall be submitted at the monthly progress meeting.

Submit updated schedule and materials specified under Article "Submittal of Progress Schedules," 5 calendar days before the progress meeting.

Since monthly Schedule Update is the application for progress payment required under Section 01_29_77, Applications for Payment, submittal and acceptance of the monthly Schedule Update is a condition precedent to the making of any progress payments.

Prepare update using most recent accepted version of schedule. Include:
Actual start dates of activities that have been started.
Actual finish dates of activities that have been completed.
Percentage of completion of activities that have been started but not finished.
Actual dates on which milestones were achieved.
Activities shall not be updated by inputting percent complete figures only without also inputting actual dates.
Retained logic shall be used in preparing Schedule Updates.
When necessary, input remaining durations for activities whose finish dates cannot be calculated accurately with a percent complete figure only.
Revisions to the schedule may be included that have been previously approved in under the following Article, "Revisions to Schedule."

Submit written narrative report in conjunction with each Schedule Update. Describe:

- Activities added to or deleted from schedule. Identify added activities in manner distinctly different from original activity designations.
- Changes in sequence or estimated duration of activities.
- Current or anticipated problems and delays affecting progress, impact of these problems and delays and measures taken to mitigate impact.
- Assumptions made and activities affected by incorporating change order work into the schedule.
- Cost and other resource loading requirements shall be adhered to concerning activities added to or deleted from the schedule.

Identify overall progress of each Major Item of Work in the Summary Schedule.

Should monthly Schedule Update show project completion earlier than current Contract completion date CONTRACTOR shall show early completion time as schedule activity, identified as “Project Float.”

Should monthly Schedule Update show project completion later than current Contract completion date CONTRACTOR shall prepare and submit a Schedule Revision in accordance with the following Article, "Revisions to Schedule."

REVISIONS TO SCHEDULE

Submit revised schedule within 5 days:

- When delay in completion of any activity or group of activities indicates an overrun of the contract time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
- When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
- When the schedule does not represent the actual progress of activities.
- When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.

When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.

Submit revised schedule and materials as specified under Article "Submittals of Progress Schedules."

Make revisions on most recently accepted version of schedule.

Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions.

Only upon acceptance of a revision by the OWNER shall it be reflected in the next monthly Schedule Update.

Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR-caused project delay (Recovery Schedule) shall not be implemented until the OWNER reviews and accepts the Schedule Revision.

PAYMENT REQUESTS AND CASH FLOW

After Baseline Schedule has been submitted and accepted by the OWNER, the CONTRACTOR shall submit on a monthly basis, a tabular report showing anticipated earnings each month of the contract period. This tabulation will be based on the summation of the cost-loaded activities each month. CONTRACTOR shall submit an updated payment schedule each month showing actual earned amounts and anticipated remaining earnings.

Utilize cost loaded monthly Schedule Updates as the applications for payment specified in Section 01_29_77, Applications for Payment. Payment application shall be a listing in Excel format of all schedule activities showing cost and percentage completion during the current month for which payment is sought. Submittal of the monthly Schedule Update shall be a condition precedent to the issuance of any payment under this Contract.

WEEKLY SCHEDULE

Submit to ENGINEER, on the last working day of every week, a progress schedule showing the activities completed during the previous week and the CONTRACTOR's schedule of activities for the following 2 weeks.

The Weekly Schedule may be a CPM schedule or a bar chart but shall utilize the logic and conform to the status of the current progress schedule. In the event that the Weekly Schedule no longer conforms to the current schedule CONTRACTOR may be required to revise the schedule in accordance with Article, "Revisions to Schedule."

The activity designations used in the Weekly Schedule shall be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.

The format of the Weekly Schedule shall be as agreed upon between the CONTRACTOR and the ENGINEER.

TECHNICAL SPECIFICATIONS

SCHEDULE OF VALUES

Requirements for Schedule of Values are specified in Section 01_29_73, Schedule of Values.

Submit, in conjunction with the Progress Schedule, a Schedule of Values identifying costs of all on-site construction activities as generated by the cost loaded schedule. Equate the aggregate of these costs to the Lump Sum Contract Price.

ADJUSTMENT OF CONTRACT TIMES

Contract time will be adjusted only for causes specified in Contract Documents. Adjustments in the Contract time shall be governed by the principles of this Article and shall be made in accordance with the provisions of Section 3.0, Progress of Work, Meeting, Schedules and Section 6.0, Change Orders of the General Conditions.

Non-excusable Delay: Actions or inactions of the CONTRACTOR, or events for which the CONTRACTOR has assumed contractual responsibility (including actions or inactions of subcontractors, suppliers or material men at any tier) which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as non-excusable delay. The CONTRACTOR shall not receive any time extension for such delays.

Excusable Delay: Events which are unforeseeable, outside the control of, and without the fault or negligence of either the OWNER or the CONTRACTOR (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as excusable delay. The CONTRACTOR is entitled to a time extension only and shall not receive any other damages.

Compensable Delay: Actions or inactions of the OWNER, or events for which the OWNER has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date shall be designated as compensable delay. The CONTRACTOR is entitled to a time extension and delay damages.

Concurrent Delay: Concurrent delay is any combination of the above three types of delay occurring on the same calendar date(s), except in cases where the combination consists of two or more instances of the same type of delay occurring on the same calendar date(s). When one cause of delay is OWNER-caused or caused by an event which is beyond the control and without the fault or negligence of either the OWNER or the CONTRACTOR and the other CONTRACTOR-caused, the CONTRACTOR is entitled only to a time extension and no delay damages.

If the CONTRACTOR believes that the OWNER has impacted its work, such that the project completion date will be delayed, the CONTRACTOR must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the CONTRACTOR to an adjustment of contract time.

Time Impact Analysis:

The Time Impact Analysis submitted by the CONTRACTOR shall utilize the accepted schedule update that is current relative to the time frame of the delay

event (change order, third party delay, or other OWNER-caused delay). The CONTRACTOR shall represent the delay event in the schedule by 1) inserting new activities associated with the delay event into the schedule, 2) revising activity logic, or 3) revising activity durations.
If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
The Time Impact Analysis submittal shall consist of 1) a fragment of the portion of the schedule affected by the delay event, 2) a narrative explanation of the delay issue and how it impacted the schedule, and 3) a CD containing the schedule file used to perform the Time Impact Analysis.

When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the CONTRACTOR chooses not to implement the revisions, the CONTRACTOR will be entitled to a time extension and no compensation for extended overhead.

Indicate clearly that the CONTRACTOR has used, in full, all project float available for the work involved in the request, including any float that may exist between the CONTRACTOR's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.

Float shall be for the mutual benefit of the OWNER and the CONTRACTOR. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.

Actual delays in activities which do not affect the critical path work or which do not move the CONTRACTOR's planned completion date beyond the Contract completion date, will not be the basis for an adjustment to the contract time.

The CONTRACTOR shall not be entitled to job-site or home office overhead beyond the CONTRACTOR's originally planned occupancy of the site if completion of the project occurs within the specified contract time.

Notify ENGINEER of a request for contract time adjustment. Submit request in accordance with ARTICLE 10 - CHANGES IN THE WORK; CLAIMS, of the General Conditions. In cases where the CONTRACTOR does not submit a request for contract time adjustment for a specific change order, delay, or CONTRACTOR request within the specified period of time, then it is mutually agreed that the particular change order, delay, or CONTRACTOR request has no time impact on the Contract completion date and no time extension is required.

The ENGINEER will, within 30 calendar days after receipt of a contract time adjustment, request any supporting evidence, review the facts and advise the CONTRACTOR in writing.

The new Progress Schedule data, if accepted by the OWNER, shall be included in the next monthly Schedule Update.

When the OWNER has not yet made a final determination as to the adjustment of the contract time, and the parties are unable to agree as to the amount of the adjustment to be reflected in the Progress Schedule, reflect that amount of time adjustment in the Progress Schedule as the ENGINEER may accept as appropriate for such interim purpose. It is understood and agreed that any such interim acceptance by the ENGINEER shall not be binding and shall be made only for the purpose of continuing to schedule the Work, until such time as a final determination as to any adjustment of the contract time acceptable to the ENGINEER has been made. Revise the Progress Schedule prepared thereafter in accordance with the final decision.

FINAL SCHEDULE SUBMITTAL

As a condition precedent to the release of retainage, the final Schedule Update shall be identified by the CONTRACTOR as the As-Built Schedule.

The As-Built Schedule shall reflect the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.

The As-Built Schedule shall be signed and certified by the CONTRACTOR S Project Manager and scheduler as being an accurate record of the way in which the project was actually constructed.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_33_00

SUBMITTAL PROCEDURES

GENERAL

SUMMARY

Section Includes: Requirements and procedures for submitting Shop Drawings, Product Data, Samples, other submittals relating to products, and as specified in individual sections.

DEFINITIONS

Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.

Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.

Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.

Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

PROCEDURES

Deliver submittals to ENGINEER at address listed on cover of Project Manual, unless another mutually agreeable place is designated.

Submit submittals in ample time for each to serve submittals' intended purpose.

Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work.

Deliver submittals under acceptable transmittal form which identifies:
Submittal date.
Project and CONTRACTOR.
Subcontractor and major supplier, when appropriate.
Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.
Variations from Contract Documents when variations are included in submittal.

Submit hard copies of specified number of copies of submittal as well as at least one electronic copy in PDF format.

Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.

When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Conditions of the Contract.

SHOP DRAWING SUBMITTAL FORM

All shop drawing submittals shall be accompanied with Shop Drawing Submittal Form found at the end of this section.

Any shop drawing submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned to the CONTRACTOR.

DEVIATIONS TRANSMITTAL FORM

Approval of a submittal, which changes or modifies the Contract Documents, shall not constitute approval of those changes or modifications unless all have been specifically identified as a deviation from the Contract Documents. CONTRACTOR shall use Submittal Deviation Form, which is provided at the end of this section to identify all deviations.

If CONTRACTOR submittal shows variations from the Contract requirements, CONTRACTOR shall describe such variations on a Submittal Deviation Form, at the time of submission. If ENGINEER approves any such variation(s), ENGINEER shall issue a Contract Change Order reflecting credits due to the contract as a result of such deviations. If the variation is minor and does not involve a change in price or in time of performance, a Change Order may not be issued.

CONTRACTOR shall be responsible for resultant changes and deviations and all additional costs which the accepted deviation requires in CONTRACTOR's work, the work of his subcontractors and suppliers, and shall effect such changes without additional cost to OWNER.

PROPOSED SUBSTITUTES "OR EQUAL" FORM

Substitutions constitute any request by the CONTRACTOR for a substitution for an "or equal" item and must be received by the ENGINEER prior to Administrative Notice to Proceed in accordance with Nevada Revised Statute 338.140(4).

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or-equal", indicating that a substitution is permitted, ENGINEER may accept materials or equipment of other Suppliers if CONTRACTOR submits sufficient information to allow ENGINEER to

determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon CONTRACTOR.

ENGINEER shall judge as to the type, function, and quality of any such substitute material or equipment and ENGINEER shall have the final decision as to whether or not a substitution is approved.

ENGINEER may require CONTRACTOR to furnish at CONTRACTOR's expense additional data about the proposed substitution.

ENGINEER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitution.

Acceptance by ENGINEER of a substitute item proposed by CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.

CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in CONTRACTOR's work, the work of his subcontractors and suppliers, and shall effect such changes without additional cost to OWNER.

The procedure for review by ENGINEER shall include the following:

If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall make a submittal with a "Substitution Request Form", which is provided at the end of this section attached to the submittal.

Unless otherwise provided by law or authorized in writing by ENGINEER, the "Substitution Request Form(s)" shall be submitted prior to Administrative Notice to Proceed.

Wherever a proposed substitute material or equipment has not been submitted prior to Administrative Notice to Proceed, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by ENGINEER, CONTRACTOR shall provide the material or equipment named in the Contract Documents.

CONTRACTOR shall certify that the proposed substitute will perform adequately the functions and achieve the results called for by the design, be at least equal in quality or utility to that specified, and be suited to the same use as that specified.

ENGINEER shall be allowed twenty-one (21) calendar days to evaluate each proposed substitute for an "or equal". If resubmittals are required, each will also be allowed twenty-one (21) calendar days for evaluation. Review time by ENGINEER shall not include delivery time to and from CONTRACTOR.

No shop drawing submittals shall be made for a substitute item nor will any substitute item be ordered, installed, or utilized without ENGINEER's prior written acceptance of CONTRACTOR's "Substitution Request Form".

ENGINEER shall record the time required by ENGINEER in evaluating substitutions proposed by CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for all associated costs for evaluating each proposed substitute.

CONTRACTOR's application using the "Substitution Request Forms" shall contain the following statements and/or information that shall be considered by ENGINEER in evaluating the proposed substitution:

The evaluation and acceptance of the proposed substitute will not prejudice CONTRACTOR's achievement of substantial completion of time.
Whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.
Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
All variations of the proposed substitute for that specified will be identified.
Available maintenance, repair, and replacement service will be indicated.
Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of all others, including CONTRACTOR's subcontractors and suppliers that may be affected by the resulting change, and a statement that the effect of such change shall be without additional cost to OWNER.

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

Submit Shop Drawings, Product Data, Samples, and other pertinent information in sufficient detail to show compliance with specified requirements.

Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.
Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
Coordinate submittal with other submittals and with the requirements of the Contract Documents.

After completion of checking, verification, and revising; stamp, sign, and date submittals indicating review and approval; and submit to ENGINEER.
Stamp and signature indicates CONTRACTOR has satisfied shop drawing review responsibilities and constitutes CONTRACTOR's written approval of shop drawing.
Shop drawings without CONTRACTOR's written approval will be returned for resubmission.

Shop Drawings: Submit 6 copies. One will be returned with reviewer's comments and stamp.

Product Data and Manufacturer's Instructions: Submit 6 copies. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.
1 copy will be returned with reviewer's comments and stamp.

Samples: Submit 2 samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments, and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.

Special Samples: Submit 1 sample labeled with reference to applicable Contract Documents. Sample and 1 label will be returned for installation in the Work.

Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

MANUFACTURER'S INSTRUCTIONS

Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.

Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

ENGINEER'S REVIEW

ENGINEER's review of submittals shall not release CONTRACTOR from CONTRACTOR's responsibility for performance of requirements of Contract Documents. Neither shall ENGINEER's review release CONTRACTOR from fulfilling purpose of installation nor from CONTRACTOR's liability to replace defective work.

Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how CONTRACTOR intends to conform with the design concepts.

ENGINEER's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.
ENGINEER's review does not extend to:

- Accuracy of dimensions, quantities, or performance of equipment and systems designed by CONTRACTOR.
- CONTRACTOR's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
- Safety precautions or programs related to safety which shall remain the sole responsibility of the CONTRACTOR.

Except as may be provided in subsequent specifications, a submittal will be returned within 30 days as either “ACCEPTED” or “NOT ACCEPTED” with appropriate comments if required.
When a submittal cannot be returned within that period, ENGINEER will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.

Not accepted submittals returned as "CORRECT AND RESUBMIT" contain specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals. Rejected submittals contain remarks relative to further submittal.

ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

Costs incurred by OWNER as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to OWNER will be made by deducting such costs from CONTRACTOR's subsequent partial payments.

MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

Shop Drawings of minor or incidental fabricated products will not be required, unless requested.

Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

SUBMITTALS FOR INFORMATION OR RECORD ONLY

Submit 6 copies of each. None will be returned.

Mill Test Reports:

- Submit 6 certified copies of factory and mill test reports for record only. No copies will be returned.
- Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.
- Pay for mill and factory tests.

Reinforcing Steel:

- Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.
- Note deviations and variations as specified for Shop Drawings.

Tunnels, Jacking, and Boring:

- Submit detailed description of tunneling or jacking operations as Shop Drawings.
- Include indications of:
  - Equipment to be used.
  - Detailed schedule for performing the Work.
  - Safety precautions to be taken.
  - Compliance with applicable Laws and Regulations.
  - Monitoring of railroad track or roadway movement.
  - Contingency plan for correcting movement.
  - Other pertinent information on items required to perform the Work.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SHOP DRAWINGS SUBMITTAL FORM

The CONTRACTOR shall use this form for all submittals. The procedure governing shop drawings submittal is contained in 01_33_00 of the specifications. Failure to comply with all requirements specified therein will constitute grounds for return of t drawings for proper resubmittal.

CHECK ONE: This is [ ] a original submittal [ ] a second submittal [ ] a ____ submittal

CONTRACT: DATE: SUBMITTAL #:

FROM: SPECIFICATION SECTION:

SUBJECT OF SUBMITTAL: PROJECT NAME:

DESCRIPTION OF SUBMITTAL:	**TOTAL # OF PAGES IN THIS SUBMITTAL:**	
Submitted as:	**(Including Drawing Sheets)**	

[ ] Per Documents
[ ] With Deviations (submittal deviation form attached)
[ ] Proposed substitution prior to Administrative Notice to Proceed (submittal substitution form attached)
[ ] A hazardous material (MSDS form is attached)
[ ] A non-hazardous material
[ ] E-File (Electronic File)

The attached submittal has been checked for accuracy, completeness, and compliance with the contract documents and is transmitted for your review.

CONTRACTOR: _____

BY: _____

AUTHORIZED REPRESENTATIVE

Review and permission to proceed does not constitute acceptance of design details, calculations, analysis, test methods, cert or material developed or selected by the Contractor and does not relieve the Contractor from full compliance with the C Documents.

REVIEW ACTION BY:

[ ] No Exceptions Noted – Work may proceed.
[ ] Exceptions Noted – Work may proceed. Resubmittal not required.
[ ] Exceptions Noted – Work may proceed. Submit hard copies per 1.01A.
[ ] Exceptions Noted – Work may proceed subject to incorporation of changes indicated; resubmit for record.

No payments shall be made until record is complete.

[ ] Rejected/Resubmit – Work may not proceed. Revise and resubmit.
[ ] For Record Only – Owner review not required.
[ ] For Record Only – Owner review not required. Submit hard copies.

COMMENTS: _____

BY: _____ _____

ENGINEER/DESIGN CONSULTANT DATE

TECHNICAL SPECIFICATIONS

SUBSTITUTION REQUEST FORM

TO BE SUBMITTED PRIOR TO NOTICE TO PROCEED IN ACCORDANCE WITH NRS 338.140 (3)

CONTRACT:	**DATE:** **SUBMITTAL #:**
FROM:	**SPECIFICATION SECTION:**
TO: **City of Carson City, Nevada**	**ATTN:**
SUBJECT OF SUBMITTAL:	**PROJECT NAME: DIGESTER REHABILITATION PROJECT – PHASE I**

Specified Item:

Section	**Page**	**Description**

The undersigned requests consideration of the following:

Proposed substitution:

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request. Applicable portions of the data are clearly identified.

The undersigned states that the following paragraphs, unless modified on attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings and will not require a change in any of the Contract Documents.
2. The undersigned will pay for changes to the design, including engineering design, detailing, and construction costs caused by th requested substitution.
3. The proposed substitution will have no adverse affect on other subcontractors or suppliers, the construction schedule (specifically th of substantial completion), or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The incorporation or use of the substitute in connection with the work is not subject to payment of any license fee or royalty.
6. Complies with all requirements identified in paragraph 1.07 of Section 01_33_00.

The undersigned further states that the function, appearance and quality of the proposed Substitution are equivalent or superior to the Sp Item.

DESIGN CONSULTANT REVIEW FOR TECHNICAL MERIT

☐ Acceptable ☐ Not Acceptable

Signature Date

Contractor's Signature:_____	☐Not Accepted ☐Received Too Late ☐ Accepted
Print Name:_____	By:_____
Contractor:_____	Engineer:_____
_____	Date:_____
Date:_____	Remarks:_____
Telephone:_____	_____
Attachments:_____	_____

Accepted by Engineer _____ Date _____

SUBMITTAL DEVIATION FORM

CONTRACT: **DATE:** **SUBMITTAL #:**

CONTRACTOR: **SPECIFICATION SECTION:**

TO: **City of Carson City, Nevada** **ATTN:**

SUBJECT OF SUBMITTAL: **PROJECT NAME:**

The following deviation is submitted in compliance with Section 01_33_00.

_____

DESCRIPTION OF PROPOSED DEVIATION:_____

_____

_____

_____

The above proposed deviation will result in the following benefits to the OWNER:

MONETARY: _____

SCHEDULE: _____

_____

CONTRACTOR: _____

BY: _____

DESIGN CONSULTANT REVIEW FOR TECHNICAL MERIT

∗ ACCEPTABLE ∗ UNACCEPTABLE _____

Signature **Date**

ENGINEER'S EVALUATION:

∗ ACCEPTED ∗ REJECTED **REVIEWED BY:** _____

Engineer **Date**

SECTION 01_35_00

SPECIAL PROCEDURES

GENERAL

SUMMARY

Section Includes: Special procedures for locating and verifying concealed existing facilities.

CONCEALED EXISTING FACILITIES

Verify locations of utilities and facilities, which may exist by consulting with the OWNER, utility companies, and Blue Stake or Underground Services Alert (USA) or other service available in area of Project.
Abide by easement and right-of-way restrictions.

Notify the OWNER, owners of facilities when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.

Assume responsibility for repair of facilities damaged by performance of the Work.

Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area.
Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.

Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities.
When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SECTION 01_35_16

ALTERATION PROJECT PROCEDURES

GENERAL

SUMMARY

Section Includes: Requirements and procedures for performing alterations to existing facilities.

SUBMITTALS

Alterations Schedule: Submit in accordance with requirements for Progress Schedules.

SEQUENCE AND SCHEDULES

Perform Work in sequences and within times specified in Section 01_14_00.

Submit separate detailed sub-schedule for alterations, coordinated with construction schedules. Indicate:

Each stage of Work and dates of occupancy of areas.
Date of Substantial Completion for each area of alterations as appropriate.
Trades and Subcontractors employed in each stage.

WORK INVOLVED WITH EXISTING OPERATING FACILITIES

Perform the Work while existing facility is in operation.

Do not jeopardize operation or materially reduce efficiency of existing facility.

Coordinate the Work with operation of the facility.
Do not begin digester cleaning, alterations of designated portions of the Work until specific permission has been granted in writing by OWNER in each case.
ENGINEER will review the planned procedure with facility manager.
Complete as quickly as possible and with as little delay as possible, connections to existing equipment and utilities, and other operations that interfere with the operation of existing facility.

Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.

Facility manager will cooperate in every way practicable to assist in expediting the Work.

When necessary for the proper operation or maintenance of portions of the facility, reschedule Work operations so that the Work will not conflict with necessary operations or maintenance of the facility.

ALTERATIONS, CUTTING, AND PROTECTION

Assign relocation, removal, cutting, and patching to trades qualified to perform in manner which causes least damage and provide means of returning surfaces to appearance of new construction.

Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining existing and new construction.

Provide temporary enclosures as specified in Section 01_50_00 to separate construction areas from existing building and from areas occupied by OWNER, and to provide weather protection.

SALVAGE MATERIALS

Salvage Materials: Materials removed from existing facility.

Handling and Storage:
Prevent damage to salvaged materials during removal, handling, and transportation of salvaged materials.
Prepare salvaged materials for long-term storage.
Store salvaged materials in location as directed by OWNER.

Pay costs associated with salvaging materials, including handling, transporting, and storage.

If materials are to be reinstalled, provide temporary storage of materials and ensure that materials are protected from damage. If materials are damaged during removal, handling, or storage, provide replacement at no additional cost to the OWNER.

PREPARATION

Identify existing materials which shall be patched, extended, or matched.

In addition to demolition specified in Section 01_35_21, and Construction specifically indicated on the Drawings, cut, move, or remove items as necessary to provide access or to allow alteration and new construction to proceed, including:
Repair or removal of hazardous or unsanitary conditions.
Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit, and wiring.
Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals, and deteriorated concrete.
Cleaning of surfaces and removal of surface finishes needed to install new construction and finishes.
Disposal of items removed and not salvaged.

Cut and remove minimum amount of existing construction in manner which avoids damage to adjacent work.

Cut finish surfaces such as masonry, tile, plaster, and metals by methods which terminate surfaces in straight line at natural points of division.

Perform cutting and patching as specified in Section 01_73_29.

TRANSITION FROM EXISTING TO NEW WORK

When new construction abuts or finishes flush with existing construction, make smooth transitions and match architecture of existing construction.

Where partitions are removed, patch floors, walls, and ceilings with finish materials which match existing materials.

Where removal of partitions results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth planes without breaks, steps, or bulkheads.

Where changes of plane exceed 2 inches, request instructions for making transition.

Trim and refinish existing doors as necessary to clear new floors.

Match patched construction with adjacent construction in texture and appearance so that patch or transition is invisible at 5-foot distance.

When finished surfaces are cut so that smooth transition is impossible, terminate existing surface in neat manner along straight line at natural line of division and provide appropriate trim.

DAMAGED SURFACES

Patch and replace portions of existing finished surfaces which are damaged, lifted and discolored with matching material.

Provide adequate support of substrate prior to patching finishes.

Refinish patched portion of painted or coated surfaces in manner which produces uniform color and texture to entire surface.

When existing surface finish cannot be matched, refinish entire surface to nearest change of plane exceeding 45 degrees.

CLEANING

Perform periodic and final cleaning as specified in Sections 01_50_00 and 01_77_00.

Clean OWNER-occupied areas daily.

Clean spillage, overspray, and heavy collection of dust in OWNER-occupied areas immediately.

At completion of each portion of Work, clean area and make surfaces ready for successive portions of Work.

At completion of alterations in each area, provide final cleaning and return space to condition suitable for use by OWNER.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SECTION 01_35_21

SELECTIVE DEMOLITION

GENERAL

SUMMARY

Section Includes: Demolition of portions of structures.

SUBMITTALS

Shop Drawings: Include:
Demolition methods of load bearing structures indicated on the Drawings, signed and sealed by structural Professional Engineer registered in the State of Nevada.
Sequence of demolition, which addresses the work restrictions indicated in Section 01_14_00.

Submittals for Information Only:
Permits and notices authorizing demolition.
Certificates of severance of utility services.
Permit for transport and disposal of debris.
Demolition procedures and operational sequence.

Project Record Documents: Include locations of service lines and capped utilities.

REGULATORY REQUIREMENTS

Dispose of debris in accordance with governing regulatory agencies.

Comply with applicable air pollution control regulations.

Obtain permits for building demolition, transportation of debris to disposal site and dust control.

PREPARATION

Obtain permission from adjacent property OWNER's when outriggers, swinging cranes, and other equipment may have to traverse adjacent property.

ENVIRONMENTAL REQUIREMENTS

Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from.

Prevent movement, settlement, or collapse of structures, walls, adjacent services, sidewalks, driveways, and trees. Provide and place bracing or shoring. Assume liability for movement, settlement, or collapse. Promptly repair damage.

Cease operations and notify ENGINEER immediately when safety of structure appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.

Provide erect and maintain barricades, lighting, guard rails, and protective devices as required to protect building occupants, general public, workers, and adjoining property.

EXISTING SERVICES

Arrange and pay for capping and plugging utility services. Disconnect and stub off. Notify affected utility company in advance and obtain approval before starting demolition.

Place markers to indicate location of disconnected services.

MAINTAINING TRAFFIC

Do not close or obstruct roadways without permits.

Conduct operations with minimum interference to public or private roadways.

MATERIALS

Materials and equipment to be retained by OWNER:
Embedded relics and antiques such as cornerstones, cornerstone contents, commemorative plaques and tablets.

CONTRACTOR shall furnish all materials, tools, equipment, devices, appurtenances, facilities and services required for performing selective demolition work.

Erect weatherproof closures for exterior openings. Maintain exit requirements.

Erect and maintain dustproof partitions as required to prevent spread of dust, fumes and smoke to other parts of building. On completion, remove partitions and repair damaged surfaces to match adjacent surfaces.

Protect interior of building from rain and water damage.

Provide and maintain protective devices to prevent injury from falling objects.

Locate guard rails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.

Cause as little inconvenience to adjacent occupied building areas as possible.

Protect landscaping, bench marks, and existing construction to remain from damage or displacement.

Carefully remove designated materials and equipment to be retained by OWNER or re-installed. Deliver materials and equipment when and where directed by ENGINEER. Store and protect materials and equipment to be re-installed.

DEMOLITION

Demolish designated portions of structures and appurtenances in orderly and careful manner.

Assume possession of demolished materials, unless specified otherwise. Remove demolished materials from site at least weekly.

Prevent airborne dust. Use water or dust palliative when necessary. Provide and maintain hoses and connections to water main or hydrant.

Do not burn materials on site.

Immediately upon discovery, remove, and dispose of contaminated, vermin infested, or dangerous materials by safe means so as not to endanger health of workers and public.

Rough grade areas affected by demolition.

Remove demolished materials, tools, and equipment upon completion of demolition.

REPAIR

Repair all damage caused by demolition and restore all paving, grading and landscaping to initial condition.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SECTION 01_35_22

SAFETY PLAN

PART 2 GENERAL

2.01 SUMMARY

A. Section Includes: Development and maintenance of a Construction Safety Plan.

2.02 REFERENCES

A. Occupational Safety and Health Administration (OSHA).

B. National Fire Protection Association (NFPA).

2.03 CONSTRUCTION SAFETY PLAN

A. Detail the Methods and Procedures to comply with Federal and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:
   1. Identification of the Certified or Licensed Safety Consultant who will prepare, initiate, maintain, and supervise safety programs, and procedures.
   2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
   3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
   4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
   5. Procedures for reporting safety or health hazards.
   6. Procedures to follow to correct a recognized safety and health hazard.
   7. Procedures for investigation of accidents, injuries, illnesses, and unusual events that have occurred at the construction site.
   8. Periodic and scheduled inspections of general work areas and specific work stations.
   9. Training for employees and workers at the jobsite.
   10. Methods of communication of safe working conditions, work practices, and required personal protection equipment.

B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of Subcontractors, suppliers, and other persons on the jobsite.
   1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
   2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

C. Transmit to OWNER and ENGINEER copies of reports and other documents related to accidents or injuries encountered during construction.

PART 3 PRODUCTS

Not Used.

PART 4 EXECUTION

Not Used.

END OF SECTION

SECTION 01_35_44

HAZARDOUS MATERIAL PROCEDURES

GENERAL

SUMMARY

Section Includes: Procedures required when encountering hazardous materials at the Work site.

REFERENCES

Steel Structure Painting Council:
- Guide 61 - Guide for Containing Debris Generated During Paint Removal Operations.
- Guide 61 - Description of Methods and Systems.
- Guide 71 - Guide for the Disposal of Lead-Contamination Surface Preparation Debris.
- PA Guide 3.

American Conference of Government Industrial Hygienists (ACGHI).

American National Standards Institute (ANSI).

National Institute for Occupational Safety and Health (NIOSH).

Occupational Safety and Health Administration (OSHA).

Society for Protective Coatings (SPCC):
- Guide 6 - Guide for Containing Debris Generated During Paint Removal Operations.
- Guide 7 - Guide for the Disposal of Lead-Contamination Surface Preparation Debris.

United States Environmental Protection Agency (EPA).

United States Code of Federal Regulation (CFR):
- Title 29 - Labor.
- 1926.62 - Lead.
- Title 40 - Protection of Environment.
- 261 - Identification And Listing Of Hazardous Waste

SUBMITTALS

Submit laboratory reports, hazardous material removal plans, and certifications.

OPERATING DIGESTERS

Observe safety precautions in vicinity of operating digesters which contain digester gases, including methane, hydrogen sulfide, and carbon dioxide.

HAZARDOUS MATERIALS PROCEDURES

Hazardous materials are those defined by the State of Nevada.

When Hazardous Materials Have Been Found:
Prepare and initiate implementation of plan of action.
Notify immediately OWNER, ENGINEER, and other affected persons.
Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with laws and regulations.

Forward to ENGINEER, copies of reports, permits, receipts, and other documentation related to remedial work.

Assume responsibility for worker health and safety, including health and safety of Subcontractors and their workers.
Instruct workers on recognition and reporting of materials that may be hazardous.

File requests for adjustments to Contract Times and Contract Price due to the finding of Hazardous Materials in the Work site in accordance with paragraph 4.06, General Conditions.
Minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

ASBESTOS MATERIALS

It is the specific intent of these Contract Documents to exclude from the Work any and all products or materials containing asbestos. No products containing asbestos shall be incorporated in the Work.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SECTION 01_42_13

ABBREVIATIONS

GENERAL

SUMMARY

Section Includes: Abbreviations and meanings.

INTERPRETATIONS

Interpret abbreviations by context in which abbreviations are used.

ABBREVIATIONS

Abbreviations used to identify Reference Standards:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ABC	Associated Air Balance Council
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ADC	Air Diffusion Council
ABMA	American Bearing Manufacturers' Association (formerly AFBMA, Anti-Friction Bearing Manufacturers' Association)
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers' Association
AI	Asphalt Institute
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASAHC	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International (Former name American Society for Testing and Materials. Still used in specifications.)
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association

AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWSC	American Welding Society Code
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BSI	Building Stone Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPSC	U.S. Consumer Product Safety Commission
CRI	Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute
CTI	Ceramic Tile Institute
DHI	Door and Hardware Institute
EIFS	Exterior Insulation and Finish System
EJCDC	Engineers Joint Contract Documents Committee
FGMA	Flat Glass Marketing Association
FIA	Factory Insurance Association
FM	Factory Mutual
FS	Federal Specifications
FTI	Facing Tile Institute
GA	Gypsum Association
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
MS	Military Specifications
NAAMM	National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NBHA	National Builders Hardware Association
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NETA	International Electrical Testing Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NIST	National Institute of Standards and Technology
NMWIA	National Mineral Wood Insulation Association
NPCA	National Paint and Coatings Association
NRCA	National Roofing Contractors Association
NTMA	National Terrazzo and Mosaic Association

NWMA	National Woodwork Manufacturer's Association
OSHA	Occupational Health and Safety Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Paint and Decorating Contractors of America
PDI	Plumbing and Drainage Institute
PEI	Porcelain Enamel Institute
PS	Product Standard
RTI	Resilient Tile Institute
SAE	Society of Automotive Engineers
SCPA	Structural Clay Products Association
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Society for Protective Coatings-Steel Structures Painting Council
TCA	Tile Council of America
UBC	Uniform Building Code (ICBO)
UL	Underwriters Laboratories, Inc.
UNS	Unified Numbering System
USDA	United States Department of Agriculture
VA	Vermiculite Association
WCLA	West Coast Lumberman's Association
WCLIB	West Coast Lumber Inspection Bureau
WPA	Western Pine Association
WPOA	Western Plumbing Officials Association
WRC	Welding Research Council
WSCPA	Western States Clay Products Association
WWPA	Western Wood Products Association

Abbreviations used in Specifications:

a	year or years (metric unit)
A	ampere or amperes
am	ante meridian (before noon)
ac	alternating current
ac-ft	acre-foot or acre-feet
atm	atmosphere
AWG	American Wire Gauge
bbl	barrel or barrels
bd	board
bhp	brake horsepower
bil gal	billion gallons
BOD	biochemical oxygen demand

Btu	British thermal unit or units
Btuh	British thermal units per hour
bu	bushel or bushels
C	degrees Celsius
cal	calorie or calories
cap	capita
cd	candela or candelas
cfm	cubic feet per minute
Ci	curie or curies
cm	centimeter or centimeters
cmu	concrete masonry unit
CO	carbon monoxide
Co.	Company
CO_2	carbon dioxide
COD	chemical oxygen demand
Corp.	Corporation
counts/min	counts per minute
cu	cubic
cu cm	cubic centimeter or centimeters
cu ft	cubic foot or feet
cu ft/day	cubic feet per day
cu ft/hr	cubic feet per hour
cu ft/min	cubic feet per minute
cu ft/sec	cubic feet per second
cu in	cubic inch or inches
cu m	cubic meter or meters
cu yd	cubic yard or yards
d	day (metric units)
day	day (English units)
db	decibels
DB	dry bulb (temperature)
dc	direct current
diam	diameter
DO	dissolved oxygen
DS	dissolved solids
emf	electromotive force
fpm	feet per minute
F	degrees Fahrenheit
ft	feet or foot
fc	foot-candle or foot candles
ft/day	feet per day
ft/hr	feet per hour
ft/min	feet per minute
ft/sec	feet per second
g	gram or grams
G	gravitational force
gal	gallon or gallons
gal/day	gallons per day

gal/min	gallons per minutes
gal/sec	gallons per second
gfd	gallons per square foot per day
g/L	grams per liter
gpd	gallons per day
gpd/ac	gallons per day per acre
gpd/cap	gallons per day per capita
gpd/sq ft	gallons per day per square foot
gph	gallons per hour
gpm	gallons per minute
gps	gallons per second
h	hour or hours (metric units)
ha	hectare or hectares
hp	high point
hp	horsepower
hp-hr	horsepower-hour or horsepower-hours
hr	hour or hours (English units)
Hz	hertz
ID	inside diameter
ihp	indicated horsepower
Inc.	Incorporated
inch	inch
inches	inches
inches/sec	inches per second
J	joule or joules
JTU	Jackson turbidity unit or units
k	kips
K	kelvin
K	thermal conductivity
kcal	kilocalorie or kilocalories
kcmil	thousand circular mils
kg	kilogram or kilograms
km	kilometer or kilometers
kN	kilonewton or kilonewtons
kPa	kilopascal or kilopascals
ksi	kips per square inch
kV	kilovolt or kilovolts
kVA	kilovolt-ampere or kilovolt-amperes
kW	kilowatt or kilowatts
kWh	kilowatt hour
L	liter or liters
lb/1000 cu ft	pounds per thousand cubic foot
lb/acre-ft	pounds per acre-foot
lb/ac	pounds per acre
lb/cu ft	pounds per cubic foot
lb/day/cu ft	pounds per day per cubic foot
lb/day/acre	pounds per day per acre
lb/sq ft	pounds per square foot

lin	linear, lineal
lin ft	linear foot or feet
lm	lumen or lumens
log	logarithm (common)
ln	logarithm (natural)
lx	lux
m	meter or meters
M	molar (concentration)
mA	milliampere or milliamperes
max	maximum
mCi	millicurie or millicuries
meq	milliequivalent
μF	microfarad or microfarads
MFBM	thousand feet board measure
mfr	manufacturer
mg	milligram or milligrams
mgd/ac	million gallons per day per acre
mgd	million gallons per day
mg/L	milligrams per liter
μg/L	micrograms per liter
μm	micrometer or micrometers
mile	mile
mil. gal	million gallons
miles	miles
min	minimum
min	minute or minutes
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeter or millimeters
mol wt	molecular weight
mol	mole
Mpa	megapascal or megapascals
mph	miles per hour
MPN	most probable number
mR	milliroentgen or milliroentgens
Mrad	megarad or megarads
mV	millivolt or millivolts
MW	megawatt or megawatts
N	newton or newtons
N	normal (concentration)
No.	number
Nos	numbers
NRC	noise reduction coefficient
NTU or ntu	nephelometric turbidity unit
oc	on center
OD	outside diameter
ORP	oxidation-reduction potential
OT	ortho-tolidine
OTA	ortha-tolidine-arsenite
oz	ounce or ounces

oz/sq ft	ounces per square foot
Pa	pascal or pascals
PE	primary effluent
pl	plate or property line
pm	post meridiem (afternoon)
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
pr	pair
psf/hr	pounds per square foot per hour
psf	pounds per square foot
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PVC	polyvinyl chloride
qt	quart or quarts
R	radius
R	roentgen or roentgens
rad	radiation absorbed dose
RAS	recycled activated sludge
RH	relative humidity
rpm	revolutions per minute
rps	revolutions per second
RW	raw water
s	second (metric units)
S	Siemens (mho)
SDI	sludge density index or silt density index
sec	second (English units)
SI	International System of Units
sp	static pressure
sp gr	specific gravity
sp ht	specific heat
sq	square
cm^2 or sq cm	square centimeter or centimeters
sq ft	square feet or foot
sq inch	square inch
sq inches	square inches
km^2 or sq km	square kilometer or kilometers
m^2 or sq m	square meter or meters
mm^2 or sq mm	square millimeter or millimeters
sq yd	square yard or yards
SS	suspended solids
STC	Sound Transmission Class
SVI	sludge volume index
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TLM	median tolerance limit
TOC	total organic carbon
TOD	total oxygen demand

TOW	top of weir
TS	total solids
TSS	total suspended solids
TVS	total volatile solids
U	U Factor/U Value
U	Coefficient of Heat Transfer
U	heat transfer coefficient
UNS	Uniform Numbering System
US	United States
V	volt or volts
VA	volt-ampere or volt-amperes
W	watt or watts
WAS	waste activated sludge
WB	wet bulb
wg	water gauge
wk	week or weeks
wt	weight
yd	yard or yards
yr	year or years (English unit)

Abbreviations used on Drawings: As listed on Drawings or in Specifications.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_45_00

QUALITY CONTROL

GENERAL

SUMMARY

Section Includes: Quality control requirements and procedures for products and workmanship and includes the following:

Sampling and testing of materials.
Testing of equipment.
Requirements for testing laboratories.
Procedures and limitations of inspection.

REFERENCES

American Society for Testing and Materials (ASTM):

E 329 - Standard for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

PRODUCTS AND WORKMANSHIP

Provide new products of specified quality, and equal to accepted samples when samples were submitted.

Perform and complete work in thorough manner.
Call ENGINEER's attention to apparent errors, conflicts, discrepancies, or omissions in Contract Documents and request instructions before proceeding with the Work.
ENGINEER will issue written clarification or interpretation of requirements of the Contract Documents.

When specified, products will be tested and inspected either at point of origin or at Work site.
Notify ENGINEER in writing well in advance of when products will be ready for testing and inspection at point of origin.
Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or reinspection at Work site.

Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

AUTHORITY AND DUTIES OF OWNER'S REPRESENTATIVE OR INSPECTOR

OWNER's Representative or Inspector employed or retained by OWNER or ENGINEER is authorized to inspect the Work.

Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.

Deficiencies or defects in the Work which have been observed will be called to CONTRACTOR's attention.

Inspector Will Not:

Alter or waive provisions of Contract Documents.
Inspect CONTRACTOR's means, methods, techniques, sequences, or procedures for construction.
Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for CONTRACTOR.
Supervise, control, or direct CONTRACTOR's safety precautions or programs; or inspect for safety conditions on Work site, or of persons thereon, whether CONTRACTOR's employees or others.

Inspector Will:

Conduct on-site observations of the Work in progress to assist ENGINEER in determining when the Work is, in general, proceeding in accordance with Contract Documents.
Report to ENGINEER whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special testing.

INSPECTION

Material and equipment, and workmanship shall be subject to inspection and rejection when not in conformance with Contract Documents.

Remove defective work and products from Work site, whether in place or not, and replace or renew with work, material or equipment in conformance with Contract Documents.

Questions concerning acceptability of materials, classification of materials, and execution of the Work will be decided by ENGINEER.

Facilitate inspection by maintaining proper facilities and providing safe access to the Work, to shops where products are in preparation, and to warehouses and storage yards where products are stored.

ENGINEER's observation of Work that will be covered:

When directed to allow observation of work before it is covered, provide timely notification of work readiness and allow ENGINEER reasonable time to observe such work before covering it.
Uncover, at CONTRACTOR's cost, work covered for which ENGINEER was not given timely notification or reasonable time to conduct observations. ENGINEER may specify time requirements for timely notification and for performing observations.

SAMPLING AND TESTING

General:

Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.

When specified in Sections where products are specified,
Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
Test materials in accordance with standards of national technical organizations.

Sampling:
Furnish specimens of materials when requested.
Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
Specimens of materials will be taken for testing whenever necessary to determine quality of material.
Assist ENGINEER in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.

Testing:
OWNER will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents.
Mill tests, soil compaction test and other specified tests shall be paid for by CONTRACTOR.
When protesting failed tests of material in place or to be used, take additional specimens and have specimens tested.
When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.

Test Standards:
Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
Standards and publication references in Contract Documents shall be edition or revision in effect on date stipulated in Document 00_72_00.

TESTING LABORATORY SERVICES

Qualification of Laboratory:
Meets "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
Meets requirements of ASTM E 329.
Has authorization to operate in state in which Project is located.
Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
Has testing equipment calibrated at reasonable intervals by devices of accuracy traceable to NBS or accepted values of natural physical constants.

Laboratory Duties:
Cooperate with ENGINEER and CONTRACTOR.
Provide qualified personnel.
Notify ENGINEER and CONTRACTOR, in writing, of response time needed to schedule testing or inspections after receipt of notice.

Perform specified inspections, sampling and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
Promptly notify ENGINEER and CONTRACTOR of observed irregularities or deficiencies of construction.
Promptly submit written report of each test and inspection; one copy each to ENGINEER, OWNER, CONTRACTOR, and one copy to file of Project Record Documents. Each report shall include:
Date issued.
Project title and number.
Testing laboratory name, address, and telephone number.
Name and signature of laboratory inspector.
Date and time of sampling or inspection.
Record of temperature and weather conditions.
Date of test.
Identification of product and Specification section.
Location of sample or test in Project.
Type of inspection or test.
Results of tests and compliance with Contract Documents.
Interpretation of test results, when requested by ENGINEER.

Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:
Release, revoke, alter or enlarge on requirements of Contract Documents.
Approve or accept portion of Work.
Perform duties of CONTRACTOR.

CONTRACTOR'S RESPONSIBILITIES:

Cooperate with laboratory personnel and provide access to construction and manufacturing operations.

Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

Provide to laboratory preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.

Furnish copies of product test reports.

Furnish Incidental Labor and Facilities:
To provide access to construction to be tested.
To obtain and handle samples at Work site or at source of product to be tested.
To facilitate inspections and tests.
For storage and curing of test samples.

Notify laboratory in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

SECTION 01_45_24

SPECIAL TESTS AND INSPECTIONS

GENERAL

SUMMARY

Section Includes: This Section describes the requirements for providing special tests and inspections required by Laws and Regulations.

REFERENCES

International Conference of Building Officials (ICBO):
2006 International Building Code (IBC) (with 2007 Northern Nevada Amendments).

DESCRIPTION

This Section describes special tests and inspections of structural assemblies and components to be performed in compliance with International Building Code, Chapter 17 - Structural Tests and Inspections, Section 1701-Special Inspections.

These special tests and inspections are in addition to the requirements specified in Section 01_45_00, Quality Control, and by the individual Sections in DIVISION 2 through DIVISION 46.

The Engineer of record acting as the OWNER's agent will employ one or more inspectors who will provide special inspections during construction.

INSPECTION

Duties of Special Inspector:
General: Required duties of the Special Inspector are described in IBC Chapter 17-STRUCTURAL TESTS AND INSPECTIONS, Section 1701-Special Inspections, Subsection 1701.3.

TESTS

Testing Laboratory: Special tests will be performed by the Engineer of record testing laboratory as specified in Section 01_45_00, Quality Control.

Selection of the material required to be tested shall be by the OWNER's Testing Laboratory and not the CONTRACTOR.

SPECIFIC TESTS AND INSPECTIONS

The following types of work which require special inspection as described in UBC Section 1701.5 includes the following:
Cast-in-place concrete.
Bolts installed in concrete which require special inspection as indicated on the Drawings.

Epoxy dowels and bolts.
Reinforcing steel.
Structural masonry which requires special inspection as indicated on the Drawings.

Refer to Appendix A, and B for the Special Inspection and Testing Schedule.

PRODUCTS

Not Used.

EXECUTION

SCHEDULE

The CONTRACTOR shall allow time necessary for Special Inspections as listed above.

Sufficient notice shall be given so that the Special Inspections can be performed. This includes time for off-site Special Inspectors to travel to site.

PROCEDURE

The Special Inspector will notify the ENGINEER of any corrections required.

The CONTRACTOR shall not proceed until the work is satisfactory to the ENGINEER.

END OF SECTION

APPENDIX A
CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE

Verification and Inspection	Continuous	Periodic
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	–	X
2. Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5B.	–	–
3. Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased.	X	–
4. Verifying use of required design mix.	–	X
5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	–
6. Inspection of concrete and shotcrete placement for proper application techniques.	X	–
7. Inspection for maintenance of specified curing temperature and techniques.	–	X
8. Inspection of prestressed concrete:		
a. Application of prestressing forces.	X	–
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.	X	–
9. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	–	X

TECHNICAL SPECIFICATIONS

APPENDIX B
MASONRY SPECIAL INSPECTION SCHEDULE

Verification and Inspection	Frequency of Inspection	
	Continuous During Task Listed	**Periodic During Task Listed**
1. As masonry construction begins, the following shall be verified for compliance:	–	X
a. Proportions of site-prepared mortar.	–	X
b. Construction of mortar joints.		X
c. Location of reinforcement and connectors.		X
d. Prestressing technique.	–	X
e. Grade and size of prestressing tendons and anchorages.	–	X
2. The inspection program shall verify:		
a. Size and location of structural elements.	–	X
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	–	X
c. Specified size, grade, and type of reinforcement.	–	X
d. Welding of reinforcing bars.	X	–
e. Protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F).	–	X
f. Application and measurement of prestressing force.	–	X
3. Prior to grouting, the following shall be verified for compliance:		
a. Grout space is clean.	–	X
b. Placement of reinforcement and connectors and prestressing tendons and anchorages.		X
c. Proportions of site-prepared grout and prestressing grout for bonded tendons.		X
d. Construction of mortar joints.		X
4. Grout placement shall be verified for compliance with code and construction document provisions.	X	–
a. Grouting of prestressing bonded tendons.	X	–
5. Preparation of any required grout specimens, mortar specimens, and/or prisms shall be observed.	X	–
6. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	–	X

TECHNICAL SPECIFICATIONS

SECTION 01_50_00

TEMPORARY FACILITIES AND CONTROLS

GENERAL

SUMMARY

Section Includes:

Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, project sign, field offices and sheds, and removal after construction.

SUBMITTALS

General: For products specified to be furnished under this Section, submit product data in accordance with Section 01_33_00.

TEMPORARY UTILITIES

Temporary Electrical Power:

Arrange with local utility to provide adequate temporary electrical service.

Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.

Provide, maintain, and pay for electric power for performance of the Work except for power required for the final 7-day operational test.

When using permanent facilities, provide separate meter and reimburse OWNER for power used in connection with performance of the Work.

Temporary Electrical Lighting:

In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by OSHA and state agency which administers OSHA regulations where Project is located.

When available, permanent lighting facilities may be used in lieu of temporary facilities.

Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by CONTRACTOR for lighting.

Temporary Heating, Cooling, and Ventilating:

Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide safe environment for workers.

Permanent heating system may be utilized when sufficiently completed to allow safe operation.

Temporary Water:

Pay for and construct facilities necessary to furnish potable water for human consumption and non-potable water for use during construction.

Remove temporary piping and connections and restore affected portions of the facility to original condition before Substantial Completion.

Pay for water used for construction prior to Substantial Completion. OWNER will provide water for 7-day final test.

Development of Potable Water Supply:

Potable water is not available at construction site.

Provide potable water for human consumption during construction period.

Furnish potable water that meets requirements of Laws and Regulations.

Development of Non-potable Water Supply:

Non-potable water is available from hydrants or hose valves within plant without cost. When combined demand of the Work and plant exceeds plant supply capacity, provide additional temporary supply capacity.

Post ample signs throughout the Work area warning that plant water is not potable.

Obtain water for construction by piping from existing remote source, drilling temporary wells, or by filtering and treating water from local irrigation or other surface water sources.

Abide by laws and regulations when drilling temporary wells or using irrigation water.

Temporary Sanitary Facilities:

Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.

At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.

Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.

First Aid: Post first aid facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.

Utilities in Existing Facilities: See Section 01_14_00 - Work Restrictions.

CONSTRUCTION AIDS

Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.

Design temporary supports with adequate safety factor to assure adequate load bearing capability.

When requested, submit design calculations by professional registered engineer prior to application of loads.

Submitted design calculations are for information and record purposes only.

Accident Prevention:

Exercise precautions throughout construction for protection of persons and property.

Observe safety provisions of applicable Laws and Regulations.

Guard machinery and equipment, and eliminate other hazards.

Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.

Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.

Barricades:

Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.

Provide barriers with flashing lights after dark.

Keep barriers in place until excavations are entirely backfilled and compacted.

Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.

Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.

Hazards in Public Right-of-Way:

Mark at reasonable intervals, trenches, and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours.

During hours of darkness, provide markers with torches, flashers, or other adequate lights.

At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades.

During hours of darkness, provide warning lights at close intervals.

Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.

Protect existing structures, trees, shrubs, and other items to be preserved on Project site from injury, damage, or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.

Fences:

Enclose site of the Work with fence adequate to protect the Work against acts of theft, violence, and vandalism.

Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence, and vandalism.

When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the Work site, provided that damaged or defaced fencing is replaced prior to Substantial Completion.

Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of plant and material on site of the work when openings in existing fences are not closed.

During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.
Fence temporary openings when openings are no longer necessary.

SECURITY

Make adequate provision for protection of the Work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

ACCESS ROADS

General:

Build and maintain access roads to and on site of the Work to provide for delivery of material and for access to existing and operating plant facilities on site.
Build and maintain dust free roads which are suitable for travel at 20 miles per hour.

Off-site Access Roads:

Build and maintain graded earth roads.
Build roads only in public right-of-way or easements obtained by OWNER.
Obtain rights-of-way or easements when electing to build along other alignment.

On-site Access Roads:

Maintain access roads to storage areas and other areas to which frequent access is required.
Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.

TEMPORARY CONTROLS

Dust Control:

Prevent dust nuisance caused by operations, unpaved roads, excavation, backfilling, demolition, or other activities.
Control dust by sprinkling with water, use of dust palliatives, modification of operations, or other means acceptable to agencies having jurisdiction.

Noise Control:

In inhabited areas, particularly residential, perform operations in manner to minimize noise.
In residential areas, take special measures to suppress noise during night hours.

Mud Control:

Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition, or other activities.

FIELD OFFICES AND SHEDS

CONTRACTOR's Field Office:

Maintain on Project site weathertight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other relevant documents. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.

REMOVAL

Remove temporary buildings and furnishings before inspection for Final Completion or when directed.

Clean and repair damage caused by installation or use of temporary facilities.

Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.

Restore existing facilities used during construction to specified or original condition.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_60_00

PRODUCT REQUIREMENTS

GENERAL

SUMMARY

Section Includes: Product requirements; product selection; products schedule; execution; manufacturer's instructions; and delivery, handling, and storage.

PRODUCT REQUIREMENTS

Comply with Specifications and referenced standards as minimum requirements.

Provide products by same manufacturer when products are of similar nature, unless otherwise specified.

Provide identical products when products are required in quantity.

Provide products with interchangeable parts whenever possible.

Require each equipment manufacturer to have maintenance facilities meeting the following requirements:
Minimum 3 years operational experience.
Location in continental United States.
Equipment and tools capable of making repairs.
Staff qualified to make repairs.
Inventory of maintenance spare parts.

PRODUCT SELECTION

When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products which meet or exceed reference standard and Specifications.

When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
Products by one of named manufacturers which meets or exceeds Specifications.
Accepted or-equals.

When products are specified with names of manufacturers and model numbers or catalog designations, provide:
Products with model numbers or catalog designations by 1 of named manufacturers.
Accepted or-equals.

When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by 1 manufacturer only, provide:
Products specified by brand or trade name, model number, or catalog designation.

Products by 1 of named manufacturers proven in accordance with requirements for or-equals to meet or exceed quality, appearance, and performance of specified brand or trade name, model number, or catalog designation. Accepted or-equals.

When Products are specified with only 1 manufacturer followed by "or Equal," provide:

Products meeting or exceeding Specifications by specified manufacturer. Accepted or-equals.

4.01 PRODUCT OPTIONS AND SUBSTITUTIONS

1. General: Whenever a product is specified using a name of a particular manufacturer or supplier, the specific item cited shall be understood as establishing type, function, dimension, appearance, and quality desired. Other manufacturer's products will be considered for acceptance provided sufficient information is submitted to the ENGINEER for review to determine that the products proposed are equivalent to those named in accordance with Section 01_33_00.

QUALITY ASSURANCE

Employ entities, that meet or exceed specified qualifications, to execute the Work.

Inspect conditions before executing subsequent portions of the Work. Accept responsibility for correcting unsatisfactory conditions upon executing subsequent portions of the Work.

Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

DELIVERY, HANDLING, AND STORAGE

Prepare Products for Shipment by:

Applying grease and lubricating oil to bearings and similar items.
Separately packing or otherwise suitably protecting bearings.
Tagging or marking products to agree with delivery schedule or Shop Drawings.
Including complete packing lists and bills of material with each shipment.
Packaging products to facilitate handling and protection against damage during transit, handling, and storage.

Transport products by methods that avoid product damage. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

Provide equipment and personnel to handle products by methods to prevent soiling or damage.

Upon delivery, promptly inspect shipments. Verify compliance with Contract Documents, correct quantities and undamaged condition of products. Immediately store and protect products and materials until installed in Work.

Store products with seals and legible labels intact.

Store moisture sensitive products in weathertight enclosures.

Maintain products within temperature and humidity ranges required or recommended by manufacturer.

Connect and operate space heaters during storage when ambient temperatures fall below temperatures recommended by manufacturer.

Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces.

Exterior Storage of Fabricated Products:
Place on above ground supports which allow for drainage.
Cover products subject to deterioration with impervious sheet covering.
Provide ventilation to prevent condensation under covering.

Store loose granular materials on solid surfaces in well-drained area. Prevent materials mixing with foreign matter.

Provide access for inspection.

MANUFACTURER'S INSTRUCTIONS

Deliver, handle, store, install, erect, or apply products in accordance with manufacturer's instructions, Contract Documents and industry standards.

Periodically inspect to assure products are undamaged and maintained under required conditions.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_71_23

FIELD ENGINEERING

GENERAL

SUMMARY

Section Includes: Field engineering to establish lines and grades for the Work.

QUALITY ASSURANCE

Qualifications of Surveyor or Engineer: Registered civil engineer or land surveyor in state of Nevada.

Accuracy of stakes, alignments, and grades may be checked randomly by ENGINEER.
Notice of when checking will be conducted will be given.
When notice of checking is given, postpone parts of the Work affected by stakes, alignments or grades to be checked until checked.
Do not assume that ENGINEER's check substitutes or complements required field quality control procedures.

CONSTRUCTION STAKES, LINES, AND GRADES

Execute the Work in accordance with the lines and grades indicated.

Make distances and measurements on horizontal planes, except elevations and structural dimensions.

SURVEY REFERENCE POINTS

Basic reference line, a beginning point on basic reference line, and a benchmark will be provided by OWNER.

From these reference points, establish other control and reference points as required to properly lay out the Work.

Locate and protect control points prior to starting sitework, and preserve permanent reference points during construction.
Make no changes or relocations without prior written notice.
Replace Project control point, when lost or destroyed, in accordance with original survey control.

Set monuments for principal control points and protect them from being disturbed and displaced.
Re-establish disturbed monuments.
When disturbed, postpone parts of the Work that are governed by disturbed monuments until such monuments are re-established.

PROJECT SURVEY REQUIREMENTS

Establish minimum of 2 permanent benchmarks on site referenced to data established by survey control points.

Record permanent bench mark locations with horizontal and vertical data on Project Record Documents.

Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

RECORD DOCUMENTS

Prepare and submit Record Documents as specified in Section 01_77_00.

Maintain complete, accurate log of control points and survey.

Affix civil engineer's or land surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_73_29

CUTTING AND PATCHING

GENERAL

SUMMARY

Section Includes: Cutting and patching existing and new construction.

SUBMITTALS

Submit in accordance with Section 01_33_00.

Cutting and Patching Plan:
- Submit details of proposed construction before cutting and patching construction commences affecting:
- Work of OWNER or of others.
- Structural integrity of element of Project.
  - Cutting and Patching Plan shall include the following:
    - Identification of Work.
    - Description of affected construction.
    - Necessity for cutting, patching, alteration, or excavation.
    - Description of proposed construction.
    - Scope of cutting, patching, alteration, or excavation.

PRODUCTS

MATERIALS

Comply with specifications and standards for products involved.

EXECUTION

PREPARATION

Provide adequate temporary support as necessary to ensure structural integrity of affected portion of Work.

Provide devices and methods to protect other portions of Project from damage and persons from injury.

Provide protection from elements for that portion of Project which may be exposed by cutting and patching, and maintain excavations free from water.

CUTTING AND PATCHING

Cut, Fit, and Patch when required to:
- Make its several parts fit together properly.
- Remove and replace construction not conforming to Contract Documents.

Remove samples of installed construction as specified for testing.
Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.

Execute cutting and demolition by methods which will prevent damage and will provide proper surfaces to receive installation of repairs.

Openings in Existing Concrete and Masonry:

Create openings by:

Saw cutting completely through concrete or masonry, or
Scoring edges of opening with saw to at least 1-inch depth on both surfaces (when accessible) and removing concrete or masonry by chipping.
Do not allow saw cuts to extend beyond limits of opening.
Make corners square and true by combination of core drilling and grinding or chipping.
Prevent debris from falling into adjacent tanks or channels in service or from damaging existing equipment and other facilities.

Sizing of Openings in Existing Concrete or Masonry:

Make openings sufficiently large to permit final alignment of pipe and fittings without deflections.
Allow adequate space for packing around pipes and conduit to ensure watertightness.

Grouting Pipes in Place:

Sandblast concrete surfaces and thoroughly clean sand and other foreign material from surfaces prior to placing grout.
Grout pipes, sleeves, castings, and conduits in place by pouring grout under a head of at least 4 inches. Vibrate grout into place. Completely fill the spaces occupied by pipes, sleeves, castings, and conduits.
Water cure the grout.

Connections to Existing Pipes:

Cut existing pipe square.
Properly prepare the ends for the connection indicated on the Drawings.
Repair any damage to existing lining and coating.

Rehabilitate all areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains.
Fill areas in existing floors, walls, and ceilings from removed piping, conduit, and fasteners with non-shrink grout and finish smooth.
Remove concrete bases for equipment and supports by:

Saw cutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2-inch below finished surface. Do not cut existing reinforcement on floors.
Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
Patch with non-shrink grout to match adjacent grade and finish.

Terminate abandoned piping and conduits with blind flanges, caps, or plugs.

Treat Existing Concrete Reinforcement as follows:

Where existing reinforcement is to remain, protect, clean, and extend into new concrete.

Where existing reinforcement is not to be retained, cut off as follows:

Where new concrete joins existing concrete at the removal line, cut reinforcement flush with concrete surface at the removal line.

Where concrete surface at the removal line is the finished surface, cut reinforcement 2-inches below the surface, paint ends with epoxy, and patch holes with dry pack mortar.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_75_17

TESTING, TRAINING, AND FACILITY START-UP

GENERAL

DEFINITIONS

PHASE I - START-UP TEST: During this phase the CONTRACTOR and Manufacturer's field representatives shall perform check starts and functional testing of individual pieces of equipment, sub-systems, and systems to assure that they are ready for the 14-day operational performance test. The functional testing shall not be combined with the 14-day operational performance test. After this phase is completed, the entire system shall be ready for the OWNER to safely operate the system as the design intended and in automatic for the 14-day operational performance test. Since the phase after the Start-up Phase is the 14-day operational performance test phase, the CONTRACTOR shall submit a written letter 5 work days prior to the 14-day operational performance test certifying that all equipment, systems, and sub-systems are operating safely and in accordance with the intent of the design, and the manufacturer's recommendations, and that all equipment, systems, and sub-systems are ready for the OWNER to start the 14-day operational performance test. The Certificate of Start-Up Services form found at the end of this section shall also be completed for each piece of equipment, system, or subsystem as each start up is completed. The CONTRACTOR cannot proceed to the next phase until all Certificates and detailed field reports are submitted to the ENGINEER for each piece of equipment, system, and sub-system.

PHASE II - 14-DAY OPERATIONAL PERFORMANCE TEST: During this phase, the OWNER shall operate the system in automatic as the design intended. If there are any interruptions during this phase, the OWNER shall immediately stop the test and notify the CONTRACTOR of the problem or deficiency. After the deficiency has been corrected by the CONTRACTOR, the 14-day operational test will start over from the beginning. Each time the test is interrupted, the test will start over at the beginning until 14 days of uninterrupted operation has taken place. The OWNER will not accept the system until the 14-day test has been completed as described above. Actual product shall be utilized during this phase of the test. Before this phase of the test can start, all safety and work items shall be substantially completed and capable of automatic operation as intended.

PHASE III - POST OPERATIONAL PERFORMANCE TEST: During this phase, the OWNER shall operate the entire system for at least 60 days. At the end of 60 days, the manufacturer representatives and CONTRACTOR shall make a complete system check to determine if the entire system is operating satisfactorily. Each manufacturer shall perform a final inspection of all equipment, systems, and subsystems to assure that all equipment and systems are operating in conformance with the intent of the design and the manufacturer's recommendations. The CONTRACTOR shall submit a "Certificate of Post Operational Performance Test" form after the 60-day test has been completed satisfactorily. The CONTRACTOR and manufacturers representative shall

each sign each applicable certificate to document that all equipment, systems and subsystems are operating per the design and the manufacturers recommendations.

INSTRUCTIONAL SERVICES: Training shall be required for equipment based on requirements specified in respective sections. The CONTRACTOR shall provide a qualified manufacturer’s representative to provide training. The CONTRACTOR shall assure that a sign in sheet is completed for each training session and that the sign in form and certificate are submitted to the ENGINEER after training is completed.

SUMMARY

Section Includes: Requirements for equipment and system testing and facility start-up, including the following:

- Written Start-up Plan.
- Certificate of Proper Installation.
- Start Up Test.
- Services of manufacturer's representatives.
- 14-Day Operational Performance Test.
- Training of OWNER's personnel.
- Post-Operational Performance Test.
- General Start-up and Testing Procedures.
- Final testing requirements for the complete facility.

GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

Contract Requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.

Complete testing, training, and start-up within the Contract Times.

Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.

Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing installation, functional testing, 14-day Operational Performance Test, and Post-Operational Performance Test.

Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

INSTALLATION

The CONTRACTOR shall provide competent and experienced technical manufacturers representatives for all equipment and systems as necessary to resolve assembly or installation procedures, which are attributable to, or associated with, equipment furnished.

After equipment is installed, CONTRACTOR shall have representatives perform initial equipment and system adjustment and calibration to equipment conforming to specifications and manufacturer’s requirements and instructions.

The CONTRACTOR shall provide ENGINEER with original reports of the following information for approval 5 work days prior to the 14-day Operational Performance Test:

A “Certificate of Installation Services” and “Certificate of Start-up Services (Use Forms at end of this section) by manufacturers’ representatives for each piece of equipment installed in the work, verifying:

That the equipment is installed per manufacturers’ recommendation and per the Contract Documents.

That equipment is tested and is functioning as intended.

That nothing in the installation voids any warranty.

That the equipment, as installed, is ready to be operated by others.

That the equipment will reliably perform the function for which it is intended.

A detailed report by manufacturers’ representatives, for review by ENGINEER of the installation services performed, including:

Description of calibration and adjustments made.

Description of any parts replaced and why replaced.

Type, brand name, and quantity of lubrication used, if any.

Description of problems encountered and corrective action taken.

Any special instructions left with CONTRACTOR or ENGINEER.

The start-up of equipment may impact the operation of the OWNER’s existing system(s). Therefore, the CONTRACTOR shall submit a detailed written Start-up plan at least sixty (60) days prior to start-up of equipment. The CONTRACTOR shall reconfirm start-up with ENGINEER 2 weeks prior to start-up. See Section 01_33_00 - Submittal Procedures for submittal processing time frames.

WRITTEN START-UP PLAN

Submit a written start-up plan for each piece of equipment and each system not less than 4 weeks prior to planned initial start-up of equipment or system.

Provide detailed plan and Progress Schedule with the following activities identified:

Manufacturer's services and scheduled dates.

Installation certifications.

Operator training and scheduled dates.

Submission of Operation and Maintenance Manual.

Phase I, Phase II and Phase III Testing and Dates.

The CONTRACTOR shall provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

The CONTRACTOR shall provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.

The CONTRACTOR shall revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

PERFORMANCE TESTING

Test equipment for proper performance at point of manufacture or assembly when specified.

When source quality control testing is specified:
Demonstrate equipment meets specified performance requirements.
Provide certified copies of test results.
Do not ship equipment until certified copies have received written acceptance from ENGINEER. Written acceptance does not constitute final acceptance.
Perform testing as specified in the equipment specification sections.

Include costs associated with witnessing performance tests in the bid price. Include costs for OWNER's representative for travel, lodging, transportation to and from lodging, and 50 Dollars meal allowance per person per day.

GENERAL START-UP AND TESTING PROCEDURES

Mechanical Systems: As specified in the individual equipment specification sections and Sections 46_05_10, 40_05_00.01, and 40_05_00.09:

Remove rust preventatives and oils applied to protect equipment during construction.
Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
Flush fuel system and provide fuel for testing and start-up.
Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
Perform cold alignment and hot alignment to manufacturer's tolerances.
Adjust V-belt tension and variable pitch sheaves.
Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.

Electrical Systems: As specified in Section 26_05_00 and the individual equipment specification sections.

Perform insulation resistance tests on wiring except 120 volt lighting, wiring, and control wiring inside electrical panels.
Perform continuity tests on grounding systems.
Test and set switchgear and circuit breaker relays for proper operation.
Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.
Check motors for actual full load amperage draw. Compare to nameplate value.

Instrumentation Systems: As specified in Section 40_61_00 and the individual equipment specification sections:

Bench or field calibrate instruments and make required adjustments and control point settings.
Leak test pneumatic controls and instrument air piping.

Energize transmitting and control signal systems, verify proper operation, ranges and settings.

START-UP TESTING

CONTRACTOR shall provide a Start-Up Test for the operation demonstration of each component of the system and of the complete systems in manual and automatic mode of operation.

CONTRACTOR shall demonstrate restart-up of equipment and systems in the manual and automatic mode of operation (when applicable) following a simulated power outage.

OWNER's representatives shall be invited to attend the start-up demonstration and shall be provided an approved agenda of activities/services to be performed at least ninety (90) days prior to the start-up date.

The CONTRACTOR shall inform the ENGINEER in writing to confirm the start-up demonstration two (2) weeks prior to the proposed date of start-up.

The CONTRACTOR shall provide "Certificate of Start-up" signed by CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed to all the parties' satisfaction. CONTRACTOR shall use the form provided at the end of this section (Use form at end of this section).

Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.

Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

The start-up is intended to fully demonstrate the system operation as a complete system. All components must be certified (Use forms at end of this section) prior to starting the 14-day Operational Performance Test.

The CONTRACTOR shall provide "Certificate of Start-up Test Services" signed by CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed. CONTRACTOR shall use the form provided at the end of this section and furnish OWNER with the original form.

CERTIFICATE OF PROPER INSTALLATION

At completion of the Start-Up Testing, the CONTRACTOR shall furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:

Has been properly installed, adjusted, aligned, and lubricated.
Is free of any stresses imposed by connecting piping or anchor bolts.

Is suitable for satisfactory full-time operation under full load conditions.
Operates within the allowable limits for vibration.
Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

Furnish written report prepared and signed by the electrical and/or instrumentation Subcontractor certifying:

Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.
Co-sign the reports along with the manufacturer's representative and subcontractors.

The CONTRACTOR shall sign the reports along with the manufacturer’s representative and complete the “Certificate of Equipment Installation” form at the end of this section for each piece of equipment and provide the original copy to the ENGINEER.

TRAINING OF OWNER'S PERSONNEL

Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment following Start-Up Testing. Utilize manufacturer's representatives to conduct training sessions.

Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than 2 sessions per week.

Provide Operation and Maintenance Manual for specific pieces of equipment or systems 1 month prior to training session for that piece of equipment or system.

Satisfactorily complete functional testing before beginning operator training.

Provide training sessions for each work shift listed below during the time periods shown. Pooling of shifts will not be permitted unless accepted by OWNER. A minimum of two training sessions is required per subject, and more if required by the amount of individual equipment requiring training.

	Shift	
Day	Tuesday, 7 a.m.- 3 p.m.	Thursday, 7 a.m.- 3 p.m.

Training Sessions: Provide training sessions for equipment as specified in the individual equipment specification sections.

i. The CONTRACTOR shall videotape all training sessions and provide a copy for the OWNER.

The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the OWNER.

The CONTRACTOR's coordinator shall coordinate the training periods with OWNER personnel and manufacturer's representatives, and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 30 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

The CONTRACTOR shall provide "Certificate of Instructional Services" signed by CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed. CONTRACTOR shall use the form provided at the end of this section and furnish OWNER with the original form.

14-DAY OPERATIONAL PERFORMANCE TEST

Complete operator training for equipment where specified in the respective sections.

Conduct 14-Day Operational Test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.

Repeat 14-Day Operational Test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

The CONTRACTOR shall provide "Certificate of 14-Day Operational Test Services" signed by CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed. CONTRACTOR shall use the form provided at the end of this section and furnish OWNER with the original form.

No work shall be deemed substantially complete until the 14-Day Operational Test has been successfully performed. The manufacturer's training shall also be completed prior to ENGINEER issuing substantial completion.

POST-OPERATIONAL PERFORMANCE TEST

Conduct Post-Operational Test for continuous period as specified.

Immediately correct defects in material, workmanship, or equipment, which became evident during operational test.

Repeat Post-Operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

The CONTRACTOR shall provide "Certificate of Post-Operational Performance Test Service" signed by CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed. CONTRACTOR shall use the form provided at the end of this section and furnish OWNER with the original form.

RECORD KEEPING

Maintain and submit following records generated during start-up and testing phase of Project:

- Daily logs of equipment testing identifying all tests conducted and outcome.
- Logs of time spent by manufacturer's representatives performing services on the job site.
- Equipment lubrication records.
- Electrical phase, voltage, and amperage measurements.
- Insulation resistance measurements.
- Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

CERTIFICATE OF EQUIPMENT INSTALLATION SERVICES

PROJECT: _____

EQUIPMENT MANUFACTURER: _____

SPECIFICATION SECTION: _____

I hereby certify that the named equipment has been inspected by the Manufacturer's Representative and further certify:

1. **That the equipment is installed per the manufacturer's recommendation and is in accordance with the Contract Documents.**
2. **That the equipment is tested and is functioning as intended.**
3. **That nothing in the installation shall void the warranty.**
4. **That the equipment, as installed, is ready to be operated by others.**
5. **That the equipment will reliably perform the function for which it is installed.**
6. **Meets requirements outlined in Section 01_75_17.**

MANUFACTURER'S REPRESENTATIVE

Signature _____ **Date** _____

Name (print) _____

Title _____

Comments _____

_____

_____

CONTRACTOR

Signature _____ **Date** _____

Name (print) _____

Title _____

Witnessed by OWNER's representative:

Inspector Signature _____ **Date** _____

Complete and submit this original form with the original detailed report to the ENGINEER for approval 5 work days prior to the 14-day Operational Performance Test. CONTRACTOR shall attach the manufacturer's field report with this form.

TECHNICAL SPECIFICATIONS

CERTIFICATE OF START-UP TEST SERVICES

PROJECT: _____

EQUIPMENT MANUFACTURER: _____

SPECIFICATION SECTION: _____

I hereby certify the equipment Manufacturer's Representative and the CONTRACTOR have inspected all equipment under this contract as installed, made adjustments and calibrations, and that the system as constructed is operating in conformance with the contract documents, specifications, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature _____ **Date** _____

Name (print) _____

Title _____

Comments _____

_____

_____

CONTRACTOR

Signature _____ **Date** _____

Name (print) _____

Title _____

Witnessed by OWNER's representative:

Inspector Signature _____ **Date** _____

Complete and submit this original form to ENGINEER upon completion. Submit detailed start-up plan 60 days prior to proposed date of start-up services. CONTRACTOR shall attach manufacturer's field report with this form.

NOTE: The 14-day operational test shall not proceed until this form is signed by all parties and submitted to the ENGINEER for approval.

TECHNICAL SPECIFICATIONS

CERTIFICATE OF 14-DAY OPERATIONAL PERFORMANCE TEST SERVICES

PROJECT: _____

EQUIPMENT MANUFACTURER: _____

SPECIFICATION SECTION: _____

I hereby certify the equipment Manufacturer's Representative and the CONTRACTOR have inspected all equipment under this contract as installed, made adjustments and that the complete system is operating in conformance with the design, Contract Documents, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature _____ **Date** _____

Name (print) _____

Title _____

Comments _____

_____

_____

_____

_____

_____

CONTRACTOR

Signature _____ **Date** _____

Name (print) _____

Title _____

Witnessed by OWNER's representative:

Inspector Signature _____ **Date** _____

Complete and submit this original form to the ENGINEER upon completion of Post Operational Performance Testing Services. CONTRACTOR shall attach manufacturer's field report with this form .

TECHNICAL SPECIFICATIONS

CERTIFICATE OF POST-OPERATIONAL PERFORMANCE TEST SERVICES

PROJECT: _____

EQUIPMENT MANUFACTURER: _____

SPECIFICATION SECTION: _____

I hereby certify the equipment Manufacturer's Representative and the CONTRACTOR have inspected all equipment under this contract as installed, made adjustments and that the complete system is operating in conformance with the design, Contract Documents, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature _____ **Date** _____

Name (print) _____

Title _____

Comments _____

_____

_____

_____

_____

_____

CONTRACTOR

Signature _____ **Date** _____

Name (print) _____

Title _____

Witnessed by OWNER's representative:

Inspector Signature _____ **Date** _____

Complete and submit this original form to the ENGINEER upon completion of Post Operational Performance Testing Services. CONTRACTOR shall attach manufacturer's field report with this form.

TECHNICAL SPECIFICATIONS

CERTIFICATE OF INSTRUCTIONAL SERVICES

PROJECT: _____

EQUIPMENT MANUFACTURER: _____

SPECIFICATION SECTION: _____

PHASE OF TRAINING: _____

TYPE OF TRAINING: ☐ **CLASSROOM** ☐ **FIELD**

I hereby certify the Equipment Manufacturer's Representative has instructed OWNER's personnel in start-up, operation and maintenance of this piece of equipment as required in Contract Documents.

MANUFACTURER'S REPRESENTATIVE

Signature _____ **Date** _____

Name (print) _____

Title _____

Comments _____

_____

_____

_____

_____

_____

CONTRACTOR

Signature _____ **Date** _____

Name (print) _____

Title _____

Witnessed by OWNER's representative:

Inspector Signature _____ **Date** _____

Complete and submit this original form to ENGINEER upon completion of each phase of training. Identify phase of training at top of form and complete a separate form for each phase of training. CONTRACTOR shall attach attendees sign-in sheet with this form.

TECHNICAL SPECIFICATIONS

SECTION 01_77_00

CLOSEOUT PROCEDURES

GENERAL

SUMMARY

Section includes: Contract closeout requirements including:
Final cleaning.
Waste disposal.
Touch-up and repair.
Disinfection of systems.
Preparation and submittal of closeout documents.
Final completion certification.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
Section 01_32_16 – Progress Schedules and Reports.]
Section 01_33_00 – Submittals Procedures
Section 01_71_23 – Field Engineering.
Section 01_75_17 – Testing, Training and Facility Start-up.
Section 01_78_23 – Operation and Maintenance Data

REFERENCES

American Water Works Association (AWWA).

FINAL CLEANING

Perform final cleaning prior to inspections for Substantial Completion.

Employ skilled workers who are experienced in cleaning operations.

Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.

Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.

Clean roofs, gutters, downspouts, and drainage systems.

Broom clean exterior paved surfaces and rake clean other surfaces of site work:

Police yards and grounds to keep clean.

Remove dust, cobwebs, and traces of insects and dirt.

Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.

Remove non-permanent protection and labels.

Polish waxed woodwork and finish hardware.

Wash tile.

Wax and buff hard floors, as applicable.

Wash and polish glass, inside and outside.

Wash and shine mirrors.

Polish glossy surfaces to clear shine.

Vacuum carpeted and soft surfaces.

Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.

Clean ducts, blowers and coils when units were operated without filters during construction.

Clean light fixtures and replace burned-out or dim lamps.

WASTE DISPOSAL

Arrange for and dispose of surplus materials, waste products, and debris off-site:
Prior to making disposal on private property, obtain written permission from OWNER of such property.

Do not create unsightly or unsanitary nuisances during disposal operations.

Maintain disposal site in safe condition and good appearance.

Complete leveling and cleanup prior to final acceptance of the Work.

TOUCH-UP AND REPAIR

Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Substantial Completion.

Refinish or replace entire surfaces, which cannot be touched-up or repaired satisfactorily.

FINAL CLEANING AND DISINFECTION OF SYSTEMS OF PLANT FACILITIES

Clean channels, pipe, basins, reservoirs, and tanks before running of 7-day test, or before facility goes on stream when 7-day test is not required. Wash, wherever practicable, or broom sweep channels**,** pipe, basins, reservoirs, and tanks.

Provide ample sampling outlets in pipe for testing.

CLOSEOUT DOCUMENTS

Submit following Closeout Submittals upon Substantial Completion and at least 7 days prior to submitting Application for Final Payment:
Evidence of Compliance with Requirements of Governing Authorities.
Project Record Documents.
Operation and Maintenance Manuals.
Warranties and Bonds.
Keys and Keying Schedule.
Evidence of Payment and Release of **[Liens] [Stop Payment Notices]** as outlined in Conditions of the Contract.
Release of claims as outlined in Conditions of the Contract.
Survey Record Documents as specified in Section 01_71_23.
Certificate of Final Completion.

PROJECT RECORD DOCUMENTS

Maintain at Project site, available to OWNER and ENGINEER, 1 copy of the Contract Documents, shop drawings, and other submittals in good order:

Mark and record field changes and detailed information contained in submittals and change orders.
Record actual depths, horizontal and vertical location of underground pipes, duct banks, and other buried utilities. Reference dimensions to permanent surface features.
Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
Identify location of spare conduits including beginning, ending, and routing through pull boxes and manholes. Record spare conductors, including number and size, within spare conduits and filled conduits.
Provide schedules, lists, layout drawings, and wiring diagrams.
Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

Maintain documents separate from those used for construction:
Label documents "RECORD DOCUMENTS."

Keep documents current:

Record required information at the time the material and equipment is installed and before permanently concealing.

Deliver record documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.

During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.

Final Schedule Submittal as specified in Section 01_32_16**.**

WARRANTIES AND BONDS

Provide executed Warranty or Guaranty Form if required by Contract Documents.

Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

CERTIFICATE OF FINAL COMPLETION

When 7-day operational test has been successfully completed, ENGINEER will certify that new facilities are operationally complete. ENGINEER will submit a list of known items (punch list) still to be completed or corrected prior to contract completion.

List of items to be completed or corrected will be amended as items are resolved by CONTRACTOR.

When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.

Upon completion of final inspection, ENGINEER will either prepare a written acceptance of the entire work or advise CONTRACTOR of work not complete. If necessary, inspection procedures will be repeated.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_78_23

OPERATION AND MAINTENANCE DATA

GENERAL

SUMMARY

Section Includes: Preparation and submittal of Operation and Maintenance Manuals.

SUBMITTALS

Submit Operation and Maintenance Manuals before field quality control testing and before training of each piece of equipment or system.

Submit six (6) Manuals for each piece of equipment or system.

Make manuals available at project site for use by construction personnel and ENGINEER.

Make additions and revisions to the Manuals in accordance with ENGINEER's review comments.

OPERATION AND MAINTENANCE MANUALS

Preparation:

Provide Operations and Maintenance Manuals in 3-ring binders with rigid covers. Utilize tab sheets to organize information.

Contents of Operation And Maintenance Manuals:

Cover Page: Equipment name, equipment tag number, project name, OWNER's name, appropriate date.

Table of Contents: General description of information provided within each tab section.

Lubrication Information: Required lubricants and lubrication schedules.

Control Diagrams:

Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.

Start-up Procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.

Operating Procedures:

Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation.

Include safety precautions and emergency operating shutdown instructions.

Preventative Maintenance Procedures: Recommended steps and schedules for maintaining equipment.

Overhaul Instructions: Directions for disassembly, inspection, repair, and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.
Parts List: Generic title and identification number of each component part of equipment; include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
Spare Parts List: Recommended number of parts to be stored at the site and special storage precautions.
Drawings: Exploded view or plan and section views with detailed callouts.
Provide electrical and instrumentation schematic record drawings.
Source (Factory) Quality Control Test Results: Provide copies of factory test reports.
Field Quality Control Test Results: After field testing is completed, insert field test reports.
Equipment Summary Form: Completed form in the format attached at the end of this Section. Insert Equipment Summary Form after the tab sheet of each equipment section. The manufacturer's standard form will not be acceptable.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM_____

2. MANUFACTURER _____

3. EQUIPMENT IDENTIFICATION NUMBER(S)_____
(maps equipment number)

4. LOCATION OF EQUIPMENT_____

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

_____

_____

_____

NAMEPLATE DATA -
- Horsepower_____
- Amperage_____
- Voltage_____
- Service Factor (S.F.)_____
- Speed_____
- ENC Type_____
- Capacity_____
- Other_____

7. MANUFACTURER'S LOCAL REPRESENTATIVE

Name_____

Address_____

Telephone Number_____

8. MAINTENANCE REQUIREMENTS_____

_____

_____

9. LUBRICANT LIST_____

_____

10. SPARE PARTS (recommendations)_____

_____

11. COMMENTS_____

TECHNICAL SPECIFICATIONS

SECTION 01_81_02

SEISMIC DESIGN CRITERIA

GENERAL

SUMMARY

Section Includes: Seismic design criteria for the following:
Anchorage of mechanical and electrical equipment.
Seismic design of tanks and anchorage of tanks.
Other structures or items as specified or indicated on the Drawings.

REFERENCES

International Building Code (IBC 2006) with 2007 Northern Nevada Amendments.

SYSTEM DESCRIPTION

Design Requirements: Design in accordance with the requirements of the International Building Code.
Seismic Use Group: II.
Seismic Design Category - E.
Site Class: D; S_{Ds}: 1.0; S_{D1}: 0.6.
International Building Code Seismic Importance Factor for Anchorage of Mechanical and Electrical Equipment: 1.5.
International Building Code Seismic Importance Factor for the Design of Tanks and the Anchorage of Tanks: 1.5.
Do not use friction to resist sliding due to seismic forces, except for water tanks designed in accordance with AWWA D100.
Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces.
Use anchor bolts, bolts, or welded studs for anchors for resisting seismic forces.
Anchor bolts used to resist seismic forces shall have a standard hex bolt head.
Do not use anchor bolts fabricated from rod stock with an L or J shape.
Do not use concrete anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchors unless indicated on the Drawings or accepted in writing by the ENGINEER.
Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections which use friction to resist seismic forces.

SUBMITTALS

Shop Drawings and Calculation: Complete Shop Drawings and seismic calculations.

Calculations shall be signed and stamped by a civil or structural Professional Engineer licensed to practice in the state where the project is located.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 01_81_04

WIND DESIGN CRITERIA

GENERAL

SUMMARY

Section Includes: Wind design criteria.

REFERENCES

International Building Code (IBC 2006) with 2007 Northern Nevada Amendments.

SYSTEM DESCRIPTION

Design Requirements: Design in accordance with the requirements of the International Building Code.
International Building Code Basic Wind Speed: 100 miles per hour.
International Building Code Wind Exposure: C.

Use anchor bolts, bolts, or welded studs for anchors for resisting wind forces.
Anchor bolts used to resist wind forces shall have a standard hex bolt head. Do not use anchor bolts fabricated from rod stock with an L or J shape.
Do not use concrete anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor unless indicated on the Drawings or accepted in writing by the ENGINEER.
Wind forces must be resisted by direct bearing on the anchors used to resist wind forces. Do not use connections which use friction to resist wind forces.

SUBMITTALS

Shop Drawings and Calculation: Complete Shop Drawings and wind calculations.

Calculations shall be signed and stamped by a civil or structural Professional Engineer licensed to practice in the state where the Project is located.

PRODUCTS

Not Used.

EXECUTION

Not Used.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_01_04

STRUCTURAL CONCRETE REPAIR

GENERAL

SUMMARY

Section includes: Repairing damaged structural concrete.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):

C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens.

C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

C 666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

SYSTEM DESCRIPTION

General: Structural repair concrete composed of cementitious material capable of being placed in formed vertical and overhead applications, and on horizontal surfaces.

Design requirements:

a. Provide material suitable for performing in environments subject to corrosive attack by chlorides and sulfates, freeze/thaw cycles, low permeability, and abrasion resistant.
b. Provide concrete repair mortar cement that is placeable from 1 inch in depth and extendable in greater depths.
c. Concrete repair mortar shall be capable of being poured in place or troweled in place to suit the conditions encountered.

4.02 SUBMITTALS

1. Product data: Submit manufacturer's data completely describing structural repair concrete materials.

2. Certificates of Compliance.

3. Manufacturer's Instructions.

4.03 QUALITY ASSURANCE

A. Manufacturer qualifications: The manufacturer of the specified product shall have been in existence, for a minimum of 10 years.

B. Allowable tolerances: Deviation from plumb or level shall not exceed 1/8 inch within 10 feet in any direction, as determined with a 10-foot straight edge.

4.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

C. Deliver, store, and handle packaged materials in the manufacturer's original, sealed containers, each clearly identified with the manufacturer's name, and name and type of product.

D. Store materials subject to damage by dirt and moisture in a clean, dry location, off the ground, and suitably protected.

4.05 PROJECT CONDITIONS

A. Existing conditions:
   1. Hot weather: ACI 305.
   2. Cold weather: ACI 306.
   3. Do not place concrete repair mortar during precipitation, unless adequate protection is provided.

PART 5 PRODUCTS

5.01 MATERIALS

A. Structural repair concrete:
   1. Manufacturers: One of the following or equal:
      a. Sika, "Sikatop 123 Plus."
   2. Compressive strength: As follows in accordance with ASTM C 109:
      a. 1 day: 2,500 pounds per square inch, minimum.
      b. 7 day: 6,000 pounds per square inch, minimum.
      c. 28 day: 8,000 pounds per square inch, minimum.
   3. Bond strength: 2,200 pounds per square inch minimum at 28 days, in accordance with ASTM C 882 modified.
   4. Slant shear bond strength: 3,300 pounds per square inch minimum at 28 days, in accordance with ASTM C 496.
   5. Flexural strength: 770 pounds per square inch minimum at 28 days, in accordance with ASTM C 78.

6. Rapid freeze/thaw durability: in accordance with ASTM C 666; Procedure A.
   a. Relative durability factor at 300 cycles: 90 minimum.
7. Working time: 30 to 40 minutes.
8. Color: Concrete gray.

B. Water: Potable, clean, not detrimental to concrete.

C. Form materials:
   1. Smooth finish:
   2. Brace as required to maintain tolerances.

PART 6 EXECUTION

6.01 EXAMINATION

A. Verify that concrete surfaces and exposed reinforcing are clean and free of contaminates.

6.02 PREPARATION

A. Prepare existing concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. Thoroughly clean reinforcement and other embedded items to remove loose rust and other objectionable matter.

C. Thoroughly wet wood forms, except coated plywood, and adjacent concrete at least 1 hour in advance of placing concrete; securely close cleanout end inspection ports; repeat wetting as necessary to keep forms damp.

6.03 PREPARATION

A. Damaged concrete:
   1. Areas to be repaired shall be clean, sound, and free of contaminants.
      a. Remove all loose and deteriorated concrete by mechanical means acceptable to the ENGINEER.
      b. Saw cut perimeter 1/2-inch maximum.
   2. Chip concrete substrate to obtain a surface profile of 1/16 inch to 1/8 inch in depth with a new fractured aggregate surface.
      a. The area to be repaired shall be not less than 1 inch in depth.
   3. Concrete removal shall extend along the reinforcing steel to locations along the bar free of bond inhibiting corrosion, and where the bar is well bonded to surrounding concrete.

B. Use the following procedures where reinforcing steel with active corrosion is encountered:
   1. Sandblast reinforcing steel to remove all contaminants and rust.
   2. Determine section loss, splice new reinforcing steel where there is more than 15 percent loss as directed by the ENGINEER.
      a. If more than half the diameter of the reinforcing steel is exposed, chip out behind the reinforcing steel a minimum of 1/2 inch. The distance chipped

behind the reinforcing steel must also equal or exceed the minimum placement depth of the accepted material.

C. Treat cracks in the substrate at the area of patching or overlay work as directed by the ENGINEER.

D. Extend existing control and expansion joints through any concrete repair.

E. Apply an epoxy-bonding agent to area to be repaired, as specified in Section 03_63_01, prior to patching concrete with polymer-modified portland cement mortar.

6.04 MIXING

A. Mix in accordance with manufacturer's mixing instructions.

6.05 INSTALLATION

A. Formed surface finishes:
   1. Smooth finish:
      a. Obtain by the use of plywood, sheet metal, or lined wood forms; no fins, pockmarks, or other irregularities shall be present in the exposed surfaces of concrete.
      b. Place no structural repair concrete without prior authorization of ENGINEER.

B. Verify that form materials are in place and ready to receive installation of concrete repair material.

C. Install in accordance with manufacturer's installation instructions.

D. In accordance with ACI recommendations, apply concrete repair material only when ambient conditions of moisture, temperature, humidity, and wind are favorable for curing.

E. Scrub mortar into substrate, filling all cracks, voids, and pores.

F. For new construction, finish of repaired area shall match required finish for concrete being repaired.

G. For existing concrete, finish of repair area shall match finish of concrete being repaired.

H. During the curing process, protect concrete repair from rain, wind, or freezing as required.
   1. Keep sufficient covering on hand at all times for protection of repair concrete.

6.06 CLEANING

A. Remove debris and excess material. Leave work site in a neat, clean condition.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_11_07

CONCRETE FORMWORK

GENERAL

SUMMARY

Section includes: Concrete formwork.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Concrete Institute (ACI):

117 - Specifications for Tolerances for Concrete Construction and Materials and Commentary.

Underwriters Laboratories (UL).

DEFINITIONS

Green concrete: Concrete with less than 100 percent of the minimum specified compressive strength f'_c.

SYSTEM DESCRIPTION

Design requirements:

Design of concrete forms, falsework, and shoring in accordance with local, state, and federal regulations.

Design forms and ties to withstand concrete pressures without bulging, spreading, or lifting of forms.

Performance requirements:

Construct forms so that finished concrete conforms to shapes, lines, grades, and dimensions indicated on the Drawings.

It is intended that surface of concrete after stripping presents smooth, hard, and dense finish that requires minimum amount of finishing.

Provide sufficient number of forms so that the work may be performed rapidly and present uniform appearance in form patterns and finish.

Use forms that are clean and free from dirt, concrete, and other debris.

Coat with acceptable form release agent if required, prior to use or reuse.

TECHNICAL SPECIFICATIONS

SUBMITTALS

Information on the CONTRACTOR's proposed forming system:

Submit in such detail as the ENGINEER may require to assure himself that intent of the Specifications can be complied with by use of proposed system.

Alternate combinations of plywood thickness and stud spacing: May be submitted.

Form release agent. Confirmation of certification for conformance to NSF 61.

PRODUCTS

MANUFACTURED UNITS

Form ties:

General:

Provide form ties for forming system selected that are manufactured by recognized manufacturer of concrete forming equipment.

Do not use wire ties or wood spreaders of any form.

Provide ties of type that accurately tie, lock, and spread forms.

Provide form ties of such design that when forms are removed, they locate no metal or other material within 1-1/2 inches of the surface of the concrete.

Do not allow holes in forms for ties to allow leakage during placement of concrete.

Cone-snap ties:

Cone-snap ties shall form a cone shaped depression in the concrete with a minimum diameter of 1 inch at the surface of the concrete and 1-1/2 inches deep.

Provide neoprene waterseal washer that is located near the center of the concrete.

Taper ties:

Neoprene plugs for taper tie holes: Size so that after they are driven, plugs are located in center third of wall thickness.

Built-up plywood forms:

Built-up plywood forms may be substituted for prefabricated forming system subject to following minimum requirements:

Size and material:

Full size 4- foot by 8-foot plywood sheets, except where smaller pieces are able to cover entire area.

Sheet construction: 5-ply plywood sheets, 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.

Wales: Minimum 2-inch by 4-inch lumber.

Studding and wales: Contain no loose knots and be free of warps, cups, and bows.

Steel or steel framed forms:

Steel forms: Provide forms that are:

Rigidly constructed and capable of being braced for minimum deflection of finish surface.

Capable of providing finish surfaces that are flat without bows, cups, or dents.

Steel framed plywood forms:

Provide forms that are rigidly constructed and capable of being braced.

Plywood paneling: 5-ply, 5/8-inch nominal or 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.

Form release agent.

Effective, non-staining, bond-breaking coating compatible with form surfaces and concrete mixes used.

External angles:

Where not otherwise indicated on the Drawings, provide with 3/4-inch bevel, formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, slabs, walls, beams, columns, and openings.

Provide 1/4-inch bevel formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, walls, and slabs at expansion, and construction joints.

Keyways: Steel, plastic, or lumber treated with form release oil, applied according to label directions.

Dovetail anchor system: System consisting of dovetail slots cast into the concrete, dovetail anchors that tie the masonry veneer to dovetail slots, and continuous wires that are embedded in the masonry and connect to the dovetail anchors.

Dovetail slot: 18 gauge, Type 304 stainless steel in accordance with ASTM A 167, foam filled, and in 10-foot lengths. Manufacturers: One of the following or equal:

Hohmann and Barnard, Inc., Hauppauge, NY, Model No. 305.

Heckmann Building Products, Inc., Chicago, IL, Model No. 100.

Dovetail anchors: 23 gauge, 1 inch wide, Type 304 stainless steel in accordance with ASTM A 167, and with seismic notch for attachment to wire embedded in masonry. Manufacturers: One of the following or equal:

Hohmann and Barnard, Inc., Hauppauge, NY, Model No. 303SV.

Heckmann Building Products, Inc., Chicago, IL, Model No. 361.

EXECUTION

EXAMINATION

Site verification of conditions:

Do not place any concrete until all forms have been thoroughly checked for alignment, level, strength, and to assure accurate location of all mechanical and electrical inserts or other embedded items.

INSTALLATION

Forms and accessories:

Vertical forms:

Remain in place minimum of 24 hours after concrete is placed.

If, after 24 hours, concrete has sufficient strength and hardness to resist surface or other damage, forms may be removed.

Other forms supporting concrete and shoring: Remain in place as follows:

Sides of footings: 24 hours minimum.

Vertical sides of beams, girders, and similar members: 48 hours minimum.

Bottom of slabs, beams, and girders: Until concrete strength reaches specified strength f'_c or until shoring is installed.

Shoring for slabs, beams, and girders: Shore until concrete strength reaches specified strength.

Wall bracing: Brace walls until concrete strength of beams and slabs laterally supporting wall reaches specified strength.

Green concrete:

No heavy loading on green concrete will be permitted.

Immediately after forms are removed, carefully examine concrete surfaces, and repair any irregularities in surfaces and finishes as specified in Section 03_30_00.

Form ties:

Cone-snap ties: Tie forms together at not more than 2-foot centers vertically and horizontally. After forms are removed from wall, fill tie holes as follows:

Remove form ties from surfaces.

Roughen cone shaped tie holes by heavy sandblasting before repair.

Dry pack cone shaped tie holes with dry-pack mortar as specified in Section 03_60_00.

Taper ties:

After forms and taper ties are removed from wall, plug tie holes with neoprene plug as follows:

Heavy sandblast and then clean tie holes.

After cleaning, drive neoprene plug into each of taper tie holes with steel rod. Final location of neoprene plug shall be in center third of wall thickness. Bond neoprene plug to concrete with epoxy.

Locate steel rod in cylindrical recess, made in plug, during driving.

At no time are plugs to be driven on flat area outside cylindrical recess.

Dry-pack of taper tie holes: After installing plugs in tie holes:

Coat tie hole surface with epoxy bonding agent and fill with dry-pack mortar as specified in Section 03_60_00.

Place dry-pack mortar in holes in layers with thickness not exceeding tie hole diameter and heavily compact each layer.

Dry-pack the outside of the hole no sooner than 7 days after the inside of the hole has been dry packed.

Wall surfaces in area of dry-packed tie holes: On the water side of water containing structures and the outside of below grade walls:

Cover with minimum of 10 mils of epoxy gel.

Provide epoxy gel coating on wall surfaces that extend minimum of 2 inches past dry-pack mortar filled tie holes.

Provide finish surfaces that are free from sand streaks or other voids.

TECHNICAL SPECIFICATIONS

Built-up plywood forms:

Studding:

Spaced at 16 inches or 24 inches on center.

Closer spacing may be required depending upon strength requirements of the forms, in order to prevent any bulging surfaces on faces of finished concrete work.

Install studs perpendicular to grain of exterior plys of plywood sheets.

Wales: Form wales of double lumber material with minimum size as specified in this Section.

Number of form reuses: Depends upon durability of surface coating or overlay used, and ability to maintain forms in condition such that they are capable of producing flat, smooth, hard, dense finish on concrete when stripped.

Steel or steel framed forms:

Steel forms:

Adequately brace forms for minimum deflection of finish surface.

Steel framed plywood forms:

Rigidly construct and brace with joints fitting closely and smoothly.

Number of form reuses: Depends upon durability of surface coating or overlay used.

Built-up plywood forms: As specified in this Section may be used in conjunction with steel forms or steel framed plywood forms for special forming conditions such as corbels and forming around items which will project through forms.

Bracing and alignment of forms:

Line and grade: Limit deviations to tolerances which will permit proper installation of structural embedded items or mechanical and electrical equipment and piping.

Formwork:

Securely brace, support, tie down, or otherwise hold in place to prevent movement.

Make adequate provisions for uplift pressure, lateral pressure on forms, and deflection of forms.

When second lift is placed on hardened concrete: Take special precautions in form work at top of old lift and bottom of new lift to prevent:

Spreading and vertical or horizontal displacement of forms.

Grout "bleeding" on finish concrete surfaces.

Pipe stubs, anchor bolts, and other embedded items: Set in forms where required.

Cracks, openings, or offsets at joints in formwork: Close those that are 1/16-inch or larger by tightening forms or by filling with acceptable crack filler.

Incidentals:

Keyways: Construct as indicated on the Drawings.

Reentrant angles: May be left square.

Level strips: Install at top of wall concrete placements to maintain true line at horizontal construction joints.

Inserts:

Encase pipes, anchor bolts, steps, reglets, castings, and other inserts, as indicated on the Drawings or as required, in concrete.

Pipe and conduit:

Install pipe and conduit in structures as indicated on the Drawings, and seal with materials as specified in Section 07_90_00.

CONSTRUCTION

Tolerances:

Finish concrete shall conform to shapes, lines, grades, and dimensions indicated on the Drawings.

The maximum deviation from true line and grade shall not exceed tolerances listed below at time of acceptance of project.

In accordance with ACI 117, paragraphs 2.1 through 2.2 and paragraphs 4.0 through 4.6, except as modified in following:

Slabs:

Slope: Uniformly sloped to drain when slope is indicated on the Drawings.

Slabs indicated to be level: Have maximum deviation of 1/8-inch in 10 feet without any apparent changes in grade.

On circular tank walls: The CONTRACTOR may deviate from finish line indicated on the Drawings by use of forms with chord lengths not to exceed 2 feet.

Inserts: Set inserts to tolerances required for proper installation and operation of equipment or systems to which insert pertains.

Maximum tolerances: As follows:

Item	Tolerance
Sleeves and Inserts	Plus 1/8 Minus 1/8 inches
Projected Ends of Anchor Bolts	Plus 1/4 Minus 0.0 inches
Anchor Bolt Setting	Plus 1/16 Minus 1/16 inches

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_15_00

CONCRETE ACCESSORIES

GENERAL

SUMMARY

Section includes:
Joint fillers.

Related sections:
The Contract Drawings are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of the CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
D 1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

SUBMITTALS

Product Data:
Synthetic sponge rubber tube: Complete physical characteristics

PRODUCTS

JOINT FILLERS

General:
Use specific type in applications as indicated on the Drawings.
No scrap or recycled materials shall be used.

Expanded polystyrene joint filler:
Properties:
Commercially available polystyrene board:
Minimum flexural strength: 35 pounds per square inch in accordance with ASTM C 203.
Compressive yield strength: Between 16 and 40 pounds per square inch at 5-percent compression.

Preformed expansion joint materials:
Bituminous fiber expansion joint material:
Properties:
Thickness: To match joint width.

Asphalt-impregnated fiber conforming to ASTM D 1751.
Manufacturers: One of the following or equal:
Durajoint.
W.R. Meadows: SealTight Fibre Expansion Joint.
Synthetic sponge rubber expansion joint material:
Properties:
Thickness: As recommended for width.
Material conforming to ASTM D 1752, Type I.
Manufacturers: One of the following or equal:
Durajoint.
W.R. Meadows: SealTight Sponge Rubber.

Synthetic sponge rubber tube:
Seamless extruded tube profile with 3/4-inch inside diameter and a minimum of 3/8-inch wall thickness.
Fit tubes to hold-down bars snugly.
Make tubes of closed-cell sponge rubber, with medium to low mass change, in accordance with ASTM D 1056, Type 2, Class B or C, Grades 4 or 5.
Manufacturers: One of the following or equal:
Armacell LLC, Esoline 2400 Grip.

EXECUTION

INSTALLATION

Joints:
Construct construction, and expansion joints as indicated on the Drawings.
Preformed expansion joint material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

Expanded polystyrene joint filler:
When filler is indicated on the Drawings or specified, place filler in correct position before concrete is placed against filler.
Fill holes and joints in filler with caulking to prevent entry of mortar into joint or passage of mortar or concrete from one side of joint to other.

A. Synthetic sponge rubber tube:
Bond synthetic sponge rubber tubes to the hold-down bars using epoxy adhesive.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_20_00

CONCRETE REINFORCING

GENERAL

SUMMARY

Section includes:
- Bar supports.
- Reinforcing bars.
- Tie wires.

REFERENCES

American Concrete Institute (ACI):
- 315 - Details and Detailing of Concrete Reinforcement.
- 318 - Building Code Requirements for Structural Concrete and Commentary.
- 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

American Welding Society (AWS):
- D1.4 - Structural Welding Code - Reinforcing Steel.

ASTM International (ASTM):
- A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- A 615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
- A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

DEFINITIONS

Give away bars: Bars that are not required by Contract Documents, but are installed by the CONTRACTOR to support the required reinforcing bars.

SYSTEM DESCRIPTION

The Drawings contain general notes concerning amount of reinforcement and placing, details of reinforcement at wall corners and intersections, and details of extra reinforcement around openings in concrete.

SUBMITTALS

Shop drawings:
- Changes to reinforcing steel contract drawing requirements:
  - Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.

Such changes will not be acceptable unless the ENGINEER has accepted such changes in writing.

Reinforcement shop drawings:

Review of reinforcement shop drawings by the ENGINEER will be limited to general compliance with the Contract Documents.

Submit reinforcement shop drawings in a complete package for each specific structure. Partial submittals will be rejected.

Samples:

Bar support chairs: Submit samples of chairs proposed for use along with letter stating where each type of chair will be used.

Procedures:

Welding procedures conforming to AWS D1.4 for reinforcement designated to be field welded.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping:

Deliver bars bundled and tagged with identifying tags.

Acceptance at site:

Reinforcing bars: Deliver reinforcing bars lacking grade identification marks accompanied by manufacturer's guarantee of grade.

SEQUENCING AND SCHEDULING

Bar supports: Do not place concrete until samples and product data for bar supports have been accepted by the ENGINEER.

PRODUCTS

MATERIALS

Bar supports:

Wire bar supports located between reinforcing bars and face of concrete:

Stainless steel. Type 304 stainless steel bar supports.

Wire bar supports located between mats of reinforcing bar:

Steel bar supports.

Reinforcing bars:

Reinforcing bars to be embedded in concrete:

ASTM A 615 Grade 60 deformed bars except for locations specified in the following paragraphs.

Actual yield strength based on mill tests of reinforcement provided shall not exceed the minimum yield strength specified in this Section by more than 18,000 pounds per square inch.

Ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25

Reinforcing bars that are required to be welded:

Low alloy ASTM A 706 Grade 60 deformed bars.

Tie wires: Annealed steel.

FABRICATION

Shop assembly:

Cut and bend bars in accordance with provisions of ACI 315, ACI 318, and ACI 350.

Bend bars cold.

Provide bars free from defects and kinks and from bends not indicated on the Drawings.

EXECUTION

EXAMINATION

Verification of conditions:

Reinforcing bars and welded wire fabric reinforcement: Verify that reinforcement is new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

PREPARATION

Surface preparation:

Reinforcing bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.

Cleaning of reinforcement materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

INSTALLATION

Reinforcing bars:

No field bending of bars will be allowed.

Hoop bars shall be rolled to the radius of the structure.

Welding:

Weld reinforcing bars where indicated on the Drawings or acceptable to the ENGINEER.

Perform welding in accordance with AWS D1.4 and welding procedures accepted by the ENGINEER.

Conform to requirements for minimum preheat and interpass temperatures.

Submit welding procedures.

Do not tack weld reinforcing bars.

Placing reinforcing bars:

Accurately place bars to meet tolerances of ACI 318 and adequately secure them in position.

Lap bars at splices as indicated on the Drawings or specified.

Unless specifically otherwise indicated on the Drawings, install bars at lap splices in contact with each other and fasten together with tie wire.

Where reinforcing bars are to be lap spliced at concrete joints, ensure that bars project from first concrete placement a length equal to or greater than the minimum lap splice length indicated on the Drawings.

Where lap splice lengths are not indicated on the Drawings, provide lap splice lengths in accordance with ACI 318 and ACI 350.

Bar supports:

Provide a sufficient number to prevent sagging, to prevent shirting, and to support loads during construction; but in no case less than quantities and at locations as indicated in ACI 315.

Do not use brick, broken concrete masonry units, spalls, rocks, wood or similar materials for supporting reinforcing steel.

Do not use give away bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to the give away bars.

If not indicated on the Drawings, provide protective concrete cover in accordance with ACI 318 and ACI 350.

Tying of bar reinforcement:

Fasten bars securely in place with wire ties.

Tie bars sufficiently often to prevent shifting.

Provide at least 3 ties in each bar length.

Do not apply to dowel lap splices or to bars shorter than 4 feet, unless necessary for rigidity.

Tie slab bars at every intersection around periphery of slab.

Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

Bar Size	**Slab Bar Spacing Inches**	**Wall Bar Spacing Inches**
Bars Number 5 and Smaller	60	48
Bars Number 6 through Number 9	96	60
Bars Number 10 and Number 11	120	96

After tying wire ties, bend ends of wire ties in towards the center of the concrete section.

The cover for wire ties shall be the same as the cover requirements for reinforcing bars.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_21_17

EPOXY BONDING REINFORCING BARS AND ALL THREAD RODS IN CONCRETE

GENERAL

SUMMARY

Section includes: Bonding reinforcing bars and all thread rods in concrete using epoxy adhesive.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American National Standards Institute (ANSI):
Standard B212.15 - Carbide Tipped Masonry Drills and Blanks for Carbide Tipped Masonry Drills.

ASTM international (ASTM):
C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

ICC Evaluation Service, Inc. (ICC-ES):
AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

Society for Protective Coatings (SSPC):
Surface Preparation Standards (SP)
SP-1 - Solvent Cleaning.

SUBMITTALS

Product Data: Furnish technical data for epoxy adhesives, including:
Installation instructions.
Independent laboratory test results.
Handling and storage instructions.

Quality control submittals:
Epoxy manufacturer's past project experience data on at least 3 similar projects supplied with proposed products within the last 3 years.
Special inspection: Provide detailed step-by-step instructions for the special inspection procedure in accordance with the building code.

ICC Evaluation Service, Inc., Evaluation Services Report in compliance with the AC308-Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

DELIVERY, STORAGE, AND HANDLING

Storage and protection.
Store epoxy components on pallets or shelving in a covered-storage area.
Control temperature above 60 degrees Fahrenheit and dispose of product if shelf life has expired.
If stored at temperatures below 60 degrees Fahrenheit, test components prior to use to determine if they still meet specified requirements.

PRODUCTS

GENERAL

Like items of materials: Use end products of one manufacturer in order to achieve structural compatibility and singular responsibility.

EPOXY ADHESIVE FOR SELF-CONTAINED CARTRIDGE SYSTEM

Epoxy adhesive shall have a current ICC Evaluation Service report documenting acceptance under AC308 for use with cracked concrete and for the seismic design categories specified.

Materials
In accordance with ASTM C 881, Type IV, Grade 3, Class B or C depending on site conditions.
2-component, 100 percent solids, insensitive to moisture, and gray in color.
Cure temperature, pot life, and workability: Compatible with intended use and environmental conditions.

Packaging.
Furnished in side-by-side cartridges with resin and hardener components isolated until mixing through manufacturer’s static mixing nozzle. Nozzle designed to thoroughly blend the components for injection from the nozzle directly into prepared hole.
Container markings: Include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

Manufacturers: One of the following or equal:
Hilti, Inc., Tulsa, OK: RE 500-SD .
Simpson Strong-Tie Company, Inc., Pleasanton, CA: SET-XP.

ALL THREAD RODS

Materials: As specified in Section 05_12_00.

TECHNICAL SPECIFICATIONS

REINFORCING BARS

As specified in Section 03_20_00.

EXECUTION

GENERAL

Provide Epoxy Adhesive Packaged as Follows:

Disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun.

Dispense components through a mixing nozzle that thoroughly mixes components.

HOLE SIZING AND INSTALLATION

Drilling holes:

Determine location of reinforcing bars or other obstructions with a non-destructive indicator device, and mark locations with construction crayon on the surface of the concrete.

Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.

Hole drilling equipment:

Electric or pneumatic rotary impact type with medium or light impact.

Drill bits: Carbide-tipped in accordance with ANSI B212-15 unless otherwise recommended by the manufacturer or required as a “condition of use” in the ICC Evaluation Report submitted.

Hollow drill bits with flushing air systems are preferred. Air supplied to hollow drill bits shall be free of oil, water, or other contaminants that will reduce bond.

Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

Hole diameter: Reinforcing bar diameter or all thread rod diameter plus 1/8 inch.

Obstructions in drill path:

If an existing reinforcing bar or other obstruction is hit while drilling hole, stop drilling hole and fill the hole with drypack mortar. Relocate the hole to miss the obstruction and drill another hole. Repeat the above until the hole has been drilled to the required depth.

Avoid drilling an excessive number of holes in an area of a structural member, which would excessively weaken the structural member and endanger the stability of the structure. Drypack holes which hit obstructions and allow drypack to reach strength equal to the existing concrete before drilling adjacent holes.

Epoxy grout may be substituted for drypack when acceptable to ENGINEER.

When existing reinforcing steel is encountered during drilling and when acceptable to ENGINEER, enlarge the hole by 1/8 inch, core through the existing reinforcing steel at the larger diameter, and resume drilling at original hole diameter.

Bent bar reinforcing bars: Where edge distances are critical, and striking reinforcing steel is likely, and if acceptable to ENGINEER, drill hole at 10 degree angle or less from axis of reinforcing bar or all thread rod being installed.

Install reinforcing bars and all thread rods to depth, spacings, and locations as indicated on the Drawings.

Do not install epoxy bonded all-thread rods or reinforcing bars in overhead applications.

Cleaning holes:

Insert long air nozzle into hole and blow out loose dust. Use compressed air that is free of oil, water, or other contaminants that will reduce bond.

Use a stiff bristle brush to vigorously brush hole to dislodge compacted drilling dust.

Repeat step 1.

Repeat above steps as required to remove drilling dust or other material that will reduce bond. The hole shall be clean and dry.

Cleaning reinforcing bars and all thread rods:

Solvent clean reinforcing bar and all thread rods over the embedment length in accordance with SSPC SP-1 Solvent Cleaning. Provide an oil and grease free surface to promote bonding of adhesive to steel.

Clean reinforcing bars and all thread rods over embedment length to bare metal. The reinforcing bars and all thread rods shall be free of oil, grease, paint, dirt, mill scale, rust, or other coatings that will reduce bond.

Filling hole with epoxy:

Fill hole with epoxy before inserting the reinforcing bar or all thread rod. Fill hole with epoxy starting from bottom of hole. Fill hole without creating air voids.

Fill hole with sufficient epoxy so that excess epoxy is extruded out of the hole when the reinforcing bar or all thread rod is inserted into the hole.

Do not install epoxy prior to receiving epoxy manufacturer's onsite training.

MANUFACTURERS' SERVICES

Furnish manufacturer's representative to conduct jobsite training for proper installation, handling, and storage of epoxy, for personnel who will perform actual installation. ENGINEER may attend training sessions.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_30_00

CAST-IN-PLACE CONCRETE

GENERAL

SUMMARY

Section includes: Cast-in-place concrete.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Concrete Institute (ACI):

305 - Hot Weather Concreting Standard.
306 - Cold Weather Concreting Standard.
318 - Building Code Requirements for Structural Concrete and Commentary.
350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.
Manual of Concrete Practice.

ASTM International (ASTM):

C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
C 33 - Standard Specification for Concrete Aggregates.
C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
C 88 - Standard Test Method of Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
C 94 - Standard Specification for Ready-Mixed Concrete.
C 114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement.
C 117 - Standard Test Method for Materials Finer that 75-m (No. 200) Sieve in Mineral Aggregates by Washing.
C 123 - Standard Test Method for Lightweight Particles in Aggregate.
C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregate.

C 143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
C 150 - Standard Specification for Portland Cement.
C 156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
C 171 - Standard Specifications for Sheet Materials for Curing Concrete.
C 172 - Standard Practice for Sampling Freshly Mixed Concrete.
C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
C 227 - Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
C 295 - Standard Guide to Petrographic Examination of Aggregates for Concrete.
C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
C 311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
C 494 - Standard Specification for Chemical Admixtures for Concrete.
C 595 - Standard Specification for Blended Hydraulic Cements.
C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
D 75 - Standard Practice for Sampling Aggregates.
D 2103 - Standard Specification for Polyethylene Film and Sheeting.

DEFINITIONS

Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.

Cementitious materials: Portland cement and fly ash.

Cold weather: A period when for more than 3 consecutive days, the average daily outdoor temperature drops below 40 degrees Fahrenheit. The average daily temperature is the average of the highest and lowest temperatures during the period from midnight to midnight. When temperatures above 50 degrees Fahrenheit occur during more than half of any 24-hour duration, the period shall no longer be regarded as cold weather.

Cold weather concreting: Operations for placing, finishing, curing, and protection of concrete during cold weather.

Green concrete: Concrete with less than 100 percent of the specified strength.

Hairline crack: Crack with a crack width of less than 4 thousandths of an inch.

Hot weather: A period when project conditions such as low humidity, high temperature, solar radiation, and high winds, promote rapid drying of freshly placed concrete.

Hot weather concreting: Operations for placing, finishing, curing, and protection of concrete during hot weather.

TECHNICAL SPECIFICATIONS

SYSTEM DESCRIPTION

Performance requirements:

General:

Except as otherwise specified, provide concrete composed of portland cement, fly ash, fine aggregate, coarse aggregate, admixtures and water so proportioned and mixed as to produce plastic, workable mixture in accordance with requirements as specified in this Section and suitable to specific conditions of placement.

Proportion materials in a manner that will secure lowest water-cementious materials ratio that is consistent with good workability, plastic and cohesive mixture, and a mixture that is within specified slump range.

Proportion fine and coarse aggregates in manner such as not to produce harshness in placing or honeycombing.

It is the intent of this Section to secure for every part of the Work concrete with homogeneous mixture, which when hardened will have required strength, watertightness, and durability:

It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces.

Construction joints have been specified and positioned in structures as indicated on the Drawings, and curing methods specified, for purpose of reducing number and size of cracks, due to normal expansion and contraction expected from specified concrete mixes. The digester dome shall be placed monolithically.

Repair cracks which develop in walls or slabs and repair cracks which show any signs of leakage until all leakage is stopped.

Pressure inject visible cracks, other than hairline cracks and crazing, in following areas with epoxy as specified in Section 03_64_24:

Floors and walls of water bearing structures.

Walls and overhead slabs of passageways or occupied spaces, outsides of which are exposed to weather or may be washed down and are not specified to receive separate waterproof membrane.

Other items not specified to receive separate waterproof membrane: Slabs over water channels, wet wells, reservoirs, and other similar surfaces.

Walls or slabs, as specified above, that leak or sweat because of porosity or cracks too small for successful pressure injection with epoxy: Seal on water or weather side by coatings of surface sealant system, as specified in this Section.

Pressure injection and sealing: Continue as specified above until structure is watertight and remains watertight for not less than 1 year after final acceptance or date of final repair, whichever occurs later in time.

Workmanship and methods: Provide concrete work, including detailing of reinforcing, conforming with best standard practices and as set forth in ACI 318, ACI 350, Manual of Concrete Practices, and recommended practices.

SUBMITTALS

Cement mill tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.

Cold weather concreting:

Procedures for the production, transportation, placement, protection, curing, and temperature monitoring for concrete during cold weather.
Procedures to be implemented upon abrupt changes in weather conditions or equipment failures.

Concrete historical mix data: Full details, including mix design calculations for concrete mixes proposed for use for each class of concrete:

a. Include information on correction of batching for varying moisture contents of fine aggregate.
b. Source quality test records with mix design submittal:
c. Include calculations for required compressive strength (f'_{cr}) based on source quality test records.

Concrete aggregate tests: Certified copies in triplicate of commercial laboratory tests not more than 90 days old of all samples of concrete aggregates:

Coarse aggregate:
- Abrasion loss.
- Clay lumps and friable particles.
- Coal and lignite.
- Materials finer than 200 sieve.
- Reactivity.
- Shale and chert.
- Soundness.

Fine aggregate:
- Clay lumps.
- Color.
- Decantation.
- Reactivity.
- Shale and chert.
- Soundness.

Drying shrinkage test data.

Fine or coarse aggregate batched from more than 1 bin: Analyses for each bin, and composite analysis made up from these, using proportions of materials to be used in mix.

Fly ash Certificate of Compliance: Identify source of fly ash and certify compliance in accordance with ASTM C 618.

For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Corrective measures for use prior to placing concrete.

Hot weather concreting: Procedures for production, placement, finishing, curing, protection, and temperature monitoring for concrete during hot weather and appropriate corrective measures.

Heating equipment for cold weather concreting: Information on type of equipment used for heating materials and new concrete in process of curing during excessively cold weather.

Information on mixing equipment.

Product data: Submit data completely describing products.

Sequence of concrete placing: Submit proposed sequence of placing concrete showing proposed beginning and ending of individual placements.

Sieve analysis: Submit sieve analyses of fine and coarse aggregates being used in triplicate at least every 3 weeks and at any time there is significant change in grading of materials.

Trial batch test data:
- Submit data for each test cylinder.
- Submit data that identifies mix and slump for each test cylinder.

Weather monitoring: Records of:
- Relative humidity.
- Site ambient temperature.
- Wind speed.

Temperature of freshly placed concrete.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping:
- Deliver, store, and handle concrete materials in manner that prevents damage and inclusion of foreign substances.
- Deliver and store packaged materials in original containers until ready for use.
- Deliver aggregate to mixing site and handle in such manner that variations in moisture content will not interfere with steady production of concrete of specified degree of uniformity and slump.

Acceptance at site: Reject material containers or materials showing evidence of water or other damage.

PROJECT CONDITIONS

Environmental requirements:
- Monitoring weather conditions:
  - Install an outdoor weather station capable of measuring and recording ambient temperature, wind speed, and humidity. Furnish instruments accurate to within 2 degrees Fahrenheit, 5 percent relative humidity, and 1 mile per hour wind speed.
  - Measure and record temperature of fresh concrete. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature of concrete.
  - Monitor and keep records of the weather forecast starting at least 48 hours prior to placing concrete in order to allow enough time for taking appropriate measures pertaining to Hot or Cold weather concreting.
- Hot weather concreting:
  - Initiate evaporation control measures when concrete and air temperatures, relative humidity of the air, and the wind velocity have the capacity to evaporate water from a free surface at a rate that is equal to or greater than

0.2 pounds per square feet per hour. Determine evaporation rate using the Menzel Formula and monograph in ACI 305 3.1.3.

When ambient air temperature is above 85 degrees Fahrenheit: Prior to placing concrete, cool forms and reinforcing steel by water cooling to below 90 degrees Fahrenheit.

Monitor weather conditions at the site including air temperature, humidity, and wind speed, to assess the need for evaporation control measures begin monitoring site conditions no later than 1 hour before the start of concrete placement. Continue to monitor site conditions at intervals of 30 minutes until concrete curing has begun.

Temperature of concrete mix at time of placement: Keep temperature below 90 degrees Fahrenheit by methods which do not impair quality of concrete.

For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Take corrective measures to minimize rapid water loss from concrete:

Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature around concrete.

Cold weather concreting:

Concrete placed below ambient air temperature of 45 degrees Fahrenheit and falling or below 40 degrees Fahrenheit:

Make provision for heating water.

Follow recommendations of ACI 306 for preparation, placement, and protection of concrete during cold weather.

If materials have been exposed to freezing temperatures to degree that any material is below 35 degrees Fahrenheit: Heat such materials.

Heating water, cement, or aggregate materials:

Do not heat in excess of 160 degrees Fahrenheit.

Protection of concrete in forms:

Do not remove forms from concrete when outside ambient air temperature is below 50 degrees Fahrenheit until concrete has attained its minimum specified compressive strength. Evidence of strength shall be based on by testing of cylinders stored in the field under equivalent conditions to those at the concrete structure.

Protect by means of covering with tarpaulins, or other acceptable covering acceptable to ENGINEER.

Provide means for circulating warm moist air around forms in manner to maintain temperature of 50 degrees Fahrenheit for at least 5 days.

SEQUENCING AND SCHEDULING

Schedule placing of concrete in such manner as to complete any single placing operation to construction, or expansion joint.

PRODUCTS

MATERIALS

Admixtures:

General:

Do not use admixtures of any type, except as specified, unless written acceptance has been obtained from the ENGINEER.

Admixtures shall be compatible with concrete and other admixtures.
Admixtures other than pozzolans shall be the products of a single manufacture to ensure compatibility.
Do not use admixtures containing chlorides calculated as chloride ion in excess of 0.5 percent by weight of cement.
Use in accordance with manufacturer's recommendations. Add each admixture to concrete mix separately.

Air entraining admixture:

Provide concrete with 5 percent, within 1 percent, entrained air of evenly dispersed air bubbles at time of placement.
In accordance with ASTM C 260.

Water reducing admixture:

May be used at the CONTRACTOR's option.
In accordance with ASTM C 494, Type A or Type D.
Not contain air-entraining agents.
Liquid form before adding to the concrete mix.
No decrease in cement is permitted as result of use of water reducing admixture.

Water Reducing Admixtures - High Range (HRWR):

HRWR shall comply with ASTM C494, Type F or G.
HRWR shall be accurately measured in accordance with the manufacturer's recommendations.
HRWR shall be added to the concrete mix at the site.
The HRWR admixture shall be able to maintain the plasticity range for extended periods of time (2 hours if necessary) without a rise in concrete temperature.
Type F or G admixtures may be used in all concrete except Class CE concrete. With the use of these admixtures, slump limit shall be between 7 inch and 9 inch, unless otherwise authorized by the manufacturer.
Other admixtures may only be used with the HRWR if approved by the HRWR manufacturer. A representative of the HRWR shall be present during any large placement, placement of slabs, or during times of unusual circumstances which may require changes to the product formulation.
HRWR agent shall be one of the following:

Rheobuild by Master Builders, Inc.
Daracem Family and ADVA-Flow by Grace.

If unsatisfactory results are obtained (voids, cracking, etc.), the use of HRWR may be terminated by the ENGINEER.

Aggregate:

General:

Provide concrete aggregates that are sound, uniformly graded, and free of deleterious material in excess of allowable amounts specified.
Grade aggregate in accordance with ASTM C 136 and D 75.
Provide unit weight of fine and coarse aggregate that produces in place concrete with weight of not less than 140 pounds per cubic foot.
Do not use aggregate made from recycled materials such as crushed and screened hydraulic-cement concrete, brick, and other construction materials.

Fine aggregate:

Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.

TECHNICAL SPECIFICATIONS

Do not provide aggregate having deleterious substances in excess of following percentages by weight of contaminating substances.
In no case shall total exceed percent listed.

Item	Test Method	Percent
Removed by decantation (dirt, silt, etc.)	ASTM C 117	3
Shale or Chert	ASTM C 123 ASTM C 295*	1 1
Clay Lumps	ASTM C 142	1

* Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles is shale or chert. If the results of Test Method C 123 are less than 1 percent, Test Method C 295 is not required.

Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with ASTM C 33.

Coarse aggregate:

Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
Not exceeding 15 percent by weight, of thin or elongated pieces having length greater than 5 times average thickness.
Deleterious substances: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.

Item	Test Method	Percent
Shale or chert	ASTM C 123 ASTM C 295**	1.25 1
Coal and lignite	ASTM C 123	1/4
Clay lumps and friable particles	ASTM C 142	1/4
Materials finer than Number 200 sieve	ASTM C 117	1/2*

* Except when material finer than Number 200 sieve consists of crusher dust, maximum amount shall be 1 percent.

** Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles is shale, chert, coal, or lignite. If the results of Test Method C 123 are less than 1.25 percent (the minimum combined percentage of shale, chert, coal and lignite), Test Method C 295 is not required.

Grading:

Aggregate for Class A, B, C, and D concrete: In accordance with ASTM C 33, Size Number 57, except as otherwise specified or authorized in writing by the ENGINEER.

Aggregate for Class CE concrete for encasement of electrical conduits: Graded in accordance with ASTM C 33, Size Number 8.

Concrete sealer:

Manufacturers: One of the following or equal:

Euclid Chemical Company: Diamond Hard.

L&M Construction Chemicals: SealHard.

Conduit encasement coloring agent:

Color: Red color concrete used for encasement of electrical ducts, conduits, and similar type items.

Manufacturers: One of the following or equal:

Davis Company, #100 Utility Red.

I. Reiss Company, Inc., equivalent product.

Euclid Chemical Company, Increte Division, “Colorcrete Brick Red.”

Conduit encasement concrete: Mix into each cubic yard of concrete 10 pounds of coloring agent.

Evaporation retardant:

Manufacturers: One of the following or equal:

BASF, Cleveland, Ohio, Confilm.

Euclid Chemical Company, Cleveland, Ohio, Eucobar.

Fly ash:

Fly ash in accordance with ASTM C 618, Class F may be used in concrete made with Type II portland cement.

Maximum of 15 percent by weight of fly ash to total weight of cementitious materials.

The total weight of cementitious materials shall not be less than minimum cementitious materials listed in Table A.

Do not use in concrete made with portland-pozzolan cement.

Loss on ignition: Not exceed 4 percent.

Keyway material: Steel, plastic, or lumber.

Portland cement:

Conform to specifications and tests in accordance with ASTM C 150, Types II or III, low alkali, except as specified otherwise.

Have total alkali containing not more than 0.60 percent.

Exposed concrete in any individual structure: Use only one brand of portland cement.
Cement for finishes or repairs: Provide cement from same source and of same type as concrete to be finished or repaired.

Surface sealant system: Manufacturers: One of the following or equal:
Radcon Laboratories, Inc., Las Vegas, Nevada, Formula Number 7.
IPA Systems, Philadelphia, Pennsylvania, Duripal.

Water:
Water for concrete, Washing Aggregate, and Curing Concrete: Clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances.
Chlorides and sulfate ions:
Water for conventional reinforced concrete: Use water containing not more than 1,000 milligrams per liter of chlorides calculated as chloride ion, nor more than 1,000 milligrams per liter of sulfates calculated as sulfate ion.
Water for prestressed or post-tensioned concrete: Use water containing not more than 650 milligrams per liter of chlorides calculated as chloride ion, or more than 800 milligrams per liter of sulfates calculated as sulfate ion.

EQUIPMENT

Mixing concrete:
Mixers may be of stationary plant, paver, or truck mixer type.
Provide adequate equipment and facilities for accurate measurement and control of materials and for readily changing proportions of material.
Mixing equipment:
Capable of combining aggregates, cementitious materials, and water within specified time into thoroughly mixed and uniform mass and discharging mixture without segregation.
Maintain concrete mixing plant and equipment in good working order and operated at loads, speeds, and timing recommended by manufacturer or as specified.
Proportion cementitious materials and aggregate by weight.

Machine mixing:
Batch plant shall be capable of controlling delivery of all material to mixer within 1 percent by weight of individual material.
If bulk cementitious materials are used, weigh them on separate visible scale which will accurately register scale load at any stage of weighing operation from zero to full capacity.
Prevent cementitious materials from coming into contact with aggregate or with water until materials are in mixer ready for complete mixing with all mixing water.
Procedure of mixing cementitious materials with sand or with sand and coarse aggregate for delivery to project site, for final mixing and addition of mixing water will not be permitted.
Retempering of concrete will not be permitted.
Discharge entire batch before recharging.
Volume of mixed material per batch: Not exceed manufacturer's rated capacity of mixer.
Mixers:

Perform mixing in batch mixers of acceptable type.
Equip each mixer with device for accurately measuring and indicating quantity of water entering concrete, and operating mechanism such that leakage will not occur when valves are closed.
Equip each mixer with device for automatically measuring, indicating, and controlling time required for mixing:
Interlock device to prevent discharge of concrete from mixer before expiration of mixing period.

Transit-mixed concrete:
Mix and deliver in accordance with ASTM C 94.
Total elapsed time between addition of water at batch plant and discharging completed mix:
Not to exceed 90 minutes.
Elapsed time at project site shall not exceed 30 minutes.
Under conditions contributing to quick setting, total elapsed time permitted may be reduced by the ENGINEER.
Equip each truck mixer with device interlocked to prevent discharge of concrete from drum before required number of turns and furnish device that is capable of counting number of revolutions of drum.
Continuously revolve drum after it is once started until it has completely discharged its batch:
Do not add water until drum has started revolving.
Right is reserved to increase required minimum number of revolutions or to decrease designated maximum number of revolutions allowed, if necessary, to obtain satisfactory mixing. The CONTRACTOR will not be entitled to additional compensation because of such increase or decrease.

Other types of mixers: In case of other types of mixers, mixing shall be as follows:
Mix concrete until there is uniform distribution of materials, and discharge mixer completely before recharging.
Neither speed nor volume loading of mixer shall exceed manufacturer's recommendations.
Continue mixing for minimum of 1-1/2 minutes after all materials are in drum, and for batches larger than 1 cubic yard increase minimum mixing time 15 seconds for each additional cubic yard or fraction thereof.

MIXES

Measurements of materials:
Measure materials by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the ENGINEER.
Furnish apparatus for weighing aggregates and cementitious materials that is suitably designed and constructed for this purpose.
Accuracy of weighing devices: Furnish devices that have capability of providing successive quantities of individual material that can be measured to within 1 percent of desired amount of that material.
Measuring or weighing devices: Subject to review by the ENGINEER. Shall bear valid seal of the Sealer of Weights and Measures having jurisdiction.
Weighing cementitious materials:
Weigh cementitious materials separately.
Cement in unbroken standard packages (sacks): Need not be weighed.

Weigh bulk cementitious materials and fractional packages.

Measure mixing water by volume or by weight.

Concrete proportions and consistency:

Provide concrete that can be worked readily into corners and angles of forms and around reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on surface.

Prevent unnecessary or haphazard changes in consistency of concrete.

Ratio of coarse aggregate to fine aggregate: Not less than 1.0 or more than 2.0 for all concrete Classes, with exception of Class CE.

Aggregate:

Obtain aggregate from source that is capable of providing uniform quality, moisture content, and grading during any single day's operation.

Maximum concrete mix water to cementitious materials ratio, minimum cementitious materials content, and slump range: Conform to values specified in Table A in this Section.

Concrete batch weights: Control and adjust to secure maximum yield. At all times, maintain proportions of concrete mix within specified limits.

Mix modification: If required, by the ENGINEER, modify mixture within limits set forth in this Section.

Concrete mixes:

Proportioning of concrete mix: Proportion mixes based on required compressive strength f'_{cr}.

Mixes:

Adjusting of water: After acceptance, do not change mixes without acceptance by ENGINEER, except that at all times adjust batching of water to compensate for free moisture content of fine aggregate.

Total water content of each concrete class: Not exceed those specified in Table A in this Section.

Checking moisture content of fine aggregate: Furnish satisfactory means at batching plant for checking moisture content of fine aggregate.

Change in mixes: Submit new mix design and perform new trial batch and test program as specified in this Section.

Hand mixed concrete:

Hand mix concrete shall not be used.

Classes of concrete:

Provide concrete consisting of 5 classes: Classes A, B, C, D, and CE. Use where specified or indicated on the Drawings.

Weight of concrete classes: Provide classes of concrete having minimum weight of 140 pounds per cubic foot.

Class B concrete: Class B concrete may be substituted for Class A concrete, when high-early strength concrete is needed in areas specifically accepted by the ENGINEER and that do not require sulfate resistant concrete.

Class C concrete: Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the Drawings.

Class D concrete: Use Class D for precast concrete items.

Class CE concrete: Use Class CE for electrical conduit encasements.

All other concrete, unless specified or otherwise indicated on the Drawings: Use Class A concrete.

TABLE A CONCRETE WITH AIR ENTRAINMENT				
Class	**Specified Compressive Strength f'_c at 28 Days (Pounds per Square Inch)**	**Water-to-Cementitious Materials Ratio**	**Cementitious Materials per Cubic Yard of Concrete by Weight (Pounds)**	**Slump Range (Inches)**
A	4,500	0.42	564	2 to 4
B (Type III cement)	4,500	0.42	564	2 to 4
C	2,500	0.62	423	3 to 6
D	4,500	0.45	564	2 to 4
CE	2,500	0.62	564	3 to 6

Pumped concrete: Provide pumped concrete that complies with all requirements of this Section.

Do not place concrete with slump outside limits indicated in Table A.

Classes:

Classes A, C, D, and CE concrete: Make with Type II low alkali portland cement.

Class B concrete: Make with Type III low alkali portland cement.

Admixtures: Provide admixtures as specified in this Section.

Air entraining admixture:

Add agent to batch in portion of mixing water.

Batch solution by means of mechanical batcher capable of accurate measurement.

SOURCE QUALITY CONTROL

Tests:

Concrete Mixes:

In lieu of ENGINEER accepted concrete mix historical data, trial batches of the proposed concrete mix designs shall be prepared by testing laboratory acceptable to the ENGINEER and results submitted.

Prepare trial batches using cementitious materials and aggregates proposed to be used for the Work.

Prepare trial batches with sufficient quantity to determine slump, workability, consistency, and finishing characteristics, and to provide sufficient test cylinders.

Test cylinders: Provide cylinders having 6-inch diameter by 12-inch length and that are prepared in accordance with ASTM C 31 for tests specified in this Section.

Determine slump in accordance with ASTM C 143.

Test cylinders from trial batch:

Test 8 cylinders for compressive strength in accordance with ASTM C 39:

Test 4 cylinders at 7 days and 4 at 28 days.

Establish ratio between 7 day and 28 day strength for mix. 7-day strength may be taken as satisfactory indication of 28-day strength provided effects on concrete of temperature and humidity between 7 day and 28 day are taken into account.

Average compressive strength of 4 test cylinders tested at 28 days:

Equal to or greater than required average compressive strength (f'_{cr}) on which concrete mix design is based.

Drying shrinkage:

Prepare 5 drying shrinkage specimens in accordance with ASTM C 157, except as modified in this Section.

Remove drying shrinkage specimens from molds at age of 23 hours within 1 hour after trial batching, then immediately place them in water at 73 degrees Fahrenheit within 3 degrees for at least 30 minutes and then measure specimens within 30 minutes thereafter to determine original length.

Then submerge specimens in saturated limewater at 73 degrees Fahrenheit within 3 degrees for moist curing.

Make measurement to determine expansion expressed as percentage of original length at age 7 days.

Use length at age 7 days as base length for drying shrinkage calculations.

Immediately store specimens in humidity controlled room maintained at 73 degrees Fahrenheit within 3 degrees and 50 percent within 4 percent relative humidity for remainder of test.

Make and report measurements to determine shrinkage expressed as percentage of base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

Drying shrinkage deformation:

Measure drying shrinkage deformation of each specimen as difference between base length and length after drying at each test age.

Measure average drying shrinkage deformation of specimens to nearest 0.0001 inch at each test age.

If drying shrinkage of any specimen departs from average of test age by more than 0.0004 inch, disregard results obtained from that specimen and test another specimen.

Shrinkage of trial batch concrete at 28 days drying age shall not exceed 0.045 percent maximum.

If trial batch tests do not meet specified requirements for slump, strength, workability, consistency, drying shrinkage, and finishing, change concrete mix design proportions and, if necessary, source of aggregate.

Perform additional trial batches and tests until an acceptable trial batch is produced that meets requirements of this Section.

Perform test batches and tests required to establish trial batches and acceptability of materials without change in Contract Price.

Do not place concrete until the concrete mix design and trial batch have been accepted by ENGINEER.

Required average compressive strength:

Determine required average compressive strength (f'_{cr}) for selection of concrete proportions for mix design, for each class of concrete, using calculated standard deviation for its corresponding specified compressive strength (f'_c,) in accordance with ACI 318 and ACI 350.

When test records of at least 30 consecutive tests that span period of not less than 45 calendar days are available, establish standard deviation as in accordance with ACI 318 and ACI 350 and as modified in this Section.

Provide test records from which to calculate standard deviation that represent materials, quality control procedures, and conditions similar to materials, quality control procedures, and conditions expected to apply in preparation of concrete for the Work.

Provide test records with materials and proportions that are more restricted than those for the Work.

Specified compressive strength (f'_c) of concrete used in test records: Within 1,000 pounds per square inch of that specified for the Work.

When lacking adequate test records for calculation of standard deviation meeting requirements, determine required average compressive strength f'_{cr} from following Table B.

TABLE B

REQUIRED AVERAGE COMPRESSION STRENGTH

Specified Compressive Strength f'_c (pounds per square inch)	**Required Average Compressive Strength f'_{cr} (pounds per square inch)**
Less than 3,000	f'_c + 1,000
3,000 to 5,000	f'_c + 1,200
Over 5,000	1.10f'_c + 700

Aggregate:

Testing of concrete aggregate is at CONTRACTOR's expense.

If there is change in aggregate source or if there is a significant change in aggregate quality or sieve analysis from same source, submit new set of design mixes covering each class of concrete and prepare new trial batches before further placing of concrete.

Sieves: Use sieves with square openings for testing grading of aggregates.

Sample aggregate in accordance with ASTM C 136 and D 75.

Fine aggregate:

Provide fine aggregate that does not contain strong alkali nor organic matter, which gives color darker than standard color when tested in accordance with ASTM C 40.

Provide aggregate having soundness in accordance with ASTM C 33 when tested in accordance with ASTM C 88.

Provide aggregate complying with reactivity requirements in accordance with ASTM C 33 when tested in accordance with ASTM C 289.

Coarse aggregate:

Soundness when tested in accordance with ASTM C 88: Have loss not greater than 10 percent when tested with sodium sulfate.

Abrasion Loss: Not exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131.

Reactivity: Not exceed limits specified in Appendix of ASTM C 33 when tested in accordance with ASTM C 289.

Fly ash:

Sampling and testing: Sample and test fly ash in accordance with ASTM C 311.

Portland cement:

Determination of alkali content: In accordance with ASTM C 114.

EXECUTION

INSTALLATION

Liquid evaporation retardant:

Under conditions that result in rapid evaporation of moisture from the surface of the concrete, immediately after the concrete has been screeded, coat the surface of the concrete with a liquid evaporation retardant.

Apply the evaporation retardant again after each work operation as necessary to prevent drying shrinkage cracks.

Conditions which result in rapid evaporation of moisture may include one or more of the following:

Low humidity.

Windy conditions.

High temperature.

Surface sealant system:

Apply as recommended by manufacturer published instructions.

Where concrete continues to sweat or leak, apply additional coats of surface sealant until the sweating or leaks stop.

Joints and bonding:

Construct digester dome as monolith with no construction or expansion joints. Locations of construction and other joints are indicated on the Drawings or as specified in this Section. In order to preserve strength and watertightness of structures, make no other joints, except as authorized the ENGINEER.

Construction joints:

At construction joints, thoroughly clean concrete of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of heavy sandblasting.

Cleaning of construction joints:

Wash construction joints free of sawdust, chips, and other debris after forms are built and immediately before concrete or grout placement. Should formwork confine sawdust, chips, or other loose matter in such manner that it is impossible to remove them by flushing with water, use vacuum cleaner for their removal, after which flush cleaned surfaces with water.

Provide cleanout hole at base of each wall and column for inspection and cleaning.

At horizontal joints: As initial placement over cold joints, thoroughly spread bed of cement grout as specified in Section 03_60_00 with a thickness of not less than 1/2 inch nor more than 1 inch.

Keyways in joints:

Provide keyways in joints as indicated on the Drawings.

Treat lumber keyway material with form release coating, applied in accordance with manufacturer's instructions.

Take special care to ensure that concrete is well consolidated around and against waterstops and waterstops are secured in proper position.

Repair of concrete: Where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, first coat surface of set concrete with epoxy bonding agent as specified in Section 03_63_01.

Conveying and placing concrete:

Convey concrete from mixer to place of final deposit by methods that prevent separation or loss of materials.

Use equipment for chuting, pumping, and conveying concrete of such size and design as to ensure practically continuous flow of concrete at delivery end without segregation of materials.

Design and use chutes and devices for conveying and depositing concrete that direct concrete vertically downward when discharged from chute or conveying device.

Keep equipment for conveying concrete thoroughly clean by washing and scraping upon completion of day's placement.

Placing concrete:

Place concrete for dome starting at the bottom and working towards the top.

Place no concrete without prior authorization of the ENGINEER.

Do not place concrete until:

Reinforcement is secure and properly fastened in its correct position and loose form ties at construction joints have been retightened.

Dowels, bucks, sleeves, hangers, pipes, conduits, anchor bolts, and any other fixtures required to be embedded in concrete have been placed and adequately anchored.

Forms have been cleaned and oiled as specified.

Do not place concrete in which initial set has occurred, or that has been retempered.

Do not place concrete during rainstorms or high velocity winds.

Protect concrete placed immediately before rain to prevent water from coming in contact with such concrete or winds causing excessive drying.

Keep sufficient protective covering on hand at all times for protection of concrete.

After acceptance, adhere to proposed sequence of placing concrete, except when specific changes are requested and accepted by the ENGINEER.

Notify the ENGINEER in writing of readiness, not just intention, to place concrete in any portion of the work:

Provide this notification in such time in advance of operations, as the ENGINEER deems necessary to make final inspection of preparations at location of proposed concrete placing.

Place forms, reinforcement, screeds, anchors, ties, and inserts in place before notification of readiness is given to the ENGINEER.

Depositing concrete:

Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing.

Do not deposit concrete in large quantities in one place and work along forms with vibrator or by other methods.

Do not drop concrete freely into place from height greater than 5 feet.

Use tremies for placing concrete where drop is over 5 feet.
Commence placement of concrete on slopes, starting at bottom of slope.

Place concrete in approximately horizontal layers not to exceed 24 inches in depth and bring up evenly in all parts of forms.

Continue concrete placement without avoidable interruption, in continuous operation, until end of placement is reached.

After concrete placement begins, continue concrete placement without significant interruption. Plan and implement precautions to prevent any delay, between layers being placed, from exceeding 20 minutes.

If concrete is to be placed over previously placed concrete and more than 20 minutes has elapsed, spread layer of cement grout not less than 1/2 inch in thickness nor more than 1 inch in thickness over surface before placing additional concrete.

Placement of concrete for slabs, beams, or walkways:

If cast monolithically with walls or columns, do not commence until concrete in walls or columns has been allowed to set and shrink.

Allow set time of not less than 1 hour for shrinkage.

Consolidating concrete:

Place concrete with aid of acceptable mechanical vibrators.

Thoroughly consolidate concrete around reinforcement, pipes, or other shapes built into the work.

Provide sufficiently intense vibration to cause concrete to flow and settle readily into place and to visibly affect concrete over radius of at least 18 inches.

Vibrators:

Keep sufficient vibrators on hand at all times to vibrate concrete as placed.

In addition to vibrators in actual use while concrete is being placed, have on hand minimum 1 spare vibrator in serviceable condition.

Do not place concrete until it has been ascertained that all vibrating equipment, including spares, are in serviceable condition.

Take special care to place concrete solidly against forms to leave no voids.

Take every precaution to make concrete solid, compact, and smooth. If for any reason surfaces or interiors have voids or are in any way defective, repair such concrete in manner acceptable to the ENGINEER.

Loading concrete:

Green concrete:

No heavy loading of green concrete will be permitted.

No backfill shall be placed against concrete walls, connecting slabs, or beams until the concrete has reached the specified strength.

Use construction methods, sequencing, and allow time for concrete to reach adequate strength to prevent overstress of the concrete structure during construction.

Curing concrete:

General:

Cure concrete by methods specified in this Section.

Keep concrete continuously moist and at a temperature of at least 50 degrees Fahrenheit for minimum of 14 days after placement.

Do not use sprayed membrane curing or sealing compounds on concrete surfaces that are to receive paint or upon which any material is to be bonded.

Water cure digester dome concrete.

Water curing:

Keep surfaces of concrete being water cured constantly and visibly moist day and night for period of not less than 14 days.

Each day forms remain in place count as 1 day of water curing.

No further curing credit will be allowed for forms in place after contact has once been broken between concrete surface and forms.

Do not loosen form ties during period when concrete is being cured by leaving forms in place.

Spray concrete at least 3 times per day, and keep concrete surfaces moist at all times during 14 day curing period.

Cold weather concreting:

Preparation before concreting:

Remove snow, ice, and frost from the surfaces, including reinforcement against which the concrete is to be placed.

The subgrade shall be free of frost before concrete placing begins.

Do not place concrete around any embedment that is at a temperature below freezing and is sufficiently massive as to cause the adjacent concrete to freeze.

Placement of concrete:

Placement temperature:

The minimum temperature of concrete immediately after placement shall be as specified in Table C.

The temperature of concrete as placed shall not exceed the values shown in Table C by more than 20 degrees Fahrenheit.

Protection temperature:

Unless otherwise specified, the minimum temperature of concrete during the protection period shall be as shown Table C.

Temperatures specified to be maintained during the protection period shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air.

Measure the temperature with a surface measuring device accurate to 2 degrees Fahrenheit.

Measure the temperature of concrete in each placement at regular time intervals as specified in the contract documents.

Termination of protection:

The maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the values listed in Table C.

Do not exceed these limits until the surface temperature of the concrete is within 20 degrees Fahrenheit of the ambient temperature of surrounding temperatures.

When the surface temperature of the concrete is within 20 degrees Fahrenheit of the ambient temperature, all protection may be removed.

Table C CONCRETE TEMPERATURE REQUIREMENTS		
Least dimension of section (inches)	**Minimum temperature of concrete as placed and maintained during the protection period (degrees Fahrenheit)**	**Maximum for gradual decrease in surface temperature during any 24 hour period after end of protection period (degrees Fahrenheit)**
Less than 12	55	50
12 to less than 36	50	40
36 to 72	45	30
Greater than 72	40	20

Curing of concrete:

Prevent concrete from drying during the required curing period. If water curing is used, terminate use at least 24 hours before any anticipated exposure of the concrete to freezing temperatures.

Protection of concrete:

Combustion heaters: Vent flue gases from combustion heating units to the outside of the enclosures.

Overheating and drying: Place and direct heaters and ducts to avoid areas of overheating or drying of the concrete surface.

Maximum air temperature: During the protection period, do not expose the concrete surface to air having a temperature more than 20 degrees Fahrenheit above the values shown in Table C unless higher values are required by an accepted curing method.

Protection against freezing:

Cure and protect concrete against damage from freezing for a minimum of 3 days, unless otherwise specified.

Maintain the surface temperature of the concrete as specified in Table C.

During periods not defined as cold weather, but when freezing temperatures may occur, protect concrete surfaces against freezing for the first 24 hours after placing.

CONCRETE FINISHING

Provide concrete finishes as specified in Section 03_35_29.

Edges of joints:

Provide joints having edges as indicated on the Drawings.

Protect wall and slab surfaces at edges against concrete spatter and thoroughly clean upon completion of each placement.

FIELD QUALITY CONTROL

Testing of concrete:

During progress of construction, the OWNER will have tests made to determine whether the concrete, as being produced, complies with requirements specified. Tests will be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 172.

The ENGINEER will make and deliver test cylinders to the laboratory and testing expense will be borne by the OWNER.

Furnish test equipment.
Make provisions for and furnish concrete for test specimens, and provide manual assistance to the ENGINEER in preparing said specimens.
Assume responsibility for care of and providing of curing conditions for test specimens in accordance with ASTM C 31.

Compressive strength tests:

Test not less than 3 cylinder specimens, 6-inch diameter by 12 inch long, for each 150 cubic yards of each class of concrete with minimum of 3 specimens for each class of concrete placed and not less than 3 specimens for each half-day's placement.
One cylinder will be tested at 7 days for information, and 2 cylinders will be tested at 28 days for acceptance.

Slump tests:

Test slump of concrete using slump cone in accordance with ASTM C 143.
Do not use concrete that does not meet specification requirements in regards to slump.
Remove such concrete from project site.
Test slump at the beginning of each placement, as often as necessary to keep slump within the specified range, and when requested to do so by the ENGINEER.

Air entrainment tests:

Test percent of entrained air in concrete at beginning of each placement, as often as necessary to keep entrained air within specified range, and when requested to do so by the ENGINEER.
Do not use concrete that does not meet Specification requirements for air entrainment.
Remove such concrete from project site.
Test air entrainment in concrete in accordance with ASTM C 173.
The ENGINEER may at any time test percent of entrained air in concrete received on project site.

Enforcement of strength requirement:

Concrete is expected to reach higher compressive strength than that which is indicated in Table A as specified compressive strength (f'_c).
Strength level of concrete: Will be considered acceptable if following conditions are satisfied:

Averages of all sets of 3 consecutive strength test results is greater or equal to specified compressive strength(f'_c).
No individual strength test (average of 2 cylinders) falls below specified compressive strength (f'_c) by more than 500 pounds per square inch.

Non-compliant tests: Immediately forward copies of non-compliant test reports to all parties on the test report distribution list. Mark test reports to highlight that they represent non-complying results.
Whenever one, or both, of 2 conditions stated above is not satisfied, provide additional curing of affected portion followed by cores taken in accordance with ASTM C 42, ACI 318, and ACI 350 and comply with following requirements:

If additional curing does not bring average of 3 cores taken in affected area to at least specified compressive strength (f'_c), designate such concrete in affected area as defective.

The ENGINEER may require the CONTRACTOR to strengthen defective concrete by means of additional concrete, additional reinforcement, or replacement of defective concrete, all of the CONTRACTOR's expense.

ADJUSTING

Repair of defective concrete:

- Remove and replace or repair defective work.
- Correct defective work as specified.
- Do not patch, repair, or cover defective work without inspection by the ENGINEER.
- Provide repairs having strength equal to or greater than specified concrete for areas involved.
- Preparation of concrete for repair:
  - Make no repair until ENGINEER has accepted method for preparing surface for repair.
  - Chip out and key imperfections in the work and make them ready for repair.
  - Surfaces of set concrete to be repaired: First coat with epoxy bonding agent as specified in Section 03_63_01.
- Methods of repair:
  - Dry pack method:
    - Use for holes having depth nearly equal to or greater than least surface dimension of hole, for cone-bolt holes, and for narrow slots cut for repair.
    - Smooth holes: Clean and roughen by heavy sandblasting before repair.
  - Mortar replacement method:
    - Use for holes too wide to dry pack and too shallow for concrete replacement.
    - Comparatively shallow depressions, large or small, which extend no deeper than nearest surface reinforcement.
  - Concrete replacement method:
    - Use when holes extend entirely through concrete section or when holes are more than 1 square foot in area and extend halfway or more through the section.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_35_29

TOOLED CONCRETE FINISHES

GENERAL

SUMMARY

Section includes: Tooled concrete finishes.

QUALITY ASSURANCE

Mock-ups:

Test panels for concrete finishes:

a. Prepare test panels for F4 finishes and tie-hole repairs for review by ENGINEER.
b. Accepted test panels serve as standard of quality and workmanship for project.

Prepare test panel showing horizontal and vertical joints proposed for project for review by the ENGINEER. Refer to finishes specified in this Section.

Test panels indicating methods for making concrete repairs: Prepare test panels for proposed repairs at beginning of project for review by ENGINEER:

Accepted test panels serve as standard for repairs during the project.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping:

Deliver and store packaged materials in original containers until ready for use.

PRODUCTS

MIXES

Mortar mix for F4 finish: Consist of 1 part cement and 1-1/2 parts of fine sand passing Number 100 screen. Mix with enough water and emulsified bonding agent to have consistency of thick cream.

Mortar mix for F5 finish: Consist of 1 part cement to 1-1/2 parts of sand which passes Number 16 screen.

EXECUTION

CONCRETE FINISHES

Cement for finishes:

Addition of white cement may be required to produce finish which matches color of concrete to be finished.

Finish vertical concrete surfaces with one of the following finishes as indicated in the Finish Schedule:

F1 finish: No special treatment other than repair defective work and fill depressions 1 inch or deeper and tie holes with mortar after removal of curing compound.

F2 finish: No special treatment other than repair defective work, remove fins, fill depressions 1/2 inch or deeper and tie holes with mortar after removal of curing compound.

F3 finish: Repair defective work, remove fins, offsets, and grind projections smooth. Fill depressions 1/4 inch or larger in depth or width and tie holes with mortar after removal of curing compound.

F4 finish: Receive same finish as specified for F3 finish, and, in addition fill depressions and holes 1/16 inch or larger in width with mortar.

"Brush-Off" sandblast surfaces prior to filling holes to expose all holes near surface of the concrete.

Thoroughly wet surfaces and commence filling of pits, holes, and depressions while surfaces are still damp.

Perform filling by rubbing mortar over entire area with clean burlap, sponge rubber floats, or trowels.

Do not let any material remain on surfaces, except that within pits and depressions.

Wipe surfaces clean and moist cure.

Finish horizontal concrete surfaces with one of the following finishes as indicated in the Finish Schedule after proper and adequate vibration and tamping:

S1 finish: Screeded to grade and leave without special finish.

S2 finish: Smooth steel trowel finish.

S3 finish: Steel trowel finish free from trowel marks. Provide smooth finish free of all irregularities.

S4 finish: Steel trowel finish, without local depressions or high points, followed by light hairbroom finish. Do not use stiff bristle brooms or brushes. Perform brooming parallel to slab-drainage. Provide resulting finish that is rough enough to provide nonskid finish. Finish is subject to review and acceptance by the ENGINEER.

Finish concrete floor surfaces to which surfacing material is applied: Finish smooth with tolerance within 1/8 inch in 10 feet in any direction from lines indicated on the Drawings.

CONCRETE FINISH SCHEDULE

Finish concrete surfaces as follows:

F4 finish for following vertical surfaces:
Digester interior and exterior vertical surfaces.

S1 finish for following surfaces:
Not used.

S2 finish for following surfaces:
Not used

S3 finish for following surfaces:
Not used.

S4 finish for following surfaces:
Top of dome.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_38_21

POST-TENSIONED CONCRETE DIGESTER DOME TENSION RING

GENERAL

SUMMARY

Section includes: Post-tensioned concrete digester dome tension ring.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Concrete Institute (ACI):

301 - Specifications for Structural Concrete.

350R - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

ASTM International (ASTM):

A 416 - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

C 150 - Standard Specification for Portland Cement.

C 939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced Aggregate Concrete in the Laboratory

C 942 - Standard Test Method for Compressive Strength of Grouts for Preplaced Aggregate Concrete in Laboratory

C 1090 - Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic Cement Grout

C 1107 - Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

C 1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

Post Tensioning Institute (PTI).

DEFINITIONS

Dead end: Is defined as end of tendon which is anchored and on which a jack will not be installed to tension tendon.

Tendon: Is defined as one or more prestressing strands installed in a duct, used in tension to impart compressive stress to concrete.

Seven-wire strand: A group of wires having a center wire enclosed tightly by 6 helically placed outer wires with a uniform pitch.

SYSTEM DESCRIPTION

Design requirements:

Scope:

The Contractor's scope shall include:

Any oversight, preparation, demolition, and removal of existing post-tensioning required to safely demolish the strands, ducts, and associated system.

Design, installation, and tensioning operation as specified herein and as indicated on the Drawings.

Buildout anchorages:

General: Design and construct additional reinforcing bars required for buildout anchorages and bursting steel at anchorage hardware as required for prestressed system being used. Use a minimum of 3 buildout anchorages equally spaced around the tension ring.

Size: Approximate size as indicated on the Drawings. Depth shall accommodate CMU veneer and allow for veneer to conceal buildout.

Base prestressing calculations on following limits of assumed design values:

Assume loss in stress in post-tensioned prestressing steel due to creep and shrinkage of concrete, creep of prestressing steel, and sequence of stressing to be not less than 32,000 pounds per square inch for regular relaxation strand and not less than 20,000 pounds per square inch for low relaxation strand.

Assume curvature coefficient of friction to be not less than 0.14.

Assume wobble coefficient of friction to be not less than 0.0015.

Ducts:

Size: Capable of allowing addition of minimum of 1 strand more than calculated number of strands required in each duct.

Inside diameter: At least 1/4 inch larger than nominal diameter of a single strand. For multiple strands, the inside cross-sectional area of the duct is at least 2 times the area of strands.

Minimum 2 inch clear spacing between the ducts.

The anchorage areas shall be designed so that tendons overlap a sufficient distance to transfer the full stress in the strands past the point of overlap by grouted bond length.

Performance requirements:

Contractor Qualifications:

The post-tensioning systems shall be produced by a Post-Tensioning Institute (PTI) Certified Plant owned and operated by the post-tensioning subcontractor

The post-tension contractor shall have constructed at least five similar concrete tanks in the last five years.

The post-tension contractor shall provide a full-time superintendent that has been responsible for the construction of at least five similar concrete tanks.

The post-tension contractor superintendent shall be a full-time employee of the post-tensioning supplier/installer and be on the project full-time during all placing, stressing and grouting operations, and shall have superintended the construction of at least five prestressed concrete tendon tanks in the last five

years. The superintendent shall be a holder of a current Certified Grouting Technician certificate from the American Segmental Bridge Institute.

The post-tensioning contractor shall have in its full-time employ a professional engineer designee with a minimum of 10 years experience in the construction of internal tendon prestressed concrete tanks available to assist in technical issues as required for the success of the project.

Calculations: Prepare by registered civil or structural engineer registered in state where Project is located.

Post-tensioned dome tension ring:

Construct at spring line of dome, circular, post-tensioned tension ring.

Sum of prestress forces in tendons at any point around dome tension ring, after losses, shall be 114,000 pounds.

Grout tendons within 48 hours of stressing. Ensure complete bond and protection of prestressing steel inside ducts and anchors.

Ensure tendons occupy position indicated on the Drawings.

Provide no less than 3 inches of concrete cover over ducts.

As a minimum, provide 2 tendons at any point around the digester dome tension ring.

Place no less than 2 and not more than 4 prestressing strands in any 1 duct.

Ensure tendons transition smoothly from their typical location in tension ring to anchorage hardware without sharp bends that will produce large tension forces in tension ring concrete or large friction losses in tendons.

As minimum, reinforce faces of buildouts anchorages with number 5 reinforcing bars at 12 inches on center.

A minimum of 50 percent of the tendons shall be continuous past an area containing anchorages for tendons.

Provide post-tensioned system and stresses complying with requirements of ACI 350R.

SUBMITTALS

Product data: Submit data completely describing products:

Shop drawings and calculations:

Submit shop drawings showing entire prestressing operation.

Include tendon placement, strand size, anchorage details reinforcing detail at the buildout.

Submit detailed calculations as specified in this Section.

The calculations shall include prestressing, elongation, bursting reinforcing at anchorage hardware, additional reinforcing for buildout, and the tendons overlap length with sufficient distance to transfer the full stress in the strands the point of overlap by grouted bond length.

Demolition Procedures:

Demolition and removal procedures of existing post-tensioning system

Test reports:

Certified copies of mill tests for prestressing strand made in accordance with applicable ASTM standards, or reports from a recognized commercial laboratory including coil numbers, breaking load, elongation, ultimate strength and elongation after galvanizing, and the properties of each coil of strand.

Prior to post-tensioning the digester dome tension ring, submit the calibration report on ram and hydraulic pressure gauges.

A ram calibration curve shall include the ram and gauge identification numbers and gauge pressure versus load.

The calibration report shall be performed within 30 days before post-tensioning the digester dome ring.

The post-tensioned concrete digester dome tension ring shall be designed by a professional engineer licensed in the state where the project is located.

Qualifications:

Post-tension contractor plant PTI certification.

Post-tension contractor project history.

Post-tension contractor superintendant certification.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping: Package prestressing strand in containers or shipping forms for protection against physical damage and corrosion during shipping and storage:

Place a corrosion inhibitor which prevents rust or other results of corrosion in the package or form, or incorporate a corrosion inhibitor carrier type packaging material:

The corrosion inhibitor shall have no deleterious effect on the steel, concrete, or bond strength of steel to concrete.

Immediately replace or restore to original condition packaging or forms damaged from any cause.

Clearly mark the shipping package or form with a statement that the package contains high-strength prestressing strand, the type of corrosion inhibitor used, and including the date packaged.

Handling: All systems for handling prestressing tendons shall have padded contact areas.

Storage and protection: Comply with all construction requirements of ACI 301 for storing and handling prestressing tendons:

Protect prestressing strand against physical damage and rust or other results or corrosion at all times from manufacture to grouting.

Prestressing strand that has sustained physical damage at any time shall be rejected:

The development of visible rust or other results of corrosion shall be cause for rejection.

Damaged materials:

Promptly replace damaged and rejected materials with undamaged materials.

The ENGINEER’s determination of materials rejection shall be final.

PRODUCTS

MATERIALS

Prestressing strands:

1/2-inch seven-wire strand, having a guaranteed minimum ultimate tensile strength of 270,000 psi, per ASTM Designation A 416, low relaxation.

Anchorages:

Anchorages shall be capable of developing at least 95 percent of minimum specified ultimate strength of prestressing steel, tested in unbonded state without exceeding anticipated set.

Provide mechanical means as part of stressing equipment for positive initial seating of wedges before force in strand is released to anchor wedges by stressing ram.

Do not use floating anchorage systems, and other anchorage systems that require wedges or other similar devices to carry load after the tendons are grouted.

Ducts for bonded tendons:

Material: Polyethylene, strong enough to retain its shape and resist damage during construction.

Other characteristics:

Completely encapsulate the post-tensioning steel and include mechanical type couplers

Capable of preventing entrance of cement paste from concrete.

Ducts constructed of material that when left in place does not cause harmful electrolytic action nor deteriorate.

Ducts capable of transmitting forces from strand through grout and the duct to surrounding concrete.

Ducts shall be continuous with no joints.

Grout materials:

Prepackaged, cement-based, pumpable, nonbleeding, high-strength, non-metallic grout formulated for duct grouting.

Meets Class C requirements per PTI specifications and ASTM C 1107.

Compressive Strength per ASTM C 942 at 28-days: 8,000 psi min

Percent Volume Change per ASTM C 1090 at 28-days: <0.2 percent

Chloride Permeability per ASTM C 1202 modified: <2,500 coulombs

Prehardened Expansion Height per ASTM C 940 at 3 hours: < 0.2 percent

Wick Induced Bleeding per ASTM C 940 at 3 hours: 0.0 percent

Flow after mixing and after 30 minutes per ASTM C 939: < 30 seconds

Manufacturers:

Masterflow 1205 by BASF.

NA-50 by US Spec.

Grout injection pipes:

Shut-off valves: Positive mechanical type.

Vent pipes:

Shut-off valves: Positive mechanical type.

MIXES

Grout:

Provide grout consisting of mixture of portland cement, water, and an admixture acceptable to ENGINEER.

Base proportions of materials on tests made on grout before grouting has begun.

Provide minimum water content necessary for proper placement, and do not exceed water-cement ratio of 0.45.

Prior to being introduced into grout pump, pass through screen with 0.07 inch maximum clear openings.

FABRICATION

Finishing:

Finishing of anchorage system: Hot-dip galvanized, except seating wedges.

EXECUTION

PREPARATION

Preparation:

Marking strands:

Mark strands in manner acceptable to the ENGINEER and by method that allows measurement of strand elongation, wedge seating, and movement of the strand in the wedges to accuracy of 1/8 inch or better.

Mark dead end of tendons so wedge seating and any movement of strand in wedges can be measured.

Color coding tendons: Color code both ends of each tendon to aid in differentiating between different tendons at anchorages.

INSTALLATION

Grout injection and vent pipes:

Fit with shut off valves and do not remove valves within first 24 hours after grout has been placed.

Bleed air and water from ducts until uniform flow of grout comes out of valves before grout is shut in under pressure by closing valves.

Metal anchorage hardware:

Protect with cover of concrete having minimum depth of 2 inches.

Tie concrete cover over anchorage hardware back to buildout anchorage concrete with minimum of number 5 reinforcing bars at 12 inches on center.

Develop bars into concrete cover with hooks.

As minimum, reinforce faces of concrete cover with number 5 reinforcing bars at 12 inches on center each way.

To facilitate construction and stressing, reinforcing bars for concrete cover over anchorage hardware may be field bent.

Stressing:

To prevent over stressing some strands and under stressing other strands in tendon, enough tension shall be placed on each strand in tendon to remove slack and equalize tension in strands:

In order to equalize tension in strands of tendon, use monostrand ram to stress each strand to 10 percent of full design tension to remove slack and equalize load on strands in a tendon.

Ensure stress in each strand is equal before full design tension is applied to tendon.

Apply tension of 20 percent of full design tension to strands in tendon.

Elongation of tendons:

Measure strand length prior to elongation.

Base calculated elongation of tendon on difference between tension of 20 percent of full design tension and full design tension.

Measure elongation as change in length of tendon after load has been transferred to wedges for 20 percent of full design tension and for 100 percent of design tension:

At end of each tendon where jack is located, measure movement of strand between 100 percent of design tension and after transfer of force in strand to wedges.

At dead end of each tendon, measure movement of strand in wedges between wedges seated for 20 percent of full design tension and after transfer of 100 percent of design tension to wedges.

Do not stress tendons until concrete has developed specified strength as determined by taking average of 3 test cylinders.

Stress tendons uniformly around dome.

Stress a set of tendons in all segments, before stressing additional sets of tendons in stressing segment.

Leave all forms supporting dome in place until prestressing of dome tension ring is completed and strands have been grouted.

Do not cut off strands with cutting torch or other method that will damage strands, galvanizing on strands, or anchorages.

Tolerances:

Determine prestressing force by both of the following methods:

Measurement of tendon elongation: Determine required elongation from average load-elongation curves for the prestressing tendons used.

Observation of jacking force on a calibrated gauge or load cell or by use of a calibrated dynamometer.

Ascertain and correct cause of any difference in force determination that exceeds 7 percent.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_60_00

GROUTING

GENERAL

SUMMARY

Section includes:

Cement grout.
Cement mortar.
Dry-pack mortar.
Epoxy grout.
Grout.
Non-shrink epoxy grout.
Non-shrink grout.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):

C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or [50-millimeter] cube specimens).
C 230 - Standard Specification for Flow Table for Use In Tests of Hydraulic Cement.
C 531 - Standard Test Method for Liner Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
C 579 - Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes.
C 939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
C 942 - Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
C 1181 - Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

SUBMITTALS

Cement grout:

Mix design.
Material submittals.

Cement mortar:
Mix design.
Material submittals.

Non-shrink grout: Submit manufacturer's literature.

Non-shrink epoxy grout: Submit manufacturer's literature.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to the jobsite in their original, unopened packages or containers, clearly labeled with the manufacturer's product identification and printed instructions.

Store materials in a cool dry place and in accordance with the manufacturer's recommendations.

Handle materials in accordance with the manufacturer's instructions.

PRODUCTS

MATERIALS

Non-shrink epoxy grout:
Manufacturers: One of the following or equal:
Five Star Products, Inc., Fairfield, CT, Five Star Epoxy Grout.
BASF Construction Chemicals, Shakopee, MN, Masterflow 648 CP Plus.
L&M Construction Chemicals, Inc., EPOGROUT.
Non-shrink epoxy grout shall be a 100 percent solid, premeasured, prepackaged system containing a 2-component thermosetting epoxy resin and inert aggregate.
Maintain a flowable consistency for at least 45 minutes at 70 degrees Fahrenheit.
Shrinkage or expansion (less than 0.0006 inches/inch) when tested in accordance with ASTM C 531.
Minimum compressive strength: 10,000 pounds per square inch at 24 hours and 14,000 pounds per square inch at 7 days when tested in accordance with ASTM C 579, Method B.
Compressive creep: Not exceed 0.0027 inches/inch when tested under a 400 pounds per square inch constant load at 140 degrees Fahrenheit in accordance with ASTM C 1181.
Coefficient of thermal expansion: Not exceed 0.000018 inches per inch per degree Fahrenheit when tested in accordance with ASTM C 531, Method B.

Non-shrink grout:
Manufacturers: One of the following or equal:
Five Star Products, Inc., Fairfield, CT, Five Star Grout.
BASF Construction Chemicals, Shakopee, MN, Masterflow 928.
L&M Construction Chemicals, Inc., Omaha, NE, CRYSTEX.
In accordance with ASTM C 1107.

Preportioned and prepackaged cement-based mixture:

It shall contain no metallic particles such as aluminum powder and no metallic aggregate such as iron filings.

It shall require only the addition of potable water.

Water for pre-soaking, mixing, and curing: Potable water.

Free from the emergence of mixing water from within or the presence of water on its surface.

Remain at a minimum flowable consistency for at least 45 minutes after mixing at 45 degrees Fahrenheit to 90 degrees Fahrenheit when tested in accordance with ASTM C 230.

If at a fluid consistency, it shall be verified in accordance with ASTM C 939.

Dimensional stability (height change):

In accordance with ASTM C 1107, volume-adjusting Grade B or C at 45 degrees Fahrenheit to 90 degrees Fahrenheit.

Have 90 percent or greater bearing area under bases.

Have minimum compressive strengths at 45 degrees Fahrenheit to 90 degrees Fahrenheit in accordance with ASTM C 1107 for various periods from the time of placement, including 5,000 pounds per square inch at 28 days when tested in accordance with ASTM C 109 as modified by ASTM C 1107.

MIXES

Cement grout:

Consist of concrete mix with coarse aggregate removed and water quantity adjusted as required.

Use the same materials for cement grout that are used for concrete.

Use water-to-cementitious materials ratio that is no more than that specified for concrete being repaired.

For spreading over the surfaces of construction or cold joints. Mix with no more water used than allowed by water-to-cementitious materials ratio specified for concrete.

Cement mortar:

Consist of concrete mix with coarse aggregate removed and water quantity adjusted as required.

Use the same materials for cement mortar that are used for concrete.

Use water-to-cementitious materials ratio that is no more than that specified for concrete being repaired.

At exposed concrete surfaces not to be painted or submerged in water: Use sufficient white cement to make color of finished patch match that of surrounding concrete.

Dry-pack mortar:

Mix in proportions by weight of 1 part portland cement to 2 parts of concrete sand.

Portland cement: As specified in Section 03_30_00.

Concrete sand: As specified in Section 03_30_00.

Use only enough water so that resulting mortar will crumble to touch after being formed into ball by hand.

Epoxy grout:

Consist of mixture of epoxy or epoxy gel and concrete sand.

Epoxy: As specified in Section 03_63_01.
Epoxy gel: As specified in Section 03_63_01.
Sand: Clean, bagged, graded, and kiln dried silica sand.
Proportioning:
For horizontal work: Consist of mixture of 1 part epoxy with not more than 2 parts sand.
For vertical or overhead work: Consist of 1 part concrete epoxy gel with not more than 2 parts sand.

Grout:
Mix in proportions by weight of 1 part portland cement to 4 parts of concrete sand.
Portland cement: As specified in Section 03_30_00.
Concrete sand: As specified in Section 03_30_00.

Non-shrink epoxy grout: Mix in accordance with manufacturer's installation instructions.

Non-shrink grout: Mix in accordance with manufacturer's installation instructions such that resulting mix has flowable consistency and is suitable for placing by pouring.

EXECUTION

EXAMINATION

Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations, and all loose material or foreign matter likely to reduce the bond or performance of grout or mortar.

PREPARATION

Surface preparation:
Remove grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond from concrete and bottoms of baseplates.
Roughen concrete surfaces by heavy sandblasting, waterblasting, chipping, or other mechanical means.
Remove loose or broken concrete.
Metal surfaces: Sandblast to a 2- to 3-mil peak-to-valley profile.

PLACEMENT

General:
Use mortar mixer with moving paddles for mixing grouts. For cement grouts, pre-wet the mixer and empty out excess water before beginning mixing.

Cement grout:
Exercise particular care in placing cement grout since it is required to furnish structural strength, impermeable water seal, or both.
Do not use cement grout that has not been placed within 30 minutes after mixing.

Epoxy grouts:
Use where indicated on the Drawings.

Wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grout.

Non-shrink grout:

Add non-shrink cement grout to a premeasured amount of water that does not exceed the manufacturer's maximum recommended water content.
Mix in accordance with manufacturer's instructions to uniform consistency.
May be drypacked, flowed, or pumped into place. Do not overwork grouts.
Do not retemper grout by adding more water after stiffening.

Non-shrink epoxy grout:

Mix in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.
Pour the hardener into the resin and mix for at least 1 minute and until mixture is uniform in color. Pour the epoxy into a mortar mixer wheelbarrow and add the aggregate. Mix until aggregate is uniformly wetted. Over mixing will cause air entrapment in the mix.
Keep temperature of non-shrink epoxy grout from exceeding manufacturer's recommendations.

Curing:

Cement based grouts:

Non-shrink grout: Cure in accordance with manufacturer's recommendations. Keep grout wet for a minimum of 7 days. Use wet burlap, a soaker hose, sun shading, ponding, and in extreme conditions, a combination of methods. Maintain grout above 40 degrees Fahrenheit until it has attained a compressive strength of 3,000 pounds per square inch, or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.

Epoxy based grouts:

Cure grouts in accordance with manufacturers' recommendations.
Do not wet cure epoxy grouts.
Do not allow any surface in contact with epoxy grout to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.

Make arrangements to have a non-shrink grout manufacturer's representative present for preconstruction meeting and during initial grout placement for grouting.

Grouting equipment bases and baseplates: As specified in Section 46_05_10.

Grouting other baseplates:

General:

All baseplate grouting shall take place from one side of a baseplate to the other in a continuous flow to avoid trapping air.
Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to the maximum level and the grout worked down.

Forms and Headboxes:

Build forms for grouts of material with adequate strength to withstand the placement of grouts.

Forms shall be rigid and liquidtight. Caulk cracks and joints with an elastomeric sealant. Line forms with polyethylene for easy grout release. Forms carefully wax with 2 coats of heavy-duty paste wax will also be acceptable.

Forms shall be 4 to 6 inches higher than the baseplate on one side of the baseplate configuration when using head pressure for placement.

Non-shrink epoxy grout:

Cut back epoxy grout after setting. Install epoxy grout with chamfer edges built into the formwork.

FIELD QUALITY CONTROL

Non-shrink grout: Test for 24-hour compressive strength in accordance with ASTM C 942.

Non-shrink epoxy grout: Test for 24-hour compressive strength in accordance with ASTM C 579, Method B.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_63_01

EPOXIES

GENERAL

SUMMARY

Section includes:
- Epoxy.
- Epoxy gel.
- Epoxy bonding agent.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
- D 638 - Standard Test Method for Tensile Properties of Plastics.
- D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

SYSTEM DESCRIPTION

Performance requirements:
- Provide epoxy materials that are new and use them within shelf life limitations set forth by manufacturer.
- Perform and conduct work of this Section in neat orderly manner.

SUBMITTALS

Product Data: Submit manufacturer's data completely describing epoxy materials.

Quality control submittals:
- Manufacturer's installation instructions.

PRODUCTS

MATERIALS

Epoxy: Water-insensitive 2-part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified.

Manufacturers: One of the following or equal:
BASF, MBT, Concresive Standard LVI.
Sika Chemical Corp., Sikadur 35 Hi-Mod LV.

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch minimum at 14 days and 77 degrees Fahrenheit cure.
Flexure Strength	ASTM D 790	11,000 pounds per square inch minimum at 14 days and 77 degrees Fahrenheit cure.
Compressive Strength	ASTM D 695	16,000 pounds per square inch minimum at 24 hours and 77 degrees Fahrenheit cure.
Bond Strength	--	Concrete shall fail before failure of epoxy.
Gel Time for 5 Mil Film	--	4 hours maximum at 77 degrees Fahrenheit.
Elongation	ASTM D 638	1 percent minimum at 14 days and 77 degrees Fahrenheit.

Epoxy gel: Manufacturers: One of the following or equal:
Sika Chemical Corp., Sikadur 31, Hi-Mod Gel.

Epoxy bonding agent: Manufacturers: One of the following or equal:
BASF, MBT, Concresive Liquid LPL.
Sika Chemical Corp., Sikadur 32 Hi-Mod LPL.
If increased tack time is required for concrete placement, epoxy resin/portland cement bonding agent as specified in Section 03_63_02 may be used instead of epoxy bonding agent.

EXECUTION

INSTALLATION

Install and cure epoxy materials in accordance with manufacturer's installation instructions.

Epoxy:
Apply in accordance with manufacturer's installation instructions.

Epoxy gel:
Apply in accordance with manufacturer's installation instructions.
Use for vertical or overhead work, or where high viscosity epoxy is required.
Epoxy gel used for vertical or overhead work may be used for horizontal work.

Epoxy bonding agent:
Apply in accordance with manufacturer's installation instructions.
Bonding agent will not be required for filling form tie holes or for normal finishing and patching of similar sized small defects.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_63_02

EPOXY RESIN/PORTLAND CEMENT BONDING AGENT

GENERAL

SUMMARY

Section includes: Epoxy resin/portland cement bonding agent.

REFERENCES

ASTM International (ASTM):

C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
C 348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

Federal Highway Administration (FHWA):

FHWA-RD-86-193 - Highway Concrete Pavement Technology Development and Testing Volume V: Field Evaluation of SHRP C9206 Test Sites (Bridge Deck Overlays).

PRODUCTS

MANUFACTURERS

Sika Corporation, Lyndhurst, New Jersey, Sika Armatec 110.

Substitutions: The use of other than the specified product will be considered, providing the CONTRACTOR requests its use in writing to the ENGINEER. This request shall be accompanied by:

A certificate of compliance from an approved independent testing laboratory that the proposed substitute product meets or exceeds specified performance criteria, tested in accordance with the specified test standards.
Documented proof that the proposed substitute product has a 1-year proved record of performance of bonding portland cement mortar/concrete to hardened portland cement mortar/concrete, confirmed by actual field tests and 5 successful installations that the ENGINEER can investigate.

MATERIALS

Epoxy resin/portland cement adhesive:

Component "A" shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
Component "B" shall be primarily a water solution of a polyamine.

TECHNICAL SPECIFICATIONS

Component "C" shall be a blend of selected portland cements and sands. The material shall not contain asbestos.

PERFORMANCE CRITERIA

Properties of the mixed epoxy resin/portland cement adhesive:
- Pot life: 75 to 105 minutes.
- Contact time: 24 hours.
- Color: Dark gray.

Properties of the cured epoxy resin/portland cement adhesive:
- Compressive strength in accordance with ASTM C 109:
  - 3 day: 4,500 pounds per square-inch minimum.
  - 7 days: 6,500 pounds per square-inch minimum.
  - 28 days: 8,500 pounds per square-inch minimum.
- Splitting tensile strength in accordance with ASTM C 496:
  - 28 days: 600 pounds per square-inch minimum.
- Flexural strength:
  - 1,100 pounds per square-inch minimum in accordance with ASTM C 348.
- Bond strength in accordance with ASTM C 882 modified at 14 days:
  - 0 hours open time: 2,800 pounds per square-inch minimum.
  - 24 hours open time: 2,600pounds per square-inch minimum.
- The epoxy resin/portland cement adhesive shall not produce a vapor barrier. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the FHWA Program Report Number FHWA/RD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

EXECUTION

INSTALLATION

Mixing the epoxy resin: Shake contents of Component "A" and Component "B." Empty all of both components into a clean, dry, mixing pail. Mix thoroughly for 30 seconds with a jiffy paddle on a low-speed with 400 to 600 revolutions per minute drill. Slowly add the entire contents of Component "C" while continuing to mix for a minimum of 3 minutes and until uniform with no lumps. Mix only that quantity that can be applied within its pot life.

Placement procedure:
- Apply to prepared surface with stiff-bristle brush, broom, or "hopper type" spray equipment:
  - For hand applications: Place fresh, plastic concrete/mortar while the bonding bridge adhesive is wet or dry, up to 24 hours.
  - For machine applications: Allow the bonding bridge adhesive to dry for 12 hours minimum.

Adhere to all limitations and cautions for the epoxy resin/portland cement adhesive in the manufacturer's current printed literature.

CLEANING

Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 03_64_24

EPOXY INJECTION SYSTEM

GENERAL

SUMMARY

Section includes: Epoxy injection system.

REFERENCES

ASTM International (ASTM):
D 638 - Standard Test Method for Tensile Properties of Plastics.
D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

SUBMITTALS

Product data:
Submit manufacturer's data completely describing epoxy injection system materials.

Quality control submittals:
Certificates of Compliance.
Manufacturer's Instructions.

PRODUCTS

MATERIALS

Manufacturers: One of the following or equal:
Master Builders, Inc., Concressive Standard LVI.
Sika Chemical Corp., Sikadur 35 Hi-Mod LV.

Epoxy:
Use epoxy materials that are new and use them within shelf-life limitations set forth by manufacturer.
Water-insensitive 2-part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified:

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch at 14 days.
Flexure Strength	ASTM D 790	11,000 pounds per square inch at 14 days.
Compressive Strength	ASTM D 695	11,000 pounds per square inch at 24 hours.
Bond Strength	--	Concrete shall fail before failure of epoxy.
Gel Time for 5 Mil Film	--	4 hours maximum.

Physical Characteristic	Test Method	Required Results
Elongation	ASTM D 638	1 percent minimum at 14 days.

EQUIPMENT

Injection pump:
- Use positive displacement injection pump with interlock to provide in-line mixing and metering system for 2 component epoxy.
- Use pressure hoses and injection nozzle designed to properly mix of 2 components of epoxy.
- Standby injection unit may be required.

EXECUTION

PREPARATION

Surface preparation:
- Sweep or clean area in vicinity of cracks that will be injected with epoxy. Leave area in generally clean condition after epoxy injection is complete.
- Clean cracks so they are free from dirt, laitance, and other loose matter.

INSTALLATION

Install and cure epoxy materials in accordance with manufacturer's installation instructions.

Mix epoxy in accordance with manufacturer's installation instructions.

Do not use solvents to thin epoxy.

Crack injection:
- Apply adequate surface seal to crack to prevent leakage of epoxy.
- Establish injection points at distance along crack not less than thickness of cracked member.
- Crack injection sequence:
  - Inject epoxy into crack at first port with sufficient pressure to advance epoxy to adjacent port.
  - Seal original port and shift injection to port where epoxy appears.
  - Continue port-to-port injection until crack has been injected for its entire length.
  - For small amounts of epoxy, or where excessive pressure developed by injection pump might further damage structure, premixed epoxy and use hand caulking gun to inject epoxy if acceptable to the ENGINEER.
  - Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
  - After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 04_05_17

MORTAR AND MASONRY GROUT

GENERAL

SUMMARY

Section includes: Mortar and grout for masonry construction.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):

C 144 - Standard Specification for Aggregate for Masonry Mortar.
C 150 - Standard Specification for Portland Cement.
C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
C 270 - Standard Specification for Mortar for Unit Masonry.
C 404 - Standard Specification for Aggregates for Masonry Grout.
C 476 - Standard Specification for Grout for Masonry.
C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
C 1019 - Standard Test Method for Sampling and Testing Grout.

DEFINITIONS

Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.

PERFORMANCE REQUIREMENTS

Compressive strength:

Mortar: Minimum 1,800 pounds per square inchat 28 days.
Grout: Minimum 2,000 pounds per square inchat 28 days.

Mortar color:

To match existing digester facade

SUBMITTALS

Product data.

Shop drawings.

Design Mixes for mortar and grout.

Test reports:
- Mortar Strength Test Results.
- Grout Strength Test Results.

QUALITY ASSURANCE

Materials for mortar and grout: Do not change source of materials which will affect the appearance of finished work after the work has started unless acceptable to ENGINEER.

PROJECT CONDITIONS

Environmental requirements:
- Cold weather requirements:
  - Cold Weather Construction: In accordance with the building code.
  - Provide adequate equipment for heating mortar and grout materials when air temperature is below 40 degrees Fahrenheit.
  - Temperatures of separate materials, including water, shall not exceed 140 degrees Fahrenheit when placed in mixer.
  - Maintain mortar temperature on boards above freezing.
- Hot weather requirements:
  - Wet mortar board before loading and cover mortar to retard drying when not being used.

PRODUCTS

MATERIALS

Portland cement:
- Type II, low alkali, containing maximum 0.6 percent total alkal in accordance with ASTM C 150.

Hydrated lime:
- Type S in accordance with ASTM C 207.

Aggregate for mortar:
- Fine aggregate: Sand in accordance with ASTM C 144.

Aggregate for grout:
- Fine aggregate: Size Number 2 in accordance with ASTM C 404.
- Coarse aggregate: Size Number 8 in accordance with ASTM C 404.

Admixtures:
- Mortar color admixture (if required to match existing façade):
  - Containing maximum 15 percent lime proof, inorganic compounds, unless recommended otherwise by manufacturer.
  - Maximum 3 percent carbon black by weight of cement.
  - Factory blend for full color saturation of mortar joint.
  - Packaging for unitized jobsite mixing at ratio of 1 unit of color per sack of portland cement.

Grout admixture:

Manufacturers: One of the following or equal:

a) Sika Corp., Sika Grout Aid, Type II.
b) Concrete Emulsions, Grout Aid GA-II.

Mortar water repellent admixture:

Manufacturers: One of the following or equal:

a) Sika Corp., Sikaproof 85.
b) W.R. Grace, Dry Block Mortar.
c) BASF, Rheopel Plus Mortar Admixture.

Other admixtures:

Prohibited, unless accepted by the ENGINEER.

Water: Clean, clear, potable, free of oil, soluble salts, chemicals, and other deleterious substances.

Other materials:

Prohibited, unless acceptable to ENGINEER.

MIXES

Mortar mix:

Portland cement-lime mortar.

Mortar mix proportions by volume: As indicated in the following table:

MORTAR TYPE	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION
S	1	Greater than 1/4 to 1/2	Not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials

Mortar mixing:

Mix on jobsite in accordance with ASTM C 270.

Mix in mechanical mixer and only in quantities needed for immediate use.

Mix for minimum 3 minutes, and maximum of 5 minutes after materials have been added to mixer.

Measurement by volume: Measurement of constituents shall be accomplished by the use of a container of known capacity.

Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units.

Use no mortar which has been standing for more than 1 hour after being mixed.

Whenever 90 minutes has elapsed since last batch was mixed, completely empty mixer drum of materials and wash down before placing next batch of materials.

Grout mix:

Grout mix proportions by volume: As indicated in the following table:

TYPE OF GROUT	PARTS BY VOLUME OF PORTLAND CEMENT	PARTS BY VOLUME OF HYDRATED LIME	AGGREGATE MEASURED IN A DAMP LOOSE CONDITION	
			Fine Aggregate	Coarse Aggregate
Coarse grout	1	0-1/10	2-1/4 to 3 times the sum of the volumes of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

Grout mixing:

Mix on jobsite or in a transit mix in accordance with ASTM C 476
Slump: 8 to 11 inches, unless otherwise accepted by the ENGINEER.
Use within 90 minutes after addition of mixing water.
Mix for minimum of 5 minutes after ingredients are added and until uniform mix is attained. Grout shall have sufficient water added to produce pouring consistency without segregation.

EXECUTION

FIELD QUALITY CONTROL

Testing of grout and mortar:

During progress of construction, the OWNER will have tests made to determine whether the grout and mortar, as being produced, complies with Specifications.
Compressive strength test for grout: In accordance with ASTM C 1019.
Do not use grout and mortar that does not meet specification.
Remove such mortar and grout from Project site.

ADJUSTING

Repair of defective masonry:
Remove and replace or repair defective work.
Do not patch, repair, or cover defective work without inspection by the ENGINEER.
Provide repairs having strength equal to or greater than specified strength for areas involved.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 04_05_23

MASONRY ACCESSORIES

GENERAL

SUMMARY

Section includes:
- Control joint filler.
- Dovetail anchors.
- Water repellent.
- Wire joint reinforcement, single Wythe type.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
- A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- A 167 - Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plant, Sheet, and Strip.
- A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- A 951 - Standard Specification for Masonry Joint Reinforcement.
- D 2000 - Standard Classification System for Rubber Products in Automotive Applications.
- D 2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

SUBMITTALS

Shop drawings.

Product data.

PRODUCTS

MANUFACTURED UNITS

Control joint filler: The key shall be of the width and shape as indicated on the Drawings. In accordance with ASTM D 2000 or ASTM D 2287.

Manufacturers: One of the following or equal:

AA Wire Products, Inc., AA2000 Blok-Tite.
Dur-O-Wall, Rapid Poly-Joint.
Vert-A-Joint Co., Vert-A-Joint.

Dovetail anchor system: System consisting of dovetail slots cast into the concrete (existing), dovetail anchors that tie the masonry veneer to dovetail slots, and continuous wires that are embedded in the masonry and connect to the dovetail anchors. See Section 03_11_07 for additional requirements at new construction.

General: Contractor shall verify the type of dovetail slot and joint reinforcing currently in-place and shall use a compatible anchor and matching joint reinforcing. The anchor listed below shall be assumed and used if compatible with existing dovetail slot.

Type: 23 gauge, 1 inch wide, Type 304 stainless steel in accordance with ASTM A 167, and with seismic notch for attachment to wire embedded in masonry. Manufacturers: One of the following or equal:

Hohmann and Barnard, Inc., Hauppauge, NY, Model No. 303SV.
Heckmann Building Products, Inc., Chicago, IL, Model No. 361.

Water repellent: Water based, methacrylate polymer with aqueous polysiloxane. Repellent shall be clear when dry.

Wire joint reinforcement:

General: Contractor shall verify the type of wire joint reinforcing currently in-place and shall use matching joint reinforcing. The joint reinforcing listed below shall be assumed and used if compatible.

Type: Single Wythe type: In accordance with ASTM A 951 with ASTM A 82, 9-gauge wire side rails and 9-gauge cross ties, sized to suit application, and galvanized in accordance with ASTM A 153, Class B (minimum 1.5 ounces zinc per square foot.

Manufacturers: One of the following or equal:

AA Wire Products, Co., AA500 Blok-Lok.
Dur-O-Wal, Inc., Ladur-type.
Wire-Bond, Ladder Type, Series 200.

EXECUTION

INSTALLATION

Install products as specified in Section 04_22_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 04_22_00

CONCRETE UNIT MASONRY

GENERAL

SUMMARY

Section includes: Concrete masonry units and accessories.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
C 90 - Standard Specification for Loadbearing Concrete Masonry Units.
C 140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
C 426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.

SUBMITTALS

Product data: Submit manufacturer's product data for block.

Shop drawings: Include elevations of each wall indicating type and layout of units, including type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints.

Samples: Include samples of stretcher units in sufficient quantity to illustrate color range.

Test reports:
Compressive strength.
Linear shrinkage.
Moisture content as a percentage of total absorption.
Total absorption.
Unit weight.

QUALITY ASSURANCE

Mock-up:
Prior to starting construction of masonry, construct minimum 4-foot square mock-up.

Use accepted materials containing each different kind and color of concrete masonry units to illustrate wall design.
When not accepted, construct another mock-up.
When accepted, mock-up will be standard of comparison for remainder of masonry work.
Upon completion of Project, dispose of mock-ups in legal manner at offsite location.

Pre-installation conference: Conduct as specified in Special Conditions 5.

DELIVERY, STORAGE, AND HANDLING

Transport and handle concrete masonry units as required to prevent discoloration, chipping, and breakage.

Store masonry units off the ground in a dry location, covered and protected from absorbing moisture. Locate storage piles, stacks, and bins to protect materials from heavy traffic.

Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

ENVIRONMENTAL REQUIREMENTS

Cold weather requirements:
In accordance with building code, provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.

Hot weather requirements:
In accordance with building code, when ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
Wet mortarboard before loading and cover mortar to retard drying when not being used.
Do not spread mortar beds more than 48 inches ahead of placing masonry units.
Place masonry units within one minute of spreading mortar.

SEQUENCING AND SCHEDULING

Order concrete masonry units well before start of installation to ensure adequate time for manufacturing and minimum 28 days for curing and drying before start of installation. Protect from weather after curing period to avoid moisture increase.

PRODUCTS

MANUFACTURED UNITS

Hollow load bearing concrete masonry units:
Class: Class 3 in accordance with ASTM C 90, Standard Level of Quality with minimum compressive strength of 1,900 pounds per square inch.
Surface texture: Match existing.
Color: Integral, Match existing.

Typical size: 6 inches wide by 8 inches high by 16 inches long, unless otherwise indicated on the Drawings, or other sizes as needed to minimize cutting.
Special sizes and shapes: As required for window and door openings, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.

Wire joint reinforcement: As specified in Section 04_05_23.

EXECUTION

PREPARATION

Protection:
Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of concrete masonry units.

Surface preparation:
Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other matter that will reduce bond.

INSTALLATION

Forms and shores:
Where required, construct forms to the shapes indicated on the Drawings:
Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
Wait at least 24 hours after grouting masonry columns or walls before applying uniform loads.
Wait at least 72 hours before applying concentrated loads.

Concrete masonry units:
Provide Standard Level of Quality.
Lay concrete masonry units dry.
Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units.
Lay units to preserve unobstructed vertical continuity of cells to be filled with grout or insulation.
Align vertical cells to be filled with grout to maintain clear, unobstructed continuous vertical cell measuring not less than 2 by 3 inches.
Ensure full mortar coverage of joints on webs of cells that will be grouted solid, and face shells.
Butter vertical head joints for thickness equal to face shell thickness of units, and shove joints tightly together so that mortar bonds to both masonry units.
Solidly fill joints from face of units to inside face of cells.
Lay units to desired height with joints of uniform thickness.
Bond shall be plumb throughout.

Lay units to avoid formation of cracks when units are placed. Keep cells of units as free of mortar as possible as masonry wall height increases.
When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
Remove mortar, mortar droppings, debris, and other obstructions and materials from inside of cell walls
Seal cleanouts after inspection and before grouting.

Bond pattern:
Lay concrete masonry units in bond pattern that matches existing, unless otherwise indicated on the Drawings.

Mortar joints:
Make joints straight, clean, smooth, and uniform in thickness.
Tool exposed joints, slightly concave. Strike concealed joints flush.
Make vertical and horizontal joints 3/8 inch thick.
Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

Wire joint reinforcement:
Lap splice longitudinal wire joint reinforcement minimum 75 wire diameters.
Place longitudinal wires in approximate centers of mortar beds with minimum 5/8-inch mortar cover on exposed faces.
Provide intersecting masonry walls with prefabricated wire joint reinforcement tees.
Rake intersecting joints 1/2 inch and caulk joints.

Grouting and reinforcement:
Where horizontal and vertical bars are spliced and adjacent lap splices are separated by more than 3 inches, the lap splice length shall be 72 bar diameters.
Where adjacent lap splices are separated by 3 inches or less, the lap splice length shall be increased by 1.3 times or the lap splices shall be staggered at least 24 bar diameters with no increase in length.
Hold vertical reinforcing bars in position at top and bottom and at intervals not exceeding 200 bar diameters. Use steel wire bar positioners to position bars. Tie reinforcing bars to dowels with wire ties.
Obtain acceptance of reinforcement placement before grouting.
Fill all spaces and cells solidly with grout.
Low-lift grouting:
Hollow unit masonry to be grouted by the low lift method shall be constructed and grouted in lifts not exceeding 5 feet.
Slushing with mortar will not be permitted.
Grout in cells shall have full contact with surface of concrete footings.
When grouting stops for 1 hour or longer, form horizontal construction joints by stopping grout placement 1-1/2 inches below top of uppermost unit containing grout.
After placement, consolidate grout using mechanical immersion vibrators designed for consolidating grout.
Placement:
Use a hand bucket, concrete hopper, or grout pump.
Place grout in final position within 1-1/2 hours after mixing. Place grout so as to completely fill the grout spaces without segregation of the aggregates.

Do not insert vibrators into lower grout placements that are in a semi-solidified state.

Cutting concrete masonry units:

When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances. Cut and fit units with power-driven carborundum or diamond disc blade saw.

Control joints:

Provide in masonry walls to match existing locations.
Make full height and continuous in appearance.
Run bond beams and bond beam reinforcing bars continuously through control joints.
Insert control joint filler in joints as wall is constructed.
Apply sealant as specified in Section 07_90_00.

Anchor bolts:

Hold anchor bolts in place with template during grouting to assure precise alignment.
Do not cut or ream members being anchored or use other means to accommodate misaligned anchor bolts in roof deck support angles.

Enclosures:

Where concrete masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
Do not cover enclosures until inspected and when appropriate, tested.

Other embedded items:

Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

Patching:

Patch exposed concrete masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

Water curing:

Protect concrete masonry units from drying too rapidly by frequently fogging or sprinkling so walls will always be visibly damp for minimum 3 days.

Miscellaneous:

Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

Water repellent:

Apply water repellent as specified in Section 07_19_00.

Grouting equipment:

Grout pumps:

Do not pump grout through aluminum tubes.

Operate pumps to produce a continuous stream of grout without air pockets.

Upon completion of each days pumping, eject grout from pipeline without contamination or segregation of the grout:

Remove waste materials and debris from the equipment.

Dispose of waste materials, debris, and all flushing water outside the masonry.

Vibrators:

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout.

Maintain at least 1 spare vibrator, at the site at all times.

Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine.

Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

CONSTRUCTION

Site tolerances: Lay masonry plumb, true to line, and with courses level. Keep bond pattern plumb throughout. Lay masonry within the following tolerances:

Maximum variation from the plumb in the lines and surfaces of columns, walls, and in the flutes and surfaces of fluted or split faced blocks:

In adjacent masonry units: 1/8 inch.

In 10 feet: 1/4 inch.

In any story or 20 feet maximum: 3/8 inch.

In 40 feet or more: 1/2 inch.

Maximum variations from the plumb for external corners, expansion joints, and other conspicuous lines:

In any story or 20 feet maximum: 1/4 inch.

In 40 feet or more: 1/2 inch.

Maximum variations from the level or grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or 20 feet maximum: 1/4 inch.

In 40 feet or more: 1/2 inch.

Maximum variations of the linear building lines from established position in plan and related portion of columns, walls, and partitions:

In any bay or 20 feet maximum: 1/2 inch.

In 40 feet or more: 3/4 inch.

Maximum variation in cross sectional dimensions of columns and in thickness of walls:

Minus: 1/4 inch.

Plus: 1/2 inch.

FIELD QUALITY CONTROL

Site tests:

OWNER will have tests performed by an independent laboratory.

Have minimum 3 concrete masonry units of each type proposed for Project tested in accordance with ASTM C 90, C 140, and C 426 to verify conformance to Specifications.

Tests shall include compressive strength, linear shrinkage, moisture content as percent of total absorption, total absorption, and unit weight.

Special inspection:

Special inspection shall be as specified in Special Conditions 9.

CLEANING

Exercise extreme care to prevent mortar splotches.

Do not attach construction supports to concrete masonry walls.

Wash off concrete scum and grout spills before scum and grout set.

Remove grout stains from walls.

Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.

Remove efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer:

Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.

Do not use muriatic acid as cleaning solution.

Do not use high pressure cleaning equipment.

PROTECTION

Provide temporary protection for exposed masonry corners subject to damage.

Bracing:

Unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse, adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse.

Keep bracing in place until permanent supporting elements of structure are in place.

Limited access zone:

Establish limited access zone prior to start of masonry wall construction.

Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.

Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.

Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

END OF SECTION

TECHNICAL SPECIFICATIONS

33SECTION 04_22_16

ANCHORED CMU VENEER

GENERAL

SUMMARY

Section includes: Anchored CMU veneer.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

SUBMITTALS

Product data.

Shop drawings: Include elevations of each wall indicating type and layout of units.

Samples: Include samples of masonry units in sufficient quantity to illustrate color range.

ICC Evaluation Report for wall ties and anchoring system.

Test reports:
Test reports for each type of CMU.
Testing and reports are to be completed by and independent laboratory.
Test reports shall include:
Compressive strength.

Letter of certification.

QUALITY ASSURANCE

Mock-up panel:
Prior to starting construction of masonry, construct minimum 4-foot square mock-up panel.
Use accepted materials containing each different kind and color of masonry units to illustrate wall design.
When not accepted, construct another mock-up panel.
When accepted, mock-up will be standard of comparison for remainder of masonry work.
Do not destroy or move mock-up panel until work is completed and accepted by the OWNER.
Upon completion of Project, dispose of mock-ups in legal manner at offsite location.

Pre-installation meeting: Conduct as specified in Special Conditions 5.

A letter of certification from the supplier of the materials attesting to compliance with the applicable specifications for grades, types, or classes included in these specifications, shall be provided at the time of, or prior to, delivery of the materials to the jobsite.

DELIVERY, STORAGE, AND HANDLING

Transport and handle masonry units as required to prevent discoloration, chipping, and breakage.

Locate storage piles, stacks, and bins to protect materials from heavy traffic.

Store masonry units off ground to prevent contamination by mud, dust, or materials likely to cause staining or other defects.

Cover materials when necessary to protect from the elements.

Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

PROJECT CONDITIONS

Cold weather requirements:
In accordance with building code.
Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.

Hot weather requirements:
When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
Wet mortarboard before loading and cover mortar to retard drying when not being used.
Do not spread mortar beds more than 48 inches ahead of placing masonry units.
Place masonry units within 1 minute of spreading mortar.

SEQUENCING AND SCHEDULING

Order masonry units well before start of installation (8 weeks minimum) to assure adequate time for manufacturing.

PRODUCTS

MANUFACTURED UNITS

CMU masonry veneer units:
CMU masonry veneer units as specified in Section 04_22_00.
Surface texture: As specified in Section 04_22_00.
Size: As specified in Section 04_22_00.
Special sizes and shapes: As required for window and door soldier coursing and custom sills where indicated on the Drawings, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.

Do not exceed variations in color and texture of samples accepted by the ENGINEER.

Mortar and grout: As specified in Section 04_05_17.

Dovetail anchors: As specified in Section 04_05_23.

Channel slot anchor system: As specified in Section 03_11_07.

EXECUTION

PREPARATION

Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of masonry units.

Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

INSTALLATION

CMU masonry veneer units:

Use dry masonry units.

Do not use wet or frozen masonry units.

Lay units in uniform and true courses, level, plumb, and without projections or offset from adjacent units.

Lay units to desired height with joints of uniform thickness.

For CMU veneer over concrete wall surfaces, install dovetail anchors and reinforcing wires as specified in Section 03_11_07.

For CMU veneer over masonry wall surfaces, install channel slot anchor system and reinforcing wires.

Spot bedding with cement mortar at all anchor locations.

Bond shall be plumb throughout.

Lay units to avoid formation of cracks when units are placed.

Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the following tolerances:

Maximum variation from the plumb in the lines and surfaces of columns, walls, and in the flutes and surfaces of fluted or split faced blocks:

In adjacent masonry units: 1/8 inch.

In 10 feet: 1/4 inch.

In any story or 20 feet maximum: 3/8 inch.

In 40 feet or more: 1/2 inch.

Maximum variations from the plumb for external corners, expansion joints, and other conspicuous lines:

In any story or 20 feet maximum: 1/4 inch.

In 40 feet or more: 1/2 inch.

Maximum variations from the level or grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or 20 feet maximum: 1/4 inch.

In 40 feet or more: 1/2 inch.

Maximum variations of the linear building lines from established position in plan and related portion of columns, walls, and partitions:

In any bay or 20 feet maximum: 1/2 inch.

In 40 feet or more: 3/4 inch.

Maximum variation in cross sectional dimensions of columns and in thickness of walls:

Minus: 1/4 inch.

Plus: 1/2 inch.

When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.

Prevent mortar from staining the face of masonry to be left exposed or painted:

Immediately remove mortar in contact with face of such masonry.

Protect all sills, ledges, and projections from droppings of mortar.

Protect doorjambs and corners from damage during construction.

Protect masonry not being worked on from rain by completely covering with a weather resistive membrane.

Mortar joints:

Make joints straight, clean, smooth, and uniform in thickness.

Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush.

Joint thickness: Make vertical and horizontal joints 3/8-inch thick.

Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

Bond pattern:

Lay masonry units in pattern that matches existing wall.

Cutting masonry units:

When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.

Cut and fit units with power-driven carborundum or diamond disc blade saw.

Control joints:

Control joint spacing:

Provide control joints in masonry walls at locations that match existing.

Make full height and continuous in appearance.

Insert control joint filler in joints as wall is constructed.

Apply sealant as specified in Section 07_90_00.

Enclosures:

Where masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.

Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.

Do not cover enclosures until inspected and when appropriate, tested.

Other embedded items:

Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

Patching:

Patch exposed masonry units in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

Water curing:

Protect masonry units from drying too rapidly by frequently fogging or sprinkling for minimum of 3 days.

Miscellaneous:

Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

Water repellent:

Apply water repellent as specified in Section 07_19_00.

Cleaning:

Exercise extreme care to prevent mortar splotches.
Do not attach construction supports to masonry walls.
Wash off brick scum and grout spills before scum and grout set.
Remove grout stains from walls.
Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
Correct efflorescence on exposed surfaces with commercially-prepared cleaning solution acceptable to masonry unit manufacturer:

Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
Do not use muriatic acid as cleaning solution.
Do not use sandblast cleaning equipment.

Forms and shores:

Where required, construct forms to the shapes indicated on the Drawings:

Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected:

Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
Wait at least 72 hours before applying concentrated loads.

PROTECTION

Provide temporary protection for exposed masonry corners subject to damage.

Bracing:

Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
Keep bracing in place until permanent supporting elements of structure are in place.

Limited access zone:

Establish limited access zone prior to start of masonry wall construction.
Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.
Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

FIELD QUALITY CONTROL

Site tests:

Efflorescence tests:

Perform efflorescence tests on mortar that will be exposed to weathering.
Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 05_12_00

STRUCTURAL STEEL

GENERAL

SUMMARY

Section includes:
- Structural steel shapes and plate.
- Fasteners:
  - All thread rods.
  - Anchor bolts.
  - Assembly bolts.
  - Concrete anchors.
  - Flush shells.
  - High strength bolts.
  - Welded studs.
  - Isolation sleeves and washers.
  - Thread coating.
  - Welding.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Institute of Steel Construction (AISC):
- Specification for Structural Steel Buildings.

American National Standards Institute (ANSI):
- B212-15 - Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.

American Welding Society (AWS):
- A5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
- A5.17 - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
- A5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
- D1.1 - Structural Welding Code - Steel.
- D1.6 - Structural Welding Code - Stainless Steel.

ASTM International (ASTM):
- A 6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
- A 29 - Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for.

A 36 - Standard Specification for Carbon Structural Steel.
A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
A 108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
A 193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
A 276 - Standard Specification for Stainless Steel Bars and Shapes.
A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
A 496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
A 992 - Standard Specification for Structural Steel Shapes.
F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
F 959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.

International Code Council Evaluation Service, Inc. (ICC-ES):
AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements.
AC58 - Acceptance Criteria for Adhesive Anchors in Masonry Elements.
AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.
AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

DEFINITIONS

Anchor bolt:
Straight steel rod or bar embedded in concrete and having 1 headed end and 1 threaded end.
Installed with headed end cast into concrete with embedment as indicated on the Drawings or specified, leaving threaded end projecting clear of concrete face as required for connection to be made.

Anchor rod:
Straight steel rod or bar embedded in concrete and having threads on each end. Threaded end to be embedded in concrete fitted with nuts or plates as indicated on the Drawings or specified, and cast into concrete with embedment as

indicated on the Drawings or specified, leaving threaded end projection clear of the concrete as required for connection to be made.

SUBMITTALS

Product data:

Post-installed anchors for use in concrete and masonry.

Manufacturer's data including catalog cuts showing materials of construction, finishes, and details of installation for each anchor type.

Quality control submittals:

Submit shop drawings of members to be fabricated before starting their fabrication.

Welder's certificates.

Test reports:

Certified copies of mill tests and analyses made in accordance with applicable ASTM standards, or reports from a recognized commercial laboratory, including chemical and tensile properties of each shipment of structural steel or part thereof having common properties.

Current ICC-ES Report for each type of post-installed anchors to be used.

QUALITY ASSURANCE

Qualifications:

Perform welding of structural metals with welders who have current AWS certificate for the type of welding to be performed.

Steel fabricators shall be certified by the AISC or other certification as recognized and accepted by the local building official having jurisdiction.

Notify ENGINEER 24 hours minimum before starting shop or field welding.

ENGINEER may check materials, equipment, and qualifications of welders.

Remove welders performing unsatisfactory Work, or require to requalification.

ENGINEER may use gamma ray, magnetic particle, dye penetrant, trepanning, or other aids to visual inspection to examine any part of welds or all welds.

CONTRACTOR shall bear costs of retests on defective welds.

CONTRACTOR shall also bear costs in connection with qualifying welders.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping: Deliver structural steel free from mill scale, rust, and pitting.

Storage and protection: Until erection and painting, protect from weather items not galvanized or protected by a shop coat of paint.

PRODUCTS

MATERIALS

Unless otherwise specified or indicated on the Drawings, materials shall conform to the following:

TECHNICAL SPECIFICATIONS

Item	ASTM Standard	Class, Grade, Type, or Alloy Number
Steel		
Plate, bars, rolled shapes (except W and WT shapes), and miscellaneous items	A 36	--
Rolled W and WT shapes	A 992	Grade 50
Hollow structural sections (HSS): Round, square, or rectangular	A 500	Grade B
Tubing, hot-formed	A 501	--
Round HSS	A 500	Grade B
Steel pipe	A 53	Grade B
Stainless steel		
Plate, sheet, and strip	A 240	Type 316*
Bars and shapes	A 276	Type 316*
* Use Type 316L if material will be welded.		

Where stainless steel is welded, use low-carbon stainless steel.

FASTENERS

General: Furnish threaded fasteners, except high strength bolts, with flat washers, and self-locking nuts, or lock washers and nuts.
Bolt heads and nuts: Hex-type.
Bolts, nuts, and washers: Of domestic manufacture.
Where bolts, including anchor bolts, nuts, washers, and similar fasteners are specified to be galvanized, galvanize in accordance with ASTM A 153.

All thread rods:
Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:
Water-containing structures:
Below and at water level.
Above water level:
Below top of walls of water-containing structures.
Under the roof, slab, beam, or walkway of enclosed water-containing structures.
Dry side of walls of water-containing structures.
Pump bases.
Type 304 or Type 316 stainless steel in accordance with ASTM F 593 for aluminum assemblies.
Hot-dip galvanized ASTM A 307 steel, or ASTM A 36 meeting the mechanical requirements of ASTM A 307, for galvanized assemblies and for applications other than those specified.

All thread rods bonded with epoxy in holes drilled in concrete: As specified in Section 03_21_17 and as indicated on the Drawings.

- Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:
  - Water-containing structures:
  - Below and at water level.
  - Above water level:
    - Below top of walls of water-containing structures.
    - Under the roof, slab, beam, or walkway of enclosed water containing structures.
    - Dry side of walls of water-containing structures.
    - Pump bases.
- Type 304 or Type 316 stainless steel in accordance with ASTM F 593 for fastening aluminum to concrete or steel.
- Hot-dip galvanized ASTM A 307 steel, or ASTM A 36 meeting the mechanical requirements of ASTM A 307, for galvanized assemblies and for applications other than those specified.

Anchor bolts:

- Forged steel bolt with straight shaft and integral heavy hex head.
  - Rods or bars with angle bend for embedment into and anchoring in concrete are not allowed.
- Anchor bolts, nuts, and washers: Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:
  - Water-containing structures:
    - Below and at water level.
    - Above water level:
      - Below top of walls of water-containing structures.
      - Under the roof, slab, beam, or walkway of enclosed water-containing structures.
      - Dry side of walls of water-containing structures.
      - Pump bases.
- Anchor bolts, nuts, and washers: Type 304 or Type 316 stainless steel for fastening aluminum to concrete or steel.
- Anchor bolts, nuts, and washers: Hot-dip galvanized ASTM F 1554, Grade 36 for applications other than those specified.

Anchor rods:

- Steel rod with straight shaft, threaded ends, and anchoring nuts or plates as indicated on the Drawings or specified:
  - Anchor bolts, nuts and washers: Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:
    - Water-containing structures:
      - Below and at water level.
      - Above water level:
      - Below top of walls of water containing structures.
      - Under the roof, slab, beam, or walkway of enclosed water-containing structures.
      - Dry side of walls of water-contained structures.

Pump bases:

Anchor bolts, nuts, and washers: Type 304 or Type 316 stainless steel for fastening aluminum to concrete or steel.

Anchor bolts, nuts, and washers: Hot-dip galvanized ASTM F 1554, Grade 36 for applications other than those specified.

Assembly bolts:

Bolts, nuts, and washers for wood baffles, collectors, and other field-assembled construction: Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:

Water-containing structures:

Below and at water level.

Above water level:

Below top of walls of water-containing structures.

Under the roof, slab, beam, or walkway of enclosed water-containing structures.

Dry side of walls of water-containing structures.

Pump bases.

Type 304 or Type 316 stainless steel in accordance with ASTM F 593 for aluminum assemblies.

Hot-dip galvanized ASTM A 307 steel for galvanized assemblies and for applications other than those specified.

Concrete anchors:

Concrete anchors for anchorage to concrete:

Concrete anchors shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC193 for cracked concrete.

Manufacturers: One of the following or approved equal:

Hilti Incorporated, Kwik Bolt TZ Expansion Anchor.

Simpson Strong Tie, Strong Bolt Wedge Anchor.

Concrete anchors for anchorage to masonry:

Concrete anchors shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC01.

Manufacturers: One of the following or approved equal:

Hilti Incorporated, Kwik Bolt 3 Expansion Anchor.

Simpson Strong Tie, Wedge-All Anchor.

Concrete anchor's integral threaded stud, wedge, washer, and nut: Type 304 or Type 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for use in wet and moist locations, including:

Water-containing structures:

Below and at water level.

Above water level:

Below top of walls of water-containing structures.

Under the roof, slab, beam, or walkway of enclosed water-containing structures.

Dry side of walls of water-containing structures.

Pump bases.

Concrete anchor's integral threaded stud, wedge, washer, and nut: Type 304 or 316 stainless steel in accordance with ASTM F 593 where indicated on the Drawings and for fastening aluminum to concrete or steel.

Concrete anchor's integral threaded stud, wedge, washer, and nut: Hot-dip galvanized carbon steel, for applications other than those specified.

Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials in order to develop holding power.

Flush shells:

Manufacturers: One of the following or approved equal:

ITW Red Head, Multi-Set II Drop-In.

Hilti Incorporated, HDI Drop-In.

Bolts, flush shells, threaded rods, washers, and nuts: Type 303 stainless steel in accordance with ASTM F 593.

High strength bolts: High strength bolts, nuts, and hardened flat washers shall be in accordance with ASTM A 325 or ASTM A 490, as indicated on the Drawings.

Welded studs:

ASTM A 108 with 50,000-pounds per square inch minimum yield strength, and 60,000-pounds per square inch minimum tensile strength.

Headed studs: Manufacturers: One of the following or approved equal:

Nelson Stud Welding Company, S3L Shear Connectors or H4L Concrete Anchors.

Stud Welding Products, Headed Concrete Anchors or Shear Connectors.

ISOLATING SLEEVES AND WASHERS

Manufacturers: One of the following or approved equal:

Central Plastics Company, Shawnee, Oklahoma.

Corrosion Control Products, PSI Inc., Gardena, CA.

Sleeves: Mylar, 1/32 inch thick, 4,000 volts per mil dielectric strength, of proper size to fit bolts and extending half way into both steel washers.
1 sleeve required for each bolt.

Washers: The inside diameter of all washer shall fit over the isolating sleeve and both the steel and isolating washers shall have the same inside diameter and outside diameter.
Proper size to fit bolts. Two insulating washers are required for each bolt.
Two 1/8-inch thick steel washers for each bolt.
G3 Phenolic:

Thickness: 1/8 inch.

Base material: Glass.

Resin: Phenolic.

Water absorption: 2 percent.

Hardness (Rockwell): 100.

Dielectric strength: 450 volts per mil.

Compression strength: 50,000 pounds per square inch.

Tensile strength: 20,000 pounds per square inch.

Maximum operating temperature: 350 degrees Fahrenheit.

GALVANIZED SURFACE REPAIR

Manufacturers: One of the following or approved equal:

Galvinox.

Galvo-Weld.

THREAD COATING

Manufacturers: One of the following or approved equal:
Never Seez Compound Corporation, Never-Seez.
Oil Research, Inc., WLR No. 111.

SUPPLEMENTARY PARTS

Furnish as required for complete structural steel erection, whether or not such parts and Work are specified or indicated on the Drawings.

FABRICATION

Shop assembly:
Fabricate structural steel in accordance with AISC "Specification for the Structural Steel Buildings - Allowable Stress Design and Plastic Design," unless otherwise specified or modified by applicable regulatory requirements.
Where anchors, connections, or other details of structural steel are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.
For Structural members such as W shapes, S shapes, channels, angles, and similar rolled shapes not available in quantity, size, and type of stainless steel specified or indicated on the Drawings:
Make full penetration welds between pieces of plate to attain same or higher section modulus and moment of inertia as members indicated on the Drawings.
Fabricate shapes using laser-fused full penetration joints. Fabricate shapes from dual grade stainless steel, fabricate beams and channels to ASTM A 6 tolerances.
Manufacturers: The following, or equal:
Stainless Structurals, LLC, Jacksonville, FL.
Where galvanizing is required, hot-dip galvanize structural steel after fabrication in accordance with ASTM A 123:
Do not electro-galvanize or mechanically-galvanize unless specified or accepted by ENGINEER.
Restraighten galvanized items that bend or twist during galvanizing.
Round off sharp and hazardous projections and grind smooth.
Take measurements necessary to properly fit work in the field. Take responsibility for and be governed by the measurements and proper working out of all the details.
Take responsibility for correct fitting of all metalwork.

EXECUTION

EXAMINATION

Verification of conditions: Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

ERECTION

General:

Fabricate structural and foundry items to true dimensions without warp or twist.
Form welded closures neatly, and grind off smooth where weld material interferes with fit or is unsightly.
Install structural items accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting structure or equipment for which intended.
Do not cock out of alignment, redrill, reshape, or force fit fabricated items.
Place anchor bolts or other anchoring devices accurately and make surfaces that bear against structural items smooth and level.
Rigidly support and brace structural items needing special alignment to preserve straight, level, even, and smooth lines. Keep structural items braced until concrete, grout, or dry pack mortar has hardened for 48 hours minimum.
Erect structural steel in accordance with AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design," unless otherwise specified or modified by applicable regulatory requirements.
Where anchors, connections, and other details of structural steel erection are not specifically indicated on the Drawings or specified, form, locate, and attach with equivalent in quality and workmanship to items specified.
Round off sharp or hazardous projections and grind smooth.
Paint or coat steel items as specified in Section 09_96_01.

Welding - General:

Make welds full penetration type, unless otherwise indicated on the Drawings.
Remove backing bars and weld tabs after completion of weld. Repair defective welds observed after removal of backing bars and weld tabs.

Welding stainless steel:

General: Comply in accordance with AWS D1.6.

Welding carbon steel:

General: Comply in accordance with AWS D1.1:

Weld ASTM A 36 and A 992 structural steel, ASTM A 500 and A 501 structural tubing, and ASTM A 53 pipe with electrodes conforming in accordance with AWS A5.1, using E70XX electrodes; AWS A5.17, using F7X-EXXX electrodes; or AWS A5.20, using E7XT-X electrodes:

Field repair cut or otherwise damaged galvanized surfaces to equivalent original condition using a galvanized surface repair.

Interface with other products:

Where steel fasteners come in contact with aluminum or other dissimilar metals, bolt with stainless steel bolts and separate or isolate from dissimilar metals with isolating sleeves and washers.
Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.

Fasteners:

General:

Install bolts, including anchor bolts and concrete anchors, to project 2 threads minimum, but 1/2 inch maximum beyond nut.

For bolts identified as ASTM A 325 and A 490, see tightening requirements under “High Strength Bolts.”

Unless otherwise specified, tighten bolts, including anchor bolts and concrete anchors, to the "snug-tight" condition, defined as tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

All thread rods bonded in drilled holes in concrete with epoxy: As specified in Section 03_21_17 and as indicated on the Drawings.

Anchor bolts:

Cast-in-place when concrete is placed.

Accurately locate anchor bolts embedded in concrete with bolts perpendicular to surface from which they project.

Do not allow anchor bolts to touch reinforcing steel.

Where anchor bolts are within 1/4 inch of reinforcing steel, isolate with a minimum of 4 wraps of 10-mil polyvinyl chloride tape in area adjacent to reinforcing steel.

In anchoring machinery bases subject to heavy vibration, use 2 nuts, with 1 serving as a locknut.

Where bolts are indicated on the Drawings for future use, first coat thoroughly with nonoxidizing wax, then turn nuts down full depth of thread and neatly wrap exposed thread with waterproof polyvinyl tape.

Furnish anchor bolts with standard hex bolt head or an equivalent head acceptable to ENGINEER unless otherwise indicated on the Drawings. “L” or “J” anchor bolts are not equivalent to an anchor bolt with a hex bolt head.

Minimum anchor bolt embedment: 10-bolt diameters, unless longer embedment is indicated on the Drawings.

Where indicated on the Drawings, set anchor bolts in metal sleeves having inside diameter approximately 2 inches greater than bolt diameter and minimum 10-bolt diameters long. Fill sleeves with grout when a machine or other equipment is grouted in place.

Anchor bolts may be cast in concrete in lieu of using concrete anchors.

Concrete anchors:

Do not use concrete anchors in lieu of anchor bolts.

Install anchors in accordance with approved ICC-ES Report. Where conflict exists between the approved ICC-ES Report and the requirements in this Section, the requirements of the Evaluation Service Report shall control.

Accurately locate concrete anchors and set perpendicular to surfaces from which they project.

Minimum embedment lengths:

Diameter Inches	Embedment Length Inches
1/4	2
3/8	2-1/2
1/2	4-1/8
5/8	4-1/2
3/4	6-1/2

Drilling holes:

Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.

Determine location of reinforcing bars, or other obstructions with a non-destructive indicator device.

Remove dust and debris from hole using compressed air.

Hole drilling equipment:

Electric or pneumatic rotary type with light or medium impact.

Drill bits: Carbide-tipped in accordance with ANSI B212-15.

Hollow drills with flushing air systems are preferred.

Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

Flush shells:

Use only where specifically indicated on the Drawings.

Install anchors in accordance with approved ICC-ES Report. Where conflict exists between the approved ICC-ES Report and the requirements in this Section, the requirements of the Evaluation Service Report shall control.

Accurately locate and set perpendicular to surfaces from which they project.

Drilling holes:

Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.

Determine location of reinforcing bars, or other obstructions with a non-destructive indicator device.

Remove dust and debris from hole using compressed air.

Hole drilling equipment:

Electric or pneumatic rotary type with light or medium impact.

Drill bits: Carbide-tipped in accordance with ANSI B212-15.

Hollow drills with flushing air systems are preferred.

Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

High strength bolts:

Consider connections with high strength bolts to be slip critical structural connections, unless otherwise indicated on the Drawings.

Connections with high strength bolts shall conform in accordance with AISC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

Furnish hardened flat washer:

Under element, nut, or bolt head, turned in tightening.

On outer plies for short slotted holes.

Verify adequate tightening of bolts by means of tension indicator washers placed as indicated in ASTM F 959, Figure 1.

Welded studs:

Butt weld with automatic stud welding gun as recommended by the manufacturer.

Ensure butt weld develops full strength of the stud.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 05_50_00

METAL FABRICATIONS

GENERAL

SUMMARY

Section includes:
- Aluminum stair nosing.
- Handrails and guardrails.
- Miscellaneous metals.
- Associated accessories to the above items.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

Aluminum Association (AA):
- DAF-45: Designations from Start to Finish.
- M12-C22-A41.

ASTM International (ASTM):
- A 36 - Standard Specification for Carbon Structural Steel.
- A 48 - Standard Specification for Gray Iron Castings.
- A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
- A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications.
- A 276 - Standard Specification for Stainless Steel Bars and Shapes.
- A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
- A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated , 150 ksi Minimum Tensile Strength.
- A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

A 635 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
A 992 - Standard Specification for Structural Steel Shapes.
B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.

American Welding Society (AWS):
A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

National Association of Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual.

Occupational Safety and Health Administration (OSHA).

DEFINITIONS

Passivation: Removal of exogenous iron or iron compounds from the surface of a stainless steel by means of chemical dissolution resulting from treatment with an acid solution that removes the surface contamination but does not significantly affect the stainless steel itself.

SUBMITTALS

Product Data:
Handrail and guardrail.

Shop drawings:
Handrails and guardrails:
Including details on connection attachments, gates, kick plates, ladders, and angles.
Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
Include erection drawings, elevations, and details where applicable.
Indicate welded connections using standard AWS A2.4 welding symbols.
Indicate net weld lengths.
Miscellaneous metals.

Quality control submittals:
Design data.

Test reports:

Guardrails: 3 copies of certified tests performed by an independent testing laboratory certifying that guardrails meet current State and OSHA strength requirements.

Gratings:

Grating manufacturers' calculations showing that gratings will meet specified design load, stress, and deflection requirements for each size grating for each span.

Reports of tests performed.

PRODUCTS

MATERIALS

General: Unless otherwise specified or indicated on the Drawings, structural and miscellaneous metals in accordance with the standards of the ASTM, including the following:

Item	ASTM Standard No.	Class, Grade Type or Alloy No.
Cast Iron		
Cast Iron	A 48	Class 40B
Steel		
Galvanized sheet iron or steel	A 653	Coating G90
Coil (plate)	A 635	--
Structural plate, bars, rolled shapes, and miscellaneous items (except W shapes).	A 36	--
Rolled W shapes	A 992	Grade 50
Standard bolts, nuts, and washers	A 307	--
High strength bolts, nuts, and hardened flat washers	A 325 A 490	--
Eyebolts	A 489	Type 1
Tubing, cold-formed	A 500	--
Tubing, hot-formed	A 501	--

TECHNICAL SPECIFICATIONS

Item	ASTM Standard No.	Class, Grade Type or Alloy No.
Steel pipe	A 53	Grade B
Stainless Steel		
Plate, sheet, and strip	A 240	Type 304* or 316**
Bars and shapes	A 276	Type 304* or 316**
Bolts (Type 304)	F593	Group 1 Condition CW
Bolts (Type 316)	F593	Group 2 Condition CW
Aluminum		
Flashing sheet aluminum	B 209	Alloy 5005-H14, 0.032 inches minimum thickness
Structural sheet aluminum-	B 209	Alloy 6061-T6
Structural aluminum	B 209 B 308	Alloy 6061-T6
Extruded aluminum	B 221	Alloy 6063-T42
* Use Type 304L if material will be welded. ** Use Type 316L if material will be welded.		

Stainless steels are designated by type or series defined by ASTM.
Where stainless steel is welded, use low-carbon stainless steel.

MANUFACTURED UNITS

Aluminum stair nosing:

Manufacturers: One of the following or equal:

Wooster Products, Inc., Type 101 Nosing.
American Safety Tread Co., Inc., Style 801 Nosing.
Material: Cast aluminum abrasive nosings with aluminum oxide granules integrally cast into metal, forming permanent, nonslip, long-wearing surface.
For installation in cast-in-place stairs.
Configuration: 4 inches wide, fabricated with integrally cast stainless steel anchors at approximately 12-inch centers. Length to extend within 3 inches of stair edge on each side.

TECHNICAL SPECIFICATIONS

Handrails and guardrails:

General:

Design and fabricate assemblies to conform to current local, State, and OSHA standards and requirements.

Coordinate layout of assemblies and post spacings to avoid conflicts with equipment and equipment operators.

Indicate on the shop drawings locations of such equipment.

Highlight locations where railings cannot be made continuous, and obtain ENGINEER's directions on how to proceed before fabricating or installing railings.

Aluminum handrails and guardrails (nonwelded pipe):

Rails, posts, and fitting-assembly spacers:

In accordance with ASTM B 429, 6005, 6063, or 6105, minimum Schedule 40, extruded aluminum pipe of minimum 1.89-inch outside diameter and 0.14-inch wall thickness.

Kick plates: 6061 aluminum alloy.

Fastenings and fasteners: As recommended or furnished by the manufacturer.

Other parts: 6063 extruded aluminum, or F214 or F514.0 aluminum castings:

Fabrications: In accordance with ASTM B 209 or ASTM B 221 extruded bars:

Bases: 6061 or 6063 extruded aluminum alloy.

Plug screws or blind rivets: Type 305 stainless steel.

Other parts: Type 300 series stainless steel.

Finish of aluminum components:

Anodized finish, 0.7 mil thick, applied to exposed surfaces after cutting.

Aluminum Association Specification M12-C22-A41, mechanical finish non specular as fabricated, chemical finish-medium matte, anodic coating-clear Class I Architectural.

Pretreat aluminum for cleaning and removing markings before anodizing.

Fabrication and assembly:

Fabricate posts in single, unspliced pipe length.

Perform without welding.

Do not epoxy bond the parts.

Maximum clear opening between assembled railing components as indicated on the Drawings.

Manufacturers: One of the following or equal:

Moultrie Manufacturing Company, Wesrail.

Golden Railings, Golden, CO, Riveted System.

Craneveyor Corporation Enerco Metals, C-V Rail.

Guardrail gates:

Supplied by guardrail manufacturer:

Of same material, quality, and workmanship as specified for guardrail system in which they will be installed.

Of design similar to that of handrail or railing system in which they will be installed.

Components: Gate frame, stainless steel self-closing device, hinges, gate stops, and durable self-locking type latch. Fabricate components in conformance with OSHA minimum strength requirements.

Fastenings and fasteners: As recommended or furnished by guardrail manufacturer for use with this system.

Miscellaneous aluminum:

Fabricate aluminum products, not covered separately in this Section, in accordance with the best practices of the trade and field assemble by riveting or bolting.

Do not weld or flame cut.

Miscellaneous stainless steel:

Provide miscellaneous stainless steel items not specified in this Section as indicated on the Drawings or specified elsewhere.

Fabricate and install in accordance with the best practices of the trade.

Cleaning and passivation.

Following shop fabrication of stainless steel members, clean and passivate fabrications.

Finish requirements: Remove free iron, heat tint oxides, weld scale and other impurities, and obtain a passive finished surface.

Provide quality control testing to verify effectiveness of cleaning agents and procedures and to confirm that finished surfaces are clean and passivated.

Conduct sample runs using test specimens with proposed cleaning agents and procedures as required to avoid adverse effects on surface finishes and base materials.

Pre-clean, chemically descale (pickle), and final clean fabrications in accordance with the requirements of ASTM A 380 to remove deposited contaminants before shipping.

Passivation by citric acid treatment is not allowed.

If degreasing is required before cleaning to remove scale or iron oxide, cleaning (pickling) treatments with citric acid are permissible; however, these treatments shall be followed by inorganic cleaners such as nitric-hydrofluoric acid.

Provide acid descaling (pickling) in accordance with Table A1.1 of Annex A1 of ASTM A 380.

After pickling, final cleaning of stainless steel shall conform to Part II of Table A2.1 of Annex A2 of ASTM A 380.

After cleaning, inspect using methods specified for “gross inspection” in ASTM A 380.

Improperly or poorly cleaned and passivated materials shall not be shipped and will not be accepted at the job site.

Miscellaneous structural steel:

Provide miscellaneous steel items not specified in this Section as indicated on the Drawings or specified elsewhere.

Fabricate and install in accordance with the best practices of the trade.

EXECUTION

EXAMINATION

Verification of conditions:

Examine work in place to verify that it is satisfactory to receive the work of this Section.

If unsatisfactory conditions exist, do not begin this work until such conditions have been corrected.

INSTALLATION

General: Install products as indicated on the Drawings, and in accordance with shop drawings and manufacturer's printed instructions, as applicable except where specified otherwise.

Aluminum stair nosing:

Install stair nosings on treads of concrete stairs, including top tread on upper concrete slab.

Omit stair nosings where concrete is submerged.

Coat aluminum surfaces in contact with concrete as specified in Section 09_96_01.

Cast stair nosings in fresh concrete, flush with tread and riser faces. Install nosing in center of step approximately 3 inches from each stair edge.

Handrails and guardrails:

General:

Fasten pipe rails to fittings with Series 300 stainless steel pop rivets or flush set screws.

Make pipe cuts clean and straight, free of burrs and nicks, and square and accurate for minimum joint-gap.

Drill and countersink holes to proper size, as required for a tight flush fit of screws and other component parts.

Space attachment brackets as indicated in the manufacturer's instructions.

Aluminum pipe handrails and guardrails:

During construction, keep exterior surfaces of handrails and guardrails covered with 0.4 millimeters, minimum, heat shrink polyethylene film.

Do not remove protective film before handrails and guardrails have been accepted by ENGINEER nor before other work in proximity of handrails and guardrails has been completed.

Discontinue handrails and guardrails at lighting fixtures.

Provide 1/8-inch diameter weep hole at base of each post.

Where protection is applied for prevention of dissimilar materials electrolysis, make application such that none of the protective material is visible in the completed assembly.

Space posts as indicated on the Drawings.

Anchor posts into concrete by grouting posts into formed holes in concrete, into stainless steel sleeves cast in concrete; or bracket mount to face of concrete surfaces as specified and indicated on the Drawings.

Space rails as indicated on the Drawings.

Make adequate provision for expansion and contraction of kick plates and rails.

Make provisions for removable sections where indicated on the Drawings.

Make lower rails a single, unspliced length between posts, or continuous.

Make top rails continuous whenever possible, and attach single, unspliced lengths to 3 posts minimum.

Draw up fasteners tight with hand wrench or screw driver.

Space attachment brackets as indicated on shop drawings or in manufacturer's installation instructions.

Completed installation shall have handrails and railings rigid and free of play at joints and attachments.

Protect handrail and guardrail finish from scratches, gouges, dents, stains, and other damage.

Replace damaged or disfigured handrails and guardrails with new.

Shortly before final acceptance of the work, and after removal of protective polyethylene film, clean handrails and guardrails with mild detergent or with soap and water.

After cleaning, thoroughly rinse handrails and guardrails and wipe with soft cloth.

Erect guardrail straight, level, plumb, and true to the positions as indicated on the Drawings. Correct deviations from true line of grade, which are visible to the eye.

Guardrail gates:

- Install gate to be a vertical plane with the guardrail when in the closed position.
- Install hinges so that each gate can swing 180 degrees from the closed position to the fully open position.
- Install so that the gates swing to the walkway side of the guardrail only.
- Install gate stops on the stationary railing posts to prohibit gates from swinging in the wrong direction.
- Install gate frames, hinges, stops, and latches in conformance with OSHA minimum strength requirements.

Stainless Steel

Welding.

- Passivate field-welded surfaces.
- Provide cleaning, pickling and passivating as specified in this Section.
- Clean using Derustit Stainless Steel Cleaner, or equal.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 07_19_00

WATER REPELLENTS

GENERAL

SUMMARY

Section includes: Water repellent for concrete masonry.

DEFINITIONS

Water repellent: Resistance to penetration of water from rainfall.

REFERENCES

International Union of Testing and Research Laboratories for Materials and Structures (RILEM):

RILEM Test Method No. 11.4, Measurement Of Water Absorption Under Low Pressure

SYSTEM DESCRIPTION

Performance requirements: Surfaces with water repellent shall be uniform in color with unaltered texture.

SUBMITTALS

Product Data.

Samples: Water repellent applied on 8-inch by 8-inch substrates to receive water repellent, marked with application date and application rate.

Manufacturer's Application Instructions.

QUALITY ASSURANCE

Manufacturer qualifications: Manufacturer of water repellents for minimum 5 years with satisfactory performance record.

Applicator qualifications: Trained, approved, and accepted by water repellent manufacturer.

Spray personnel qualifications: Minimum 2 years of experience spraying exotic coatings.

Regulatory requirements: Comply with volatile organic compound regulations.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in manufacturer's original containers with seals unbroken and labeled with manufacturer's batch number.

Store materials in original, unopened containers in compliance with manufacturer's printed instructions.

ENVIRONMENTAL REQUIREMENTS

Apply water repellent under temperature and relative humidity conditions before, during, and after application in accordance with manufacturer's instructions.

Allow surfaces to dry for minimum 5 days after rains.

PROJECT CONDITIONS

Make proper material allowance based upon substrate material and surface configuration when determining quantities of material.

WARRANTY

Warrant to furnish and apply water repellent on walls that experience water penetration because of failure of water repellent for minimum 5 years.

PRODUCTS

MANUFACTURERS

Water repellent sealer:
Manufacturers: One of the following or equal:
Rainguard Products, Inglewood, CA.
ProSoCo, Inc., Kansas City, KS.

MATERIALS

Water repellent sealer for concrete and concrete masonry: Silane/Siloxane; Volatile Organic Compound compliant; free of silicone oils, paraffin wax, or urethanes.
Manufacturers: One of the following or equal:
Rainguard, BLOK-LOK.

EQUIPMENT

Spray equipment: High-volume, low-pressure, airless, with maximum 60 pounds per square inch pressure:
Pump: Non-atomizing, able to flow material on walls at minimum 1 to 1-1/2 gallons per minute.
Orifice size for concrete, slump block, exposed concrete aggregate, and cement plaster: 0.060 to 0.110 inches.
Orifice size for brick, clay brick tile, brick veneer, stone, and wood: 0.060 inches.

EXECUTION

EXAMINATION

Carefully inspect installed construction. Verify that construction is ready for repellent application.

Require manufacturer's representative to verify that water repellent may be installed.

PREPARATION

Allow concrete or masonry walls to cure at least 30 days before applying water repellent.

Clean wall surfaces of soil, mud, efflorescence, or other detrimental materials.

Tuck-point or caulk cracks, other than hairline cracks.

Route out defective mortar joints, point with mortar and tool.

Moisture content: Apply water repellent sealer when moisture content of substrate is 15 percent or less.

APPLICATION ON CONCRETE, CONCRETE MASONRY, EXPOSED CONCRETE AGGREGATE, AND CEMENT PLASTER

Apply water repellent in accordance with manufacturer's printed instructions.

Apply flood coat using low-pressure spray equipment.

Start at top of wall and work down using overlapping horizontal passes.

Hold spray head 8 to 10 inches from surface so saturation coat runs freely down wall 6 to 10 inches below point of application on most substrates.

Spray by traveling horizontally to ensure uniform coverage.

Overlap each following pass by centering spray head on bottom line of the previous pass.

Trigger gun off at end of each pass to avoid applying excessive amount of material. Do not over apply.

Avoid application in hot or windy weather as premature drying can cause whitish residue on walls.

FIELD QUALITY CONTROL

Twenty days after application, test water repellent on CMU surfaces using RILEM Test Method No. 11.4.

CONTRACTOR shall perform a 20-minute RILEM baseline test on dry untreated CMU units of each type to receive water repellent. Test results (water loss in mililiter) shall be compared to CMU units in walls after water repellent application.

On water repellant coated CMU, a RILEM tube test resulting in 5 mililiter or less after 20 minutes is necessary to qualify for 5-year warranty.

Notify the ENGINEER and manufacturer at least 72 hours in advance of test.

Where tested wall areas fail to pass RILEM tube test, apply additional coat of water repellent on entire wall from corner to corner.

Test all locations where directed by the ENGINEER.

CLEANING

Concrete, concrete masonry, exposed concrete aggregate, and cement plaster: Clean drips, runs, and overspray residue while still wet, using detergent and water. Clean application and spray equipment with detergent and water immediately following use.

Brick, clay brick tile, brick veneer, stone, and wood: Clean drips, runs, and overspray residue with petroleum type thinner following application.

Clean application and spray equipment according to the manufacturer's recommendations.

Remove excess materials, equipment, and debris incidental to water repellent application upon completion.

PROTECTION

During application, protect water repellent treated and adjacent surfaces from damage.

Protect glass, aluminum, and other surfaces from overspray.

Protect concrete sidewalks from runoff. Soak with water immediately prior to application on adjacent walls.

Repair damaged areas promptly.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 07_90_00

JOINT SEALANTS

GENERAL

SUMMARY

Section includes:
- Acrylic-Latex sealant.
- Silicone sealant.
- Synthetic rubber sealing compound.
- Synthetic sponge rubber filler.
- Related materials.

REFERENCES

American Association of State Highway and Transportation Officials (AASHTO):
- M 198 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

ASTM International (ASTM):
- C 920 - Standard Specification for Elastomeric Joint Sealants.
- C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

SUBMITTALS

Product data.

Samples, include color selections.

Manufacturer's Installation Instructions.

Warranty.

QUALITY ASSURANCE

Manufacturer qualifications: Manufacturer of proposed product for minimum 5 years with satisfactory performance record.

Installer qualifications: Manufacturer approved installer of products similar to specified products on minimum 5 projects of similar scope as Project with satisfactory performance record.

TECHNICAL SPECIFICATIONS

PROJECT/SITE CONDITIONS

Environmental requirements: Do not apply sealant on wet or frosty surfaces or when surface temperature is higher than 100 degrees Fahrenheit or lower than recommended by the manufacturer.

DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products in accordance with manufacturer's recommendations.

Code date packages. Do not use material older than manufacturer’s published shelf life. Store materials at temperatures lower than 80 degrees Fahrenheit. Condition materials in accordance with manufacturer’s instructions prior to installation.

SEQUENCING AND SCHEDULING

Caulk joints prior to painting.

WARRANTY

Warrant to correct defective products for minimum 5 years in accordance with manufacturer's standard warranty.

PRODUCTS

ACRYLIC-LATEX SEALANT

Permanently flexible, nonstaining, and nonbleeding latex modified acrylic sealant compound, colors as selected by ENGINEER from manufacturer's standard options.
Manufacturers: One of the following or equal:
Tremco, Tremflex 834.
Pecora Corp., Number AC-20.
Sonneborn, Sonolac.

SILICONE SEALANT

ASTM C 920, Type S, Grade NS, Class 25, single component silicone sealant.
Manufacturers: One of the following or equal:
Tremco, Proglaze.
Pecora Corp., Number 864.
Dow Corning, Number 795.
General Electric, Number 1200 Series.

SYNTHETIC RUBBER SEALING COMPOUND

Manufacturer: One of the following or equal:
Sika Corporation, Lyndhurst, NJ, Sikaflex 2c NS or SL
Polymeric Systems, Inc., PSI 275.
Pacific Polymers, Garden Grove, CA, Elastothane 227R.

Material: In accordance with ASTM C 920 Type M, Grade P (pourable), Class 25 and Type M, Grade NS (non-sag), Class 25; multi-part polyurethane; able to cure at room temperature to firm, highly resilient polymer; able to perform satisfactory when continuously submerged in water or sewage and exposed to direct sunlight in dry condition; with the following properties determined at 75 degrees Fahrenheit and 50 percent relative humidity:

Base: Polyurethane rubber.
Solids: Minimum 97 percent.
Application time: Minimum 2 hours.
Cure time: Maximum 3 days.
Tack free time: 24 hours.
Ultimate hardness: Non-sag 25, Pourable/SL 40, within 5 Shore A.
Tensile strength: Non-sag 120 pounds per square inch minimum and self-leveling minimum 170 pounds per square inch when tested in accordance with ASTM D 412.
Ultimate elongation: Minimum 490 percent when tested in accordance with ASTM D 412.
Tear resistance: Non-sag 45 pounds per inch minimum and self-leveling minimum 85 pounds per inch when tested in accordance with ASTM D 624, Die C.
Service temperature range: Minus 25 degrees to 158 degrees Fahrenheit.

Color: Gray to match concrete, unless indicated on the Drawings.

SYNTHETIC SPONGE RUBBER FILLER

Closed-cell expanded sponge rubber manufactured from synthetic polymer neoprene base, or resilient polyethylene foam backer rod. Manufacturers: One of the following or equal:

Presstite, Number 750.3 Ropax Rod Stock.
Rubatex Corp., Rubatex-Cord.

Characteristics:

Suitable for application intended.
Strength: As necessary for supporting sealing compound during application.
Resiliency: Sufficient resiliency to prevent significant load transfer across joint.
Resistance to environmental conditions of installation.
Bonding: No bonding to the sealing compound.
Structure: Cellular, prevents wicking or absorption of water.
Compatibility with other materials in joint and acceptance by manufacturer of sealing compound.
Size: Minimum 25 percent greater than nominal joint width.

RELATED MATERIALS

Primer: Nonstaining type, recommended by sealant manufacturer to suit application.

Joint cleaner: Noncorrosive, nonstaining, compatible with joint forming materials and as recommended by sealant manufacturer.

Bond breaker tape: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

EXECUTION

EXAMINATION

Verify acceptability of joint dimensions, physical, and environmental conditions.

Verify that surfaces are dry, clean, and free of dirt, grease, curing compound, and other residue which might interfere with adhesion of sealants.

PREPARATION

Allow concrete to cure thoroughly before caulking.

Synthetic sponge rubber filler:
- Prepare surfaces designated to receive filler in accordance with manufacturer's installation instructions.
- Do not stretch filler beyond its normal length during installation.

Caulking:
- Verify that surfaces are dry, clean, and free of dirt, grease, curing compounds, and other residue that might interfere with adhesion of sealant.
- Concrete, masonry, wood, and steel surfaces: Clean and prime in accordance with manufacturer's instructions prior to caulking.

Synthetic rubber sealing compound:
- Ensure surfaces to which synthetic rubber must bond are dry and free of dust, dirt, and other foreign residue.
- Heavy sandblasted caulking groove to sound surface, and prime with manufacturer's recommended primer for particular surface.

For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but neither more than 5/8 inches deep nor less then 3/8 inches deep.

For normal moving building joints sealed with elastomeric sealants not subject to traffic, fill joints to depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.

For joints sealed with acrylic-latex sealants, fill joints to depth in range of 75 percent to 125 percent of joint width.

Use joint filler to achieve required joint depths, to allow sealants to perform properly.

Prepare surfaces and install synthetic sponge rubber filler in accordance with manufacturer's recommendations.

Do not stretch filler beyond normal length during installation.

Apply bond breaker when recommended by joint sealer manufacturer.

INSTALLATION

Synthetic sponge rubber filler: Install filler in accordance with manufacturer's installation instructions.

Caulking, joints, and sealing:

- Construct expansion, contraction, and construction joints as indicated on the Drawings.
- Install pipe and conduit in structures as indicated on the Drawings.
- Caulk doors, windows, louvers, and other items installed in or over concrete openings inside and out.
- Use synthetic rubber sealing compound for caulking where indicated on the Drawings or as specified, except for masonry construction and where specified otherwise.
- Complete caulking prior to painting.
- Verify that concrete is thoroughly cured prior to caulking.
- When filler compressible material is used, use untreated type.
- Apply caulking with pneumatic caulking gun.
- Use nozzles of proper shape and size for application intended.
- Maintain continuous bond between caulking and sides of joint to eliminate gaps, bubbles, or voids and fill joint in continuous operation without layering of compound.
- Employ experienced applicators to caulk joints and seams in neat workmanlike manner.
- To hasten curing of compound when used on wide joints subject to movement, apply heat with infrared lamps or other convenient means.
- Apply synthetic rubber sealing compound with pneumatic caulking tool or other acceptable method.

CLEANING

Clean surfaces adjacent to sealant as work progresses.

Remove excess uncured sealant by soaking and scrubbing with sealant cleaning solvent.

Remove excess cured sealant by sanding with Number 80 grit sandpaper.

Leave finished work in neat, clean condition.

SCHEDULE

Acrylic latex:

- Use where indicated on the Drawings.
- Interior joints with movement less than 7.5 percent and not subject to wet conditions.

Silicone:

- Use where indicated on the Drawings.
- Joints and recesses formed where window, door, louver and vent frames, and sill adjoin masonry, concrete, stucco, or metal surfaces.
- Door threshold bedding.

Moist or wet locations, including joints around plumbing fixtures.
Stainless steel doors and frames, including joints between applied stops and frames, and around anchor bolts.
Plenum joints.

Synthetic rubber sealing compound, non-sag Type II:

Use where indicated on the Drawings.
Water-bearing and earth-bearing concrete structures.
Joints in masonry, concrete vertical surfaces, and metal-faced panels in vertical surfaces.
Joints between sheet metal flashing and trim.
Joints between sheet metal flashing and trim, and vertical wall surfaces.
Small voids between materials requiring filling for weathertight performance in vertical surfaces.
Perimeters of frames of doors, windows, louvers, and other openings where bonding is critical to airtight performance.
Expansion and control joints in masonry vertical surfaces.

Synthetic rubber sealing compound, self-leveling Type I:

Use where indicated on the Drawings.
Expansion and control joints in masonry, concrete horizontal surfaces, and metal panels in horizontal surfaces.
Small voids between materials requiring filling for weathertight performance in horizontal surfaces.
Pavement joints.
Perimeters of frames of doors, windows, louvers, and other openings in horizontal surfaces where bonding is critical to airtight performance.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 09_96_01

HIGH-PERFORMANCE COATINGS

GENERAL

SUMMARY

Section includes: Field applied coatings.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
D 4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

NACE International (NACE):
SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
SP0188-06 - Discontinuity (Holiday) Testing of Protective Coatings.

National Association of Pipe Fabricators (NAPF):
500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

NSF International (NSF):
61 - Drinking Water System Components - Health Effects.

Society for Protective Coatings (SSPC):
SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
SP-1 - Solvent Cleaning.
SP-2 - Hand Tool Cleaning.
SP-3 - Power Tool Cleaning.
SP-5 - White Metal Blast Cleaning.
SP-6 - Commercial Blast Cleaning.
SP-7 – Brush-Off Blast Cleaning.
SP-10 – Near-White Blast Cleaning.

U.S. Environment Protection Agency (EPA):
Method 24 - Surface Coatings.

TECHNICAL SPECIFICATIONS

DEFINITIONS

Submerged metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.

Submerged concrete and masonry surfaces: Surfaces which are or will be:
Underwater.
In structures which normally contain water.
Below tops of walls of water containing structures.

Exposed surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.

Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.

Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.

Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.

Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

PERFORMANCE REQUIREMENTS

Coating materials shall be especially adapted for use in wastewater treatment plants.

Coating materials used in contact with potable water supply systems shall be certified to NSF 61.

SUBMITTALS

General: Submit in accordance with General Conditions 4.0.

Shop drawings:
- Schedule of proposed coating materials.
- Schedule of surfaces to be coated with each coating material.

Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
- Regulatory requirements: Submit data concerning the following:
  - Volatile organic compound limitations.
  - Coatings containing lead compounds and PCBs.
  - Abrasives and abrasive blast cleaning techniques, and disposal.
  - NSF certification of coatings for use in potable water supply systems.

Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.

Certificates: Submit in accordance with requirements for Product Data.

Manufacturer's Instructions: Include the following:
- Special requirements for transportation and storage.
- Mixing instructions.
- Shelf life.
- Pot life of material.
- Precautions for applications free of defects.
- Surface preparation.
- Method of application.
- Recommended number of coats.
- Recommended dry film thickness (DFT) of each coat.
- Recommended total dry film thickness (DFT).
- Drying time of each coat, including prime coat.
- Required prime coat.
- Compatible and non-compatible prime coats.
- Recommended thinners, when recommended.
- Limits of ambient conditions during and after application.
- Time allowed between coats (minimum and maximum).
- Required protection from sun, wind, and other conditions.
- Touch-up requirements and limitations.
- Minimum adhesion of each system submitted in accordance with ASTM D 4541.

Manufacturer's Representative’s Field Reports.

Operations and Maintenance Data: Submit as specified in Section 01_77_00.
- Reports on visits to project site to view and approve surface preparation of structures to be coated.
- Reports on visits to project site to observe and approve coating application procedures.
- Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

Quality Assurance Submittals:
- Quality Assurance plan.
- Qualifications of coating applicator including List of Similar Projects.

Certifications:
- Submit notarized certificate that:
  - All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations.

QUALITY ASSURANCE

Applicator qualifications:
- Minimum of 5 years experience applying specified type or types of coatings under conditions similar to those of the Work:
  - Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
- Manufacturer approved applicator when manufacturer has approved applicator program.

Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
Approved and licensed by elastomeric polyurethane (100 percent solids) manufacturer to apply 100 percent solids elastomeric polyurethane system.
Applicator of off-site application of coal tar epoxy shall have successfully applied coal tar epoxy on similar surfaces in material, size, and complexity as on the Project.

Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible volatile organic compound limits and do not contain lead:

Do not use coal tar epoxy in contact with drinking water or exposed to ultraviolet radiation.

Certification: Certify that applicable pigments are resistant to discoloration or deterioration when exposed to hydrogen sulfide and other sewage gases and product data designates coating as suitable for wastewater service.

Field samples:

Prepare and coat a minimum 100 square foot area between corners or limits such as control or construction joints of each system.
Approved field sample may be part of Work.
Obtain approval before painting other surfaces.

Pre-installation conference: Conduct as specified in Special Conditions 5.

Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.

Services of coating manufacturer’s representative: Arrange for coating manufacturer’s representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be “shop primed and coated”.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products as specified in General Conditions 7.0.

Remove unspecified and unapproved paints from Project site immediately.

Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
Do not deliver materials aged more than 12 months from manufacturing date.

Store coatings in well-ventilated facility that provides protection from the sun weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.

Take precautions to prevent fire and spontaneous combustion.

PROJECT CONDITIONS

Surface moisture contents: Do not coat surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:

Plaster and gypsum wallboard: 12 percent.
Masonry, concrete, and concrete block: 12 percent.
Interior located wood: 15 percent.
Concrete floors: 7 percent.

Do not apply coatings:

Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
When light on surfaces measures less than 15 foot-candles.
When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
When relative humidity is higher than 85 percent.
When surface temperature is less than 5 degrees Fahrenheit above dew point.
When surface temperature exceeds the manufacturer's recommendation.
When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
Apply clear finishes at minimum 65 degrees Fahrenheit.

Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.

Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.

Dehumidification and heating for coating of digester interiors, wet wells, and high humidity enclosed spaces:

Provide dehumidification and heating of digester interior spaces in which surface preparation, coating application, or curing is in progress according to the following schedule:

October 1 to April 30: Provide continuous dehumidification and heating as required to maintain the tanks within environmental ranges as specified in this Section and as recommended by the coating material manufacturer. For the purposes of this Section, “continuous” is defined as 24 hours per day and 7 days per week.

May 1 to September 30: Provide temporary dehumidification and heating as may be required to maintain the tanks within the specified environmental ranges in the event of adverse weather or other temporary condition. At CONTRACTOR’s option and at his sole expense, CONTRACTOR may suspend work until such time as acceptable environmental conditions are restored, in lieu of temporary dehumidification and heating. Repair or replace any coating or surface preparation damaged by suspension of work, at CONTRACTOR’s sole expense.

Equipment requirements:

Capacity: Provide dehumidification, heating, and air circulation equipment with minimum capacity to perform the following:

Maintain the dew point of the air in the tanks at a temperature at least 5 degrees Fahrenheit less than the temperature of the coldest part of the structure where work is underway.

Reduce dew point temperature of the air in the tanks by at least 10 degrees Fahrenheit in 20 minutes.

Maintain air temperature in the tanks at 60 degrees minimum.

Systems:

Site electrical power: Not available for CONTRACTOR's use.

Dehumidification: Provide desiccant or refrigeration drying. Desiccant types shall have a rotary desiccant wheel capable of continuous operation. No Liquid, granular, or loose lithium chloride drying systems will be allowed.

Heating: Electric, indirect combustion, or steam coil methods may be used. Direct fired combustion heaters will not be allowed during abrasive blasting, coating application, or coating cure time.

Design and submittals:

CONTRACTOR shall prepare dehumidification and heating plan for this project, including all equipment and operating procedures.

Suppliers of services and equipment shall have not less than 3 years experience in similar applications.

Supplier: The following or equal:

Cargocaire Corporation (Munters) or equal.

Submit dehumidification and heating plan for ENGINEER's review.

Monitoring and performance:

Measure and record relative humidity and temperature of air, and structure temperature twice daily (beginning and end of work shifts) to verify that proper humidity and temperature levels are achieved inside the work area after the dehumidification equipment is installed and operational. Test results shall be made available to the ENGINEER upon request.

Interior space of the working area and tank(s) shall be sealed and a slight positive pressure maintained as recommended by the supplier of the dehumidification equipment.

The filtration system used to remove dust from the air shall be designed so that it does not interfere with the dehumidification equipment's ability to control the dew point and relative humidity inside the reservoir.

The air from the tank, working area, or dust filtration equipment shall not be recirculated through the dehumidifier during coating application or when solvent vapors are present.

SEQUENCING AND SCHEDULING

Sequence and Schedule: As specified in Section 01_35_16 and 01_14_00.

MAINTENANCE

Extra materials: Deliver as specified in Section 01_77_00. Include minimum 1 gallon of each type and color of coating applied:

When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.

When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

TECHNICAL SPECIFICATIONS

PRODUCTS

MANUFACTURERS

Special coatings: One of the following or equal:
- Carboline: Carboline, St. Louis, MO.
- Devoe: International Protective Coatings, Louisville, KY.
- Dudick: Dudick, Inc., Streetsboro, OH.
- Henkel: Henkel North America, Madison Heights MI.
- PPG Amercoat: PPG Protective & Marine Coatings, Brea, CA.
- Rustoluem : Rustoleum Corp., Sommerset, NJ.
- Sanchem: Sanchem, Chicago, IL.
- Superior: Superior Environmental Products, Inc., Addison, TX.
- S-W: Sherwin-Williams Co., Cleveland, OH.
- Tnemec: Tnemec Co., Kansas City, MO.
- Wasser: Wasser High Tech Coatings, Kent, WA.
- ZRC: ZRC Worldwide Innovative Zinc Technologies, Marshfield, MA.

PREPARATION AND PRETREATMENT MATERIALS

Metal pretreatment: As manufactured by one of the following or equal:
- Henkel: Galvaprep 5.
- International: AWLGrip Alumiprep 33.

Surface cleaner and degreaser: As manufactured by one of the following or equal:
- Carboline Surface Cleaner No. 3.
- Devoe: Devprep 88.
- S-W: Clean and Etch.

COATING MATERIALS

Alkali resistant bitumastic: As manufactured by one of the following or equal:
- Carboline: Bitumastic No. 50.
- S-W: Targuard.
- Wasser: MC-Tar.
- As specified for Coal Tar Epoxy Substitute.

Wax coating: As manufactured by the following or equal:
- Sanchem: No-Ox-Id A special.

High solids epoxy (self priming) not less than 72 percent solids by volume: As manufactured by one of the following or equal:
- Carboline: Carboguard 891.
- Devoe: Bar Rust 233H.
- PPG Amercoat: Amerlock 2.
- S-W: Macropoxy 646.
- Tnemec: HS Epoxy Series 104.

Aliphatic or aliphatic-acrylic polyurethane: As manufactured by one of the following or equal:
- Carboline: Carbothane 134 VOC.
- Devoe: Devthane 379.

PPG Amercoat: Amershield VOC.
Non-submerged: S-W High Solids Polyurethane.
Tnemec: Endura-Shield II Series 1075 (U).

Asphalt varnish: AWWA C 500.

Coal tar epoxy substitute: As manufactured by one of the following or equal:
Devoe: Devtar 5A HS.
S-W : Macropoxy 646 Black.

Concrete floor coatings: As manufactured by one of the following or equal:
Carboline: Semstone 140SL.
Devoe: Devran 124.
Dudick: Polymer Alloy 1000.
Tnemec: Tneme-Glaze Series 282.

Waterborne acrylic emulsion: As manufactured by one of the following or equal:
S-W: DTM Acrylic B66W1.
Tnemec: Tneme-Cryl Series 6.

Galvanizing Zinc Compound: As manufactured by one of the following or equal:
ZRC: Cold Galvanizing Compound.

MIXES

Mix in accordance with manufacturer's instructions.

EXECUTION

GENERAL PROTECTION

Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection.

Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
Mask off surfaces of items not to be coated or remove items from area.

Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and in particular, surfaces within storage and preparation area.

Place cotton waste, cloths, and material which may constitute fire hazard in closed metal containers and remove daily from site.

Remove electrical plates, surface hardware, fittings, and fastenings, prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

GENERAL PREPARATION

Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.

Protect following surfaces from abrasive blasting by masking, or other means:
Threaded portions of valve and gate stems, grease fittings, and identification plates.
Machined surfaces for sliding contact.
Surfaces to be assembled against gaskets.
Surfaces of shafting on which sprockets are to fit.
Surfaces of shafting on which bearings are to fit.
Machined surfaces of bronze trim, including those slide gates.
Cadmium-plated items except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
Galvanized items, unless scheduled to be coated.

Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.

Concrete:

Allow new concrete to cure for minimum of 28 days before coating.
Clean concrete surfaces of dust, mortar, fins, loose concrete particles, form release materials, oil, and grease. Fill voids so that surface is smooth. Etch or brush off-blast clean in accordance with SSPC SP-7 to provide surface profile equal to 40- to 60-grit sandpaper, or as recommended by coating manufacturer.
All concrete surfaces shall be vacuumed clean prior to coating application.

Ferrous metal surfaces:

Remove grease and oil in accordance with SSPC SP-1.
Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
Abrasive blast surfaces prior to coating.
When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.
When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching-up.
Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP-10, unless blasting may damage adjacent surfaces, prohibited or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP-3.
Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP-5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.
All abrasive blast cleaned surfaces shall be blown down with clean dry air and or vacuumed.

Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.

Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.

Galvanized surface:

Degrease or solvent clean (SSPC SP-1) to remove oily residue.
Power tool or hand tool clean or whip abrasive blast.
Test surface for contaminants using copper sulfate solution.
Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.

Shop primed metal:

Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP-10, unless greater degree of surface preparation is required by coating manufacturer’s representative.
Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP-2, SP-3, or SP-6, as directed by the ENGINEER.
When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer’s representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP-10.
When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP-10.
When prime coat not authorized by ENGINEER is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP-10.
Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.

Cadmium-plated, zinc-plated, or sherardized fasteners:

Abrasive blast in same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.

Abrasive blast components to be attached to surfaces which cannot be abrasive blasted before components are attached.

Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.

Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.

PVC and FRP Surfaces:

Prepare surfaces to be coated by light sanding (de-gloss) and wipe-down with clean cloths, or by solvent cleaning in strict accordance with coating manufacturer's instructions.

Cleaning of previously coated surfaces:

Utilize cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:

Cleaning agent: Biodegradable non-flammable and containing no volatile organic compounds.
Manufacturer: The following or equal:

Steam clean and degrease surfaces to be coated to remove oils and grease. Cleaning of surfaces utilizing the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high-pressure washing, or hand washing as approved by the coating manufacturer's representative and the ENGINEER.

Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.

Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

Remove grilles, covers, and access panels for mechanical and electrical system from location and coat separately.

Prepare and finish coat-primed equipment with color selected by the ENGINEER.

Prepare and prime and coat insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.

Replace identification markings on mechanical or electrical equipment when coated over or spattered.

Prepare and coat interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.

Prepare and coat dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels.

Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.

Prepare and coat both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

Color code equipment, piping, conduit, and exposed ductwork and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with Contract Documents.

GENERAL APPLICATION REQUIREMENTS

Apply coatings in accordance with manufacturer's instructions.

Coat metal unless specified otherwise:

Aboveground piping to be coated shall be empty of contents during application of coatings.

Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.

Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.

Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacturer's recommended special primer.

Prime shop primed metal surfaces. Spot prime exposed metal of shop primed surfaces before applying primer over entire surface.

Multiple coats:

- Apply minimum number of specified coats.
- Apply additional coats when necessary to achieve specified thicknesses.
- Apply coats to thicknesses specified, especially at edges and corners.
- When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
- Lightly sand and dust surfaces to receive high gloss finishes, unless instructed otherwise by coating manufacturer.
- Dust coatings between coats.

Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.

Remove spatter and droppings after completion of coating.

Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.

Plural component application: Drums shall be premixed each day. All gauges shall be working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to insure set time is complete prior to each application. Hardness testing shall be preformed after each application.

Spray application:

- Stripe coat edges, welds, nuts, bolts, difficult to reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.
- When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray application.
- Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
- Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.

Drying and recoating:

- Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- For submerged service the CONTRACTOR shall provide a letter to the ENGINEER that the lining system is fully cured and ready to be placed into service.

Limit drying time to that required by these Specifications or coating manufacturer's instructions.
Do not allow excessive drying time or exposure which may impair bond between coats.
Recoat epoxies within time limits recommended by coating manufacturer.
When time limits are exceeded, abrasive blast clean and de-gloss clean prior to applying another coat.
When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces which cannot be abrasive blasted, coat components before attachment.
Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
Touch up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
Leave no holidays.
Sand and feather in to a smooth transition and recoat and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to naked eye.

Concrete:
Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

ALKALI RESISTANT BITUMASTIC

Preparation:
Prepare surfaces in accordance with general preparation requirements.

Application:
Apply in accordance with general application requirements and as follows:
Apply at least 2 coats, 8- to 14-mils dry film thickness each.

WAX COATING

Preparation:
Prepare surfaces in accordance with general preparation requirements.

Application:
Apply in accordance with general application requirements and as follows:
Apply at least 1/32-inch thick coat with 2-inch or shorter bristle brush.
Thoroughly rub coating into metal surface with canvas covered wood block or canvas glove.

HIGH SOLIDS EPOXY SYSTEM

Preparation:
Prepare surfaces in accordance with general preparation requirements and as follows:
Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP-5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-10.

Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP-10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP-6.
Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP-7.

Application:

Apply coatings in accordance with general application requirements and as follows:

Apply minimum 2-coat system with minimum total dry film thickness (DFT) of 12 mils.
Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
Coat metal to be submerged before installation when necessary, to obtain acceptable finish, and to prevent damage to other surfaces.
Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

Preparation:

Prepare surfaces in accordance with general preparation requirements and as follows:

Prepare concrete surfaces in accordance with general preparation requirements.
Touch up shop primed steel and miscellaneous iron.
Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
Lightly sand (de-gloss) fiberglass and poly vinyl chloride (PVC) pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
Abrasive blast clean ductile iron surfaces.

Application:

Apply coatings in accordance with general application requirements and as follows:

Apply 3 coat system consisting of:
Primer: 4 to 5 mils dry film thickness high solids epoxy.
Intermediate coat: 4 to 5 mils dry film thickness high solids epoxy.
Topcoat: 2.5 to 3.5 mils dry film thickness aliphatic or aliphatic-acrylic polyurethane topcoat.

Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.

TECHNICAL SPECIFICATIONS

ASPHALT VARNISH

Preparation:
Prepare surfaces in accordance with general preparation requirements.

Application:
Apply coatings in accordance with general application requirements and as follows:
Apply minimum 2 coats.

COAL TAR EPOXY SUBSTITUTE

Preparation:
Prepare surfaces in accordance with general preparation requirements and in accordance with the coating manufacturer's printed instructions.

Application:
Apply 2 coats at 6 mils to 8 mils each, for a minimum total DFT of 12 mils.

CONCRETE FLOOR COATINGS

Preparation:
Prepare surfaces in accordance with general application requirements and in strict a accordance with coating manufacturer’s instructions.

Application:
Apply primer if required by coating manufacturer.
Apply 1 or more coats as recommended by coating manufacturer to receive a minimum total dry film thickness of 25 mils, color as selected by OWNER.

Final topcoat shall include non-skid surface, applied in strict accordance with coating manufacturer's instructions.

WATERBORNE ACRYLIC EMULSION

Preparation:
Remove all oil, grease, dirt, and other foreign material by Solvent Cleaning in accordance with SSPC SP-1.
Lightly sand all surfaces and wipe thoroughly with clean cotton cloths before applying coating.

Application:
Apply 2 or more coats to obtain a minimum dry film thickness (DFT) of 5.0 mils.

FIELD QUALITY CONTROL

Each coat will be inspected. Strip and remove defective coats, prepare surfaces and recoat. When approved, apply next coat.

Control and check dry film thicknesses and integrity of coatings.

Measure dry film thickness with calibrated thickness gauge.

Dry film thicknesses on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gage or Positector 6000.

Verify coat integrity with low-voltage sponge or high-voltage spark holiday detector, for submerged service, in accordance with SP0188 06. Allow ENGINEER to use detector for additional checking.

Check wet film thickness before coal tar epoxy coating cures on concrete or non-ferrous metal substrates.

Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:

Notify ENGINEER 24 hours in advance of each visit by coating manufacturer's representative.

Provide ENGINEER with a written report by coating manufacturer's representative within 48 hours following each visit.

SCHEDULE OF ITEMS NOT REQUIRING COATING

General: Unless specified otherwise, the following items do not require coating:

- Items that have received final coat at factory and not listed to receive coating in field.
- Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
- Buried or encased piping or conduit.
- Exterior concrete.
- Galvanized steel wall framing, galvanized roof decking, galvanized electrical conduits, galvanized pipe trays, galvanized cable trays, and other galvanized items:
  - Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
    - Clean damaged areas by SSPC SP-1, SP-2, SP-3, or SP-7 as required.
    - Apply 2 coats of a Galvanizing Zinc Compound in strict accordance with manufacturer’s instructions.
  - Grease fittings.
  - Fiberglass ducting or tanks in concealed locations.
  - Steel to be encased in concrete or masonry.

SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 46_05_11.

- High solids epoxy and polyurethane system: Interior and exterior non-immersed ferrous metal surfaces including:
  - Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
  - Motors and motor accessory equipment.
  - Drive gear, drive housing, coupling housings, and miscellaneous gear drive equipment.

Valve and gate operators and stands.
Structural steel including galvanized structural steel.
Exposed metal decking.
Exterior of tanks and other containment vessels.
Mechanical equipment supports, drive units, and accessories.
Pumps not submerged.
Metal in contact with concrete or masonry.
Other miscellaneous metals.

High solids epoxy system:

Field priming of ferrous metal surfaces with defective shop prime coat where no other prime coat is specified; for non-submerged service.
Bell rings, underside of manhole covers and frames.
Exterior of submerged piping and valves other than stainless steel or PVC piping.
Submerged pipe supports and hangers.
Stem guides.
Other submerged iron and steel metal unless specified otherwise.
Submerged piping.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_00

COMMON WORK RESULTS FOR ELECTRICAL

GENERAL

SUMMARY

Section includes:

General requirements applicable to all Electrical Work.
General requirements for electrical submittals.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

Interfaces to equipment, instruments, and other components:

The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.
Provide all material and labor needed to install the actual equipment furnished, and include all costs to add any additional conduit, wiring, terminals, or other electrical hardware to the Work, which may be necessary to make a complete, functional installation based on the actual equipment furnished:
Make all changes necessary to meet the manufacturer's wiring requirements. Submit all such changes and additions to the ENGINEER for acceptance as specified in General Conditions 6.0.
Review the complete set of Drawings and Specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include any such items that appear on the Drawings or in the Specifications from another discipline in the scope of Work:

If a conflict between Drawings and Specifications is discovered, refer conflict to the ENGINEER as soon as possible for resolution.

All electrical equipment and systems for the entire Project must comply with the requirements of the Electrical Specifications, whether referenced in the individual Equipment Specifications or not:

The requirements of the Electrical Specifications apply to all Electrical Work specified in other sections, including HVAC controls, packaged mechanical systems, LCPs, VCPs, etc.
Inform all vendors supplying electrical equipment or systems of the requirements of the Electrical Specifications.

The OWNER is not responsible for any additional costs due to the failure of the CONTRACTOR to notify all subcontractors and suppliers of the Electrical Specifications requirements.

Contract Documents:

General:

The Drawings and Specifications are complementary and are to be used together in order to fully describe the Work.

Specifications:

The General and Supplementary Conditions of the Contract Documents govern the Work.

These requirements are in addition to all General Requirements.

Contract Drawings:

The Electrical Drawings show desired locations, arrangements, and components of the Electrical Work in a diagrammatic manner.

Locations of equipment, control devices, instruments, boxes, panels, etc. are approximate only; exercise professional judgment in executing the Work to ensure the best possible installation:

The equipment locations and dimensions indicated on the Drawings are approximate. Use the shop drawings to determine the proper layout, foundation, and pad requirements, etc. for final installation. Coordinate with all subcontractors to ensure that all electrical equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.

The CONTRACTOR has the freedom to select any of the named manufacturers as identified in the individual specification sections; however, the ENGINEER has designed the spatial equipment layout based upon a single manufacturer and has not confirmed that every named manufacturer's equipment fits in the allotted space. It is the CONTRACTOR's responsibility to ensure that the equipment being furnished fits within the defined space.

Installation details:

The Contract Drawings include typical installation details, the CONTRACTOR is to use to complete the Electrical Work. For cases where a typical detail does not apply, develop installation details that may be necessary for completing the Work, and submit these details for review by the ENGINEER.

Alternates/Alternatives:

Coordinate with General Conditions, GC 6.0 for substitute item provisions.

Changes and change orders:

As specified in General Conditions, GC 6.0

REFERENCES

Code compliance:

The publications are referred to in the text by the basic designation only. The latest edition accepted by the Authority Having Jurisdiction of referenced publications in effect at the time of the bid governs.

TECHNICAL SPECIFICATIONS

The standards listed are hereby incorporated into this Section

American National Standards Institute (ANSI).
ASTM International (ASTM).
Illuminating Engineering Society (IES) of North America.
Institute of Electrical and Electronics Engineers (IEEE).
Institute of Power Cable Engineers Association National Board of Fire Underwriters (NBFU).
Insulated Power Cable Engineers Association (IPCEA).
InterNational Electrical Testing Association (NETA).
International Society of Automation (ISA).
National Electrical Manufacturers Association (NEMA):
250 - Enclosures for Electrical Equipment (1000 V Maximum).
National Fire Protection Association (NFPA):
70 - National Electric Code (NEC).
National Institute of Standards and Technology (NIST).
Requirements of the serving Utilities.
Rules of the National Board of Fire Underwriters.
Safety Orders of Industrial Accident Commission.
Underwriters' Laboratories, Inc. (UL).

Compliance with laws and regulations:

As specified in General Conditions 1.0.

DEFINITIONS

Definitions of terms and other electrical and instrumentation considerations as set forth by:

IEEE.
NETA.
ISA.
NEC.
NEMA.
NFPA.

Specific definitions:

FAT: Factory acceptance test.
ICSC: Instrumentation and controls subcontractor.
LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
PCIS: Process control and instrumentation system.
RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.
Space: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that does not physically contain a device but is capable of accepting a device with no modifications to the equipment, i.e., provide all standoffs, bus, and hardware, as part of the space.

Spare: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that physically contains a device with no load connections to be made.

VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the ICSC. These panels may contain PLCs, RIO, OIT, HMI, etc.

Unequipped space: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that does not physically contain a device, standoff, bus, hardware, or other equipment.

SYSTEM DESCRIPTION

General requirements:

The Work includes everything necessary for and incidental to executing and completing the Electrical Work indicated on the Drawings and specified in the Specifications and reasonably inferable there from:

The Electrical Drawings are schematic in nature; use the Structural, Architectural, Mechanical, and Civil Drawings for all dimensions and scaling purposes.

It is the intent of these Specifications that the entire electrical power, instrumentation, and control system be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of equipment furnished by others as well as equipment furnished by the CONTRACTOR, whether or not specifically mentioned but which are necessary for successful operation.

Provide all Electrical Work, including conduit, field wiring, and connections by the electrical subcontractor under the provisions of the Electrical Specifications for all aspects of the Work, including heating, ventilating, and air conditioning.

Coordinate all aspects of the Work with the electrical subcontractor and other subcontractors before bidding in order to ensure that all costs associated with a complete installation are included. The OWNER is not responsible for any change orders due to lack of coordination of the Work between the CONTRACTOR, the electrical subcontractor, the other subcontractors or suppliers.

Demolition:

Where demolition is specified or indicated on the Drawings, disconnect all associated electrical equipment and render the equipment safe.

Remove and dispose of all conduit, wire, electrical equipment, controls, etc. associated with the items and/or areas to be demolished as indicated on the Drawings unless otherwise indicated.

Salvage electrical equipment as specified in Section 01_35_21.

For each piece of equipment to be removed, remove all ancillary components (e.g. instruments, solenoid valves, disconnect switches, etc.).

Conduit:

Where conduit removal, other than associated with equipment to be removed, is indicated on the Drawings**:**

Remove exposed conduit to the point of encasement or burial.

Cut conduit flush and plug or cap encased or buried conduit.

Where conduits are to remain in place and removal is not indicated on the Drawings:

Cap conduit open ends.

Re-label empty conduits as spare.

Remove all wire back to the source for all conduits to be removed or abandoned in place.

Provide new nameplates for modified electrical distribution equipment, motor control centers etc. to identify equipment and circuits that are no longer used as spares.

Provide new typewritten schedules for all modified panelboards.

Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:

Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before starting any Work. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.

Provide and document interface with, modifications to, upgrades, or replacement of existing circuits, power systems, controls, and equipment.

Provide all trenching, forming, rebar, concrete, back filling, hard surface removal and replacement, for all items associated with the Electrical Work and installation: As specified in the Contract Documents.

Defective Work:

As specified in General Conditions 3.0.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and this Section.

General:

Instruct all equipment suppliers of submittals and operation and maintenance manuals of the requirements in this Section.

Furnish the submittals required by each section in the Electrical Specifications.

Adhere to the wiring numbering scheme specified in Section 26_05_53 throughout the Project:

Uniquely number each wire.

Wire numbers must appear on all Equipment Drawings.

Use equipment and instrument tags, as indicated on the Drawings, for all submittals.

Submittal organization:

First page:

Specification section reference.

Name and telephone number of individual who reviewed submittal before delivery to ENGINEER.

Name and telephone number of individual who is primarily responsible for the development of the submittal.

Place for CONTRACTOR’s review stamp and comments.

Next pages:

Provide confirmation of specification compliance in a tabular form that individually lists each specification section, paragraph, and sub-paragraphs and unequivocally states compliance with said requirement or takes exception to the requirement and lists the reason for said exception and offers alternative means for compliance.

Include a response in writing to each of the ENGINEER's comments or questions for submittal packages which are re-submitted:

In the order that the comments or questions were presented throughout the submittal.

Referenced by index section and page number on which the comment appeared.

Acceptable responses to ENGINEER's comments are either:

ENGINEER's comment or change is accepted and appropriate changes are made.

Explain why comment is not accepted or requested change is not made.

Explain how requirement will be satisfied in lieu of comment or change requested by ENGINEER.

Any re-submittal, which does not contain responses to the ENGINEER's previous comments shall be returned for Revision and Re-submittal.

No further review by the ENGINEER will be performed until a response for previous comments has been received.

Remaining pages:

Actual submittal data:

Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section.

For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is intended to be used.

Operation and maintenance manuals:

As specified in General Conditions 8.0.

Material and equipment schedules:

Furnish a complete schedule and/or matrix of all materials, equipment, apparatus, and luminaries that are proposed for use:

Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

Roof penetrations:

Submit details of all portions of the electrical installation that penetrate the roof. Include details showing support of the penetrating component, and the sealing means to be utilized.

Record Documents:

Provide Record Documents of all Electrical Drawings.

Record Drawing requirements:

Update Record Drawings weekly.

Record Drawings must be fully updated as a condition of the monthly progress payments.

Submit Record Drawings upon completion of the Work for final review.

Clearly and neatly show all changes including the following:

All existing pipe, conduit, wire, instruments or other structures encountered or uncovered during construction.

Calculations:

Where required by specific Electrical Specifications:

Because these calculations are being provided by a registered professional engineer, they will be reviewed for form, format, and content but will not be reviewed for accuracy and calculation means.

Factory acceptance test:

As specified in Section 01_33_00.

QUALITY ASSURANCE

Furnish all equipment listed by and bearing the label of UL or of an independent testing laboratory acceptable to the ENGINEER and the Authority Having Jurisdiction.

DELIVERY, STORAGE, AND PROTECTION

Shipping precautions:

After completion of shop assembly and successful factory testing, pack all equipment in protective crates, and enclose in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture.

Place dehumidifiers, when required, inside the polyethylene coverings.

Skid-mount the equipment for final transport.

Provide lifting rings for moving without removing protective covering.

Display boxed weight on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

Delivery and inspection:

Deliver products in undamaged condition, in manufacturer's original container or packaging with identifying labels intact and legible. Include date of manufacture on label.

Special instructions:

Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.

PROJECT OR SITE CONDITIONS

Site conditions:

Provide an electrical, instrumentation and control system, including all equipment, raceways, and any other components required for a complete installation that meets the environmental conditions for the Site as specified in the General Requirements and below.

Seismic classification:

Provide all electrical equipment and construction techniques suitable for the seismic requirements for the Site, as specified in Section 01_81_02.

Wind:

Provide all electrical equipment and construction techniques suitable for the Site wind loading criteria, as specified in Section 01_81_04.

Site security:

Abide by all security and safety rules concerning the Work on the Site, as specified in Section 01_35_22.

Outdoor installations:

Provide electrical, instrumentation and control equipment suitable for operation in the ambient conditions where the equipment is located.
Provide heating, cooling, and dehumidifying devices incorporated into and included with electrical equipment, instrumentation and control panels to maintain the enclosures within the rated environmental operating ranges as specified in this Section for the equipment:
Provide all wiring necessary to power these devices.

Provide enclosures for electrical, instrumentation and control equipment, regardless of supplier or subcontractor furnishing the equipment, that meet the requirements outlined in NEMA Standard 250 for the following types of enclosures:

NEMA Type 1: Intended for indoor use, primarily to provide a degree of protection from accidental contact with energized parts or equipment.
NEMA Type 4: Intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation, and freezing.
NEMA Type 4X: Made from corrosion resistant materials (fiberglass reinforced plastic, 316 stainless steel or equal) and are intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation and freezing, and corrosion.
NEMA Type 12: Intended for indoor use, primarily to provide a degree of protection from dust, falling dirt and dripping non-corrosive liquids.
NEMA Type 6: Rated for submergence.
NEMA Type 6P: Rated for prolonged submergence.
NEMA Type 7: Intended for installation in locations where explosive or combustible gas or vapors may be present (Class I Division 1 or Class I Division 2) meeting the requirements outlined in Section 26_05_02.

Plant area Electrical Work requirements:

Provide all Electrical Work in accordance with the following table, unless otherwise specifically indicated on the Drawings:

PLANT AREA	NEMA ENCLOSURE TYPE	EXPOSED CONDUIT TYPE	ENVIRONMENT W = WET D = DAMP C = CLEAN/DRY X = CORROSIVE H = HAZARDOUS	SUPPORT MATERIALS
Digester No. 1 & No. 2 Interior	7, 4X	PCS	H: Class 1, Div1	SST
Digester No. 1 & No. 2 Exterior Dome	7, 4X	PCS	H: Class 1, Div 1. 10’-0” vertically from dome surface, in accordance with NFPA 820; Class 1, Div 2. 15’-0” vertically from interface with Class 1, Div 1 area, in accordance with NFPA 820.	SST

PLANT AREA	NEMA ENCLOSURE TYPE	EXPOSED CONDUIT TYPE	ENVIRONMENT W = WET D = DAMP C = CLEAN/DRY X = CORROSIVE H = HAZARDOUS	SUPPORT MATERIALS
Digester No. 1 & No. 2 Exterior Wall	7, 4X	PCS	H: Class 1, Div 1. 5'-0" horizontally from wall surface, in accordance with NFPA 820; Class 1, Div 2. 5'-0" horizontally from interface with Class 1, Div 1 area, in accordance with NFPA 820.	SST

Modify exposed conduit runs as specified in Section 26_05_33.

SCHEDULING

General:

As specified in General Conditions 3.0.
General scheduling requirements are specified in General Conditions 3.0.
Work restrictions and other scheduling requirements are specified in Special Conditions 3.

WARRANTY

Warrant the Electrical Work as specified General Conditions, GC 8.9:

Provide additional warranty as specified in the individual Electrical Specifications.

SYSTEM START-UP

Replace or modify equipment, software, and materials that do not achieve design requirements after installation in order to attain compliance with the design requirements:

Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the ENGINEER.

MAINTENANCE

Before Substantial Completion, perform all maintenance activities required by any sections of the Specifications including any calibrations, final adjustments, component replacements or other routine service required before placing equipment or systems in service.

Furnish all spare parts as required by other sections of the Specifications.

TECHNICAL SPECIFICATIONS

PRODUCTS

MANUFACTURERS

Provide similar items of same manufacturer throughout the electrical and instrumentation portion of the Project.

Allowable manufacturers are specified in individual Electrical Specifications.

MATERIALS

Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products and that bear all approvals and labels as required by the Specifications.

Provide materials complying with the applicable industrial standard as specified in General Conditions 4.0.

Stainless steel:

Where stainless steel is indicated or used for any portion of the Electrical Work, provide a non-magnetic, corrosion-resistant alloy, ANSI Type 316, satin finish.
Provide exposed screws of the same alloys.
Provide finished material free of any burrs or sharp edges.
Use only stainless steel hardware, when chemically compatible, in all areas that are or could be in contact with corrosive chemicals.
Use stainless steel hardware, when chemically compatible, in all chemical areas or areas requiring NEMA Type 4X construction.
Do not use stainless steel in any area containing chlorine, gas or solution, chlorine products or ferric chloride.

SOURCE QUALITY CONTROL

Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products.

Arrange with all manufacturers of the electrical equipment, to allow the OWNER and ENGINEER to inspect and witness the testing of the equipment at the site of fabrication:

Testing includes the cabinets, special control systems, power equipment, and other pertinent systems and devices.

Factory testing is specified in the individual sections of the Electrical Specifications.

EXECUTION

EXAMINATION

The electrical subcontractor is required to attend a pre-bid conference and examine the premises completely before bidding. It is the electrical subcontractor's responsibility to be fully familiar with the existing conditions and local requirements and regulations.

Review the site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.

Provide a complete electrical system:

Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical, PCIS, and HVAC system.

INSTALLATION

Equipment locations shown on Electrical Drawings may change due to variations in equipment size or minor changes made by others during construction:

Verify all dimensions indicated on the Drawings:

Actual field conditions govern all final installed locations, distances, and levels.

Review all Contract Documents and approved equipment shop drawings and coordinate Work as necessary to adjust to all conditions that arise due to such changes.

Make minor changes in location of equipment before rough in, as directed by the OWNER or ENGINEER.

Install all material and equipment in accordance with the manufacturer's installation instructions, including anchoring methods and leveling criteria:

Where CONTRACTOR asks to deviate from the manufacturer's recommendations, such changes must be reviewed and accepted by the ENGINEER and manufacturer before installation.

Cutting and patching:

Perform all cutting, patching, channeling, core drilling, and fitting required for the Electrical Work, except as otherwise directed:

Secure the permission of the ENGINEER before performing any operation likely to affect the strength of a structural member such as drilling, cutting or piercing:

Before cutting, channeling, or core drilling any surface, ensure that no penetration of any other systems will be made:

Verify that area is clear and free of conduits, cables, piping, ductwork, post-tensioning cables, etc.

Use tone-locate system or X-ray to ensure that area is clear of obstructions.

Review the complete Drawing set to ensure that there are no conflicts or coordination problems before cutting, channeling, or core drilling any surface.

Perform all patching to the same quality and appearance as the original work.

Employ the proper tradesmen to secure the desired results. Seal around all conduits, wires, and cables penetrating walls, ceilings, and floors in all locations with a fire stop material, typically:

3M	CP 25WB+	Caulk.
3M	Fire Barrier	Putty.

Seal around conduit penetrations of below grade walls with a waterproof, non-shrink, non-metallic grout, unless otherwise indicated on the typical installation details:

Use the installation details indicated on the Drawings as a guide for acceptable sealing methods.

Install all conduits and equipment in such a manner as to avoid all obstructions and to preserve headroom and keep openings and passageways clear:

Install all conduits and equipment in accordance with working space requirements as outlined in the NEC.

This includes any panel, disconnect switch or other equipment that can be energized while open exposing live parts regardless of whether is likely to require examination or has serviceable parts.

Where the Drawings do not show dimensions for locating equipment, install equipment in the approximate locations indicated on the Drawings.

Adjust equipment locations as necessary to avoid any obstruction or interferences.

Where an obstruction interferes with equipment operation or safe access, relocate the equipment.

Where the Drawings do not indicate the exact mounting and/or supporting method to be used, use materials and methods similar to the mounting details indicated on the Drawings.

Earthwork and concrete:

Install all trenching, shoring, concrete, backfilling, grading and resurfacing associated with the Electrical Work:

Requirements as specified in the Contract Documents.

Roof penetrations:

Seal conduit penetrations in accordance with roofing manufacturer's instructions.

Terminations:

Provide and terminate all conductors required to interconnect power, controls, instruments, panels, and all other equipment.

Miscellaneous installation requirements:

In case of interference between electrical equipment indicated on the Drawings and the other equipment, notify the ENGINEER as specified in General Conditions 6.0.

Location of manholes and pullboxes indicated on the Drawings are approximate. Coordinate exact location of manholes and pullboxes with Mechanical and Civil Work.

Provide additional manholes or pullboxes to those shown where they are required to make a workable installation.

Equipment tie-downs:

Anchor all instruments, control panels, and equipment by methods that comply with seismic and wind bracing criteria, which apply to the Site.

FIELD QUALITY CONTROL

Inspection:

Allow for inspection of electrical system installation as specified in Section 01_45_00.

Provide any assistance necessary to support inspection activities.

ENGINEER inspections may include, but are not limited to, the following:

Inspect equipment and materials for physical damage.

Inspect installation for compliance with the Drawings and Specifications.

Inspect installation for obstructions and adequate clearances around equipment.
Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.
Inspect equipment nameplate data to verify compliance with design requirements.
Inspect raceway installation for quality workmanship and adequate support.
Inspect cable terminations.
Schedule structural engineer to inspect all mounting of electrical devices and all penetration and connections to structures.

Field testing:
Notify the ENGINEER when the Electrical Work is ready for field acceptance testing.
Record results of the required tests along with the date of test:
Use conduit identification numbers to indicate portion of circuit tested.

Workmanship:
Leave wiring in panels, manholes, boxes, and other locations neat, clean, and organized:
Neatly coil and label spare wiring lengths.
Shorten, re-terminate, and re-label excessive used as well as spare wire and cable lengths, as determined by the ENGINEER.

CLEANING

As specified in Section 01_77_00.

Remove all foreign material and restore all damaged finishes to the satisfaction of the ENGINEER and OWNER.

Clean and vacuum all enclosures to remove all metal filings, surplus insulation and any visible dirt, dust or other matter before energization of the equipment or system start-up:
Use of compressors or air blowers for cleaning is not acceptable.

Clean and re-lamp all new and existing luminaires that were used in the areas affected by the construction, and return all used lamps to the OWNER.

As specified in other sections of the Contract Documents.

DEMONSTRATION AND TRAINING

Furnish all personnel and equipment necessary to conduct the demonstration and training requirements as specified in the individual sections.

PROTECTION

Protect all Work from damage or degradation until Substantial Completion.

Maintain all surfaces to be painted in a clean and smooth condition.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_02

HAZARDOUS CLASSIFIED AREA CONSTRUCTION

GENERAL

SUMMARY

Section includes:

Executing and completing Work in hazardous and/or classified areas as defined by the National Electrical Code (NEC) Articles 500 through 516, NFPA 820, and as indicated on the Drawings and specified in the Specifications.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

DEFINITIONS

As specified in Section 26_05_00.

Specific definitions:

For the purposes of these Specifications, the terms "Hazardous" and "Classified" will be considered synonymous.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0.

QUALITY ASSURANCE

As specified in Section 26_05_00.

Regulatory requirements:

All wiring in hazardous and/or classified locations shall comply with all applicable articles of the NEC, in particular Articles 500 through 516.

Except as modified in Articles 500 through 516, all other applicable rules contained in the NEC shall apply to electric equipment and wiring installed in hazardous and/or classified locations.

All devices used in Class I Division 1 or Division 2 areas must have visible manufacturer installed nameplates specifically stating the Class, Division, and Group for which the device is approved.

TECHNICAL SPECIFICATIONS

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

PRODUCTS

COMPONENTS

Conduit and sealing fittings:
As specified in Section 26_05_33.

Conduit boxes and bodies:
As specified in Section 26_05_34.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Conduit installation:
As specified in Section 26_05_33.
Wrench tighten all conduit joints to minimize sparking when fault current flows through the conduit system.
Make all conduit connections so that there are a minimum of 5 threads fully engaged in the connection.
Flexible conduit:
Class I Division 1 hazardous areas:
Approved and marked suitable for Class I Division 1.
Listed for compatibility with the group type atmosphere where used.
Class I Division 2 areas:
Liquid-tight metal conduit with approved fittings.
Maximum length as specified in Section 26_05_33.

Sealing fittings:
Provide an approved seal, no more than 12 inches from the enclosure, for all conduits entering an enclosure containing switches, circuit breakers, fuses, relays, resistors, or any other apparatus which may produce arcs, sparks, or high temperatures:
Only explosion proof unions, couplings, elbows, capped elbows, and conduit bodies similar to “L”, “T”, and “X” may be installed between the sealing fitting and the enclosure.
Provide entire assemblies approved for Class I locations for self sealing or factory sealed assemblies where the equipment that may produce arcs, sparks, or high temperatures is located in a compartment separate from the compartment containing splices or taps, and an integral seal is provided where conductors pass from one compartment to the other:
Seals are required in all conduit connections to the compartment containing splices and must be within 12 inches of the enclosure.
Install a conduit seal within 12 inches of the boundary in each conduit run entering or leaving a classified location. No union, coupling, box, or fitting is

allowed in the conduit between the sealing fitting and the point at which the conduit leaves the classified location.

For underground conduits entering or leaving a classified location or between Class I Division 1 and Division 2 locations:

Provide a conduit seal at both points where the conduit emerges from the ground:

Place the conduit seal within 18 inches of finished grade.

No union, coupling, box, or fitting is allowed in the conduit system between the seal fitting and the point at which the conduit enters the ground.

Separate all conductors within the conduit system and seal using an approved packing dam installed to both hold the sealing compound and to maintain the separation between the wires:

Remove the outer jacket of multi-conductor non-shielded cables in the area of the sealing fitting and separate each conductor from the cable and seal individually.

Install seals with drains in all electrical control stations, low points of conduit or any place where moisture may condense and accumulate.

Install the sealing compound with a minimum thickness of 5/8 inch or the trade size of the conduit, whichever is greater.

Boxes and fittings:

Class I Division 1 areas:

Utilize threaded connections for all metallic boxes, fittings, and joints to the conduit system.

Class I Division 2 areas:

Provide approved grounding bushings on conduits entering and exiting metallic boxes to bond the conduits together.

Outlet boxes and bodies:

Provide conduits bodies and boxes suitable for the conduit system as specified in Section 26_05_33.

Class I Division 2 areas:

Boxes not containing arcing parts:

Material and NEMA ratings as specified in Section 26_05_00.

Pressed metal boxes are not allowed.

Provide heavy duty cast construction type conduit fittings and joints:

Explosion proof rated fittings and joints are not necessary.

Any enclosure containing arcing parts, etc. shall have all construction associated with the enclosure, conduit system, etc. conforming to Class I Division 1 construction.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_19

600 VOLT OR LESS WIRES AND CABLES

GENERAL

SUMMARY

Section includes:
600 volt class wire and cable.
Instrumentation class wire and cable.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

ASTM International (ASTM):
B 3 - Standard Specification for Soft or Annealed Copper Wire.
B 8 - Standard Specification for Concentric-Lay–Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

CSA International (CSA).

Insulated Cable Engineers Association (ICEA):
NEMA WC 70/ICEA S-95-658-1999 - Standard for Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
NEMA WC 57/ICEA S-73-532 - Standard for Control, Thermocouple Extension, and Instrumentation Cables.

National Electrical Code (NEC).

National Electrical Manufacturers Association (NEMA):
250 – Enclosures for Electrical Equipment (1000 V Maximum).

National Fire Protection Association (NFPA):
72 - National Fire Alarm and Signaling Code.
101 - Life Safety Code.

Telecommunications Industry Association/Electronics Industry Association (TIA/EIA):
568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard.

Underwriter's Laboratories Inc., (UL):
- 44 - Thermoset-Insulated Wires and Cables.
- 1424 - Standard for Cables for Power-Limited Fire-Alarm Circuits.
- 1569 - Standard for Metal-Clad Cables.
- 2196 - Standard for Tests for Fire Resistive Cables.
- 2225 - Standard for Cables and Cable-Fittings For Use in Hazardous (Classified) Locations.

DEFINITIONS

As specified in Section 26_05_00.

Definitions of terms and other electrical considerations as set forth in the:
- ASTM.
- ICEA.

NEMA:
- Type 4 enclosure in accordance with NEMA 250.
- Type 4X enclosure in accordance with NEMA 250.

SYSTEM DESCRIPTION

Furnish and install the complete wire and cable system.

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:
- Manufacturer of wire and cable.
- Insulation:
  - Type.
  - Voltage class.
- American wire gauge (AWG) size.
- Conductor material.
- Pulling compounds.

Shop drawings:
- Show splice locations.

QUALITY ASSURANCE

As specified in Section 26_05_00.

All wires and cables shall be UL listed and labeled.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START-UP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

One of the following or equal:
- 600 volt class wire and cable:
  - General Cable.
  - Okonite Company.
  - Southwire Company.
- Instrumentation class wire and cable:
  - Alpha Wire Company.
  - Belden CDT.
  - General Cable BICC Brand.
  - Okonite Company.
  - Rockbestos Surprenant Cable Corporation.

MATERIALS

Conductors:
- Copper in accordance with ASTM B 3.

MANUFACTURED UNITS

General:
- Provide new wires and cables manufactured within 1 year of the date of delivery to the Site.
- Permanently mark each wire and cable with the following at 24-inch intervals:
  - AWG size.
  - Voltage rating.
  - Insulation type.
  - UL symbol.
  - Month and year of manufacture.
  - Manufacturer's name.
- Identify and mark wire and cable as specified in Section 26_05_53:
  - Use integral color insulation for Number 2 AWG and smaller wire.
  - Wrap colored tape around cable larger than Number 2 AWG.

600 volt class wire and cable:
- Provide AWG or kcmil sizes as indicated on the Drawings:
  - When not indicated on the Drawings, size wire as follows:
    - In accordance with the NEC:
      - Use 75 degree Celsius ampacity ratings.
      - Ampacity rating after all derating factors, equal to or greater than rating of the overcurrent device.
  - Provide Number 12 AWG minimum for power conductors.
  - Provide Number 14 AWG minimum for control conductors.
- Provide Class B stranding in accordance with ASTM B 8:

Provide Class C stranding where extra flexibility is required.

Insulation:
- XHHW-2.
- 90 degrees Celsius rating.

Instrumentation class cable:
- Type TC.
- Suitable for use in wet locations.
- Voltage rating: 600 volts.
- Temperature rating:
  - 90 degrees Celsius rating in dry locations.
  - 75 degrees Celsius rating in wet locations.
- Conductors:
  - Insulation:
    - Flame-retardant PVC, 15 mils nominal thickness, with nylon jacket 4 mils nominal thickness.
  - Number 16 AWG stranded and tinned.
  - Color code:
    - Pair: Black and white.
    - Triad: Black, white and red.
    - Multiple pairs or triads:
      - Color-coded and numbered.
- Drain wire:
  - 18 AWG.
  - Stranded, tinned.
- Jacket:
  - Flame retardant, moisture and sunlight resistant PVC.
  - Ripcord laid longitudinally under jacket to facilitate removal.
- Shielding:
  - Individual pair/triad:
    - Minimum 1.35-mil double-faced aluminum foil/polyester tape overlapped to provide 100 percent coverage.
  - Multiple pair or triad shielding:
    - Group shield: Minimum 1.35-mil double-faced aluminum foil/polyester tape overlapped to provide 100 percent coverage.
    - Completely isolate group shields from each other.
    - Cable shield: 2.35 mils double-faced aluminum and synthetic polymer backed tape overlapped to provide 100 percent coverage.
  - All shielding to be in contact with the drain wire.

ACCESSORIES

Wire ties:
- One of the following or equal:
  - T&B "Ty-Rap" cable ties.
  - Panduit cable ties.

Wire markers:
- As specified in Section 26_05_53.

SOURCE QUALITY CONTROL

Assembly and testing of cable shall comply with the applicable requirements of ICEA S-95-658-1999.

Test Type XHHW-2 in accordance with the requirements of UL 44.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Color-coding:
- Color-coding shall be consistent throughout the facility.
- The following color code shall be followed for all 240/120 volt and 208/120 volt systems:
  - Phase A - Black.
  - Phase B - Red.
  - Phase C - Blue.
  - Single phase system - Black for one hot leg, red for the other.
  - Neutral - White.
  - High phase or wild leg - Orange.
  - Equipment ground - Green.
- The following color code shall be followed for all 480/277 volt systems:
  - Phase A - Brown.
  - Phase B - Orange.
  - Phase C - Yellow.
  - Neutral - Gray.
  - Equipment ground - Green.
- The following color code shall be followed for all 120 VAC control wiring:
  - Power - Red.
  - Neutral - White.
- The following color code shall be followed for all general purpose DC control circuits:
  - Grounded conductors - White with blue stripe.
  - Ungrounded conductors - Blue.
- Switch legs shall be violet. Three-way switch runners shall be pink.
- Wires in intrinsically safe circuits shall be light blue.
- Wire colors shall be implemented in the following methods:
  - Wires manufactured of the desired color.
  - Continuously spiral wrap the first 6 inches of the wire from the termination point with colored tape:
    - Colored tape shall be wrapped to overlap 1/2 of the width of the tape.

Install conductors only after the conduit installation is complete, and all enclosures have been vacuumed clean, and the affected conduits have been swabbed clean and dry:
- Install wires only in approved raceways.
- Do not install wire:
  - In incomplete conduit runs.

Until after the concrete work and plastering is completed.

Properly coat wires and cables with pulling compound before pulling into conduits:

For all Number 4 AWG and larger, use an approved wire-pulling lubricant while cable is being installed in conduit:

Ideal Products.
Polywater Products.
3M Products.
Greenlee Products.
Or equal as recommended by cable manufacturer.
Do not use oil, grease or similar substances.

Cable pulling:

Prevent mechanical damage to conductors during installation.
For cables Number 1 AWG and smaller, install cables by hand.
For cables larger than Number 1 AWG, power pulling winches may be used if they have cable tension monitoring equipment.
Provide documentation that maximum cable pulling tension was no more than 75 percent of the maximum recommended level as published by the cable manufacturer. If exceeded, the ENGINEER may, at his discretion, require replacement of the cable.
Ensure cable pulling crews have all calculations and cable pulling limitations while pulling cable.
Make splices or add a junction box or pullbox where required to prevent cable pulling tension or sidewall pressure from exceeding 75 percent of manufacturer’s recommendation for the specified cable size:
Make splices in manholes or pull boxes only.
Leave sufficient slack to make proper connections.

Use smooth-rolling sheaves and rollers when pulling cable into cable tray to keep pulling tension and bending radius within manufacturer’s recommendations.

Install and terminate all wire in accordance with manufacturer's recommendations.

Neatly arrange and lace conductors in all switchboards, panelboards, pull boxes, and terminal cabinets by means of wire ties:
Do not lace wires in gutter or panel channel.
Install all wire ties with a flush cutting wire tie installation tool:

Use a tool with an adjustable tension setting.

Do not leave sharp edges on wire ties.

Terminate solid conductors at equipment terminal screws with the conductor tightly wound around the screw so that it does not protrude beyond the screw head:

Wrap the conductor clockwise so that the wire loop is closed as the loop is tightened.
Do not use crimp lugs on solid wire.

Terminate stranded conductors on equipment box lugs such that all conductor strands are confined within the lug:
Use ring type lugs if box lugs are not available on the equipment.

Splices:

Provide continuous circuits from origin to termination whenever possible:
Obtain ENGINEER's approval prior to making any splices.
Lighting and receptacle circuit conductors may be spliced without prior approval from the ENGINEER.
Where splices are necessary because of extremely long wire or cable lengths that exceed standard manufactured lengths:
Splice box NEMA rating requirements as specified in Section 26_05_00.
Make splices in labeled junction boxes for power conductors.
Make splices for control and instrument conductors in terminal boxes:
Provide terminal boards with setscrew pressure connectors, with spade or ring lug connectors.
Power and control conductors routed in common raceways may be spliced in common junction boxes.
Clearly label junction and terminal boxes containing splices with the word "SPLICE."
Leave sufficient slack at junction boxes and termination boxes to make proper splices and connections. Do not pull splices into conduits.
Install splices with compression type butt splices and insulate using a heat-shrink sleeve:
In NEMA Type 4 or NEMA Type 4X areas, provide heat-shrink sleeves that are listed for submersible applications.
Splices in below grade pull boxes, in any box subject to flooding, and in wet areas shall be made waterproof using:
a) A heat shrink insulating system listed for submersible applications.
b) Or an epoxy resin splicing kit.

Apply wire markers to all wires at each end after being installed in the conduit and before meg-ohm testing and termination.

Instrumentation class cable:

Install instrumentation class cables in separate raceway systems from power cables:
Install instrument cable in metallic conduit within non-dedicated manholes or pull boxes.
Install cable without splices between instruments or between field devices and instrument enclosures or panels.
Do not make intermediate terminations, except in designated terminal boxes as indicated on the Drawings.
Shield grounding requirements as specified in Section 26_05_26.

Signal cable:

Separate and isolate electrical signal cables from sources of electrical noise and power cables by minimum 12 inches.

Wiring allowances:

Equipment locations may vary slightly from the drawings. Include an allowance for necessary conductors and terminations for motorized equipment, electrical outlets, fixtures, communication outlets, instruments, and devices within 10 linear feet of locations indicated on the Drawings.
Locations for pull boxes, manholes, and duct banks may vary slightly from the drawings. Include an allowance for necessary conductors and related materials to

provide conductors to all pull boxes, manholes and duct banks within 20 linear feet of locations indicated on the Drawings.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

Grounding:
As specified in Section 26_05_26.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_26

GROUNDING AND BONDING

GENERAL

SUMMARY

Section includes:
- Grounding electrodes.
- Grounding electrode conductors.
- Equipment grounding conductors.
- Main bonding jumper.
- Ground connections.
- General requirements for grounding.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

ASTM International (ASTM):
- B 3 - Standard Specification for Soft or Annealed Copper Wire.
- B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

DEFINITIONS

As specified in Section 26_05_00.

SYSTEM DESCRIPTION

Ground equipment and raceway systems so that the completed installation conforms to all applicable code requirements.

Provide a complete electrical grounding system as indicated on the Drawings and as specified including but not limited to:
- Grounding electrodes.
- Bonding jumpers.
- Ground connections.

Provide bonding jumpers and wire, grounding bushings, clamps and appurtenances required for complete grounding system to bond equipment and raceways to equipment grounding conductors.

The ground system resistance (electrode to ground) of the completed installation, in accordance with the InterNational Electrical Testing Association, Inc (NETA), shall be:
5 ohms or less for industrial systems.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and 26_05_00.

Product data:
Catalog cut sheets.

QUALITY ASSURANCE

As specified in Section 26_05_00.

All grounding components and materials shall be UL listed and labeled.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START-UP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

Compression connectors: One of the following or equal:
FCI Burndy.
Thomas & Betts.

Ground rods: One of the following or equal:
Erico.
Harger.
Conex.

Ground cable: One of the following or equal:
Nehring.
Harger.
Southwire.

Precast ground well boxes: One of the following or equal:
Brooks Products, 3-RT Valve Box.
Christy Concrete Products, G12 Valve Box.

TECHNICAL SPECIFICATIONS

MATERIALS

Ground rod:
- Minimum: 3/4-inch diameter, 10 feet long.
- Uniform 10-mil covering of electrolytic copper metallically bonded to a rigid steel core:
  - The copper-to-steel bond shall be corrosion resistant.
- In accordance with UL 467.
- Sectional type joined by threaded copper alloy couplings.
- Fit the top of the rod with a threaded coupling and steel-driving stud.

Ground cable:
- Requirements:
  - Soft drawn (annealed).
  - Concentric lay, coarse stranded in accordance with ASTM B 8.
  - Bare copper in accordance with ASTM B 3.
- Size is as indicated on the Drawings, but not less than required by the National Electrical Code (NEC).

Compression connectors:
- Manufactured of high copper alloy specifically for the particular grounding application.
- Suitable for direct burial in earth and concrete.
- Identifying compression die number inscription to be impressed on compression fitting.

Equipment grounding conductors:
- Conductors shall be the same type and insulation as the load circuit conductors:
  - Use 600-volt insulation for the equipment grounding conductors for medium voltage systems.
  - Minimum size in accordance with the NEC.

Grounding electrode conductors:
- Minimum size in accordance with the NEC.

Main bonding jumpers and bonding jumpers:
- Minimum size in accordance with the NEC.

ACCESSORIES

Precast ground well boxes:
- Minimum 10-inch interior diameter.
- Traffic-rated cast iron cover.
- Permanent “GROUND” marking on cover.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Provide a separate, green insulated, grounding conductor in each raceway independent of raceway material:

Multi-conductor power and control cables shall include an integral green insulated grounding conductor.

Provide a separate grounding conductor in each individual raceway for parallel feeders.

Provide a separate grounding conductor for each motor and connect at motor terminal box. Do not use bolts securing motor box to frame or cover for grounding connectors:

When grounding motors driven by variable frequency drives (VFD), comply with the requirements of the VFD manufacturer.

Provide a grounding type bushing with lug for connection of grounding conductor for conduits that originate from each motor control center section, switchboard, or panelboard:

Individually bond these raceways to the ground bus in the equipment.

Provide grounding type bushings with lugs for connection of grounding conductor at both ends of metallic conduit runs. Bond ground bushings to the grounding system.

Provide a green insulated wire-grounding jumper from the ground screw to a box grounding screw and, for grounding type devices, to equipment grounding conductor.

Ground connections:

All connections to the ground grid system, the duct bank grounding system, equipment, ground rods, etc., shall be made using compression type grounding connectors, UL listed, and labeled for the application.

Make ground connections in accordance with the manufacturer's instructions.

Do not conceal or cover any ground connections until the ENGINEER or authorized representative has established and provided written confirmation that every grounding connection is as indicated on the Drawings and specified in the Specifications.

Grounding electrode system:

Ground rods:

Locations as indicated on the Drawings.

Length of rods forming an individual ground array shall be equal in length.

Drive ground rods and install grounding conductors before construction of concrete slabs and duct banks.

Pre-crimp all ground rods, as recommended by the manufacturer, before crimping connector to ground rod.

Metal underground water pipe:

Bond metal underground domestic water pipe to grounding electrode system.

Metal frame of building or structure:

Bond metal frame of building or structure to grounding electrode system.

Extend grounding conductors through concrete to accessible points for grounding equipment and electrical enclosures.

Install grounding system at each structure where switchgear, motor control centers, switchboards, panelboards, panels, or other electrical equipment are installed.

Shield grounding:

Shielded instrumentation cable shall have its shield grounded at one end only unless shop drawings indicate otherwise:

The grounding point shall be at the control panel or at the power source end of the signal carried by the cable.

Terminate the shield drain wire on a dedicated terminal block.

Use manufacturer's terminal block jumpers to interconnect ground terminals.

Connection to the panel main ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

Install ground rods in precast ground wells.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

Measure grounding electrode system resistance to ground in accordance with IEEE 81.

ADJUSTING

Under the direction of the ENGINEER, add additional parallel connected ground rods and/or deeper driven rods until the ground resistance measurement meets the specified resistance requirements:

Use of salts, water, or compounds to attain the specified ground resistance is not acceptable.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_29

HANGERS AND SUPPORTS

GENERAL

SUMMARY

Section includes:

Mounting and supporting electrical equipment and components.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

DEFINITIONS

As specified in Section 26_05_00.

SYSTEM DESCRIPTION

Design requirements:

- Demonstrate the following using generally accepted engineering methods:
  - That the anchors to the structure are adequate to resist the loads generated in accordance with the Building Code and equipment requirements.
  - That the required load capacity of the anchors can be fully developed in the structural materials to which they are attached.
- Design loading and anchoring requirements:
  - As indicated in the Building Code unless otherwise specified.
  - Seismic loading requirements:
    - Freestanding or wall-hung equipment shall be anchored in place by methods that will satisfy the requirements for the seismic design specified in Section 26_05_00.
  - Wind loading requirements:
    - All exterior freestanding equipment shall be anchored in place by methods that will satisfy the requirements for wind design specified in Section 26_05_00.
  - Minimum safety factor against overturning: 1.5.
  - The foundation and structures to which hangers and supports are attached shall be capable of withstanding all anchor loads.

Performance requirements:

Hangers and supports individually and as a system shall resist all weights and code-required forces without deflections and deformations that would

damage the supporting elements, the equipment supported, or the surrounding construction.

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:
- Supports:
  - Materials.
  - Geometry.
  - Manufacturer.
- Hardware:
  - Materials.
  - Manufacturer.

Shop drawings:
- Complete dimensioned and scalable shop drawings of all supporting structures, trapezes, wall supports, etc.
- Complete anchoring details for equipment, lighting and raceway, supporting structures, trapezes, wall supports for all equipment in excess of 200 pounds, and all freestanding supports:
  - Stamped by a professional engineer licensed in the state where the Project is being constructed.
  - Said submittals, by virtue of the fact that they bear the stamp of a registered engineer, will be reviewed for general consistency with the requirements specified in the Contract Documents, but not for context, accuracy, or method of calculation.
- Include data on attachment hardware and construction methods that will satisfy the design loading and anchoring criteria.

Installation instructions:
- Furnish anchorage instructions and requirements based on the seismic and wind conditions of the Site:
  - Stamped by a professional engineer licensed in the state where the Project is being constructed.

QUALITY ASSURANCE

As specified in Section 26_05_00.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

PROJECT OR SITE CONDITIONS

As specified in Section 26_05_00.

WARRANTY

As specified in Section 26_05_00.

SYSTEM STARTUP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

One of the following or equal:
- Thomas & Betts.
- Power-Strut.
- Unistrut.
- Cooper B-Line.
- Robroy.
- Aickinstrut.

MATERIALS

Use materials appropriate for the area as specified in Section 26_05_00.

Hot dip galvanized steel:
- Supports:
  - In accordance with ASTM A 123 or A 153.
  - Minimum zinc coating thickness of 2.6 mils.
- Hardware:
  - Electro-galvanized.
  - In accordance with ASTM A 153.

Stainless steel:
- Supports:
  - In accordance with ASTM A 240.
  - ANSI Type 316 material.
- Hardware:
  - ANSI Type 316 material.

PVC coated galvanized steel:
- Supports:
  - Hot dip galvanized steel as specified in this Section.
  - PVC coating thickness of 10 to 20 mils.
- Hardware:
  - ANSI Type 316 material.

Fiberglass:
- Supports:
  - Vinyl ester.
- Hardware:
  - Polypropylene.
  - Thermal plastic elastomer.
  - Fiberglass reinforced plastic.

ACCESSORIES

Anchors:
As specified in Section 05_12_00.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Mount all raceways, cabinets, boxes, fixtures, instruments, and devices on CONTRACTOR-fabricated racks unless otherwise indicated on the Drawings. Provide the necessary sway bracing to keep trapeze type structures from swaying.

Brace and anchor freestanding equipment supports using methods that provide structural support based on the seismic loads and wind loads:
Lateral deflection at top of supports not to exceed support height divided by 240 unless otherwise approved by the ENGINEER.

Provide fabricated steel support pedestals for wall mounted panels that weigh more than 200 pounds:
Fabricate pedestals out of welded angle, tube sections, or preformed channel.
If the supported equipment is a panel or cabinet, match the supported equipment in physical appearance and dimensions.
Provide auxiliary floor supports for transformers hung from stud walls and weighing more than 200 pounds.
Mount all equipment, cabinets, boxes, instruments, and devices in damp or wet locations on minimum of 7/8-inch preformed mounting channel.
Mount channel vertically along the length of the device so that water or moisture may run freely behind the device.

Corrosion protection:
Isolate dissimilar metals, except where required for electrical continuity.
Use neoprene washers, 9-mil polyethylene tape, or gaskets for isolation.

Raceway:
Furnish all conduit racks and trapeze structures needed to support the raceway from the structure.
Group conduits and position on racks to minimize crossovers.
Provide the necessary bracing to keep trapeze type structures from swaying under loads from cable installation, seismic forces, or wind forces.

Anchoring methods:
Solid concrete: Anchor bolts, anchor rods or post-installed anchors as specified in Section 05_12_00.
Metal surfaces: Machine screws or bolts.
Hollow masonry units: Post-installed anchors as specified in Section 05_12_00.

When supporting devices on metal or wood stud construction, bridge studs with preformed channel, and mount the devices to the channel.

Re-coat all scratches, cuts, and drilled holes in galvanized surfaces with CRC "Zinc-It" or similar product.

Re-coat all drilled holes and cut surfaces on PVC-coated materials.

Seal all drilled holes and cut surfaces on fiberglass materials.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_33

CONDUITS

GENERAL

SUMMARY

Section includes:
- Metallic conduits:
  - Rigid galvanized steel (GRC).
  - Polyvinyl chloride coated steel (PCS).
  - Liquid-tight flexible metal (SLT).
  - Explosion proof flexible (EFLX).
- Nonmetallic conduits:
  - Rigid nonmetallic (PVC).
- Conduit bodies.
- Conduit fittings and accessories.
- Conduit installation.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

American National Standards Institute (ANSI):
- C80.1 - Electrical Rigid Steel Conduit.
- C80.3 - Steel Electrical Metallic Tubing.
- C80.5 - Electrical Rigid Aluminum Conduit.
- C80.6 - Electrical Intermediate Metal Conduit.

National Electrical Manufacturer's Association (NEMA):
- RN-1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Steel Conduit.
- TC2 - Electrical Polyvinyl Chloride (PVC) Conduit.
- TC3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
- TC13 - Electrical Nonmetallic Tubing.
- TC14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

Underwriters Laboratories (UL):
- 1 - Standard for Flexible Metal Conduit.
- 6 - Standard for Electrical Rigid Metal Conduit - Steel.

6A - Standard for Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel.
360 - Standard for Liquid-Tight Flexible Steel Conduit.
651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
797 - Standard for Electrical Metallic Tubing - Steel.
1242 - Standard for Electrical Intermediate Metal Conduit - Steel.
1653 - Standard for Electrical Nonmetallic Tubing.
1660 - Standard for Liquid-Tight Flexible Nonmetallic Conduit.
1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

DEFINITIONS

As specified in Section 26_05_00.

Specific definitions and abbreviations:

Conduit bodies: A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of 2 or more conduit sections. Includes, but not limited to: shapes C, E, LB, T, X, etc.
Conduit fitting: An accessory that serves primarily a mechanical purpose. Includes, but not limited to: bushings, locknuts, hubs, couplings, reducers, etc.
GRC: Galvanized rigid steel conduit.
PCS: PVC coated rigid steel conduit.
PCA: PVC coated rigid aluminum conduit.
IMC: Intermediate metallic conduit.
EMT: Electrical metallic tubing.
PVC: Polyvinyl chloride rigid nonmetallic conduit.
SLT: Sealtight – liquid-tight flexible conduit.
EFLX: Explosionproof flexible conduit.
FLX: Flexible metallic conduit.
NFC: Nonmetallic flexible conduit.
ENT: Electrical nonmetallic tubing.
RAC: Rigid aluminum conduit.
FRD: Fiberglass reinforced duct.
NPT: National pipe thread.

SYSTEM DESCRIPTION

Provide conduits, conduit bodies, fittings, junction boxes and all necessary components, whether or not indicated on the Drawings, as required, to install a complete electrical raceway system.

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:

Furnish complete manufacturer’s catalog sheets for every type and size of conduit, fitting, conduit body, and accessories to be used on the Project.
Furnish complete manufacturer’s recommended special tools to be used for installation if required.

Certifications:

Furnish PVC-coated conduit manufacturer's certification for each installer.

Record Documents:

Incorporate all changes in conduit routing on electrical plan drawings.
Dimension underground and concealed conduits from building lines.

QUALITY ASSURANCE

As specified in Section 26_05_00.

All conduits, conduit bodies, and fittings shall be UL listed and labeled.

Every installer of PCA or PCS conduits shall be certified by the manufacturer for installation of the conduit.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

Do not expose type PVC, FRD, NFC, and ENT to direct sunlight.

Do not store conduit in direct contact with the ground.

PROJECT OR SITE CONDITIONS

As specified in Section 26_05_00.

SEQUENCING

Before installing any conduit or locating any device box:

Examine the complete set of Drawings and Specifications, and all applicable shop drawings.
Verify all dimensions and space requirements and make any minor adjustments to the conduit system as required to avoid conflicts with the building structure, other equipment, or the work of other trades.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START-UP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

Galvanized rigid steel conduit:

One of the following or equal:

Western Tube and Conduit.

Allied Tube and Conduit.
Wheatland Tube Co.

Polyvinyl chloride coated rigid steel conduit:
One of the following or equal:
Robroy Industries.
Ocal, Inc.
Perma Kote.

Flexible metallic conduit:
One of the following or equal:
AFC Cable Systems.
Allied Tube and Conduit.
ALFLEX.
Electriflex.

Seal tight liquid-tight flexible conduit:
One of the following or equal:
Southwire.
AFC Cable Systems.
Electriflex.
Anaconda.

Explosion proof flexible conduit:
One of the following or equal:
Appleton.
Crouse Hinds.
Hubbell Killark.

Rigid nonmetallic polyvinyl chloride conduit:
One of the following or equal:
Carlon.
Cantex.
Triangle Conduit and Cable.

Conduit bodies:
One of the following or equal:
Crouse-Hinds.
Appleton.
O-Z / Gedney.
Ocal.
Robroy.
Carlon.

Conduit sleeve:
One of the following or equal:
Crouse-Hinds.
Appleton.
O-Z / Gedney.

Conduit seals:
One of the following or equal:
Appleton.
Crouse-Hinds.
O-Z / Gedney.

Conduit hangers and supports:
As specified in Section 26_05_29.

Conduit through wall and floor seals:
The following or equal:
O-Z / Gedney:
Type "WSK".
Type “CSM”.

COMPONENTS

GRC:
All threads: NPT standard conduit threads with a 3/4-inch taper per foot:
Running conduit threads are not acceptable.
Hot-dip galvanized inside and out:
Ensures complete coverage and heats the zinc and steel to a temperature that ensures the zinc alloys with the steel over the entire surface.
Electro-galvanizing is not acceptable.
Manufactured in accordance with:
UL-6.
ANSI C80.1.

PCS:
The steel conduit, before PVC coating, shall be new, unused, hot-dip galvanized material, conforming to the requirements for type GRC.
Coated conduit conforms to NEMA Standard RN-1:
The galvanized coating may not be disturbed or reduced in thickness during the cleaning and preparatory process.
Factory bonded PVC jacket:
The exterior galvanized surfaces shall be coated with primer before PVC coating to ensure a bond between the zinc substrate and the PVC coating.
Nominal thickness of the exterior PVC coating shall be 0.040 inch except where part configuration or application of the piece dictate otherwise.
PVC coating on conduit and associated fittings shall have no sags, blisters, lumps, or other surface defects and free of holes and holidays.
The PVC adhesive bond on conduit and fittings shall be greater than the tensile strength of the PVC plastic coating:
Confirm bond with certified test results.
A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings:
Nominal thickness of 0.002 inch.
Conduit having areas with thin or no coating are not acceptable.
All threads shall be coated with urethane.
The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperature above 30 degrees Fahrenheit (-1 degree Celsius).

PCS conduit bodies and fittings:

Malleable iron.

The conduit body, before PVC coating, shall be new, unused material and shall conform to appropriate UL standards.

The PVC coating on the outside of conduit bodies shall be 0.040 inch thick and have a series of longitudinal ribs to protect the coating from tool damage during installation.

0.002 inch interior urethane coating.

Utilize the PVC coating as an integral part of the gasket design.

Stainless steel cover screws heads shall be encapsulated with plastic to assure corrosion protection.

A PVC sleeve extending 1 conduit diameter or 2 inches, whichever is less, shall be formed at each female conduit opening.

The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used.

The sleeve shall provide a vapor and moisture tight seal at every connection.

SLT:

Temperature rated for use in the ambient temperature at the installed location but not less than the following:

General purpose:

Temperature range -20 degrees Celsius to +80 degrees Celsius.

Oil resistant:

Temperature range -20 degrees Celsius to +60 degrees Celsius.

Sunlight resistant, weatherproof, and watertight.

Manufactured from single strip steel, hot-dip galvanized on all 4 sides before conduit fabrication.

Strip steel spiral wound resulting in an interior that is smooth and clean for easy wire pulling.

Overall polyvinyl chloride jacket.

With integral copper ground wire, built in the core, in conduit trade sizes 1/2 inch through 1-1/4 inch.

EFLX:

Suitable for the hazardous Class and Group where installed:

As specified in Section 26_05_00.

Metallic braid shall provide continuous electrical path.

Stainless steel construction.

Provide fittings and unions as required for the installation.

PVC:

Extruded from virgin polyvinyl chloride compound:

Schedule 40 unless otherwise specified.

Schedule 80 extra heavy wall where specified.

Rated for 90 degrees Celsius conductors or cable.

Rated for use in direct sunlight.

Conduit bodies:

Material consistent with conduit type:

Malleable iron bodies and covers when used with type GRC conduit.

PVC bodies and covers when used with type PVC.

PVC-coated malleable iron bodies and covers when used with type PCS.
PVC-coated copper-free cast aluminum bodies and covers when used with type PCA.

Conduit bodies to conform to Form 8, Mark 9, or Mogul design:

Mogul design conforming to NEC requirements for bending space for large conductors for conduit trade sizes of 1 inch and larger with conductors #4 AWG and larger, or where required for wire bending space.

Gasketed covers attached to bodies with stainless steel screws secured to threaded holes in conduit body.

ACCESSORIES

Connectors and fittings:

Manufactured with compatible materials to the corresponding conduit.

Insulated throat metallic bushings:

Construction:

Malleable iron or zinc plated steel when used with steel conduit.
Positive metallic conduit end stop.
Integrally molded non-combustible phenolic insulated surfaces rated 150 degrees Celsius.
Use fully insulated bushings on nonmetallic conduit system made of high impact 150 degrees Celsius rated non-combustible thermosetting phenolic.

Insulated grounding bushings:

Construction:

Malleable iron or steel, zinc plated, with a positive metallic end stop.
Integrally molded non-combustible phenolic insulated surfaces rated 150 degrees Celsius.
Tin plated copper grounding saddle for use with copper or aluminum conductors.

Electrical unions (Erickson Couplings):

Construction:

Malleable iron for use with steel conduit.
Concrete tight, 3-piece construction.
Rated for Class I Division 1 Group D in hazardous areas.

FLX fittings:

Provide insulated die-cast connectors with ridges that thread into the inside of the conduit to achieve a force fit.
Binding screw connectors are not acceptable.

SLT fittings:

Construction:

Malleable iron.
Furnished with locknut and sealing ring.
Liquid-tight, rain-tight, oil-tight.
Insulated throat.
Furnish as straight, 45-degree elbows and 90-degree elbows.
Designed to prevent sleeving:

Verify complete bonding of the raceway jacket to the plastic gasket seal.

Equipped with grounding device to provide ground continuity irrespective of raceway core construction. Grounding device, if inserted into raceway and directly in contact with conductors, shall have rolled over edges for sizes under 5 inches.

Where terminated into a threadless opening using a threaded hub fitting, a suitable moisture resistant/oil resistant synthetic rubber gasket shall be provided between the outside of the box or enclosure and the fitting shoulder. Gasket shall be adequately protected by and permanently bonded to a metallic retainer.

Corrosion resistant and outdoor SLT fittings:

Construction:

PVC-coated liquid-tight fittings with a bonded 0.040-inch thick PVC coating on the metal connector to form a seal around the SLT conduit. Insulated throat and an integral sealing ring.

Hubs for threaded attachment of steel conduit to sheet metal enclosures:

Construction:

Insulated throat.
PVC coated when used in corrosive areas.
Bonding locknut.
Recessed neoprene O-ring to assure watertight and dust-tight connector.
One half (1/2)-inch through 1-1/4-inch steel zinc electroplated.
One and one half (1-1/2)-inch through 6-inch malleable iron zinc plated.
Aluminum with aluminum conduit.

Usage:

All conduits in damp, wet, outdoor, and corrosive areas shall use threaded hubs for connections to sheet metal enclosures.

Sealing fittings:

Construction:

40 percent wire fill capacity.
PVC-coated when used in corrosive areas.
Malleable ductile iron with steel conduit.
Crouse-Hinds Type EYD where drains are required.
Crouse-Hinds Type EYS where drains are not required.
UL listed for use in Class I, Division 1, Groups A, B, C, D; Class I, Division 2, Groups A, B, C, D; Class II, Divisions 1 and 2; Groups E, F, and G.

Sealing compound:

Fiber filler and cement as recommended by the sealing fitting manufacturer.
Approved for the conditions and use.
Not affected by surrounding atmosphere or liquids.
Melting point shall be 200 degrees Fahrenheit minimum.

PVC fittings:

Shall include the following:

Couplings.
Terminal adapters.
Female adapters.
Caps.
Reducer bushings.
Duct couplings.
End bells.

Expansion couplings.
Duct couplings 5 degree.
C - pull fittings.
E - pull fittings.
LB - pull fittings.
LL - pull fittings.
LR - pull fittings.
T - pull fittings.
X - pull fittings.

Materials:

All devices shall be made of PVC, using the same materials as used for Type PVC conduit.
All metal hardware shall be stainless steel.

Through wall and floor seals:

Materials:

Body: casting of malleable or ductile iron with a hot-dip galvanized finish.
Grommet: neoprene.
Pressure rings: PVC coated steel.
Disc material: PVC coated steel.

Expansion/deflection couplings:

Use to compensate for movement in any directions between 2 conduit ends that they connect.
Shall allow movement of 3/4 inch from the normal in all directions.
Shall allow angular movement for a deflection of 30 degrees from normal in any direction.
Constructed to maintain electrical continuity of the conduit system.
Materials:

End couplings: Bronze or galvanized ductile iron.
Sleeve: Neoprene.
Bands: Stainless steel.
Bonding jumper: Tinned copper braid.

Expansion couplings:

Shall allow for expansion and contraction of conduit:
Permitting 8-inch movement, 4 inches in either direction.
Constructed to maintain electrical continuity of the conduit system.
Materials:

Head: Malleable or ductile iron.
Sleeve: Steel.
Insulating bushing: Phenolic.
Finish: Hot-dip galvanized.

Conduit markers:

As specified in Section 26_05_53.

SOURCE QUALITY CONTROL

As specified in Section 26_05_00.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

General:

- Conduit routing:
  - The Electrical Drawings are diagrammatic in nature:
    - Install conduit runs as specified with schematic representation indicated on the Drawings and as specified.
    - Modify conduit runs to suit field conditions, as accepted by the ENGINEER:
      - Make changes in conduit locations that are consistent with the design intent but are dimensionally different, or routing to bypass obstructions.
    - Make changes in conduit routing due to the relocation of equipment.
    - The Electrical Drawings do not indicate all required junction boxes and pull boxes:
      - Provide junction boxes and pull boxes to facilitate wire pulling as required:
        - To meet cable manufacturer's pulling tension requirements.
        - To limit total conduit bends between pull locations.
        - Install junction boxes and pull boxes at locations acceptable to the ENGINEER.
  - The CONTRACTOR is responsible for any deviations in general location, conduit size, routing, or changes to the conduit schedule without the express written approval or direction by the ENGINEER:
    - The ENGINEER is the sole source in determining whether the change is constituted as a deviation:
    - Perform any changes resulting in additional conduits, or extra work from such deviations.
    - Incorporate any deviations on the Record Documents.
- Use only tools recommended by the conduit manufacturer for assembling conduit system.
- Provide adequate clearances from high-temperature surfaces for all conduit runs.
- Provide minimum clearances as follows:
  - Clearances of 6 inches from surfaces 113 degrees Fahrenheit to 149 degrees Fahrenheit.
  - Clearances of 12 inches from surfaces greater than 149 degrees Fahrenheit.
  - Keep conduit at least 6 inches from the coverings on hot water and steam pipes, 18 inches from the coverings on flues and breechings and 12 inches from fuel lines and gas lines.
  - Where it is necessary to route conduit close to high-temperature surfaces, provide a high-reflectance thermal barrier between the conduit and the surface.
- Support conduit runs on water-bearing walls a minimum of 7/8-inch away from wall on an accepted preformed channel:
  - Do not run conduit within water-bearing walls unless otherwise indicated on the Drawings.
- Do not install 1 inch or larger conduits in or through structural members unless approved by the ENGINEER.

Run conduit exposed to view parallel with or at right angles to structural members, walls, or lines of the building:

Install straight and true conduit runs with uniform and symmetrical elbows, offsets, and bends.

Make changes in direction with long radius bends or with conduit bodies.

Install conduit with total conduit bends between pull locations less than or equal to 270 degrees.

Route all exposed conduit to preserve headroom, access space and work space and to prevent tripping hazards and clearance problems:

Install conduit runs so that runs do not interfere with proper and safe operation of equipment and do not block or interfere with ingress or egress, including equipment removal hatches.

Route conduit to avoid drains or other gravity lines. Where conflicts occur, relocate conduit as required.

When installing conduit through existing slabs or walls make provisions for locating any possible conflicting items where conduit is to penetrate. Use tone signal or X-ray methods to make certain that no penetrations will be made into existing conduit, piping, cables, post-tensioning cables, etc.

Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture.

Install conduit through wall and floor seals where indicated on the Drawings.

For existing and new 2-inch and larger conduit runs, snake conduits with conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of conduit:

Remove and replace conduits through which mandrel will not pass.

Provide all sleeves and openings required for the passage of electrical raceways or cables even when these openings or sleeves are not specifically indicated on the Drawings.

Install complete conduit systems before conductors are installed.

Provide metallic conduits terminating in transformer, switchgear, motor control center or other equipment conduit windows with grounding bushings and ground with a minimum No. 6 AWG ground wire.

Lighting and receptacle conduits:

Install conduit runs for lighting and receptacle circuits, whether or not indicated on the Drawings:

Minimum conduit size:

3/4 inch for exposed conduits.

1 inch for underground or in slab conduits.

Provide conduit materials for the installed location as specified in Section 26_05_00.

Hazardous areas:

As specified in Section 26_05_00 for hazardous areas and specific Class and Division.

As specified in Section 26_05_02 for hazardous area conduit installation requirements.

TECHNICAL SPECIFICATIONS

Conduit usage:

Exposed conduits:

Rigid conduit:

Install the rigid conduit type for each location as specified in Section 26_05_00.

Minimum Size: 3/4-inch.

Flexible conduit:

Use flexible conduit for final connections between rigid conduit and motors, vibrating equipment, instruments, control equipment or where required for equipment servicing:

Use type SLT with rigid metallic conduit.

Use type NFC with PVC conduit.

Use type EFLX in Class I Division 1 locations.

Minimum size: 3/4-inch:

1/2 when required for connection to instruments.

Maximum length:

Conduit Trade Size	Flexible Conduit Length (in)
1/2	18
3/4	18
1	18
1-1/4	18
1-1/2	18
2	36
2-1/2	36
3	36
3-1/2	38
4	40

Concrete encased and embedded conduits:

Type PVC Schedule 40 and PVC coated rigid metallic conduit as specified below:

Use Type PCS in underground and embedded installation as follows:

Stub-up and risers to grade floor or equipment from nonmetallic conduits.

Entering and exiting underground or embedded conduit runs a minimum 12 inches above and below grade or finished floor.

For any and all bends where the total deflection is greater than 45 degrees.

Minimum size:

2 inches in duct banks unless otherwise indicated on the Drawings.

1 inch for in slab conduits unless otherwise indicated on the Drawings.

Direct buried conduits:

Type PCS.

Minimum size: 1 inch.

PVC coated rigid metallic conduit:

Use specifically manufactured or machined threading dies to manufacturer's specifications to accommodate the PVC jacket.

GRC:

Conduit shall be cut square and reamed before threading.

PVC:

Conduit terminations shall be via threaded adapters into threaded hubs on the junction boxes or conduit bodies.

Conduit terminations into boxes without threaded hubs shall utilize a threaded adapter and a flat neoprene washer on the outside of the box.

Use a locknut on the inside of the box to tighten the adapter to the box.

Route conduit to afford it the maximum physical protection.

If necessary, cover conduit to afford additional protection when it cannot be shielded by the structure or machinery frames.

Use Schedule 80 where exposed runs may be subject to physical damage.

Conduit joints and bends:

General:

Where conduit is underground, under slabs on grade, exposed to the weather or in NEMA Type 4 or NEMA Type 4X locations, make joints liquid-tight.

Keep bends and offsets in conduit runs to an absolute minimum.

All bends shall be symmetrical.

The following conduit systems shall use large radius sweep elbows:

Underground conduits.

Conduits containing shielded cables.

Provide large radius factory-made bends for 1-1/4-inch trade size or larger.

Make field bends with a radius of not less than the requirements found in the NEC:

The minimum bending radius of the cable must be less than the radius of the conduit bend.

Make all field bends with power bending equipment or manual benders specifically intended for the purpose:

Make bends so that the conduit is not damaged and the internal diameter is not effectively reduced.

Replace all deformed, flattened, or kinked conduit.

Threaded conduit:

Cut threads on rigid metallic conduit with a standard conduit cutting die that provides a 3/4-inch per foot taper and to a length such that all bare metal exposed by the threading operation is completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that all joints become secure and wrench tight just preceding the point where the conduit ends would butt together in couplings or where conduit ends would butt into the ends or shoulders of other fittings.

Thoroughly ream conduit after threads have been cut to remove burrs.

Use bushings or conduit fittings at conduit terminations.

On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing “Galvabar” or CRC “Zinc It.”

Coat conduit threads with an approved electrically conductive sealant and corrosion inhibitor that is not harmful to the conductor insulation:

Apply to the male threads and tighten joints securely.

Clean excess sealant from exposed threads after assembly.

Securely tighten all threaded connections.

Any exposed threaded surface must be cleaned and coated with a galvanizing solution so that all exposed surfaces have a galvanized protective coating.

PVC:

Use approved solvent-weld cement specifically manufactured for the purpose. Spray type cement is not allowed.

Apply heat for bends so that conduit does not distort or discolor. Use a spring mandrel as required to assure full inside diameter at all bends:

Utilize a heater specifically for PVC conduit as recommended by the conduit manufacturer.

Conduit sealing and drainage:

Conduit drainage and sealing other than required for hazardous and classified areas:

Provide sealing and drainage in vertical drops of long (in excess of 20 feet), exterior, above grade conduit runs at the points at which the conduit enter buildings, switchgear, control panels, lighting panelboards, and other similar enclosures.

Provide seal fittings with drains in vertical drops directly above grade for exterior, above grade conduit runs that are extended below grade.

Provide conduit seals with drains in areas of high humidity and rapidly changing temperatures:

Where portions of an interior raceway pass through walls, ceilings or floors that separate adjacent areas having widely different temperatures.

Provide conduit seals similar to O/Z Gedney (Type CSM) on all conduits between corrosive and non-corrosive areas.

Seal one end only of all underground conduits at highest point with O/Z Gedney sealing (non-hazardous) filling, or equal.

Install seals with drains where moisture may condense and accumulate at all control panels, junction boxes, pullboxes, low points of conduit or any additional locations.

Conduit supports:

General:

Provide appropriate hangers, supports, fasteners, and seismic restraints to suit applications:

As specified in Section 26_05_29.

Provide support materials consistent with the type of conduit being installed as specified in Section 26_05_00.

Support conduit at the intervals required by the NEC.

Perforated strap and plumbers tape are not acceptable for conduit supports.

Above suspended ceilings:

Support conduit on or from the structure, do not support conduit from hanging wires or suspended ceiling grid.

Concealed conduit on wood:

Use 2-hole galvanized steel straps screwed or nailed to the wood or hammer-driven stamped galvanized type supports having serrated or sawtooth edges on the driven portion and designed specifically for the size and type of conduit being supported. Drive these latter supports so that the conduit is tightly and rigidly supported. Replace any dented or damaged conduit.

In steel stud construction:

Tie conduit at maximum 4-foot intervals with No. 16 gauge double annealed galvanized wire or conduit clips so that conduit cannot move from vibration or other causes.

Conduit on concrete or masonry:

Use 1-hole malleable iron straps with metallic or plastic expansion anchors and screws or support from preset inserts.

Use preset inserts in concrete when possible.

Use pipe spacers (clamp backs) in wet locations.

On plaster or stucco, use 1-hole malleable iron straps with toggle bolts.

Conduit on metal decking:

Use 1-hole malleable iron straps with 1-inch long cadmium-plated Type A panhead sheet metal screws. Fully or partially hammer-driven screws are not acceptable.

Suspended conduit:

Use malleable iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter), Kindorf, or equal.

For grouped conduits, construct racks with threaded rods and tiered angle iron or preformed channel cross members. Clamp each conduit individually to a cross member. Where rods are more than 2 feet long, provide rigid sway bracing.

Supports at structural steel members:

Use beam clamps.

Drilling or welding may be used only as specified or with approval of the ENGINEER.

PCS systems:

Provide right angle beam clamps and U bolts specially formed and sized to snugly fit the outside diameter of the coated conduit. Provide "U" bolts with PVC encapsulated nuts that cover the exposed portions of the threads. Securely fasten exposed conduits with Type 316 stainless steel clamps or straps.

Miscellaneous:

Seal roof penetrations for raceways and other items that penetrate the roof in accordance with roofing manufacturer’s instructions and as indicated on the Drawings.

Provide electrical unions at all points of union between ends of rigid conduit systems that cannot otherwise be coupled:

Running threads and threadless couplings are not allowed.

Replace any conduit installed that the ENGINEER determines does not meet the requirements of this Specification.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_34

BOXES

GENERAL

SUMMARY

Section includes:
Raceway system boxes.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

American National Standards Institute (ANSI).

ASTM International (ASTM):
A 47 - Standard Specification for Ferritic Malleable Iron Castings.
D 149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
D 495 - Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation.
D 570 - Standard Test Method for Water Absorption of Plastics.
D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

Joint Industry Conference (JIC).

National Electrical Code (NEC).

National Electrical Manufacturers Association (NEMA):
250 - Enclosures for Electrical Equipment (1000 V Maximum).

Underwriters Laboratories, Inc. (UL):
94 - Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

TECHNICAL SPECIFICATIONS

DEFINITIONS

As specified in Section 26_05_00.

Specific definitions:

Arcing parts: Circuit breakers, motor controllers, switches, fuses, or any device intended to interrupt current during its operation.

Raceway system boxes: Boxes that are used for wire and cable pullboxes, conduit junction boxes, or terminal boxes.

SYSTEM DESCRIPTION

Provide boxes and conduit bodies as indicated on the Drawings or as needed to complete the raceway installation.

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:

- Manufacturer.
- Materials.
- Dimensions:
  - Height.
  - Width.
  - Depth.
  - Weight.
  - NEMA rating.
    - Conduit entry locations.
- Catalog cut sheets.
- Installation instructions.

Shop drawings:

- Include identification and sizes of pull boxes.

QUALITY ASSURANCE

As specified in Section 26_05_00.

Regulatory requirements:

- Outlet boxes shall comply with all applicable standards of:
  - JIC.
  - NEC.
  - NEMA.
  - UL.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

PROJECT OR SITE CONDITIONS

As specified in Section 26_05_00.

TECHNICAL SPECIFICATIONS

SEQUENCING

As specified in Section 26_05_00.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START UP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

One of the following or equal:
- Cast device boxes:
  - Appleton.
  - Crouse - Hinds.
  - OZ/Gedney.
- Formed steel enclosures:
  - Hoffman.
  - Thomas and Betts.
  - Stahlin.
  - Rittal.

MANUFACTURED UNITS

Threaded-hub boxes:
- Construction:
  - With internal green ground screw.
  - Furnished with a suitable gasketed cover.
  - With integral cast mounting lugs when surface mounted.
  - Conduit sizes range from 3/4 inch to 1 inch.
  - Tapered threaded hubs with integral bushing.
- Aluminum (copper free) boxes:
  - High strength copper free 4/10 of 1 percent maximum alloy for use with aluminum rigid conduit.
- Malleable iron boxes:
  - Conforming to ASTM A 47 Grade 32510.

Class I Division 1 areas:
- Provide boxes designed and listed for Class I Division 1 locations and group type atmosphere in which they will be used:
  - The approval ratings must be permanently marked on each item.

Class I, Division 2 areas:
- For boxes not containing arcing parts:
  - As specified in Section 26_05_00.
  - Pressed metal boxes are not allowed.

For boxes containing arching parts provide:

Boxes designed and listed for Class I Division 1 locations and group type atmosphere in which they will be used:

The approval ratings must be permanently marked on each item.

Cast copper - free aluminum box and cover.

Precision machined flame path between box and cover with neoprene o-ring.

Cast-in-place mounting feet for horizontal or vertical mounting.

For applications requiring hinged cover, provide flexible hinge mounting either left or right side.

External flange.

Provisions for mounting pan.

Ground lug.

Formed steel enclosures:

Steel:

NEMA Type 12.

Fabricated from 14-gauge steel, minimum.

All seams continuously welded ground smooth.

Door:

Rolled lip around 3 sides.

Attached to enclosure by means of a continuous stainless steel hinge and pin.

Neoprene door gasket to provide a watertight, dusttight, oiltight seal:

Attached with an adhesive.

Retained by a retaining strip.

Fabricate all external removable hardware for clamping the door to the enclosure body from zinc-plated heavy gauge steel:

With a hasp and staple for padlocking.

Provide large enclosures with door and body stiffeners for extra rigidity.

No holes or knockouts.

Finish:

ANSI-61 gray electrostatically applied polyester powder inside and out over cleaned and primed surfaces.

White electrostatically applied polyester powder mounting plate.

Heavy gauge steel external mounting brackets when surface mounted.

Stainless steel:

NEMA Type 4X:

Boxes in locations subject to flooding or temporary submersion:

NEMA Type 6.

Fabricated from 14-gauge Type 316 stainless steel.

All seams continuously welded.

Door:

Rolled lip around 3 sides.

Attached to enclosure by means of a continuous stainless steel hinge and pin.

Neoprene door gasket to provide a watertight seal:

Attached with an adhesive.

Retained by a retaining strip.

Fabricate all external removable hardware for clamping the door to the enclosure body from heavy gauge stainless steel:

With a hasp and staple for padlocking.

Provide large enclosures with door and body stiffeners for extra rigidity.
No holes or knockouts.
Finish:
Brushed.
Stainless steel external mounting brackets when surface mounted.

Cast iron junction boxes:
NEMA Type 4.
Recessed cover boxes.
Suitable for use outdoors where subject to rain, dripping, or splashing water.
Designed for flush mounting in walls or floors:
Can be surface mounted using mounting lugs.
Construction:
Cast iron box.
Covers:
Checkered plate covers suitable for foot traffic.
When used in areas subject to vehicular traffic H-20 loading.
Hot dip galvanized.
Neoprene gasket.
Stainless steel screw covers.

ACCESSORIES

Fasteners:
Screws, nuts, bolts, and other threaded fasteners:
Stainless steel.

Provide breather and drain fittings where appropriate.

Internal panels:
Provide internal panels where required for mounting of terminal strips or other equipment
With plated steel shoulder studs.
Steel with white polyester powder finish.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

General:
Provide materials and construction suitable for environmental conditions at the location of the box as specified in Section 26_05_00.
Support all wall mounted NEMA Type 4 or NEMA Type 4X boxes to maintain a minimum of 7/8-inch free air space between the back of the enclosure and the wall:
Use machined spacers to maintain air space; built-up washers are not acceptable.
Use stainless steel or nylon materials for spacers.
Use cast malleable iron boxes when box must support other devices.

Size boxes in accordance with NEC requirements and to provide sufficient room for the future components and cables indicated on the Drawings.
For fire-rated construction, provide materials and installation for use in accordance with the listing requirements of the classified construction.

Pull boxes and junction boxes:
Size pull boxes in accordance with NEC requirements and to provide sufficient room for any future conduits and cables as indicated on the Drawings.
Install pull boxes such that access to them is not restricted.

For boxes not indicated:
Provide types and mountings as required to suit the equipment and that will be consistent with the conduit system and environmental conditions as indicated in Section 26_05_00.
For junction and pull boxes: Use galvanized steel boxes with flush covers.
Other fire rated construction: Use materials and methods to comply with the listing requirements for the classified construction.

Hazardous locations:
All metallic boxes, fittings, and joints shall utilize threaded connections to the conduit system.
All threaded connections shall be wrench tightened so that at least 5 threads are fully engaged.
Conduits entering and exiting metallic boxes in Class I Division 2 areas shall utilize approved grounding bushings to bond the conduits together.
Provide the following types of conduit bodies and boxes:
Malleable iron bodies and boxes with GRC conduit systems.
PVC coated conduit bodies and boxes with PCS conduit systems.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

CLEANING

As specified in Section 26_05_00.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_05_53

ELECTRICAL IDENTIFICATION

GENERAL

SUMMARY

Section includes:

Identifying electrical, instrumentation, and process equipment and components.
Material, manufacturing, and installation requirements for identification devices.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

DEFINITIONS

As specified in Section 26_05_00.

SYSTEM DESCRIPTION

Nameplates:

Provide a nameplate for each piece of mechanical equipment, process equipment, valve, pump, mixer, feeder, fan, air-handling unit, motor, switch, receptacle, controller, instrument transducer, instrument power supply, solenoid, motor control center, starter, panelboard, switchboard, individually mounted or plug-in type circuit protector or motor controller, disconnect switch, bus duct tap switch, time switch, relay and for any other control device or major item of electrical equipment, either located in the field or within panels.
Provide all nameplates of identical style, color, and material throughout the facility.
Device nameplates information:

Designations as indicated on the Drawings and identified on the Process and Instrumentation Drawings.
Device tag and loop number ID (#) (e.g. EDV-#).
Circuit ID (e.g. LPA-11).
Area served (e.g. Lighting Chemical Building).

Wire numbers:

Provide the following wiring numbering schemes throughout the project for field wires between process control module, (PCM), vendor control panels, (VCP), motor control centers, (MCC), field starters, field instruments, etc.

TECHNICAL SPECIFICATIONS

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:
- Nameplates:
  - Color.
  - Size:
    - Outside dimensions.
    - Lettering.
  - Material.
  - Mounting means.
- Nameplate schedule:
  - Show exact wording for each nameplate.
  - Include nameplate and letter sizes.
- Wire numbers:
  - Manufacturer's catalog data for wire labels and label printer.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START UP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

Nameplates and signs:
- One of the following or equal:
  - Brady.
  - Seton.

Conductor and cable markers:
- Non heat-shrinkable tubing:
  - One of the following or equal:
    - Brady.
    - Seton.
- Marker printer:
  - The following or equal:
    - Brady.
- Pre-printed slip-on sleeve markers:
  - The following or equal:
    - Grafoplast.
    - ENGINEER knows of no equal.

TECHNICAL SPECIFICATIONS

MATERIALS

Nameplates:
Fabricated from white-center and red face or black-center, white face laminated plastic engraving stock:
3/32-inch thick material.
Two-ply.
With chamfered edges.
Block style engraved characters of adequate size to be read easily from a distance of 6 feet:
No characters smaller than 1/8 inch in height.

Conductor and cable markers:
Machine printed black characters on white tubing.
Ten point type or larger.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Nameplates:
Attach nameplates to equipment with rivets, bolts, or sheet metal screws, approved waterproof epoxy-based cement or install in metal holders welded to the equipment.
On NEMA Type 4, NEMA Type 4X, or NEMA Type 7 enclosures, use epoxy-based cement to attach nameplates.
Nameplates shall be aligned and level or plumb to within 1/64 inch over the entire length:
Misaligned or crooked nameplates shall be remounted, or provide new enclosures at the discretion of the ENGINEER.

Conductor and cable markers:
Apply all conductor and cable markers before termination.
Non heat-shrinkable tubing:
Tubing shall be sized for the wire and insulation on which it is to be placed.
Tubing shall be tight on the wire.
Characters shall face the open panel and shall read from left to right or top to bottom.
Marker shall start within 1/32 inch of the end of the stripped insulation point.

FIELD QUALITY CONTROL

Replace any nameplates, signs, conductor markers, cable markers, or raceway labels that in the sole opinion of the ENGINEER do not meet the ENGINEER’s aesthetic requirements.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_41_01

LIGHTNING PROTECTION

GENERAL

SUMMARY

Section includes:
Design and installation of a complete lightning protection system for Digester No. 1. Include provisions to accommodate the connection of a future lightning protection system for Digester No. 2. Digester exterior walls are approximately 26’-0’ above grade.
Materials and components for the lightning protection system.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR’s responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR’s Work.

REFERENCES

As specified in Section 26_05_00.

Lightning Protection Institute (LPI):
LPI-175 - Standard of Practice.

National Fire Protection Association (NFPA):
ANSI/NFPA 780 - Standard for the Installation of Lightning Protection Systems.

Underwriters Laboratories, Inc. (UL):
96 - Standard for Lightning Protection Components.
96A - Standard for Installation Requirements for Lightning Protection Systems.

DEFINITIONS

As specified in Section 26_05_00.

Specific definitions:
LPI: Lightning Protection Institute.

SYSTEM DESCRIPTION

Retain the services of a lightning protection contractor to design, furnish, and install a complete lightning protection system, connected to the facility grounding system.

Lightning protection system: ANSI/NFPA 780; Class I UL 96A; master labeled system(s) protecting roof-mounted mechanical equipment consisting of:
Air terminals on roof(s).

Bonding of structure and other metal objects.
Grounding electrodes.
Interconnecting conductors.

Connect the lightning protection system to the facility grounding electrode.

The installing contractor is responsible for all costs associated with UL inspection of the lightning protection system, including any costs associated with re-inspection necessary to obtain the UL 96A Master Label.

SUBMITTALS

Furnish submittals as specified in Sections 01_33_00 and 26_05_00.

Product data:
- Provide samples and pertinent catalog data for:
  - Air terminals.
  - Conductors.
  - Connectors.
  - Accessories.
  - Include dimensions and materials of each component, and include indication of listing in accordance with UL 96.

Shop drawings:
- Including but not limited to:
  - Layout of air terminals with the respective configuration of the zone of protection.
  - Grounding electrodes, and bonding connections to structure and other metal objects.
  - Type, size and locations for:
    - Terminal.
    - Electrode.
    - Conductor.
  - Conductor routing details.
  - Connection details.
  - Termination details.
  - Applicable air terminal and other calculations.
- Details showing installation of air terminals, conductors, and connectors.

Certificates:
- Submit 2 notarized photocopies of the completed Application for UL Master Label for each lightning protection system.
- Submit written confirmation of having obtained UL Master Label for each lightning protection system.
- Photocopy of UL and LPI Installers' Certificate(s) for installation of lightning protection systems.
- Written confirmation regarding the system manufacturer's and the system installer's membership in the Lightning Protection Institute.
- Proof of the manufacturer and installer having been UL-listed for at least 5 years.

Record Documents:
- Provide Record Documents as specified in Sections 01_77_00 and 26_05_00.

Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.
Manufacturer's installation instructions.

QUALITY ASSURANCE

As specified in Section 26_05_00.

Conform to the requirements of the UL and NFPA standards for lightning protection systems:
Components shall be listed in accordance with UL 96.

Manufacturer’s qualifications:
Company specializing in lightning protection equipment with minimum 5 years documented experience and a fully certified manufacturer member of the Lightning Protection Institute:
Listed in section "Lightning Conductor, Air Terminals and Fittings" of the UL "Electrical Construction Materials Directory" for at least 5 years previous to this Contract's bid opening date.

Installers qualifications: Authorized installer for manufacturer with minimum 5 years documented experience and LPI-certified installer for installation of lightning protection systems for at least 5 years previous to this CONTRACTOR's bid opening date.

The lightning protection system shall meet the applicable requirements of NFPA 780.

Upon completion of installation the lightning protection contractor to have the building lightning system physically inspected by Underwriters Laboratories and furnish a UL Master Label for the building:
Application for the UL Master Label without a physical inspection by UL is unacceptable.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

SEQUENCING

Pre-installation conference:
Convene a pre-installation conference one week before commencing the Work of this Section, as specified in Special Condition 5 and 26_05_00.

Coordinate Work with other trades to ensure neat, correct, and unobtrusive installation.

Coordinate the Work of this Section with roofing and exterior and interior finish installations.

WARRANTY

As specified in Section 26_05_00.

TECHNICAL SPECIFICATIONS

SYSTEM STARTUP

As specified in Section 26_05_00.

PRODUCTS

MANUFACTURERS

One of the following or equal:
- Erico.
- Thompson Lightning Protection, Inc.
- Harger Lightning and Grounding.
- VFC, Inc.

MATERIALS

Air terminals:
- Material: Aluminum**.**
- Size: 3/8-inch by 18-inch minimum extending a minimum of 12 inches above the object to be protected.
- On flat or walkable roofs, provide air terminals with:
  - Mushroom type blunt tip incapable of impalement if fallen upon.
  - Spring mounted and capable of being pushed flush to the roof.
- Air terminal bases:
  - Cast aluminum with bolt pressure cable connections securely mounted with stainless steel screws or bolts.

Ground rods:
- As specified in Section 26_05_26.

Ground plate: Copper.

Conductors:
- Perimeters:
  - Aluminum.
- Down conductors:
  - Copper.
  - At least 32 strands of 17 gauge or larger copper wire weighing not less than 215 pounds per 1000 feet.
  - UL listed for the application.
- Cable fasteners:
  - Electrolytically compatible with conductors and mounting surface:
  - Spaced in accordance with LPI and NFPA requirements.

Connectors and splicers:
- Make connections between dissimilar metals with approved bimetallic connectors.

Miscellaneous materials:
- Copper of type and size recommended by the manufacturer of the lightning protection system.
- Stainless steel bolts, screws, and other threaded fasteners.

EXECUTION

EXAMINATION

It is the responsibility of the lightning protection subcontractor to review the electrical system design, and provide any and all additional equipment and materials needed in order to construct a master labeled UL lightning protection system.

Verify that surfaces are ready to receive work.

Verify that field measurements are as indicated on the Drawings.

Protect elements surrounding Work of this Section from damage or disfiguration.

INSTALLATION

As specified in Section 26_05_00.

Install systems in accordance with manufacturer's instructions unless otherwise specified in this Section.

Installation must be made under the supervision of an LPI certified master installer.
Physically connect lightning protection equipment to structural roof framing members including metal deck.
Do not attach lightning protection equipment to rigid roof insulation.

Conductor installations:

Install the lightning protection roof system(s) grounding and bending conductors exposed on flat roof areas and concealed at ridge roof areas.
Install main downleads completely concealed and sleeved.
Other than for the purpose of protecting downlead conductors from damage up to 6 feet above grade level, do not use exposed conduits to conceal the downleads on the exterior of the outside walls.
Use minimum 1-inch PVC conduits to protect lightning system conductors from damage.

Clearances: Assure 6-foot minimum distance required by NEC:

From lightning rod conductors to non-current-carrying metal parts of electrical equipment unless they are bonded to the rods.
From lightning system conductors to open conductors of communication systems.
From lightning protection grounding electrodes to electrodes of other grounding systems.

Extend air terminals a minimum of 12 inches above object to be protected.

Maintain horizontal or downward coursing of main conductor and ensure that bends have at least an 8-inch radius and that no bend of a conductor forms an included angle of less than 90 degrees.

Install ground electrodes not less than 1 foot below grade and not less than 2 feet from foundation walls.

Interconnection of metals:

Bond all metal bodies within 6 feet of the conductor to the system with approved fittings and conductor.
Connections between dissimilar metals shall be made with approved bimetallic connections.
Bond metal bodies of inductance located within 6 feet of a conductor or object with secondary bonds.

Bond all isolated metallic bodies at or below the roof subject to inductance and within 6 feet of lightning protection system conductors.

Provide necessary common grounds between the lightning protections system and the electric and telephone service entrance wires, TV and radio antenna grounds.

Ensure that air terminals are installed to withstand calculated wind force due to 100 miles per hour winds or as specified in Section 01_81_04, whichever is greater with a 1.3 gust factor without structural damage and without damage to integrity of the lightning protection system.

Protect down conductors entering corrosive soil against corrosion by a protective coating for not less than 3 feet above grade level and for the entire length below grade level until connection to the ground ring and rods.

FIELD QUALITY CONTROL

As specified in Section 26_05_00:

Provide the services of Underwriters Laboratories, Inc. to physically inspect the entire lightning protection system and issue the UL Master Label:
Furnish Underwriters' Laboratories, Inc. Master Label as evidence that the installation has met with UL 96A code requirements.

PROTECTION

As specified in Section 26_05_00.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 26_50_01

LIGHTING

GENERAL

SUMMARY

Section includes:

Luminaires, lamps, ballasts, poles, and accessories.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 26_05_00.

American National Standards Institute (ANSI):

C62.41 - Recommended Practice for Surge Voltage in Low-Voltage AC Power Circuits.

C82.11 - High Frequency Fluorescent Lamp Ballast.

C82.4 – Ballasts for High-Intensity Discharge and Low Pressure Lamp.

C82.77 - Harmonic Emission limits - Related Power Quality Requirements for Lighting Equipment.

Underwriters Laboratories (UL):

935 - Fluorescent Lamp Ballasts.

1029 - High -Intensity Discharge Lamp Ballast.

1570 - Fluorescent Lighting Fixtures.

1572 - High Intensity Discharge Lighting Fixtures.

DEFINITIONS

As specified in Section 26_05_00.

Specific definitions and abbreviations:

BF: Ballast factor - Measure of light output from lamp operated by commercial ballast as compared to a laboratory standard reference ballast

BEF: Ballast efficacy factor - Value used to evaluate various lighting systems based on light output and power input.

CCT: Correlated color temperature - Scientific scale to describe how "warm" or how "cool" the light source is, measured in Kelvin.

Crest factor - ratio of peak lamp current to RMS or average lamp operating current.

Efficacy - Lumen output per unit of power supplied to ballast (lumens per watt).

EMI: Electromagnetic Interference - Electrical interference (noise) generated by electrical and electronic devices.

FC: Foot Candles - Measure of light level on a surface being illuminated.
HID: High intensity discharge - A lamp containing a filled arc tube in which the active element becomes vaporized and is discharged into the arc stream to produce light.
Instant start - Lamp starting method in which lamps are started by high voltage input with no preheating of lamp filaments.
Luminaire - Lighting unit.
Programmed start - lamp starting method that utilizes an integrated circuit to preheat the lamp filament while not allowing the lamp to ignite and then applies the open circuit voltage to start the lamp.
Pulse start - An HID ballast with a high voltage igniter that provides high voltage pulses to ionize the gas within the lamp.
Rapid start - Lamp starting method in which lamp filaments are heated while open circuit voltage is applied to facilitate lamp ignition.
THD: Total harmonic distortion - The combined effect of harmonic Distortion on the AC waveform produced by a ballast or other device.

SYSTEM DESCRIPTION

Provide luminaires, and accessories for all lighting systems, complete and operable, in accordance with the requirements of the Contract Documents.

Individual luminaire types are indicated on the Drawings and on the Luminaire Schedule.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and 26_05_00.

Product data:
- Luminaires:
  - Catalog literature for each luminaire specified, cross-referenced to the luminaire type on the Luminaire Schedule in the Drawings.
  - Provide for each luminaire type:
    - Materials.
    - Type of diffuser.
    - Hardware.
    - Gasketing.
    - Reflector.
    - Chassis.
    - Finish and color.
    - Ballast type and protection.
    - Lamp:
      - Type.
      - Wattage.
      - Lumen output:
        - Initial.
        - Mean.
      - Correlated color temperature.
      - Lamp lumen depreciation.
      - Efficacy.
      - Base.

Picture of luminaire.
Dimensioned drawings:
Effective projected area rating for pole mounted luminaires.
Weight.
Photometric data:
Coefficient of utilization tables based on the IES zonal cavity system by an approved testing laboratory.
Luminaire dirt depreciation factor.
Candlepower distribution curves.
Average luminaire brightness.
Lumen output charts.
Furnish support method for interior luminaires weighing more than 30 pounds and all wall-mounted luminaires:
Support methods shall be based on seismic requirements at the project site as specified in Section 26_05_00.

Luminaire substitutions:
Provide complete literature for each luminaire substitution:
Submittals for substituted luminaires shall be sufficient for competent comparison of the proposed luminaire to the originally specified luminaire:
Photometric data:
IES file in standard IES format.
Coefficient of utilization tables based on the IES zonal cavity system by an approved testing laboratory.
Candlepower distribution curves.
Average luminaire brightness.
Lumen output charts.
Power requirements in watts and volt-amperes.
Calculations:
Provide software generated calculations showing illuminance levels in footcandles and power usage in watts per square foot for each of the areas in which substitutions are proposed:
Use surface reflectance values and luminaire light loss factors approved by the ENGINEER to perform all calculations.
Substitutions for specified luminaires will be evaluated upon quality of construction, light distribution, energy use, appearance, and maintenance.
Substitutions shall comply with all applicable building codes.

Ballast:
Provide for each ballast type:
Type of ballast.
Lamp wattage.
Input voltage.
Input watts.
Starting line current.
Operating line current.
Sound rating.
Power factor.
Ballast factor.
Starting temperature.

Luminaire poles:

Submit complete data for each pole type including but not limited to:

Material.
Finish and color.
Handholes.
Anchoring.
Luminaire attachment methods and fittings.
Pole height.
Pole dimensions.
Bolthole circle layout and hardware.
Accessories.
Provide the EPA wind load rating.

Shop drawings.

Calculations:

Provide complete design calculations and installation documents for pole mounting piers and poles mounted from structures:

Include in the calculations the wind and seismic requirements at the project site.

Calculations and design shall be performed by and signed by a Professional Engineer registered in the state where the project is being constructed:

Because this design is being provided by a Professional Engineer, the submittal will be reviewed for form and content but not reviewed for technical completeness, methods, or calculations.

Record documents:

Update the Luminaire Schedule in the Drawings to reflect the acceptable substitutions, after the substitution has been reviewed and accepted by the ENGINEER.

QUALITY ASSURANCE

As specified in Section 26_05_00.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 26_05_00.

PROJECT OR SITE CONDITIONS

As specified in Section 26_05_00.

SCHEDULING

Exterior and outdoor lighting system operation shall be demonstrated during the hours of darkness.

Lighting demonstration shall occur within 2 weeks before substantial completion.

WARRANTY

As specified in Section 26_05_00.

SYSTEM START UP

As specified in Section 26_05_00.

MAINTENANCE

Replace all lamps used during construction.

PRODUCTS

MANUFACTURERS

Luminaires: One of the following or equal:
As noted on the Luminaire Schedule.

Lamps: One of the following or equal:
General Electric Company.
Osram Sylvania.
North American Philips Lighting Company.

Substitutions:
The lighting design and luminaire selection has been based upon the photometric data of the identified luminaire. It is the CONTRACTOR's responsibility to ensure and prove to the ENGINEER at time of submittal the substitutions meet the quality and photometric requirements of the original design.

EQUIPMENT

Luminaires:
General:
Pre-wired with leads of 18-AWG, minimum, for connection to building circuits.
Provide the luminaires furnished per the Luminaire Schedule in the Drawings:
The Specifications noted herein are an addition or supplement to the Luminaire Schedule.
Exterior/outdoor luminaires:
Luminaires in combination with their mounting pole and bracket shall be capable of withstanding:
Wind levels at the project site without damage.
Seismic levels at the project site.
Corrosion-resistant hardware and hinged doors or lens retainer.
Luminaires in hazardous areas:
In accordance with NEC Article 500 requirements.
UL labeled and identified for hazardous area.
Marking on Class I and II Division 1 and 2 areas shall identify the applicable material classification group.
Marking shall include the temperature class (T code).

Lamps:
General:
Provide lamps as indicated on the Luminaire Schedule.

Lamps selected to mate with luminaires selected.
Suitable for operation in any burning position unless otherwise indicated in the Contract Documents.

Luminaire control:

COMPONENTS

Luminaire poles:
- As indicated on the Luminaire Schedule.
- Anchor Bolts:
  - Use anchor bolts, bolts, or welded studs for anchors for resisting seismic and wind forces.
  - Standard hex bolt head.
  - Do not use anchor bolts fabricated from rod stock with an L or J-shape.
  - Complete with leveling shims.
- Anchor base:
  - Fabricated from the same type of material as the pole shaft.
  - Base plate to telescope the pole shaft.
  - Welded top and bottom along the entire perimeter.
  - With slotted boltholes on the bolt circles as submitted.
- Pole shaft:
  - As indicated on the Luminaire Schedule.
- Handhole:
  - Reinforced handhole located approximately 18 inches above the base.
  - Complete with cover fabricated from the same material as the pole shaft and stainless steel attachment screws.
  - With an integral ground connection nut, 1/2-inch by 13-inch UNC welded to the pole for connection to the grounding system.
- Shroud:
  - Fabricated from the same type of material as the pole shaft.
  - 1-piece formed channel section that shall conform to the pole shaft taper.
  - Secured by a locking device with provisions for a padlock to prevent accidental lowering.
- Fastening hardware:
  - All fasteners shall be stainless steel.
- Finish:
  - As indicated on the Luminaire Schedule.

EXECUTION

INSTALLATION

As specified in Section 26_05_00.

Install luminaires per the manufacturer’s guidelines and submitted installation calculations to meet seismic and wind requirements at the project site.

Special techniques:
- Support luminaires from structural elements capable of carrying the total weight.

Luminaire poles:

Set poles on anchor bolts and secured with double nuts on each bolt.

Dry-pack the pole base, after the luminaire and pole has been leveled and plumbed.

Bond metal poles to the plant grounding system, utilizing a ground lug connection within the pole.

FIELD QUALITY CONTROL

As specified in Section 26_05_00.

ADJUSTING

Aim and verify all exterior and outdoor luminaires alignment, during dark evening hours, as directed by OWNER or the ENGINEER.

CLEANING

As specified in Section 26_05_00.

Clean all lenses, diffusers, and reflectors.

Refinish all luminaire's trim, poles and support brackets, where finish has been damaged.

Clean and re-lamp all luminaires (new and old), used during construction for construction lighting, before substantial completion.

DEMONSTRATION AND TRAINING

As specified in Section 26_05_00.

Perform the lighting demonstration, in accordance with this Section, witnessed by the OWNER and the ENGINEER. The entire lighting system shall be observed to verify luminaires are properly focused and aimed.

Switching functions are in accordance with the Contract Documents and verify all:

Photocell operation.

Switching operations.

PROTECTION

As specified in Section 26_05_00.

SCHEDULES

Refer to the Luminaire Schedule in the Drawings.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 40_05_00.01

COMMON WORK RESULTS FOR GENERAL PIPING

GENERAL

SUMMARY

Section includes: Basic piping materials and methods.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Society of Mechanical Engineers (ASME):

B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24.

B16.47 - Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard.

American Water Work Association (AWWA):

C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

C207 - Standard for Steel Pipe Flanges for Waterworks Services-Size 4 In. Through 144 In.

ASTM International (ASTM):

A 193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.

A 194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

F 37 - Standard Test Methods for Sealability of Gasket Materials.

DEFINITIONS

Buried pipe: Pipe that is buried in the soil, or cast in a concrete pipe encasement that is buried in the soil.

Exposed pipe: Pipe that is located above ground, or pipe that is located inside a structure, supported by a structure, or cast into a concrete structure.

Underground piping: Piping actually buried in soil or cast in concrete that is buried in soil.

Underwater piping: Piping below tops of walls in basins or tanks containing water.

Wet wall: Wall with water on at least 1 side.

SUBMITTALS

Product data:
- Escutcheons.
- Flange bolts.
- Gaskets.
- Link -type seals.
- Certifications of compliance with reference standard for lead limits.

PRODUCTS

ESCUTCHEONS

Material: Chrome-plated steel plate.

Manufacturers: One of the following or equal:
- Dearborn Brass Company, Model Number 5358.
- Keeney Manufacturing Company, Model Number 102 or Number 105.

LINK TYPE SEALS

Characteristics:
- Modular mechanical type, consisting of interlocking neoprene or synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.
- Assemble links solely with stainless steel bolts and nuts to form a continuous rubber belt around the pipe.
- Provide a nylon polymer pressure plate with Type 316 stainless steel hardware.
- Isolate pressure plate from contact with wall sleeve.

Manufacturers: One of the following or equal:
- Calpico, Incorporated.
- Pipeline Seal and Insulator, Inc., Link-Seal.

FLANGE BOLTS

Ductile iron pipe:
- Bolts and nuts for ductile iron pipe flanges and stainless steel pipe flanges shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
- Provide a washer for each nut. Washer shall be of the same material as the nut.
- Nuts shall be Heavy hex-head, Type 2H.
- Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
- Tap holes for cap screws or stud bolts when used.

Lubricant for stainless steel bolts and nuts:
- Chloride-free.
- Manufacturers: One of the following or equal:
  - Huskey FG-1800.

GASKETS

Gaskets for ductile iron piping:

Suitable for pressures equal to and less than 150 pounds per square inch gauge, temperatures equal to or less than 250 degrees Fahrenheit, and raw sewage service.

Gasket material:

Neoprene elastomer with minimum Shore A hardness value of 70.

Reinforcement: Inserted 13-ounce nylon fabric cloth for pipes 20 inch or larger.

Thickness: Minimum 3/32-inch thick for less than 10-inch pipe; minimum 1/8 inch thick for 10-inch and larger pipe.

Manufacturers: One of the following or equal:

Pipe less than 20 inches in diameter:

Garlock, Style 7797.

John Crane, similar product.

Pipe 20 inches in diameter and larger:

Garlock, Style 8798.

John Crane, similar product.

Gaskets for flanged joints in Digester gas piping:

Digester gas in stainless steel, or black steel piping: Suitable for pressures equal to or less than 150 pounds per square inch gauge, temperatures equal to or less than 200 degrees Fahrenheit, and digester gas and mild acid concentrations.

Material:

Microcellular Teflon outer layers with rigid center layer.

Sealability in accordance with ASTM F 37, less than 0.55 millimeters per hour leakage of iso-octane at 1,000 pounds per square inch gasket load and 9.8 pounds per square inch fluid pressure.

Manufacturers: One of the following or equal:

Garlock, Style 3545.

John Crane, similar product.

Gaskets for flanged joints in ductile iron or steel water piping:

Suitable for hot or cold water, pressures equal to or less than 150 pounds per square inch gauge, and temperatures equal to or less than 160 degrees Fahrenheit.

Material:

Neoprene elastomer, compressed, with non-asbestos fiber reinforcement.

Teflon ring; or Teflon envelope with non-asbestos filler.

Manufacturers: One of the following or equal:

Garlock, Bluegard 3300.

John Crane, similar product.

Provide gaskets suitable for the specific fluids and pressure and temperature conditions.

LEAD LIMITS

Comply with NSF 61.

EXECUTION

EXAMINATION

Verification of existing conditions:

Locate and expose existing structures, piping, conduits, and other facilities and obstructions that may affect construction of underground piping before starting excavation for new underground piping and appurtenances.

Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.

Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

INSTALLATION

General:

Piping drawings:

Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.

Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.

Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.

Piping alternatives:

Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.

Alternative pipe ratings:

Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price.

Piping of different material may not be substituted in lieu of specified piping.

Valves in piping sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.

For flanged joints, where 1 of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.

Unless otherwise indicated on the Drawings, piping at pipe joints, fittings, couplings, and equipment shall be installed without rotation, angular deflection, vertical offset, or horizontal offset.

Wall and slab penetrations:

Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.

For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.

Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.

Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.

Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.

Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.

Seal openings around piping running through walls and roof of Digesters gastight with synthetic rubber sealing compound.

Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.

Core drilled openings:

Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.

Determine location of reinforcing bars or other obstructions with a non-destructive indicator device.

Remove dust and debris from hole using compressed air.

Exposed piping:

Install exposed piping in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings:

Install piping runs plumb and level, unless otherwise indicated on the Drawings.

Slope plumbing drain piping with a minimum of 1/4 inch per foot downward in the direction of flow.

Slope digester gas piping to drip traps or low-point drains at a minimum of 1/2 inch per foot where condensate flows against the gas, or at a minimum of 1/4 inch per foot where condensate flows with gas.

Install exposed piping after installing equipment and after piping and fitting locations have been determined.

Support piping: As specified in Section 40_05_07.01.

Do not transfer pipe loads and strain to equipment.

In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.

Assemble piping without distortion or stresses caused by misalignment:

Match and properly orient flanges, unions, flexible couplings, and other connections.

Do not subject piping to bending or other undue stresses when fitting piping.

Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.

Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.

Alter piping assembly to fit, when proper fit is not obtained.

Install eccentric reducers or increasers with the top horizontal for pump suction piping.

Condensate in digester gas piping:

Slope digester gas piping to drip traps or low-point drains at minimum 1/2 inch per foot where condensate flows against the gas or 1/4 inch per foot where condensate flows with gas.

Install tapered filler pieces between flanges at high points of straight runs to provide for slope reversals.

Do not subject piping to high stresses in order to change direction.

Provide pipe taps, threaded nipples, and 1-inch plug valves at low points in concrete utility boxes with lids.

Restraining piping:

Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:

When piping is underground, use concrete thrust blocks, mechanical restraints, or push-on restraints.

When piping is aboveground or underwater, use mechanical or structural restraints.

Determine thrust forces by multiplying the nominal cross sectional area of the piping by design test pressure of the piping.

Provide restraints with ample size to withstand thrust forces resulting from test pressures:

During testing, provide suitable temporary restraints where piping does not require permanent restraints.

Place concrete thrust blocks against undisturbed soil.

Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.

Provide underground mechanical restraints where specified in the Piping Schedule.

Connections to existing piping:

Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:

Protect domestic water/potable water supplies from contamination:

Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.

Provide devices approved by OWNER of domestic water supply system to prevent flow from other sources into the domestic supply system.

Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.

Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.

For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

Connections to in-service piping:

As specified in Special Conditions 1.0.

Connections between ferrous and nonferrous metals:

Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.

Nonferrous metals include aluminum, copper, and copper alloys.

Flanged connections between dissimilar metals such as ductile iron pipe and steel pipe:

Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

CLEANING

Piping cleaning:

Upon completion of installation, clean piping interior of foreign matter and debris. Perform special cleaning when required by the Contract Documents.

Cleaning potable water piping:

Flush and disinfect potable water piping as specified in General Conditions 7.0.

PIPING SCHEDULE

PIPING SCHEDULE

Process Abbrev.	Service	Nominal Diameter (inches)	Material	Pressure Class Special Thickness Class Schedule Wall Thickness	Pipe Spec. Section	Joints/ Fittings	Test Pressure/ Method	Lining	Coating	Service Conditions	Comments
DG	Digester Gas										
	Aboveground	3-10	SST	SCH 10S	40_05_23.01	WLD or FL, FL where shown	15 psig/LH	None	None		
DS	Digested Sludge										
	Aboveground	< 4	304SST	Sch 40	40_05_23.01	Threaded or Welded	50 psig/HH	None	None		
	Aboveground	4-10	DIP	CL 53	40_05_19.01	FL or GE	50 psig /HH	EC	EPP		

Abbreviations:

1. The following abbreviations used in the column of test method refer to the respective methods as specified in Section 40_05_00.09.
   - AM Air method
   - GR Gravity method
   - HH High head method
   - LH Low head method
   - SC Special case
2. Abbreviations to designate piping include the following:
   - B&SP Bell and spigot
   - CI Cast iron
   - CISP Cast iron soil pipe
   - CL Class, followed by the designation
   - CM Cement mortar
   - CTP Coal tar pitch
   - DIP Ductile iron piping
   - EC Epoxy-Ceramic
   - EPP Epoxy polyurethane coating
   - FL Flange
   - GA Gauge, preceded by the designation
   - GE Grooved end joint
   - GL Glass lined
   - GSP Galvanized steel pipe
   - MJ Mechanical joint
   - NPS Nominal pipe size, followed by the number in inches
   - psi pounds per square inch
   - psig pounds per square inch gauge
   - PE Polyethylene
   - PEE Polyethylene encasement
   - PTW Polyethylene tape wrap
   - PVC Polyvinyl Chloride
   - SCH Schedule, followed by the designation
   - SCRD Screwed-On
   - SST Stainless steel
   - SW Solvent welded
   - VCP Vitrified clay piping
   - WLD Weld

END OF SECTION

SECTION 40_05_00.09

PIPING SYSTEMS TESTING

GENERAL

SUMMARY

Section includes: Test requirements for piping systems.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

National Fuel Gas Code (NFGC).

American Society of Mechanical Engineers (ASME):

B31.3 - Process Piping.

B31.8 - Gas Transmission and Distribution Piping Systems.

Underwriters Laboratories Inc. (UL).

TESTING REQUIREMENTS

General requirements:

Testing requirements are stipulated in Laws and Regulations; are included in the Piping Schedule in Section 40_05_00.01; are specified in the specifications covering the various types of piping; and are specified in this Section.

Requirements in Laws and Regulations supersede other requirements of Contract Documents, except where requirements of Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.

Test plumbing piping in accordance with Laws and Regulations, the plumbing code, and UL requirements.

Test natural gas or digester gas piping:

For less than 125 pounds per square inch gauge working pressure, test in accordance with mechanical code, as or the National Fuel Gas Code, whichever is more stringent.

For 125 pounds per square inch gauge or greater working pressure, test per ASME B31.3 or ASME B31.8, whichever is more stringent.

When testing with water, the specified test pressure is considered to be the pressure at the lowest point of the piping section under test.

Lower test pressure as necessary (based on elevation) if testing is performed at higher point of the pipe section.

Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.

Water for testing, cleaning, and disinfecting:
Water for testing, cleaning, and disinfecting will be provided as specified in Section 01_50_00.

Pipes to be tested: Test only those portions of pipes that have been installed as part of this Contract. Test new pipe sections prior to making final connections to existing piping. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections. Do not use existing valves as test plug or bulkhead.

Unsuccessful tests:
Where tests are not successful, correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
Repeat testing until tests are successful.

Test completion: Drain and leave piping clean after successful testing.

Test water disposal: Dispose of testing water at the Plant Headworks in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.

SUBMITTALS

Submit as specified in General Conditions, GC 4.0 and Section 01_33_00 .

Schedule and notification of tests:
Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
Notification of readiness to test: Immediately before testing, notify ENGINEER in writing of readiness, not just intention, to test piping.
Have personnel, materials, and equipment specified in place before submitting notification of readiness.

SEQUENCE

Clean piping before pressure or leak tests.

Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.

Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.

Backfill and compact trench, or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.

Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

PRODUCTS

Not Used.

EXECUTION

TESTING HIGH-HEAD PRESSURE PIPING

Test piping for which the specified test pressure in the Piping Schedule is 20 pounds per square inch gauge or greater, by the high head pressure test method, indicated "HH" in the Piping Schedule.

General:

- Test connections, hydrants, valves, blowoffs, and closure pieces with the piping.
- Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.
- Do not include valves, equipment, or piping specialties in test sections if test pressure exceeds the valve, equipment, or piping specialty safe test pressure allowed by the item's manufacturer.
- During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
- Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.
- When test results indicate failure of selected sections, limit tests to piping:
  - Between valves.
  - Between a valve and the end of the piping.
  - Less than 500 feet long.
- Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.

Testing procedures:

- Fill piping section under test slowly with water while venting air:
  - Use potable water for all potable waterlines and where noted on the Piping Schedule.
- Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of minimum 24 hours.
- Raise pressure to the specified test pressure and inspect piping visually for leaks:
- Consider visible leakage testing complete when no visible leaks are observed.

Pressure test with maximum leakage allowance:

- Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.
- Pressure test piping after completion of visible leaks test.

For piping systems using joint designs other than flanged, threaded, or welded joints, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:

Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.

Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.

When leakage is allowed, calculate the allowable leakage by the following formula:

$$L = S \times D \times P^{1/2} \times 133{,}200^{-1}$$

wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inches gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

x = The multiplication symbol.

TESTING LOW-HEAD PRESSURE PIPING

Test piping for which the specified test pressure is less than 20 pounds per square inch gauge, by the low head pressure test method, indicated "LH" in the Piping Schedule.

General:

Test pressures shall be as scheduled in Section 40_05_00.01.

During the performance of the tests, test pressure shall not vary more than plus or minus 2 pounds per square inch gauge with respect to the specified test pressure.

Test connections, blowoffs, vents, closure pieces, and joints into structures, including existing bell rings and other appurtenances, with the piping.

Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.

Visible leaks test:

Subject piping under test to the specified pressure measured at the lowest end.

Fill piping section under test slowly with water while venting air:

Use potable water for all potable waterlines and where noted on the Piping Schedule.

Before pressurizing for the tests, retain water in piping under slight pressure for the water absorption period of minimum 24 hours.
Raise pressure to the specified test pressure and inspect piping visually for leaks. Consider testing complete when no visible leaks are observed.

Pressure test with maximum leakage allowance:
Pressure test piping after completion of visible leaks test.
Accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
Consider the pressure test to be complete when makeup water added is less than the allowable leakage of 80 gallons per inch of nominal diameter, per mile of piping section under test after 24 hours, and no damage to piping and appurtenances has occurred.
Successful completion of the leakage test shall have been achieved when the observed leakage is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.

Optional joint test:
When joint testing is allowed by note in the Piping Schedule, the procedure shall be as follows:
Joint testing will be allowed only for low head pressure piping.
Joint testing does not replace and is not in lieu of any testing of the piping system or trust restraints.
Joint testing may be performed with water or air.
Joint test piping after completion of backfill and compaction to the top of the trench.
Joint testing with water:
Measure test pressure at the invert of the pipe. Apply pressure of 4 feet plus the inside diameter of the pipe in water column within 0.20 feet in water column.
Maintain test pressure for 1 minute.
Base the allowable leakage per joint on 80 gallons per inch nominal diameter, per mile of piping, per 24 hours equally distributed to the actual number of joints per mile for the type of piping.
Consider the pressure test to be complete when makeup water added is less than the allowable leakage.
Successful completion of the joint test with water shall have been achieved when the observed leakage is equal or less than the allowable leakage.
Joint testing with air:
Apply test pressure of 3 pounds per square inch gauge with a maximum variation of plus 0.20 and minus 0.00 pounds per square inch.
Maintain test pressure for 2 minutes.
Consider the pressure test to be complete when the test pressure does not drop below 2.7 pounds per square inch for the duration of the test.

END OF SECTION

SECTION 40_05_06.55

PIPING INSULATION

GENERAL

SUMMARY

Section includes: Insulation for piping and related systems.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):

A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.

C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

C 547 - Standard Specification for Mineral Fiber Pipe Insulation.

C 552 - Standard Specification for Cellular Glass Thermal Insulation.

C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

C 929 - Standard Practice for Handling, Transporting, Shipping, Storage, Receiving, and Application of Thermal Insulation Materials for Use in Contact with Austenitic Stainless Steel.

C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D 2310 - Standard Classification of Machine-Made "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe.

E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

DEFINITIONS

Concealed: Piping above suspended ceilings and within walls, partitions, shafts, or service spaces and spaces not normally exposed to view but not buried.

Exterior: Piping that is installed outside a building or within a pipe trench or tunnel.

Flame spread and smoke density: Burning characteristics determined in accordance with ASTM E 84. No units apply to value.

Interior: Piping that is installed inside a building.

K factor: Thermal conductivity determined in accordance with ASTM C 177 or C 518 and expressed in units of hour-square feet -degrees Fahrenheit.

Mineral fiber: Fibers manufactured of glass, rock, or slag processed from a molten state, with or without a binder.

Water vapor permeance: Water vapor transmission determined in accordance with ASTM E 96 and expressed in units of perm-inch.

SUBMITTALS

Product data:

Insulation properties: Include K factor, thickness, density, operating temperature limits, tensile strength, compressive strength, moisture absorption, flame spread, and smoke developed in accordance with ASTM E 84 and corrosivity to stainless steel piping in accordance with ASTM C 795.

Jacket properties: Include covering material, cover thickness, tensile strength, tear strength, permeability in accordance with ASTM E 96, flame spread, and smoke developed in accordance with ASTM E 84, closure type or devices, and accessories.

Insulating blankets: Include materials, performance characteristics, method of attaching to equipment, listing of locations where insulating blankets will be installed.

Manufacturer's application instructions: Include assembly and application drawings and detailed instructions.

Laboratory report: Provide certified laboratory report stating that insulation is not manufactured using chlorinated polymers and does not contain chlorides, bromides, sulfates, or fire-rated materials.

DELIVERY, STORAGE, AND HANDLING

Store insulation materials and accessories under cover and protected from moisture.

Handle and store insulation for use on stainless steel in accordance with ASTM C 929.

SEQUENCING AND SCHEDULING

Pressure test piping and complete application of coating system before applying insulation.

When piping is to be heat traced, install and functionally test heat tracing before installation of insulation.

Before beginning installation of piping insulation, verify that the ENGINEER has accepted piping tests, pipe coating applications, and heat tracing tests.

PRODUCTS

PIPE INSULATION, GENERAL REQUIREMENTS

Insulation thicknesses: Provide insulation thickness in inches in accordance with the following table. Insulation thickness shown is nominal. Manufacturing tolerance of 15 percent variation is permissible.

Required Insulation Thicknesses (inches)					
Service Temperature Range as Designated in Insulation Schedule at End of this Section	**Nominal Pipe Diameters**				
	1 inch & less	**1.25 to 2 inch**	**2.5 to 4 inch**	**5 to 10 inch**	**Over 10 inch**
Above 200 degrees Fahrenheit	2.0	2.5	3.0	3.5	3.5
100 to 200 degrees Fahrenheit	1.5	1.5	1.5	2.0	2.5
40 to 100 degrees Fahrenheit	0.5	1.0	1.0	1.5	2.0
Below 40 degrees Fahrenheit	1.0	1.0	1.5	2.0	2.0
Heat Traced Pipes	1.0	1.0	1.0	1.5	2.0
Aeration Air Pipes	0.5	0.5	1.0	1.0	1.0

PIPE INSULATION

Insulation types: Provide in accordance with the insulation types listed and scheduled.

Insulation, Type 1:
- Insulation material: Closed cell elastomeric insulation.
- Manufacturers: One of the following or equal:
  - Armstrong World Industries, AP Armaflex.
  - Apache Products Company, ISO-25.
- Minimum temperature range: Minus 40 degrees Fahrenheit to plus 220 degrees Fahrenheit.
- K factor at 75 degrees Fahrenheit: Not more than 0.27 BTU-inch/hour-square feet degrees Fahrenheit.
- Fire ratings:
  - Flame spread: 25 or less.
  - Smoke density: 50 or less for insulation thicknesses up to 1.5 inches.
- Joints: Seal with manufacturer’s recommended contact adhesive to form continuous water barrier.

Insulation, Type 2:

Insulation material: Preformed mineral fiberglass insulation made from glass fibers bonded with a thermosetting resin.
In accordance with ASTM C 547, Class 1.
Provide with factory installed vapor barrier.

Material: White kraft paper bound to aluminum foil in accordance with ASTM C 1136, Type I.

Longitudinal lap seals: Pressure-sensitive, self-sealing longitudinal lap strip with factory applied adhesive.
Circumferential butt seals: 4-inch wide tape or similar properties or 4-inch wide overlap with adhesive seal.
Vapor barrier permeability: 0.02 perms or lower.
Vapor barrier flame spread rating: 25 or less.

Minimum temperature range: Minus 0 degrees Fahrenheit to plus 850 degrees Fahrenheit.
K factor at 75 degrees Fahrenheit: Not more than 0.23 BTU-inch/hour-square feet degrees Fahrenheit.
Maximum moisture absorption, volume percent: 5.
Manufacturers: One of the following or equal:

Owens-Corning Fiberglas Corp.
Johns Manville
Knauf Fiber Glass.

Insulation, Type 3:

Insulation material: Rigid cellular glass in accordance with ASTM C 552, Type II.
Temperature range: Minus 450 degrees Fahrenheit to plus 900 degrees Fahrenheit.
K factor at 75 degrees Fahrenheit: Not more than 0.32 BTU-inch/hour-square feet degrees Fahrenheit.
Minimum average density: 7.5 pounds per cubic foot.
Maximum moisture absorption, volume percent: 5.
Minimum compressive strength: 87 pounds per square inch.
Moisture permeability: 0.00 perm-inch.
Manufacturers: One of the following or equal:

Pittsburgh Corning Corporation, Foamglas.
Cell-U-Foam Corporation, Ultra-CUF.

INSULATION JACKETS

Jacket, Type 1:

Material: 28 ounces per square yard polyvinyl chloride on polyester fabric; total thickness 0.028 inches minimum.
Fire rating: 25 maximum flame spread, smoke developed 50 or less.
Color: As selected by the ENGINEER from manufacturer's standard colors.
Overlap: 1-inch minimum at joints and fittings.
Joint seal: Self-sealing lap tape.
Fittings: Factory made with full thickness insulation.
Manufacturers: One of the following or equal:

Accessible Products, Techlite Insulation, 379 SSL Series.

Jacket, Type 2:

Material: Ultraviolet resistant polyvinyl chloride jacketing, 20 mil minimum thickness.
Fire rating: 25 maximum flame spread, smoke developed 50 or less.
Color: White.
Overlap: 1-inch minimum at joints and fittings.
Joint seal: PVC solvent welded or adhesive as recommended by the manufacturer.
Fittings: Factory made with full thickness insulation.
Manufacturers: One of the following or equal:
- Johns Manville, Zeston 2000 PVC.
- Proto Corp., LoSMOKE PVC.
- Speedline Smoke Safe PVC Jacketing System.
- Knauf Covering System.

Jacket, Type 3:

Material: Aluminum, Alloy 5005; 0.016-inch (26 gauge) minimum thickness.
Overlap: Overlap circumferential joints 4-inches minimum; overlap longitudinal joints 1-inch minimum; longitudinal joints oriented to minimize water entry.
Bands: 0.5 inch wide, 0.0508 inch (16 gauge) thick aluminum, same alloy as jacket or 0.0179 inch thick Type 304 stainless steel; install on 18 inch centers, uniformly spaced and at all fitting joints.
Joint seal: Apply waterproof adhesive at joints and overlaps.
Fittings: Custom fit of same materials.
Manufacturers: One of the following or equal:
- Childers Products.
- Premetco International.

VAPOR BARRIERS

Vapor barrier, Type 1:

Material: White kraft paper bound to aluminum foil in accordance with ASTM C 1136, Type 1.
Permeability: 0.02 perms or lower.
Maximum flame spread rating: 25.
Edge seal: Pressure sensitive tape lap seal.
Circumferential joints: 4-inch wide tape or 4-inch overlap with adhesive seal.

Vapor barrier, Type 2:

Material: Mastic.
Manufacturers: One of the following or equal:
- Benjamin Foster, No. 30-76.
- Insul-Coustic, No. I.C.-580.
- Foster Products, 36-10/46-10 Weatherite.
- Childers Products CP10/11 Vi-Acryl.

RELATED MATERIALS

Cover adhesive: Premium adhesive as recommended by the insulation cover supplier for heavy-duty service in corrosive, wet environments. Standard duty adhesives are not permitted.

REMOVABLE INSULATING BLANKETS

In piping systems specified to be insulated, use removable insulating blankets for valves, meters, strainers, filters, catalytic converters, engine exhaust silencers, and other in-line piping appurtenances and equipment requiring periodic servicing.

Size limits: Use removable insulating blankets for equipment and piping appurtenances 3 inch in nominal size and larger. Insulate equipment and piping appurtenances less than 3 inch with molded sections of insulation or by field cutting insulation to conform to the shape of the component and to fit tightly around the component.

Manufacturers: One of the following, or equal:
- Pittsburgh Corning, Temp-Mat.
- Accessible Products, Thermazip 2000 Jacket.
- Thermal Energy Products, Inc., Energy Wrap.

Low temperature insulating blankets rated up to 800 degrees Fahrenheit:
- Use: For service temperatures up to 800 degrees Fahrenheit.
- Insulation: Fiberglass fiber, K factor 0.27 at 75 degrees Fahrenheit.
- Cover: 17-ounce fabric with both sides covered with silicone impregnated glass cloth suitable for temperatures up to 800 degrees Fahrenheit.
- Cover fasteners: Use one of the following systems:
  - Grommets in the blanket and stainless steel wire; or
  - 1-inch wide straps with stainless steel rectangular ring buckles and Velcro on strap tail.

High temperature insulating blankets rated up to 1,400 degrees Fahrenheit:
- Rated for sustained service temperatures up to 1,400 degrees Fahrenheit.
- Insulation: Ceramic fiber, K factor 0.50 at 600 degrees Fahrenheit, insulation material suitable for up to 2,300 degrees Fahrenheit, thickness to match adjacent piping insulation specified thickness.
- Cover: 17-ounce silicone impregnated fiberglass cloth suitable for temperatures up to 1,400 degrees Fahrenheit.
- Cover fasteners: Use one of the following systems:
  - Grommets in the blanket and stainless steel wire; or
  - 1-inch wide straps with stainless steel rectangular ring buckles and Velcro on strap tail.

EXECUTION

EXAMINATION

Verification of conditions: Before installing insulation, verify satisfactory completion of pressure tests of piping systems and functional tests of heat tracing equipment.

Examine piping surfaces and verify that surfaces are dry and free of loose scale, rust, dirt, oil, or water before applying insulation. When specified, paint or coat pipe surfaces as specified in Section 09_96_01 before installing insulation.

Examine insulation materials and accessories before installation. Do not install insulation and jackets that have been damaged or insulation that has become wet due to exposure to water.

INSTALLATION

Install insulation and jacket materials in accordance with manufacturer's written instructions.

Apply insulation in smooth, clean manner with tight and finished smooth joints. Fit insulation tightly against surfaces. Insulate each continuous run of pipe with full-length sections of insulation with a single piece cut to length to complete the run of pipe. Do not use cut pieces or scraps to complete the installation.

Butt longitudinal and circumferential insulation joints firmly together.

Maintain the integrity of vapor barrier jacketing. Do not use staples to hold vapor barrier overlaps in place.

Apply sealant or cement when previous applications of adhesives and cement have thoroughly dried.

Apply insulation to permit expansion or contraction of pipelines without damage to insulation or jacketing.

Fittings:

Insulate fittings by covering with mitered sections of insulation or utilize factory-made prefabricated fitting shapes.
Terminate preformed pipe jackets or covering at sufficient distance from flanges to permit removal of bolts.
Overlap flange and flanged fitting insulation on adjacent pipe covering by at least 2 inches.

Valves:

Insulate valves 3-inch in nominal size and larger with removable insulating blankets.
Size blanket to extend up to packing gland only so that replacement of packing does not require removal of insulating blanket.

Provide continuous insulation through and over pipe supports and provide protection saddles at supports.

Extend insulation against insulation end protection shields or covers so that insulation voids do not exist and provide watertight end seals and covers where insulation terminates.

Insulate pipeline strainers to permit removal of strainer basket without disturbing insulation on strainer body.

Provide continuous pipe insulation and covering through sleeves or openings in walls and floors. When buried pipe enters a building through a below grade wall or slab penetration, begin insulation system on interior side of penetration.

Apply premolded pipe insulation with extended legs when used on pipe traced with either tubing or electric cable type.

Thermally isolate all insulation closure locations (end caps, transitions, etc.) Type 1 or 2 jacket installation on piping with potential reach temperatures greater than 150 degrees Fahrenheit.

Apply piping identification on jackets as specified in Section 46_05_11.

INSULATION SCHEDULE

Service Designation (1)	Location(2)	Insulation Type(3)	Jacket Type(3)	Service Temp. °F(4)	Vapor Barrier
Low Pressure Digester Gas and flame arresters	Exterior	3	3	10-150	1
Drain	Exterior	3	3	10-150	1

Notes:

1. Refer to Piping Schedule in Section 40_05_00.01 for service designations.
2. Insulation jackets are not required for interior installations that are concealed. See definitions for description of concealed locations.
3. CONTRACTOR may select from options listed.
4. Unless noted otherwise, use service temperature range provided in this table to establish insulation thickness as required by Table in Paragraph 2.01A.
5. Service temperature based on engine rating. Use Type I calcium silicate for exhaust temperatures up to 1,000 degrees Fahrenheit, use Type II calcium silicate for exhaust temperatures above 1,000 degrees Fahrenheit.
6. Install insulation on all aeration air piping located within the Blower Building from the discharge of blowers to 10 feet above floor slab. Insulation is not required for aeration air piping that is installed higher than 10 feet above the floor slab.
7. Insulate all piping systems that are specified to be heat traced.

END OF SECTION

SECTION 40_05_07.01

PIPE SUPPORTS

GENERAL

SUMMARY

Section includes: Supports for pipe, fittings, valves, and appurtenances.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

ASTM International (ASTM):
A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
A 967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

Manufacturer's Standardization Society (MSS):
SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.
SP-69 - Pipe Hangers and Supports - Selection and Application.

SUBMITTALS

Shop drawings: Include schedule, indicating where supports will be installed, and drawings of pipe support system components.

Seismic calculations stamped by Nevada Professional Engineer

PRODUCTS

PIPE SUPPORTS

Hanger rods: Sized to match suspended pipe hanger, or as indicated on the Drawings:
Manufacturers: One of following or equal:
For stainless steel piping:
Bergen-Power, Figure 133.
Nibco-Tolco, Figure 103.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 140.
Bergen-Power, Figure 133.

Cooper B-Line Systems, Inc., Figure B3205.

Hanger rods, continuously threaded: Sized to match suspended pipe hanger, or as indicated on the Drawings:
- Manufacturers: One of the following or equal:
  - For stainless steel piping:
    - Bergen-Power, Figure 94.
    - FM Stainless Fasteners.
  - For steel and ductile iron piping:
    - Anvil International, Figure 146.
    - Bergen-Power, Figure 94.

Eye bolts:
- For stainless steel piping:
  - Type 316 stainless steel, welded and rated equal to full load capacity of rod.
- For all other piping, unless indicated on the Drawings:
  - Welded and rated equal to full load capacity of rod.

Welded eyebolt rod:
- Manufacturers: One of the following or equal:
  - For stainless steel piping:
    - Nibco-Tolco, Figure 101.
    - FM Stainless Fasteners.
  - For all other piping, unless indicated on the Drawings:
    - Anvil International, Figure 278.
    - Bergen-Power, Figure 93.
    - Cooper B-Line Systems, Inc., Figure B3210.

Adjustable ring hangers: MSS SP-69, Type 7 or Type 9 (system dependent):
- Manufacturers: One of the following or equal:
  - For stainless steel piping:
    - Nibco-Tolco, Figure 1C.I.
    - Bergen-Power, Figure 100SS.
  - For all other piping, unless indicated on the Drawings:
    - Anvil International, Figure 97.
    - Cooper B-Line Systems, Inc., Figure B3172.

Adjustable clevis hangers: MSS SP-69, Type 1:
- Manufacturers: One of the following or equal:
  - For stainless steel piping:
    - Cooper B-Line Systems, Inc, Figure B3100 or B3102.
    - FM Stainless Fasteners, Figure 60.
  - For all other piping, unless indicated on the Drawings:
    - Anvil International, Figure 260 or Figure 590.
    - Bergen-Power, Figure100.
    - Cooper B-Line Systems, Inc., Figure B3100 or B3102.

Adjustable clevis hangers for insulated pipe: Oversize:
- Manufacturers: One of the following or equal:
  - For stainless steel piping:
    - Nibco-Tolco, Figure 1A.

For all other piping, unless indicated on the Drawings:
Anvil International, Figure 300.
Bergen-Power, Figure 100EL.
Cooper B-Line Systems, Inc. Figure B3108.

Single rod hangers for steam pipe: MSS SP-69, Type 43; malleable iron or steel yoke and roller hangers; swivel to allow rotation of yoke on rod:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 324.
Cooper B-Line Systems, Inc., Figure B3110.
FM Fasteners, Figure 81.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 181.
Cooper B-Line Systems, Inc., Figure B3110.

Double rod hangers for steam pipe: MSS SP-69, Type 41:
Manufacturers: One of the following or equal:
For stainless steel piping:
FM Stainless Fasteners, Figure 71.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 171.
Cooper B-Line Systems, Inc., Figure B3114.

Brackets: MSS SP-69, Type 32 with back plate; rated for 1,500 pounds:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 30M.
Cooper B-Line Systems, Inc., Figure B3066.
FM Stainless Fasteners, Figure 98.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 195.
Cooper B-Line Systems, Inc., Figure B3066.

Standard U-bolt: MSS SP-69, Type 24:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 110.
Cooper B-Line Systems, Inc., Figure B3188.
FM Stainless Fasteners, Figure 37.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 137.
Bergen-Power, Figure 283.
Cooper B-Line Systems, Inc., Figure B3188.

Riser clamps: MSS SP-69, Type 8:
Manufacturers: One of the following or equal:
For stainless steel piping:
Cooper B-Line Systems, Inc., Figure B3373.
FM Stainless Fasteners, Figure 61.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 261.

Bergen-Power, Figure 126.
Cooper B-Line Systems, Inc., Figure B3373.

Pipe clamps: MSS SP-69, Type 4:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 4.
Cooper B-Line Systems, Inc., Figure 3140.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 212.
Bergen-Power, Figure 175.
Cooper B-Line Systems, Inc., Figure B3140.

Adjustable offset pipe clamp:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 4.
Cooper B-Line Systems, Inc., Figure B3149.
FM Stainless Fasteners, Figure 63.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 100.
Cooper B-Line Systems, Inc., Figure B3149.

Offset pipe clamp:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 8.
Cooper B-Line Systems, Inc., Figure 3148.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 103.
Cooper B-Line Systems, Inc., Figure B3148.

Floor stand or stanchion saddles: MSS SP-69, Type 37. Provided with U-bolt hold down yokes:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 318.
FM Stainless Fasteners, Figure 59.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 259.
Bergen-Power, Figure 125.
Cooper B-Line Systems, Inc., Figure B3090.

Spring hangers:
Manufacturers: One of the following or equal:
For stainless steel piping:
Bergen-Power, Figure 920.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure B-268, Type G.
Bergen-Power, Figure 920.

One hole pipe clamps:
Manufacturers: One of the following or equal:
For stainless steel piping:
Not used.
For all other piping:
Anvil International, Figure 126.
Carpenter & Paterson, Figure 237S.

Welded beam attachment: MSS SP-69, Type 22:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 304.
Cooper B-Line Systems, Inc., Figure 3083.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 66.
Bergen-Power, Figure 113A or 113B.
Cooper B-Line Systems, Inc., Figure B3083.

Heavy pipe clamp: MSS SP-69, Type 4:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 4H.
For all other piping, unless called out otherwise on the Drawings:
Anvil International, Figure 216.
Bergen-Power, Figure 298.

PTFE pipe slide assembly: MSS SP-58, Type 35 with lateral and vertical restraint:
Manufacturers: One of the following or equal:
For stainless steel piping:
Nibco-Tolco, Figure 426.
For all other piping, unless indicated on the Drawings:
Anvil International, Figure 257, Type 3.
Cooper B-Line Systems, Inc., Figure B3893.

Anchor bolts, concrete anchors, concrete inserts, powder-actuated fasteners, and sleeve anchors: As specified in Section 05_12_00.

MATERIALS

Pipe supports:
Stainless steel (Type 304 or 316):
Use in the following applications:
All submerged locations, above water level but below top of wall inside water bearing structures;
Support for stainless steel piping systems;
Where specifically indicated on the Drawings.
Field welding and fabrication of supports is prohibited.
Shop-fabricated supports:
Finish requirements: Remove free iron, heat tint oxides, weld scale, and other impurities, and obtain a passive finished surface.
At the shop, perform pickling and passivation on all surfaces inside and out in accordance with ASTM A 380 or A 967.

Passivation treatments using citric acid are not allowed.

Fasteners:
As specified in Section 05_12_00.

EXECUTION

INSTALLATION

Properly support, suspend, or anchor exposed pipe, fittings, valves, and appurtenances to prevent sagging, overstressing, or movement of piping; and to prevent thrusts or loads on or against connected pumps, blowers, and other equipment.

Field verify support location, orientation, and configuration to eliminate interferences prior to fabrication of supports.

Carefully determine locations of inserts. Anchor to formwork prior to placing concrete.

Use flush shells only where indicated on the Drawings.

Do not use anchors relying on deformation of lead alloy.

Do not use powder-actuated fasteners for securing metallic conduit or steel pipe larger than 1 inch to concrete, masonry, or wood.

Suspend pipe hangers from hanger rods and secure with double nuts.

Install continuously threaded hanger rods only where indicated on the Drawings.

Use adjustable ring hangers or adjustable clevis hangers, for 4 inch and smaller diameter pipe.

Use adjustable clevis hangers for pipe larger than 4 inches in diameter.

Secure pipes with double-nutted U-bolts or suspend pipes from hanger rods and hangers.
For stainless steel piping, use stainless steel U-bolts.
For all other piping, use galvanized U-bolts.

Support spacing:
Support 2-inch and smaller piping on horizontal and vertical runs at maximum 5 feet on center, unless otherwise specified.
Support larger than 2-inch piping on horizontal and vertical runs at maximum 10 feet on center, unless otherwise specified.
Support exposed polyvinyl chloride and other plastic pipes at maximum 5 feet on center, regardless of size.
Support tubing, copper pipe and tubing, fiber-reinforced plastic pipe or duct, and rubber hose and tubing at intervals close enough to prevent sagging greater than 1/4 inch between supports.

Install supports at:

- Any change in direction.
- Both sides of flexible pipe connections.
- Base of risers.
- Floor penetrations.
- Connections to pumps, blowers, and other equipment.
- Valves and appurtenances.

Securely anchor plastic pipe, valves, and headers to prevent movement during operation of valves.

Anchor plastic pipe between expansion loops and direction changes to prevent axial movement through anchors.

Provide elbows or tees supported from floors with base fittings where indicated on the Drawings.

Support base fittings with metal supports or when indicated on the Drawings support on concrete piers.

Do not use chains, plumbers' straps, wire, or similar devices for permanently suspending, supporting, or restraining pipes.

Supports, clamps, brackets, and portions of support system bearing against copper pipe: Copper plated, copper throughout, or isolated with neoprene or polyvinyl chloride tape.

Where pipe is insulated, install over-sized supports and hangers.

Install insulation shield in accordance with MSS SP-69, Type 40. Shield shall be galvanized steel unless otherwise specified or indicated on the Drawings.

Install riser clamps at floor penetrations and where indicated on the Drawings.

Coat support system components as specified in Section 09_96_01.

END OF SECTION

SECTION 40_05_19.01

DUCTILE IRON PIPE, AWWA C151

GENERAL

SUMMARY

Section includes: Ductile iron pipe, joints, fittings, gaskets, and pipe linings and coatings.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Society of Mechanical Engineers (ASME):

B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

American Water Works Association (AWWA):

C104 - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
C115 - Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
C150 - Standard for Thickness Design of Ductile-Iron Pipe.
C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
C153 - Standard for Ductile-Iron Compact Fittings for Water Service.
C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.
C606 - Standard for Grooved and Shouldered Joints.

American Welding Society (AWS):

D11.2 - Guide for Welding Iron Castings.

ASTM International (ASTM):

A 47 - Standard Specifications for Ferritic Malleable Iron Castings.
A 183 - Standard Specifications for Carbon Steel Track Bolts and Nuts.
A 536 - Standard Specifications for Ductile Iron Castings.
C 283 - Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

Ductile Iron Pipe Research Association (DIPRA):
Thrust Restraint Design Manual.

NACE International (NACE):
SP0188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

National Association of Pipe Fabricators, Inc. (NAPF):
500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.

Society for Protective Coatings (SSPC):
PA-2 - Measurement of Dry Coating Thickness With Magnetic Gages.

SUBMITTALS

Product data: Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, pipe linings, and coatings.

Shop drawings:
Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, connections to structures, and thrust restraint system layouts.
Thrust restraint systems: Calculations and layout for restrained joint thrust restraint systems.

Test reports:
Submit Coating Manufacturer's Technical Representative's reports.

QUALITY ASSURANCE

Pre-installation meeting:
Arrange for Coating Manufacturer's Technical Representative to attend preconstruction conferences, and to make periodic visits to factory or shop to inspect surface preparation of pipe, fittings, and accessories; and to inspect application of linings to interior and coatings to exterior of pipe, fittings, and accessories.

DELIVERY, STORAGE, AND HANDLING

Block piping and associated fittings for shipment to prevent damage to coatings and linings.

Carefully handle piping and associated fittings during loading, unloading, and installation.
Do not drop piping material from cars or trucks.
Lower piping by mechanical means.
Do not drop or pound pipe to fit grade.

Protect gaskets and polyethylene encasement from long-term exposure to sunlight.

Store piping, fittings, and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

PRODUCTS

MANUFACTURED UNITS

Ductile iron piping:
- Typical type:
  - In accordance with AWWA C150 and AWWA C151.
  - Pressure class or special thickness class as indicated in the Piping Schedule provided in Section 40_05_00.01.
- Type with screw-on flanges:
  - In accordance with AWWA C115 with minimum special thickness Class 53 wall thickness as required for screw-on flanges.
  - Special thickness class as indicated in the Piping Schedule as specified in Section 40_05_00.01.

Joints:
- Flanged joints:
  - Screw-on flanges: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ASME B16.1. In addition, comply with the following requirements:
    - Ductile iron.
    - Long hub, threaded, and specially designed for ductile iron pipe.
    - After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.
  - Bolt holes on flanges: 2-holed and aligned at both ends of pipe.
  - Cap screw or stud bolt holes: Tapped.
  - Bolts and nuts: As specified in Section 40_05_00.01.
  - Gaskets: Standard styrene butadiene copolymer (SBR) unless specified otherwise in Section 40_05_00.01.

Fittings:
- Ductile iron in accordance with AWWA C110
- Joint type: Same as that of the associated piping as specified in Section 40_05_00.01.
- Plain end-to-flanged joint connectors using setscrews are not acceptable.

Pipe linings:
- Ceramic Epoxy Lining:
  - Manufacturers: One of the following or equal:
    - U. S. Pipe, PROTECTO 401.
  - Material: Amine cured novalac epoxy containing at least 20 percent by volume of ceramic quartz pigment.
  - Application:
    - Lining shall only be applied by manufacturer-authorized representative with no less than 5 years of experience in applying the specified material.
    - The application of the lining shall be preformed in strict adherence to the manufacturer’s published specifications.

Coverage:
Push-on Joints: provide 6 mils minimum and 10 mils maximum coverage of join compound as specified by the manufacturer for the bell gasket area and spigot ends.
Mechanical Joints: Extend lining from spigot end to edge of gauging ring.
Source Quality Control:
Test pipe and fitting lining with a magnetic film thickness gauge.
Testing shall be preformed in accordance with the method outlined in SSPC PA-2 Film Thickness Rating.
Lining integrity of all pipes shall be tested using a holiday detection testing instrument set at the voltage as specified by the coating manufacturer.
Repair all holidays in strict accordance with the recommendations of the coating manufacturer, and re-test.
Discard piping or reline piping when pinholes or discontinuities are found.

Coatings:
Asphalt varnish: Factory applied.
Primer:
Factory applied for field coating.
Compatible with materials as specified in Section 09_96_01.

EXECUTION

INSTALLATION

General:
Install ductile iron piping in accordance with AWWA C600, modified as specified in Section 40_05_00.01.

Joints:
Install types of joints as specified in the piping schedule provided in Section 40_05_00.01.
Mechanical joints are not acceptable in above ground applications.
Field closure for restrained push-on pipe:
Locate field closures in areas where thrust calculations demonstrate restraint is not required.
Grooved joints:
Install piping with grooved joints where specified in the piping schedule as specified in Section 40_05_00.01 or indicated on the Drawings.
Assemble grooved joints in accordance with manufacturer's published instructions.
Support grooved-end pipe in accordance with manufacturer's published instructions.
Install at least 1 support between consecutive couplings.

FIELD QUALITY CONTROL

Testing ductile iron piping:
Test as specified in Section 40_05_00.01.

Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104.
When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.
Discard lined piping and fittings found to have pinholes, crazing, or fish scales, which expose the metal substrate.

END OF SECTION

SECTION 40_05_23.01

STAINLESS STEEL PIPE AND TUBING

GENERAL

SUMMARY

Section includes: Stainless steel piping and tubing.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Society of Mechanical Engineers (ASME):

B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.

B31.3 - Process Piping.

B36.19 - Stainless Steel Pipe.

ASTM International (ASTM):

A 182 - Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

A 193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

A 194 - Standard Specification for Carbon and Alloy Steel Nuts and Bolts for High Pressure or High Temperature Service, or Both.

A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

A 276 - Standard Specification for Stainless Steel Bars and Shapes.

A 312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

A 403 - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.

A 774 - Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Services at Low and Moderate Temperatures.

A 778 - Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

A 790 - Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe.
A 928 - Standard Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal.
A 967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

DESIGN REQUIREMENTS

Piping layout: Lay out and fabricate piping systems with piping sections as long as possible, while still allowing shipment, so that joints are minimized.

Piping design indicated on the Drawings illustrates piping layout and configuration and does not indicate the location of every joint and flexible coupling that may be needed to connect piping sections fabricated in the shop. Add joints and flexible couplings in a manner that achieves intent of maximizing size of individual piping sections.

Shop fabrication: Fabricate piping sections in the shop and pickle and passivate at point of manufacture.

Field assembly:

Field welding is prohibited.

Assemble shop-fabricated piping in the field using the joints designed into the piping layout or by using flexible couplings.

SUBMITTALS

Layout drawings: Detailed layout drawings showing dimensions and alignment of pipes; location of valves, fittings, and appurtenances; location of field joints; location of pipe hangars and supports; connections to equipment or structures; location and details of shop welds; and thickness and dimensions of fittings and gaskets. Prepare layout drawings.

Product data:

Photographs, drawings, and descriptions of pipe, fittings, welding procedures, and pickling and passivating procedures.

Material specifications for pipe, gaskets, fittings, and couplings.

Data on joint types and components used in the system including, flanged joints, grooved joint couplings and screwed joints.

Manufacturing certifications.

Welder and weld operator qualification certificates and welding procedures.

PRODUCTS

STAINLESS STEEL PIPE

General:

Pipe sizes specified in the Specifications and indicated on the Drawings are nominal.

Wall thickness:
As specified in Section 40_05_00.01.

Piping material and manufacturing:
Comply with the requirements outlined in the following table:

Service	Stainless Steel Grade	Pipe Manufacturing Process
Digester Gas, Oxygen and Ozone Service, Membrane and Reverse Osmosis Filtration Systems with chloride concentrations less than 1,000 parts per million and/or free chlorine less than 4 parts per million at ambient temperatures.		
Piping 3 inches in nominal diameter and larger	Type 316L or LDX 2101 stainless steel in accordance with ASTM A 240	Type 316L in accordance with ASTM A 778
		Type LDX 2101 in accordance with ASTM A 790
Piping less than 3 inches in nominal diameter	Type 316L or LDX 2101 stainless steel in accordance with ASTM A 240	Type 316L in accordance with ASTM A 312
		Type LDX 2101 in accordance with ASTM A 790

Chemical analysis certificates.

Fittings for piping 3 inches in nominal diameter and greater:
Material: In accordance with ASTM A 240 stainless steel, grade to match the pipe.
Manufacturing standard: In accordance with ASTM A 774.
Wall thickness of fitting: In accordance with ASME B36.19 for the schedule of pipe specified.
End configuration: As needed to comply with specified type of joint.
Dimensional standards:
Fittings with weld ends: In accordance with ASME B16.11.
Fittings with flanged ends: In accordance with ASME B16.5, Class 150.

Fittings for piping less than 3 inches in diameter:
Material: In accordance with ASTM A 240 stainless steel, grade to match the pipe.
Manufacturing standard: In accordance with ASTM A 403, Class WP.
Wall thickness and dimensions of fitting: In accordance with ASME B16.11 and as required for the schedule of pipe specified.
End configuration: As needed to comply with specified type of joint.
Forgings in accordance with ASTM A 182, or barstock in accordance with ASTM A 276. Match forging or barstock material to the piping materials.

Piping joints:
Joint types, piping greater than 2 inches in diameter, general:
Where type of joint is specifically indicated on the Drawings or specified, design and shop-fabricate piping sections utilizing type of joint illustrated or scheduled.

Where type of joint is not specifically indicated on the Drawings or as specified in Section 40_05_00.01 Piping Schedule, design and shop-fabricate piping sections utilizing any of the following joint types:
Flanged joints.
Joints in digester gas, ozone and oxygen piping systems, membrane and reverse osmosis filtration systems:
Aboveground piping: flanged, or grooved,
Buried piping: Welded or mechanically restrained.
Joints in piping 2 inches in diameter and smaller: screwed with Teflon tape thread lubricant, as specified in Section 40_05_00.01.
Flanged joints: Conforming to the requirements in accordance with ASME B16.5, Class 150**,** 300, or 600, as scheduled.

Gaskets:
Digester Gas: EPDM as specified in Section 40_05_00.01.

Bolts for flanges:
Bolts and nuts: Type 316 stainless steel in accordance with ASTM A 193 heavy hex head.
Bolt length such that after installation, end of bolt projects 1/8-inch to 3/8-inch beyond outer face of nut.
Nuts: In accordance with ASTM A 194 heavy hex pattern.

Fabrication of pipe sections:
Welding: Weld in accordance with ASME B31.3.
Weld seams:
Full penetration welds, free of oxidation, crevices, pits and cracks, and without undercuts.
Provide weld crowns of 1/16 inch with tolerance of plus 1/16 inch and minus 1/32 inch.
Where internal weld seams are not accessible, use gas tungsten-arc procedures with internal gas purge.
Where internal weld seams are accessible, weld seams inside and outside using manual shielded metal-arc procedures.
Field welded joints must be passivated inside and out.

Cleaning (pickling) and passivation:
Following shop fabrication of pipe sections, straight spools, fittings, and other piping components, clean (pickle) and passivate fabricated pieces.
Clean (pickle) and passivate in accordance with ASTM A 380 or A 967.
If degreasing is required before cleaning to remove scale or iron oxide, cleaning (pickling) treatments with citric acid are permissible.
However, these treatments must be followed by inorganic cleaners such as nitric acid/hydrofluoric acid.
Passivation treatments with citric acid are not allowed.
Finish requirements: Remove free iron, heat tint oxides, weld scale, and other impurities, and obtain a passive finished surface.
For piping less than 2-inches in diameter:
Following shop fabrication of piping sections, descale, clean and seal piping section in accordance with CGA Standard G-4.1.

STAINLESS STEEL TUBING

Stainless steel tubing:
Seamless tubing made of Type 316L stainless steel and in accordance with ASTM A 269, wall thickness not less than 0.035 inch.

Fittings: Swage ferrule design:
Components made of:
Type 316 stainless steel.
Double acting ferrule design, providing both a primary seal and a secondary bearing force.
Flare type fittings are not acceptable.
Manufacturers: One of the following or equal:
Crawford Fitting Company, Swagelok.
Hoke, Gyrolok.
Parker, CPI.

Valves for use with stainless steel tubing:
Ball type valves with swage ends to match tubing diameter.
Constructed from:
Type 316 stainless steel with TFE seats.
Manufacturers: The following or equal:
Crawford Fitting Company, Swagelok.

SOURCE QUALITY CONTROL

Visually inspect pipe for welding defects such as crevices, pits, cracks, protrusions, and oxidation deposits.

Provide written certification that the pipe as supplied are in accordance with ASTM A 778. Supplemental testing is not required.

Provide written certification that the fittings as supplied are in accordance with ASTM A 774.
Supplementary testing is not required.

Thoroughly clean any equipment before use in cleaning or fabrication of stainless steel.

Storage: Segregate location of stainless steel piping from fabrication of any other piping materials.

Shipment to site:
Protect all flanges and pipe ends by encapsulating in dense foam.
Securely strap all elements to pallets with nylon straps. Use of metallic straps is prohibited.
Cap ends of tube, piping, pipe spools, fittings, and valves with non-metallic plugs.
Load pallets so no tube, piping, pipe spools, fittings, or valves bear the weight of pallets above.
Notify ENGINEER when deliveries arrive so ENGINEER may inspect the shipping conditions.

ENGINEER may reject material due to improper shipping methods or damage during shipment.

EXECUTION

FIELD ASSEMBLY OF SHOP-FABRICATED PIPING SECTIONS

Join shop-fabricated piping sections together using backing flanges, flexible couplings, flanged coupling adapters, grooved couplings, or flanges.

Slope horizontal lines so that they can be drained completely.

Provide valve drains at low points in piping systems.

Install eccentric reducers where necessary to facilitate draining of piping system.

Provide access for inspection and flushing of piping systems to remove sediment, deposits, and debris.

FIELD QUALITY CONTROL

Test piping to pressure and by method as specified in Section 40_05_00.01.
If pressure testing is accomplished with water:
- Use only potable quality water.
- Piping: Thoroughly drained and dried or place immediately into service.

Visually inspect pipe for welding defects such as crevices, pits, cracks, protrusions, and oxidation deposits.

PROTECTION

Preserve appearance and finish of stainless steel piping by providing suitable protection during handling and installation and until final acceptance of the Work.
- Use handling methods and equipment to prevent damage to the coating, include the use of wide canvas slings and wide padded skids.

Do not use bare cables, chains, hooks, metal bars, or narrow skids.
- Store stainless steel piping and fittings away from any other piping or metals. Storage in contact with ground or outside without projection from bad weather is prohibited.
- Protect stainless steel piping and fittings from carbon steel projections (when grinding carbon steel assemblies in proximity) and carbon steel contamination (do not contact stainless steel with carbon steel wire brush or other carbon steel tool).

END OF SECTION

SECTION 40_05_51

COMMON WORK RESULTS FOR VALVES

GENERAL

SUMMARY

Section includes: Basic requirements for valves.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Water Works Association (AWWA):
C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.

ASTM International (ASTM):
A 126 - Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
A 536 - Standard Specification for Ductile Iron Castings.

NSF International (NSF):
61 - Drinking Water System Components - Health Effects.

Society for Protective Coatings (SSPC):
SP 7 - Brush-Off Blast Cleaning.
SP 10 - Near-White Blast Cleaning.

DESIGN REQUIREMENTS

Pressure rating:
Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
When a piping system is specified in the Piping Schedule to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.

Valve to piping connections:
Valves 3 inch nominal size and larger: Flanged ends.
Valves less than 3 inch nominal size: Screwed ends.

Plastic valves in plastic piping:
Up to 2.5 inches: Provide solvent or heat welded unions.
3 inches and above: Provide solvent or heat welded flanges.

SUBMITTALS

Submit as specified in General Conditions 4.0.

Product data:
Submit the following information for each valve:
Valve type, size, pressure rating, Cv factor.
Coatings.
Manual valve actuators:
Information on valve actuator including size, manufacturer, model number.
Certified drawings with description of component parts, dimensions, weights, and materials of construction.
Certifications of reference standard compliance:
Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61.
Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.

Operation and maintenance data:
Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and all non-manual valves. Include information on valve operators in operation and maintenance instruction manual.

QUALITY ASSURANCE

Manufacturer qualifications:
Valves manufactured by manufacturers whose valves have had successful operational experience in comparable service.

DELIVERY STORAGE AND HANDLING

Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

PRODUCTS

MATERIALS

Stainless steel: In accordance with ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.

Valve and operator bolts and nuts:
Fabricated of stainless steel for the following installation conditions:
Submerged in sewage or water.
In an enclosed space above sewage or water.
In structures containing sewage or water, below top of walls.
At openings in concrete or metal decks.

Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11.

Bronze and brass alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.

Valve bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.

INTERIOR PROTECTIVE LINING

When specified in the particular valve specification, provide valves with type of protective lining specified in the particular valve Specification.

Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.

Lining types:
High solids epoxy:
Product equivalent to high solids epoxy specified in Section 09_96_01.
Certified in accordance with NSF 61 for drinking water use.
Interior: Coat valve interior with manufacturer's equivalent high performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the ENGINEER. Manufacturer shall provide for approval, coating information sufficient to allow ENGINEER to assess equivalence to the specified high solids epoxy coating specified in Section 09_96_01.
Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer.
Repair holidays and other irregularities and retest coating.
Repeat procedure until holidays and other irregularities are corrected.

VALVE OPERATORS

Valve operator "Open" direction: Open counterclockwise.

Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels.

Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.
Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case,

stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.

Fit valves located more than 6 feet above operating level with chain operated handles or valve wheels.
Chains: Sufficient length to reach approximately 4 feet above the operating level.
Where chains constitute a nuisance or hazard to operating personnel, provide holdbacks or other means for keeping the chains out of the way.

Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves, and other valves located below the operating deck or level, are specified or indicated on the Drawings to be key operated; provide 2 inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

EXECUTION

EXAMINATION

Preparation prior to installation:
Install valves after the required submittal on installation has been accepted.
Determine after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.

Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

INSTALLATION

Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.

Where needed, furnish and install additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
Where such additional valves are required for operation and maintenance of the particular equipment furnished by CONTRACTOR.
Where such additional valves are required as a result of a substitution or change initiated by CONTRACTOR.

Install valves with their stems in vertical position above the pipe, except as follows:
Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
Install buried plug valves with geared operators with their stems in a horizontal position.

Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.

Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.

Valves with threaded connections:

Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.

Apply pipe joint compound or Teflon tape on external (male) threads to prevent forcing compound into valve seat area.

Valves with flanged connections:

Align flanges and gasket carefully before tightening flange bolts.

When flanges are aligned, install bolts and hand tighten.

Tighten nuts opposite each other with equal tension before moving to next pair of nuts.

Valves with soldered connections:

Do not overheat connection to prevent damage to resilient seats and metal seat rings.

Position valves in full open position before starting soldering procedure.

Apply heat to piping rather than to valve body.

END OF SECTION

SECTION 40_05_62

PLUG VALVES

GENERAL

SUMMARY

Section includes:
- Lubricated.
- Non-lubricated.
- Multi-port plug valves for digester gas service shall be as specified in Section 46_73_19.

Related sections:
- The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Water Works Association (AWWA):
- C517 - Resilient-Seated Cast Iron Eccentric Plug Valves.

ASTM International (ASTM):
- A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- A 536 – Standard Specification for Ductile Iron Castings.

SUBMITTALS

Shop drawings: Submit the following information as specified in General Conditions 4.0 and 40_05_51:
- Product data.
- Operation and maintenance data.

PRODUCTS

NON-LUBRICATED PLUG VALVES

Manufacturers: One of the following or equal:
- DeZurik, "PEF."
- Milliken Valves.

Design:
- Type: Non-lubricated eccentric type, in accordance with AWWA C517.

Plug face: Resilient material that operates satisfactorily at a temperature of 180 degrees Fahrenheit continuous and 215 degrees Fahrenheit intermittent, except for valves in compressed air or digester gas service.

Valves in compressed air service: Resilient material suitable for continuous duty at 250 degrees Fahrenheit.

Valves in digester gas service: Resilient material suitable for petroleum or digester gas at continuous duty at 180 degrees Fahrenheit.

Compression washer: Provide flat compression washer made of Teflon, or of a material having equal physical characteristics on valve stem between plug and bonnet.

Stem seals: Provide stem seals serviceable without unbolting the valve bonnet assembly.

Clearly mark valves to indicate their open and closed positions.

Provide valves with ends as required by piping details indicated on the Drawings.

Materials:

Body and plug: ASTM A 126, Class B, cast-iron, with plug face of Viton material suitable for the intended service as specified under paragraph "Design" above.

Body seats in valves 3-inch size and larger: Provide with overlay of not less than 90-percent nickel and minimum thickness of 1/8 inch on surfaces contacting the plug face.

Stem bearing and bottom bearing: Type 316 stainless steel.

Internal parts, except the body and plug: Type 316 stainless steel.

Exposed nuts, bolts, and washers: Zinc plated. Exception: Exposed nuts, bolts, and washers for buried service: Stainless steel.

VALVE OPERATORS

Furnish valves with an operating wrench or worm gear operator:

Equip valves 4 inch nominal size and smaller with a lever operator.

Equip valves 6 inch nominal size and larger with a worm gear operator.

COATING

Coat interior metal surfaces as specified in Section 40_05_51.

Coat exterior metal surfaces as specified in Section 09_96_01.

EXECUTION

INSTALLATION

Install valves as specified in Section 40_05_51 and the manufacturer’s instructions.

Install valves so that in the closed position the pressure in the pipeline applies a seating head on the valves.

Lubrication: Lubricate plug valves and fill extended lubricant pipes with lubricant suitable for service intended.

Install valves so that in the open position the plug is located in the top half of the valve body.

END OF SECTION

SECTION 40_05_63

BALL VALVES

GENERAL

SUMMARY

Section includes: Metal body ball valves.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Society of Mechanical Engineers (ASME):
B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.

American Water Works Association (AWWA):
C507 - Standard for Ball Valves 6 Inch Through 48 Inch.

ASTM International (ASTM):
A 48 - Standard Specification for Gray Iron Castings.
A 216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
A 351 - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

SYSTEM DESCRIPTION

General: Unless otherwise indicated on the Drawings use:
Metal body ball valves on metallic pipelines.

Do not use metal body ball valves in sodium hypochlorite or sodium bisulfite systems.

SUBMITTALS

Shop drawings: Submit the following information as specified in General Conditions 4.0 and 40_05_51:
Product data.
Operation and maintenance data.

PRODUCTS

METAL BODY BALL VALVES, LESS THAN 6 INCH SIZE

Manufacturers: One of the following, or equal:
- Apollo Valves as manufactured by Conbraco Industries, Inc.
- Metso Automation/Jamesbury.
- NIBCO, Inc.
- Flow-Tek, Inc.

General:
- Type: Non-lubricated, full port and capable of sealing in either direction.
- End connections:
  - Threaded or solder ends for sizes 3-inch and smaller.
  - Class 150 flanged for sizes larger than 3 inch.
  - Flanges: In accordance with ASME B16.1 standards.
- Stem packing: Manually adjustable while valve is under pressure.
- Shafts:
  - Rigidly connected to the ball by a positive means.
    - Design connection to transmit torque equivalent to at least 75 percent of the torsional strength of the shaft.
- Handles: Stainless steel latch lock handle with vinyl grip and stainless steel nut designed to open and close the valve under operating conditions.
- Temperature limits: Suitable for operation between minus 20 and 350 degrees Fahrenheit.

Materials:
- Valves in copper lines: Bronze body.
- Valves in steel and ductile iron piping: Ductile iron or cast steel body.
- Valves in stainless steel piping: Stainless steel body, material type to match piping material as specified in Section 40_05_00.01.
- Ball: Type 304 or 316 stainless steel, Type 316 in digester gas applications.
- Seats: PTFE.
- Stem seals: PTFE or Viton.
- Bearings: Self-lubricated, corrosion resistant material that will not contaminate potable water.
- Valves for combustible fluid applications (digester gas, natural gas, fuel oil, etc.) must be of fire safe design.

EXECUTION

INSTALLATION

General: Install each type of valve in accordance with manufacturers' printed instructions.

Special techniques:
- PVC ball valves for hypochlorite service:
  - Provide valve with factory drilled 0.125-inch hole in the upstream side of the ball.
  - Provide an engraved plastic tag permanently attached to the valve stem stating "One side of ball drilled for hypochlorite service."

END OF SECTION

SECTION 40_05_64

BUTTERFLY VALVES

GENERAL

SUMMARY

Section includes: Butterfly valves.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Society of Mechanical Engineers (ASME):

B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125 and 250.

B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24.

American Water Works Association (AWWA):

C110 - Standard for Ductile-Iron and Gray-Iron Fittings.

C504 - Rubber-Seated Butterfly Valves.

C540 - Standard for Power-Actuating Devices for Valves and Sluice Gates.

C550 - Protective Interior Coatings for Valves & Hydrants.

C606 - Standard for Grooved and Shouldered Joints.

ASTM International (ASTM):

A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

A 216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for Higher-Temperature Service.

A 276 - Standard Specification for Stainless Steel Bars and Shapes.

A 351 - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

A 395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

A 479 - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

A 515 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate - and Higher-Temperature Service.

A 516 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower-Temperature Service.

A 536 - Standard Specification for Ductile Iron Castings.

A 564 - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.

A 582 - Standard Specification for Free-Machining Stainless Steel Bars

B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrate.

Compressed Gas Association (CGA):
Standard G-4.1 - Cleaning Equipment for Oxygen Service.

NSF International (NSF):
Standard 61 - Drinking Water System Components - Health Effects.

United States Code of Federal Regulations (CFR):
21 - Food and Drugs.

SYSTEM DESCRIPTION

Design requirements:
Industrial class butterfly valves:
Industrial class butterfly valves capable of 150 pounds per square inch leak tight shut off.

Usage:
Provide and install butterfly valve types as outlined in the Butterfly Valve Application Schedule at the end of this Section.

Performance requirements:
Tight shutoff at the pressure rating of the valve with pressure applied in either direction.
Suitable for the following service conditions:
Throttling.
Frequent operation.
Operation after long periods of inactivity.
Installation in any position and flow in either direction.

SUBMITTALS

Shop drawings: Submit the following information as specified in General Conditions 4.0 and 40_05_51:
Product data
Certificates:
Interior epoxy coatings: Affidavit of compliance attesting that epoxy coatings applied to interior surfaces of butterfly valves comply with all provisions in accordance with AWWA C550.
Operation and Maintenance Data.

PRODUCTS

INDUSTRIAL CLASS BUTTERFLY VALVES

Manufacturers: One of the following or equal:
SPX/DeZurik Style BOS.
Tyco-Keystone Figure AR2.

Valve body:

Pressure rating: 150 pounds per square inch, minimum.

Material: Cast iron, ASTM A 126, Class B or Ductile Iron, ASTM A 395, Grade 60/40/18.

Body design: Lugged style body with drilled and tapped boltholes in accordance with ASME B16.1, Class 125 and Class 150 flange drilling dimensions.

Disc:

Materials:

Air and water service: Cast iron, ASTM A 126, Class B or Ductile Iron, ASTM A 536, Grade 65/45/12 or Type 316 stainless steel, ASTM A 351, Grade CF8M.

Natural gas and digester gas service: Type 316 stainless steel, ASTM A 351, Grade CF8M.

Disc edge: Nickel-plated when cast iron or ductile iron disc is used.

Shaft and bearings:

Shaft: Type 316 stainless steel, ASTM A 276.

Shaft bearings: Self-lubricating sleeve type, Teflon with stainless steel or fiberglass backing.

Disc pins: Secure valve disc to shaft by means of solid, smooth-sided, taper or dowel pins, Type 316 stainless steel:

Extend pins through shaft and mechanically secure in place.

Seats:

Material:

Natural gas and digester gas applications: Neoprene or Buna N.

All other applications: EPDM.

Seat retention ring, if used on larger sizes: Type 316 stainless steel or bronze, ASTM B 584, with stainless steel fasteners. For all such valves, bond the seat to the retention ring.

Valve shaft packing:

Natural gas and digester applications: Neoprene or Buna N.

All other applications: EPDM or Teflon.

BUTTERFLY VALVE ACTUATORS

Manual actuators for aboveground valves 10 inches in nominal size and smaller for gas service.

For valves operating at pressures up to and including 250 pounds per square inch, provide hand lever type with locking device so that the valve can be locked in any position with a wing nut.

Locking device: Rigid, allowing no vibration or chattering of the valve.

Hand lever: 12 inches long, with handgrip.

For valves operating at pressures above 250 pounds per square inch, provide totally enclosed worm gear actuator mounted on the valve.

Manual actuators for aboveground valves in nominal sizes and in service applications other than specified above, except for valves 30 inches and larger.

For valves operating at pressures up to and including 250 pounds per square inch, provide either a totally enclosed worm gear actuator or a totally enclosed traveling nut actuator mounted on the valve.

For valves operating at pressures above 250 pounds per square inch, provide totally enclosed worm gear actuator mounted on the valve.

Position indication:

For all aboveground worm gear or traveling nut manual actuators, provide position indication on the actuator enclosure.

COATING

Shop coat interior and exterior metal surfaces of valves, except as follows:

Interior machined surfaces.

Surfaces of gaskets and elastomeric seats and stem seals.

Bearing surfaces.

Stainless steel surfaces and components.

Coating material for potable water applications:

Formulate coating material from materials in accordance with CFR 21.

Field applied coatings:

Additional coating of the valve exterior will be required to match the epoxy or epoxy/polyurethane paint system as specified in Section 09_96_01.

When shop applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.

When shop applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.

Surface coatings:

Interior surfaces of valves used in low-pressure gas service: High temperature coating for range of 150 to 350 degrees Fahrenheit, as specified in Section 09_96_01.

Exterior surfaces of valves, actuators, and accessories:

Submerged valves: High solids epoxy.

Polished and machined surfaces: Apply rust-preventive compound.

Coating materials:

High temperature coating: As specified in Section 09_96_01 and in accordance with AWWA C550.

Rust-preventive compound: One of the following or equal:

Houghton, Rust Veto 344.

Rust-Oleum, R-9.

EXECUTION

INSTALLATION

Install valves with valve shafts horizontal, unless a vertical shaft is required to suit a particular installation, and unless a vertical shaft is indicated on the Drawings.

Install pipe spools or valve spacers in locations where butterfly valve disc travel may be impaired by adjacent pipe lining, pipefittings, valves, or other equipment.

BUTTERFLY VALVE APPLICATION SCHEDULE

Acceptable butterfly valve types and body styles are listed in the Butterfly Valve Application Schedule provided at the end of this Section. Furnish and install butterfly valves in accordance with this Schedule.

BUTTERFLY VALVE APPLICATION SCHEDULE	
Valve Type and Style	**Acceptable Applications**
Industrial Class Butterfly Valves – Lugged Body Design	Aboveground in the following service applications only: - Aeration Air Systems - Natural Gas Systems - Digester Gas Systems - Chilled and Hot Water Systems
Industrial Class Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.

END OF SECTION

SECTION 40_61_00

COMMON WORK RESULTS FOR PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

GENERAL

SUMMARY

Section includes:

General requirements applicable to all Process Control and Instrumentation Work.

General requirements for process control and instrumentation submittals.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

Items involving electrical, control, and instrumentation construction may be indicated on the Drawings or specified in the Specifications that do not apply specifically to electrical, control and instrumentation systems.

Interfaces to equipment, instruments, and other components:

The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers, which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.

Provide all material and labor needed to install the actual equipment furnished, include all costs to add any additional instruments, wiring, control system inputs/outputs, controls, interlocks, electrical hardware etc., which may be necessary to make a complete, functional installation based on the actual equipment furnished:

Make all changes necessary to meet the manufacturer's wiring requirements.

Submit all such changes and additions to the ENGINEER for acceptance as specified in General Conditions 6.0.

Review the complete set of Drawings and Specifications in order to ensure that all items related to the instrumentation and control systems are completely accounted for. Include any items that appear on Drawings or in Specifications from another discipline in the scope of Work:

If a conflict between Drawings and Specifications is discovered, refer conflict to the ENGINEER as soon as possible for resolution.

All instrumentation, and control equipment and systems for the entire project to comply with the requirements specified in the Instrumentation and Control Specifications, whether referenced in the individual Equipment Specifications or not:

The requirements of the Instrumentation and Control Specifications apply to all Instrumentation and Control Work specified in other Specifications, including, LCPs, VCPs, etc.

Inform all vendors supplying instrumentation, control systems, panels, and/or equipment of the requirements of the Instrumentation and Control Specifications.

The OWNER is not responsible for any additional costs due to the failure of the CONTRACTOR to notify all subcontractors and suppliers of the Instrumentation and Control Specifications' requirements.

Contract Documents:

General:

The Drawings and Specifications are complementary and are to be used together in order to fully describe the Work.

Specifications:

General Conditions and Special Conditions of the Contract Documents govern the Work.

These requirements are in addition to all General Requirements.

Contract Drawings:

The Instrumentation and Control Drawings show in a diagrammatic manner, the desired locations, and arrangements of the components of the Instrumentation Work. Follow the Drawings as closely as possible, use professional judgment and coordinate with the other trades to secure the best possible installation, use the entire Drawing set for construction purposes.

Locations of equipment, control devices, instruments, boxes, panels, etc. are approximate only, exercise professional judgment in executing the Work to ensure the best possible installation:

The equipment locations and dimensions indicated on the Drawings and elevations are approximate. Use the shop drawings to determine the proper layout, foundation, and pad requirements, etc. for final installation. Coordinate with all subcontractors to ensure that all instrumentation and control equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.

The CONTRACTOR has the freedom to select any of the named manufacturers as identified in the individual Specifications; however, the ENGINEER has designed the spatial equipment layout based upon a single manufacturer and has not confirmed that every named manufacturer's equipment fits in the allotted space. It is the CONTRACTOR's responsibility to ensure that the equipment being furnished fits within the defined space.

Installation details:

The Contract Drawings include installation details showing means and methods for installing instrumentation and control equipment. For cases where typical details are not provided or compatible with an installed location, develop installation details that are necessary for completing the Work, and submit these details for review by the ENGINEER.

Alternates/Alternatives:
Substitute item provisions as specified in General Conditions, GC 6.0.

Changes and change orders:
As specified in General Conditions, GC 6.0.

REFERENCES

Code compliance:
As specified herein:
The publications are referred to in the text by basic designation only. The latest edition accepted by the Authority Having Jurisdiction of referenced publications in effect at the time of Bid governs.
The following codes and standards are hereby incorporated into this Section:
American National Standards Institute (ANSI):
B16.5 - Pipe Flanges and Flanged Fittings.
American Petroleum Institute (API):
RP551 - Process Measurement Instrumentation.
RP552 - Transmission Systems.
RP553 - Refinery Control Valves.
RP554 - Process Instrumentation and Control.
RP555 - Process Analyzers.
RP556 - Fired Heaters & Steam Generators.
RP557 - Guide to Advanced Control Systems.
ASTM International (ASTM):
A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
FM Global (FM).
Institute of Electrical and Electronics Engineers (IEEE).
International Electrotechnical Commission (IEC)
InterNational Electrical Testing Association (NETA).
International Organization for Standardization (ISO):
9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation and Servicing.
International Society of Automation (ISA):
5.1 - Instrumentation Symbols and Identification.
5.2 - Binary Logic Diagrams for Process Operations.
5.3 - Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems.
5.4 - Instrument Loop Diagrams.
5.5 - Graphic Symbols for Process Displays.
7.00.01 - Quality Standard for Instrument Air.
RP - 12.4 - Pressurized Enclosures.
18.1 - Annunciator Sequences and Specifications.
20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.
TR20.00.01 - Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations Updated with 27 New Specification Forms in 2004-2005.
50.00.01 - Compatibility of Analog Signals for Electric Industrial Process Instruments.

51.1 - Process Instrumentation Terminology.
RP60.3 - Human Engineering for Control Centers.
71.01 - Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity.
71.02 - Environmental Conditions for Process Measurement and Control Systems: Power.
71.03 - Environmental Conditions for Process Measurement and Control Systems: Mechanical Influences.
71.04 - Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants.

National Electrical Manufacturers Association (NEMA):
250 - Enclosures for Electrical Equipment (1000 V Maximum).

National Fire Protection Association (NFPA):
70 - National Electric Code (NEC).
496 - Purged and Pressurized Enclosures for Electrical Equipment, where applicable.
820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

Underwriters Laboratories, Inc. (UL):
508 - Industrial Control Equipment.

Compliance with Laws and Regulations:
A s specified in Document 00_72_00.

DEFINITIONS

Definitions of terms and other electrical and instrumentation considerations as set forth by:

FM.
IEC.
IEEE.
ISA.
ISO.
NEC.
NETA.
NFPA.
NIST.
UL.

Specific definitions:

Control circuit: Any circuit operating at 120 volts alternating current (VAC) or direct current (VDC) or less, whose principal purpose is the conveyance of information (including performing logic) and not the conveyance of energy for the operation of an electrically powered device.

Panel: An instrument support system that may be either a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term “panel” in these Contract Documents is interpreted as a general term, which includes flat surfaces, enclosures, cabinets and consoles.

Power circuit: Any circuit operating at 90 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.
Signal circuit: Any circuit operating at less than 50 VAC or VDC, which conveys analog information or digital communications information.
Digital bus: A communication network, such as Profibus, Foundation Fieldbus, or DeviceNet, allowing instruments and devices to transmit data, control functions and diagnostic information.
2-Wire transmitter (loop powered): A transmitter that derives its operating power supply from the signal transmission circuit and requires no separate power supply connections. As used in this Section, two-wire transmitter refers to a transmitter that provides 4 to 20 milliamperes current regulation of a signal in a series circuit with an external 24 VDC driving potential:
Fieldbus communications signal or both.
Powered transmitters: A transmitter that requires a separate power source (120 VAC, 240 VAC, etc.) in order for the transmitter to develop its signal. As used in this Section, the produced signal may be either a 4 to 20 milliampere current signal, a digital bus communications signal or both.
System supplier - As specified in ICSC Qualifications in the Quality Assurance article of this Section.

Acronym definitions:

CCS: The SCADA central computer system (CCS) consisting of personal computers and software. The personal computer-based hardware and software system that includes the operator interface, data storage, data retrieval, archiving, alarming, historian, reports, trending, and other higher level control system software and functions.

DPDT: Double-pole, double-throw.

ES: Enterprise system: Computer based communications or data sharing system utilized for non-process control functions such as E-mail, sharing files, creating documents, etc.

FAT: Factory acceptance test.

HART: Highway addressable remote transducer.

HOA: Hand-Off-Auto control function that is totally PLC based. In the Hand mode, equipment is started or stopped, valves are opened or closed through operator direction under the control of the PLC software. In the Auto mode, equipment is started or stopped and valves are opened or closed through a control algorithm within the PLC software. In the Off mode, the equipment is prohibited from responding from the PLC control.

HMI: Human machine interface: PLC based operator interface device consisting of an alphanumeric or graphic display with operator input functionality. The HMI is typically a flat panel type of display mounted on the front of a PLC enclosure with either a touch screen or tactile button interface.

ICSC: Instrumentation and control system contractor: Subcontractor who specializes in the design, construction, fabrication, software development, installation, testing, and commissioning of industrial instrumentation and control systems.

IJB: Instrument junction boxes: A panel designed with cord sets to easily remove, replace or relocate instrument signals.

I/O: Input/Output.
IP: Internet protocol or ingress protection.
LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
LAN: Local area network: A control or communications network that is limited to the physical boundaries of the facility.
LOR: Local-Off-Remote control function. In the Remote mode, equipment is started or stopped, and valves are opened or closed through the PLC based upon the selection of the HOA. In the Local mode, equipment is started or stopped, valves are opened or closed based upon hardwired control circuits completely independent of the PLC with minimum interlocks and permissive conditions. In the Off mode, the equipment is prohibited from responding to any control commands.
NJB: Network junction box. An enclosure that contains multiple access points to various networks within the facility. Networks could be Ethernet, Ethernet/IP, Fieldbus, RIO etc.
OIT: Operator interface terminal: PC-based interface device used for operator interface with the SCADA system.
P&ID: Process and instrumentation diagram.
PC: Personal computer.
PCIS: Process control and instrumentation system: Includes the entire instrumentation system, the entire control system, and all of the Work specified in the Instrumentation and Control Specifications and depicted on the Instrumentation Drawings.
PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
PJB: Power junction box: An enclosure with terminal blocks that distribute power to multiple instruments.
PLC: Programmable logic controller.
RIO: Remote I/O device for the PLC consisting of remote I/O racks, or remote I/O blocks.
RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.
SCADA: Supervisory control and data acquisition system: A general name for the computerized system that gathers and processes data from sensors and applies operational controls to the process equipment. It includes the PLCs and/or RTUs, HMI PLC-based operator interface units, related interconnecting communications systems, and the CCS operator interface and data management system.
SPDT: Single-pole, double-throw.
SPST: Single-pole, single-throw.
UPS: Uninterruptible power supply.
VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the ICSC. These panels may contain PLCs, RIO, OIT, HMI, etc.
WAN: Wide area network: A control or communications network that extends beyond the physical boundaries of the facility.

SYSTEM DESCRIPTION

General requirements:

The Work includes everything necessary for and incidental to executing and completing the Instrumentation and Control System Work indicated on the Drawings and specified in the Specifications and reasonably inferable there from including but not limited to:

- Preparing hardware submittals for field instrumentation.
- Prepare the test plan, the training plan, and the spare parts submittals.
- Procure all hardware.
- Perform bench calibration and verify calibration after installation.
- Conduct the performance tests.
- Prepare operation and maintenance manuals.
- Conduct training classes.
- Prepare Record Drawings.
- Develop all requisite Record Drawings associated with equipment provided under the Contract Documents and OWNER furnished and existing equipment.
- Resolve signal, power, or functional incompatibilities between the PCIS and interfacing devices.
- Perform all required corrective and preventative maintenance.

It is the intent of these Specifications that the entire electrical power, instrumentation, and control system be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of all equipment furnished by others, as well as equipment furnished by the CONTRACTOR, whether or not specifically mentioned but which are necessary for successful operation.

Coordinate all aspects of the Work between CONTRACTOR and all subcontractors before bidding to ensure that all costs associated with a complete installation are included. The OWNER is not responsible for any change orders due to lack of coordination of the Work between the CONTRACTOR, the ICSC, the other subcontractors or suppliers.

Where demolition is indicated on the Drawings, the electrical subcontractor is responsible for disconnecting equipment electrical connections and rendering the equipment safe. The ICSC is responsible for physically removing all instrumentation to be demolished and return it either to the OWNER or dispose of it as directed by the OWNER’s representative.

Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment.

- Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before performing any Work.
- Provide and document interface with, modifications to, upgrade, or replacement of existing circuits, power systems, controls, and equipment.

Defective Work:

- As specified in General Conditions 3.0.

Operating facility:

Portions of this existing facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:

All outages must be of minimal duration and fully coordinated and agreed to by the OWNER. Adjust the construction to meet the requirements of the OWNER.

As weather and facility demand conditions dictate, re-adjust the construction schedule to meet the demands placed upon OWNER by its users.

Where portions of the Work are in existing facilities and require interface to existing circuits, power systems, controls and equipment, perform comprehensive and detailed field investigations of existing conditions. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and this Section.

General:

Instruct all equipment suppliers of submittals and operation and maintenance manuals of the requirements in this Section.

Furnish the submittals required by each section in the Electrical Specifications.

Adhere to the wiring numbering scheme specified in Section 26_05_53 throughout the Project:

Uniquely number each wire.

Wire numbers must appear on all Equipment Drawings.

Use equipment and instrument tags, as indicated on the Drawings, for all submittals.

Submittal organization:

First page:

Specification section reference.

Name and telephone number of individual who reviewed submittal before delivery to ENGINEER.

Name and telephone number of individual who is primarily responsible for the development of the submittal.

Place for CONTRACTOR’s review stamp and comments.

Next pages:

Provide confirmation of specification compliance in a tabular form that individually lists each specification section, paragraph, and sub-paragraphs and unequivocally states compliance with said requirement or takes exception to the requirement and lists the reason for said exception and offers alternative means for compliance.

Include a response in writing to each of the ENGINEER’s comments or questions for submittal packages which are re-submitted:

In the order that the comments or questions were presented throughout the submittal.

Referenced by index section and page number on which the comment appeared.

Acceptable responses to ENGINEER's comments are either:
ENGINEER's comment or change is accepted and appropriate changes are made.
Explain why comment is not accepted or requested change is not made.
Explain how requirement will be satisfied in lieu of comment or change requested by ENGINEER.
Any re-submittal, which does not contain responses to the ENGINEER's previous comments shall be returned for Revision and Re-submittal.
No further review by the ENGINEER will be performed until a response for previous comments has been received.

Remaining pages:
Actual submittal data:
Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section.
For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is intended to be used.

Submittal preparation:
During the period of preparation of submittals, the CONTRACTOR shall authorize direct, informal liaison between the ICSC and the ENGINEER for exchange of technical information. As a result of this liaison, certain minor refinements and revisions may be authorized informally by the ENGINEER, which do not alter the scope of Work or cause increase or decrease in the Contract price or times. During this informal exchange, no oral statement by the ENGINEER shall be construed to give formal approval of any component or method, nor shall any statement be construed to grant exception to, or variation from, these Contract Documents.
In these Contract Documents, some items of Work are represented schematically, and are designated for the most part by numbers, as derived from criteria in ANSI/ISA S5.1:
Employ the nomenclature and numbers designated in this Section and on the Drawings exclusively throughout shop drawings, data sheets, and similar submittals.
Replace any other symbols, designations, and nomenclature unique to a manufacturer's, suppliers, or subcontractor's standard methods with those identified in this Section and on the Drawings.

Specific submittal requirements:
Shop drawings:
Required for materials and equipment listed in this and other sections.
Furnish sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications.
Shop drawings requirements:
Front, side, and, rear elevations, and top and bottom views, showing all dimensions.
Locations of conduit entrances and access plates.
Component layout and identification.

Schematic and wiring diagrams with wire numbers and terminal identification.
Connection diagrams, terminal diagrams, internal wiring diagrams, conductor size, etc.
Anchoring method and leveling criteria, including manufacturer's recommendations for the Project site seismic criteria.
Weight.
Finish.
Nameplates:
As specified in Section 26_05_53.
Temperature limitations, as applicable.

Adhere to wiring numbering scheme outlined in Section 26_05_53 throughout the Project:
Uniquely number each wire per the Specifications.

Wire numbers must appear on all equipment drawings.

Organize the shop drawing submittals for inclusion in the Operation and Maintenance Manuals:
Furnish the initial shop drawing submittal bound in one or more standard size, 3-ring, D-ring, loose leaf, vinyl plastic, hard cover binders suitable for bookshelf storage.
Binder ring size: 2 inches.

Include the letterhead and/or title block of the firm responsible for the preparation of all shop drawings. Include the following information in the title block, as a minimum:
The firm's registered business name.
Firm's physical address, email address, and phone number.
OWNER's name.
Project name and location.
Drawing name.
Revision level.
Personnel responsible for the content of the drawing.
Date.

The work includes modifications to existing circuits:
Clearly show all modifications to existing circuits.
In addition, show all existing unmodified wiring to clearly depict the functionality and electrical characteristics of the complete modified circuits.

Product data:

Submitted for non-custom manufactured material listed in this and other sections and shown on shop drawings.

Include:
Catalog cuts.
Bulletins.
Brochures.
Quality photocopies of applicable pages from these documents.
Identify on the data sheets the Project name, applicable specification section, and paragraph.
Identify model number and options for the actual equipment being furnished.
Neatly cross out options that do not apply or equipment not intended to be supplied.

Adhere to wiring numbering scheme outlined in Section 26_05_53 throughout the Project:

Uniquely number each wire per the Specifications.

Wire numbers must appear on all equipment drawings.

Detailed sequence of operation for all equipment or systems.

Operation and maintenance manuals:

As specified in General Conditions 8.0.

Furnish the ENGINEER with a complete set of written operation and maintenance manuals 8 weeks before energization start-up and/or commissioning.

Submit preliminary sets of these manuals to the ENGINEER for review of format and content:

ENGINEER will return 1 set with comments.

Revise and/or amend as required and submit the requisite number of copies to the ENGINEER 15 days before Pre-commissioning of the systems.

Incorporate changes that occur during startup and submit as part of the final manuals.

Provide comprehensive information on all systems and components to enable operation, service, maintenance, and repair.

Include Record Documents and the approved shop drawing submittals, modified for conditions encountered in the field during the work.

Include signed results from Calibration, Pre-commissioning, and Performance Testing.

Provide installation, connection, operating, calibration, setpoints (e.g., pressure, pump control, time delays, etc.), adjustment, test, troubleshooting, maintenance, and overhaul instructions in complete detail.

Provide exploded or other detailed views of all instruments, assemblies, and accessory components together with complete parts lists and ordering instructions.

Operational Manual:

Prepare and provide a simplified version of the standard manufacturer’s HMI software and system operations manual that includes basic instructions in the application of the system as required for operators in day-to-day operations.

Spare parts list:

Include a priced list of recommended spare parts for all the equipment furnished under this Contract:

Include recommended quantities sufficient to maintain the furnished system for a period of 5 years.

Annotate the list to indicate which items, if any and quantity are furnished as part of this Contract.

Provide the name, address, and phone number of manufacturer and manufacturer's local service representative of these parts.

Control and Software Record Documents:

Include complete documentation of all the software programs provided for the entire control systems, including:

Listings of all application software on both hard copy and CD-ROM.

Database, both hard copy and CD-ROM.

Communication protocols.

All documentation necessary to maintain, troubleshoot, modify, or update the software system.

Organize the operation and maintenance manuals for each process in the following manner:

Section A - Process and Instrumentation Diagrams.
Section B - Control Descriptions.
Section C - (Not Used).
Section D - Instrument Summary.
Section E - Instrument Data Sheets and Brochures.
Section F - Sizing Calculations.
Section G - Instrumentation Installation Details.
Section H - Test Results.
Section I - Operational Manual.
Section J - Spare Parts List.
Section K - Control System Software.

Material and equipment schedules:

Furnish a complete schedule and/or matrix of all materials, equipment, apparatus, and luminaries that are proposed for use:

Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

Itemized instrument summary:

Submit a hard copy of the instrument summary.

List all of the key attributes of each instrument including:

Tag number.
Manufacturer.
Model number.
Service.
Area location.
Calibrated range.

Instrument data sheets and cut sheets:

Furnish fully completed data sheets, both electronically in Microsoft Word or Excel and in hardcopy, for each instrument and component according to ISA S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves. The data sheets provided with the instrument specifications are preliminary and are not complete. They are provided to assist with the completion of final instrument data sheets. Additional data sheets may be required. Include the following information on the data sheet:

Component functional description specified in this Section and indicated on the Drawings.

Manufacturers model number or other product designation.
Tag number specified in this Section and indicated on the Drawings.
System or loop of which the component is a part.
Location or assembly at which the component is to be installed.
Input and output characteristics.
Scale range with units and multiplier.
Requirements for electric supply.
Requirements for air supply.
Power consumption.
Response timing.

Materials of construction and of component parts that are in contact with, or otherwise exposed to, process media, and or corrosive ambient air.
Special requirements or features, such as specifications for ambient operating conditions.
Features and options that are furnished.

Provide a technical brochure or bulletin ("cut sheet") for each instrument on the project. Submit with the corresponding data sheets:

Where the same make and model of instrument is used in 2 or more applications on the project, and the process applications are nearly identical, and the materials, features and options are identical submit one brochure or bulletin for the set of identical instruments.
Include a list of tag numbers for which it applies with each brochure or bulletin.
Furnish technical product brochures that are complete enough to verify conformance with all Contract Document requirements, and to reflect only those features supplied with the device.
Cross out models, features, options, or accessories that are not being provided.
Clearly mark and identify special options and features.

Organization: Index the data sheets and brochures in the submittal by systems or loops.

Installation recommendations:

Submit the manufacturer's printed recommendations for installation of instrumentation equipment.

Shop drawings:

General:

Coordinate all aspects of the Work so that a complete, instrumentation, computer, and control system for the facility is supported by accurate shop and record drawings:

Clearly show every wire, circuit, and terminal provided under this contract on one or more submitted wiring diagrams.

Upon completion of the Work, update all shop drawings to indicate the final as-built configuration of the systems:

Should an error be found in a shop drawing during installation or startup of equipment, note the correction, including any field changes found necessary, on the drawing and submit the corrections in the Record Documents.
Update, check, and revise all wiring drawings and other submitted drawings and documents to show final installed conditions.

Submittal Documents:

Submit final Record Documents before Substantial Completion or earlier if so specified in General Conditions 8.0 or the General Requirements.

Review and Corrections:

Correct any Record Documents or other documents found to be incomplete, not accurate, of poor quality, or containing errors.

Promptly correct and re-submit Record Documents returned for correction.

Furnish written information prepared specifically for this Project using .pdf and printed on 8.5-inch by 11-inch plain bond paper:

Provide electronic copies of these documents on CD-ROM disks.

Review and corrections:

Correct any record documents or other documents found to be incomplete, not accurate, of poor quality, or containing errors.

Promptly correct and re-submit record documents returned for correction.

Instrument Installation Drawings:

Submit, instrument installation, mounting, and anchoring details for all components and assemblies, including access requirements and conduit connection or entry details.

Furnish for each instrument a dedicated 8 1/2-inch by 11-inch installation detail that pertains to the specific instrument by tag number.

For each detail, provide certification and the hard copies, by the instrument manufacturer, that the proposed installation is in accordance with the instrument manufacturer's recommendations and is fully warrantable.

For each detail, provide, as a minimum, the following contents:

Necessary sections and elevation views required to define instrument location by referencing tank, building or equipment names and numbers, and geographical qualities such as north, south, east, west, basement, first floor, etc.

Ambient temperature and humidity where the instrument is to be installed.

Corrosive qualities of the environment where the instrument is to be installed.

Hazardous rating of the environment where the instrument is to be installed.

Process line pipe or tank size, service and material.

Process tap elevation and location

Upstream and downstream straight pipe lengths between instrument installation and pipe fittings and valves.

Routing of tubing and identification of supports.

Mounting brackets, stands, anchoring devices, and sun shades.

Conduit entry size, number, location, and delineation between power and signal.

NEMA ratings of enclosures and all components.

Clearances required for instrument servicing.

List itemizing all manufacturer makes, model numbers, quantities, lengths required, and materials of each item required to support the implementation of the detail.

Instrumentation and Control System Contractor Statement of Qualifications:

Submit statement of qualifications of the proposed ICSC in accordance with subsequent requirements of this Section.

Testing, Calibration, and Start-up Submittal:

General testing submittal requirements are specified in this Section. Additional requirements are specified in Section 40_80_01 and other Sections.

Test Procedure Submittals:

Submit the proposed procedures to be followed during tests of the PCIS and its components in two parts:

Preliminary Submittal: Outline of the specific proposed tests and examples of proposed forms and checklists.

Detailed Submittal: After successful review of the Preliminary Submittal, submit the proposed detailed test procedures, forms, and checklists. Include a statement of test objectives with the test procedures.

Provide certified and witnessed test and calibration checklists for each of the following tests:

Calibration, adjustment, and test details for all components and systems.

Factory Acceptance Tests.

Loop Validation Tests:

Loop Validation Certifications:

After the field device loop tests have been successfully completed for all individual instruments, all separate analog control networks, all valves, all VCPs, all motors, all local operator interface panels, all motor control centers, etc., submit a certified copy of all test forms signed by the CONTRACTOR, ICSC and the OWNER's Representative, with test data entered, together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, inspected, and tested.

Pre-commissioning Test.

Performance Test.

Factory Acceptance Test:

Include complete test procedures and forms to be used during the test.

Test reports:

As specified in Section 01_33_00.

Include the following:

A description of the test.

List of equipment used.

Name of the person conducting the test.

Date and time the test was conducted.

All raw data collected.

Calculated results.

Each report signed by the person responsible for the test.

Additional requirements for acceptance test reports are specified in Section 40_80_01.

Factory acceptance test:

As specified in Section 01_33_00.

QUALITY ASSURANCE

Manufacture instruments at facilities certified to the quality standards of ISO 9001.

DELIVERY, STORAGE, AND HANDLING

Store all equipment and materials delivered to the job site in a location that will not interfere with the construction or the OWNER's operations.

Shipping precautions:

After completion of shop assembly, pack all equipment, cabinets, panels, and consoles in protective crates and enclose in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture.
Place dehumidifiers when required, inside the polyethylene coverings.
Skid-mount the equipment for final transport.
Provide lifting rings for moving without removing protective covering.
Display boxed weight on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

Special instructions:

Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.

Tagging:

Tag each component and/or instrument to identify its location, instrument tag number, and function in the system.
Firmly attach a permanent tag indelibly machine marked with the instrument tag number, as given in the tabulation, on each piece of equipment constituting the PCIS.
Tag instruments immediately upon receipt in the field.
Prominently display identification on the outside of the package.
Utilize the Tag and Loop Number identifications shown on the P&IDs.

Delivery and inspection:

Deliver products in undamaged condition, in manufacturer's original container or packaging with identifying labels intact and legible. Include date of manufacture on label.

PROJECT OR SITE CONDITIONS

Site conditions:

Provide a PCIS, including all equipment, raceways and any other components required for a complete installation that meets the environmental conditions for the Site as specified in the General Requirements and below.

Seismic classification:

Provide all equipment and construction techniques suitable for the seismic requirements for the site, as specified in Section 01_81_02.

Wind:

Provide all equipment and construction techniques suitable for the site wind loading criteria, as specified in Section 01_81_04.

Area classifications:

Furnish enclosures that match the area classifications as specified in Section 26_05_00.

Site security:

Abide by all security and safety rules concerning the Work on the Site, as specified in General Conditions 7.0.

WARRANTY

Warrant the PCIS as specified in General Conditions, GC 8.9:

Provide additional warranty as specified in the individual Instrumentation and Control Specifications.

SYSTEM START-UP

Replace or modify equipment, software, and materials that do not achieve design requirements after installation in order to attain compliance with the design requirements:

Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the ENGINEER.

MAINTENANCE

Before Substantial Completion, perform all maintenance activities required by the Contract Documents including any calibrations, final adjustments, component replacements or other routine service required before placing equipment or systems in service.

Furnish all spare parts as required by the Contract Documents.

Provide additional spare parts specified in other sections of the Instrumentation and Control Specifications.

Submit all special tools and spare parts, suitably wrapped and identified, before performance testing commences.

PRODUCTS

MANUFACTURERS

Provide similar items from a single manufacturer throughout the PCIS portion of the Project.

Allowable manufacturers are specified in individual instrument and equipment specifications in other sections of the Instrumentation and Control Specifications.

MATERIALS

Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these devices and that bear all approvals and labels as required by the Specifications.

Provide materials complying with the applicable industrial standard as specified in the Contract Documents.

COMPONENTS

Furnish all meters, instruments, and other components that are the most recent field proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise specified to match existing equipment.

Unless otherwise specified, furnish individual instruments that have a minimum accuracy of ±0.5 percent of full scale and a minimum repeatability of ±0.25 percent of full scale.

Signal transmission:

Analog signals:

Furnish analog measurements and control signals that vary in direct linear proportion to the measured variable, unless otherwise indicated.

Furnish electrical analog signals outside control panels that are 4 to 20 milliamperes 24 VDC, except as indicated.

Analog signals within enclosures may be 1 to 5 VDC.

Electrically or optically isolate all analog signals from other signals.

Furnish regulated analog signals that are not affected by changes in supply voltage or load resistance within the unit's rating.

Maintain the total 4 to 20 milliamperes loop impedance to 10 percent below the published value at the loop operating voltage.

Where necessary, reduce loop impedance by providing current-to-current (I/I) isolation amplifiers for signal re-transmission.

All pneumatic signals: 3 to 15 pounds per square inch gauge.

Discrete input signal as indicated in the controller hardware specification.

Discrete output signals:

Dry contacts or TRIAC outputs (with express written approval by the ENGINEER) as needed to coordinate with the field device.

Provide external terminal block mounted fuse with blown fuse indication for all discrete outputs.

Provide interposing relays for all discrete outputs for voltage and/or current compatibilities.

Provide interposing relays as required for functionality of the control circuit.

Discrete circuit configuration:

Configure discrete control circuits to fail safe, on loss of continuity or loss of power.

Alarm contacts: Fail to the alarm condition.

Control contacts fail to the inoperative condition unless otherwise indicated on the Drawings.

Grounding:

Provide control panels with a signal ground bus, isolated from the power ground bus:

Provide multiple panels in one location with a common point for signal ground bus connection to ground.

Ground single point ground shields and measurement loops at the source panel external terminals, unless otherwise noted, by bonding to the control panel signal ground bus.

Provide isolating amplifiers within control panels for field equipment possessing a grounded input or output, except when the panel circuit is galvanically isolated.

ACCESSORIES

Provide flow conditioning devices or other required accessories if necessary to meet the accuracy requirements in the Contract Documents.

SOURCE QUALITY CONTROL

Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products that bear all approvals and labels as required by the Specifications.

Arrange with all manufacturers of the equipment and fabricators of panels and cabinets, to allow the OWNER and ENGINEER to inspect and witness the testing of the equipment at the site of fabrication:

Equipment includes the cabinets, special control systems, flow measuring devices, and other pertinent systems and devices.

Factory testing is specified in Section 40_80_01 and other sections of the Electrical, and the Instrumentation and Control Specifications.

EXECUTION

EXAMINATION

Review the existing Site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.

Provide a complete instrumentation and control system:

Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical, and process control and instrumentation system.

INSTALLATION

Equipment locations indicated on the Drawings may change due to variations in equipment size or minor changes made by others during construction:

Verify all dimensions as indicated on the Drawings:

Actual field conditions govern all final installed locations, distances, and levels.

Review all information indicated on the Drawings, including architectural, structural, mechanical, instrumentation, and the accepted electrical, instrumentation, and mechanical shop drawings, and coordinate Work as necessary to adjust to all conditions that arise due to such changes.

Make minor changes in location of equipment before rough in, as directed by the OWNER or ENGINEER.

Perform all related Electrical Work in accordance with the applicable sections of the Electrical Specifications.

The PCIS configurations are diagrammatic:

The locations of equipment are approximate unless dimensioned.

Where Project conditions require, make reasonable changes in locations and arrangements.

Field instruments installation:

Install field instruments as specified in the Contract Documents, ANSI/API 550 and 551, and the manufacturer's instructions.

Mount field instruments so that they can be easily read, readily approached, and easily serviced, and so they do not restrict access to mechanical equipment:

Mount field instruments on a pipe stand or local panel, if they are not directly mounted, unless otherwise indicated on the Drawings.

Provide sun shields for all field electronic instruments exposed to direct sunlight.

Make connections from rigid conduit systems to field instruments with PVC coated flexible conduit:

Type of flexible conduit required for the area classification:

Area classification as specified in Section 26_05_00.

Maximum length of 18 inches.

Connect field instruments with cable as specified in the Electrical Specifications, except when the manufacturer requires the use of special cable, or otherwise specified in this Section:

Special cable applications shall be in accordance with the NEC.

Verify the correctness of each installation:

Polarity of electric power and signal connections.

Ensure all process connections are free of leaks.

Process sensing lines and air tubing:

Install individual tubes parallel and/or perpendicular to and near the surfaces from which they are supported.

Provide supports for rigid tubing at intervals of not more than 3 feet.

Slope horizontal runs of instrument tubing at a minimum of 1/16th inch per foot to allow for draining of any condensate.

Bends:

Use proper tool.

Make bends for parallel lines symmetrical.

Make bends without deforming or thinning the walls of the tubing.

Square-cut and clean all ends of tubing before being inserted in the fittings.

Provide bulkhead fittings at all panels requiring pipe and/or tubing entries.

Use stainless steel tubing for all piping hard piped from the air header, unless otherwise indicated on the Drawings or not compatible with the fluids or atmosphere in the area:

Use flexible connections only on moving equipment and under the constraint that the length shall be less than 1.5 times maximum travel of the equipment.

Conduit, cables, and field wiring:

Provide all PCIS equipment cables, and process LAN communication networks under the Instrumentation and Control Specifications.

Provide terminations and wire identification as specified in the Electrical Specifications.

Protect all wiring from sharp edges and corners.

Provide all conduits, fittings, boxes, etc. in accordance with all the requirements of the Electrical Specifications.

Equipment tie-downs:

Anchor all instruments, control panels, and equipment by methods that comply with seismic and wind bracing requirements, which apply to the Site. All control panels, VCPs, LCPs, RTUs, PCMs, etc., shall be permanently mounted and tied down to structures.

Instrument tagging:

As specified in Section 26_05_53.

Provide all field-mounted instruments with nameplates:

Nameplates engraved with the instrument's full tag number as indicated on the Drawings:

Affix tags with stainless steel wire fasteners.

Provide all back of panel instruments with nameplates:

Engraved with the instrument's full tag number as indicated on the Drawings:

Provide all front of panel instruments with a nameplate:

Engraving to include the instrument's full tag number and service description.

Secure nameplates to the panel with stainless steel screws.

Use an approved adhesive if screws would violate the NEMA or other ratings of the enclosure.

Cable and conductor termination:

Terminate all cables and conductors on terminal blocks.

Terminal block enclosures:

Suitable for the area classification as specified in Section 26_05_00.

Surge protection:

Provide outdoor field instrument loops with voltage surge protection units installed on the instruments.

Individually fuse each 4-20 milliamperes direct current loop with a 1/16 ampere fuse between power supplies and receiver surge protectors.

Provide voltage surge protection for 4 wire transmitters and analyzers:

Protect both power source and signal loop.

FIELD QUALITY CONTROL

Inspection:

Allow for inspection of PCIS installation as specified in General Conditions4.0. Provide any assistance necessary to support inspection activities.

ENGINEER inspections may include, but are not limited to, the following:

Inspect equipment and materials for physical damage.

Inspect installation for compliance with Drawings and Specifications.

Inspect installation for obstructions and adequate clearances around equipment.

Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.

Inspect equipment nameplate data to verify compliance with design requirements.
Inspect cable terminations.
Inspect/witness instrument calibrations/verifications.
Inspection activities conducted during construction do not satisfy inspection requirements specified in Section 40_80_01.

Field testing is specified in Section 40_80_01. Additional general requirements are specified in General Conditions 4.0.

Installation supervision:
Ensure that the entire PCIS is installed in a proper and satisfactory manner.
At a minimum, the ICSC shall provide the following services:
Installation resources:
Coordinate with the CONTRACTOR regarding installation requirements of the Contract Documents.
Provide technical assistance to installation personnel by telephone:
Furnish installation personnel with at least one copy of the approved submittals, including all installation details.
Periodic inspections during the construction period.
A complete check of the completed installation to ensure that it is in conformance with the requirements of the equipment manufacturer and the Contract Documents.
Field verify accuracy and calibration of all instruments.

ADJUSTING

Make all revisions necessary to the control system software, as directed by the ENGINEER. It is understood that the CONTRACTOR knows and agrees that changes will be required in the control system software during the factory acceptance tests, the pre-commissioning, performance testing, start-up and during the warranty period.

CLEANING

As specified in General Conditions 8.0.

Vacuum clean all control panels and enclosures before start-up and again after final completion of the project.

Clean all panel surfaces.

Return to new condition any scratches and/or defects.

Wipe all instrument faces and enclosures clean.

Leave wiring in panels, manholes, boxes, and other locations in a neat, clean, and organized manner:
Neatly coil and label all spare wiring lengths.
Shorten, re-terminate, and re-label excessive spare wire and cable lengths, as determined by the ENGINEER.

As specified in other sections of the Contract Documents.

DEMONSTRATION AND TRAINING

Demonstration requirements are specified in Section 40_80_01.

Instrumentation training:

Furnish training covering all instruments and control panels.

Furnish the specified quantity of training, allocated to cover new instruments and hardwired controls as described in this Section and specifically determined in the approved training plan.

Train maintenance staff in the use, cleaning, calibration, maintenance, and troubleshooting of all the instruments furnished within this Project.

Furnish training on the operation of new hardwired controls.

Analytical instrument training:

Furnish training covering all analytical instruments.

Furnish the specified quantity of training, allocated to cover new analytical instruments as specified in this Section and specifically determined in the approved training plan.

Train maintenance staff in the use, cleaning, calibration, maintenance, and troubleshooting of all the analytical instruments furnished within this Project.

Provide training by manufacturer.

PROTECTION

Protect all Work from damage or degradation until date of Substantial Completion.

END OF SECTION

SECTION 40_72_24

LEVEL MEASUREMENT - RADAR PULSE TIME OF FLIGHT (PTOF)

GENERAL

SUMMARY

Section includes:
Non-contact radar (PTOF) level instruments for monitoring top of foam blanket level in Digester No. 1.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

Provide all instruments identified in the Contract Documents.

REFERENCES

As specified in Section 40_61_00.

DEFINITIONS

As specified in Section 40_61_00.

Specific definitions:
PTOF: Pulse Time of Flight.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and 40_61_00.

QUALITY ASSURANCE

As specified in Section 40_61_00.

Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

Examine the complete set of Contact Documents and verify that the instruments are compatible with the installed conditions including:

1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
2. Physical conditions:
   a. Installation and mounting requirements.
   b. Location within the process.

c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 40_61_00.

PROJECT OR SITE CONDITIONS

As specified in Section 40_61_00.

WARRANTY

As specified in Section 40_61_00.

MAINTENANCE

As specified in Section 40_61_00.

PRODUCTS

MANUFACTURERS

One of the following or equal:
Ohmart Vega, VegaPuls 66.
Endress+Hauser equivalent.

MANUFACTURED UNITS

Pulse Time of Flight :
- General:
  - Instrument emits radar pulses via a transmitter- C-band (approx. 6 GHz) frequency.
  - The pulses reflect from the surface being measured and are received back at the instrument via a sensor.
  - The instrument measures the pulse travel time between the transmitter, surface, and receiver to calculate the level.
  - Safety:
    - Shall not generate frequency waves with power levels hazardous to humans.
- Performance requirements:
  - Accuracy: Level:
    - 0.25 inch.
- Element:
  - Level element must conform to the process material compatibility as indicated on the Instrument Data Sheets or the Instrument Index.

Connections:

Process: The antenna design shall be suitable for mounting in a nozzle as indicated in the drawings.

The design shall be such that product condensation on the antenna shall not affect the performance of the gauge. It shall be possible to choose between either parabolic-, cone-, rod-shaped antennas.

Transmitter:

Microprocessor-based signal converter/transmitter.

Power supply:

24 VDC - 2 wire loop powered.

Power consumption: 15 VA maximum.

Outputs:

Isolated 4-20 mA DC with HART communication protocol.

Backlit digital display for level or volume.

Self-diagnostics and automatic data checking.

Signal integrity:

Immune to radio frequency and electromagnetic interference with field strength of 15 volts/meter or less over a frequency range of 50 Hz to 460 MHz.

Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.

Protected terminals and fuses in a separate compartment, which isolates field connection from electronics.

Indication: Local - 5-digit display.

Enclosure rating: NEMA Type 4X, Type 7.

Instruments located within hazardous classified areas shall be explosion proof:

Class 1, Division 1 and 2, Group A, B, C, and D.

Electrical connection: 1/2 inch male NPT.

ACCESSORIES

Software: Provide Windows based PC software for configuration and echo mapping.

Provide sun shield for outdoor installations.

SOURCE QUALITY CONTROL

As specified in Section 40_61_00.

Factory calibrate each level transmitter at a facility that is traceable to NIST (National Institute of Standards and Technology).

Provide complete documentation covering the traceability of all calibration instruments.

EXECUTION

INSTALLATION

As specified in Section 40_61_00.

Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

FIELD QUALITY CONTROL

As specified in Section 40_61_00.

Provide manufacturer's services to perform start-up and calibration or verification.

ADJUSTING

Verify factory calibration of all instruments in accordance with the manufacturer's instructions:

Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

CLEANING

As specified in Section 40_61_00.

DEMONSTRATION AND TRAINING

As specified in Section 40_61_00.

Demonstrate performance of all instruments to the Engineer before commissioning.

Furnish 2 hours of OWNER training.

PROTECTION

As specified in Section 40_61_00.

SCHEDULES

The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:

Instruments may be indicated on the Drawings, specified in the Specifications or both.

END OF SECTION

TECHNICAL SPECIFICATIONS

A/E:	**Carollo Engineers**	**RADAR PTOF LEVEL INSTRUMENTS**						
						Spec. No.		**Rev.**
Contractor:		**No**	**By**	**Date**	**Revision**	40_72_24		
Project:						**Contract**		**Date**
Customer:								
Plant:						**Req.**		**P.O.**
Location:								
BOM No.:						**By**	**Chk**	**App**
File:								

G	**1**	**Instrument Tag Number**	**LE/LIT-**		
E	**2**	**Service**			
N	**3**	**P&ID**			
	4	**Other**			
	5	**Type**	Pulse Time of Flight (PTOF)		
P	**6**	**Housing Material**			
R	**7**	**Measurement Range**			
O	**8**	**Op. Temp. Range**			
B	**9**	**Manufacturer**			
E	**10**	**Model**			
	11	**Model Number**			
	12	**Antenna Style**	Probe		
	13	**Other**			
	14	**Other**			
	15	**Other**			
	16	**Other**			
	17	**Type**	Pulse Time of Flight (PTOF)		
T	**18**	**Operating Mode**			
R	**19**	**Enclosure**			
A	**20**	**Mounting**			
N	**21**	**Temperature Range**			
S	**22**	**Voltage Requirements**			
M	**23**	**Power**	Loop Powered (24 VDC)		
I	**24**	**Accuracy**	± 0.25 inches		
T	**25**	**Calibrated Range**			
T	**26**	**Display**	Multi Character LCD		
E	**27**	**Output**	4-20 mA		
R	**28**	**Calibration**			
	29	**Status Relay**			
	30	**Manufacturer**			
	31	**Model No.**			
	32	**Damping**			
	33	**Elect. Entry**			
	34	**Other**			
O	**35**				
P	**36**				
T	**37**				
S	**38**				

Notes:

SECTION 40_73_23

PRESSURE/VACUUM MEASUREMENT - DIRECT

GENERAL

SUMMARY

Section includes:
Pressure transmitters and indicators.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

Provide all instruments identified in the Contract Documents.

REFERENCES

As specified in Section 40_61_00.

DEFINITIONS

As specified in Section 40_61_00.

NEMA:
Type 7 enclosure in accordance with NEMA 250.

Specific definitions:
Lower range value (LRV): Lowest pressure that the pressure transmitter is capable of measuring.
Upper range value (URV): Highest pressure that the pressure transmitter is capable of measuring.
Calibrated range: The range that the pressure transmitter is configured to measure. The low end of the calibrated range must be greater than the LRV of the transmitter. The high end of the calibrated range must be less than or equal to the URV. The calibrated range corresponds to the flow signal sent from the transmitter.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0.

Provide complete documentation covering the traceability of all calibration instruments.

QUALITY ASSURANCE

As specified in Section 40_61_00.

Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
Process conditions: Fluids, pressures, temperatures, flows, materials etc.
Physical conditions:
- Installation and mounting requirements.
- Location within the process.
- Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

Notify the ENGINEER if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 40_61_00.

PROJECT OR SITE CONDITIONS

Project environmental conditions as specified in Section 40_61_00.
Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

WARRANTY

As specified in Section 40_61_00.

MAINTENANCE

Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PRODUCTS

MANUFACTURERS

One of the following or equal:
- Rosemount: 3051 Series.
- Yokogawa: EJA Series.
- ABB: 264 Series.
- Endress & Hauser: Cerabar S Series.
- SMAR: LD300 Series.

TECHNICAL SPECIFICATIONS

MANUFACTURED UNITS

Pressure transmitters – direct:

General:

Pressure transmitter assembly shall include a diaphragm type pressure transducer and microprocessor based transmitter for measurement of gauge, vacuum, or absolute pressure.

Performance requirements:

Calibrated pressure range: -5 to 24 in W.C.

Maximum ratio of total instrument range to calibrated span: 10 to 1.

Accuracy:

Reference accuracy: Plus or minus 0.075 percent of calibrated span, including effects of hysteresis, nonlinearity, and repeatability.

Total performance accuracy: Plus or minus 0.30 percent of calibrated span, including reference accuracy effects, static pressure and ambient temperature effects.

Stability: Plus or minus 0.15 percent of upper range limit over 5 years.

Element:

Diaphragm type transducer integral to pressure transmitter.

Diaphragm material: Ceramic.

Process material compatibility:

Verify all material compatibilities with the instrument manufacturer.

Process connection: As specified in the Instrument Data Sheets.

Transmitter:

Power supply:

24 VDC - 2 wire loop powered.

Power consumption: 3 VA maximum.

Outputs:

Isolated 4-20mA DC with HART communication protocol.

Provided with electronic microprocessor.

Adjustments: Adjustable electronic zero and span, with elevated or suppressed zero as required by application. Adjustment shall be possible without mechanical fulcrum points or handheld configurator.

Local display:

5-digit LCD.

Scaled in engineering units.

Enclosure: NEMA Type 4X, Type 7.

Over range protection: To maximum process line pressure.

Conduit: 1/2 inch male NPT.

Components:

Transmitter mounting:

As specified in the Instrument Data Sheets.

Provide all necessary hardware for transmitter mounting.

ACCESSORIES

Provide valve manifolds as specified below:

Valve manifolds shall have one piece bonnet with a metal to metal seal to the valve body below the bonnet threads.

Requirements:

Bonnet lock pin to prevent accidental loosening.
Gas leak tested metal-to-metal hard seat design for hard seat valves.
Gas leak tested soft seat design with replaceable seat for soft seat valves.
Manifold valves shall have straight through portion for bi-directional flow and easy roddable cleaning.
Manifold valves shall allow for direct or remote instrument mounting.
Shall be able to withstand pressures up to 6,000 psi for soft seat valves and 10,000 psi for hard seat valves at maximum 200 degrees Fahrenheit.
Materials of construction:
Body material: Type 316 stainless steel.
O-Ring: Teflon.
2-Valve manifolds:
1 isolation valve and 1 drain/vent and calibration valve.
Mount valve manifold integrally to the transmitter.
Valve manifold and transmitter shall be assembled by Manufacturer and shipped as an assembly.
Provide sunshades for outdoor installations.

SOURCE QUALITY CONTROL

As specified in Section 40_61_00.

Factory calibrate each instrument with a minimum 3-point calibration or according to Manufacturer's standard at a facility that is traceable to the National Institute of Standards and Technology.

Submit calibration data sheets to the ENGINEER at least 30 days before shipment of the instruments to the project site.

EXECUTION

EXAMINATION

Examine the installation location for the instrument and verify that the instrument will work properly when installed.

Notify the ENGINEER promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

INSTALLATION

As specified in Section 40_61_00.

Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

FIELD QUALITY CONTROL

As specified in Section 40_61_00.

Provide manufacturer's services to perform start-up and calibration or verification.

ADJUSTING

As specified in Section 40_80_01.

CLEANING

As specified in Section 40_61_00.

DEMONSTRATION AND TRAINING

As specified in Section 40_61_00.

PROTECTION

As specified in Section 40_61_00.

END OF SECTION

SECTION 40_73_29

PRESSURE/VACUUM MEASUREMENT - DIFFERENTIAL

GENERAL

SUMMARY

Section includes:
Differential pressure transmitters and indicators.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

Provide all instruments specified in the Contract Documents.

REFERENCES

As specified in Section 40_61_00.

National Institute of Standards and Technology (NIST).

DEFINITIONS

As specified in Section 40_61_00.

Specific definitions:
Lower range value (LRV): Lowest pressure that the pressure transmitter is capable of measuring.
Upper range value (URV): Highest pressure that the pressure transmitter is capable of measuring.
Calibrated range: The range that the pressure transmitter is configured to measure. The low end of the calibrated range must be greater than the LRV of the transmitter. The high end of the calibrated range must be less than the URV. The calibrated range corresponds to the pressure signal sent from the transmitter.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0 and 40_61_00.

Product data:
Accessories such as diaphragm seals, valve manifold, snubbers, and pulsation dampeners.

Provide complete documentation covering the traceability of all calibration instruments.

QUALITY ASSURANCE

As specified in Section 40_61_00.

Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:

Process conditions: Fluids, pressures, temperatures, flows, materials, etc.

Physical conditions:

Installation and mounting requirements.

Location within the process.

Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

Notify the ENGINEER if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

DELIVERY, STORAGE, AND HANDLING

As specified in Section 40_61_00.

PROJECT CONDITIONS

Project environmental conditions as specified in Section 40_61_00.

Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

WARRANTY

As specified in Section 40_61_00.

MAINTENANCE

Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PRODUCTS

MANUFACTURERS

One of the following or equal:

Rosemount Series 3051.

Endress + Hauser Deltabar S Series.

Foxboro Model IDP10

MANUFACTURED UNITS

Pressure transmitters - differential:

- General:
  - Differential pressure transmitter assembly shall include a diaphragm-type pressure transducer and microprocessor-based transmitter for measurement of differential pressure.
  - Differential pressure transmitters shall be used for differential pressure liquid level measurement in the Digesters as indicated on the Drawings.
- Performance requirements:
  - As specified in data sheets or instrument index.
  - Maximum ratio of total instrument range to calibrated span: 10 to 1.
  - Accuracy:
    - Reference accuracy: Plus or minus 0.075 percent of calibrated span, including effects of hysteresis, nonlinearity, and repeatability.
    - Total performance accuracy: Plus or minus 0.30 percent of calibrated span, including reference accuracy effects, static pressure and ambient temperature effects.
    - Stability: Plus or minus 0.15 percent of upper range limit over 5 years.
- Element:
  - Diaphragm-type transducer integral to differential pressure transmitter.
  - Diaphragm material: Stainless steel or ceramic.
  - Wetted materials: Stainless steel:
    - Process material compatibility:
    - Verify all material compatibilities with the instrument Manufacturer.
  - Diaphragm fill fluid: Silicon Oil.
  - Process connection: 1/2 inch NPT.
- Transmitter:
  - Power supply:
    - 24 VDC - loop powered.
    - Power consumption: 3 VA maximum.
  - Outputs:
    - Isolated 4-20 mA DC.
  - Provided with electronic microprocessor.
  - Adjustments: Adjustable electronic zero and span, with elevated or suppressed zero as required by application. Adjustment shall be possible without mechanical fulcrum points or handheld configurator.
  - Square root extraction for flow calculation.
  - Local display:
    - 5-digit LCD.
    - Scaled in engineering units.
  - Enclosure: NEMA Type 7
  - Overrange protection: To maximum process line pressure.
  - Conduit connection: 1/2-inch male NPT.
- Components:
  - Transmitter mounting:
    - As specified in the data sheets or instrument index.
    - Provide all necessary hardware for transmitter mounting.

ACCESSORIES

Provide metering type 5-valve manifold

- Valve manifolds shall have one piece bonnet with a metal to metal seal to the valve body below the bonnet threads.
- Requirements:
  - Bonnet lock pin to prevent accidental loosening.
  - Gas leak tested metal-to-metal hard seat design for hard seat valves.
  - Gas leak tested soft seat design with replaceable seat for soft seat valves.
  - Manifold valves shall have straight through portion for bi-directional flow and easy roddable cleaning.
  - Manifold valves shall allow for direct or remote instrument mounting.
  - Shall be able to withstand pressures up to 6,000 psi for soft seat valves and 10,000 psi for hard seat valves at maximum 200 degrees Fahrenheit.
  - Materials of construction:
  - Body material: Type 316 stainless steel.
  - O-Ring: Teflon.
  - Metering 5-valve manifold:
    - 2 isolation valves, 2 equalizing valves, 1 vent/drain and calibration valve for differential pressure applications.
- Mount valve manifold integrally to the transmitter.
- Valve manifold and transmitter shall be assembled by Manufacturer and shipped as an assembly.

Provide integral diaphragm seals.

- General:
  - Diaphragm seal and pressure instrument shall be assembled by pressure instrument manufacturer and shipped as an assembly.
- Requirements:
  - Seal type:
    - Metallic diaphragm: Welded to upper housing.
  - Diaphragm: Type 316 stainless steel.
  - Lower housing: Type 316 stainless steel.
  - Upper housing: Manufacturer’s standard.
  - Fill fluid: Silicon oil.
- Manufacturers, one of the following or equal:
  - Ashcroft:
    - Flushing connection: Type 741.
    - Without flushing connection: Type 740.
  - Mansfield and Green:
    - Flushing connection: Type SGT.
    - Without flushing connection: Type SBT.
  - Wika, Type L990.40.
  - Rosemount.
- Diaphragm seal and transmitter shall be assembled by manufacturer and shipped as an assembly.

Provide flanged diaphragm for tank or vessel level measurement:

- Flanged diaphragm and transmitter shall be assembled by Manufacturer and shipped as an assembly.

Provide sunshades for outdoor installations.

SOURCE QUALITY CONTROL

As specified in Section 40_61_00.

Each differential pressure transmitter shall be factory calibrated with 5-point calibration at a facility that is traceable to the NIST.

Provide complete documentation covering the traceability of all calibration instruments.

EXECUTION

EXAMINATION

Examine the installation location for the instrument and verify that the instrument will work properly when installed.

Notify the ENGINEER promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

INSTALLATION

As specified in Section 40_61_00.

Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

FIELD QUALITY CONTROL

As specified in Section 40_61_00.

Provide manufacturer's services to perform start-up and calibration or verification.

ADJUSTING

Verify factory calibration of all instruments in accordance with the manufacturer's instructions:

Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

CLEANING

As specified in Section 40_61_00.

DEMONSTRATION AND TRAINING

As specified in Section 40_61_00.

Demonstrate performance of all instruments to the ENGINEER before commissioning:

Furnish 8 hours of OWNER training.

PROTECTION

As specified in Section 40_61_00.

END OF SECTION

SECTION 40_80_01

TESTING, CALIBRATION, AND COMMISSIONING

GENERAL

SUMMARY

Section includes:

Testing requirements that apply to all process control and instrumentation systems for the entire Project.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

As specified in Section 40_61_00.

DEFINITIONS

As specified in Section 40_61_00.

SUBMITTALS

Furnish submittals as specified in General Conditions 4.0.

General:

Reference additional detailed test submittal scheduling and prerequisite requirements as specified in the Sequencing article of Section 40_61_00.

For each test described in Parts 2 and 3 of this Section, and described in other sections of the Instrumentation and Control Specifications, prepare and submit complete test plans, test procedures, test forms, test binders, test reports, and other submittals, as specified below.

Submit manufacturer's certifications and manufacturer's field reports where required.

Submit test plans, procedures, forms, and binders for approval by the ENGINEER before scheduling or performing tests.

Develop the PCIS system test submittals in consultation and cooperation with all applicable subcontractors.

Additional test form and test procedure requirements are specified with individual test requirements.

Test procedures:

Provide a statement of test objectives for each test.

Specify who will perform the tests, specifically what testing equipment will be used (including serial numbers and NIST-traceable calibration), and how the testing equipment will be used.
Describe the expected role of the ENGINEER, as well as any requirements for assistance from OWNER's staff.
Provide the forms and checklists to be used.

Test forms:
Provide test and calibration forms and checklists for each of the following:
- Calibration.
- Factory acceptance tests.
- Loop validation tests.
- Pre-commissioning test.
- Performance test.

Test forms shall include the detailed test procedures, or shall include clear references to separate pages containing the complete test procedure applicable to each form. If references to procedures are used, the complete procedure shall be included with each test binder.
Every page of each test form shall include project name, date, time, name of person conducting the test, signature of person conducting the test, and for witnessed tests, place for signature of person (ENGINEER and OWNER) witnessing the test.

Testing binders:
Sub-system to be tested, provide and submit a test binder containing all test procedures and individual test forms for the test. References to other documents for test procedures and requirements are not acceptable.
Fill out in advance headings and all other information known before the test.
Include applicable test plan information, as well as a list of all test prerequisites, test personnel, and equipment.
Include or list reference material and provide separately at the time of the test.
Record test results and verify that all test requirements and conditions have been met.

Factory acceptance test procedure additional minimal requirements:
Prepare and submit a factory acceptance test procedure which includes:
Control system testing block diagram.
Estimated test duration.
Details on the simulator construction, components, and operation.

Test reports:
At the conclusion of each test, submit a complete test report, including all test results and certifications.
Include all completed test binders, forms, and checklists.
Submission, review, and acceptance of each test report is generally required before the start of the sub-system.

QUALITY ASSURANCE

Test personnel:
Furnish qualified technical personnel to perform all calibration, testing, and verification. The test personnel are required to be familiar with this Project and

the equipment, software, and systems before being assigned to the test program.

SCHEDULING

As specified in Section 40_61_00.

PRODUCTS

Not Used.

EXECUTION

INSTALLATION

As specified in Section 40_61_00.

Installation supervision:
Provide as specified in Section 40_61_00.

FIELD QUALITY CONTROL

General:
The OWNER reserves the right to test any specified function, whether or not explicitly stated in the test submittals.
Failure testing:
In addition to demonstrating correct operation of all specified features, demonstrate how the system reacts and recovers from abnormal conditions including, but not limited to:
Equipment failure.
Operator error.
Communications sub-system error.
Power failure.
Process equipment failure.
High system loading conditions.
Conduct testing Monday through Friday during normal working hours for no more than 8 hours per day. Testing at other times requires approval of the ENGINEER.

Manufacturer services:
Provide as specified in Section 40_61_00.

Sequencing:
See additional requirements specified in the Sequencing article of Section 40_61_00.

Calibration:
After installation but before starting other tests, calibrate and adjust all instruments, devices, valves, and systems, in conformance with the component manufacturer's instructions and as specified in these Contract Documents.

Components having adjustable features are to be set carefully for the specific conditions and applications of this installation. Test and verify that components and/or systems are within the specified limits of accuracy.
Replace either individually or within a system, defective elements that cannot achieve proper calibration or accuracy.
Calibration points:
Calibrate each analog instrument at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span, using test instruments with accuracies traceable to National Institute of Standards and Technology (NIST).
Field verify calibration of instruments that have been factory-calibrated to determine whether any of the calibrations are in need of adjustment.
Analyzer calibration:
Calibrate and test each analyzer system as a workable system after installation. Follow the testing procedures directed by the manufacturers' technical representatives.
Complete instrument calibration sheets for every field instrument and analyzer.
Calibration tags:
Attach a calibration and testing tag to each instrument, piece of equipment, or system.
Sign the tag when calibration is complete.

Figure 1
Network Test Sequence and Responsibilities

Ultrasonic and radar check out:
Check response under all operating conditions.
Provide Echo Transmission and signal quality on all level transmitters including guided and unguided units.
Provide printout of the actual transmission and all parameters.

SCHEDULES

Example test forms:
Example test forms are attached at the end of this Section. They may be used as a starting point for the development of Project-specific test forms for this Project.
The example test forms are not intended to be complete or comprehensive. Edit and supplement the forms to meet the requirements for testing and test forms specified in this Section and other Contract Documents.

END OF SECTION

TECHNICAL SPECIFICATIONS

	INSTALLATION AND CERTIFICATION CHECKLIST DOCUMENTATION	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

A COPY OF LATEST ISSUE OF THE FOLLOWING DOCUMENTS ARE INCLUDED IN THIS INSTRUMENT INSTALLATION CERTIFICATION FILE:

- ☐ INSTRUMENT SPECIFICATION SHEETS (FOR ALL INSTRUMENTS IN THE LOOP)
- ☐ INSTRUMENT INSTALLATION DETAILS (FOR ALL INSTRUMENTS IN THE LOOP)
- ☐ INSTRUMENT LOOP WIRING DIAGRAMS
- ☐ INSTRUMENT INSTALLATION CERTIFICATION CHECKLIST
- ☐ SIZING CALCULATIONS
- ☐ INSTRUMENT INSTALLATION SCHEDULE (APPLICABLE PART)
- ☐ NAMEPLATE SCHEDULE (APPLICABLE PART)
- ☐ VENDOR LITERATURE CALIBRATION INFORMATION

	No	Yes
INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?	☐	☐

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, WHEN COMPLETED:

- ☐ BENCH CALIBRATED PER SPEC SHEET
- ☐ VERIFIED PER P&ID NO
- ☐ CORRESPONDS TO SPECIFICATION SHEET NO.
- ☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO.
- ☐ INSTALLATION CORRECT PER DETAIL NO.
- ☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- ☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS? ☐ No ☐ Yes

FIELD CALIBRATION CHECK

CONTACT NO.	FUNCTION	FOR SIGNAL	CONTACT IS TO	AT SPECIFIED VALUE FOR		ACTUAL TRIP POINT WAS…	
1	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
2	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
3	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	
4	☐ ALARM	☐ INCR	☐ OPEN	SET PT =		SET PT =	
	☐ S/D PERM	☐ DECR	☐ CLOSE	RESET =		RESET =	

NOTE: PERM IS ABBREVIATED FOR PERMISSIVE

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?

INSTRUMENT TYPE INDICATOR ☐ TRANSMITTER ☐ CONTROLLER ☐

☐ OTHER DESCRIPTION _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

BENCH CALIBRATION CHECK

INPUT RANGE = _____ OUTPUT RANGE = _____

HEAD CORRECTION = _____ ☐ LINEAR

CALIBRATED SPAN = _____ ☐ SQUARE ROOT

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

CHECK BELOW, WHEN COMPLETED:

☐ BENCH CALIBRATED PER SPECIFICATION SHEET _____

☐ VERIFIED PER P&ID NO _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

FIELD CALIBRATION CHECK

INPUT RANGE = _____ OUTPUT RANGE = _____

% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	

☐ DIRECT ☐ REVERSE

☐ ACTION VERIFIED AT 50% SPAN

☐ ACTION VERIFIED AT _____ SPAN

CONTROLLER SETTINGS								
SETTING	GAIN	PB	RESET (INTEGRAL)	DERIV. (RATE)	HIGH LIMIT	LOW LIMIT	ELEV. ZERO	ZERO SUPP
PRE-TUNE								
POST-TUNE								

PRE-TUNE SETTINGS					
	GAIN	PB	RESET (REPEAT/MIN)	RESET (MIN/REPEAT)	DERIVATION (MINUTES)
FLOW:	1.0	100	10	0.1	N/A
LEVEL	1.0	100	MIN.	MAX.	N/A
PRESSURE	2.0	50	2.0	0.5	N/A
TEMP.	4.0	25	0.1	10	OFF

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	ANALYZERS INSTALLATION AND CALIBRATION CHECKLIST	

☐ No ☐ Yes

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS?

TYPE OF INSTRUMENT _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, IF TRUE

☐ BENCH CALIBRATED PER SPECIFICATION SHEET _____

☐ VERIFIED PER P&ID NO _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER DETAIL NO. _____

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ ☐

INSTRUMENT LOOP IS PART OF AN EQUIPMENT START UP/SHUTDOWN INTERLOCKS? No Yes

VALVE TAG NO. _____ SERIAL NO. _____

☐ TRANSDUCER TAG NO. _____ SERIAL NO. _____

☐ SOLENOID TAG NO. _____ SERIAL NO. _____

☐ VOLUME BOOSTER TAG NO. _____ SERIAL NO. _____

☐ POSITIONER _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

TRANSDUCER CHECK					
INPUT RANGE =			OUTPUT RANGE =		
CALIBRATED SPAN =			CALIBRATED SPAN =		
BENCH					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		
FIELD					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		

CHECK BELOW, IF TRUE:

☐ BENCH CALIBRATED PER ABOVE _____

☐ VERIFIED PER P&ID NO. _____

☐ CORRESPONDS TO SPECIFICATION SHEET NO. _____

- ☐ VALVE SPECIFICATION NO. _____
- ☐ TRANSDUCER SPECIFICATION NO. _____
- ☐ SOLENOID SPECIFICATION NO. _____

☐ WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____

☐ INSTALLATION CORRECT PER INSTRUMENT INSTALLATION DETAILS _____

- ☐ VALVE DETAIL NO.

TECHNICAL SPECIFICATIONS

☐ TRANSDUCER DETAIL NO. _____

☐ SOLENOID DETAIL NO. _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	

☐ ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED

☐ INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL

☐ ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

VALVE CHECK			
FLOW CHECK	☐ PROCESS FLOW DIRECTION THRU THE VALVE IS CORRECT		
SAFETY CHECK	ON LOSS OF AIR VALVE FAILS ☐ OPEN ☐ CLOSE	ON LOSS OF POWER SOLENOID FAILS ☐ TO VENT ☐ TO VALVE	
TRAVEL CHECK	FULL OPEN AT _____ PSI	FULL CLOSED AT _____ PSI	MEASURED TRAVEL _____ INCHES
SEATING CHECK	☐ ON BENCH ☐ IN-LINE	RESULTS	ACTUATOR BENCH SET

POSITIONER CHECK
VALVE FULL OPEN AT _____ PSI TO POSITIONER
VALVE FULL CLOSED AT _____ PSI TO POSITIONER

VOLUME BOOSTER CHECK
BYPASS VALVE (GAIN) ADJUSTING SCREW BACKED OUT _____ TURNS FROM CLOSED TO ENSURE QUICK BUT STABLE OPERATION (TYPICALLY 1-1/2 TO 2 TURNS)

REMARKS _____

_____

_____

_____

_____

_____

_____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	DEVICENET INSTALLATION TESTING	

Devicenet Network _____

Network Installation Characteristics

Architecture	Baud Rate	Trunk Media	Drop Media
☐ Single Master	☐ 125 kBaud	☐ Thick Round	☐ Thick Round, Unshielded
or			
☐ Multi Master	☐ 250 kBaud	☐ Thin Round	☐ Thin Round, Shielded
☐ Redundant Power Supplies	☐ 500 kBaud		☐ Thick Round, Shielded
☐ Per Network			

Installed Node List

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	☐ 11	☐ 12	☐ 13	☐ 14	☐ 15
☐ 16	☐ 17	☐ 18	☐ 19	☐ 20	☐ 21	☐ 22	☐ 23	☐ 24	☐ 25	☐ 26	☐ 27	☐ 28	☐ 29	☐ 30	☐ 31
☐ 32	☐ 33	☐ 34	☐ 35	☐ 36	☐ 37	☐ 38	☐ 39	☐ 40	☐ 41	☐ 42	☐ 43	☐ 44	☐ 45	☐ 46	☐ 47
☐ 48	☐ 49	☐ 50	☐ 51	☐ 52	☐ 53	☐ 54	☐ 55	☐ 56	☐ 57	☐ 58	☐ 59	☐ 60	☐ 61	☐ 62	☐ 63

☐ All nodes present and in accordance with network drawings/specifications

☐ ODVA approved devices

☐ Nodes/devices accessible for inspection and maintenance

☐ Nodes/devices properly addressed

Comments: _____

Media Inspection

Trunk Cable	Drop Cable	Installation
☐ ODVA approved	☐ ODVA approved	☐ No evidence of physical damage
☐ Labeling complete	☐ Labeling complete	☐ Installed in protective raceway
☐ Cable/conductor terminations	☐ Cable/conductor terminations	☐ Bending radius not exceeded
☐ Terminating resistors at ends	☐ Max drop length < 20'	☐ Cable supports in place
		☐ V- and shield are grounded
		☐ Clearance from high temperature/voltage sources
		☐ No installation subject to vibration

Comments: _____

Network Power Supplies

TECHNICAL SPECIFICATIONS

Power Supply Equipment	Supply Source (120 VAC)	Network Power Tap (24 VDC)
☐ ODVA compliant	☐ Overcurrent protection	☐ Overcurrent protection
☐ Quantity and ratings	☐ Conductor size	☐ Conductor size

Comments: _____

_____

_____

SECTION 43_08_02

TESTING AND REPAIR OF LEAKS IN DIGESTERS

GENERAL

SUMMARY

Section includes:
Testing digesters with concrete dome for leaks.
Sealing leaks in digester.

Related sections:
The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

DEFINITIONS

Gas leak: Recurrent formation of bubbles in soap solution.

Water leak: Presence of visible moisture on outside of digester walls.

SUBMITTALS

Product data: Submit data completely describing products.

PRODUCTS

EPOXY FOR SEALING CONCRETE DOME

Manufacturers: One of the following or equal:
BASF Construction Chemicals North America, Epoxeal GS Structural.
Sika Corporation, Sikadur 55 SLV.

EXECUTION

FIELD QUALITY CONTROL

Preparation for testing:
Prepare digester for testing by sealing and plugging visible cracks and imperfections in digester wall and floor with epoxy.
Disconnect air hose during test period.

Testing digesters for leaks: After minimum of 28 days after digester concrete has been placed, after exterior piping is connected, and coating is applied to interior of concrete dome, conduct digester leak test as follows:

- Pipe pieces, hatches, holes through roof, and pressure relief and vacuum breaker valve: Ensure following:
  - Pipe pieces and hatches that are installed through walls have been installed and plugged.
  - Holes through concrete dome shall have their final fittings in place.
  - Pressure relief and vacuum breaker valve assemblies are in place and operable.
  - Block and anchor piping. No temporary blocking or anchoring will be allowed.
- Fill digester with water to elevation of 4648.00 feet and allowed to stand full for 48 hours.
  - Maintain gas pressure of 15 inches of water column for this period by trapping air in the concrete dome and adding such air as is necessary by means of a compressor.
  - Periodically examine outside of reconstructed portions of the digester for water leaks and mop entire surface of concrete dome with soap solution to detect gas leaks.
  - Mark any leaks discovered by foregoing methods for repair.
  - At conclusion of 48-hour period, lower water level in sealed digester until vacuum release operates, but not to more than 3 inches of water column of vacuum without manually unsealing.
- Test gasketed connections around safety equipment, hatch covers, and similar type items.
- Repair leaks as specified in this Section.
- After leaks have been repaired, retest digester by repeating entire test procedure for digesters.
- Sewage effluent:
  - OWNER will supply effluent for testing digesters for leaks.
  - Transport said effluent to and from digesters and furnish pumps, mechanical and electrical materials, power, equipment, and labor used in testing digesters for leaks.

Required results: Successful test is defined as no leaks using definitions as specified in this Section.

ADJUSTING

Repair imperfections in the portions of the reconstructed digester encountered during construction, which in opinion of the ENGINEER are structural, as specified in Section 03_30_00.

Repair of leaks in digester:

- Repairs of leaks in concrete dome:
  - Preparation for epoxy repair: Light sandblast concrete surfaces before applying epoxy.
  - Repair leaks in concrete dome, by placing dome under vacuum, as specified in this Section, and applying epoxy to surface in areas marked for repair.

Fill digester with water to elevation of 4648.00 feet.
Lower water level in sealed digester to place not more than 3 inches of water column of vacuum on interior of dome.
Manually unseal vacuum release valve on concrete dome should vacuum release valve fail to operate at 3inches of water column vacuum.
Coat concrete surfaces of concrete dome that are marked for repair with primer and epoxy while 2 to 3 inches of water column of vacuum are maintained on interior of concrete dome.
Maintain 2 to 3 inches of water column of vacuum on interior of concrete dome for published cure time and for not less than 1 hour after placing of epoxy.
Application of epoxy:
Apply epoxy in accordance with manufacturer's instructions.
Apply minimum of 2 coats of epoxy.

Multiple applications may be required to comply with manufacturer's instructions and to attain satisfactory results.

Sprinkle white cement on final epoxy application in order to approximate concrete color.

END OF SECTION

SECTION 46_01_72

DIGESTER CLEANING

GENERAL

SUMMARY

Section includes: Cleaning of anaerobic digesters.

Work included: Furnish labor, services, materials, equipment, transportation, permits, fees, applicable taxes and others items as necessary to complete cleaning of Digester 1, as specified in this Section, included, but not limited to the following:

Remove, properly dewater, and dispose of interior contents of anaerobic digesters. See below for description of contents and history of operation.

Provide adequate purging and ventilation of the digesters for safe access and explosion hazard mitigation prior to draining tank, during anaerobic digester cleaning, and during inspection by OWNER.

Provide odor control measures for all the work as described in this Section.

Provide safety measures for all work described in this Section, including confined space entry equipment and procedures and barricades around the site.

Record drawings of all anaerobic digesters are available for review at the OWNER's office.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

Digester cleaning contractor:

The work specified in this Section shall be performed by a digester cleaning subcontractor hired by the CONTRACTOR.

Experience: Digester cleaning contractor shall minimum 10 years of experience and have recent experience cleaning digesters for at least 5 municipal facilities of similar or larger size.

REFERENCES

Occupational Safety and Health Administration (OSHA).

SAFETY REQUIREMENTS

General:

The CONTRACTOR shall be solely and completely responsible for the safety of all persons and property during the contract period.
The CONTRACTOR shall take necessary precautions to ensure protection of the health and safety of human life and follow all confined space procedures.
The CONTRACTOR shall meet the following safety requirements, and any additional measures necessary to ensure protection of health and safety:

- All digester gas shall be completely purged using an inert gas (i.e. nitrogen gas) to eliminate the risk of fire or explosion prior to opening and/or draining anaerobic digester tank. CONTRACTOR shall furnish purging gas and all necessary equipment.
- Interior air quality shall be tested continuously once hatches are opened for ventilating, draining, cleaning, and follow-up inspection.
- Log all air sampling information.
  - Test interior air for methane, carbon dioxide, carbon monoxide, hydrogen sulfide, and lower explosion limit.
  - If readings exceed OSHA standards for a working environment, do not enter the digesters.
- Provide proper ventilation to maintain OSHA quality standards.
- Fire and explosion hazards exist from high methane content digester gas.
- Gas safety measures shall be taken while working on the digesters.
- Do not allow the following materials or any other flammable type materials in or around a digester:
  - Petroleum products.
  - Flammable clothing.
- Do not allow any ignition source within a safe distance of the digester, including, but not limited to:
  - Sparking equipment or tools including boots with nails and tacks on soles.
  - Welding equipment.
  - Cigarettes and lighters.
  - Non-explosion proof electrical equipment and motors.
- Temporary blind flanges shall be installed on gas piping to prevent backflow of digester gas during the digester cleaning. Remove upon completion of the digester cleaning.
- All safety related accidents shall be reported to the OWNER not more than 24 hours after occurrence.
- Enter digesters using only the hatches located at the ground level.
- If hazardous materials are encountered, set up a decontamination system and develop procedures for using such a system.

Nuisance:

Take immediate steps to alleviate nuisance problems such as spills, odors and others as directed by the OWNER.

Hazardous substances:

If the CONTRACTOR uses any hazardous substance to which the OWNER employees may be exposed, the CONTRACTOR shall supply

to the OWNER, the trade name of the hazardous substance and a copy of Material Safety Data Sheet (MSDS).

Safety equipment:

Safety equipment provided shall include but not be limited to the items from the following items:

Explosion and oxygen deficiency meters.
Ladders with safety apparatus.
Self-contained breathing apparatus, or air line(s) extended inside the digesters.
Safety harness, tether, and retrieval device.
Explosion-proof lights.
Explosion-proof ventilation fans.
Non-sparking tools.
Biosolids pumps: Positive displacement or centrifugal pumps with special impellers or explosion proof pumps and motors if used near or lowered into digested biosolids atmosphere.
Dewatering equipment: Explosion proof pumps and motors if used near digested biosolids atmosphere.

Ensure that no hazardous condition relevant to basic hygiene protection, odors, vectors, unsightly spills, or explosive conditions will exist or develop that could be of concern to public or plant personnel safety or health.

DIGESTER DESCRIPTION

Dimensions/components:

The digesters are circular, concrete tanks with [fixed concrete] covers and sloped bottoms. The configurations of the digesters are as follows, all dimensions must be confirmed by the contractor:

Digester No.	**1**
Diameter, feet	50
Sidewater Depth (normal), feet	29
Approximately Effective Volume, cubic feet	57,000

The major components of the digesters are biosolids feed, effluent and recirculation return lines, digester overflow box, roof mounted gas collection equipment, sample hatches, sight glasses, and access ports as indicated in the Drawings.

Contents/history of operation:

The digesters were last cleaned in *FILL-IN* and have not been taken out of service or cleaned since.
The contents include anaerobically digested biosolids, organic and inorganic materials, nonvolatile materials, debris, rags, grits, and other materials that have accumulated.
Assume a homogeneous solids content of 6 to 10 percent.

Do not assume anaerobic digester is of typical condition for purposes of cleaning.

Equipment, procedures, and efficiencies for cleaning shall be specifically based on the contents and history of operation described in this Section.

CONTRACTOR shall assume that significant additional effort beyond normal procedures will be required for fluidizing, loosening, and pumping the contents.

The digester may be lowered to an elevation that will be coordinated with the City operation staff prior to cleaning.

SUBMITTALS

Submit the following to the OWNER as part of an Anaerobic Digester Cleaning Work Plan submittal for review prior to commencement of the work:

- Equipment for cleaning, screening, and dewatering.
- Equipment for disposal of the removed materials off from the plant site.
- Equipment for odor control.
- Plans and permits for disposal of the removed materials.
- Cleaning progress schedule, work schedule, and biosolids outage plan.
- Proposed disposal site.
- Site-specific health and safety plans.
  - Submittal of health and safety plans are for record purposes only and shall not be reviewed.
- Site plan showing the following:
  - Equipment laydown areas.
  - Temporary piping routing plans.
  - Location of screening and dewatering equipment.

Review of submittal by the OWNER shall not relieve the CONTRACTOR from responsibility for deviations from requirements specified, unless the CONTRACTOR has in writing at the time of submission requested and received written approval from the OWNER for specific deviations.

Review of submittal information shall not relieve the CONTRACTOR from responsibility for errors or omissions in the submittal.

PRODUCTS AND MATERIALS

TEMPORARY MATERIALS

Provide temporary pumping, piping, valves, and equipment required for cleaning, odor control, gas purging, safety measures, and other work as specified.

All other materials, not specifically described, but required for proper completion of the work specified, shall be provided by the CONTRACTOR.

EXECUTION

WORK SCHEDULE

Plan the work and carry it out with minimum interference to plant operation.

Prior to starting the work, confer with the OWNER and develop an approved work schedule and outage plan which permits the plant facilities to function as normally as practical.

It may be necessary to perform parts of the work outside normal working hours, as directed by the OWNER.

This work shall be performed at no additional cost to the OWNER.

Cooperate in scheduling work as required by the OWNER and abide by the OWNER's decision in resolving project coordination problems, at no additional cost to the OWNER.

All work requiring shutdown of plant systems or facilities or interruptions of plant operations shall be done during low flow periods and as directed by the OWNER.

Submit a system outage request to the OWNER for review and approval prior to commencing digester-cleaning work.

Outage plan shall include a time schedule for shutdown of plant facilities, change of plant systems operation, or temporary removal of plant facilities required to meet the needs of cleaning operation.

Any operational functions of the existing plant that are required to be done to facilitate the CONTRACTOR’s work shall be done by the plant personnel only.

The plant operation and maintenance personnel will cooperate in every way that is practicable in order to expedite the CONTRACTOR's operation; however, if it is necessary for the proper operation or maintenance of portions of the plant, the CONTRACTOR shall reschedule his operations so there shall be no conflict with necessary operations or maintenance of the plant.

Once cleaning of digester is complete, allow OWNER 14 days from notice of completion of cleaning to inspect tank interior prior to scheduling subsequent digester tank cleaning or return to service.

REMOVAL OF THE DIGESTER CONTENTS

Remove the balance of the material not utilized to seed other anaerobic digesters, in preparation for cleaning.

Provide appropriate screening and mechanical dewatering equipment to dewater digester contents on site.

All equipment rentals, labor, power, water, polymer, loading, off haul, disposal, and other costs shall be included in the CONTRACTOR’s lump sum bid.

CONTRACTOR shall be responsible for all purging and safety requirements for opening the hatches before entry.

Wash thoroughly the entire interior of the digesters to completely remove foreign materials from concrete and metal surfaces after removal of the contents.

Notify the OWNER for final inspection upon the completion of the cleaning.

HAULING AND DISPOSAL

Haul and dispose of materials removed from the digesters off-site in accordance with all applicable laws.

ODOR CONTROL

Develop odor control measures for the work specified.

Odor control measures shall include piping, equipment, chemicals, and other items as required to reduce the odor to an unnoticeable level as determined by the OWNER.

Odor control measures shall be submitted to the OWNER for review prior to commencing work.

CLEAN-UP

Maintain the project site in a clean and orderly condition at all times.

Any spillage, debris, or excess materials shall be cleaned up and removed from the plant site.

Do not wash materials into the plant drains.

Walkways, driveways, and passways shall be maintained in a manner that will not be a safety hazard to the plant personnel, or become an obstruction or interfere with performance of normal and routine tasks.

Upon completion of the cleaning, remove all materials and equipment from the plant site.

WASHDOWN WATER

The plant's 3W system can be used for the cleaning and washdown purposes.

The plant's 3W may be obtained from any fire hydrant or outdoor hose bibb.

The plant 3W system has a limited capacity and pressure.

CONTRACTOR may need to utilize multiple locations to access sufficient water volume for their needs, and provide booster pumps as required.

Provide all distribution pumps, hoses, piping, traffic ramps over pipes, valves and fittings, proper supports and anchors as required to convey the water from the point of connection to the point of use.

Provide signage throughout the work area advising employees and other persons on the site that the water is not potable.
Ensure that the water obtained from the plant is free of any impurities detrimental to intended use.
Provide an alternative source of washdown water if plant water 3W system is not suitable for use.

ELECTRICAL POWER

Obtain a source of electrical power at the CONTRACTOR's expense.
Provide a portable generator for the needed electrical power.
Provide adequate jobsite distribution facilities conforming to applicable codes and safety regulations.

TRAFFIC CONTROL

Ensure that no obstruction to normal traffic patterns within the plant exists at any time.

Provide sufficient bridging or overhead devices for temporary piping installed in any traffic area to allow vehicles to drive over or under without damage to the piping.

INSPECTION

Pre-Inspection for concrete roof or domed anaerobic digesters:
Notify OWNER of intent to clean each concrete roof or domed anaerobic digester 2 weeks in advance of cleaning operations.
OWNER will conduct a cover inspection utilizing soapy water mopped over entire surface of dome to identify any possible leaks as specified in Section 43_08_02.
CONTRACTOR shall furnish labor to assist OWNER in wetting dome and marking of any identified leaks.

Notify the OWNER 2 weeks in advance of completion dates of cleaning for each digester.

At completion of cleaning of each digester, OWNER will spend 1 week inspecting each digester interior.
Inspection shall serve to verify the following:
Cleaning was completed in compliance with the specifications.
Inspection of existing coatings to determine remaining useful life.
Condition of existing digester accessories and whether replacement is required.
Coordinate activities with OWNER’s inspection and assist OWNER during inspection.
Assistance includes opening both dome and ground level hatches, removing and reinstalling inspection ports at each digester, providing confined space entry supervision, and OWNER’s use of CONTRACTOR’s safety equipment
Provide scaffolding to allow OWNER to inspect digester interior.

Scaffolding shall allow inspection for full height and around entire perimeter of digester interior.

END OF SECTION

SECTION 46_05_10

COMMON WORK RESULTS FOR MECHANICAL EQUIPMENT

GENERAL

SUMMARY

Section includes: Basic design and performance requirements for mechanical equipment.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American Gear Manufacturer's Association (AGMA) Standards:

6001-E08 – Design and Selection of Components for Enclosed Gear Drives.

American Bearing Manufactures Association (ABMA) Standards:

9 - Load Ratings and Fatigue Life for Ball Bearings.

11 - Load Ratings and Fatigue Life for Roller Bearings.

American Petroleum Institute (API):

682 - Shaft Sealing Systems for Centrifugal and Rotary Pumps.

ASTM International (ASTM):

A 36 - Standard Specification for Carbon Structural Steel.

A 48 - Standard Specification for Gray Iron Castings.

A 125 - Standard Specification for Steel Springs, Helical, Heat-Treated.

A 536 - Standard Specification for Ductile Iron Castings.

A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B 61 - Standard Specification for Steam or Valve Bronze Castings.

B 62 - Standard specification for Composition Bronze or Ounce Metal Castings.

B 505 - Standard Specification for Copper Alloy Continuous Castings.

B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

Food and Drug Administration (FDA).

Hydraulic Institute (HI).

NSF International (NSF).

DEFINITIONS

Special tools: Tools that have been specifically made for use on unit of equipment for assembly, disassembly, repair, or maintenance.

Resonant frequency: That frequency at which a small driving force produces an ever-larger vibration if no dampening exists.

Rotational frequency: The revolutions per unit of time usually expressed as revolutions per minute.

Critical frequency: Same as resonant frequency for the rotating elements or the installed machine and base.

Peak vibration velocity: The root mean square average of the peak velocity of the vibrational movement times the square root of 2 in inches per second.

Rotational speed: Same as rotational frequency.

Maximum excitation frequency: The excitation frequency with the highest vibration velocity of several excitation frequencies that are a function of the design of a particular machine.

Critical speed: Same as critical frequency.

Free field noise level: Noise measured without any reflective surfaces (an idealized situation); sound pressure levels at 3 feet from the source unless specified otherwise.

Operating weight: The weight of unit plus weight of fluids or solids normally contained in unit during operation.

SYSTEM DESCRIPTION

General:

Provisions specified under each technical equipment specification prevail over and supersede conflicting provisions as specified in this Section.

Provide equipment and parts that are suitable for stresses, which may occur during fabrication, transportation, erection, and operation.

Provide equipment that has not been in service prior to delivery, except as required by tests.

Like parts of duplicate units are to be interchangeable.

When 2 or more units of equipment for the same purpose are required, provide products of same manufacturer.

Equipment manufacturer's responsibility extends to selection and mounting of gear drive units, motors or other prime movers, accessories, and auxiliaries required for proper operation.

When necessary, modify manufacturer's standard product to conform to specified requirements or requirements indicated on the Drawings and contained in Laws and Regulations.

Material requirements:

Materials: Suitable for superior corrosion resistance and for services under conditions normally encountered in similar installations.

Dissimilar metals: Separate contacting surfaces with dielectric material.

Equipment mounting and anchoring:

Mount equipment on cast iron or welded steel bases with structural steel support frames.

Utilize continuous welds to seal seams and contact edges between steel members.

Grind welds smooth.

Provide bases and supports with machined support pads, dowels for alignment of mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits.

Provide jacking screws in bases and supports for equipment weighing over 1,000 pounds.

Anchorage of equipment to concrete: Perform calculations and determine number, size, type, strength, and location of anchor bolts or other connections.

Provide bolt sleeves for anchor bolts for heavy equipment.

Adjust bolts to final location and fill sleeve with non-shrink grout.

Anchorage of equipment to metal supports: Perform calculations and determine number, size, type, strength, and location of bolts used to connect equipment to metal supports.

Design equipment anchorage, supports, and connections for dead load, running loads, loads during start-up, seismic load, and other loads as required for proper operation of equipment.

Seismic design:

Design equipment anchorage and related details for seismic design criteria as specified.

For equipment with operating weight of 400 pounds or more, provide calculations for:

Determine operating weight and centroid of equipment.

Calculate forces and overturning moments.

Calculate shear and tension forces in equipment anchorages, supports, and connections.

Design equipment anchorage, supports, and connections based on calculated shear and tension forces.

Equipment units weighing 50 pounds or more: Provide with lifting lugs or eyes to allow removal with hoist or other lifting device.

SUBMITTALS

Product data:

For each item of equipment:

Design features.
Load capacities.
Efficiency ratings.
Material designations by UNS alloy number or ASTM Specification and Grade.
Data needed to verify compliance with the Specifications.
Catalog data.
Name plate data.
Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
Gear reduction units:
Engineering information in accordance with applicable AGMA standards.
Gear mesh frequencies.

Shop drawings:
Drawings for equipment:
Drawings that include outline drawings, cut-away drawings, parts lists, material specification lists, and other information required to substantiate that proposed equipment complies with specified requirements.
Outline drawings showing equipment, driver, driven equipment, pumps, seal, motor(s) or other specified drivers, variable frequency drive, shafting, U-joints, couplings, drive arrangement, gears, baseplate or support dimensions, anchor bolt sizes and locations, bearings, and other furnished components.
Installation and checkout instructions including leveling and alignment tolerances, grouting, lubrication requirements, and initial start-up procedures.
Wiring, control schematics, control logic diagrams and ladder logic or similar for computer based controls.
Recommended or normal operating parameters such as temperatures and pressures.
Alarm and shutdown set points for all controls furnished.

Calculations:
Calculations and other information to substantiate equipment base plates, supports, bolts, anchor bolts, and other connections meet minimum design strength requirements and seismic design criteria specified in Section 01_81_02.
Calculations shall be signed and stamped by a civil or structural engineer registered to practice in the state where the Project is located.

Quality control submittals:
Submit factory test reports before shipment.
Start-up plan: Proposed plan for field-testing equipment as specified in General Conditions 8.0.
Certificate of Proper Installation: As specified in Section 01_75_17.
Submit material test reports a specified in the equipment sections.

Operation and maintenance manuals:

As specified in General Conditions 8.0.
Submit prior to training of OWNER's personnel.
Make available at project site complete copy of manuals for use by field personnel and ENGINEER during start-up and testing of equipment.
Include manufacturer and model number of every bearing; include calculated ball pass frequencies of the installed equipment for both the inner and outer raceways.
Include motor rotor bar pass frequencies.

QUALITY ASSURANCE

Manufacturer's field service:
Furnish services of authorized representative specially trained in installation of equipment:
Visit project site and perform tasks necessary to certify installation.
Furnish Certificate of Proper Installation as specified in Section 01_75_17.

DELIVERY, STORAGE, AND HANDLING

Packing and shipping:
Equipment: Pack in boxes, crates, or otherwise protect from damage and moisture, dust, or dirt during shipment, handling, and storage.
Bearings: Separately pack or otherwise suitably protect during transport.
Spare parts: Deliver in boxes labeled with contents, equipment to which spare parts belong, and name of CONTRACTOR.

Protection:
Equipment: Protect equipment from deleterious exposure.
Painted surfaces: Protect against impact, abrasion, discoloration, and other damage.

SEQUENCING AND SCHEDULING

Equipment anchoring: Obtain anchoring material and templates or setting drawings from equipment manufacturers in adequate time for anchors to be cast-in-place when concrete is placed.

Coordinate details of equipment with other related parts of the Work, including verification that structures, piping, wiring, and equipment components are compatible.

General start-up and testing of equipment:
Perform general start-up and testing procedures after operation and maintenance manuals for equipment have been received.
Conduct functional testing of mechanical or electrical systems when each system is substantially complete and after general start-up and testing procedures have been successfully completed.
Functional testing requirements as specified in General Conditions 7.0 and the equipment sections.

MAINTENANCE

Special tools:
When specified, provide special tools required for operation and maintenance.
Mark or tag and list such tools in maintenance and operations instructions. Describe use of each tool.

Spare parts:
Assume responsibility until turned over to OWNER.
Store in enclosed facilities.
Furnish itemized list and match identification tag attached to every part.
List parts by generic title and identification number.
Furnish name, address, and telephone number of supplier and spare parts warehouse.

WARRANTY

Warrant the Work as specified in General Requirements.

PRODUCTS

MATERIALS

Ferrous materials:
Steel for members used in fabrication of assemblies: ASTM A 36.
Iron castings: ASTM A 48, tough, close-grained gray iron, free from blowholes, flaws, and other imperfections.
Ductile iron castings: ASTM A 536, Grade 65-45-12, free from flaws and imperfections.
Galvanized steel sheet: ASTM A 653, minimum 0.0635 inch (16 gauge).
Expanded metal: ASTM A 36, 13 gauge, 1/2-inch flat pattern expanded metal.

Nonferrous materials:
Stainless steel: Type 304 or 316 as specified. Provide L grade where welding required.
Bronze in contact with liquid: Composition of not more than 2 percent aluminum nor more than 6 percent zinc; UNS Alloy C83600, C92200 or C93700 in accordance with ASTM B 61, B 62, B 505, or B 584, when not specified otherwise.

Dielectric materials for separation of dissimilar metals:
Neoprene, bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other materials.

Anchors bolts: minimum 0.5-inch diameter.

Non-shrink grout: As specified in Section 03_60_00.

FABRICATION

Nameplates:
- Engraved or stamped on Type 304 stainless steel and fastened to equipment at factory in an accessible and visible location.
- Indicate following information as applicable:
  - Manufacturer's name.
  - Equipment model number and serial number.
  - Maximum and Normal rotating speed.
  - Horsepower.
  - Rated capacity.
  - Service class per applicable standards.
- Nameplates for pumps: Include:
  - Rated total dynamic head in feet of fluid.
  - Rated flow in gallons per minute.
  - Impeller, gear, screw, diaphragm, or piston size.
- Gear reduction units: Include:
  - AGMA Class of service.
  - Service factor.
  - Input and output speeds.

Bolt holes in equipment support frames:
- Do not exceed bolt diameter by more than 25 percent, up to limiting maximum diameter oversize of 1/4 inch.

Shop finishing:
- Provide factory and field coating as specified in Section 09_96_01. If not specified in Section 09_96_01, provide coating as follows:
  - Bases and support frames in contact with concrete or other material: Coat contacting surfaces with minimum of 2 coats of zinc chromate primer before installation or grouting.
  - Shop primer for steel and iron surfaces, unless specified otherwise:
    - Manufacturers: One of the following or equal:
      - Ameron, Amercoat 185 Universal Primer.
      - Cook, 391-N-167 Barrier Coat.
      - Kop-Coat, Pug Primer.
      - Tnemec, 37-77 Chem-Prime.
      - Valspar, 13-R-28 Chromox Primer.
  - Coat machined, polished, and nonferrous surfaces which are not to be painted with rust-preventive compounds:
    - Manufacturers: One of the following or equal:
      - Houghton, Rust Veto 344.
      - Rust-Oleum, R-9.
  - Coating for ferrous metal surfaces, except stainless steel: High solids polyamine epoxy.
  - Finish painting of motors: Shop finish paint with manufacturer's standard coating, unless otherwise specified in Section 09_96_01.

EXECUTION

EXAMINATION

Inspect all components for shipping damage, conformance to specifications, and proper torques and tightness of fasteners.

PREPARATION

Metal work embedded in concrete:

- Accurately place and hold in correct position while concrete is being placed.
- Clean surface of metal in contact with concrete immediately before concrete is placed.

Concrete surfaces designated to receive non-shrink grout:

- Heavy sandblast concrete surface in contact with non-shrink grout.
- Clean concrete surfaces of sandblasting sand, grease, oil, dirt, and other foreign material that may reduce bond to non-shrink grout.
- Saturate concrete with water. Concrete shall be saturated surface damp at time non-shrink grout is placed.

Field measurements:

- Prior to fabrication of equipment, take measurements for installation of equipment and verify dimensions indicated on the Drawings.
- Ensure equipment and ancillary appurtenances fit within available space.

INSTALLATION

Install equipment in accordance with manufacturer's installation instructions and recommendations.

Grouting equipment bases and baseplates with non-shrink grout:

- Grout with non-shrink grout as specified in Section 03_60_00.
- Comply with equipment manufacturer's installation instructions for grouting spaces, and tolerances for level and alignments, both vertical and horizontal.
- Grout after piping connections are complete and in alignment with no strain transmitted to equipment.
- Grout base when equipment is leveled and in alignment.
- Place grout, filling voids under equipment bases and other supports including recesses between anchor bolts and sleeves:
  - Extend grout to edge of equipment bases or baseplates and bevel at 45 degrees around units.
  - Grouts must be cut back to the lower edge of baseplates after reaching initial set.
  - Provide a 45-degree angle cut back.
  - Finish surfaces with slope that prevents ponding water within grouted areas.

Forms and headboxes for non-shrink grouts or non-shrink epoxy grouts: As specified in Section 03_60_00.

Special techniques: Use applicable special tools and equipment, including precision machinist levels, dial indicators, and gauges as required in equipment installations.

Tolerances:

Completed equipment installations: Comply with requirements for intended use and specified vibration and noise tolerances.

FIELD QUALITY CONTROL

Perform operational testing as required by General Conditions 7.0.

MANUFACTURER'S REPRESENTATIVE

Field checkout: Before field-testing and start-up, provide services of factory-trained field service representative to certify the equipment has been installed, aligned, and checked in accordance with the manufacturer’s instructions and the Specifications.

Testing: Provide services of factory trained representative to observe and advise the CONTRACTOR during field quality control testing.

Training: When training is specified, provide services of factory-trained representative to perform training as specified in Section 01_75_17.

END OF SECTION

SECTION 46_73_19

DIGESTER APPURTENANCES

GENERAL

SUMMARY

Section includes: Digester accessories including the following:
- Digester gas sediment and moisture traps.
- Flame arresters.
- Manometers.
- Non-sparking gastight manhole covers.
- Pressure/vacuum relief valves.
- Sample hatches.
- Sight glasses.
- 3 Way Multiport valves for digester gas service.

Related sections:

The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

REFERENCES

American National Standards Institute (ANSI).

American Society of Mechanical Engineers (ASME):
- B16.1 - Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 150.
- Boiler and Pressure Vessel Code, Section VIII.

SUBMITTALS

Product data.

WARRANTY

Provide product warranty as specified in Section 46_05_10.

PRODUCTS

MATERIALS

Zinc content of bronze or brass in contact with sewage or digester gas: Maximum 6 percent zinc.

Components and materials: Suitable for use with digester gas containing hydrogen sulfide.

DIGESTER GAS SEDIMENT AND MOISTURE TRAPS

Manufacturers: One of the following or equal:
- Varec, Model 233.
- Groth Model 8330.
- Shand & Jurs Model 97120.

Materials: Type 316 Stainless steel.

Features:
- 150 pound flanged ANSI connections.
- Provide large reservoir capacity welded steel sediment and moisture traps as indicated on the Drawings.
- Design working pressure 25 pounds per square inch gauge.
- Remove condensate and sediment automatically from digester gas through a combination of centrifugal force and a sharp drop-in velocity.
- Removable top cover with integral 3/4-inch inspection pipe.
- 2-inch blowout/drain connection.
- 1-inch drain connection with manual drip trap as indicated on the Drawings.
- Provide pyrex sight glass with external 1/2-inch connections.
- Provide bronze isolation valves, and drain cock.
  - Manufacturers: One of the following or equal:
    - Varec, Model 218.
    - Shand & Jurs Model 9712.
    - Groth Model F010.

FLAME ARRESTERS

Manufacturers: One of the following or equal:
- Varec, Model 5000 for vertical installation or Model 5010 horizontal installation.
- Groth Model 7618 for vertical installation or Model 7628 horizontal installation.
- Shand & Jurs Model 94306 for vertical installation or Model 94307 for horizontal installation.

Materials:
- Body: Aluminum.
- Fasteners: Type 316 stainless steel.

Features:
- Net free area through banks: Minimum 3 times the corresponding size standard pipe.
- Bank assembly: Able to slide easily out of housing for inspection and cleaning.
- Bank sheets: Corrugated rectangular shaped or spiral-wound crimped ribbon, arranged for easy removal

Drain connection for horizontal installation: 1/2-inch drain connection with manual drip trap as indicated on the Drawings.
Sizes: As indicated on the Drawings.
Rated for 5 pounds per square inch gauge.
Indicated on the Drawings

NON-SPARKING GASTIGHT MANHOLE COVERS

Manufacturers: One of the following or equal:
Varec, 220 Series.
Groth Model 8200.
Shand & Jurs, Model 95210.

Materials:
Base and Cover: Aluminum**.**
Hardware and fasteners: Type 316 Stainless Steel.

Features:
30-inch diameter, unless otherwise indicated on the Drawings.
Non-sparking, gas-tight seal.
Provide handwheel or wing nuts on clamping mechanism for easy entry.
Pressure rated for 1 pound per square inch.

PRESSURE/VACUUM RELIEF VALVES.

Manufacturers: One of the following or equal:
Varec, Figure 2010; or combine with flame arrester: Varec Figure 5810.
Shands & Jurs, Model 94020 or combination unit with flame arrester Model 97570.
Groth Model 1200A or combination unit with flame arrester Model 8800A.

Materials:
Body: Aluminum.
Trim: Type 316 Stainless steel.
Seal: Buna-N.

Features:
Pressure pallet with removable lead weights for adjusting setting in 1-inch water column increments.
Adjustable from 2 inches water column of vacuum to 15 inches water column of pressure.
Certified pressure leakage rate of no greater than 1 SCFH of leakage at 90 percent of the set point.
125 pound flanged ANSI connections.
Pressure rated for 2 pounds per square inch.

SAMPLE HATCHES

Manufacturers: One of the following or equal:

Varec, Series 42.
Shand & Jurs, Model 95021.
Groth Model 6100.

Materials:
Aluminum cover with replaceable Buna-N seat insert.

Features:
125-pound ANSI flanged mounting connection as indicated on the Drawings.
Inclined foot pedal to facilitate opening and handwheel or quick clamp type lock-down device.
Pressure rated for 3 pounds per square inch.

SIGHT GLASSES

Manufacturers: The following or approved equal:
Shand & Jurs Model 97186.

Materials:
Frame and Cover: Aluminum.
Window Material: Tempered glass.
Gasket Material: Neoprene.

Components:
Viewing ports:
Tempered glass able to withstand 1 pound per square inch gauge internal pressure.
Minimum 10-inch diameter view port.
2 per sight glass.
Cleaning mechanism: Internal wiper, Type 316 stainless steel spray piping, and nozzles.
Nozzles for cleaning inside portion of glass as indicated on the Drawings.
Wiper assembly: Able to be moved clear from viewing ports during viewing, with a packed gland.

Assembly: Gastight assembly.

3-WAY MULTIPORT VALVES FOR DIGESTER GAS SERVICE

CONTRACTOR has option to provide valves meeting the requirements for either Alternative A or Alternative B:
Alternative A: Multiport plug valve:
Manufacturers: One of the following or equal:
Durco, Series G4 Sleeveline.
Tufline, Figure 037.
Materials:
Body: Type 316 Stainless steel.
Plug: Type 316 Stainless steel.
Seal: Fire resistant.

Features:
3-way multiport, 180-degree rotation with shutoff to either port, but always with one or a portion of both ports open.
Fire sealed.
Gear operated.
Flanges: ASME B16.1 pressure Class 150.]

Alternative B: Safety selector valve:
Manufacturers: One of the following or equal:
Varec, Safety Selector Valve (SSV).
Shand & Jurs, Model 97190 3-Way Safety Selector Valve.
Materials:
Body: Aluminum.
Rotor material: Aluminum or Type 316 stainless steel.
Trim: Type 316 Stainless steel.
Seat seal: Teflon.
Features:
3-way multiport, rotor and isolation disc assembly with shutoff to either port, but always with one port or a portion of both ports open.
Pressure rated for 15 pound per square inch gauge at 100 degrees Fahrenheit.
Temperature rated for 400 degrees Fahrenheit.
Flanges: ASME B16.1 pressure Class 150 Flat Faced.

All 3-way multiport valves shall be supplied by a single manufacturer.

EXECUTION

INSTALLATION

Conform to manufacturer's installation instructions and as specified in Section 46_05_10.

Install specialty items for gas systems where indicated on the Drawings.

Pressure/vacuum relief valves:
Locate pressure relief and vacuum breaker valves with flame arrester on the digester as indicated on the Drawings.
Set pressure relief valve at 11-inches water column and vacuum breaker at 2-inches water column, negative.

MANUFACTURER'S FIELD SERVICES

Require manufacturer to inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up as specified in this Section and in Section 46_05_10.

Training: As specified in Special Conditions 12.

END OF SECTION

2013 PREVAILING WAGE RATES
CARSON CITY

DATE OF DETERMINATION: October 1, 2012

APPLICABLE FOR PUBLIC WORKS PROJECTS BID/AWARDED OCTOBER 1, 2012 THROUGH SEPTEMBER 30, 2013*

***Pursuant to NAC 338.040(3), "After a contract has been awarded, the prevailing rates of wages in effect at the time of the opening of bids remain in effect for the duration of the project."**

As Amendments/Addenda are made to the wage rates, such will be posted to sites of the respective counties. Please review regularly for any amendments posted or contact our offices directly for further assistance with any amendments to the rates.

AIR BALANCE TECHNICIAN
ALARM INSTALLER
BOILERMAKER
BRICKLAYER
CARPENTER
CEMENT MASON
ELECTRICIAN-COMMUNICATION TECH.
ELECTRICIAN-LINE
ELECTRICIAN-NEON SIGN
ELECTRICIAN-WIREMAN
ELEVATOR CONSTRUCTOR
FENCE ERECTOR
FLAGPERSON
FLOOR COVERER

GLAZIER
HIGHWAY STRIPER
HOD CARRIER-BRICK MASON
HOD CARRIER-PLASTERER TENDER
IRON WORKER
LABORER
MECHANICAL INSULATOR
MILLWRIGHT
OPERATING ENGINEER
OPERATING ENG. STEEL FABRICATOR/ERECTOR
OPERATING ENGINEER-PILEDRIVER
PAINTER
PILEDRIVER (NON-EQUIPMENT)
PLASTERER
PLUMBER/PIPEFITTER
REFRIGERATION
ROOFER (Does not include sheet metal roofs)
SHEET METAL WORKER
SPRINKLER FITTER
SURVEYOR (NON-LICENSED)
TAPER
TILE /TERRAZZO WORKER/MARBLE MASON
TRAFFIC BARRIER ERECTOR
TRUCK DRIVER
WELL DRILLER
LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK)
SOIL TESTER (CERTIFIED)
SOILS AND MATERIALS TESTER

PREVAILING WAGE RATES INCLUDE THE BASE RATE AS WELL AS ALL APPLICABLE FRINGES

NRS 338.010(21) "Wages" means:

(a) The basic hourly rate of pay; and

(b) The amount of pension, health and welfare, vacation and holiday pay, the cost of apprenticeship training or other similar programs or other bona fide fringe benefits which are a benefit to the workman.

NRS 338.035 Discharge of part of obligation of contractor or subcontractor engaged on public work to pay wages by making certain contributions in name of workman. The obligation of a contractor engaged on a public work or a subcontractor engaged on a public work to pay wages in accordance with the determination of the Labor Commissioner may be discharged in part by making contributions to a third person pursuant to a fund, plan or program in the name of the workman.

CRAFT	RATE
AIR BALANCE TECHNICIAN	**ADD SHEET METAL ZONE RATE**
Air Balance-Journeyman	62.27
Air Balance-Foreman	66.52
Air Balance-General Foreman	70.77
ALARM INSTALLER	
Alarm Installer-Journeyman	30.47
BOILERMAKER	
Boilermaker	65.94
BRICKLAYER	**ADD ZONE RATE**
Bricklayer-Journeyman	33.68
Bricklayer-Foreman	34.93
Bricklayer-General Foreman	36.68
CARPENTER	**ADD ZONE RATE**
Carpenter-Journeyman	39.55
Carpenter-Foreman	42.30
CEMENT MASON	**ADD ZONE RATE**
Cement Mason-Journeyman	35.40
Cement Mason-Foreman	37.40
ELECTRICIAN COMMUNICATION TECHNICIAN	**ADD ZONE RATE**
Communication Technician-Installer	30.47
Communication Technician	33.67
Communication-Senior Technician	36.15
ELECTRICIAN-LINE	**SEE AMENDMENT 1**
Electrician-Groundman	32.55

Electrician-Lineman	50.91
Electrician-Foreman	56.21
Electrician-General Foreman	61.58
Heavy Equipment Operator	40.99
ELECTRICIAN-NEON SIGN	
Electrician-Neon Sign	46.20
ELECTRICIAN-WIREMAN	**ADD ZONE RATE**
Wireman	50.78
Cable Splicer	54.51
Wireman-Foreman	54.51
Wireman-General Foreman	58.23
ELEVATOR CONSTRUCTOR	
Elevator Constructor-Journeyman Mechanic	80.41
Elevator Constructor-Mechanic in Charge	88.15
FENCE ERECTOR	
Fence Erector	37.69
FLAGPERSON	**ADD LABORER ZONE RATE**
Flagperson	28.45
FLOOR COVERER	
Floor Coverer-Journeyman	36.36
Floor Coverer-Foreman	38.86
GLAZIER	
Glazier	19.97
HIGHWAY STRIPER	**ADD LABORER ZONE RATE**
Highway Striper	34.07

HOD CARRIER-BRICK MASON TENDER	ADD ZONE RATE
Brick Mason-Journeyman	30.10
Brick Mason-Foreman	30.60

HOD CARRIER-PLASTER TENDER	ADD ZONE RATE
Plasterer Tender-Journeyman	34.76
Plasterer-Gun Tender	35.76
Plasterer Tender-Foreman	36.12

IRON WORKER	
Ironworker-Journeyman	57.75
Ironworker-Foreman	61.05
Ironworker-General Foreman	64.68

LABORER SEE GROUP CLASSIFICATIONS	ADD ZONE RATE
Landscaper	26.16
Furniture Mover	27.66
Group 1	31.32
Group 1A	28.45
Group 2	31.42
Group 3	31.57
Group 4	31.82
Group 4A	33.07
Group 5	32.12
Group 6	-
Nozzlemen, Rodmen	32.12
Gunmen, Materialmen	31.82
Reboundmen	31.47
Gunite Foremen	32.52

MECHANICAL INSULATOR	
Mechanical Insulator-Mechanic	57.13
Mechanical Insulator-Foreman	60.34

Mechanical Insulator-General Foreman	63.55

MILLWRIGHT	**ADD ZONE RATE**
Millwright	51.76

OPERATING ENGINEER SEE GROUP CLASSIFICATIONS	**ADD ZONE RATE**
Group 1	44.11
Group 1A	46.87
Group 2	47.40
Group 3	47.67
Group 4	48.41
Group 5	48.71
Group 6	48.88
Group 7	49.13
Group 8	49.72
Group 9	50.04
Group 10	50.39
Group 10A	50.58
Group 11	50.82
Group 11A	52.46
Group 11B	53.27
Foreman	52.46
Add 7% to base rate for "Second" Shift	
Add 12.5% to base rate for "Special" shift	

OPERATING ENGINEER-STEEL FABRICATOR & ERECTOR SEE GROUP CLASSIFICATIONS	**ADD ZONE RATE**
Group 1	59.41
Group 1 Truck Crane Oiler	53.24
Group 1 Oiler	51.28
Group 2	57.90
Group 2 Truck Crane Oiler	52.99

Group 2 Oiler	51.07
Group 3	56.66
Group 3 Truck Crane Oiler	52.77
Group 3 Oiler	50.85
Group 3 Hydraulic	52.44
Group 4	54.93
Group 5	53.83
Add 7% to base rate for "Second" Shift	
Add 12.5% to base rate for "Special" Shift	

OPERATING ENGINEER -PILEDRIVER SEE GROUP CLASSIFICATIONS	**ADD ZONE RATE**
Group 1	58.88
Group 1 Truck Crane Oiler	53.42
Group 1 Oiler	51.50
Group 2	57.34
Group 2 Truck Crane Oiler	53.21
Group 2 Oiler	51.30
Group 3	55.89
Group 3 Truck Crane Oiler	52.99
Group 3 Oiler	51.07
Group 4	54.38
Group 5	53.27
Group 6	52.16
Group 7	51.20
Group 8	50.24
Add 7% to base for "Second" Shift	-
Add 12.5% to base for "Special" Shift	-

PAINTER	SEE AMENDMENT **15**
Brush/Roller Painter	32.40
Spray Painter/Paperhanger	33.25

Sandblaster	32.90
Structural Steel & Steeplejack	33.40
Swing Stage	34.40
Special Coating Application-Brush	33.25
Special Coating Application-Spray	33.40
Special Coating Application-Spray Steel	33.65
Foreman	$1.00 above highest Journeyman

PILEDRIVER

Piledriver-Journeyman	50.81
Piledriver-Foreman	54.30

PLASTERER	**ADD ZONE RATE**
Plasterer-Journeyman	36.37
Plasterer-Foreman	38.62

PLUMBER/PIPEFITTER

Plumber-Journeyman	45.45
Plumber-Foreman	48.41
Plumber-General Foreman	51.36

REFRIGERATION

Refrigeration-Journeyman	43.68

ROOFER (Does not include sheet metal roofs)

Roofer	20.03

SHEET METAL WORKER	**ADD ZONE RATE**
Sheet Metal-Journeyman	50.10
Sheet Metal-Foreman	53.04
Sheet Metal-General Foreman	55.97

SPRINKLER FITTER	
Sprinkler Fitter-Journeyman	55.22
Sprinkler Fitter-Foreman	57.97
Sprinkler Fitter-General Foreman	60.22
SURVEYOR	**ADD ZONE RATE**
Surveyor	47.67
TAPER	
Taper	37.59
TILE SETTER/TERRAZZO WORKER/MARBLE MASON-FINISHER	
Tile, Terrazzo and Marble Finisher	26.04
TILE SETTER/TERRAZZO WORKER/MARBLE MASON	**ADD ZONE RATE**
Tile Setter-Journeyman	35.32
Tile Setter-Foreman	36.57
Tile Setter-General Foreman	38.32
Terrazzo/Marble Mason-Journeyman	36.82
Terrazzo/Marble Mason-Foreman	38.07
Terrazzo/Marble Mason-General Foreman	39.83
TRAFFIC BARRIER ERECTOR	**ADD LABORER ZONE RATE**
Traffic Barrier Erector	31.32
TRUCK DRIVER	
Truck Driver	19.76
WELL DRILLER	
Well Driller	23.01

LUBRICATION AND SERVICE ENGINEER (MOBILE AND GREASE RACK)	**ADD OPERATING ENG. ZONE RATE**
Lubrication and Service Engineer (mobile and grease rack)	49.72
SOIL TESTER (CERTIFIED)	
Soil Tester (Certified)	40.12
SOILS AND MATERIALS TESTER	
Soils and Materials Tester	40.12

Job Descriptions for Recognized Classes of Workmen

Regarding job descriptions for public works projects, please take notice of the following:

1. Pursuant to NAC 338.0095(1)(a), "A workman employed on a public work must be paid based on the type of work that the workman actually performs on the public work and in accordance with the recognized class of the workman."
2. The work description for a particular class is not intended to be jurisdictional in scope nor to be construed as limiting or prohibiting any worker from performing the work of one or more classes.
3. Any person who believes that a type of work is not classified, or who otherwise needs clarification pertaining to the recognized classes or job descriptions, shall contact the Labor Commissioner, in writing, for a determination of the applicable classification and pay rate for a particular type of work.
4. The job descriptions set forth or referenced herein supersede any and all descriptions previously agreed upon by the Labor Commissioner in any settlement agreements or stipulations arising out of contested matters.
5. The following specific provisions, where applicable, shall prevail over any general provisions of the job descriptions:

    - Amendments to the prevailing wage determinations;
    - Group Classifications and/or descriptions recognized by the Labor Commissioner and included with wage determinations for a particular type of work in a particular county.

AIR BALANCE TECHNICIAN, includes but is not limited to:
Inspecting, testing, programming, documenting, adjusting and balancing heating, cooling and ventilating systems using specialized tools and testing equipment to attain performance standards specified in the design of the systems.

ALARM INSTALLER, includes but is not limited to:

1. Installing or testing electrical protective signaling systems used to provide notification of fire, burglary or other irregularities on the premises of the subscriber of the system;
2. Installing of wiring and signaling units;
3. Repairing electrical protective signaling systems
4. Starting up, programming and documenting systems;

BOILERMAKER, includes but is not limited to:

1. Constructing, assembling, maintaining and repairing stationary steam boilers and boiler house auxiliaries;
2. Aligning structures or plate sections to assemble boiler frame tanks or vats;
3. Assisting in the testing of assembled vessels, directing cleaning of boilers and boiler furnaces;
4. Inspecting and repairing boiler fittings, including, without limitation, safety valves, regulators, automatic-control mechanisms, water columns and auxiliary machines.

BRICKLAYER, includes but is not limited to:

1. Laying materials, including without limitation, brick, structural tile and blocks of concrete, cinder, glass, gypsum and terra cotta, but not including stone, to construct or repair walls, partitions, arches, sewers, and other structures;
2. Laying and aligning bricks, blocks or tiles to build or repair structures for high temperature equipment, including, without limitation, cupola, kilns, ovens and furnaces; and
3. Fastening or fusing brick or other building materials to structures with wire clamps, anchor holes, torches or cement.
4. Pointing-cleaning-caulking of all types of masonry; caulking of window frames encased in masonry on brick, stone or cement structures, including grinding and cutting out on such work and sand blasting, steam cleaning and gunite work.
5. Pointing, cleaning and weatherproofing of buildings, grain elevators and chimneys built of stone, brick or concrete, including grinding and cutting out, sand blasting and gunite work on the same.

CARPENTER, includes but is not limited to:

1. Laying out, constructing, erecting, fabricating, installing and repairing structures and fixtures of wood, plywood, or alternative materials, doors and hardware and the fastening of the same, inclusive of garage or overhead door openers, cabinets, framework, floors, and acoustical ceiling systems using carpenter's hand tools and power tools;
2. Installing or erecting metal studs, drywall, lathing, wall partitions, prefabricated EFIS panels or any other system of panels that is attached to the interior or exterior of any building or structure, insulation and all types of ceilings;
3. Pre-cast concrete and concrete form work which includes but is not limited to: setting of templates, layout, fabrication, constructing, placing, erection, rigging and hoisting, stripping and removing of all forms which are to be reused;
4. Plywood decking, including, without limitation, stacking and installation of the plywood and the plywood decking;
5. Cutting, setting, removing of beam sides and soffits, bracing, and pads;

6. Constructing all wood panel forms and frame wall;
7. Building, erecting and disassembling self-supporting scaffolds that are more than 14 feet in height;
8. Laying out, cutting, joining, fitting of Foam Architectural Elements if same are attached mechanically; and
9. Shaping, cutting and planing by any means if done by hand or machine.

CEMENT MASON, includes but is not limited to:

1. Smoothing and finishing surfaces of poured concrete floors, walls, sidewalks and curbs to specified textures;
2. Patching holes with fresh concrete or an epoxy compound;
3. Molding expansion joints and edges through the use of edging tools, jointers and straightedges;
4. Setting of curb and gutter forms one board high;

ELECTRONIC COMMUNICATION TECHNICIAN, includes but is not limited to:

1. Pulling cable, installing and trimming devices, terminating loops, circuits, or other data gathering points;
2. Termination of main control panels, racks, or other head end equipment, as well as testing of all circuits from the field devices to the main control panels and/or equipment;
3. Utilizing test equipment for the purpose of troubleshooting and verifying the integrity of the circuits in question;
4. Using hand tools to assemble and install data communication lines and equipment computer systems, antennas and towers;
5. Disassembling equipment to adjust, repair or replace parts using hand tools;
6. Starting up, programming and documenting systems;
7. Measuring, cutting, splicing, connecting, soldering and installing wire and cable associated with communication systems

ELECTRICIAN LINEMAN, includes but is not limited to:

1. Erecting and repairing wood poles and prefabricated light duty metal towers, cable and related equipment to construct overhead transmission and distribution power lines used to conduct electrical energy between generating stations, substations and consumers;
2. Directing and assisting electrician ground men in attaching cross arms, insulators, lightning arresters, switches, wire conductors and auxiliary equipment to poles and towers in preparation of erecting the poles or towers;
3. Climbing erected poles or towers and installing equipment such as transformers

4. Strings wire conductors between erected poles with assistance of ground helpers and adjusts slack in conductors to compensate for contraction and elongation of conductors due to temperature variations, using winch.

ELECTRICIAN GROUNDMAN, includes but is not limited to:

1. Working under the direct supervision of linemen, including the operation of jackhammers and man hauls;
2. Loading and unloading of materials and equipment used by electrician lineman.
3. Does not include climbing poles, towers or other structures or working in the proximity of energized lines or equipment;

ELECTRICIAN-NEON SIGN, includes but is not limited to:

1. Installing, servicing and repairing plastic, neon and illuminated signs;
2. Ascending ladders or operating hydraulic or electric hoist to install, service, or examine sign to determine cause of malfunction;
3. Wiring, rewiring or removing defective parts and installing new parts using electrician's tools;
4. Removing sign or part of sign for repairs, such as structural fabrication, scroll repair, or transformer repair;

ELECTRICIAN WIREMAN, includes but is not limited to:

1. Laying out plans, installing, testing and repairing wiring, electrical fixtures, apparatus and control equipment;
2. Measuring, cutting, bending, threading, assembling and installing electrical conduit by using tools including, without limitation, a hacksaw, pipe threader, or conduit bender;
3. Pulling wiring through conduit;
4. Splicing wires;
5. Connecting wiring to lighting fixtures and power equipment;
6. Installing control and distribution apparatus, including, without limitation, switches, relays and circuit breakers, and fastening such apparatus into place;
7. Connecting power cables to equipment, including, without limitation, electric ranges and motors, and installing grounding leads;
8. Testing the continuity of a circuit to ensure electrical compatibility and safety of components using testing instruments, including, without limitation, an ohmmeter, a battery and buzzer, and an oscilloscope;
9. As necessary, cutting and welding steel structural members;

ELEVATOR CONSTRUCTOR, includes but is not limited to:

1. Assembling, installing, repairing and maintaining electric and hydraulic freight and passenger elevators, escalators and dumbwaiters;
2. Cutting pre-fabricated sections of framework, rails and other elevator components to specified dimensions, using acetylene torch, power saw, and disc grinder;
3. Installing cables, counterweights, pumps, motor foundations, escalator drives, guide rails, elevator cars, and control panels, using hand tools;

FENCE ERECTOR, includes but is not limited to:

1. Erecting or repairing chain link, wooden, tortoise, wire/wire mesh, or temporary fencing;
2. Mixing and pouring concrete around bases of posts and tamping soil into post hole to embed post;
3. Digging post holes with a spade, post hole digger or power driven auger;
4. Aligning posts through the use of lines or by sighting;
5. Verifying vertical alignment of posts with a plumb bob or spirit level;

FLAG PERSON, includes but is not limited to:

1. Directing movement of vehicular traffic through construction projects;
2. Distributing traffic control signs and markers along site in designated pattern;
3. Informing drivers of detour routes through construction sites;

FLOOR COVERER, includes but is not limited to:

1. Applying blocks, strips or sheets of shock-absorbing, sound-deadening or decorative covering to floors and walls, including carpets or rugs;
2. Measuring and cutting covering materials, such as rubber, linoleum, astro-turf, or cork tile and foundation material such as felt, using rule, straightedge, linoleum knife and snips;
3. Spreading adhesive cement over floor to cement foundation material to floor for sound-deadening, and to prevent covering from wearing at the board joints;
4. Rolling finished floors to smooth the floor and press cement into base and covering;
5. Fitting of devices for the attachment of carpet, linoleum, rubber and all resilient floor coverings and the fitting of metal edges, corners and caps used in the installation of the foregoing materials and all other preparatory work;

GLAZIER, includes but is not limited to:

1. Installing, setting, cutting, preparing, or removal of glass, or materials used in lieu thereof, including, without limitation, in windows, doorways, showers, bathtubs, skylights and display cases;

2. Installing glass on surfaces, including, without limitation, fronts of buildings, interior walls and ceilings;
3. Installing pre-assembled framework for windows and doors designed to be fitted with glass panels, including stained glass windows by using hand tools;
4. Loading and arranging of glass on trucks at the site of the public work;

HIGHWAY STRIPER, includes but is not limited to:

1. Painting highways, streets and parking surfaces by using manually propelled or mechanically propelled machines, brushes, rollers or spray guns;
2. Installing any device or application of any material used in lieu of paint for traffic direction, including, without limitation, buttons, tapes, plastics, rumble bars and other similar materials;

HOD CARRIER-BRICK MASON TENDER, includes but is not limited to:

1. Tending to or assisting brick masons, bricklayers and stonemasons;
2. Mixing, packing, wheeling and tempering mortar and fire clay;
3. Mixing, supplying and holding materials or tools;
4. Mixing, handling and conveying all other materials used by brick masons, bricklayers and stone masons;
5. Building scaffolds, trestles, boxes and swinging staging used exclusively by bricklayers and stone masons;
6. Hanging cables and placing putlogs;
7. Carrying bricks and mortar in a hod;
8. Cleaning work area and equipment of bricklayers and stone masons

HOD CARRIER-PLASTERER TENDER, includes but is not limited to:

1. Serving Plasterers in any capacity;
2. Handling materials after the materials are delivered as used by a Plasterer;
3. Building and handling all necessary trestle, scaffolding and planking of scaffolding for the exclusive use of Plasterers;
4. Building mortar boxes, mortar boards and stands.

IRONWORKER, includes but is not limited to:

1. Performing duties, as part of a crew, to raise, place and unite girders, columns and other structural steel members to form completed structures or structure frameworks;
2. Setting up hoisting equipment for raising and placing structural steel members;
3. Fastening steel members to cable of hoist, using chains, cable or rope;
4. Forcing steel members into final position using turnbuckles, crowbars, jacks, hand tools;

5. Aligning rivet holes in steel members with corresponding holes in previously placed steel members by driving drift pins to handle of wrench through holes;
6. Bolting aligned steel members to keep them in position until the steel members can be permanently riveted, bolted or welded into place;
7. Cutting and welding steel members;
8. Installing and repairing gates, iron doors, flagpoles, iron fences and roof decking;
9. Installing corrugated sheets when attached to steel frames;
10. Stud welding of all iron, steel and metal to structural steel;
11. Handling and setting of steel and metal joists;
12. Loading, unloading, hoisting, handling, signaling, placing and erecting of pre-stressed and pre-cast materials;
13. Handling, racking, sorting, cutting, bending, hoisting, placing, burning, welding and tying all material used to reinforce concrete construction;

LABORER, includes but is not limited to:

Perform tasks involving physical labor at building, highway, and heavy construction projects, tunnel and shaft excavations, and demolition sites. May operate hand and power tools of all types: air hammers, earth tampers, cement mixers, small mechanical hoists, and a variety of other equipment and instruments. May clean and prepare sites, dig trenches, set braces to support the sides of excavations, erect scaffolding, clean up rubble and debris, and remove asbestos, lead, and other hazardous waste materials. May assist other craft workers.

MARBLE MASON, includes but is not limited to:

1. Cutting, tooling, and setting marble slabs in floors and walls of buildings and renovating and polishing marble slabs previously set in buildings;
2. Trimming, facing and cutting marble to a specific size using a power saw, cutting and facing equipment, and hand tools
3. Drilling holes in marble slabs and attaching brackets;
4. Spreading mortar on the bottom and sides of a marble slab and on the side of adjacent marble slabs;
5. Setting blocks in positions, tamping a marble slab into place and anchoring bracket attachments with wire;
6. Filling joints between marble slabs with grout and removing excess grout with a sponge;
7. Cleaning and beveling cracks and chips on marble slabs using hand tools and power tools;
8. Heating cracked or chipped areas of a marble slab with a blowtorch and filling the defect with a composition mastic that matches the grain of the marble slab; and
9. Polishing marble slabs and other ornamental stone to a high luster by using hand tools and power tools.

MECHANICAL INSULATOR, includes but is not limited to:

1. Covering and lining structures with cork, canvas, tar paper, magnesia and related materials;
2. Installing blown-on insulation on pipe and machinery;
3. Lining of mechanical room surfaces and air handling shafts;
4. Filling and damming of fire stops and penetrations including, but not limited to, electrical and mechanical systems;
5. Foam applications for the purpose of thermal, acoustical, or fire protective purposes, including RTV foams or equivalents, applied to mechanical or electrical systems;
6. Duct lining and duct wrapping, direct application and installation of fire protection of grease ducts, exhaust systems, or any other ductwork for acoustical or thermal purposes;
7. Insulation of field joints on pre-insulated underground piping and the pouring of Gilsilite or its equivalent;
8. The application of material, including metal and PVC jacketing, on piping, fittings, valves, flanges, boilers, ducts, plenums, flues, tanks, vats, equipment and any other hot or cold surface for the purpose of thermal control;

MILLWRIGHT, includes but is not limited to:

1. Installing machinery and equipment according to layout plans, blueprints and other drawings in industrial establishments by using hoists, lift trucks, hand tools and power tools;
2. Dismantling machines by using hammers, wrenches, crowbars and other hand tools;
3. Assembling and installing equipment, including, without limitation, shafting, conveyors, monorails and tram rails, by using hand tools and power tools;
4. Constructing foundations for machines by using hand tools and building materials, including, without limitation, wood, cement and steel;
5. Assembling machines and bolting, welding, riveting or otherwise fastening them to a foundation or other structure by using hand tools and power tools; and
6. Repairing and lubricating machines and equipment (at the site of the public work) assembled and used by millwrights.

OPERATING ENGINEER, includes but is not limited to:

Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement.

PAINTER, includes but is not limited to:

1. All painting of walls, equipment, buildings, bridges and other structural surfaces by using brushes, rollers and spray guns;
2. Application of wall coverings/wall paper;
3. Removing old paint to prepare surfaces before painting the surface;
4. Mixing colors or oils to obtain desired color or consistency;
5. Sanding surfaces between coats and polishing final coat to a specified finish;
6. Cutting stencils and brushing and spraying lettering and decorations on surfaces;
7. Washing and treating surfaces with oil, turpentine, mildew remover or other preparations;
8. Filling cracks, holes and joints with caulk, putty, plaster or other filler by using caulking gun or putty knife;

PILEDRIVER, includes but is not limited to:

1. Operating pile drivers mounted on skids, barge, crawler, treads or locomotive crane to drive piling as foundations for structures including, without limitation, buildings, bridges and piers;
2. Barking, shoeing, splicing, form building, heading, centering, placing, driving, staying, framing, fastening, automatic pile threading, pulling and/or cutting off of piling;
3. Fabricating, forming, handling and setting of all such pre-cast, pre-stressed and post-stressed shapes that are an integral part of docks, piers, wharves, bulkheads, jetties, and similar structures;

PIPEFITTER, includes but is not limited to:

Assembling, installing, modifying and maintaining pipe systems, pipe supports and pneumatic equipment and related machines and equipment components for steam, hot water, heating, cooling, lubricating, sprinkling and industrial and processing systems which may require:

a. Cutting, threading and hammering pipe to specifications using tools, including, without limitation, saws, cutting torches and pipe threaders and benders;
b. Attaching pipes to walls, structures and fixtures, including without limitation, radiators or tanks, using brackets, clamps, tools, or welding equipment;
c. Coating non-ferrous piping materials by dipping in mixture of molten tin and lead to prevent erosion, or galvanic and electrolytic action;

PLASTERER, includes but is not limited to:

1. Applying coats of plaster onto interior or exterior walls, ceilings, or partitions of buildings to produce a finished surface according to blueprints, architects' drawings and oral instruction;
2. Creating decorative textures in finish coat by using sand, pebbles or stones;

3. Installing guide wires on exterior surfaces of buildings to indicate thickness of plaster or stucco;
4. Applying weatherproof, decorative covering to exterior surfaces of a building;
5. Molding and installing ornamental plaster pieces, panels and trim;
6. Directing workers to mix plaster to a desired consistency;
7. Assembly of EFIS panels;
8. Laying out, cutting, joining, fitting and installation of Architectural Foam Elements which are trowel applied or adhesive set;
9. Applying, shaping, cutting, and planing in preparation for netting done by hand or machine;
10. All plaster or synthetic finishes applied to Foam Architectural Elements

PLUMBER, includes but is not limited to:

Assembling, installing and repairing pipes, fittings and fixtures for heating, water and drainage systems inside of buildings and to a point 5 feet outside of buildings which may therein require:

a. Repairing and maintaining plumbing by replacing defective washers, repairing or mending broken pipes, and opening clogged drains;
b. Assembling pipe sections, tubing and fittings by using screws, bolts, solder, plastic solvent and caulking;
c. Installing pipe assemblies, fittings, valves and fixtures, including, without limitation, sinks, toilets and tubs, by using hand tools and power tools;
d. Cutting openings in structures, excluding concrete, to accommodate pipe and pipe fittings by using hand tools and power tools;
e. Filling pipes and plumbing fixtures with water or air and observing pressure gauges to detect and locate leaks.

REFRIGERATION MECHANIC, includes but is not limited to:

1. Installing and repairing industrial and commercial refrigeration systems;
2. Mounting compressors, condensers and other refrigeration components to the frame of a refrigerator by using hand tools and acetylene welding equipment;
3. Assembling structural and functional components needed for refrigeration, including, without limitation, controls, switches, gauges, wiring harnesses, valves, pumps, compressors, condensers, cores and pipes;
4. Installing expansion and control valves by using hand tools and acetylene welding equipment;
5. Cutting, bending, threading and connecting pipe from functional components to water, power or refrigeration systems;
6. Fabricating and assembling components and structural portions of a refrigeration system;

ROOFER, includes but is not limited to:

1. Installing and covering roofs and structures with slate, asphalt, wood and other related materials, other than sheet metal, by using brushes, knives, punches, hammers and other tools;
2. Spraying roofs, sidings and walls with material to bind, seal, insulate or soundproof sections of a structure;
3. Installation of all plastic, slate, slag, gravel, asphalt and composition roofing, and rock asphalt mastic when used for damp and waterproofing;
4. Installation of all damp resisting preparations when applied on roofs with mop, three-knot brush, roller, swab or spray system;
5. All types of preformed panels used in waterproofing;
6. Handling, hoisting and storing of all roofing, damp and waterproofing materials;
7. The tear-off and/or removal of roofing and roofing materials;

SHEET METAL WORKER, includes but is not limited to:

1. Fabricating, assembling, dismantling, installing or repairing:
    - Sheet metal roofs, including #30 felt roofing paper installed to form a metal roofing system;
    - Sheet metal parts or equipment, including, without limitation, duct work, metal lockers and kitchen equipment;
    - Air-veyor and air-handling systems, regardless of materials used;
2. Setting up and operating fabrication machines to cut, bend and straighten sheet metal;
3. Shaping metal over anvils, blocks or forms using a hammer;
4. Operating soldering and welding equipment to join sheet metal parts;
5. Inspecting, assembling and smoothing seams and joints of burred surfaces;
6. Welding, soldering, bolting, riveting, screwing, clipping, caulking or bonding component parts to assemble products by using hand tools, power tools and devices for lifting and handling;

SPRINKLER FITTER, includes but is not limited to:

Installing, dismantling, maintaining, repairing, adjusting and correcting all fire protection and fire control systems, including the installation of piping or tubing, appurtenances and equipment pertaining thereto, including both overhead and underground water mains, fire hydrants, and hydrant mains, standpipes and hose connection to sprinkler systems, sprinkler tank heaters, air lines and thermal systems used in connection with sprinkler and alarm systems.

SURVEYOR, includes but is not limited to:

1. Planning ground surveys designed to establish base lines, elevation and other geodetic measurements;
2. Compiling data relevant to the shape, contour, gravitation, location, elevation and dimension of land and land features on or near the surface of the Earth for engineering, map making, mining, land evaluation, construction and other purposes;
3. Surveying bodies of water to determine navigable channels and to secure data for construction of breakwaters, piers and other marine structures;
4. Computing data necessary for driving and connecting underground passages, underground storage and volume of underground deposits.

TAPER, includes but is not limited to:

1. Sealing joints between plasterboard or other wallboards to prepare a wall surface for painting or papering;
2. Mixing sealing compound by hand or with a portable electric mixer and spreading the compound over the joints between boards using a trowel, broad knife, or spatula;
3. Filling cracks and holes in walls and ceilings with sealing compound ;
4. Applying texturing compound and primer to walls and ceiling to prepare a surface for a final finish by using brushes, rollers and spray guns;
5. Coating of joint compound or taping mud;

TERRAZZO WORKER, includes but is not limited to:

1. Applying cement, sand, pigment and marble chips to floors and stairways to attain durable and decorative surfacing according to specifications or drawings;
2. Spreading mixtures of sand, cement and water over surface with a trowel to form terrazzo;
3. Cutting metal division strips and pressing the metal division strips into a terrazzo base so that top edges form a desired design or pattern and define level of finished floor surface;
4. Spreading mixtures of marble chips, cement, pigment and water over a terrazzo base to form a finished surface by using a float and trowel;
5. Pre-casting terrazzo blocks in wooden forms

TILE SETTER, includes but is not limited to:

1. Applying tile and materials made for tile in tile-like units to walls, floors, ceilings and promenade roof decks following design specification;
2. Applying glazed, unglazed, mosaic and other ceramic tiles, which are used as a surface on floors, walls, ceilings, and other surfaces and which must be set to specific grade;
3. Applying and floating all setting beds into which glazed, unglazed, mosaic, or other ceramic tiles are set;
4. Leveling and plumbing tiles to a specified grade

TILE, TERRAZZO AND MARBLE FINISHER, includes but is not limited to:

1. Supplying and mixing construction materials for a tile setter, terrazzo worker or marble setter;
2. Applying grout and finishing the surface of installed tile, terrazzo and marble;
3. Cleaning installed tile, terrazzo and tile surfaces;
4. Renovation and filling chipped, cracked and broken pieces of tile, terrazzo and marble;
5. Grinding and polishing tile, terrazzo and marble;
6. Assisting a tile setter, terrazzo worker or marble setter;

TRAFFIC BARRIER ERECTOR, includes but is not limited to:

Erects or places instruments to provide directional assistance to traffic on or near the public works construction project.

TRUCK DRIVER, includes but is not limited to:

Driving a tractor trailer combination or a truck to transport goods or materials at the site of a public work or between sites of a public work. (Also, see descriptions listed with Truck Driver rates, if any.)

WELL DRILLER, includes but is not limited to:

1. Setting, operating or tending to portable drilling rig machinery and related equipment to drill wells;
2. Extending stabilizing jackscrews to support and level a drilling rig;
3. Installing water well pumps;
4. Drillings wells for industrial water supplies, irrigation water supplies or water supplies for any other purpose; dewatering or other similar purposes; exploration; hole drilling for geologic and hydrologic information; and core drilling for geologic information.

GROUP CLASSIFICATIONS

LABORER, includes but is not limited to:

Group 1
All cleanup work of debris, grounds, and building including windows and tile

Dumpmen or Spotter (other than asphalt)
Handling and Servicing of Flares, Watchmen
General Laborer
Guide Posts and Highway Signs
Guardrail Erection and Dismantling
Limber, Brushloader and Piler
Pavement Marking and Highway Striping
Traffic Control Supervisor

Group 2
Choker setter or Rigger (clearing work only) Pittsburgh
Chipper and similar type brush shredders
Concrete worker (wet or dry) all concrete work not listed in Group 3
Crusher or Grizzly Tender
Greasing Dowels
Guinea Chaser (Stakemen)
Panel Forms (wood or metal) handling, cleaning and stripping of Loading and unloading,
(Carrying and handling of all rods and material for use in reinforcing concrete
Railroad Trackmen (maintenance, repair or builders)
Sloper
Semi-Skilled Wrecker (salvaging of building materials other than those listed in Group 3)

Group 3
Asphalt Workers (Ironers, Shovelers, Cutting Machine)
Buggymobile
Chainsaw, Faller, Logloader and Bucker
Compactor (all types)
Concrete Mixer under 1/2 yard
Concrete Pan Work (Breadpan type), handling, cleaning\stripping
Concrete Saw, Chipping, Grinding, Sanding, Vibrator
Cribbing, Shoring, Lagging, Trench Jacking, Hand-Guided Lagging Hammer
Curbing or Divider machine
Curb Setter (precast or cut)

Ditching Machine (hand-guided)
Drillers Helper, Chuck Tender
Form Raiser, Slip Forms
Grouting of Concrete Walls, Windows and Door Jams
Headerboardmen
Jackhammer, Pavement Breaker, Air Spade
Mastic Worker (wet or dry)
Pipewrapper, Kettlemen, Potmen, and men applying asphalt, creosote and similar type materials
All Power Tools (air, gas, or electric), Post Driver
Riprap-Stonepaver and RockSlinger, including placing of sack concrete wet or dry
Rototiller
Rigging and Signaling in connection with Laborers' work
Sandblaster, Potmen, Gunmen or Nozzlemen
Vibra-screed
Skilled Wrecker (removing and salvaging of sash, windows, doors, plumbing and electrical fixtures)

Group 4
Burning and Welding in connection with Laborers' work
Joy Drill Model TWM-2A, Gardner Denver Model DN143 and similar type drills (in accordance with Memorandum of Understanding between Laborers and Operating Engineers dated at Miami, Florida, Feb. 3, 1954) and Track Drillers, Diamond Core Drillers, Wagon Drillers, Mechanical Drillers on Multiple Units
High scalers
Concrete pump operator
Heavy Duty Vibrator with Stinger 5" diameter or over
Pipelayer, Caulker and Bander
Pipelayer-waterline, Sewerline, Gasoline, Conduit
Cleaning of Utility Lines
Slip Lining of Utility Lines (including operation of Equipment)
TV Monitoring and Grouting of Utility Lines
Asphalt Rakers

Group 4A

Foreman

Group 5
Construction Specialists
Blasters and Powdermen, all work of loading, placing, and blasting of all powder and explosives of any type, regardless of method used for such loading and placing
Asbestos removal

Lead abatement
Hazardous waste
Material removal

Group 6
Gunite Foremen, Nozzlemen, Rodmen, Gunmen, Materialmen, Reboundmen

OPERATING ENGINEER, includes but is not limited to:

Group 1
Engineer Assistant

Group 1A
Heavy Duty Repairman Helper
Oiler
Parts man

Group 2
Compressor Operator
Material Loader and/or Conveyor Operator (handling building materials)
Pump Operator

Group 3
Bobcat or similar loader, 1/4 cu. yd. or less
Concrete Curing Machines (streets, highways, airports, canals)
Conveyor Belt Operator (tunnel)
Forklift (under 20)
Engineer Generating Plant (500 K.W.)
Mixer Box Operator (concrete plant)
Motorman
Rotomist Operator
Oiler (truck crane)

Group 4
Concrete Mixer Operator, Skip type
Dinky Operator
Forklift (20' or over) or Lumber Stacker
Ross Carrier
Skip Loader Operator (under one (1) cu. yd.)
Tie Spacer

Group 5
Concrete Mixers (over one (1) cu. yd.)
Concrete Pumps or Pumpcrete Guns
Elevator and Material Hoist (one (1) drum)
Groundman for Asphalt Milling and similar

Group 6
Auger type drilling equipment up to and including 30 ft. depth digging capacity m.r.c.
Boom Truck or Dual Purpose a-Frame Truck
B.L.H. Lima Road Pactor or similar
Chip Box Spreader (Flaherty type or similar)
Concrete Batch Plant (wet or dry)
Concrete Saws (highways, streets, airports, canals)
Locomotives (over thirty (30) tons)
Maginnis International Full Slab Vibrator (airports, highways, canals and warehouses)
Mechanical Finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types)
Mechanical Burn, Curb and/or Curb and Gutter Machine (concrete or asphalt)
Pavement Breaker, Truck Mounted, with compressor combination
Pavement Breaker or Tamper (with or without compressor combination)
Power Jumbo Operator (setting slip-forms, etc., in tunnels)
Roller Operator (except asphalt)
Self-Propelled Tape Machine
Self-Propelled Compactor (single engine)
Self-Propelled Power Sweeper Operator
Slip-Form Pump (power-driven by hydraulic, electric, air, gas, etc. lifting device for concrete forms)
Small Rubber-Tired Tractors
Snooper Crane, Paxton-Mitchell or similar
Stationary Pipe Wrapping, Cleaning and Bending Machine Operator

Group 7
Auger type drilling equipment over 30 ft. depth digging capacity m.r.c.
Compressor (over 2)
Concrete Conveyor or Concrete Pump, truck or equipment mounted (any assistance required shall be performed by an Assistant to Engineer) Boom length to apply
Concrete Conveyor, Building Site
Drilling and Boring Machine, vertical and horizontal (not to apply to waterliners, wagon drills or jack hammers)
Crusher Plant Engineer
Generators
Kolman Loader
Material Hoist (two (2) or more drums)

Mechanical Finishers or Spreader Machine (asphalt, Barber-Greene or similar)
Mine or Shaft Hoist
Pipe Bending Machines (pipeline only)
Pipe Cleaning Machines (tractor-propelled and supported)
Pipe Wrapping Machines (tractor-propelled and supported)
Portable Crushing and Screening Plants
Post Driller And/Or Driver
Pumps (over 2)
Roller Operator (asphalt)
Screedman (except asphaltic or concrete paving)
Screedman (Barber-Greene and similar) (asphaltic or concrete paving)
Self-Propelled Boom-Type Lifting Device (center mount) (on ten (10) ton capacity or less)
Slusher Operator
Surface Heater and Planer Operator
Trenching Machine (maximum digging capacity three (3) ft. depth) (Any assistance in the operation, if needed, shall be performed by an Assistant to Engineer)
Truck-Type Loader
Welding Machines (gasoline or diesel)

Group 8
Asphalt Plant Engineer
Asphalt Milling Machine
Cast-In-Place Pipe-Laying Machine
Combination Slusher and Motor Operator
Concrete Batch Plant (multiple units)
Dozer Operator
Drill Doctor
Elevating Grader Operator
Grooving and Grinding Machine (highways)
Ken Seal Operator
Loader (up to and including two and one-half (2 1/2) cu. yds)
Mechanical Trench Shield
Mixermobile
Push Cats
Road Oil Mixing Machine Operator Wood-Mixer (and other similar Pugmill equipment)
Rubber-Tired Earthmoving Equipment (up to and including thirty-five (35) cu. yds. "struck " m.r.c., Euclids, T-Pulls, DW10, 20, 21 and similar)
Self-Propelled Compactors with Dozer; Hyster 450, Cat 825 or similar
Sheepfoot
Small Tractor (with boom)
Soil Stabilizer (P & H or equal)
Timber Skidder (rubber-tired) or similar equipment

Tractor-Drawn Scraper
Tractor Operator
Tractor-Mounted Compressor Drill Combination
Trenching Machine Operator (over three (3) feet depth)
Tri-Batch Paver
Tunnel Badger or Tunnel Boring Machine Operator
Tunnel Mole Boring Machine
Vermeer T-600b Rock Cutter

Group 9
Chicago Boom
Combination Backhoe and Loader (up to and including 3/8 cu. yd.)
Combination Mixer and Compressor (gunite)
Heavy Duty Repairman and/or Welder
Lull Hi-Lift (twenty (20) feet or over)
Mucking Machine
Sub-Grader (Gurries or other types)
Tractor (with Boom) (D6 or larger)
Track-Laying-Type Earthmoving Machine (single engine with tandem scrapers)

Group 10
Boom-Type Backfilling Machine
Bridge Crane
Cary-Lift or similar
Chemical Grouting Machine
Derricks (two (2) Group 10 Operators required when swing engine remote from hoist)
Derrick Barges (except excavation work)
Euclid Loader and similar types
Gradesetter, Grade Checker
Heavy Duty Rotary Drill Rigs
Lift-Slab (Vagtborg and similar types)
Loader (over two and one-half (2 1/2 cu. yds. up to and including four (4) cu. yds.)
Locomotive (over one hundred (100) tons, single or multiple units)
Multiple-Engine Earthmoving Machines (Euclid Dozers, etc.)
Pre-Stress Wire Wrapping Machine
Rubber-Tired Scraper, Self-Loading
Single-Engine Scraper (over thirty-five (35) cu. yds.)
Shuttle Car (Reclaim Station)
Train Loading Station
Trenching Machine multi-engine with sloping attachments (Jefco or similar)

Vacuum Cooling Plant
Whirley Crane (up to and including twenty-five (25) tons)

Group 10A
Backhoe-Hydraulic (up to and including one (1) cu. yd.)
Backhoe (up to and including one (1) cu. yd.) (Cable)
CMI Dual Lane Auto-Grader SP30 or similar type
Cranes (not over twenty-five (25) tons) (hammerhead and gantry)
Finish Blade
Gradalls (up to and including one (1) cu. yd.)
Motor Patrol Operator
Power Shovels, Clamshells, Draglines, Cranes (up to and including one (1) cu. yd.)
Rubber-Tired Scraper, Self-Loading (twin engine)
Self-Propelled Boom-Type Lifting Device, center mount (over 10 tons up to and including 25 tons)

Group 11
Automatic Asphalt or Concrete Slip-Form Paver
Automatic Railroad Car Dumper
Canal Trimmer
Cary Lift, Campbell or similar type
Cranes (over twenty-five (25) tons)
Euclid Loader when controlled from the Pullcat
Highline Cableway Operator
Loader (over four (4) cu. yds. up to and including twelve (12) cu. yds.)
Multi-Engine Earthmoving Equipment (up to and including seventy-five (75) cu. yds. struck m.r.c.)
Multi-Engine Scrapers (when used to Push Pull)
Power Shovels, Clamshells, Draglines, Backhoes Gradalls (over one (1) cu. yd. and up to and including seven (7) cu. yds. m.r.c.)
Self-Propelled Boom-Type Lifting Device (center mount) (over 25 tons m.r.c.)
Self-Propelled Compactor (with multiple-propulsion power units)
Single-Engine Rubber-Tired Earthmoving Machine, with Tandem Scraper
Slip-Form Paver (concrete or asphalt)
Tandem Cats and Scraper
Tower Crane Mobile (including Rail Mount)
Truck Mounted Hydraulic Crane when remote control equipped (over 10 tons up to and including 25 tons)
Universal Liebher and Tower Cranes (and similar types)
Wheel Excavator (up to and including seven hundred fifty (750) cu. yds. per hour)
Whirley Cranes (over twenty-five (25) tons)

Group 11A
Band Wagons (in conjunction with Wheel Excavators)
Operator of Helicopter)when used in construction work)
Loader (over twelve (12) cu. yds.)
Multi-Engine Earthmoving Equipment (over seventy-five (75) cu. yds. "struck" m.r.c.)
Power Shovels. Clamshells, Draglines, Backhoes, and Gradalls (over seven 7 cu. yds. m.r.c.)
Remote-Controlled Earth Moving Equipment
Wheel Excavator (over seven hundred fifty (750) cu. yds. per hour)

Group 11B
Holland Loader or similar or Loader (over 18 cu. yds.)

OPERATING ENGINEERS - Steel Fabricator & Erector

Group 1
Cranes over 100 tons
Derrick over 100 tons
Self-Propelled Boom Type Lifting Devices over 100 tons

Group 2
Cranes over 45 tons up to and including 100 tons
Derrick, 100 tons and under
Self Propelled Boom Type Lifting Device, over 45 tons
Tower Crane

Group 3
Cranes, 45 tons and under
Self Propelled Boom Type Lifting Device, 45 tons and under

Group 4
Chicago Boom
Forklift, 10 tons and over
Heavy Duty Repairman/Welder

Group 5
Boom Cat

OPERATING ENGINEER -Piledriver

Group 1
Derrick Barge Pedestal mounted over 100 tons
Clamshells over 7 cu. yds.
Self Propelled Boom Type Lifting Device, over 100 tons
Truck Crane or Crawler, land or barge mounted over 100 tons

Group 2
Derrick Barge Pedestal mounted 45 tons up to and including 100 tons
Clamshells up to and including 7 cu. yds.
Self Propelled Boom Type Lifting Device over 45 tons
Truck Crane or Crawler, land or barge mounted, over 45 tons up to and including 100 tons

Group 3
Derrick Barge Pedestal mounted under 45 tons
Self Propelled Boom Type Lifting Device 45 tons and under
Skid/Scow Piledriver, any tonnage
Truck Crane or Crawler, land or barge mounted 45 tons and under

Group 4
Assistant Operator in lieu of Assistant to Engineer
Forklift, 10 tons and over
Heavy Duty Repairman/Welder

Group 5
No current classification

Group 6
Deck Engineer

Group 7
No current classification

Group 8
Deckhand
Fireman

ZONE RATES

BRICKLAYER
In addition to BRICKLAYER rates add the applicable amounts per hour, calculated based on a radius of over fifty (50) miles from the Washoe County Courthouse in Reno, Nevada:
Zone 1-0-35 Miles $0.00
Zone 2-36-75 Miles $1.25
Zone 3-Over 75 Miles $5.37

CARPENTER (Building and Heavy Highway and Dam Construction)
In addition to CARPENTER rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:
Zone 1-0 to 50 miles $0.00 (road miles of either the Carson City Courthouse or the Washoe County Courthouse)
Zone 2-51-150 miles $3.00
Zone 3-151-300 miles $4.00
Zone 4-301 miles and over $5.00

CEMENT MASON/PLASTERER
In addition to CEMENT MASON/PLASTERER rates add the applicable amounts per hour, calculated from the Reno Post Office, 50 So. Virginia St., Reno, Nevada:
Zone 1-0-90 miles $0.00
Zone 2-91 miles and over $8.00

ELECTRICIAN
In addition to Electrician rates add the applicable amounts per hour, calculated from the Washoe County Courthouse:
Zone 1-0-70 miles $0.00
Zone 2-71-90 miles $6.00
Zone 3 -91 miles and over $8.00

HOD CARRIER-BRICK MASON TENDER
In addition to Hod Carrier Brick Mason Tender rates, add the applicable amounts per hour, calculated based on a radius from the Washoe County Courthouse:
Zone 1-35 to 75 miles $1.25
Zone 2-76 miles and over $7.50

HOD CARRIER-PLASTERER
In addition to Hod Carrier Plasterer rates add the applicable amounts per hour, calculated based on a radius from So. Virginia St., Reno, Nevada:

Zone 1-70 miles	$0.00
Zone 70 miles and over	$8.00

LABORER (Highway and Dam Construction only)
In addition to LABORER rates add the applicable amounts per hour, calculated based on a radius from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-0 to 50 miles	$0.00
Zone 2-51 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

LABORER (Building Construction)
In addition to LABORER rates add the applicable amounts per hour, calculated based on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-0 to 50 miles	$0.00
Zone 2-51 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

MILLWRIGHT
In addition to MILLWRIGHT rates, add the applicable amounts per hour, calculated on road miles from either the Carson City Courthouse or the Washoe County Courthouse:

Zone 1-1 to 15 miles	$0.00
Zone 2-15 to 35 miles	$1.50
Zone 3-35 miles and over	$3.25

OPERATING ENGINEER
In addition to: OPERATING ENGINEER; STEEL FABRICATOR and ERECTOR, PILEDRIVER, SURVEYOR, and LUBRICATION AND SERVICE ENGINEER rates add the applicable amounts per hour calculated based on a radius from the Washoe County Courthouse:

Zone 1-0 to 75 miles	$0.00
Zone 2-75 to 150 miles	$3.00
Zone 3-151 to 300 miles	$4.00
Zone 4-301 miles and over	$5.00

SHEET METAL WORKER
In addition to SHEET METAL WORKER rates, add the applicable amounts per hour, calculated based on a radius from the courthouse in Reno, Nevada:

Zone 1-0 to 75 miles	$0.00
(including the City of Fallon and the Fallon Naval Air Base)	
Zone 2-over 75 miles	$8.12

SHEET METAL WORKER – AIR BALANCE TECHNICIAN, ONLY
In addition to AIR BALANCE rates, add the applicable amounts per hour, calculated on a radius from the City Hall of Las Vegas, Nevada:

Zone 1-0 to 30 miles	$0.00
Zone 2-31 to 50 miles	$2.50
Zone 3-51 to 100 miles	$3.50 (including Laughlin)
Zone 4-over 100 miles	$5.00

TILE SETTER/TERRAZZO WORKER/MARBLE MASON
In addition to TILE SETTER/TERRAZZO WORKER/MARBLE MASON rates add the applicable amounts per hour, calculated based on a radius of over thirty-five (35) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1-0-35 Miles	$0.00
Zone 2-35-75 Miles	$1.25
Zone 3-Over 75 Miles	$5.00