SET NO._____

SPECIFICATIONS & CONTRACT DOCUMENTS

PROJECT MANUAL
FOR

ALTO LAKES WATER AND SANITATION DISTRICT
PHASE I WATER TREATMENT PLANT PROJECT

VOLUME 1 OF 2

February 15, 2010

Alto Lakes Water & Sanitation District

ALTO LAKES WATER AND SANITATION DISTRICT
BOARD MEMBERS

EARL ADAMY	**CHAIRMAN**
DAN KNORR	**VICE-CHAIR**
GARY PARKER	**SECRETARY**
BILL POPE	**TREASURERE**
ROBERT DECKER	**DIRECTOR**

PSC PARKHILLSMITH&COOPER

ALTO LAKES WATER AND SANITATION DISTRICT
PHASE I WATER TREATMENT PLANT PROJECT

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SECTION 00020
ADVERTISEMENT FOR BIDS

ALTO LAKES WATER AND SANITATION DISTRICT
214 LAKESHORE DR.
ALTO, NM 88312

ALTO LAKES WATER AND SANITATION DISTRICT
PHAES I WATER TREATMENT PLANT PROJECT

Separate and sealed bids for construction of the **ALTO LAKES WATER AND SANITATION DISTRICT PHASE I WATER TREATMENT PLANT PROJECT** in Alto, NM, will be received by the Alto Lakes Water and Sanitation District (ALW&SD) located at the District office located at 214 Lakeshore Dr. Alto, NM 88312 until 3:00 p.m., local time, July 1, 2010 and at that time and place, will be publicly opened and read aloud.

The work under this contract shall be for furnishing all labor, materials, transportation and services for the construction and installation of the following work:

Construction of a new 140 gpm iron and manganese removal plant with associated pumps and site piping, 2,500 square foot pre-engineered building with laboratory, control room, office, electrical room and restroom, 60,000 gallon steel ground storage tank, 5,278 linear feet of dual 8-inch HDPE pipe, valves and fittings, pavement replacement, sod replacement and all appurtenances and components required to complete the facilities. Also included in the project are electrical and instrumentation/control equipment, project mobilization, pre-construction video taping, storm water pollution prevention and trench safety.

Contract documents may be examined and obtained over the internet through the office of PARKHILL, SMITH & COOPER, INC. (ENGINEER), 810 East Yandell, El Paso Texas, 79902 (915) 533-6811. Hardcopy plans may be printed but will not be offered by the Owner or Engineer

A non-mandatory pre-bid meeting will be held on June 15, 2010 at 11:00 A.M. at the ALW&SD Office. A site tour will be held after the pre-bid meeting to allow bidders to familiarize themselves with on-site conditions.

Each Bid shall be submitted in accordance with the Instructions to Bidders and be accompanied by a Bid Bond in the amount of five percent (5%) of the amount bid, by an acceptable bid surety. A certified check or bank draft payable to the Alto Lakes Water & Sanitation District, or negotiable U.S. Government Bonds (as par value) may be submitted in lieu of the Bid Bond.

The Successful Bidder must furnish a 100 percent Performance Bond and a 100 percent Payment Bond, in accordance with the Instructions to Bidders and the General Conditions.

By submission of the bid, Bidder fully understands the requirements of the Contract Documents and agrees to comply with all requirements thereof.

Attention is called to the fact that the Contractor on this project must comply with the provisions of the Labor Standards contained in the specifications and must pay not less than the prevailing wage rates, as issued by the Department of Labor. The successful bidder must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

The ALW&SD reserves the right to reject any or all Bids or to waive any informality in the Bidding.

All contractors/subcontractors who are debarred, suspended or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project.

Bids may be held by the Engineer for a period not to exceed 30-days from the date of the Bid Opening for the purpose of reviewing the Bids and investigating the Bidder's qualifications, prior to awarding the Contract.

The ALW&SD is an Affirmative Action and Equal Opportunity Employer. Small, Minority and Female Owned firms are encouraged to submit Bids for this project.

SECTION 00100
INSTRUCTIONS TO BIDDERS

SECTION 00100
INSTRUCTIONS TO BIDDERS

1. Interpretations or Addenda
   a) No oral interpretations will be made to any bidder. Each request for an interpretation shall be made in writing to the engineer no less than seven (7) days prior to the bid opening. Each interpretation made will be in the form of an Addendum to the contract documents and will be distributed to all parties holding contract documents no less than five (5) days prior to the bid opening. It is, however, the bidder's responsibility to make inquiry as to any addenda issued. All such addenda shall become part of the contract documents and all bidders shall be bound by such addenda.
   b) The use of the brand names in the specifications or plan sheets on this project is for the purpose of describing a standard of quality, performance and characteristics desired and not intended to limit or restrict competition.

2. Contingent Award of Contract
   a) Any contract or contracts awarded as a result of the Advertisement for Bids are expected to be funded in part by money from the New Mexico Finance Authority. Neither the State of New Mexico nor any of its departments, agencies, or employees is or will be a party to this Advertisement for Bids or any resulting contract.

3. Equal Employment Opportunity and Affirmative Action
   a) Equal Opportunity in Employment - All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin. Bidders on this work will be required to comply with the President's Executive Order No. 11246, as amended by Executive Order 11375, and as supplemented in Department of Labor regulations 41 CFR Part 60.
   b) The Bidder's Certifications regarding Equal Employment Opportunity and Non-Segregated Facilities (WRD-255) must be submitted with bid.

4. Bid Guarantee
   a) Each bidder shall furnish a bid guarantee equivalent to five (5%) percent of the bid price. If a bid bond is provided, the contractor shall utilize a surety company which is authorized to do business in New Mexico in accordance with Art. 7.19-1. Bond of Surety Company; Chapter 7 of the Insurance code.
   b) A certified check or bank draft payable to the Locality or negotiable U.S. Government Bonds (as par value) may be submitted in lieu of the Bid Bond.

5. Award of Contract to Nonresident Bidder
   a) A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located.
   b) A nonresident bidder is a contractor whose corporate offices or principal place of business is outside of the state of New Mexico.

c) The bidder will complete form WRD-259 which must be submitted with the bid.

6. Copies of Bidding Documents
   a) Complete electronic files in PDF format of the Bidding Documents are available, as stated in the Advertisement or Invitation to Bid may be obtained through the **office of PARKHILL, SMITH & COOPER, INC. (ENGINEER), 810 East Yandell, El Paso Texas 79902, (915) 533-6811**.
   b) Complete sets of Bidding Documents must be used in preparing Bids; neither the Owner nor the Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
   c) Owner and Engineer, in making Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

7. Bid Form
   a) All bids must be submitted on the forms provided and are subject to all requirements of the Contract Documents, including the Drawings.
   b) All blanks on the Bid Form must be completed in Ink. Bids which do not have all blanks filled in or completed may be rejected at the Owner's option.
   c) Bids by corporations must be executed in the corporate name by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.
   d) Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of partnership must be shown below the signature.
   e) All bids must be regular in every respect and no inter-lineation, excisions or special conditions may be made or included by the bidder.
   f) The Locality may consider as irregular any bid on which there is an alteration of or departure from the bid form and, at its option, may reject any irregular bid.
   g) In order to submit a bid valued at more than fifty thousand dollars ($50,000), or in order to respond to a request for proposals, or to be considered for award of any portion of a public works project greater than fifty thousand dollars ($50,000) for a public works project that is subject to the Public Works Minimum Wage Act, the contractor, serving as prime contractor or not, shall be registered with the Labor and Industrial Division of the Labor Department.
   h) A subcontractor shall provide a performance and payment bond on a public works building project if the subcontractor's contact for work to be performed on a project is fifty thousand dollars ($50,000) or more.
   i) The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).
   j) The address and telephone number for communications regarding the Bid must be shown.
   k) The Prompt Payment Act allows a local public body forty-five days to make payment after submission of an undisputed request for payment when grant money is a source of funding.

8. Determining Lowest Responsible, Responsive Bidder

To demonstrate that the Bidder is responsible and able to perform the Work, each Bidder must be prepared to submit written evidence, such as financial data, previous experience, present commitments and other data as may be called for below. Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to Award of the Contract.

In determining the lowest responsible, responsive Bidder, in addition to price, the following elements will be considered:

a) the number and scope of conditions attached to the bid;
b) whether the bidder can perform the contract and provide the service promptly, or within the time required, without delay or interference;
c) the previous and existing compliance by the bidder with laws relating to the contract or service;
d) any previous or existing noncompliance by the bidder with specifications, or requirements relating to time of submission of specified data such as samples, models, drawings, certificates, or other information;
e) the sufficiency of the financial resources and ability of the bidder to perform the contract or to provide the service;
f) the experience of the bidder in performing work similar in type, size and complexity to this project, as demonstrated by a listing of projects, with verifiable references (names, addresses, phone numbers, etc.), successfully completed.

9. Minimum General Requirements for Prime Bidder

a) The Bidder, or at least two Key Personnel, directly assigned to this project and employed by the Bidder, must demonstrate Successful Completion of a project similar in nature and scope to this project within the past five (5) years.
b) Each bidder shall submit a statement of the bidder's qualifications. The Locality shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform his obligations under the contract, and the bidder shall furnish the locality all such information and data for this purpose as it may request. The right is reserved to reject any bid where an investigation of the available data does not satisfy the Locality that the bidder is qualified to carry out properly the terms of the contract.

10. Contract Time

The numbers of Calendar Days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the Contract Time) are set forth in the Agreement. Completion within this time is of the essence in the performance of this contract.

11. Liquidated Damages

Provisions for liquidated damages, if any, are set forth in the Agreement.

12. Pre-Bid Conference

a) A non-mandatory pre-bid conference will be held at 11:00 A.M. on the 14th day of April, 2010 at the ALW&SD office, located at 214 Lakeshore Dr., Alto, NM 88312. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference.
b) A site tour will be held after the pre-bid conference to allow bidders to familiarize themselves with on-site conditions.

13. Submission of Bids

a) Separate and sealed bids for construction of the **ALTO LAKES WATER & SANITATION DISTRICT PHASE I WATER TREATMENT PLANT** in Alto, NM, will be received by the ALW&SD at the District office office located at 214 Lakeshore Dr., Alto, NM 88312 until 4:00 p.m., local time, April 28, 2010 and at that time and place, will be publicly opened and read aloud.

b) Bids shall be enclosed in an opaque sealed envelope, marked with the Project title and name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

c) Bid received prior to the advertised hour of opening shall be kept securely sealed. The officer appointed to open the bids shall decide when the specified time has arrived and no bid received thereafter will be considered.

14. Sales and Use Taxes

Owner is exempt from Municipal and State Sales and Use Taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Contract Price.

15. Bid Modifications Prior to Bid Opening

a) Any Bidder may modify his bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Locality prior to the closing time, and provided further, the Locality is satisfied that a written confirmation of the telegraphic modification over the signature of the Bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition, subtractions or other modifications so that the final prices or terms will not be know by the Locality until the sealed bid is open. If written confirmation is not received within two (2) days from the closing time, no consideration will be given to the telegraphic modification.

b) Likewise, any Bidder may modify a bid by submitting a supplemental bid in person prior to the scheduled closing time for receipt of bids. Such supplemental bid should mention only additions or subtractions to the original bid so as to not reveal the final prices or terms to the Locality until the sealed bid is open.

c) Erasures or other corrections in the bid must be noted over the signature of the bidder.

16. Subcontractors, Suppliers, and Others

a) The Bidder is required to identify all Subcontractors and Suppliers who will perform work in the amount of five thousand dollars ($5000.00) or more of the Bid; and to provide their own and their subcontractor's business classification (Small Locally-Owned Business Enterprise, Minority Business Enterprise, Woman Owned Business Enterprise, or Other). The Bidder shall submit with his Bid a list of all proposed Subcontractors and Suppliers.

b) If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, either Owner or Engineer may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute, in which case the apparent Successful Bidder shall submit an acceptable substitute, that Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution and Owner may consider such price adjustment in evaluating Bids and making the Contract Award.

c) After Award, Bidder shall provide a copy of the proposed subcontracts (unexecuted copies are acceptable at this time) to Purchasing indicating the scope and the value of work to be

subcontracted or to be obtained through a purchase order to a Supplier. After execution of this Agreement by Owner and Bidder, contractor shall provide copies of the executed subcontracts and purchase orders to Suppliers to the Owner's Contracts Department prior to submittal of the first Application for Payment.

17. Opening of Bids

The Locality shall, at the time and place fixed for the opening of bids, cause each bid to be publicly opened and read aloud, irrespective of any irregularities therein.

18. Withdrawal of Bids

Bidder may withdraw the Bid before the time fixed for the opening of Bids by communicating his purpose in writing to the Locality. Upon receipt of such notice, the unopened Bid will be returned to the Bidder. The bid guaranty of any bidder withdrawing his bid in accordance with the above will be returned promptly.

19. Execution of Agreement

The failure of the successful bidder to execute the agreement and supply the required bonds within ten (10) days after the prescribed forms are presented for signature, or within such extended period as the Locality may grant shall constitute a default and the Locality may, at its option either award the contract to the next lowest responsible bidder, or re-advertise for bids. In either case, the Locality may charge against the bidder the difference between the amount of the bid, and the amount for which a contract is subsequently executed irrespective of whether this difference exceeds the amount of the bid bond. If a more favorable bid is received through re-advertisement, the defaulting bidder shall have no claim against the Locality for a refund.

20. Award of Contract

a) Owner reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time or changes in the Work and the right to disregard all immaterial, nonconforming, nonresponsive, unbalanced or conditional Bids. Also, Owner reserves the right to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to the Bidder, whether because the Bid is not responsive or the Bidder is not responsible because the Bidder is deemed to be unqualified or of doubtful financial ability or fails to meet any other pertinent criteria established by Owner.

b) Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

c) Any bids submitted in which there is a material failure to comply with the Bid requirements or specifications will be rejected and the contract will be awarded to the lowest responsible Bidder conforming to the specifications unless the Owner decides to reject all Bids.

d) In evaluating Bids, Owner will consider the responsiveness of the Bid, responsibility of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

e) Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary General Conditions or other sections of this bid document. Owner also may consider the operating costs, maintenance requirements, performance data and guarantees

of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award or as a substitute.

f) Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

g) If the contract is to be awarded, it will be awarded to the lowest Bidder whose responsibility has been evaluated in accordance with these Instructions to Bidders.

h) If the contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within 60 days after the day of the Bid opening, or such reasonable time as the funding agency may require.

21. Signing of Agreement

a) When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached.

b) Within fifteen days hereafter, Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds and a copy of the Certificate of Insurance along with a copy or copies of the actual Insurance policy or policies. Within ten days thereafter, Owner shall deliver two fully signed counterparts to Contractor.

QUALIFICATION AND FINANCIAL DISCLOSURE STATEMENT

BIDDER: _____

PROJECT NAME: _____

1. ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

1.2 How many years has your organization been in business under its present business name?

1.3 If your organization is a corporation, answer the following:

1.3.1 Date of incorporation: _____

1.3.2 State of incorporation: _____

1.3.3 President's name: _____

1.3.4 Vice-president's name(s): _____

_____

1.3.5 Secretary's name: _____

1.3.6 Treasurer's name: _____

1.4 If your organization is a partnership, answer the following:

1.4.1 Date of organization: _____

1.4.2 Type of partnership (if applicable): _____

1.4.3 Name(s) of general partner(s): _____

1.5 If your organization is individually owned, answer the following:

1.5.1 Date of organization: _____

1.5.2 Name of owner: _____

1.6 If the form of your organization is other than those listed above, describe it and name the principals:

2. LICENSING

2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable. Indicate name, license number and expiration date for Master Electrician or other trade required under the Instructions to Bidders section of this Bid.

2.2 List jurisdictions in which your organization's partnership or trade name is filed.

3. EXPERIENCE

3.1 List the categories of work that your organization normally performs with its own forces.

3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

3.2.1 Has your organization ever failed to complete any work awarded to it?

3.2.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

3.2.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

3.4 State total worth of work in progress and under contract:

3.5 State annual amount of construction work performed each year during the past five years:

3.6 List the construction experience and present commitments of the key individuals of your organization. Bidder hereby certifies that the Resident Superintendent has the authority to act on behalf of the Contractor at all times. No substitution shall be made without the written authorization of the Owner and the Engineer based upon acceptance of the qualifications of the proposed substitute.

3.7 Provide evidence that the Bidder meets the minimum criteria called out in Section 00100 Instructions to Bidders.

3.8 Provide the MWBE CERTIFICATION SUMMARY FORM found at the end of Section 00300.

4. REFERENCES

4.1 Trade References:

4.2 Bank References:

4.3 Surety:

Name and telephone number of Bonding Company: _____

Name, telephone and address of Agent: _____

_____

_____

5. FINANCING

5.1 Financial Statement – Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement.

5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

6. SIGNATURE

6.1 To be executed by a Principal of the firm authorized to certify the foregoing information:

_____, being duly sworn, deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

6.2 Dated at _____ this _____ day of _____, 200___.

Name of Organization: _____

By: _____

_____
(Printed Name)

Title: _____

SECTION 00130
ATTORNEY'S REVIEW CERTIFICATION

SECTION 00130
ATTORNEY'S REVIEW CERTIFICATION

I, the undersigned, _____, the duly authorized and acting legal representative of the _____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and am of the opinion that each of the agreements may be duly executed by the proper parties, acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties; and that the agreements shall constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

Attorney's signature: _____ Date: _____

Print Attorney's name: _____

END OF SECTION

SECTION 00150
NONCOLLUSION AFFIDAVIT OF PRIME BIDDER

SECTION 00150
NONCOLLUSION AFFIDAVIT OF PRIME BIDDER

State of _____)
County of _____)
_____, being first duly sworn, deposes and says that:

(1) He is _____ of _____, the Bidder that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with another Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix an overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Alto Lakes Water & Sanitation District or any person interested in the proposed Contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

(Signed) _____

_____
Title

Subscribed and sworn to me this _____ day of _____.

By: _____
Notary Public

My commission expires _____

END OF SECTION

SECTION 00300
BID FORM

BID FORM

PROJECT IDENTIFICATION: ALTO LAKES WATER & SANITATION DISTRICT

PHASE I WATER TREATMENT PLANT

Name and Address of OWNER:: Alto Lakes Water & Sanitation District
214 Lakeshore Drive
Alto, NM 88312

1. The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

2. BIDDER accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty days after the day of Bid opening. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within fifteen days after the date of OWNER's Notice of Award.

3. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   A. BIDDER has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

Date	Number

   B. BIDDER has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

   C. BIDDER has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in Section 02010 – Subsurface Investigation and accepts the extent of the technical data contained in such reports and drawings.

   D. BIDDER has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to supplement those referred to in "C." above) which pertain to the subsurface or physical conditions

at the site or otherwise may affect the cost, progress, performance or furnishing of the Work as BIDDER considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Paragraph 4.2 of the General Conditions.

E. BIDDER has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities.

F. BIDDER has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

G. BIDDER has given ENGINEER written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to BIDDER.

H. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; BIDDER has not solicited or induced any person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

4 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

UNIT PRICE SCHEDULE

Item No.	Estimated Quantity	Brief Description of Item With Unit Bid Price in Words	Unit Bid Price In Figures	Amount In Figures
1.	**Lump Sum**	**Mobilization, Insurance, Bonds, Moving-in and Moving out related expenses, complete, for the sum of (NOT TO EXCEED 5% OF TOTAL BID):** **_____ Dollars and** **_____Cents, Lump Sum.**	**$ _____**	**$ _____**
2.	**Lump Sum**	**Furnish and Maintain SW3P Best Management Practices (BMPs) complete in place for the sum of:** **_____Dollars and** **_____Cents, Lump Sum.**	**$ _____**	**$ _____**
3.	**Lump Sum**	**Video tape for project area and application fields with two DVD format copies, complete, for the sum of:** **_____ Dollars and** **_____Cents, Lump Sum.**	**$ _____**	**$ _____**
4.	**5,900 L.F.**	**Trench Safety System, complete with sheeting, bracing or trench box method for utility piping, complete for the sum of:** **_____Dollars and** **_____Cents, per Linear Foot.**	**$ _____**	**$ _____**
5.	**0.3 Acre**	**Clear and Grubbing of treatment plant site, complete in place for the sum of:** **_____Dollars and** **_____Cents, per Acre.**	**$ _____**	**$ _____**
6.	**5,278 L.F.**	**Furnish and install dual 8-inch pressure pipe with tie-ins, valves, fittings, bedding, backfill and testing, complete in place for the sum of:** **_____Dollars and** **_____Cents, per Linear Foot.**	**$ _____**	**$ _____**
7.	**Lump Sum**	**Furnish and install 6-inch and 8-inch site piping with valves, fittings, thrust restraints, bedding, backfill and testing, complete in place for the sum of:** **_____Dollars and** **_____Cents, per Lump Sum.**	**$ _____**	**$ _____**

Item No.	Estimated Quantity	Brief Description of Item With Unit Bid Price in Words	Unit Bid Price In Figures	Amount In Figures
8.	**Lump Sum**	**Furnish and install 60,000 gallon welded steel water storage tank including foundation, coating, ladder, access points, testing and all other appurtenances, complete in place for the sum of: _____Dollars and _____Cents, per Lump Sum.**	**$ _____**	**$ _____**
9.	**Lump Sum**	**Furnish and Install 2,500 square foot pre-engineered steel building including foundation, insulation, interior walls, doors, windows, heating and cooling systems bathroom fixtures and cabinets, lab sink with cabinets, interior and exterior lighting, complete in place for the sum of: _____Dollars and _____Cents, per Lump Sum.**	**$ _____**	**$ _____**
10.	**Lump Sum**	**Furnish and Install Manganese Oxide based water treatment skid including three pressure vessels with media, electrically operated valves, control panel with programmable logic controller and program, backwash recycle pump, 6,000 gallon backwash decant tank, chlorine dosing system and all treatment train appurtenances, complete in place for the sum of: _____ Dollars and _____Cents, per Lump Sum.**	**$ _____**	**$ _____**
11.	**Lump Sum**	**Furnish and install variable speed filter influent pump skid and variable speed finish water pump skid with associated suction and discharge piping, valves and fittings, variable speed drives, and emergency stops, complete in place for the sum of: _____ Dollars and _____Cents, per Lump Sum.**	**$ _____**	**$ _____**
12.	**Lump Sum**	**Furnish and install 6,000 finished water tank and associated pipeing and instrumentation. Complete in place for the sum of: _____Dollars and _____Cents per Lump Sum.**	**$ _____**	**$ _____**
13.	**Lump Sum**	**Furnish and install WTP Electrical and Instrumentation, complete in place for the sum of: _____Dollars and _____Cents per Lump Sum.**	**$ _____**	**$ _____**

Item No.	Estimated Quantity	Brief Description of Item With Unit Bid Price in Words	Unit Bid Price In Figures	Amount In Figures
14.	**450 S.Y.**	**Furnish and install 15' Driveways with compacted 6-inch thick base course as shown on the plans, complete in place _____Dollars and _____Cents, per Square Yard.**	**$ _____**	**$ _____**

TOTAL PRICE (Items 1 through 14 constitutes the Total Bid Price):

Price in Words_____

_

_____($_____

)

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

5. Bidder agrees that the Work will be substantially complete within **150** calendar days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions within **180** calendar days after the date when the Contract Times commence to run.

   Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract Times.

WRD-255 – BIDDER'S CERTIFICATIONS

BIDDER'S CERTIFICATIONS

Project Name _____

Project Number _____

Contract For _____

The following certifications must be completed by the bidder for each contract.

A. EQUAL EMPLOYMENT OPPORTUNITY:

( ) I have developed and have on file at my establishment affirmative action programs pursuant to 41 CFR Part 60-2.

( ) I have participated in previous contract(s) or subcontract(s) subject to the equal opportunity clause under **Executive Orders 11246 and 11375**. I have filed all reports due under the requirements contained in 41 CFR 60-1.7.

( ) I have not participated in previous contracts(s) subject to the equal opportunity clause under **Executive Orders 11246 and 11375**.

( ) I will obtain a similar certification from any proposed subcontractor(s), when appropriate.

B. NONSEGREGATED FACILITIES

( ) I certify that I do not and will not maintain any facilities provided for my employees in a segregated manner, or permit my employees to perform their services at any location under my control where segregated facilities are maintained; and that I will obtain a similar certification prior to the award of any federally assisted subcontract exceeding $10,000 which is not exempt from the equal opportunity clause as required by 41 CFR 60-1.8.

I understand that a false statement on this certification may be grounds for rejection of this bid proposal or termination of the contract award.

_____

Typed Name & Title of Bidder's Authorized Representative

_____

Signature of Bidder's Authorized Representative Date

_____

_____

Name & Address of Bidder

WRD-259 – VENDOR COMPLIANCE WITH RECIPROCITY ON NON-RESIDENT BIDDERS

WRD-259
3/20/02

VENDOR COMPLIANCE WITH RECIPROCITY ON NON-RESIDENT BIDDERS

Government Code 2252.002 provides that, in order to be awarded a contract as low bidder, a non-resident bidder must bid projects for construction, improvements, supplies or services in Texas at an amount lower than the lowest Texas resident bidder by the same amount that a Texas resident bidder would be required to underbid a non-resident bidder in order to obtain a comparable contract in the state in which the non-resident's principal place of business is located. A non-resident bidder is a contractor whose corporate offices or principal place of business is outside of the state of Texas. This requirement does not apply to a contract involving Federal funds. The appropriate blanks in Section A must be filled out by all out-of-state or non-resident bidders in order for your bid to meet specifications. The failure of out-of-state or non-resident contractors to do so will automatically disqualify that bidder. Resident bidders must check the blank in Section B.

A. Non-resident vendors in _____(give state), our principal place of business, are required to be _____ percent lower than resident bidders by state law. A copy of the statute is attached.

Non-resident vendors in _____(give state), our principal place of business, are not required to underbid resident bidders.

B. Our principal place of business or corporate offices are in the State of Texas:_____

BIDDER:

_____
Company

_____
City State Zip

_____
By: (please print)

_____
Signature

_____
Title: (please print)

THIS FORM MUST BE RETURNED WITH THE BID

SECTION 00430
BID BOND

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

BID
Bid Due Date:
Project (Brief Description Including Location):

BOND
Bond Number:
Date (Not later than Bid due date):
Penal sum _____ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER	SURETY
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00500
STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR ON THE BASIS OF A STIPULATED PRICE

SECTION 00500
STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR ON THE BASIS OF A STIPULATED PRICE

AGREEMENT

THIS AGREEMENT, made this _____day of _____, 2010, by and between

The Alto Lakes Water & Sanitation District hereinafter called "OWNER" and _____. doing business as a corporation hereinafter called "CONTRACTOR".

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

1. The CONTRACTOR will commence and complete the construction of the **ALTO LAKES WATER & SANITATION DISTRICT PHASE I WATER TREATMENT PLANT** that includes all work under SECTION 00300 - Bid Form.

   Construction of a new 140 gpm iron and manganese removal plant with associated pumps and site piping, 2,500 square foot pre-engineered building with laboratory, control room, office, electrical room and restroom, 60,000 gallon steel ground storage tank, 5,278 linear feet of dual 8-inch HDPE pipe, valves and fittings, pavement replacement, sod replacement and all appurtenances and components required to complete the facilities. Also included in the project are electrical and instrumentation/control equipment, project mobilization, pre-construction video taping, storm water pollution prevention and trench safety.

.

2. ENGINEER – The project has been designed by Parkhill, Smith & Cooper, Inc., 810 East Yandell Dr., El Paso, Texas 79902, (915) 533-6811, who is hereafter called ENGINEER and who is to act as OWNER's representative, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

3. The CONTRACTOR will furnish all of the materials, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT as described herein.

4. CONTRACT TIME – The CONTRACTOR will commence the work required by the CONTRACT DOCUMENTS within **15** calendar days after the date of the NOTICE TO PROCEED. The Work will be substantially complete within **150** calendar days after the date when the Contract Time commence to as provided in Paragraph 2.03 of the General Conditions, and will complete and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions within **180** calendar days after the date when the Contract Time commence to run.

Liquidated Damages - The Contractor agrees to pay to Owner as Liquidated Damages, Three Hundred Dollars ($300.00) per calendar day that expires after the time specified for Substantial Completion. After Substantial Completion, if the Contractor neglects, refuses or fails to complete the remaining work within the contract time or any proper extension thereof granted by the Engineer, Contractor shall pay Owner Fifty Dollars ($50.00) for each calendar day that expires after the time specified for Final Completion.

5. CONTRACT PRICE – The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of **$ _____** or as shown in the BID schedule.

6. PAYMENT PROCEDURES

   a) This is a Unit Price Work Agreement. The Contractor shall be paid based on the unit prices in the Bid Form and the number of units completed and accepted. The Engineer has 14 days to make recommendation of payment application.
   b) CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.
   c) Prior to Substantial Completion, progress payments will be made in an amount equal to the percentages indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with Paragraph 14.02 of the General Conditions.

   Ninety-five percent of Work completed, including 95 percent of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in Paragraph 14.02 of the General Conditions).

   d) This contract allows the Owner to make payment within 45 days after submission of an undisputed request for payment.
   e) Final Payment – Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by the ENGINEER as provided in said Paragraph 14.07.

7. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

   a) Advertisement for Bids-
   b) Instructions to Bidders
   c) Qualifications and Financial Disclosure Statement
   d) Attorney's Review Certificate
   e) Noncollusion Affidavit of Prime Bidder
   f) BID FORM
   g) WRD-225 – Bidder's Certifications
   h) WRD-259 – Vendor Compliance with Reciprocity on Non-Resident Bidders
   i) BID BOND
   j) Standard Form of Agreement Between Owner and Contractor on the Basis of a Stipulated Price
   k) Performance Bond
   l) Payment Bond
   m) Certificate of Insurance
   n) General Contract Conditions for Construction
   o) Supplemental Contract Conditions
   p) ED-103 – Contractor's Act of Assurance
   q) ED-104 – Contractor's Resolution on Authorized Representative
   r) General Wage Rates

s) NOTICE OF AWARD
t) NOTICE TO PROCEED
u) CHANGE ORDER
v) DRAWINGS prepared by PARKHILL, SMITH & COOPER, INC. TITLED ALTO LAKES WATER & SANITATION DISTRICT PHASE I WATER TREATMENT PLANT PROJECT. numbered 1 through 23, Dated February, 2010.
w) Specifications prepared by ALTO LAKES WATER & SANITATION DISTRICT PHASE I WATER TREATMENT PLANT PROJECT. numbered 1 through 23, Dated February, 2010.
x)
y) ADDENDA:

No. 1, dated _____, 2010

No. 2, dated _____, 2010

No. 3, dated _____, 2010

f) The OWNER will pay to the CONTRACTOR in the manner and at such times as set forth in the General Contract Conditions such amounts as required by the CONTRACT DOCUMENTS.

g) This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns. IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement (3 COPIES) each of which shall be deemed an original on the date first above written.

OWNER:

ALTO LAKES WATER & SANITATION DISTRICT

By _____

Name _____

Title _____

(SEAL)

ATTEST:

Name_____
(Please Type)

Title_____

CONTRACTOR:

_____

BY_____

Name_____
(Please Type)

Title_____

(SEAL)

ATTEST:

Name_____
(Please Type)

Title_____

SECTION 00610
PERFORMANCE BOND

SECTION 00610

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

EJCDC No. C-610 (2002 Edition)
Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:

3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and

3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and

3.3. Owner has agreed to pay the Balance of the Contract Price to:

1. Surety in accordance with the terms of the Contract;

2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:

4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or

2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

8. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.

12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone
Surety Agency or Broker
Owner’s Representative (Engineer or Other Party)

SECTION 00615
PAYMENT BOND

SECTION 00615

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company:

Signature: _____ (Seal)
Name and Title:

SURETY

_____ (Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

EJCDC No. C-615 (2002 Edition)
Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

2. With respect to Owner, this obligation shall be null and void if Contractor:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with Contractor:

1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety; that is sufficient compliance.

6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:

6.1. Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2. Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone
Surety Agency or Broker:
Owner's Representative (engineer or other party):

SECTION 00650
CERTIFICATE OF INSURANCE

CERTIFICATE OF INSURANCE

ISSUE DATE

PRODUCER

INSURED

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

COMPANIES AFFORDING COVERAGE

COMPANY LETTER A

COMPANY LETTER B

COMPANY LETTER C

COMPANY LETTER D

COMPANY LETTER E

COVERAGES

THIS IS TO CERTIFY THAT POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS, AND CONDITIONS OF SUCH POLICIES.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE	POLICY EXPIRATION DATE	ALL LIMITS IN THOUSANDS
	GENERAL LIABILITY COMMERCIAL GENERAL LIABILITY CLAIMS MADE OCCURRENCE OWNER'S & CONTRACTORS PROTECTIVE				GENERAL AGGREGATE $ PRODUCTS-COMP/OPS AGGREGATE $ PERSONAL & ADVERTISING INJURY ★ $ EACH OCCURRENCE $ FIRE DAMAGE (ANY ONE FIRE) $ MEDICAL EXPENSES (ANY ONE PERSON) $
	AUTOMOBILE LIABILITY ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS GARAGE LIABILITY				CSL $ CSL $ CSL $ CSL $
	EXCESS LIABILITY OTHER THAN UMBRELLA FORM				$ EACH OCCURRENCE / AGGREGATE
	WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				STATUTORY $ (EACH ACCIDENT) $ (DISEASE-POLICY LIMIT) $ (DISEASE-EACH EMPLOYEE)
	OTHER				

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/RESTRICTIONS/SPECIAL ITEMS

★ DELETE EMPLOYEE EXCLUSIONS

ADDITIONAL INSURED / CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED OR MATERIALLY CHANGED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY SHALL PROVIDE 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT.

AUTHORIZED REPRESENTATIVE

SECTION 00710
GENERAL CONTRACT CONDITIONS

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the Controlling Law.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT FUNDING AGENCY EDITION

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

ACEC
American Council of Engineering Companies

National Society of Professional Engineers
Professional Engineers in Private Practice

ASCE American Society of Civil Engineers

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
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AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General Contractors of America

and the

Construction Specification Institute

Knowledge for Creating and Sustaining the Built Environment

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Funding Agency Edition No. C-521 (2002 Edition). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001, 2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800, 2002 Edition).

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GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

2. *Agency* – The Federal or state agency named as such in the Agreement.

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

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

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

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

7. *Bidder* – The individual or entity who submits a Bid directly to Owner.

8. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents (including all Addenda).

9. *Bidding Requirements* – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.

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

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

12. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

13. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

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

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

16. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.

17. *Cost of the Work* – See Paragraph 11.01.A for definition.

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

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

20. *Engineer* – The individual or entity named as such in the Agreement.

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

22. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

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

24. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

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

26. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

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

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

31. *PCBs* – Polychlorinated biphenyls.

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

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

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

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

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

37. *Related Entity* – An officer, director, partner, employee, agent, consultant, or subcontractor.

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

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

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

41. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

42. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

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

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

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

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

47. *Successful Bidder* – The Bidder submitting a responsive Bid to whom Owner makes an award.

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

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

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

51. Unit Price Work – Work to be paid for on the basis of unit prices.

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

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

1.02 *Terminology*

A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.

B. *Intent of Certain Terms or Adjectives*

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

C. *Day*

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

D. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

   a. does not conform to the Contract Documents, or

   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or

   c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

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

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

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

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

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

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

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

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

2.02 *Copies of Documents*

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

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 *Starting the Work*

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

2.05 *Before Starting Construction*

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

1. a preliminary Progress Schedule;

2. a preliminary Schedule of Submittals; and

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

2.06 *Preconstruction Conference*

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

2.07 *Initial Acceptance of Schedules*

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

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

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

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

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

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

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage

as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

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

3.02 *Reference Standards*

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

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

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

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

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

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

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. Resolving Discrepancies

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

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

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

3.04 *Amending and Supplementing Contract Documents*

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

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

1. A Field Order;

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

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

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

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

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

3.06 *Electronic Data*

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

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

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any,

of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

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

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

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

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

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

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by

Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

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

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

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

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

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

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

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

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

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

4.05 *Reference Points*

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

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

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

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

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

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

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

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

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

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

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

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.

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

5.02 *Licensed Sureties and Insurers*

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

5.03 *Certificates of Insurance*

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

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

5.04 *Contractor's Liability Insurance*

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

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

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

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

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. by any other person for any other reason;

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

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

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

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

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

3. include completed operations insurance;

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

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

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

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.

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

5.05 *Owner's Liability Insurance*

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

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (Contractor shall be responsible for any deductible or self-insured retention.). This insurance shall:

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

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

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

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

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

6. include testing and startup; and

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

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

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

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

5.07 *Waiver of Rights*

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

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

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

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

5.08 *Receipt and Application of Insurance Proceeds*

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

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

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

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

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

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

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

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

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

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

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

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances,

fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

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

6.04 *Progress Schedule*

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

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

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

6.05 *Substitutes and "Or-Equals"*

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

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

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

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

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

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

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

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

2. Substitute Items

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

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

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

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

1) shall certify that the proposed substitute item will:

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

b) be similar in substance to that specified, and

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

2) will state:

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

b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

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

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

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

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is

equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

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

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

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

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

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

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

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

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

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

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

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

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

6.07 *Patent Fees and Royalties*

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

B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

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

6.09 *Laws and Regulations*

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

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

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

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

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

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

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

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

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

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

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

6.12 *Record Documents*

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

6.13 *Safety and Protection*

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

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

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

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

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

6.14 *Safety Representative*

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

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17 *Shop Drawings and Samples*

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

1. *Shop Drawings*

a. Submit number of copies specified in the General Requirements.

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

2. *Samples*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

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

C. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and

d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

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

D. *Engineer's Review*

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

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

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

E. *Resubmittal Procedures*

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

6.18 *Continuing the Work*

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

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.

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

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

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

Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

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

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

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

6.21 *Delegation of Professional Design Services*

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

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all

performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

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

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

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

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

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

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

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

7.02 *Coordination*

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

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

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

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

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

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

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

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

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

8.03 *Furnish Data*

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

8.04 *Pay When Due*

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

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 *Insurance*

A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

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

8.11 *Evidence of Financial Arrangements*

A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

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

9.02 *Visits to Site*

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

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

9.03 *Project Representative*

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

9.04 *Authorized Variations in Work*

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

9.05 *Rejecting Defective Work*

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

9.06 *Shop Drawings, Change Orders and Payments*

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

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

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

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

9.07 *Determinations for Unit Price Work*

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

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

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

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

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

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

9.09 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

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

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

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

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

10.02 *Unauthorized Changes in the Work*

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

10.03 *Execution of Change Orders*

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

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

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

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

10.04 *Notification to Surety*

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

10.05 *Claims*

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

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

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

1. deny the Claim in whole or in part,

2. approve the Claim, or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

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

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

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

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

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

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

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

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

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

11.02 *Allowances*

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

B. Cash Allowances

1. Contractor agrees that:

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

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

C. *Contingency Allowance*

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

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

11.03 *Unit Price Work*

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

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

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

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

1. the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

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

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

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

12.01 *Change of Contract Price*

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

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

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

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

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

C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

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

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

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

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

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

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

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

12.02 *Change of Contract Times*

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

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

12.03 *Delays*

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

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

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

1. delays caused by or within the control of Contractor; or

D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

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

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

13.01 *Notice of Defects*

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

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

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

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

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

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

3. as otherwise specifically provided in the Contract Documents.

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

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

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

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

13.04 *Uncovering Work*

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

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

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

13.05 *Owner May Stop the Work*

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

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

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

13.07 *Correction Period*

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

1. repair such defective land or areas; or

2. correct such defective Work; or

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

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

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

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

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

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

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

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

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

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

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

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

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

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

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

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

B. *Review of Applications*

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

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

a. the Work has progressed to the point indicated;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

C. *Payment Becomes Due*

1. 45 days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due as stated in the extended payment clause on each plan sheet, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment*

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

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

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

   c. the Contractor's performance or furnishing of the Work is inconsistent with funding Agency requirements;

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

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

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

3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 *Contractor's Warranty of Title*

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

14.04 *Substantial Completion*

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

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

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

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

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

14.05 *Partial Utilization*

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

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

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

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment*

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

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

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

B. *Engineer's Review of Application and Acceptance*

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

C. *Payment Becomes Due*

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

14.08 *Final Completion Delayed*

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

14.09 *Waiver of Claims*

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

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

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

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

15.02 *Owner May Terminate for Cause*

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

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

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

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

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

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

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

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

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages

incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.

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

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

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

15.03 *Owner May Terminate For Convenience*

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

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

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

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

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

15.04 *Contractor May Stop Work or Terminate*

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

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

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

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

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

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

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or

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

17.02 *Computation of Times*

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

17.03 *Cumulative Remedies*

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

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Agency Not a Party*

A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

18.02 *Contract Approval*

A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit GC-A) before Owner submits the executed Contract Documents to Agency for approval.

B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer.

B. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

B. In the event this Contract is terminated as provided in paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an

amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

A. For all negotiated contracts and negotiated modifications (except those of $10,000 or less), Owner, Agency, the Comptroller General, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.

18.06 *Small, Minority and Women's Businesses*

A. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps shall consist of: (1) including qualified small, minority and women's businesses on solicitation lists; (2) assuring that small, minority and women's businesses are solicited whenever they are potential sources; (3) dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses; (4) establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women's businesses; (5) using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; (6) requiring each party to a subcontract to take the affirmative steps of this section; and (7) Contractor is encouraged to procure goods and services from labor surplus area firms.

18.07 *Anti-Kickback*

A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

18.08 *Clean Air and Pollution Control Acts*

A. If this Contract exceeds $100,000, Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401 *et seq.*) and the Federal Water Pollution Control Act as amended (33 USC 1251 *et seq.*). Contractor will report violations to the Agency and the Regional Office of the EPA.

18.09 *State Energy Policy*

A. Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.

18.10 *Equal Opportunity Requirements*

A. If this Contract exceeds $10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment

Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

C. Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

18.11 *Restrictions on Lobbying*

A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed $100,000 at any tier under a Federal loan that exceeds $150,000 or a Federal grant that exceeds $100,000. If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 USC 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

A. When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:

1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.

2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.

3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

EXHIBIT GC-A

Certificate of Owner's Attorney

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows:

I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

_____

Date: _____

SECTION 00810
SUPPLEMENTAL CONTRACT CONDITIONS

SECTION 00810
SUPPLEMENTAL CONTRACT CONDITIONS

1. SUPRESSION

The Owner and the contractor agree that the Supplemental Conditions apply to that work eligible for New Mexico Finance Authority assistance to be performed under this contract and these clauses supersede any conflicting provisions of this contract.

2. PRIVITY OF CONTRACT

Funding for this project is expected to be provided in part by the New Mexico Finance Authority. Neither the State of New Mexico, nor any of its departments, agencies or employees is, or will be, a party to this contract or any lower tier contract.

3. DEFINITIONS

(a) The term Owner means the local entity contracting for the construction services.
(b) The term "NMFA" means the Executive Administrator of the New Mexico Finance Authority, or other person who may be at the time acting in the capacity or authorized to perform the functions of such Administrator, or the authorized representative thereof.

4. LAWS TO BE OBSERVED

In the execution of the Contract, the Contractor must comply with all applicable Local, State and Federal laws, including but not limited to laws concerned with labor, safety, minimum wages, and the environment. The Contractor shall make himself familiar with and at all times shall observe and comply with all Federal, State, and Local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the Owner, New Mexico Finance Authority, and their representatives against any claim arising from violation of any such law, ordinance or regulation by himself or by his subcontractor or his employees.

5. REVIEW BY OWNER, and NMFA

(a) The Owner, authorized representatives and agents of the Owner, and NMFA shall, at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the Owner through authorized representatives or agents.
(b) Any such inspection or review by the NMFA shall not subject the State of New Mexico to any action for damages.

6. PERFORMANCE AND PAYMENT BONDS

Each contractor awarded a construction contract furnish performance and payment bonds:

(a) the performance bond shall include without limitation guarantees that work done under the contract will be completed and performed according to approved plans and specifications and in accordance with sound construction principles and practices; and

(b) the performance and payment bonds shall be in a penal sum of not less than 100 percent of the contract price and remain in effect for one year beyond the date of approval by the engineer of the political subdivision.

(c) The contractor shall utilize a surety company that is authorized to do business in New Mexico.

7. PROGRESS PAYMENTS AND PAYMENT SCHEDULE

(a) The Contractor shall submit for approval immediately after execution of the Agreement, a carefully prepared Progress Schedule, showing the proposed dates of starting and completing each of the various sections of the work, the anticipated monthly payments to become due the Contractor, and the accumulated percent of progress each month.

(b) The following paragraph applies only to contracts awarded on a lump sum contract price:

COST BREAKDOWN - The Contractor shall submit to the Owner a detailed breakdown of his estimated cost of all work to be accomplished under the contract, so arranged and itemized as to meet the approval of the Owner or funding agencies. This breakdown shall be submitted promptly after execution of the agreement and before any payment is made to the Contractor for the work performed under the Contract. After approval by the Owner the unit prices established in the breakdown shall be used in estimating the amount of partial payments to be made to the Contractor.

(c) Progress Payments.

(1) The Contractor shall prepare his requisition for progress payment as of the last day of the month and submit it, with the required number of copies, to the Engineer for his review. Except as provided in Paragraph (3) of this subsection, the amount of the payment due the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting: (1) five percent (5%) of the total amount, as a retainage and (2) the amount of all previous payments. The total value of work completed to date shall be based on the actual or estimated quantities of work completed and on the unit prices contained in the agreement (or cost breakdown approved pursuant to section 6.b relating to lump sum bids) and adjusted by approved change orders. The value of materials properly stored on the site shall be based upon the estimated quantities of such materials and the invoice prices. Copies of all invoices shall be available for inspection by the Engineer.

(2) The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the Owner. Such payments shall not constitute a waiver of the right of the Owner to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this Contract complete and satisfactory to the Owner in all details.

(3) This clause applies to contracts when the Owner is a Municipal Utility District, or Water Control and Improvement District. The retainage shall be ten percent of the amount otherwise due until at least fifty percent of the work has been completed. After the project is fifty percent completed, the District may reduce the retainage from ten percent to no less than five percent.

(4) The five percent (5%) retainage of the progress payments due to the Contractor may not be reduced until the building of the project is substantially complete and a reduction in the retainage has been authorized by the NMFA.

(5) The following clause applies only to contracts where the total price at the time of execution is $400,000 or greater and the retainage is greater than 5% and the Owner is not legally exempted from the condition (i.e. certain types of water districts).

The Owner shall deposit the retainage in an interest-bearing account, and the interest earned on such retainage funds shall be paid to the Contractor after completion of the contract and final acceptance of the project by the Owner.

(d) Withholding Payments. The Owner may withhold from any payment otherwise due the Contractor so much as may be necessary to protect the Owner and if so elects may also withhold any amounts due from the Contractor to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and will not require the Owner to determine or adjust any claims or disputes between the Contractor and his subcontractors or Material dealers, or to withhold any moneys for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

(e) Payments Subject to Submission of Certificates. Each payment to the Contractor by the Owner shall be made subject to submission by the Contractor of all written certifications required of him and his subcontractors by Section 3 hereof (relating to labor standards) and other general and special conditions elsewhere in this contract.

(f) Final Payment

(1) Upon satisfactory completion of the work performed under this contract, as a condition before final payment under this contract or as a termination settlement

under this contract the contractor shall execute and deliver to the Owner a release of all claims against the Owner arising under, or by virtue of, this contract, except claims which are specifically exempted by the contractor to be set forth therein. Unless otherwise provided in this contract, by State law or otherwise expressly agreed to by the parties to this contract, final payment under this contract or settlement upon termination of this contract shall not constitute a waiver of the Owner's claims against the contractor or his sureties under this contract or applicable performance and payment bonds.

(2) After final inspection and acceptance by the Owner of all work under the Contract, the Contractor shall prepare his requisition for final payment which shall be based upon the carefully measured or computed quantity of each item of work at the applicable unit prices stipulated in the Agreement or cost breakdown (if lump sum), as adjusted by approved change orders. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all previous payments.

(3) The retainage and its interest earnings, if any, shall not be paid to the Contractor until the NMFA has authorized a reduction in, or release of, retainage on the contract work.

(4) Withholding of any amount due the Owner, under general and/or special conditions regarding "Liquidated Damages," shall be deducted from the final payment due the Contractor.

8. WORKMAN'S COMPENSATION INSURANCE COVERAGE

(a) The contractor shall certify in writing that the contractor provides workers' compensation insurance coverage for each employee of the contractor employed on the public project.

(b) Each subcontractor on the public project shall provide such a certificate relating to coverage of the subcontractor's employees to the general contractor, who shall provide the subcontractor's certificate to the governmental entity.

(c) A contractor who has a contract that requires workers' compensation insurance coverage may provide the coverage through a group plan or other method satisfactory to the governing body of the governmental entity.

(d) The employment of a maintenance employee by an employer who is not engaging in building or construction as the employer's primary business does not constitute engaging in building or construction.

(e) In this section:

(1) "Building or construction" includes:

A) erecting or preparing to erect a structure, including a building, bridge, roadway, public utility facility, or related appurtenance;

B) remodeling, extending, repairing, or demolishing a structure; or

C) otherwise improving real property or an appurtenance to real property through similar activities.

(2) "Governmental entity" means this state or a political subdivision of this state. The term includes a municipality.

9. CHANGES

(a) The Owner may at any time, without notice to any surety, by written order, make any change in the work within the general scope of the contract, including but not limited to changes.
   (1) In the specifications (including drawings and designs);
   (2) In the time, method or manner of performance of the work;
   (3) In the Owner-furnished facilities, equipment, materials, services or site, or
   (4) Directing acceleration in the performance of the work.
   (5) The original contract price may not be increased under this section by more than 25 percent. The original contract price may not be decreased under this section by more than 25 percent without the consent of the contractor.

(b) A change order shall also be any other written order (including direction, instruction, interpretation or determination) from the Owner which causes any change, provided the contractor gives the Owner written notice stating the date, circumstances and source of the order and that the contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement or conduct of the Owner shall be treated as a change under this clause or entitle the contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the contractor's cost or the time required to perform any part of the work under this contract, whether or not changed by any order, the Owner shall make an equitable adjustment and modify the contract in writing. Except for claims based on defective specifications, no claim for any change under paragraph (a)(2) above shall be allowed for any costs incurred more than 20 days before the contractor gives written notice as required in paragraph (a)(2). In the case of defective specifications for which the Owner is responsible, the equitable adjustment shall include any increased cost the contractor reasonably incurred in attempting to comply with those defective specifications.

(e) If the contractor intends to assert a claim for an equitable adjustment under this clause, the contractor must, within 30 days after receipt of a written change order under paragraph (a)(1) or the furnishing of a written notice under paragraph (a)(2), submit a written statement to the Owner setting forth the general nature and monetary extent of such claim The Owner may extend the 30-day period. The contractor may include the statement of claim in the notice under paragraph (2) of this changes clause.

(f) No claim by the contractor for an equitable adjustment shall be allowed if made after final payment under this contract.

(g) Changes that involve an increase in price will be supported by documentation of the cost components in a format acceptable to the Owner.

10. PREVAILING WAGE RATES

This Contract is subject to Government Code Chapter 2258 concerning payment of Prevailing Wage Rates. The Owner will determine what are the general prevailing rates in accordance with the statute. The applicable provisions include, but are not limited to the following:

§ 2258.021. Right to be Paid Prevailing Wage Rates

(a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
  (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
  (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.

(b) Subsection (a) does not apply to maintenance work.

(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

Added by Acts 1995, 74th Leg., ch. 76, § 5.49(a), eff. Sept. 1, 1995. Amended by Acts 1997, 75th Leg., ch. 165, § 18.01, eff. Sept. 1, 1997.

§ 2258.023. Prevailing Wage Rates to be Paid by Contractor and Subcontractor; Penalty

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.

(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.

(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.

(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

Added by Acts 1995, 74th Leg., ch. 76, § 5.49(a), eff. Sept. 1, 1995.

§ 2258.024. Records

(a) A contractor and subcontractor shall keep a record showing.
  (1) the name and occupation of each worker employed by the contractor or subcontractor in the construction of the public work; and
  (2) the actual per diem wages paid to each worker.

(b) The record shall be open at all reasonable hours to inspection by the officers and agents of the public body.

Added by Acts 1995, 74th Leg., ch. 76, § 5.49(a), eff. Sept. 1, 1995.

§ 2258.025. Payment Greater Than Prevailing Rate Not Prohibited

This chapter does not prohibit the payment to a worker employed on a public work an amount greater than the general prevailing rate of per diem wages.

Added by Acts 1995, 74th Leg., ch. 76, § 5.49(a), eff. Sept. 1, 1995.

11. EQUAL EMPLOYMENT OPPORTUNITY AND AFFIRMATIVE ACTION - This provision only applies to Clean Water State Revolving Fund Program projects and Drinking Water Financial Assistance Program projects which receive funds made directly available by Federal funding and the contract agreement is for more than $10,000.

    During the performance of this contract, the Contractor agrees as follows:

    (a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or natural origin. The Contractor will take affirmative action to ensure that applicants are employed, and that the employees are treated during employment without regard to their race, color, religion, sex, age, handicap, or natural origin. Such action shall include, but not be limited to the following: 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 apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

    (b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, handicap, or natural origin.

    (c) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or worker's representative of the Contractor's commitments under this section , and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

    (d) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, the Age Discrimination in Employment Act of 1967,29 U.S.C.A. 621 (1985), Executive Order 12250 of November 2, 1980, the Rehabilitation Act of 1973, 29 U.S.C.A. 701 et seq. (1985), and of the rules, regulations, and relevant orders of the Secretary of Labor.

    (e) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

    (f) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the portion of the sentence immediately preceding paragraph (a) and the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: PROVIDED, HOWEVER, That in the event a Contractor becomes involved in, or is threatened with , litigation with a subcontractor or vendor as a result of such direction by the administering agency the Contractor may request the United States to enter into such litigation to protect the interest of the United States.

(h) The Contractor will comply with Executive Order 11246 based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR part 60-4 and its efforts to meet the goals established for the geographic area wher the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. The goals are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any office of federal contract compliance programs office or from federal procurement contracting officers. The Contractor is expected to make substantially uniform progress toward its goal in each craft during the period specified.

Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the notice which contains the applicable goals set for minority and female participation and which is set forth in the solicitations from which this contract resulted.

12. ARCHEOLOGICAL DISCOVERIES AND CULTURAL RESOURCES

No activity which may affect a State Archeological Landmark is authorized until the Owner has complied with the provisions of the Antiquities Code of New Mexico. The Owner has previously coordinated with the appropriate agencies and impacts to known cultural or archeological deposits have been avoided or mitigated. However, the Contractor may encounter unanticipated cultural or archeological deposits during construction.

If archeological sites or historic structures which may qualify for designation as a State Archeological Landmark according to the State Historical Preservation Office, or that may be eligible for listing on the National Register of Historic Places in accordance with 36 CFR Part 800, are discovered after construction operations are begun, the Contractor shall immediately cease operations in that particular area and notify the Owner, the NMFA, and the State Historical Preservation Office. The Contractor shall take reasonable steps to

protect and preserve the discoveries until they have been inspected by the Owner's representative and the NMFA. The Owner will promptly coordinate with the State Historical Preservation Office and any other appropriate agencies to obtain any necessary approvals or permits to enable the work to continue. The Contractor shall not resume work in the area of the discovery until authorized to do so by the Owner.

13. ENDANGERED SPECIES

No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of New Mexico Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species.

If a threatened or endangered species is encountered during construction, the Contractor shall immediately cease work in the area of the encounter and notify the Owner, who will immediately implement actions in accordance with the ESA and applicable State statutes. These actions shall include reporting the encounter to the NMFA, the U. S. Fish and Wildlife Service, and the Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the work to continue, or implement other mitigative actions. The Contractor shall not resume construction in the area of the encounter until authorized to do so by the Owner.

14. HAZARDOUS MATERIALS

Materials utilized in the project shall be free of any hazardous materials, except as may be specifically provided for in the specifications.

If the Contractor encounters existing material on sites owned or controlled by the Owner or in material sources that are suspected by visual observation or smell to contain hazardous materials, the Contractor shall immediately notify the Engineer and the Owner. The Owner will be responsible for the testing for and removal or disposition of hazardous materials on sites owned or controlled by the Owner. The Owner may suspend the work, wholly or in part during the testing, removal or disposition of hazardous materials on sites owned or controlled by the Owner. The Owner may suspend the work, wholly or in part during the testing, removal or disposition of hazardous materials on sites owned or controlled by the Owner.

15. PROJECT SIGN

A project IDENTIFICATION SIGN will be provided to the contractor. The contractor shall erect the sign in a prominent location at the construction project site or along a major thoroughfare within the community as directed by the Owner.

16. OPERATION AND MAINTENANCE MANUALS AND TRAINING

(a) The Contractor shall obtain installation, operation, and maintenance manuals from manufacturers and suppliers for equipment furnished under the contract. The Contractor shall submit three copies of each complete manual to the Engineer within

90 days after approval of shop drawings, product data, and samples, and not later than the date of shipment of each item of equipment to the project site or storage location.

(b) The Owner shall require the Engineer to promptly review each manual submitted, noting necessary corrections and revisions. If the Engineer rejects the manual, the Contractor shall correct and resubmit the manual until it is acceptable to Engineer as being in conformance with design concept of project and for compliance with information given in the Contract Documents. Owner may assess Contractor a charge for reviews of same items in excess of three (3) times. Such procedure shall not be considered cause for delay. Acceptance of manuals by Engineer does not relieve Contractor of any requirements of terms of Contract.

(c) The Contractor shall provide the services of trained, qualified technicians to check final equipment installation, to assist as required in placing same in operation, and to instruct operating personnel in the proper manner of performing routine operation and maintenance of the equipment.

(d) Operations and maintenance manuals specified hereinafter are in addition to any operation, maintenance, or installation instructions required by the Contractor to install, test, and start-up the equipment.

(e) Each manual to be bound in a folder and labeled to identify the contents and project to which it applies. The manual shall contain the following applicable items:

(1) A listing of the manufacturer's identification, including order number, model, serial number, and location of parts and service centers.
(2) A list of recommended stock of parts, including part number and quantity.
(3) Complete replacement parts list.
(4) Performance data and rating tables.
(5) Specific instructions for installation, operation, adjustment, and maintenance.
(6) Exploded view drawings for major equipment items.
(7) Lubrication requirements.
(8) Complete equipment wiring diagrams and control schematics with terminal identification.

17. AS-BUILT DIMENSIONS AND DRAWINGS

(a) Contractor shall make appropriate daily measurements of facilities constructed and keep accurate records of location (horizontal and vertical) of all facilities.

(b) Upon completion of each facility, the Contractor shall furnish Owner with one set of direct prints, marked with red pencil, to show as-built dimensions and locations of all work constructed. As a minimum, the final drawings shall include the following:

(1) Horizontal and vertical locations of work.
(2) Changes in equipment and dimensions due to substitutions.
(3) "Nameplate" data on all installed equipment.
(4) Deletions, additions, and changes to scope of work.
(5) Any other changes made

18. INSURANCE

Add new paragraphs immediately after paragraph 5.3 of the General Conditions, to read as follows:

The commercial general liability and other insurance with the exception of workers' compensation shall also include the interests of the OWNER, ENGINEER and ENGINEER's consultant as additional insured as their interests may appear on the insurance certificate.

If the general liability policy is on a "claims made" basis, it shall remain in effect for two years after final payment. If policy is on a "per occurrence" basis, the completed operations insurance coverage shall remain in effect until two years after final payment.

The requirement for evidence of completed operations insurance for at least two years after final payment can be satisfied by a letter from the insurance company acknowledging the requirement, stating the expiration date of the current policy and agreeing to send an appropriate renewal certificate.

The limits of liability for the insurance required by paragraphs 5.3 through 5.7 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations and Limits of coverage under Paragraph 5.3 vary with the Contract Value as shown in the following table:

TABLE 1: **LIMITS OF COVERAGE FOR ALL CONSTRUCTION PROJECTS**	AUTOMOBILE (5.3.7) {Combined Single Limit}	COMMERCIAL LIABILITY (5.3.3 through 5.3.6) {Combined Single Limit}	WORKER'S COMPENSATION (5.3.2) {Employer's Liability} Per Accident Per Employee Per Disease	UMBRELLA (5.3.8) {Combined Single Limit}
CONTRACTS LESS THAN $500,000: Occurrence Aggregate	$ 500,000	$ 500,000 $1,000,000	$ 500,000 $ 500,000	N/A N/A
CONTRACTS $500,000 TO $10,000,000: Occurrence Aggregate	$1,000,000	$1,000,000 $2,000,000	$1,000,000 $1,000,000	$1,000,000 $2,000,000

5.3.1 and 5.3.2 Workers' Compensation, etc. under paragraphs 5.3.1 and 5.3.2 of the General Conditions:

(1) State: Statutory
(2) Employer's Liability: In accordance with Table 1.

Worker's Compensation and Employer's Liability shall include the following:

"The policy shall be endorsed to provide that insurer waives any right of subrogation it may acquire against the OWNER, ENGINEER, and ENGINEER's Consultants in the work, by reason of any payment made on account of injury, including death resulting therefrom, sustained by any employee of the insured."

(3) Definitions:

Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the State, or a coverage agreement showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project. CONTRACTOR agrees not to preclude coverage under their policy if they hire a subcontractor or service provider without worker's compensation.

Duration of the project - includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

Persons providing services on the project ("subcontractor" in NM. Labor Code 406.5096) includes all persons or entities performing all or part of the services the CONTRACTOR has undertaken to perform on the projects, regardless of whether that person contracted directly with the CONTRACTOR and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

(4) The CONTRACTOR shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of the Labor Code for all employees of the CONTRACTOR providing services on the project, for the duration of the project.

(5) The CONTRACTOR must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

5.3.3, 5.3.4, 5.3.5 and 5.3.6 Commercial General Liability (under paragraphs 5.3.3 through 5.3.6 of the General Conditions):

(1) Combined Single Limits (Bodily Injury and Property Damage); Operations and Products Liability, Broad Form Property Damage: In amounts specified in Table 1.

(2) Personal Injury, with employment exclusion deleted: In amount specified in Table 1.

5.3.7. Comprehensive Automobile Liability, (combined single limit) covering use of owned, non-owned, hired, rented or leased vehicles: In accordance with Table 1.

5.3.8. Umbrella Liability:

The CONTRACTOR shall purchase and maintain until final payment Umbrella Liability Insurance. This insurance shall include the interests of the OWNER, ENGINEER and ENGINEER's consultants in the Work (all of whom shall be included as additional insured parties) and shall insure against all claims in excess of the limits provided under workers' compensation and employers' liability, commercial automobile liability and general liability policies. Subrogation against the OWNER and other additional insured parties shown above shall be waived to the same extent as was required in the underlying policies to this Umbrella(s). The limits of liability shall be in accordance with Table 1.

END OF SECTION

SECTION 00840
GENERAL WAGE REQUIREMENTS

BILL RICHARDSON
GOVERNOR

KEN ORTIZ
SECRETARY

NEIL MEONI
DEPTUY SECRETARY

STATE OF NEW MEXICO
DEPARTMENT OF WORKFORCE SOLUTIONS
Public Works Bureau
625 Silver Ave SW, Suite 410
Albuquerque, NM 87102
(505) 841-4400 / FAX (505) 841-4423

TERESA C. GOMEZ
DEPUTY SECRETARY

Dear Owner/Contracting Agency:

The enclosed wage decision packet must be used in the contract resulting from the bid opening on this project and, excluding the Notification of Award, and Subcontractor List, **MUST BE FORWARDED** to the prospective general contractor that has been awarded the bid. The general contractor must post the complete wage decision at the job site in an easily accessible place. Failure to do so may result in fines. Furthermore, each subcontractor must receive a copy of the wage decision and use these rates to pay all employees.

LABOR ENFORCEMENT FUND – STRICTLY ENFORCED

NOTE: Any general contractors must be registered with the **Labor Enforcement Fund** prior to the bidding process or the bid shall be deemed invalid. All subcontractors or tier subcontractors bidding more than $60,000 on a Public Works contract **MUST** be registered with the Labor & Industrial Division. Visit our website at www.dws.state.nm.us, click "Public Works" for a Labor Enforcement Fund Form and other forms. **REMINDER TO THOSE PREPARING BID DOCUMENTS:** IF BIDS ARE NOT OPENED BY 12/31/10; NEW WAGE RATES *MAY* BE REQUIRED. IF YOU HAVE ANY QUESTIONS, PLEASE CALL **505-841-4417**.

Weekly certified payrolls are required on all public works projects. All certified payrolls must be submitted to the general contractor and the owner/contracting agency. The general contractor must have copies of certified payrolls available to this office within ten days of a written request. Please do **NOT** submit any certified payrolls to our office unless our office requests them.

NM Apprenticeship and Training Fund payments are paid by each general contractor/subcontractor/tier(s) to either an approved apprenticeship program or to our office **(NMDWS, Public Works Bureau, PO Box 27428, Albuquerque, NM 87125-7428).** Payments are due for all hours in each trade a company has on the job site that has an apprenticeship contribution rate on the state wage decision. These payments are for the hours worked by both journeyman and apprentices, regardless of whether the company has apprentices or not. If the project has both Federal and State funding, the payments are still required. Only when the project has all Federal funds, is the project exempt. On Type "A" projects, where there are no contribution rates, apprenticeship payments do not apply. On projects with two types of construction, the contribution applies for the work under the type construction with contribution rates. Failure to pay Apprenticeship contributions is a violation of the Apprentice and Training Act and may result in penalties. If you have any Apprenticeship questions, please feel free to call (505) 841-4403.

BILL RICHARDSON
GOVERNOR

KEN ORTIZ
SECRETARY

STATE OF NEW MEXICO
DEPARTMENT OF WORKFORCE SOLUTIONS
Public Works Bureau
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TERESA C. GOMEZ
DEPUTY SECRETARY

NOTICE TO ALL PUBLIC WORKS CONTRACTORS

PERTINENT INFORMATION IN ACCORDANCE WITH THE NM PUBLIC WORKS MINIMUM WAGE ACT

The Public Works Bureau insures compliance of the Public Works Minimum Wage Act (13-4-11 through 13-4-17, NMSA 78). This office issues prevailing wage rates for each project for inclusion in the bid documents. After a project contract is signed, the **Notification of Award (NOA)** and **Subcontractor List** must be completed and sent to the Public Works Bureau by the Contracting Agency or it's agent. The **Statement of Intent to Pay Prevailing Wages** must be completed by the contractors performing work on the project and sent through the General Contractor to the Public Works Bureau. A Statement of Intent to Pay Prevailing Wages is required from each construction contractor before they start work on a state or locally funded construction project costing a total of $60,000 or more. Every contractor (general, sub, second tier, etc.) must pay those rates through weekly payment and payroll.

Wage rates include a base rate and a fringe rate of pay. In many cases, an additional cost to the contractor is an apprenticeship contribution rate per hour for both journeyman and apprentices. A **monthly apprenticeship contribution compliance form and check for payment** (when applicable) is required and should be sent to NMDWS, Public Works Bureau, PO Box 27428, Albuquerque, NM 87125-7428. After a contractor completes work on a project, but before his final payment, an **Affidavit of Wages Paid** must be completed and sent to the Public Works Bureau – through the General Contractor.

Each employee must receive the full base and fringe rate per hour for all hours worked in their job classification, regardless of the qualifications or license held. The only exception is for workers with a current certification in approved apprenticeship programs. The apprentice must also receive the full benefit of the fringe rate. Fringe benefits may also be paid into approved health benefit programs, pension programs, life insurance programs, company holiday and vacation programs and/or training programs that are not apprenticeship programs (*i.e.:* an OSHA 10 safety program). If fringe benefits are paid to a third-party account, the employee must have quarterly statements provided to them. The third way of paying fringe benefits, is to pay as a combination of cash and into approved programs. This office will sometimes ask for complete breakdowns of all payment to insure total compliance.

The minimum wage, or greater, as shown on individual wage decisions must be paid. "In addition, the contractor, subcontractor employer or any person acting as a contractor shall be liable to any affected employee for liquidated damages in the sum of one hundred dollars ($100.00) for each calendar day on which a contractor, subcontractor, employer or any person acting as a contractor has willfully required or permitted an individual laborer or mechanic to work in violation of the provisions of the Public Works Minimum Wage Act" (13-4-14.C, NMSA 78). When questions arise about the requirements of the Act or the Public Works Minimum Wage Act Policy Manual they must be resolved as soon as possible. If you have questions, please call (505) 841-4417.

LABOR ENFORCEMENT FUND
(STRICTLY ENFORCED)

13-4-13.1 Public works contracts; registration of contractors and subcontractors.

A. Except as otherwise provided in this subsection, in order to submit a bid valued at more than sixty thousand dollars ($60,000) in order to respond to a request for proposals or to be considered for award of any portion of a public works project greater than sixty thousand dollars ($60,000) for a public works project that is subject to the Public Works Minimum Wage Act [13-4-10 NMSA 1978], the contractor, serving as a prime contractor or not, shall be registered with the division. Bidding documents issued or released by a state agency or political subdivision of the state shall include a clear notification that each contractor, prime contractor or subcontractor is required to be registered pursuant to this subsection. The provisions of this section do not apply to vocational classes in public schools or public post-secondary educational institutions.

B. The state or any political subdivision of the state shall not accept a bid on a public works project subject to the Public Works Minimum Wage Act from a prime contractor that does not provide proof or required registration for itself.

C. Contractors and subcontractors may register with the division on a form provided by the division and in accordance with workforce solutions department rules. The division shall charge an annual registration fee of two hundred dollars ($200). The division shall issue to the applicant a certificate of registration within fifteen days after receiving from the applicant the completed registration form and the registration fee.

D. Registration fees collected by the division shall be deposited in the labor enforcement fund.

13-4-14.1 Labor enforcement fund; creation; use.

The "labor enforcement fund" is created in the state treasury. The fund shall consist of contractor and subcontractor registration fees collected by the labor and industrial division of the labor department and all investment and interest income from the fund. The fund shall be administered by the division, and money in the fund is appropriated to the division for administration and enforcement of the Public Works Minimum Wage Act [13-4-10 NMSA 1978]. Money in the fund shall not revert to the general fund at the end of a fiscal year.

13-4-14.2 Registration cancellation, revocation, suspension; injunctive relief.

The director may:

A. cancel, revoke or suspend with conditions, including probation, the registration of any party required to be registered pursuant to the Public Works Minimum Wage Act [13-4-10 NMSA 1978] for failure to comply with the registration provisions or for good cause, subject to appeal pursuant to Section 13-4-15 NMSA 1978; and

B. seek injunctive relief in district court for failure to comply with the registration provisions of the Public Works Minimum Wage Act.

LABOR ENFORCEMENT FUND

NEW MEXICO DEPARTMENT OF WORKFORCE SOLUTIONS
LABOR RELATIONS DIVISION
APPLICATION FOR PUBLIC WORKS
CONTRACTOR REGISTRATION

All applications must be accompanied by $200 payable to the "LABOR ENFORCEMENT FUND"
Do Not Send Cash

Send to: **Labor Enforcement Fund**
PO Box 27679
Alb., NM 87125-7679

1. _____
Contractor/Subcontractor – Company Trade Name

_____
Mailing Address City State Zip Code

_____
Area Code / Telephone Number

_____
E-Mail Address or Fax Number

2. _____
Printed Name of First Qualifying Party (Owner of Company)

3. Type of Business ☐Individual/Sole Proprietor ☐Partnership ☐Corporation ☐Other _____

4. INCOMPLETE APPLICATIONS WILL BE RETURNED TO SENDER

APPLICANT STATEMENT

As the responsible applicant-contractor, I understand:

- the application is subject to verification and that I agree to provide any additional documentation as requested by the Labor Relations Division director.
- failure to provide full and timely disclosure of any required information or documentation may result in the denial of this application for registration.
- that payment in the exact amount of Two Hundred Dollars USD ($200.00) is due with this application.
- that registration is for one calendar year (365 days) from the date notice of registration is posted on the Department of Workforce Solutions website. <www.dws.state.nm.us>
- that I am submitting this application for the purpose of a legal transaction with the State of New Mexico Department of Workforce Solutions.
- that failure to send this application and payment to the address shown above will result in delayed or denied registration.
- that it is my (the contractor's) responsibility to ensure that my registration is current.

I certify, under penalty of perjury, that the information contained in this application for registration is accurate, true, and complete to the best of my knowledge.

_____ _____
Signature Date

_____
Print Name and Title

Revised July 16, 2007

STATEMENT OF INTENT TO PAY PREVAILING WAGES

To Be Filled ***Before*** Construction Starts

Please type or print in ink. Incomplete forms will be returned without approval.

Mail or fax to: Public Works Bureau, 625 Silver Ave SW, Ste 410, Albuquerque, NM 87102

Call: (505) 841-4409 - Fax: (505) 841-4423 (Fax transmission preferred)

GENERAL CONTRACTOR INFORMATION		
Company Name:		
Address:		
City:	State:	Zip:
Phone:	Fax:	
Estimated Start Date:	**State Wage Dec. #:**	
Project Title:	Project Physical Address:	
Total Contract Amt:	Estimated Completion Date:	
PRINT NAME:	SIGNATURE:	

SUBCONTRACTOR:	**Subcontract amount:**	Start Date of Work
Company Name:		on This Project:
Address:		
City:	State:	Zip:
Phone:	Fax:	
PRINT NAME:	SIGNATURE:	

2ND. TIER SUB	**2nd Tier Contract amount**	Start Date of Work
Company Name:		on This Project::
Address:		
City:	State:	Zip:
Phone:	Fax:	
PRINT NAME:	SIGNATURE:	

I hereby certify that the above information is correct and that all workers I employ on this public works project were paid no less than the Prevailing Wage Rate(s) as determined by the Department of Workforce Solutions, Public Works Bureau for this project as identified by the State Wage Decision No. I understand that contractors who violate Prevailing Wage Laws (i.e., incorrect job classification, improper payment of prevailing wages, and/or overtime, etc.), are subject to debarment procedures and shall be required to pay any back wages due to workers. (Ref. LID Public Works Minimum Wage Act Policy Manual (11.1.2 NMAC) & Public Minimum Wage Act (13-4-11 through 13-4-18, NMSA 78)).

LID Approval of This Form **Date**

NOTE: After 7/01/09, ALL tiers of contractors with contracts over $60,000, MUST be registered with the Department of Workforce Solutions, Public Works Bureau. The registration form is available on our web page at www.dws.state.nm.us under Public Works and Additional Forms. Fill in the Labor Enforcement Fund form and mail to the post office box listed at the top of the form. Go to the same page that the form is on to check the list of Registered Contractors.

(See IMPORTANT information on back!)

INSTRUCTIONS FOR FILLING OUT STATEMENT OF INTENT

FOR GENERAL CONTRACTOR:

1. Fill in general contractor information and provide signature.
2. State Wage Dec. No. as listed in bid documents. (example: BE-07-0123 B)
3. Project Title - Listed in bid documents. Whatever the project is.
4. Project Physical Address - Exact location of project (job site).
5. Estimated Start & Completion Dates of project
6. General Contractor's Contract Amount - Project cost .

FOR SUBCONTRACTOR:

1. Fill in general contractor information, but general contractor signature is not needed.
2. Fill in subcontractor section as indicated and provide signature. Send to GC. Sub-contract amount – list subcontract amount.
   PLEASE NOTE: A SEPARATE SIGNED FORM IS NEEDED FOR EACH CONTRACTOR.

FOR 2ND. TIER SUB:

1. Fill in general contractor information, but general contractor signature is not needed.
2. Fill in subcontractor section; subcontractor signature not needed. Send to GC.
3. Fill in 2nd. Tier sub section and provide signature.
4. 2nd Tier contract amount – list amount.

For 3rd TIER & HIGHER: Attach a copy of this completed form & list the 3rd tier contractor info under the 2nd tier contractor with a note.

Effective July 1, 2009 - ALL contractors bidding on public works contracts for $60,000 or more MUST be registered with the Labor & Industrial Division prior to bidding the project. The registration form may be found on the DWS web page at www.dws.state.nm.us under Public Works and Forms. Print the Labor Enforcement Fund Form and mail it along with a check for $200 to the address at the top of the form. A list of registered contractors may be reviewed on the same page as the registration form. Registration is good for one year, and after registration, contractors may bid as many contracts as they wish. Upon expiration of the registration, contractors may complete projects, but in order to bid new ones after the expiration, they must register again. NOTE: All Statements of Intent to Pay Prevailing Wages must go to the GC to submit to the Department of Workforce Solutions for approval. DWS will return approved Affidavits to the GC who should forward to the subs.

NOTE: If form is faxed, we do not need the originals, unless the fax is not legible.

AFFIDAVIT OF WAGES PAID

To Be Filled ***After*** Construction Is Complete

Please type or print in ink. Incomplete forms will be returned without approval.

Mail or fax to: Public Works Bureau, 625 Silver Ave SW, Ste 410, Albuquerque, NM 87102

Call (505) 841-4409 Fax: (505) 841-4423 (Fax transmission is preferred)

GENERAL CONTRACTOR INFORMATION		
Company Name:		
Address:		
City:	State:	Zip:
Phone:	Fax:	
Estimated Completion Date:	**State Wage Dec. #:**	
Project Title:	Project Physical Address:	
PRINT NAME:	SIGNATURE:	

Subcontractor:		Date you completed work on
Company Name:		This project
Address:		DATE:
City:	State:	Zip:
Phone:	Fax:	
PRINT NAME:	SIGNATURE:	

2ND. TIER SUB: (Who is paying you? Fill in name above)		Date you completed work on
Company Name:		This project
Address:		DATE:
City:	State:	Zip:
Phone:	Fax:	
PRINT NAME:	SIGNATURE:	

I hereby certify that the above information is correct and that all workers I employ on this public works project were paid no less than the Prevailing Wage Rate(s) as determined by the Department of Workforce Solutions, Public Works Bureau for this project as identified by the State Wage Decision No. I understand that contractors who violate Prevailing Wage Laws (i.e., incorrect job classification, improper payment of prevailing wages, and/or overtime, etc.), are subject to debarment procedures and shall be required to pay any back wages due to workers. (Ref. LID Public Works Minimum Wage Act Policy Manual (11.1.2 NMAC) & Public Minimum Wage Act (13-4-11 through 13-4-18, NMSA 78)).

LID Approval of this Form **Date**

NOTE: After 7/01/09, ALL tiers of contractors with contracts over $60,000, MUST be registered with the Department of Workforce Solutions, Public Works Bureau. The registration form is available on our web page at www.dws.state.nm.us under Public Works and Additional Forms. Fill in the Labor Enforcement Fund form and mail to the post office box listed at the top of the form. Go to the same page that the form is on to check the list of Registered Contractors.

(See IMPORTANT information on back!)

Revised 1/25/10

INSTRUCTIONS FOR FILLING OUT AFFIDAVIT OF WAGES PAID

FOR GENERAL CONTRACTOR:

1. Fill in general contractor information and provide signature.
2. State Wage Dec. No. as listed in bid documents. (example: BE-07-0123 B)
3. Project Title - Listed in bid documents. Whatever the project is.
4. Project Physical Address - Exact location of project (job site).
5. Estimated Completion Date of Project

FOR SUBCONTRACTOR:

1. Fill in general contractor information, but general contractor signature is not needed.
2. Fill in subcontractor section as indicated and provide signature. Send to GC. PLEASE NOTE: A SEPARATE SIGNED FORM IS NEEDED FOR EACH CONTRACTOR

FOR 2ND. TIER SUB:

1. Fill in general contractor information, but general contractor signature is not needed.
2. Fill in subcontractor section; subcontractor signature not needed. Send to GC.
3. Fill in 2nd. Tier sub section and provide signature.
4. 2nd Tier contract amount – list amount.

For 3rd TIER & HIGHER: Attach a copy of this completed form & list the 3rd tier contractor info under the 2nd tier contractor with a note.

Effective July 1, 2009 - ALL contractors bidding on public works contracts for $60,000 or more MUST be registered with the Labor & Industrial Division prior to bidding the project. The registration form may be found on the DWS web page at www.dws.state.nm.us under Public Works and Forms. Print the Labor Enforcement Fund Form and mail it along with a check for $200 to the address at the top of the form. A list of registered contractors may be reviewed on the same page as the registration form. Registration is good for one year, and after registration, contractors may bid as many contracts as they want. Upon expiration of the registration, contractors may complete projects, but in order to bid new ones after the expiration, they must register again. NOTE: All Affidavits of Wages Paid must go to the GC to submit to the Department of Workforce Solutions for approval. DWS will return approved Affidavits to the GC who should forward them to the subs.

NOTE: If form is faxed, originals are not required to be sent, unless the fax is illegible.

TYPE "A" - STREET, HIGHWAY, UTILITY & LIGHT ENGINEERING

Effective January 1, 2010

Trade Classification	Base Rate	Fringe Rate
Bricklayer/Blocklayer/Stonemason	17.74	0.26
Carpenter/Lather	15.99	0.44
Cement Mason	15.52	0.26
Ironworker	21.77	6.03
Painter (Brush/Roller/Spray)	17.56	0.44
Electricians (outside)		
Groundman	26.79	11.03
Equipment Operator	29.61	11.03
Lineman/Wireman or Tech	30.20	11.03
Cable Splicer	31.38	11.03
Plumber/Pipefitter	28.30	4.07
Laborers		
Group I	13.73	0.35
Group II	14.03	0.35
Group III	14.43	0.35
Operators		
Group I	15.74	0.26
Group II	15.94	0.26
Group III	16.52	0.26
Group IV	16.54	0.26
Group V	16.53	0.26
Group VI	16.69	0.26
Group VII	16.74	0.26
Group VIII	16.89	0.26
Group IX	17.39	0.26
Group X	18.19	0.26
Truck Drivers		
Group I	13.32	0.26
Group II	13.52	0.26
Group III	13.72	0.26
Group IV	13.92	0.26

NOTE: SUBSISTENCE AND INCENTIVE PAY DO NOT APPLY TO TYPE "A" CONSTRUCTION.

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TYPE "B" - GENERAL BUILDING

Effective January 26, 2010

Trade Classification	Base Rate	Fringe Rate	Apprenticeship	Subsistence & Incentive Rates
Asbestos Worker - Heat & Frost Insulator	27.35	10.23	$0.20	
Boilermaker	18.40	3.78	$0.20	
Bricklayer/Blocklayer/Stonemason	22.85	6.00	$0.74	
Carpenter/Lather	20.86	6.25	$0.36	
Cement Mason	17.72	7.45	$0.34	
Electricians				
Outside Classifications				
Groundman	22.32	8.62	$0.36	
Equipment Operator	25.14	8.62	$0.36	
Lineman/Tech	25.73	8.62	$0.36	
Cable Splicer	26.91	8.62	$0.36	
Inside Classifications				
Wireman/Technician	27.80	8.06	$0.37	**Refer to Note 1**
Cable Splicer	29.53	8.06	$0.37	
Sound Classifications				
Installer	23.39	8.31	$0.24	
Technician	24.94	8.31	$0.24	
Soundman	27.01	8.31	$0.24	
Elevator Constructor	33.61	14.99	$0.24	
Elevator Constructor Helper	15.55	3.56	$0.25	
Glazier	20.15	4.15	$0.35	
Ironworker	25.00	10.00	$0.53	**Refer to Note 2**
Painter (Brush/Roller/Spray)	16.60	3.88	$0.36	
Paper Hanger	19.71	8.42	$0.35	
Drywall Finisher/Taper	19.64	3.91	$0.34	
Plasterer	18.65	7.15	$0.35	
Plumber/Pipefitter	28.30	11.00	$0.63	**Refer to Note 3**
Roofer	15.18	0.50	$0.54	
Sheetmetal Worker	26.56	13.41	$0.45	**Refer to Note 4**
Soft Floor Layer	20.74	4.40	$0.35	
Sprinkler Fitter	24.41	11.27	$0.28	
Tile Setter	14.80	1.20	$0.00	
Tile Setter Helper	13.00	1.02	$0.00	
Laborers				
Group I	15.04	4.25	$0.27	
Group II	15.61	4.25	$0.27	
Group III	15.91	4.25	$0.27	
Group IV	16.01	4.25	$0.27	
Group V	16.21	4.25	$0.27	
Group VI	16.36	4.25	$0.27	

TYPE "B" - GENERAL BUILDING

Effective January 26, 2010

Trade Classification	Base Rate	Fringe Rate	Apprenticeship	Subsistence & Incentive Rates
Operators				
Group I	28.03	5.16	$0.50	
Group II	29.07	5.16	$0.50	
Group III	29.15	5.16	$0.50	
Group IV	29.21	5.16	$0.50	
Group V	29.27	5.16	$0.50	
Group VI	29.37	5.16	$0.50	
Group VII	29.47	5.16	$0.50	
Group VIII	30.55	5.16	$0.50	
Truck Drivers				
Group I	20.56	5.34	$0.55	
Group II	20.68	5.34	$0.55	
Group III	20.76	5.34	$0.55	
Group IV	20.88	5.34	$0.55	
Group V	20.93	5.34	$0.55	
Group VI	21.03	5.34	$0.55	
Group VII	21.13	5.34	$0.55	
Group VIII	21.27	5.34	$0.55	
Group IX	21.42	5.34	$0.55	

NOTE: SUBSISTENCE AND INCENTIVE RATES BY TRADE & LOCATION

#1 - Inside Electricians working at a Los Alamos County job site get $4.10/hr. subsistence pay plus base/fringe.

#1 - Inside Electricians working at a Lea County job site get $75.00/day subsistence pay plus base/fringe.

#2 - Ironworkers working on projects 50+ miles over the most direct regularly traveled route from Albuquerque, or the employee's home, whichever is closer, shall be paid $5.00/hr. subsistence plus base/fringe. The "Big I" Interchange in Albuquerque, or the employee's home, respectively shall be used as basing points. The current State of New Mexico Official Highway Map shall be the reference for routes and distances. All of Santa Fe County shall be $5.00/hr subsistence area.

#3 - Plumbers/Pipefitters working at a Los Alamos County job site get $.80/hr. incentive pay plus base/fringe.

#4 - Sheet Metal Workers working at a Los Alamos County job site get $2.00/hr. incentive pay plus base/fringe.

#4 - Sheet Metal Workers living 60+ miles from a San Juan County job site get $3.00/hr. subsistence pay plus base/fringe.

#4 - Sheet Metal Workers working 90+ miles from contractors homebase & employees home get $50.00/day subsistence pay plus base/finge.

TYPE "H" - HEAVY ENGINEERING

Effective January 26, 2010

Trade Classification	Base Rate	Fringe Rate	Apprenticeship
Asbestos Worker - Heat & Frost Insulator	27.35	10.23	0.20
Boilermaker	18.50	3.31	0.56
Bricklayer/Blocklayer/StoneMason	20.78	4.73	0.54
Carpenter/Lather	20.86	6.00	0.35
Millwright/Piledriver	26.38	5.96	0.40
Cement Mason	21.83	6.98	0.40
Electricians			
Outside Classifications			
Groundman	21.14	10.23	0.25
Equipment Operator	23.96	10.23	0.25
Lineman/Tech	24.55	10.23	0.25
Cable Splicer	25.73	10.23	0.25
Inside Classifications			
Wireman/Tech	26.85	8.36	0.54
Cable Splicer	28.58	8.36	0.54
Sound Classifications			
Installer	0.00	0.00	0.00
Technician	0.00	0.00	0.00
Soundman	0.00	0.00	0.00
Glazier	0.00	0.00	0.00
Ironworker	31.04	9.40	0.42
Painter (Brush/Roller/Spray)	16.00	3.78	0.00
Plumber/Pipefitter	28.30	11.00	0.32
Roofer	19.56	11.34	0.23
SheetmetalWorker	27.56	14.20	0.42
Operators			
Group I	33.08	6.98	0.35
Group II	33.28	6.98	0.35
Group III	33.86	6.98	0.35
Group IV	33.88	6.98	0.35
Group V	33.88	6.98	0.35
Group VI	34.03	6.98	0.35
Group VII	34.08	6.98	0.35
Group VIII	34.23	6.98	0.35
Group IX	34.73	6.98	0.35
Group X	35.53	6.98	0.35

TYPE "H" - HEAVY ENGINEERING

Effective January 26, 2010

Trade Classification	Base Rate	Fringe Rate	Apprenticeship
Laborers			
Group I	14.95	4.27	$0.26
Group II	15.25	4.27	$0.26
Group III	15.55	4.27	$0.26
Group IV	16.12	4.27	$0.26
Group V	16.37	4.27	$0.26
Group VI	15.10	4.27	$0.26
Group VII	15.04	4.27	$0.26
Group VIII	15.50	4.27	$0.26
Group IX	15.70	4.27	$0.26
Group X	16.37	4.27	$0.26
Truck Drivers			
Group I	15.05	4.94	$0.26
Group II	15.25	4.94	$0.26
Group III	15.45	4.94	$0.26
Group IV	15.65	4.94	$0.26

NOTE: SUBSISTENCE AND INCENTIVE PAY DO NOT APPLY TO TYPE "H" CONSTRUCTION.

BILL RICHARDSON
GOVERNOR

KEN ORTIZ
SECRETARY

STATE OF NEW MEXICO
DEPARTMENT OF WORKFORCE SOLUTIONS
Public Works Bureau
625 Silver Ave SW, Suite 410
Albuquerque, NM 87102
(505) 841-4400 / FAX (505) 841-4423

TERESA C. GOMEZ
DEPUTY SECRETARY

NOTICE

Public Works Apprenticeship and Training Act

Statute 13-4D-4.B states:

"Public works construction projects, except for street, highway, bridge, road, utility or maintenance contracts with employers who elect not to participate in training, shall not be constructed unless an employer agrees to make contributions to approved apprentice and training programs in New Mexico in which the employer is a participant or to the public works apprentice and training fund administered by the public works bureau of the labor and industrial division of the labor department. Contributions shall be made in the same manner and in the same amount as apprentice and training contributions required pursuant to wage rate determinations made by the director."

For a copy of the above-mentioned act, please contact our office at **(505) 841-4403**.

For contractors that are not participants in an approved apprenticeship program, submit Apprenticeship & Training Contribution Compliance Statement and Payment to:

NMDWS
Public Works Bureau
PO Box 27428
Albuquerque, NM 87125-7428

APPRENTICESHIP CONTRIBUTION PROGRAM

The following are easy reminders regarding this program:

1. For "B", "C", & "H" Projects: Whenever you have any workers on the job (even if you are not using apprentices), you are required to pay into the Apprenticeship Training Program as outlined in the Apprenticeship & Training Act. This applies to all contractors, subcontractors, 2nd tiers, etc. Your wage rates will show which jobs have apprenticeship contributions.

2. If you have apprentices on the job, they must have a journeyman working with them. The ratio must be one-to-one.

3. The Apprenticeship Contribution is not considered part of the fringe benefits. It is totally separate.

4. The Apprenticeship Compliance Statement from our office (or our website) is the only form you may use. Do NOT modify our form or generate your own.

5. As noted on the Apprenticeship Compliance Statement, these forms are due on the 15th of every month for the length of the project. If no work was done for that month, send us a copy letting us know there was no work done.

6. Submit Apprenticeship Compliance Statements with payments to: NMDWS, Public Works Bureau, PO Box 27428, Albuquerque, NM 87125-7428

New Mexico Department of Workforce Solutions - Public Works Bureau
625 Silver Ave SW, Suite 410 - Albuquerque, NM 87102
Phone:(505) 841-4408 Fax: (505) 841-4423

Bill Richardson
Governor

Ken Ortiz
Department of Workforce
Solutions
Secretary

CHECK OUT THE DEPARTMENT OF WORKFORCE SOLUTIONS WEBSITE FOR VALUABLE INFORMATION

www.dws.state.nm.us

Click on "Public Works"

~ OR ~

PHONE:

Public Works Questions:
Patricia – (505) 841- 4409
Lori – (505) 841-4408
Nicolina – (505) 841 - 4403
Michael - (505) 841- 4417

FAX Number:
(505) 841- 4423

Apprenticeship Questions:
(505) 841- 4403

New Mexico Public Works

Construction

The NM Public Works Minimum Wage Act applies to employers and employees working on state/locally funded public works construction jobs. Information here is not an official interpretation of the Act, but this pamphlet can serve as a general guide to the law. You may find additional information and Rules & Regulations derived from the Act on the NMDWS web page at **www.dws.state.nm.us**

1. How does the Act apply?
The Act and the Public Works Bureau's Policy Manual govern all public works (PW) construction projects costing more than $60,000 and funded in part or in whole by state/local funds. Wages set by LID must be paid as a minimum. Employees must be paid weekly. If the project has federal funding as well, the pay is figured by comparing the total rate in each trade from the state and federal wage decisions and paying the higher of the two.

2. What is a Wage Decision?
A wage decision is the set of wage rates for a specific public works construction project. The person putting together project bid documents requests a wage decision by submitting a request on our website that describes the scope of work. The type of work determines the type of rates issued. The four sets of rates are for:

"A" – Street, Highway, Utility and Light Engineering;
"B" – General Building;
"C" – Residential; and
"H" – Heavy Engineering.

If 80% of the project is *not* in one type of construction, two or more types of rates may be issued. A wage decision expires when new wage rates are approved – unless the bid opening takes place, or is within 10 days of taking place. When the bids are opened before the expiration, those rates are good for the life of the project.

3. When is a new Wage Decision required?
A new wage decision is required when the bids are not opened within 10 days after the approval of new wage rates. Then both a new wage decision and new rates will apply.

4. What is sent along with a Wage Decision?
Several forms are sent out with the wage decision that must be used by contractors:

a. A Notification of Award must be sent to the Public Works Bureau from the contracting agency or general contractor listing all subcontractors before work starts;
b. A Statement of Intent to Pay Prevailing Wages must be sent to the contracting agency from each contractor, subcontractor and second tier contractor before work starts;
c. An Apprenticeship Contribution Compliance Statement (for all except Type "A" projects) is due by the 15th of each month from all contractors, subcontractors, and second tier contractors;
d. A wage rate poster must be displayed in an easily accessible place at the job site to show all employees what their minimum rates of pay are; and
e. An Affidavit of Wages Paid must be submitted to the contracting agency after a contractor finishes work but before the final payment.

5. When does overtime pay start?
Overtime pay starts after 40 hours of work in a seven-day workweek for the same employer, regardless of how many projects the employee works on.

6. How is overtime pay computed?
Overtime pay is 1.5 times the base pay with fringes added back. For example, if the base is $12/hr. and the fringe benefit is $2/hr., the total overtime rate is 12 x 1.5 + 2 or 18 + 2 = 20.

7. How can I file a wage claim?
If you think your employer owes you more wages, you may file a wage claim at any NMDWS office, or call our Hotline at 1-888-370-0013. You should keep copies of pay stubs, a diary of when and where you worked, and the work performed.

8. What does the term "at will State" mean?
New Mexico is an "at will State" and the term means that an employer may hire and fire employees at will.

PAYROLL STATEMENT OF COMPLIANCE

Wage Decision No.: _____

I, _____, _____ do hereby state:
(Name of Signatory Party) (Title)

(1) that I pay or supervise the payment of the persons employed by: _____
(Contractor or Subcontractor)
on the _____
(Name of Project)
that during the payroll period commencing on the _____day of_____, 20__and ending the _____day of _____, 20__, all persons employed on said project have been paid the full weekly wages earned, that no deductions have been or will be made either directly or indirectly to or on behalf of said _____ from the full weekly wages earned by any
(Contractor or Subcontractor)
person, other than deductions permitted by law. Anyone found in violation of the NM Public Works Minimum Wage Act [13-4-11 to 13-4-17 NMSA 1978] could be subject to penalties and debarment.

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborer or mechanic conform with the work he performed.

(3) That any apprentice(s) employed in the above period are duly registered in a bona fide apprenticeship program registered with the State Apprenticeship agency recognized by the Bureau of Apprenticeship & Trng., US Dept. of Labor, or properly enrolled in a bona fide training program approved for application on public works construction projects by the appropriate state (SAC) and/or federal agency(ies) (BAT) if and as required by law & applicable federal regulation.

(4) **FRINGE BENEFITS:** ***(Please Spell Out Any/All Acronyms)***

__(a) ARE PAID TO APPROVED PLAN, FUND, OR PROGRAM in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above-referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate program for the benefit of such employees.

If paid to an approved plan, fund, or program, please fill out name of program w/fringe breakdown per hour below:

Name of Program Used for Fringe Benefits:				
Pension =	**Health/Welfare =**	**Holiday/Vac. =**	**Life Ins. =**	**Training* =**
(If additional space is needed for more programs/fringe breakdowns, please attach a separate page.)				

FRINGE BENEFITS:

1. *Pension*
2. *Health/Welfare*
3. *Holiday/Vacation*
4. *Life Insurance*
5. *Training (not Apprenticeship) **

FRINGE BREAKDOWN SAMPLE:

Fringe Benefit:	Amount:
401(K) Plan	$8.98/hr.
Vacation	$2.23/hr.

__(b) **Paid to Union Program** - If paid to a Union and fringe benefits differ from employee to employee, and/ or job contract, please provide fringe breakdown for each employee and attach copy of Union contract.

__(c) ARE PAID IN CASH, each laborer or mechanic listed in the above-referenced payroll has been paid as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract.

Section 13-1D-1 to Section 13-1D-8, NMSA 1978 provides for employers to agree to make contributions to approved apprentice & training programs in New Mexico in which the employer is a participant to the public works apprentice and training fund administered by the Public Works Bureau of the Labor & Industrial Division of the New Mexico State Department of Labor. Contributions shall be made in the same manner and in the same amount as apprentice and training contributions required pursuant to wage rate determinations made by the Labor & Industrial Division Director.

APPRENTICESHIP CONTRIBUTIONS: (Please check applicable blank)

__Check paid to: NM Public Works Apprenticeship & Training Fund - Public Works Bureau, Labor & Industrial Div.

__Check paid to: _____ _____
(Name & address of approved Apprenticeship & Training Program) (Program No.)

Print Name of Certifying Official:	Signature of Certifying Official:	Title & Phone No.:	Date:

The willful falsification of any of the above statements may subject the contractor or subcontractor to civil or criminal prosecution. See Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

Revised April/2006

New Mexico Department of Workforce Solutions – Public Works Section
P.O. Box 27428, Albuquerque, NM 87125-7428 (new address for payments only)
(505) 841-4403 (505) 841-4420 - Fax

(Payment is not required for Type "A" Projects – Street, Highway, Utility & Light Engineering)

Apprenticeship & Training Contribution Compliance Statement

For the **Month** of:_____,20___ ____

(*Circle One*)
Contractor / Sub / 2nd. Tier Sub: _____

Address:_____ City:_____ State:_____ Zip:_____ Phone_____

Project Name: State Wage Dec.No.

(DO NOT submit payments on 100% federally-funded projects)

(SAMPLE ENTRY) Classification(s)	Week Ending 8/4	Week Ending 8/11	Week Ending 8/18	Week Ending 8/25	Week Ending 8/31	Total Hours	Appr. Rate per Hour	Total Classif. Contr.Amt
LABORER	4	7	0	0	30	41	.20	8.20
Classification(s)	Week Ending	Week Ending	Week Ending	Week Ending	Week Ending	Total Hours	Appr. Rate per Hour	Total Classif. Contr.Amt

PLEASE CHECK APPROPRIATE BLANK:

☐ Paid to: PUBLIC WORKS APPRENTICESHIP & TRAINING FUND (Mail to **P.O. BOX**)

Check No_____ **Check Amt:**_____

Payroll Clerk's (PRINT)
Name:_____ Signature:_____ Phone:_____

Forms due **by 15th of each month** on every public works project that has apprenticeship contribution on the wage decision. In accordance with the NM Apprenticeship & Training Act, **payment is due for each journey person,** even if your company has no apprentices.

(WE WILL NOT ACCEPT CREDITS WHEN PAYMENT IS OVER PAID)

Each wage decision needs a separate compliance statement, but only one check is needed for all statements.

(When paying to an approved program, complete section below & mail this form along with a copy of the check to the following address: Public Works Bureau, 625 Silver Ave SW, Ste 410, Albuquerque, NM 87102

____Paid to: Name of Approved NM Apprenticeship Program
Address:_____ Phone:_____
Apprenticeship Program No.:_____
(If in doubt, call 841-4403)

Print Name of Certifying Official:_____ Phone:_____

Signature of Certifying Official:_____ Date:_____

Revised 9/2008

NEW MEXICO DEPARTMENT OF WORKFORCE SOLUTIONS - PUBLIC WORKS BUREAU
QUESTIONS?? Call OR E-mail:

Patricia Barela @ (505) 841-4411 OR patricia.barela@state.nm.us or
Lori Griego @ (505) 841-4408 OR lori.griego2@state.nm.us or
Michael Fanestiel @ (505) 841-4417 OR michael.fanestiel@state.nm.us fax (505) 841-4423

Contracting Agency/Owner	County	Decision Date	Decision No.
Alto Lakes Water &	Lincoln	05/27/10	LI-10-0763 A/B/H
Sanitation District		Expires for Bids	
Type of Construction: A/B/H		12/31/10	

Description of Work: Alto Lakes Phase I Water Treatment Plant
Dual 8 inch water transmission main; 2500 square foot pre-engineered building; Water Storage Tank and water treatment plant including pumps, valves, piping, filtration units and chemical addition

***REMINDER* to those preparing BID documents:** If bids are not opened by the above "Expires for Bids" date, a **NEW** wage decision may be required. If bids are NOT submitted before new wage rates go into effect, a NEW wage decision WILL be required. Call the Public Works Bureau at (505) 841-4417 to check status of new wage rates.

NOTICES

ALL contractors **MUST** have an active registration with the Labor Enforcement Fund before bidding on any public works project. Bids from contractors who are not registered will be considered **INVALID**.

The General/Prime Contractor selected for this project **MUST** submit a completed Statement of Intent to Pay Prevailing Wages to the Contracting Agency (or it's agent) before any work is started.

Sub-contractors & 2nd/3rd Tier Contractors **MUST** also submit Statements through their General/Prime before they start work. The General/Prime is responsible for informing the Contracting Agency or it's agent whenever there is a change to the subcontractors on the project.

The Contracting Agency or it's agent **MUST** fill out and submit the Notification of Award and Subcontractor list to the Public Works Bureau and forward the remainder of this wage decision package to the General/Prime Contractor that is awarded the project contract. That contractor is also responsible for making certain that all subcontractors have copies of the wage decision and other needed forms.

The General/Prime Contractor **MUST** post the wage rate table at the job site outside the Superintendent's trailer/office in an easily accessible place.

Workers **MUST** be classified & paid according to the work they perform, regardless of qualifications.

These wage rates are good for the life of a project.

New Mexico Department of Workforce Solutions
Public Works Bureau
625 Silver Ave SW, Suite 410, Albuquerque, NM 87102
Michael Fanestiel (505) 841-4417 OR michael.fanestiel@state.nm.us Patricia Barela (505) 841-4409 OR patricia.barela@state.nm.us
Lori Griego (505) 841-4408 OR lori.griego2@state.nm.us fax (505) 841-4423

Wage Decision # LI-10-0763 A/B/H
NOTIFICATION OF AWARD (NOA)

***Description and Location of Work*: Alto Lakes Phase I Water Treatment Plant**
Dual 8 inch water transmission main; 2500 square foot pre-engineered building; Water Storage Tank and water treatment plant including pumps, valves, piping, filtration units and chemical addition

City of Alto Lincoln County High Mesa

REMINDER for Agency Conducting BID Process: **If bids are NOT submitted before new wage rates go into effect, a NEW wage decision WILL be required.**
When the Contract is awarded for this project the Wage Rate Poster and the Wage Rate Packet, excluding this NOA and Subcontractor List, must be delivered to the ***GENERAL/PRIME CONTRACTOR.*** The Contracting Agency or its agent must complete this form (including the next page listing all of the subcontractors including 2nd tier subcontractors) and fax or mail it to the address above. ***If the project is canceled,*** this form must be completed by the agency conducting the bid process. Failure to submit the NOA in a timely manner is a violation of paragraph 11.1.2.10.B (3) of the Public Works Minimum Wage Act Policy Manual.

General/Prime Contractor Company Name:_____ License#:_____

Address:_____ City:_____ State:_____ Zip:_____

Telephone: _____ Fax:_____

Project Contact's name:_____ E-Mail:_____

Approximate Date Work to Start:_____

Estimated Completion Date:_____

Estimated Cost of Project:_____

Bid Opening Date:_____

Note: The General/Prime Contractor MUST mail/fax in their Statement of Intent to Pay Prevailing Wages to the Contracting Agency or its agent before beginning work on the project. Each Subcontractor (and all tiers of subcontractors) **MUST** also mail/fax their Statement of Intent to Pay Prevailing Wages through the General/Prime Contractor before they start work. After work on the project is completed (**but before final payments),** subcontractors and all tiers of subcontractors must mail/fax (through the General/Prime Contractor) an Affidavit of Wages Paid.

Signature for Contracting Agency (or agent) _____
Printed Name_____
Date _____

SUBCONTRACTOR LIST

Do NOT list suppliers or professional services (such as surveyors)
INCLUDE individual subcontractor dollar amount for project

Please include **2nd & 3rd Tier** subcontractors. Make extra copies of form if necessary.

Wage Dec. # LI 10-0763 A/B/H

General Contractor: _____

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2nd TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2nd TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2ne TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2nd TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2nd TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

Company Name: _____
Address: _____ City: _____ State: ____ Zip: _____
E-Mail Address: _____ License No.: _____
Phone No.: _____ Fax No.: _____ Sub ____ 2ne TIER ____ (To Whom) 3rd TIER ____ (To Whom)
Work to be performed: Amount ($):

TECHNICAL SPECIFICATIONS

DESIGN PROFESSIONAL RESPONSIBILITY

The specifications sections authenticated by my seal and signature are limited to the following:

DIVISION 2 – SITE WORK
SECTION 02010 SUBSURFACE INVESTIGATION
SECTION 02100 SITE PREPARATION
SECTION 02221 EXCAVATING, BACKFILLING, & COMPACTING FOR UTILITIES
SECTION 02222 EXCAVATING, BACKFILLING & COMPACTING FOR PAVEMENT
SECTION 02230 BASE COURSE
SECTION 02600 SCHEDULE OF PIPE
SECTION 02605 MANHOLES
SECTION 02610 PIPE, VALVES & FITTING MATERIALS
SECTION 02730 PIPE INSTALLATION
SECTION 02732 HDPE PIPE

DIVISION 3 – CONCRETE
SECTION 03300 CAST-IN-PLACE CONCRETE
SECTION 03600 GROUT

DIVISION 5 – METAL
SECTION 05500 METAL FABRICATIONS

DIVISION 7 – THERMAL AND MOISTURE PROTECTION
SECTION 07210 BUILDING INSULATION
SECTION 07900 JOINT SEALERS

DIVISION 8 – DOORS AND WINDOWS
SECTION 08110 STEEL DOORS AND FRAMES
SECTION 08331 OVERHEAD COILING DOORS
SECTION 08700 HARDWARE
SECTION 08800 GLAZING

DIVISION 9 – FINISHES
SECTION 09250 GYPSUM BOARD SYSTEMS
SECTION 09900 PAINTING
SECTION 09915 COATING SYSTEMS FOR STEEL TANKS

DIVISION 11 – EQUIPMENT
SECTION 11100 VERTICAL PRESSURE FILTERS W/ CATALYTIC FILTER MEDIA
SECTION 11600 PUMPS
SECTION 11960 CHLORINATION EQUIPMENT

DIVISION 13 – SPECIAL CONSTRUCTION
SECTION 13121 PRE-ENGINEERED METAL BULDINGS
SECTION 13220 GROUND WATER STORAGE TANK

DIVISION 15 – MECHANICAL
SECTION 15060 HANGERS AND SUPPORTS
SECTION 15075 MECHANICAL INDENTIFICATION
SECTION 15080 MECHANICAL INSULATION
SECTION 15141 MECHANICAL PIPING

DESIGN PROFESSIONAL RESPONSIBILITY

The specifications sections authenticated by my seal and signature are limited to the following:

DIVISION 16 – ELECTRICAL

16000	Electrical General Provisions
16111	Conduit
16123	Wires and Cables
16130	Boxes
16140	Wiring Devices
16170	Grounding and Bonding
16190	Supporting Devices
16265	Variable Frequency Drives
16441	Enclosed Switches
16470	Panelboards
16670	Surge Protection Device
16990	Electrical System Testing and Start-up

DIVISION 17 – INSTRUMENTATION

17000	General Requirements for Instrumentation
17030	Reference Forms
17160	Cabinets And Enclosures
17230	Transmitters and Process Switches
17235	SCADA Equipment

2/15/10

SECTION 01010
GENERAL

SECTION 01010

GENERAL

PART 1 - GENERAL DESCRIPTION OF THE PROJECT

The Alto Lakes Water and Sanitation District Phase I Water Treatment Plant project includes construction of a new 140 gpm water treatment plant (WTP), 60,000 gallon ground storage tank and associated transmission mains.

The propose project includes construction of a new 140 gpm iron and manganese removal plant with associated pumps and site piping, 2,500 square foot pre-engineered building with laboratory, control room, office, electrical room and restroom, 60,000 gallon steel ground storage tank, 5,278 linear feet of dual 8-inch HDPE pipe, valves and fittings, pavement replacement, sod replacement and all appurtenances and components required to complete the facilities. Also included in the project are electrical and instrumentation/control equipment, project mobilization, pre-construction video taping, storm water pollution prevention and trench safety.

PART 2 - CONTRACT TIME AND GENERAL ORDER OF CONSTRUCTION

Completion of the project within the time allotted is of the essence. The Contractor shall commit all necessary forces and equipment to complete the project within the contract time allowed for meeting the following schedule for the project. Liquidated damages apply to Substantial and Final Completion as defined in the Agreement.

COMPLETION	DATE/CALENDAR DAYS
Substantial	150 days after NTP
Final	180 days after NTP

PART 3 - CONTRACTOR'S RESPONSIBILITY FOR COMPLETE FACILITY

It is the intent of these specifications that the Project be a complete workable facility, functioning in accordance with the general description provided herein. Therefore, it is the direct responsibility of the Contractor to furnish, install and construct the complete facilities required by the plans and specifications for the prices stated in the Contract, and to take account of all subsidiary requirements of the equipment furnished to that end, so that the entire facilities function in accordance with the specified requirements.

PART 4 - RIGHTS-OF-WAY (ROW)

4.1 GENERAL

The project is located in easements obtained in the R.O.W. of the Alto Lakes Golf Course and Alto, NM platted streets and on property owned by the Alto Lakes Water and Sanitation District,

The Contractor shall use the minimum area practicable for construction of the facilities, regardless of the type of right-of-way, and shall be governed by the specific requirements for each type of right-of-way as set out herein. Excess excavated material shall be removed from the rights-of-way and disposed of by the Contractor as required by the governing agency and/or the Owner of the right-of-way. All rights-of-way shall be restored at a minimum, to their original condition. If necessary, verification of existing conditions shall be provided by viewing of the videotapes showing the route prior to construction. Such viewings shall be intended to resolve any potential disputes as to the condition of the right-of-way prior to construction.

PART 5 - CONTRACTOR'S SUPERINTENDENCE

The Contractor shall keep on the project, at all times during its progress, a qualified Resident Superintendent, approved by the Engineer. The Resident Superintendent shall speak English fluently and be capable of communicating with the Public, the Engineer, and the Owner. The Superintendent shall be cooperative, and authorized to receive orders and to act for the Contractor. If an approved Superintendent is not available the Owner may suspend work until one is available. Changes of Superintendent must be approved by the Engineer and the Owner.

All workers employed by the Contractor shall have such skill and experience as will enable them to properly perform the duties assigned. Any person employed by the contractor or a subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner, or is disrespectful, intemperate, disorderly or otherwise objectionable, shall at the written request of the Engineer be forthwith reassigned or discharged and shall not be deployed again on any portion of the work without written consent of the Engineer.

PART 6 - SAFETY AND SECURITY

The Contractor shall be fully responsible for the safety and security of all work areas at all times. Security includes protection of both the Owner’s and Contractor’s properties. The Contractor shall take such measures as are necessary to prevent access of animals and unauthorized persons onto the project site. Such measures shall include fencing, posting of signs, temporary closure of excavations, or other means, and shall be maintained throughout the course of the work including nighttime, weekend, and holiday periods. Work procedures deemed to be inadequate by the Engineer to meet this requirement shall be immediately corrected by the Contractor.

PART 7 - EMERGENCY COMMUNICATION PROCEDURES

Since it is necessary that prompt action be taken in case of any emergency, the Contractor shall maintain, at all times during construction, a local telephone listing where responsible supervisory personnel may be contacted twenty-four hours a day. The telephone number shall be given to the Alto Lakes Water and Sanitation District so that contact can be made in the event of any emergency.

PART 8 - AS-BUILT DIMENSIONS & DRAWINGS

The Contractor shall make appropriate and accurate daily measurements of facilities constructed (horizontal and vertical) and keep accurate records of all facilities.

The Contractor's "As-Built" drawings will be reviewed as a condition of payment each month based on being up to date and acceptably accurate to the site conditions.

Upon completion of each facility, the Contractor shall furnish the Engineer with one set of direct prints, marked with red pencil, to show as built dimensions and locations of work constructed.

PART 9 - LOCATION AND PROTECTION OF EXISTING FACILITIES

The Contractor shall be fully responsible for all underground facilities, which are shown on the drawings or which can be located by the Contractor with reasonable effort, or which are brought to the attention of the Contractor, in any manner. He will not be held responsible for such underground facilities, with respect to which he could, otherwise have had no previous knowledge. The Contractor shall be responsible for notifying the Engineer if any unknown facilities are uncovered and for protecting those facilities after they are uncovered.

The Contractor shall be responsible for the protection of all electric poles, light poles, etc., which occur along the pipeline routes. The Contractor shall provide whatever temporary shoring is necessary to ensure that all poles are adequately supported, braced, etc.; so that the pole does not sink, shift, tilt, or otherwise move from its original position. Any removal of guy wires or anchors and setting of any wires or anchors shall be done at the Contractor's expense. Any measures the Contractor intends to use to support any type of pole shall be based upon prior approval of the Engineer and the owner of the pole.

The Contractor shall coordinate with the Alto Lakes Water and Sanitation District, their subcontractors, as well as any other utility company for the relocation, bypassing or protection of existing utilities. Any work associated with the relocation or bypassing of existing utilities shall be reflected in the Contractor's project schedule. In order to complete the work expeditiously and without delay to the project, all requirements of the Contract Documents shall apply to the utility or subcontractor performing any relocation, bypassing or protection of existing utilities. All work associated with relocating, bypassing or protection of existing utilities shall be at the expense of the Contractor, unless otherwise noted on the drawings. Prior to the commencement of any relocation or bypass work, the Contractor shall submit his plan for carrying out the work to the Engineer for approval.

PART 10 - DAMAGE TO PRIVATE PROPERTY

The Contractor shall be responsible for any damage to private property caused by the construction project. The Contractor, upon receipt of a complaint of damage, shall within 15 days, respond in writing with a proposal to repair said damage or a letter with reasons explaining why the damage was not caused by the construction.

Except for extenuating circumstances beyond the control of the Contractor, the damage shall be repaired completely within 30 days of the complaint.

PART 11 - NIGHTTIME, WEEKEND AND HOLIDAY WORK

If the Contractor desires to perform any work between the hours of 5 p.m. and 7 a.m.., or that exceeds 8 hours per day, Monday through Friday, or on Saturdays, Sundays or legal holidays, he shall request permission from the Owner, through the Engineer, in writing at least seven (7) days in advance of starting such work. The Contractor shall acquire any necessary permits associated with such work and comply with all permit conditions and all laws and ordinances related thereto.

PART 12 - APPROVAL OF EQUIPMENT AND MATERIALS

All materials shall be new and shall be designed for the function and service specified herein. No materials shall be used in the project except those that have been approved by the Engineer. Approval for installation or incorporation in the project will be given only after submittal and subsequent examination of shop and installation drawings, manufacturer's specifications, test results, or other data required in the various sections of these specifications. Final approval and acceptance of items will be made only after such items are in operation and have met all specified tests.

PART 13 - VIDEO TAPE OF PIPELINE ROUTE, WWTP SITE, IRRIGATION STATION, AND LAND APPLICATION SITE

Prior to any construction, the pipeline routes and WTP site, shall be video taped by the Contractor accompanied by the Engineer to show existing conditions of roadways, adjacent properties, structures, fences, utilities, and land. The video tape shall be converted to DVD format. Two copies of the videotape along with two DVD discs shall be given to the Engineer. The Engineer will review the video and DVD for completeness and quality. Should the Engineer determine that the video is not satisfactory the Contractor will be required to re-video the project. Payment for the video taping shall be for the lump sum price per job as shown on the proposal.

PART 14 - SHOP DRAWING REVIEW COSTS

One initial shop drawing submittal and one re-submittal will be reviewed by the Engineer at no cost to the Contractor. Subsequent reviews on resubmitted shop drawings will be reviewed at a cost to the Contractor of $85.00 per hour. Contractor shall indicate by stamp and/or signature of authorized personnel that the Contractor has reviewed the submittal before transmitting the submittal to the Engineer

PART 15 - STAKING OUT THE WORK

The Engineer will supply horizontal control points and semi-permanent benchmarks upon contract award as stated on the drawings. The Contractor shall be responsible for all construction surveying and field staking; and shall be responsible for installing all pipelines and other work to the lines and grades established from the Engineer's survey control points.

The Contractor must satisfy himself before commencing work as to the meaning or correctness of all horizontal control points and benchmarks, and no claim will be entertained for or on account of any alleged inaccuracies, unless the Contractor notified the Engineer thereof in writing before commencing the work thereon. The Contractor will be held responsible for the preservation of all such control points and benchmarks in their positions: in case any of them are lost or destroyed, all expense incurred by the Engineer in replacing them shall be charged against the Contractor and paid for by him before the completion and final acceptance of the work. Payment for the staking out of the work shall be included in the per unit price of pipeline installed as shown on the proposal.

The Contractor shall have a surveyor licensed in the state of New Mexico set off-set stakes at a minimum of 100-foot intervals for installation of the pipeline(s), lift station, layout of the aerated and effluent storage pond. The Contractor must preserve these stakes throughout the duration of construction. The Contractor shall provide cut sheets to the Engineer a minimum of seven (7) days ahead of pipe laying operations.

PART 16 - SEQUENCE OF CONSTRUCTION

16.1 All sequence of construction activities will be coordinated with the Owner through the Engineer.

A. Sequence of construction is left to the Contractor. Pipeline being placed in the golf course right of way shall be coordinated with golf tournament activity in order to not disrupt play. The following milestones apply to the project.

1. Milestone 1, Substantial Completion. The Engineer will review the work and issue a punch list of work to be completed. Only minor punch list items can remain to qualify the work to be substantially complete as verified by the Engineer.

2. Final completion shall be achieved upon approval of close out documentation, as-built drawings and completion of punch list items.

PART 17 - PAYMENT

Payment made for all work covered in this section will be included in the unit prices per item or will be included in the lump sum price per job, as indicated in the Proposal. Such payments shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with the provisions of this section.

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected products.

1.2 AUTHORITY

A. Measurement methods delineated in specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the specific specification section shall govern.
B. The Engineer will take all measurements and compute quantities accordingly.
C. The Contractor shall assist the Engineer by providing necessary equipment, workers, and survey personnel as required by the Engineer.

1.3 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in the Bid Form are for contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Engineer shall determine payment as stated in the General Conditions.
B. If the actual Work requires greater or lesser quantities than those quantities indicated in the Bid Form, the Contractor shall provide the required quantities at the unit prices contracted, except as otherwise stated in the General Conditions, the contract drawings, or other sections within the specifications.

1.4 METHODS OF MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Reinforcing steel, rolled or formed steel or other metal shapes will be measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies will be measured by CRSI or AISC Manual of Steel Construction or by use of scale weights.
B. Measurement by Volume:

1. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.
2. Excavation and Embankment Materials: Measured by cubic dimensions using the average end area method.

C. Measurement by Area: Measured as a square dimension using either mean length and width or radius of a circle (or portion of a circle).
D. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
E. Stipulated Price Measurement: Measured by unit designated in the agreement.

F. Other: Includes items measured by weight, volume, area, or lineal means or combinations, as appropriate, as a completed item or unit of the Work.

1.6 NONCONFORMANCE ASSESSMENT

A. The Contractor shall remove and replace the Work, or portion of the Work, not conforming to the Contract Documents at no expense to the Owner.
B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:

1. The nonconforming Work will remain as is, but the unit price will be adjusted to a lower price at the discretion of the Engineer.
2. The nonconforming Work will be modified as authorized by the Engineer, and the unit price will be adjusted to a lower price at the discretion of the Engineer, if the modified Work is deemed to be less suitable than originally specified.

C. Specification sections may modify these options or may identify a percentage or specific equation to be used for a price reduction.
D. The authority of the Engineer to assess the nonconforming Work and identify payment adjustment is final.

1.7 NONPAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable to the Engineer.
2. Products determined as nonconforming before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work, unless specified otherwise.
6. Loading, hauling, and disposing of rejected products.

1.8 REQUIREMENTS

A. The general scope of work under each bid item includes all labor, equipment and materials required for construction of completely functional and operational facilities as shown on the Drawings and in these Specifications.
B. All estimated quantities for unit price bid items stipulated in the bid proposal are approximate and are to be used only (a) as a basis for estimating the probable cost of the work and (b) for the purpose of comparing the bids submitted for the work. The actual amount of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for unit price work and materials will be the actual amount of work done and material furnished as measured by the Engineer.
C. All measurements and payments will be based on completed and accepted work performed in strict accordance with the Drawings and Specifications and in accordance with contract unit bid prices. Incidental work and items not listed in the contract-unit bid price schedule will not be paid for separately, but will be included in the payment for the listed item or items and shall be full compensation for all labor, equipment, materials,

testing and incidentals necessary to perform the work in accordance with these contract documents.

D. Separate payment will not be made for related items of subsidiary work, but will be considered as part of the bid items in the proposal. Payment will be made for all work covered in this section at the contract unit price bid items or be included in the lump sum bid item prices for items in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

PART 2 - MEASUREMENT

2.1 GENERAL

Two general classes of pay items exist consisting of:

Unit price Items: Payment for the various unit price items will be made at the particular contract price per unit as shown on the proposal. The unit price for the individual pipeline items shall specifically include all costs associated with the following: construction staking, construction facilities, coordination, site preparation, excavation, thrust restraint, backfilling and compacting for utilities, protection of adjacent utilities and pertinent structures, all pipe bedding, all pipe and accessories, joint bonding and test stations, concrete, and all other items of the project not indicated as being covered under the other specific bid items shown in the Proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

Lump Sum Items: Lump sum items are to be paid for at a lump sum price per job, not in measured increments. Lump sum items shall include all work and materials involved in the installation, construction or performance of work, including incidental and subsidiary items as may be required to complete that item as shown on the drawings and designated in the specifications.

2.2 MOBILIZATION

Measurement for mobilization and demobilization shall be on a lump sum basis for the mobilization and demobilization of equipment, support vehicles, personnel and tools, for the completion of the part of the project for which it pertains.

Payment shall include all costs for Contractor's mobilization and demobilization, insurance and bond, construction permits and fees, job trailers, site administration expenses, stand pipe and temporary meter service, expenses for noise mitigation, utilities to the job trailers including power, telephone and construction water needs. This shall include all costs for contract closeout, site cleanup, and all costs associated with Contractor's demobilization from site. This bid item shall be limited to a maximum of five (5) percent of the bid price for the part of the project to which it pertains. A maximum of 60% of the mobilization bid amount will be paid for mobilization to the project. The 60% shall be paid once temporary facilities are onsite and ready for occupancy. The remainder will be paid for demobilization after demobilization of the project occurs. **Bid Item Number 1**, is for mobilization and demobilization as defined herein.

2.3 SWP3 (STORM WATER POLLUTION PREVENTION PLAN)

Payment for storm water pollution prevention measures including the design, construction, and maintenance for entrances, protection of inlets and spillways and will be made at a lump sum price per job as described in the bid form. Contractor shall comply with TXR 150000, Construction Permit for Storm Water Discharges. **Bid Item Number 2** is for the SWP3.

2.4 VIDEO TAPE OF PROJECT AREA

Prior to any construction, the site and access roadway shall be videotaped by the Contractor accompanied by the Engineer, to show existing conditions of the project area, adjacent properties, structures and utilities. The video tape shall be converted to DVD format. Two copies of the videotape along with two (2) DVD discs for each segment of the project as determined by the Engineer shall be given to the Engineer. Submittal shall include labels including project title and date recorded. Payment for the videos shall be for the lump sum price per job as shown on the proposal. **Bid Item Number 3** is for video taping of project area.

2.5 TRENCH SAFETY

The length of the Trench Safety System that has been used shall be determined by measurement along the centerline of the pipe alignment using horizontal stationing, installed with no deduction being made for manholes, vaults or fittings. Payment for Trench Safety System, measured as prescribed above, shall be made at the unit price per linear foot of the Trench Safety System bid item. Payment of all work prescribed under this item shall be full compensation for the Trench Safety System including any design, testing, inspection, or additional excavation and backfill required, for furnishing, placing, maintaining and removing all shoring, sheeting, or bracing, for all borings, for all required compaction and for all other labor, materials, tools, equipment, and incidentals necessary to complete the Trench Safety System work. **Bid Item Number 4** is for the Trench Safety System.

2.6 CLEARING AND GRUBBING

Site clearing for construction shall be paid for at a unit price per acre of land cleared. Work shall include removal of stumps, and other vegetation as identified on the drawings. Removed material is to be disposed of offsite in accordance with City Requirements. The contractor shall be responsible for initial removal and for maintaining the site clear of objectionable vegetation up to Final Completion. **Bid Item Number 5** is for Clearing and Grubbing.

2.7 PIPING ITEMS

Pipelines of the class and function specified, including: surveying and staking, trenching, excavating; pipe; bedding; bonding and test stations shall be paid for at a unit price per linear foot. Length of pipe and other per linear foot items will be determined by measurement along the centerline of the pipe alignment using horizontal stationing, installed with no deduction being made for vaults, manholes, or fittings. Trench safety shall be considered separate from pipeline items for measurement and payment purposes. **Bid Item Number 6 and 7** are for pipeline items.

Testing of all pipelines shall be paid for as part of the unit price per linear foot of the pipeline bid item indicated on the proposal. Five percent (5%) of the pipeline unit price will be withheld until

the pipeline is successfully tested per the specifications. This breakdown shall be shown in the Contractors submitted schedule of values for the work.

2.8 60,000 GALLON STEEL WATER STORAGE TANK

The welded steel tank and foundation shall be paid on a lump sum basis. The lump sum price for installation of the tank shall include but is not limited to: costs for surveying and staking; excavation; trench safety system; form work; concrete placement, backfilling and compaction; grout; steel water storage tank and appurtenances as shown in the plans and protective coatings, necessary for a complete facility. **Bid Item Number 8** is for furnishing and installing the water storage tank.

2.9 PRE-ENGINEERED STEEL BUILDING

The 2,500 square foot pre-engineered metal building shall be paid on a lump sum basis. The lump sum price for installation of the building shall include but is not limited to: costs for surveying and staking; excavation; trench safety system; form work and reinforcing for foundation; concrete placement, backfilling and compaction; grout; metal building, doors, window, interior partitions, electrical, mechanical and plumbing and appurtenances as shown in the plans, necessary for a complete facility. **Bid Item Number 9** is for furnishing and installing the pre-engineered steel building.

2.10 MANGANESE OXIDE FILTRATION SYSTEM

The manganese oxide filtration system shall be paid on a lump sum basis. The lump sum price for installation of the treatment equipment shall include but is not limited to: cost of piping, valves, fittings, pressure vessels, polyethylene backwash tank, back wash decant system, chlorination system, sequestering system with day tank and agitator, electrical, instrumentation and controls and appurtenances as shown in the plans, necessary for a complete facility. **Bid Item Number 10** is for furnishing and installing the manganese oxide filtration system.

2.11 VARIABLE SPEED PUMPING SYSTEMS

The filter influent and finished water pump skids shall be paid on a lump sum basis. The lump sum price for installation of the pump skids shall include but is not limited to: costs for pump skids, valves, fittings, electrical power, instrumentation and controls, wiring and installation, as shown in the plans, necessary for a complete facility. **Bid Item Number 11** is for furnishing and installing the pump skids.

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2.12 6,000 GALLON FINISHED WATER TANK

The finished water tank shall be paid on a lump sum basis. The lump sum price for installation of the tank shall include but is not limited to: costs for polyethylene tank, piping, instrumentation and appurtenances as shown in the plans, necessary for a complete facility. **Bid Item Number 12** is for furnishing and installing the finished water storage tank.

2.13 WATER TREATMENT PLANT ELECTRICAL AND INSTRUMENTATION

The water treatment plant electrical and instrumentation shall be paid on a lump sum basis. The lump sum price for installation of the building electrical and instrumentation required to connect the communications between all components of the treatment system and all electrical items not covered in other bid items as shown in the plans, necessary for a complete facility. **Bid Item Number 13** is for furnishing and electrical and instrumentation.

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2.14 COMPACTED BASECOURSE DRIVEWAY

The access driveway around the plant building and ground storage tank shall be paid on the unit price per square yard of base course installed. Base course shall include **6-inches** of **Type A, Grade 3** crushed stone material. Base course shall be measured in square yards, limited to the areas shown in the drawings. The actual number of square yards of base course to be paid for shall not exceed the area of the surfacing specified on the drawings. Any base course placement outside the limits shown on the drawings shall be without compensation to the Contractor. **Bid Item Number 14** is for the pond driveway.

PART 3 - PAYMENT

3.1 PAYMENT INCLUDES

A. Full compensation for all required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application, or installation of an item of the Work; and Contractor's overhead and profit.

3.2 UNIT PRICE BID

A. Total compensation for required Unit Price Work shall be included in the Unit Price bid. Claims for payment as Unit Price Work, but not specifically covered in the list of unit prices of the bid items will not be accepted.

3.3 STORED MATERIALS

A. Interim payments for stored materials will be made only for materials to be incorporated under items covered in unit prices, unless disallowed elsewhere.

3.4 PROGRESS PAYMENTS

A. Progress payments will be based on the Engineer's observations and evaluations of quantities incorporated in the Work multiplied by the unit price.

3.5 FINAL PAYMENT

A. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities determined by the Engineer multiplied by the unit price for Work which is incorporated in or made necessary by the Work.

3.6 PAYMENT FOR THIS SECTION

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal for quantities of work constructed, authorized and accepted. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 01040
COORDINATION

SECTION 01040

COORDINATION

PART 1 - COORDINATION

The Contractor shall be responsible for ascertaining the nature and extent of any collateral work done by others. The Contractor shall include in his bid all costs associated with coordinating with others. The Contractor shall not be entitled to additional compensation resulting from coordination of this work with simultaneous or collateral work on other projects. If necessary to avoid or minimize damage or delay, the Contractor shall redeploy his work force to other areas of the work, at no cost to the Owner.

PART 2 - COORDINATION WITH THE OWNER

All coordination between the Contactor and the Owner (Alto Lakes Water & Sanitation District) shall be through the Engineer. The Contractor shall be responsible for coordinating all tie-ins. The Contractor shall give a 72 hour notice to the Engineer prior to starting work at any tie-in location.

PART 3 - COORDINATION WITH PROPERTY OWNERS

The Contractor shall be responsible for the notification of property owners, business and residents along the pipeline route to explain the construction to them. The Contractor shall be responsible for providing access to the businesses, schools and residences for all property owners, customers and residents at all times.

Notification of all business and residents and property owners shall be by printed handout approved by the Owner and Engineer. The Contractor shall furnish proof to the Engineer that each resident along the route has been notified.

Any resident unable to park their vehicle at their residence due to construction shall be provided with a secure place to park as near to the residence as possible by the Contractor at no cost to the Owner.

The Contractor shall be responsible for coordinating with the property owner to determine the actual location of existing sewer lines to avoid conflicts and establish locations for future sewer connection tie-ins from the property line to the property owner's sewer lines. New sewer connections to existing lots are only generally located on the plans.

PART 4 - COORDINATION WITH POLICE, FIRE, AND EMS

The Contractor will be responsible for coordination with school district buses, police, fire and EMS agencies. This coordination will include notification at least 1 week in advance of work affecting traffic flow through a given area. This will require coordination with the development and implementation of the traffic control plan.

PART 5 - COORDINATION WITH VARIOUS AGENCIES AND DEPARTMENTS

The Contractor shall be responsible for coordination with the land owners, the ALW&SD, or any other utilities/ agencies involved. The Contractor shall notify Lincoln County for coordination of backfill, paving operations, etc. for work within Alto rights-of-way.

PART 6 - PAYMENT

Payment for all work covered in this section will be included as part of the unit price per unit or lump sum at the tie-ins for the installation of facilities as indicated in the Proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 01300
MATERIAL AND EQUIPMENT SUBMITTALS

SECTION 01300

MATERIAL AND EQUIPMENT SUBMITTALS

PART 1 - GENERAL

1.1 Submittals for all materials and equipment are to be provided by the Contractor. Submittals shall be submitted to the Engineer as required by the paragraph 6 in the General Contract Conditions. Installation instructions, manufacturer's specifications, and all other pertinent data, required by the Engineer to determine approval for installation of the equipment, shall be submitted to the Engineer. Such drawings and other data shall be submitted to the Engineer at the earliest practicable date, with due account being taken of the necessity for having equipment and materials prior to construction of the facilities, which require said materials or equipment to be installed.

1.2 The Engineer will require approximately 14 calendar days to review each submittal, shop drawing, and other correspondence. Delay in submission of shop drawings will not, of itself, be grounds for granting of an Extension of Time.

PART 2 - SHOP DRAWINGS

2.1 Contractor shall submit within 15 days after NTP the following submittal documents:

A. Preliminary Schedule of Values
B. Preliminary Construction Schedule
C. Schedule of shop drawings
D. Trench Safety Plan

2.2 The Contractor shall submit complete engineering data on all items and materials to be furnished. Shop drawings submitted to the Engineer without first having been checked by the Contractor, will be returned to the Contractor. The Contractor is required at a minimum to provide the following information in the required submittals/shop drawings:

A. Contractor shall indicate by stamp and/or signature of authorized personnel that the Contractor has reviewed the submittal before transmitting the submittal to the Engineer.

B. Identify each manufacturer/supplier, including address and phone number, by brand and trade name, number, size and rating and whatever other data is necessary to properly identify and check materials and equipment.

C. Each submittal item shall refer to a specification and paragraph in which the item was specified.

D. The Contractor shall submit the number of shop drawings for his use, plus four (4) copies to be retained by the Engineer.

E. For structural shop drawings, the Contractor shall review the drawings and then submit one correctable translucent print and one blue or black-line copy for review. Upon completion of the review by the Engineer, the reproducible print will be returned to the

Contractor. Upon receipt of the reproducible print, the Contractor shall immediately make sufficient copies of the Shop drawings for job use and distribution, and will provide the Engineer with 4 blue or black-line copies with the Engineer's marks and comments for use during construction.

F. Accessories, finish, etc., not submitted or identified with submitted equipment shall be furnished and installed as specified.

G. The words "AS SPECIFIED" will not be considered sufficient identification.

H. Any variations from the specified materials or equipment shall be clearly identified. Any of these variations which may require modifications to the pipeline or appurtenances, which the “as specified” material or equipment would not, will be at no cost to the Owner.

I. Additional requirements or information required on specific shop drawing submittals are detailed in the individual Specification Sections.

PART 3 - OPERATION & MAINTENANCE MANUALS

3.1 At the time of manufacturer’s inspection of installation of the equipment, the Engineer shall be furnished with one copy of the complete installation, operation and maintenance manuals, for each item of equipment for approval. Upon Engineer’s approval, the Contractor shall subsequently bind five (5) sets of the approved manuals in a large post type binder(s) (of a type approved by the Engineer) with index tabs identifying the various pieces of equipment. Each equipment item section shall include, but not be limited to the following:

A. Name, address and telephone number of nearest commercial service representative who can supply parts and service.
B. Descriptive literature, including illustrations covering the operation features of the equipment and its components, specific for this installation, with all inapplicable information omitted or marked through.
C. Serial numbers or other identifying marks shall be noted on drawings and on test/performance reports.
D. Operating, maintenance and troubleshooting information.
E. Complete connection, interconnection and assembly diagrams and operational circuit diagrams.
F. Certified for Construction Shop Drawings.
G. Certified Performance or Test Curves.
H. Applicable Test Procedures.
I. List of electrical relay settings and control and alarm settings

3.2 Manuals shall be organized into volumes, indexed generally per the list given below. All data pertinent to that equipment/item shall be included in that section.

A. Equipment: Station Pumps, sump pumps, etc.
B. Electrical & instruments including section for Engineer’s PLC Programming data.
C. Mechanical: Piping, valves, plumbing fixtures, ventilation equipment and accessories, etc.

PART 4 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items shown in the proposal. Either payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 01310
CONSTRUCTION AND PROGRESS REPORTS

SECTION 01310

CONSTRUCTION AND PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 GENERAL

The work shall be executed with such progress as required to prevent any delay to other contractors, the contract milestones, or the general completion of the project.

The Contractor shall provide a statement to the Engineer describing his computerized scheduling capability for review and approval. This statement shall include the following as a minimum:

A. Identification, qualifications, and experience of the member(s) of the Contractor's scheduling staff or any other Consultant's staff.
B. References of not less than two previous projects on which the Contractor or Consultant has utilized computerized CPM scheduling, which were of not less than one-quarter of the value of the present contract.
C. The name and description of the project management software and computer hardware to be utilized on this Contract.

1.2 CONSTRUCTION SCHEDULE

The Contractor shall show the sequence and interdependence of activities required for complete performance of all the work. The Contractor's Construction Schedule shall begin with the date of the Notice To Proceed and conclude with the date of Final Completion of the Contract. Float or slack time accrues to the benefit of the Owner but is a resource available to both parties as needed to meet contract milestones and the contract completion date. Accordingly, no time extensions will be granted nor delay damages paid until a delay occurs which extends the work beyond the Contract completion date.

Pursuant to the Float Sharing requirements of the Contract Documents, (1) use of float suppression techniques such as preferential sequencing, use of lead/lag logic restraints, extended Activity times, or imposed dates and (2) use of Float Time disclosed or implied by the use of alternate float suppression techniques shall be shared to the proportionate benefit of the Owner, Contractor, and Contractor's Subcontractors.

Comments made by the Engineer on the Contractor's Construction Schedule during review will not relieve the Contractor from compliance with requirements of the Contract Documents. This review is only for general conformance with the schedule concept of the project and general compliance with the information given in the Contract Documents.

PART 2 - SUBMITTALS

The Contractor shall submit the following items as specified in this section:
A. Overall schedule
B. Scheduled reports

C. Progress reports

PART 3 - PROGRESS OF THE WORK

3.1 GENERAL

The Contractor shall execute work at such times and on such parts of the project, and with such forces, materials, and equipment, to assure completion in the time established by the Contract.

3.2 ACTIVITY COORDINATION

To ensure consistency with General Contractor's breakdown of work and nomenclature, each Subcontractor shall work in concert with the General Contractor throughout all aspects of schedule development.

3.3 ACTIVITIES

The work activities comprising the Contractor's Construction Schedule shall be of sufficient detail to assure adequate planning and execution of the work, such that the schedules provide an appropriate basis for monitoring and evaluating the progress of the work. A work activity is defined as an activity which requires time and resources (manpower, equipment, and/or material) to complete.

Show information in such detail that duration times of activities will range normally from one to fifteen calendar days. However, no activity shall have more than thirty (30) calendar days' duration for any onsite operation. Selected exceptions may be approved by the Engineer where sub-networks will be used. The selection and number of the Contractor's construction activities shall be subject to review of the Engineer.

If requested by the Engineer, the Contractor, at the Contractor's sole expense, shall provide highly detailed short-term schedules for specific crucial items (work-arounds, start-up, etc.)

PART 4 - SCHEDULE

4.1 GENERAL

A. Preliminary Network Analysis: Within 15 calendar days after the date of Award of the Contract the Contractor shall submit a preliminary network analysis indicating the Contractor's planned operations for the first 60 days after the notice to proceed. This should also indicate the Contractor's general approach to the remainder of the work and the cost of activities expected to be completed or partially completed before submittal and review of the completed network analysis.

B. Completed Network Analysis: Within 45 calendar days after the date of Award of The Contract or 10 days after the Notice To Proceed, whichever date is earlier, the Contractor shall submit a completed CPM network analysis including diagrams, mathematical analysis, and computer printouts, as determined in consultation with the Engineer. This analysis is for review and acceptance as a condition precedent to approval of first pay application.

C. Detailed Network Diagram: The Contractor's Construction Schedule shall include time-scaled network diagrams based on calendar days. The network diagrams shall be Critical Path Method (CPM) precedence format and shall show the sequence and interdependence of activities required for complete performance of the work. A calendar shall be shown on all sheets.

Each activity shall be plotted so that the beginning and completion dates of said activity can be accurately determined by graphical comparison with the calendar scale.

4.2 SCHEDULED REPORTS

A. The Contractor shall prepare schedule listings of the information in the network diagram in tabular format, sorted according to early start, within responsibility, or as directed by Engineer.
B. The schedule listings shall show activity numbers, description, responsibility, total duration in work days, percent complete, early-start date, late-start date, early-finish date, and total float for each activity in the network diagram.
C. The Overall Schedule and subsequent revisions shall reflect actual progress of the project. The Contractor shall sign and submit one reproducible and three copies of the initial Overall Schedule and each revision.
D. If the initial submittal or a subsequent revision does not meet the requirements specified, the Contractor shall revise the Overall Schedule and resubmit until it is acceptable to the Engineer. Failure to submit and adequately update the Overall Schedule, and schedule reports, will be considered cause for withholding partial payments otherwise due under the Contract.

4.3 PROGRESS REPORTS

A. Once biweekly on a date mutually agreed upon by the Contractor, Owner's Representative, and Engineer, a meeting will be held at which time the schedule will be reviewed. Immediately prior to the meeting the Contractor shall obtain the necessary information to update the Overall Schedule to reflect progress to date and furnish sufficient copies of the updated schedule at the meeting for review.

The schedule provided by the Contractor at the biweekly meetings with the Engineer and Owner shall be a detailed two (2) week look ahead schedule for the work to be performed during the current week and subsequent week period. This schedule shall be updated biweekly by the Contractor with copies available for the biweekly meetings. The Contractor shall invite his subcontractors to participate in the biweekly meetings, or if requested to do so by the Engineer.

B. In updating the schedule, progress will be reviewed for the following items:
    1. To identify those activities started and completed during the previous period.
    2. For remaining duration, from the date of update, required to complete each activity started but not completed.
    3. For review of durations for activities not yet started.
    4. For addition of Change Orders and proposed sequencing changes to the network diagram and schedule listings.

C. At least twice each month, and utilizing data accumulated during the previous joint Owner-Engineer-Contractor reviews, Contractor shall revise the network diagram and generate updated schedule reports.

D. Whenever revised scheduling documents are submitted, they shall be accompanied by a written narrative report. The narrative report shall:

1. Describe amount of progress since the last revision in terms of activities started, continuing, and completed.
2. Describe problem areas, current and anticipated delay factors, and the estimated impact on performance of other activities and completion dates.
3. Explain corrective action taken or proposed.

PART 5 - MAINTAINING SCHEDULE

5.1 If at any time during the project the Contractor fails to complete an activity by its latest scheduled completion date, which late completion will impact the end date of the work past the Contract substantial completion due date, the Contractor shall submit within 7 calendar days plans to reorganize the work force to return to the original schedule for review and approval of owner.

5.2 The Contractor will add equipment, or construction forces, as well as increase working hours, if operations fall behind schedule at any time.

5.3 Addition of equipment or construction forces, increasing working hours, or other method, manner, or procedure to return to the contractually required completion date will not be justification for an increase in Contract Price or treated as acceleration.

5.4 Contractor shall plan, schedule, and coordinate construction operations and activities in a manner that will facilitate progress of work.

PART 6 - PAYMENT

Payment for all work covered in this section will be included as part of the mobilization line item as indicated in the Proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICE

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

Testing Laboratory Services and Contractor responsibilities related to those services. Where tests of materials or any portions of the Work are required by law/ordinance or public authority, the Contractor shall bear all costs of such tests, shall give timely notice of readiness thereof and shall furnish to the Engineer the required certification of testing or approval. Tests specified in the Technical Specifications shall fall into four categories:

(1) Those required for approval of materials prior to use, which serve the same purpose as shop drawings or samples.
(2) Those required by law.
(3) Those necessary for acceptance of equipment, and/or facilities.
(4) Those made during the progress of the Work to check compliance with the requirements of the Contract Documents.

The Contractor shall bear all the costs of the tests in the first three categories.

The tests made in the fourth category will be made at the discretion of the Engineer and will be paid by the Contractor through an allowance item in the Contract. The Engineer shall select, coordinate with, and oversee the Testing Laboratory. The Contractor shall contract with the testing laboratory and furnish the materials for the samples and shall cooperate with the Engineer, or Testing Laboratory, in securing samples. Invoices for this testing will be submitted by the testing laboratory to the Contractor. The Contractor shall pay the testing laboratory and submit the invoices with the Contractor's monthly pay request for reimbursement by the Owner. All failing tests in this category shall be borne by the Contractor.

The tests in the fourth category shall include tests normally performed by a commercial testing laboratory for materials such as: density tests for pipe bedding, trench and/or structural backfill, sub-grade, base course, and hot mix; proctor tests and Atterberg Limits for pipe bedding, trench and/or structural backfill, sub-grade and base course; in place densities for Asphalt pavement, including Marshall stability, Asphalt extraction and gradation tests; cylinders for concrete compressive strength, mortar cubes and prisms for grout strength.

1.2 REFERENCES

A. ASTM D3740 – Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
B. ASTM E329 – Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used In Construction.

1.3 SELECTION AND PAYMENT

A. The Engineer shall select, coordinate with, and oversee the Testing Laboratory for Category 4 testing.

B. The Contractor will contract with and pay for services of an independent testing laboratory to perform inspection and testing identified in individual Specification Sections.
C. Invoices for this testing will be submitted by the testing laboratory to the Contractor. The Contractor shall pay the testing laboratory and submit the invoices with the Contractor's monthly pay request for reimbursement by the Owner through an allowance item contained in the Agreement. All failing tests in this category shall be borne by the Contractor.
D. Employment of the testing laboratory shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.
E. Contractor shall schedule and monitor testing as required to provide timely results and to avoid delay to the Work.

1.4 LABORATORY REPORTS

A. The Engineer will receive 3 copies and the Contractor will receive 2 copies of laboratory reports from the testing laboratory. One of the Contractor's copies shall remain at site field office for the duration of the project. Test results which indicate non-conformance shall be transmitted immediately via fax from the testing laboratory to the Contractor and the Engineer.

1.5 LIMITS ON TESTING LABORATORY AUTHORITY

A. The laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.
B. The laboratory may not approve or accept any portion of the Work.
C. The laboratory may not assume any duties of the Contractor.
D. The laboratory has no authority to stop the Work.

1.6 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall notify the Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. The Contractor shall notify the Engineer if specification section requires the presence of the Engineer.
B. The Contractor shall cooperate with laboratory personnel in collecting samples to be tested or collected on site.
C. The Contractor shall provide access to the Work and to manufacturer's facilities.
D. The Contractor shall provide samples to the laboratory in advance of their intended use to allow thorough examination and testing.
E. The Contractor shall provide incidental labor and facilities for access to the Work to be tested; to obtain and handle samples at the site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.
F. The Contractor shall arrange with the laboratory and pay for
    1. Retesting required for failed tests
    2. Retesting for nonconforming Work
    3. Additional sampling and tests requested by Contractor beyond specified requirements.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONDUCTING TESTING

A. Laboratory sampling and testing shall conform to ASTM D3740 and ASTM E329, plus other test standards specified in individual Specification Sections.

PART 4 - PAYMENT

Payment for Category 4 Tests shall be covered under an allowance item in the Agreement based on invoices from the Testing Laboratory to the Contractor for first time tests. No separate payment shall be made for testing under Categories 1-3.

END OF SECTION

SECTION 01440
CONTRACTOR'S QUALITY CONTROL

SECTION 01440

CONTRACTOR'S QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for quality assurance and control of installation and manufacturer's field services and reports.

1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. The Contractor shall exercise quality control procedures over suppliers, manufacturers, products, services, site conditions and workmanship to produce Work of specified quality at no additional cost to the Owner.
B. The Contractor shall comply fully with manufacturers' installation instructions, including each step in sequence.
C. The Contractor shall request clarification from Engineer before proceeding should manufacturers' instructions conflict with Contract Documents.
D. The Contractor shall comply with specified standards as minimum requirements for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. The Contractor shall use persons qualified to produce the specified level of workmanship.

1.3 REFERENCES

A. The Contractor shall obtain copies of standards and maintain them at the job site when required by individual Specification Sections.

1.4 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification sections, the Contractor shall provide material or product suppliers' or manufacturers' technical representative to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, operator training, test, adjust, and balance of equipment as applicable and to initiate operation as required. The Contractor shall conform to minimum time requirements for start-up operations and operator training if defined in Specification sections.
B. At the Engineer's request, the Contractor shall submit qualifications of manufacturer's representative to the Engineer 15 days in advance of required representative's services. The representative shall be subject to approval of the Engineer.
C. The manufacturer's representative shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions. The representative shall submit a report within 14 days of observation to the Engineer for review.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

PART 4 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items shown in the proposal. Either payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - WATER FOR CONSTRUCTION

The Contractor shall make his own arrangements for a supply of potable drinking water for his employees and shall keep such supply available at all times.

Water to be used for construction and testing shall be furnished to the Contractor by the Owner under set conditions and charges contained as negotiated with the Alto Lakes Water and Sanitation District (ALW&SD)after contract award.

1.1 INSTRUCTIONS TO CONTRACTORS REQUESTING FIRE HYDRANT METER

A. The ALW&SD will have the meter installed when construction begins. The Contractor must coordinate with ALW&SD at 575-336-4333 to have a Contractor's Representative at the specified fire hydrant(s) for the installation of the meter. The Contractor shall be responsible to secure the valve on the meter to ensure unauthorized use.

B. Readings will be taken monthly from the fire hydrant meter by the ALW&SD personnel. Consumption will be billed monthly by the 15th of the month. Payment is due 10 working days later. If not paid, fire hydrant meter will be removed.

C. Immediately after completion of the construction project, the Contractor must coordinate with ALW&SD for removal of the meter. The Utility will remove the meter within two working days.

D. A final bill will be consolidated for any damages to the fire hydrant(s) or the fire hydrant meter(s) in addition to any assessments due to violations. Charges will be deducted from the original deposit. Any shortages must be paid before Final Acceptance of the project will be made; any overages will be refunded within 15 days of payment of the final bill.

1.2 NOTES TO CONTRACTORS

A. Additional fire hydrant meters will not be issued for other fire hydrants within a 2,000-foot radius of the fire hydrant requested. Deposits and Set-up/Removal fees are due for each meter on a project.

B. The fire hydrant meter shall not be moved for any reason by the Contractor. If the Contractor needs to move the meter to another fire hydrant, the Contractor must request another fire hydrant meter.

1. Neither non-metered consumption removal of the meter, nor tampering with the fire hydrant or valve will be allowed under any circumstances. The Contractor agrees that by executing the water meter agreement any violations of these requirements shall be grounds for immediate removal of the meter and a $500 assessment for water losses for each occurrence.
2. The adapter that is installed for use of the Fire Department on the fire hydrant meter must not be removed. This is considered as tampering and violation fees will be assessed.

PART 2 - ELECTRIC POWER FOR CONSTRUCTION

The Contractor shall furnish and install, at his own expense, all temporary electrical facilities required for construction and safety operation. Separate electrical metering shall be provided and power used shall be paid for by the Contractor, regardless of the source of the power. The Contractor shall furnish power during start-up activities and shall continue to furnish power until the Owner has assumed use of the project or until substantial completion is achieved.

PART 3 - SANITARY FACILITIES

The Contractor shall provide adequate toilet facilities for use by his personnel and shall maintain such facilities in a clean and sanitary condition throughout the construction period. Such facilities shall be conveniently located for use by the personnel and the entire area shall be maintained in a clean and sanitary condition. After completion of the work, all temporary toilet facilities shall be removed from the site. No toilet facility shall be located within 200' of an existing well.

PART 4 - TRAFFIC PLAN: Refer to Section 01010 of these specifications.

PART 5 - DUST CONTROL

The Contractor shall furnish and maintain at all times equipment necessary to affect the control of dust over the entire working area. The control of dust shall mean that no construction activity shall take place without applying such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.

PART 6 - CONSTRUCTION STAGING AREA

The Contractor shall be responsible for obtaining (at his/her cost) a construction staging area for equipment and materials storage, construction offices, etc., that the Contractor feels is necessary for the project.

The Contractor may obtain, at his choosing, permission from private property owners to stage materials within private property, at such reasonable distances that are in the vicinity of the installation. The Contractor must provide documentation from the property owner indicating that he has been granted permission.

PART 7 - OFFICE FACILITIES

The Contractor shall provide office facilities for the use of the Engineer. The office shall be a minimum of 200 square feet in size. The office will be equipped with toilet facilities and be adequately lighted, heated and cooled. The office will be furnished with a desk, chair, plan table, fax machine, phone, table and chairs for meetings and locking file cabinet. The Contractor shall provide a phone and line capable of making local calls and have a separate line for the fax machine and make all necessary provisions for its placement and safety throughout the duration

of the project. The Contractor shall provide weekly cleanup of the office facilities to include sweeping and cleaning of the bathroom. The Contractor shall be responsible for all maintenance of the office and its facilities. Location of the office will be determined after award of the contract and mutually agreed upon between the Owner and Engineer.

PART 8 - PAYMENT

Payment for all work covered in this section will be included as part of the mobilization line item as indicated in the Proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications.

END OF SECTION

SECTION 02010
SUBSURFACE INVESTIGATION

SECTION 02010

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

Soil borings were made throughout the project to determine design parameters for the installation of the facilities. The soil borings were not made for trench safety design. The boring logs are available for review by prospective bidders at the Engineer's office (Parkhill, Smith & Cooper Inc., at 810 East Yandell, El Paso, Texas). These borings represent the conditions encountered in the bore-hole on the date of the test as determined by standard geotechnical techniques. Any interpretations or conclusions drawn from the information presented are done at the Contractor's sole risk. If the Contractor requires more accurate information concerning soil conditions or depths to the groundwater table, the Contractor shall obtain such information at his own expense.

The project geotechnical report dated September 1, 2009, was completed by AMEC, Inc. and entitled "Geotechnical Study, Alto Lakes Water Treatment Plant, Alto, New Mexico."

END OF SECTION

SECTION 02100
SITE PREPARATION

SECTION 02100

SITE PREPARATION

PART 1 - SCOPE

The work covered by this section of the specifications consists of preparing the jobsite for construction operations by the removal and disposal of all obstructions from the right-of-way and from designated easements, where removal of such obstructions is not otherwise provided for in the plans and specifications.

Such obstructions shall include abandoned structures and utility lines, fences, trees, shrubs, vegetation, curbs, gutters, sidewalks, driveways, pavement, concrete and stone rubble, rubbish and all miscellaneous debris.

The Contractor shall furnish all materials, equipment, tools, labor, superintendence and incidentals required to perform the work as indicated on the drawings, as directed by the Engineer, and as specified herein.

PART 2 - OBSTRUCTIONS OTHER THAN VEGETATION

Concrete, pavement, fences, rubble, trash and miscellaneous debris shall be removed to a depth of 1 foot below natural ground. The Contractor shall complete this operation by blading, bulldozing, or other approved methods so that the jobsite shall be free of holes, ditches, and other abrupt changes in elevation and irregularities of contour.

PART 3 - CLEARING

Clearing shall consist of removal and disposal of trees and other vegetation as well as downed timber, snags, brush and rubbish within the areas to be cleared within the working areas as shown in the drawings. Individual trees, groups of trees or other vegetation not required to be removed and occurring outside the earthwork area shall be protected against unnecessary cutting, breaking or skinning of roots, skinning and brushing of bark, or smothering of trees by stockpiling construction materials or excavated materials within drip lines.

PART 4 - GRUBBING

Stumps, matted roots and roots larger than 2 inches in diameter shall be removed from within 6 inches of the surface of areas work areas designated on the plans, except in roadways. Materials as described above within 18 inches of finished subgrade of roadways in either cut or fill sections shall be removed. Areas disturbed by grubbing will be filled as specified hereinafter in Section 02221 - Excavating, Backfilling and Compacting for Utilities and Section 02222 - Excavating, Backfilling and Compacting for Pavement.

PART 5 - DISPOSAL

The Contractor shall dispose of all material removed from the jobsite in a manner satisfactory to the Engineer in accordance with the New Mexico Environmental Department.

PART 6 - PAYMENT

Payment for all work covered in this section will be included as part of the contract unit price per unit or will be included in the lump sum price per job as shown in the proposal. Either such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications.

END OF SECTION

SECTION 02221
EXCAVATING, BACKFILLING, & COMPACTING FOR UTILITIES

SECTION 02221

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - SCOPE

This section covers all site excavating, backfilling and compacting of trenches for pipe and pipe accessories and other utilities.

There shall be no separate pay item for excavating, backfilling and compacting trenches. Over excavation not at the direction of the Engineer is to be corrected by the Contractor at the Contractor's expense. OSHA regulations apply to all excavation and trenching.

PART 2 - TRENCHES

Pipe trenches shall be excavated to the lines, and grades shown on the drawings or as established by the Engineer. Before excavation begins in paved areas, the existing pavement shall be cut or sawed to a neat line by methods that meet the approval of the Engineer. The maximum width of the trench from the pipe invert to the top of the trench shall be as detailed on the Limits of Excavation indicated on the Contract Drawings. The procedures for the treatment of trench walls shall be as prescribed by the trench safety system. In some areas of limited right-of-way or when necessary to protect existing facilities, the slope of the trench wall shall be limited. Where necessary to stay within the maximum width limits at the top of the pipe, the trench shall be adequately braced and sheeted. The Contractor shall be fully responsible for any damage to adjacent structures and other work in progress.

Where special pipe bedding material is not required, the trench shall be excavated to an even grade so that the bottom of the pipe will rest on the bottom of the trench throughout the entire length of the pipe. In obtaining a true and even grade, the excavated trench bottom shall be wetted as necessary to facilitate compaction. The bottom of the trench shall be compacted by mechanical means to consolidate all loose material disturbed during excavation. No compaction tests will be required on the bottom of the trench, however, the entire width and length of trench shall be compacted such that no loose material remains. Any part of the trench excavated below grade shall be corrected by filling with approved materials and thoroughly compacting. If clay, rock or other unyielding material is encountered in the bottom of the trench, it shall be removed to a depth of six (6) inches below grade, refilled with selected materials, and compacted to a minimum of 90% maximum density and ± 2% optimum moisture in accordance with ASTM D-1557 to specified grade.

Bell holes of ample dimensions shall be dug at each joint to permit the jointing of the pipe to be made properly, and to prevent the pipe from resting on or being supported by the bell.

Any water encountered during excavation shall be removed by the Contractor in such a manner as to allow the trenching and pipe laying operations to proceed in a dry trench. Pipe shall not be installed in a trench that is wet.

Trench digging machinery may be used to make trench excavations except in places where operation of same would cause damage to existing structures either above or below ground. In such instances, hand methods shall be employed. The Contractor shall locate all existing underground lines, whether or not they are shown on the drawings, sufficiently in advance of trenching operations to prevent any damage thereto. Extreme care shall be taken to prevent such damage and the Contractor shall be fully responsible for damage to any such lines. The Contractor shall pothole and locate all utility lines at least four (4) days or 1,000 feet ahead of pipeline placement operations (whichever is more), to allow the Engineer adequate time to initiate any necessary changes in alignment and/ or grade of the pipeline.

There will be no classification of excavated materials and all materials encountered shall be excavated as required. Adjacent structures shall be protected from damage by construction equipment. Excavated material may be stockpiled along the side of the trench in accordance with the approved trench safety plan and in a manner which will not endanger the work. Within street rights-of-way excavated material shall be removed as necessary from the street to allow traffic to pass in a safe manner. In no case will excavated material be allowed to be stockpiled in street or public rights of way.

Excavation for manholes shall be made as required providing space for constructing the structure and trench safety system if applicable.

The use of explosives will not be permitted.

PART 3 - TRENCH EXCAVATION SAFETY SYSTEM

3.1 GENERAL

A. This item covers the requirements for the Contractor to provide the design and construction of trench safety system for all trenches excavated. The Contractor will be required to install a trench system to provide for the safe excavation of all trenches exceeding a depth of five (5) feet as per OSHA standards. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-596, 29 U.S.C. Specs. 651 et. Seq., the Occupational Safety and Health Act of 1970 (OSHA), and all amendments thereto, and to enforce and comply with all provisions of this act. In addition, on projects in which trench excavation will exceed five (5’), the Contractor and all of its subcontractors shall comply with all requirements of 29 C.F.R. secs., and 1926.652 and 1926.653, OSHA Safety and Health Standards, which are more fully described herein.

3.2 DESCRIPTION

A. This section shall govern the Trench Safety Systems required for the construction of all trench excavation to be utilized in the project including all additional excavation and backfill necessitated by the safety system. Trench Safety Systems shall be suitable for construction of pipelines, utilities, etc. that are installed below grade and shall be sufficient to fully protect public or private property including other existing utilities and structures below, or above grade. Trench Safety Systems include, but are not limited to, sloping of side of excavation, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering, or diversion of water to provide an adequately dry trench or hole for installation of pipe.

B. The Contractor shall be responsible for the design of systems, and procedures such as the use of sheet piling, shoring, or other means of temporary support to protect existing buildings, streets, highways, water conveying structures, and any other structures. In the case of existing utilities, the Contractor may elect, at his cost, to remove the utilities under the stipulated condition that the removal and subsequent replacement of these utilities shall meet with the approval of the Engineer, the Owner, the Utility owner, and all agencies having jurisdiction of the structure or property. In all cases, the Contractor shall be fully responsible for the protection of public or private property and for any person or persons, who, as a result of the Contractor's work, may be injured.

C. The successful responsible bidder will be required to submit 6 sets of trench excavation plans with a trench safety system to the Engineer for review within 15 calendar days of Notice to Proceed.

D. Plans must be designed and sealed by a professional engineer registered in the State of Texas with professional experience in geotechnical engineering. The Contractor is responsible for obtaining borings and soil analysis as required for the design and preparation of the trench excavation plan and trench safety system. The trench excavation plan and the trench safety system are to be designed in conformance with OSHA standards and regulations.

E. No trenching in excess of five (5) feet below existing grade will be allowed until the trench excavation plan is reviewed and returned to the Contractor. Any changes in the trench excavation plan after initiation of construction will not cause an Extension of Time or Change Order but such changes will require the same review process as the original excavation plan.

F. The Contractor accepts sole responsibility for compliance with all applicable safety requirements. The review is only for general conformance with OSHA safety standards; and review of the trench excavation plan does not relieve the Contractor of any or all construction means, methods, technique and procedures. Any property damage or bodily injury, including death that arises from use of the trench excavation plan shall remain the sole responsibility and liability of the Contractor.

3.3 CONSTRUCTION METHODS

A. Trench Safety Systems shall be accomplished in accordance with the detailed specifications set out in the provisions of Excavations, Trenching, and Shoring, Federal Occupational Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended including proposed Rules published in the Federal Register (Vol. 54, No. 209) on Tuesday, October 31, 1989 or subsequent revisions. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-653. Legislation that has been enacted by the Texas Legislature (H.B. No. 662 and H.B. No. 665) with regard to Trench Safety Systems, is hereby also incorporated, by reference, into these specifications.

3.4 SAFETY PROGRAM

A. The Contractor shall submit a safety program specifically for the construction of trench excavations together with the trench excavation plans for Trench Safety Systems. The trench safety program shall be in accordance with OSHA Standards governing the presence and activities of individuals working in and around trench excavation.

Contractors have two generally accepted methods, or combinations thereof, to meet OSHA Standards for Trench Excavation:

1. Utilization of Trench Box.
2. Shoring, Sheeting, and Bracing Methods.
3. Sloping, Benching.

B. Contractor electing to utilize a Trench Box must submit physical dimensions, materials, position in the trench, expected loads, and the strength of the box. The Trench Box shall be designed by a Professional Engineer.

C. Contractor electing to utilize Shoring, Sheeting, and Bracing must submit dimensions and materials of all uprights, stringers, cross-bracing, and spacing required to meet OSHA requirements, all designed by a Professional Engineer.

D. Contractor electing to utilize sloping and benching methods shall have methods designed by a Professional Engineer.

E. The Safety Program must indicate in which areas the Plan will be utilized.

F. No claims for delay will be permitted for Contractor delay in obtaining approval of the safety program.

3.5 INSPECTION

A. The Contractor shall provide a qualified person to make daily inspections of the Trench Safety Systems to ensure that the systems meet OSHA requirements. The Contractor shall provide this person's name as part of the post-bid, pre-award Key Personnel Qualifications submittal. The Contractor shall maintain a permanent record of daily inspections.

B. If the evidence of possible cave-ins, or slides, is apparent, all work in the trench shall cease until the necessary precautions have been taken by the Contractor to safeguard personnel entering the trench. It is the sole duty, responsibility, and prerogative of the Contractor, not the Owner or the Owner's designated representative, to determine the specific applicability of the designed trench safety systems to each field condition encountered on the project.

3.6 INDEMNIFICATION

A. The Contractor shall indemnify and hold harmless the Owner, Engineer, their employees and representatives and/or agents, from any and all damages, costs (including without limitation, legal fees, court costs, and the cost of investigation), judgments or claims, by anyone, including workers or the general public, for injury or death of persons resulting from the collapse or failure of trenches constructed under this contract.

B. The Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner, in case that claims are made that the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to inspections, failure to issue stop work orders and the hiring of the Contractor.

3.7 EMERGENCIES

A. In any emergency situation which may threaten or affect the safety or welfare of persons or property, the Contractor shall act at it's discretion to prevent possible damage, injury, or loss. Any additional compensation or extension of time claimed for such action shall be considered in view of the cause of the emergency and in accordance with the general conditions.

PART 4 - OPEN TRENCH RESTRICTION

Stringing out pipeline, ahead of trenching operations, in street right-of-way shall be limited to the linear footage of pipeline that can be installed in one days work. Under no circumstances will pipeline by allowed to be strung out or stored in street-right-of-ways for any longer than one day. Except where otherwise specified, indicated on the Plans, or accepted in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion, shall not exceed the lengths as set forth below. The definition of "open trench" for the purpose of this description will include excavation, pipe laying, backfilling, and pavement replacement. The descriptions under the area designations are general in nature and may be amended in writing by the Engineer due to particular or peculiar field conditions.

A. Business District Areas – 300 Linear Feet.
B. Residential Areas – One (1) Block or 300 Linear Feet, whichever is the least.
C. Undeveloped Areas 1000 Linear Feet (open trench shall not exceed length of one days pipe laying).

Any excavated areas shall be considered as "open trench" until all pavement replacements have been made, or until all trenches outside of pavement replacement areas have been backfilled, compacted and replaced to original condition in accordance with these Contract Documents. Trenches across streets shall be completely backfilled, and temporary or permanent pavement placed within 48 hours after laying the pipe.

The Contractor shall provide substantial steel plates, properly secured in place, with adequate trench bracing which shall be used to bridge across trenches at street and alley crossings and at commercial and residential driveways, where trench backfill and temporary patches have not been completed before the end of the Contractor's regular working hours. Safe and convenient passage for pedestrians shall be provided at all times. The Engineer may designate an enclosed or railed passage for the safe access of pedestrian traffic at any location adjacent to construction activities as he deems necessary. **Access to fire stations, fire hydrants, schools, hospitals, EMS and emergency response shall be maintained at all times**.

PART 5 - BEDDING

Bedding and bedding zone for the pipe shall be as specified in the applicable portions of Section 02730 - PIPE INSTALLATION.

PART 6 - BACKFILLING

6.1 GENERAL

A. All trenches shall be backfilled in accordance with this section as soon as practicable after the pipe has been installed with the specified bedding condition. As soon as practicable after laying and jointing of the pipe, the completion of bedding, and the completion of structures, the trench shall be backfilled.

6.2 MATERIAL

A. The backfill material immediately adjacent to the pipe or bedding material shall meet the gradation requirements specified in Section 02730. The material shall be free from rocks, boulders, clay or other unsuitable material(s).

6.3 PLACEMENT OF BACKFILL

A. If the bedding requirements do not require special bedding zone material to the top or above the pipe, the first lift of backfill material shall be placed carefully under and around the pipe haunch and thoroughly compacted by means of mechanical tamping. When the first lift has been mechanically compacted, the second lift shall be to two-thirds (2/3) the depth of the pipe and compacted as specified. The final lift may be to one foot above the top of pipe. Placing each lift will be dependent upon the diameter of the pipe and in no case shall each lift exceed 8 inches in thickness based upon loose measure. The backfilling of the remainder of the trench shall be done in the following manner: The backfill material shall be placed in the trench in layers not to exceed 8 inches, moistened or aerated as necessary to obtain optimum moisture, and compacted with approved mechanical compaction equipment until the required density is obtained. Vibratory rollers may not be used in city streets. Depending upon the mechanical compaction equipment used, the Engineer may allow the Contractor to lay thicker lifts. If the Contractor feels it can achieve passing density tests, based upon the density requirements of the contract with thicker lifts than 8 inches by loose measure, it shall first submit it's proposed method of compaction, type of equipment to be used and the desired lift thickness. The Engineer shall make the determination as to whether or not the Contractor's proposed methods are acceptable. In utilizing existing spoil for backfill material, any spoil that contains obvious and excessive amounts of clay and/or large cobbles (+3") shall not be acceptable for use in any zone. The Engineer shall make the determination as to whether excavated spoil is acceptable for backfill material.

B. Density requirements shall be as follows:
For all backfill in areas to be paved, or in structural fill areas, a density of not less than 95 percent per ASTM D-1557 shall be obtained from the top of subgrade to 18 inches below the top of subgrade. A density of 90 percent per ASTM D-1557 shall be obtained from 18 inches below the top of subgrade to top of pipe bedding zone.

C. For all backfill not in paved or structural fill areas, density of not less than 90% per ASTM D-1557 shall be obtained from top of pipe bedding zone to the ground surface.

D. The jetting method of water tamping or the water ponding method will not be allowed.

E. Slamming the excavator bucket down on backfill is not an acceptable means for compaction. Contractor shall use sheepsfoot, wheel rollers or other approved mechanical compaction equipment and techniques.

6.4 FIELD QUALITY CONTROL

A. Field densities of the backfill shall be taken every 300 linear feet of pipe installation, in accordance with ASTM D2922, at the following depths:
1. 1/3 pipe height
2. Springline
3. Top of pipe
4. Every lift thereafter to ground surface

B. Additionally, one moisture density curve shall be obtained for each type of material used in accordance with ASTM D1557, and one sieve analysis and one plasticity index for each type of imported material used in accordance with ASTM C136 and D4318.

6.5 BACKFILL AND MAINTENANCE

A. Following the completion of backfilling, the Contractor will maintain the trench surface in a satisfactory manner until final completion and acceptance of the finished project. The maintenance shall include blading from time to time as necessary, filling depressions caused by settlement, and other work required to keep the areas and roads in satisfactory condition.

B. Any settlement which occurs before and during the 1-year warranty period shall be repaired by the Contractor at his expense.

PART 7 - PAYMENT

Payment for all work covered in this section (except Trench Safety System), will be included as part of the unit bid price for the installation of the site piping as shown in the bid proposal.

Work required for the Trench Safety System will be paid for at the unit bid price stated in the bid proposal.

Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

OSHA 1926 SUBPART P
For Information Only

If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deckload.

(d) *First-aid and lifesaving equipment.* (1) Provisions for rendering first aid and medical assistance shall be in accordance with subpart D of this part.

(2) The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

(3) Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

(e) *Commercial diving operations.* Commercial diving operations shall be subject to subpart T of part 1910, §§ 1910.401–1910.441, of this chapter.

[39 FR 22801, June 24, 1974, as amended at 42 FR 37674, July 22, 1977]

§ 1926.606 Definitions applicable to this subpart.

(a) *Apron*—The area along the waterfront edge of the pier or wharf.

(b) *Bulwark*—The side of a ship above the upper deck.

(c) *Coaming*—The raised frame, as around a hatchway in the deck, to keep out water.

(d) *Jacob's ladder*—A marine ladder of rope or chain with wooden or metal rungs.

(e) *Rail*, for the purpose of § 1926.605, means a light structure serving as a guard at the outer edge of a ship's deck.

Subpart P—Excavations

AUTHORITY: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

SOURCE: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a ''registered professional engineer'' within the meaning of this standard when approving designs for ''manufactured protective systems'' or ''tabulated data'' to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with §1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as ''trench boxes'' or ''trench shields.''

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See ''Faces.''

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less

(measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See ''Shield.''

Trench shield. See ''Shield.''

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called ''sheeting.''

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) *Surface encumbrances*. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations*. (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps*. (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations*. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic*. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads*. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with §1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50–1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably

expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with §1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

§ 1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical

(34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall

be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and

there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

APPENDIX A TO SUBPART P OF PART 1926—SOIL CLASSIFICATION

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653–85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS–121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained

material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—''Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).'') Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a miminum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

APPENDIX B TO SUBPART P OF PART 1926—SLOPING AND BENCHING

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in §1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely

to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B–1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with §1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B–1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)[1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK TYPE A [2] TYPE B TYPE C	VERTICAL (90°) 3/4 : 1 (53°) 1:1 (45°) 1½: 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

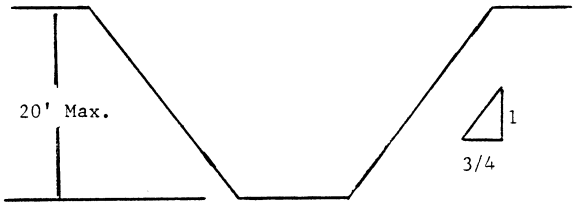
Figure B–1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

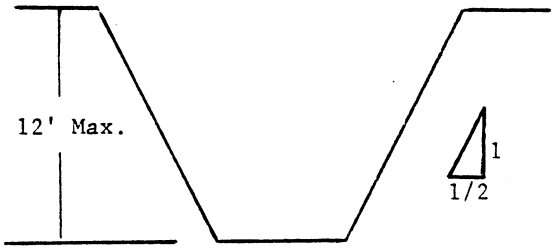
B–1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



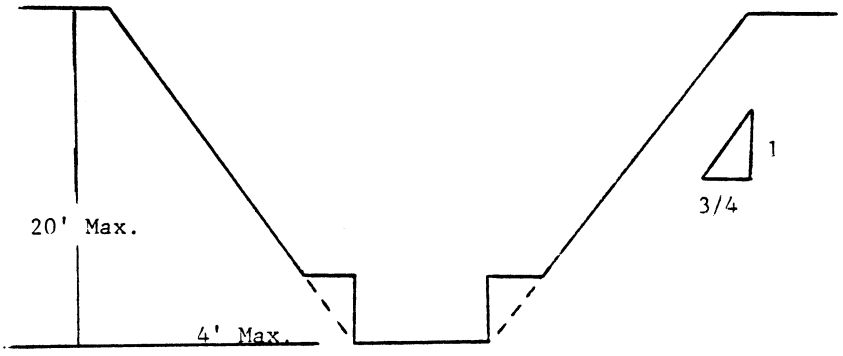
SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

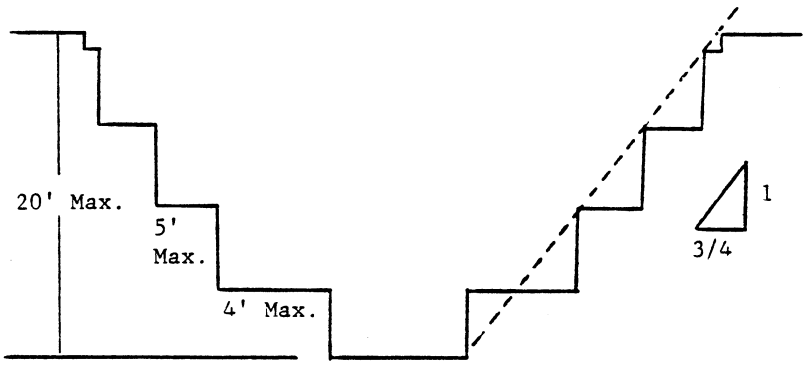


SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

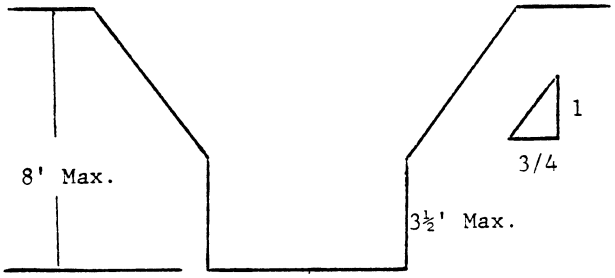


SIMPLE BENCH



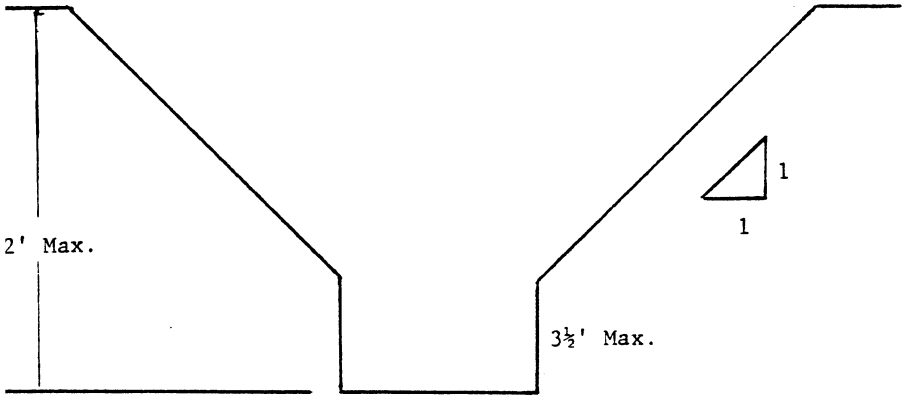
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



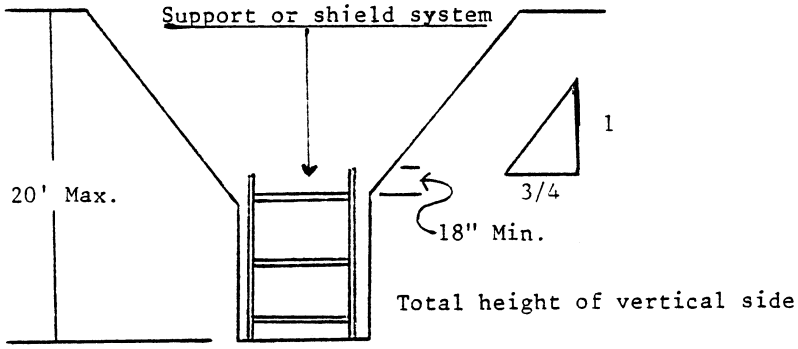
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

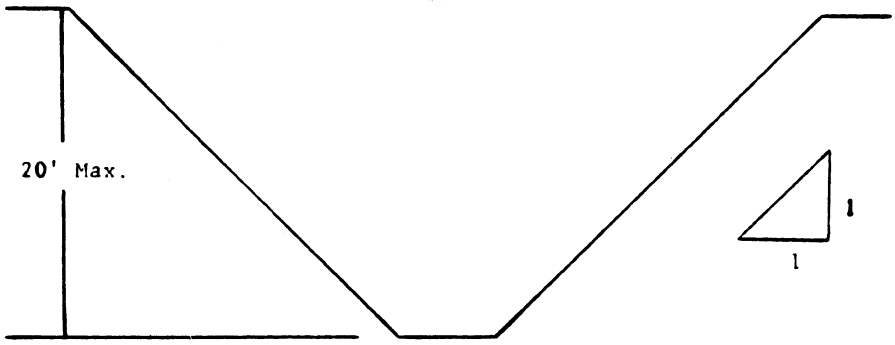


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

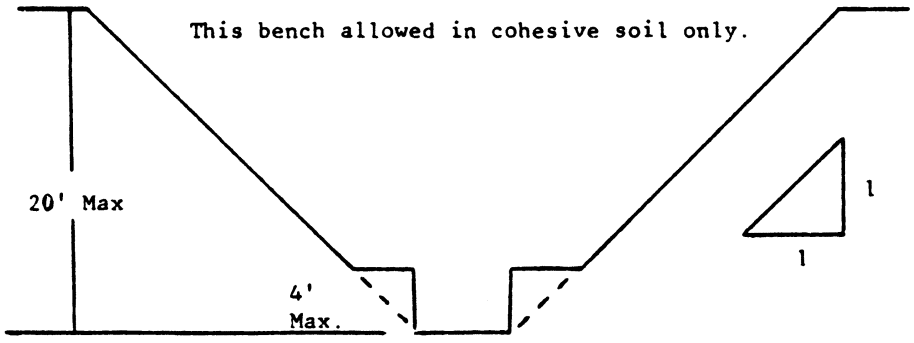
B–1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

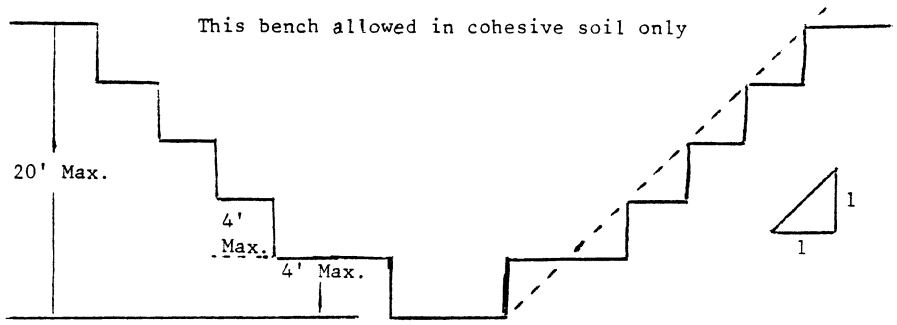


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

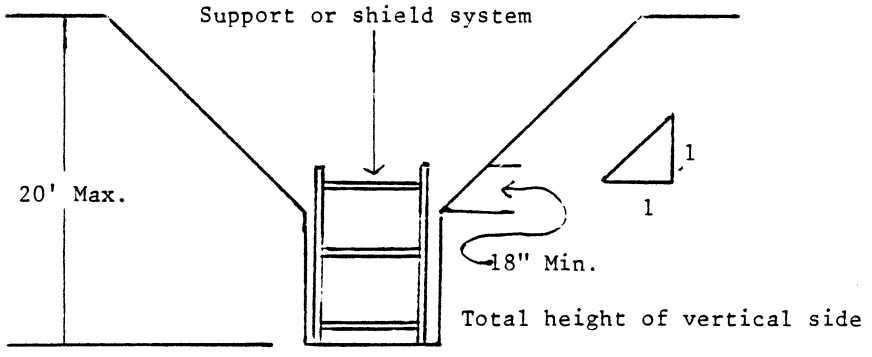


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

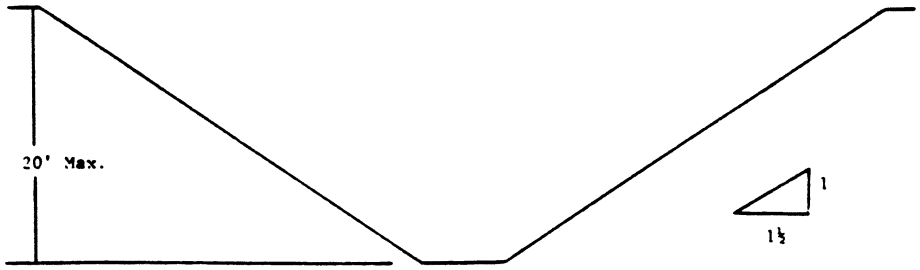


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

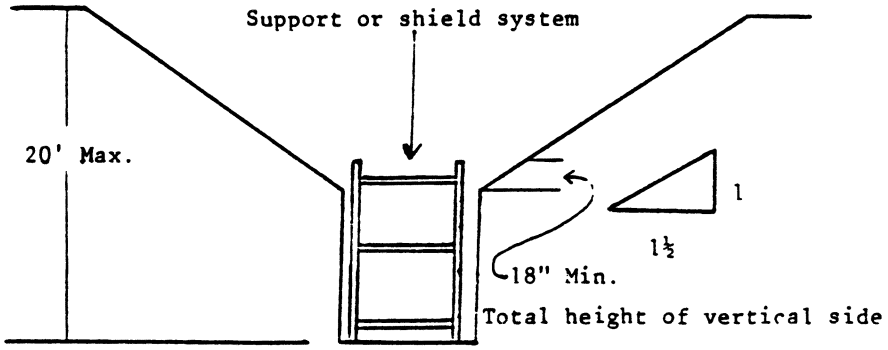
B–1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

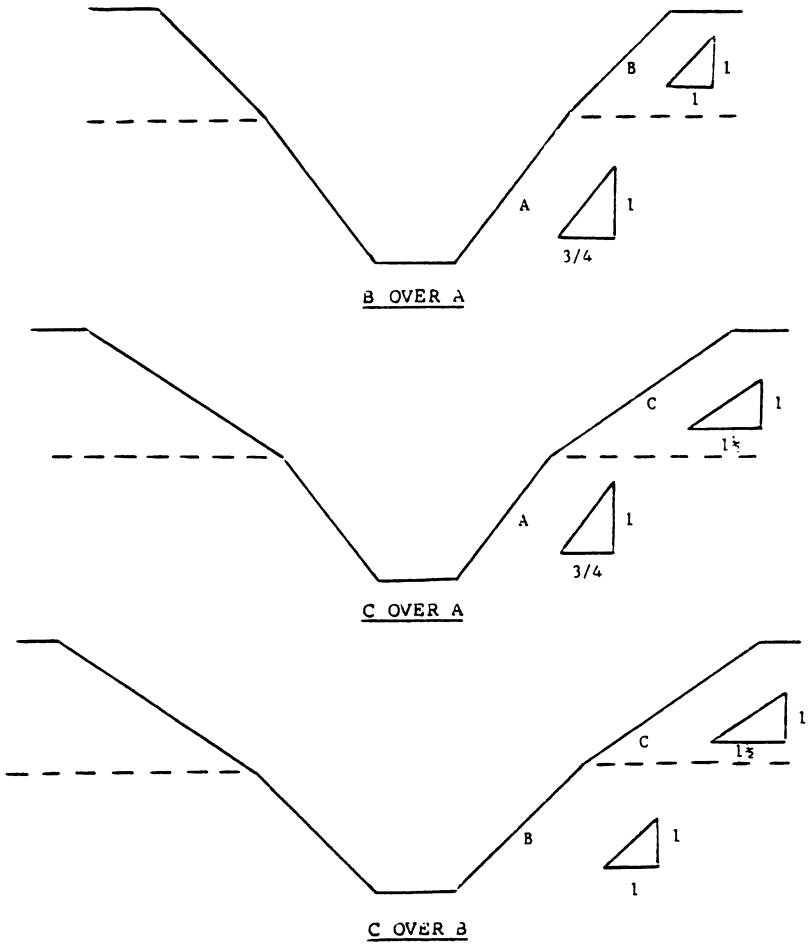


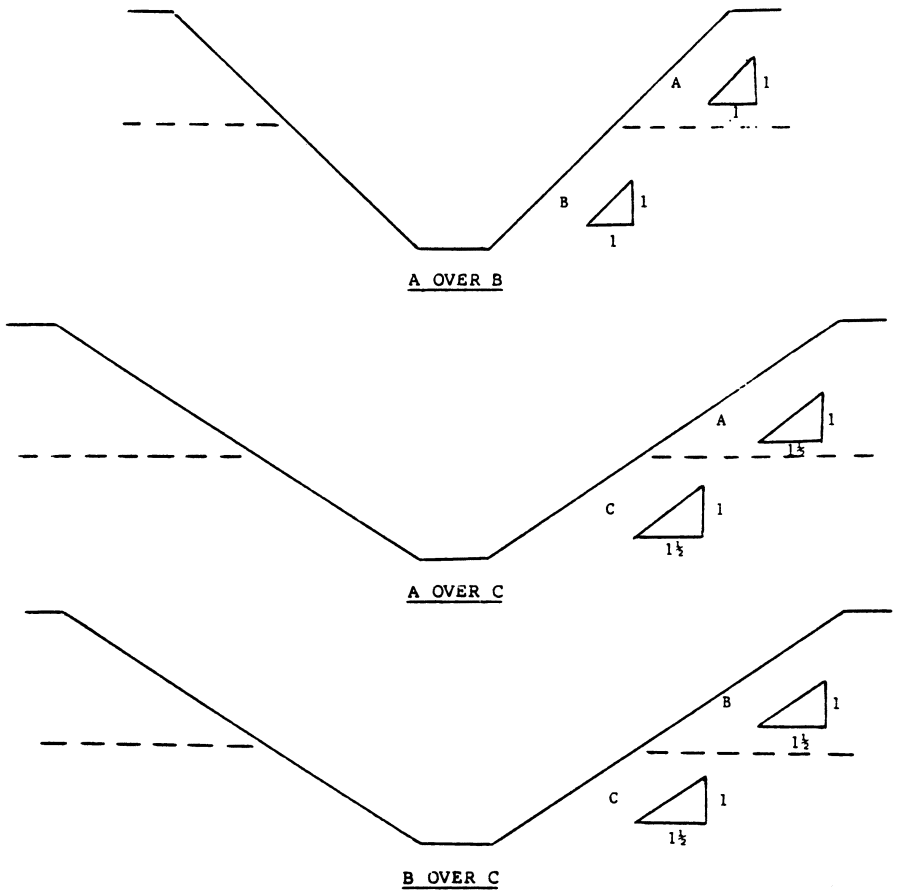
VERTICAL SIDED LOWER PORTION

3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B–1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.


B
1
1
A
1
3/4
B OVER A
C
1
1½
A
1
3/4
C OVER A
C
1
1½
B
1
1
C OVER B



2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

APPENDIX C TO SUBPART P OF PART 1926—TIMBER SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C–1.1, C–1.2, and C–1.3, and Tables C–2.1, C–2.2 and C–2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of

the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, ''Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations.'' In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under §1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with §1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term ''adjacent'' as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C–1.1,* for acceptable arrangements of timber can be used.

Arrangement #B1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called ''skip shoring.''

Arrangement #B2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #B3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.
Space 8×10 wales at four feet vertically.
Space 2×6 uprights at five feet horizontally.

Arrangement #B4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.
Space 10×10 wales at four feet vertically.
Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C–1.2 three acceptable arrangements of members are listed.

Arrangement #B1

Space 6×6 crossbraces at six feet horizontally and five feet vertically.
Space 8×8 wales at five feet vertically.
Space 2×6 uprights at two feet horizontally.

Arrangement #B2

Space 6×8 crossbraces at eight feet horizontally and five feet vertically.
Space 10×10 wales at five feet vertically.
Space 2×6 uprights at two feet horizontally.

Arrangement #B3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.
Space 10×12 wales at five feet vertically.
Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C–1.3 two acceptable arrangements of members can be used.

Arrangement #B1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.
Space 10×12 wales at five feet vertically.
Position 2×6 uprights as closely together as possible.
If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #B2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.
Space 12×12 wales at five feet vertically.
Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C–1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.
Space 12×12 wales at five feet vertically.
Use 3×6 tight sheeting.

Use of Tables C–2.1 through C–2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), ''Design of Protective Systems.''

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement cf crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H + 72 psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X5	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES								UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed Oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **												
	CROSS BRACES						WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15			CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES						WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)				VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)					
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15			CLOSE					
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	8X8	5	3X6					
	UP TO 8	6X6	6X6	6X6	8X8	8X8	10X10	5	3X6					
	UP TO 10	6X6	6X6	8X8	8X8	8X8	10X12	5	3X6					
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	8X8	8X8	8X8	10X10	5	4X6					
	UP TO 8	8X8	8X8	8X8	8X8	8X8	12X12	5	4X6					
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	10X12	5	4X6					
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

APPENDIX D TO SUBPART P OF PART 1926—ALUMINUM HYDRAULIC SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must

first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled ''Aluminum Hydraulic Shoring; Typical Installations.''

(d) *Basis and limitations of the data.* (1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufaturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D–1.1, D–1.2, D–1.3 and D–1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D–1.1 and D–1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D–1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The

trench is 16 feet deep and 9 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #B2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D–1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D–1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D–1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D–1.1, D–1.2, D–1.3, and D–1.4.*

(1) For applications other than those listed in the tables, refer to §1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to §1926.652(c)(2) and §1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5×3.5×0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

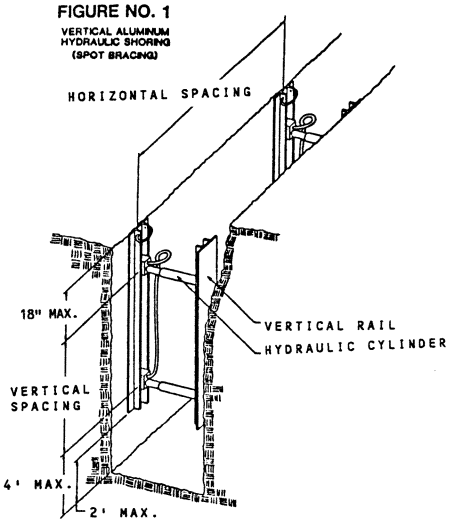


FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

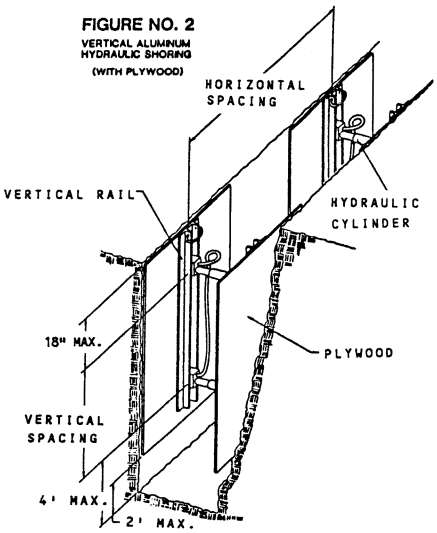


FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

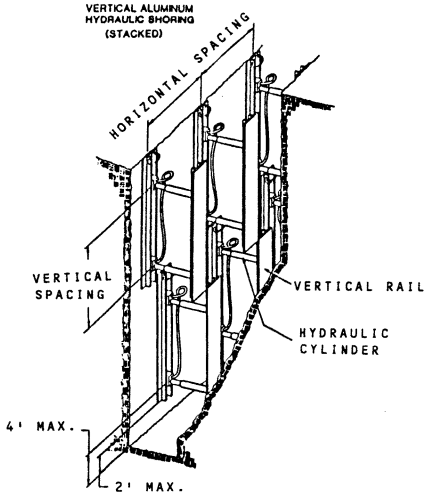


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)

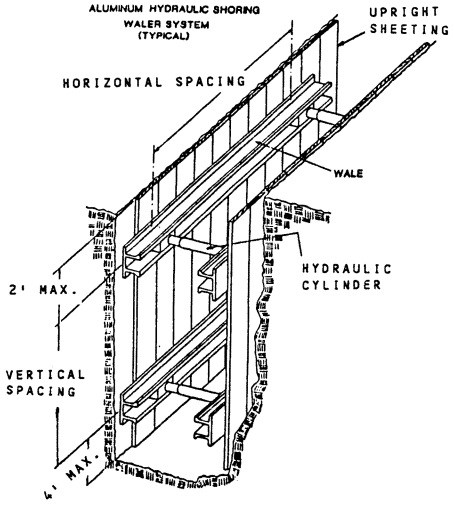


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (**1**): See Appendix D, Item (g) (1)
Note (**2**): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (**2**)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (**1**)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (**1**): See Appendix D, Item (g) (1)
Note (**2**): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ.SPACING (ON CENTER)		
	VERTICAL SPACING	* SECTION MODULUS	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
(FEET)	(FEET)	(IN^3)									
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN			
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN	—	—	3x12
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN			
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN	—	3x12	—
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN			
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN	3x12	—	—
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	* SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (**1**): See Appendix D, item (g) (1)
Notes (**2**): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

APPENDIX E TO SUBPART P OF PART 1926—ALTERNATIVES TO TIMBER SHORING

Figure 1. Aluminum Hydraulic Shoring

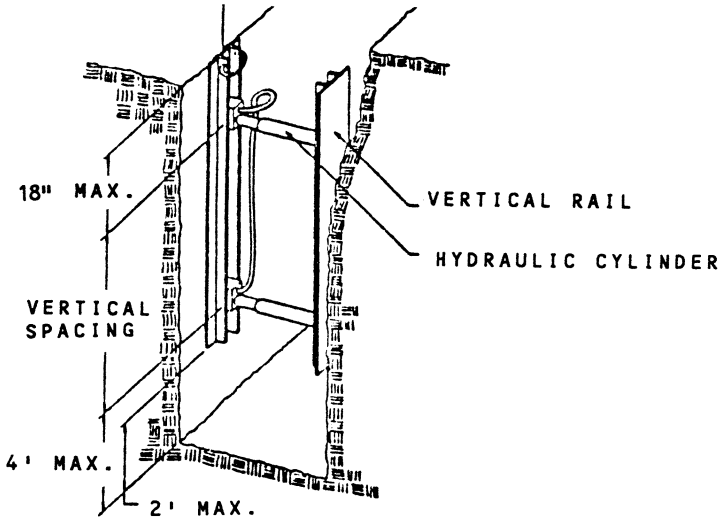


Figure 2. Pneumatic/hydraulic Shoring

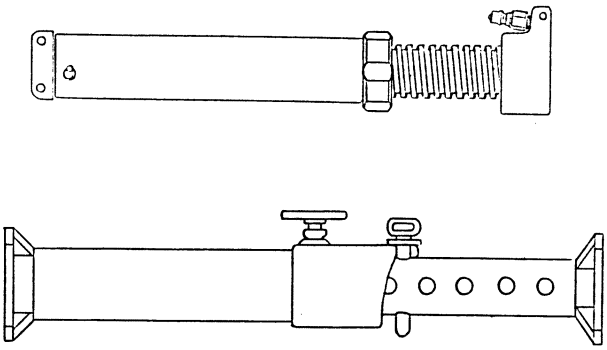


Figure 3. Trench Jacks (Screw Jacks)

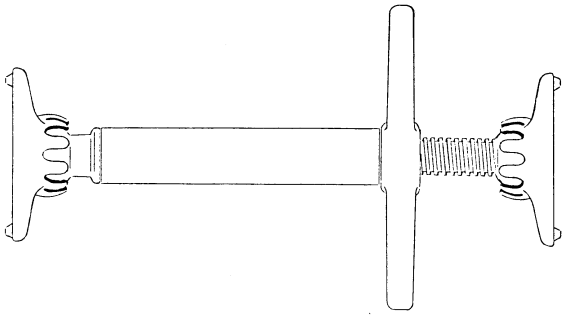
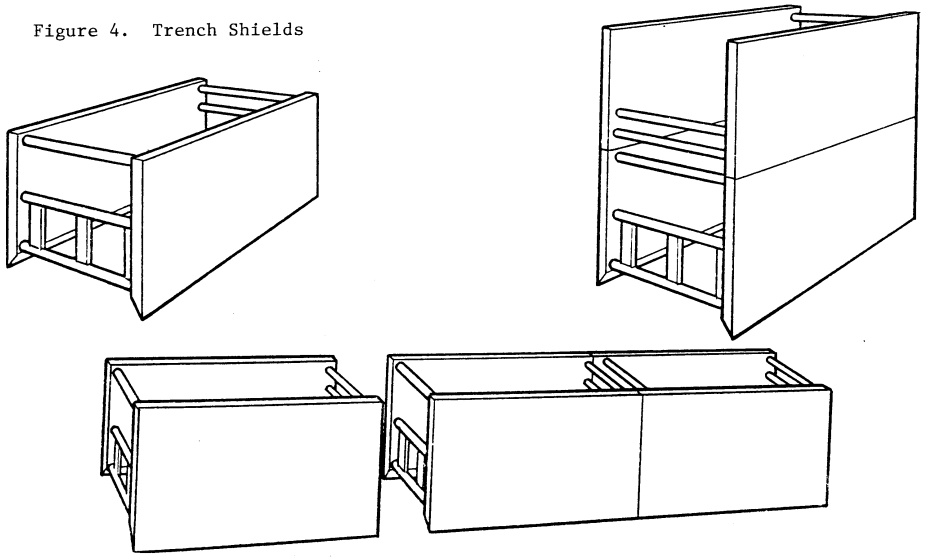


Figure 4. Trench Shields



APPENDIX F TO SUBPART P OF PART 1926—SELECTION OF PROTECTIVE SYSTEMS

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with §1926.652 (b) and (c).

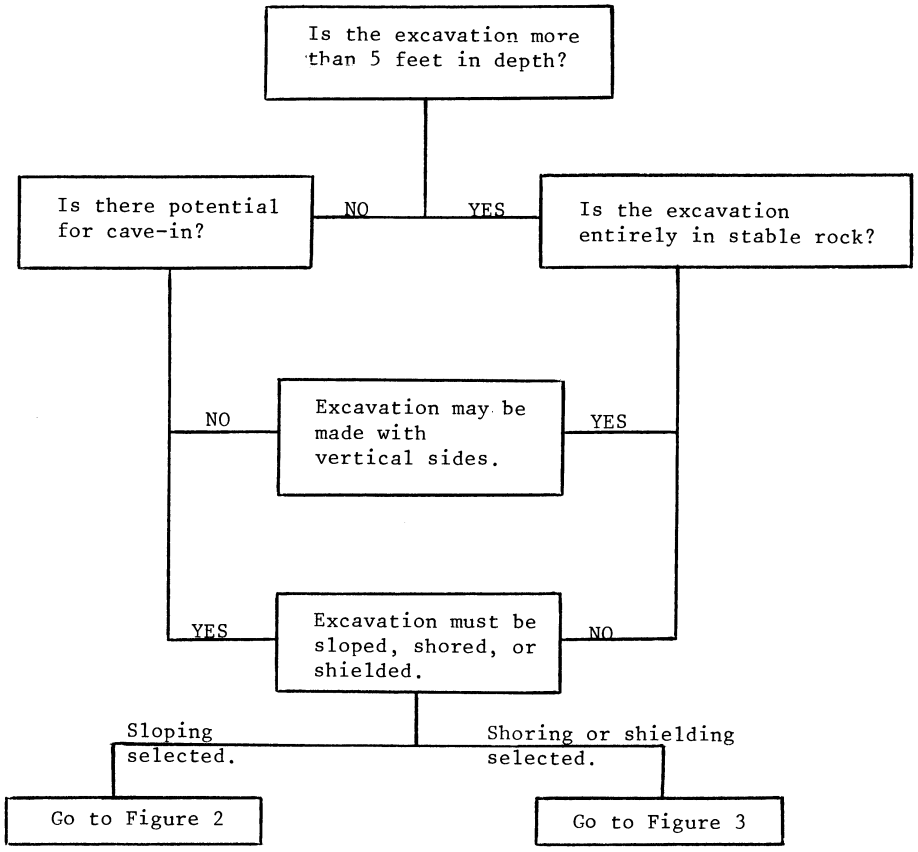


FIGURE 1 - PRELIMINARY DECISIONS

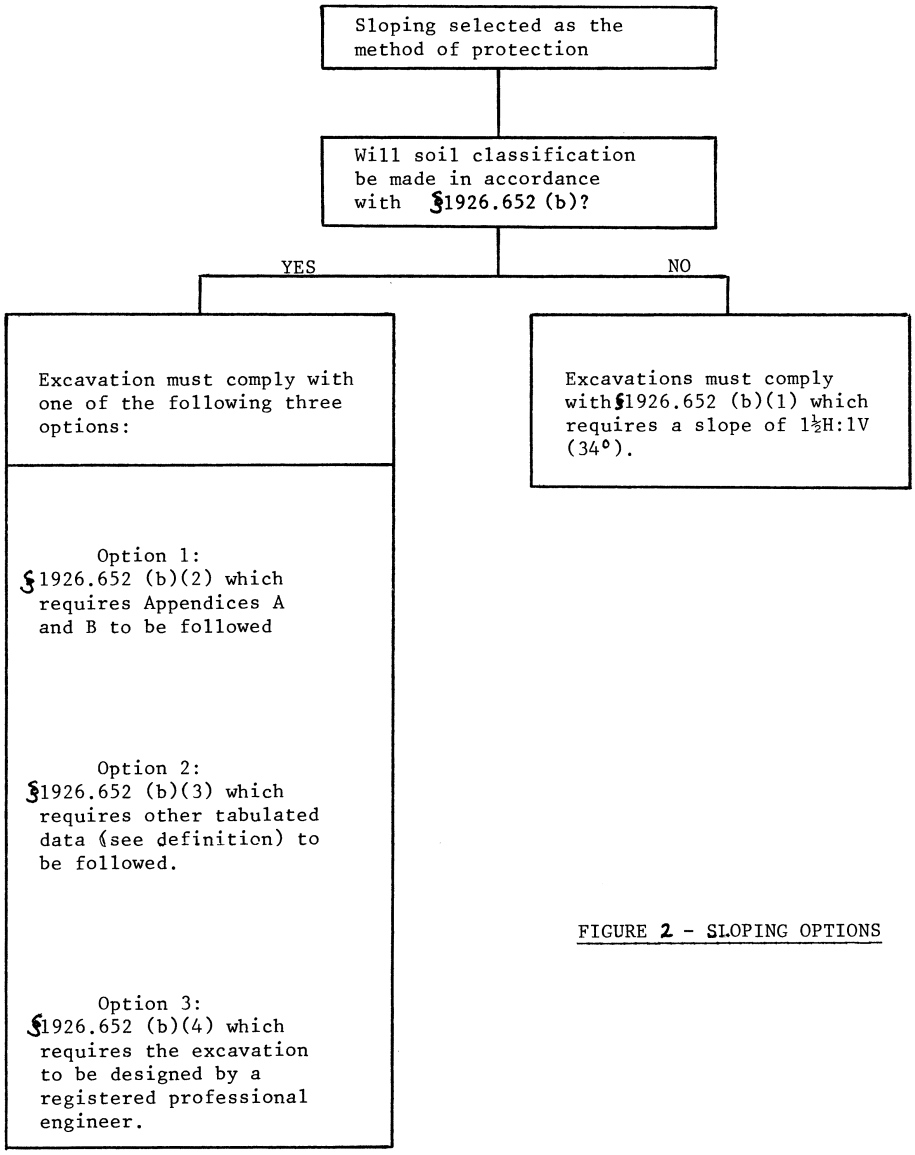


FIGURE 2 - SLOPING OPTIONS

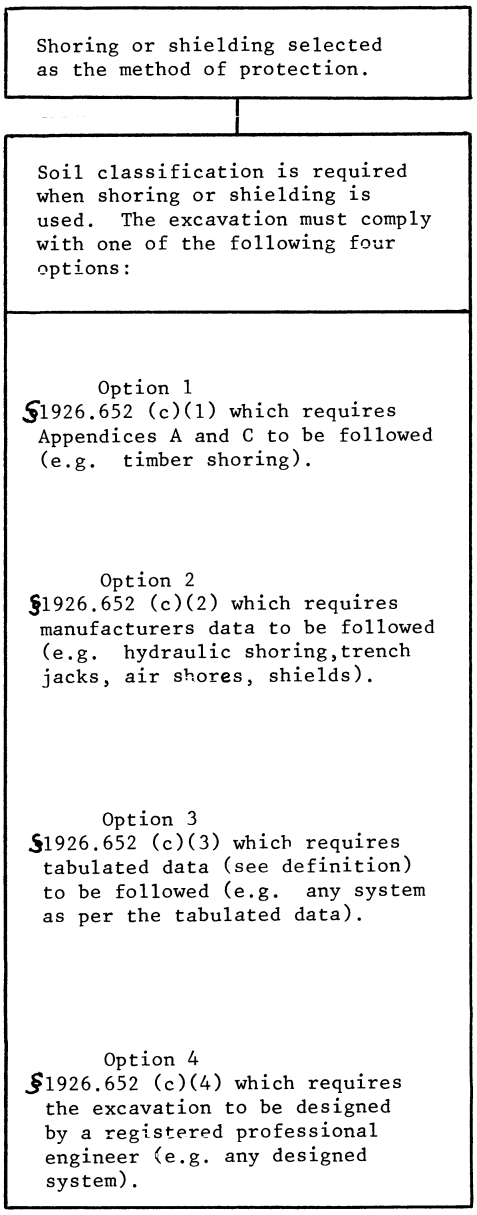


FIGURE 3 - SHORING AND SHIELDING OPTIONS

SECTION 02223
EXCAVATING, BACKFILLING AND COMPACTING FOR STRUCTURAL FILL MATERIAL AND GRADING

SECTION 02223

EXCAVACATING, BACKFILLING AND COMPACTING STRUCTURAL FILL MATERIAL AND GRADING

PART 1 - GENERAL

1.1 SCOPE OF THE WORK

A. The work covered by this section of the specifications consists of all earthwork required to excavate, sub-excavate, backfill, compact, and prepare ground surfaces upon which concrete structures are to be constructed, except trenches for pipelines when located outside the limits designated to be sub-excavated and/or receive Structural Fill. The work shall also include removal and disposal of any unacceptable or excess materials and any necessary dewatering or excavation of unsuitable materials. Refer to Sections 02221 for additional requirements.

B. The Contractor shall furnish all materials, equipment, tools, labor, superintendence and incidentals required to perform the work as indicated on the drawings, as directed by the Engineer, and as specified herein.

C. Excavation of whatever material encountered for all structures in the project; sub-excavation and removal of clay soils and finer grained surface soils or other undesirable materials, including all accessories, shall be made as required by the drawings or as specified herein. Materials acceptable for Structural Fill that may be imported from an offsite borrow source or from the site shall be subject to the approval of the Engineer. Filling, backfilling, overall grading and finish grading to grades and elevations shown on the drawings, including dewatering as required, are also the obligation of the Contractor under the requirements of this section. Stockpile acceptable excess excavated material, if any, as directed by the Engineer. Material unsuitable for use in the Structural Fill or backfill or grading shall be removed from the site.

D. The work shall be performed to prepare ground surfaces and to place Structural Fill in those areas where concrete structures as described in the drawings, are to be constructed. Preparation of the ground surfaces shall include all necessary grading, excavating, sub-excavating compaction treatment, filling, backfilling, borrowing and stockpiling of material, disposing of unacceptable or excess material, wetting, compacting, shaping and rolling.

E. The work shall be performed to the dimensions, typical sections, and lines and grades indicated on the drawings or established by the Engineer and in accordance with these specifications.

F. Bidders shall make such investigation of the nature of the materials to be encountered in excavation as they deem necessary and shall assume all responsibility for fully informing themselves of the character of such material. Data available on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner and Engineer will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data will be made available for the convenience of the Contractor at the Engineer's office. The Contractor is encouraged to take any additional borings or obtain any other subsurface information which he may deem appropriate for preparing his proposal.

G. No separate payment will be made for any special procedure used in connection with the excavation work, including but not limited to dewatering operations, disposal of any unacceptable or excess excavated materials, or rock excavation or any special preparation required to achieve the required compaction of the sub-excavated or excavated surfaces if required. The cost of such procedures shall be included in the contract price for the work.

H. The use of explosives in performing this work will not be permitted.

I. Existing structures and pipe not shown to be removed either above or below ground shall be protected from damage as specified in the General Conditions.

1.2 EXISTING CONDITIONS

A. The presence of ground water is not anticipated within the expected excavation depths as indicated in the subsurface data.

B. Compaction tests will be made at the expense of the Owner. However, when compaction tests show that the material has not been compacted to the required density, and additional compaction and testing are required, the cost of such tests shall be borne by the Contractor. Failed tests shall be deducted from the monthly progress payments due the Contractor.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300, Submittals.

B. Test Reports: When borrow material or outside materials are proposed for use by the Contractor, the Contractor shall employ a commercial testing lab to test and submit the following reports directly to the Engineer for review from the testing agency.

1. Name and location of source(s) for imported soils and aggregate materials. Cost of tests will be paid for by the Contractor.
2. Certified tests reports and analysis certifying that imported soils and aggregate materials proposed for use in the project conform to specified requirements.
3. Imported materials to be supplies from the same source throughout the work. Change of source requires Engineer's approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Fill material shall be free of any organic or deleterious substances and shall not contain cobbles or lump over three (3) inches in greatest dimension. Structural Fill material in the structure area shall consist of soils that conform to the following physical characteristics:

Sieve Size Square Openings)	Percent Passing by weight
3 inch	100
3/4 inch	70-100
No.4	40-100
No. 200	5-20

The plasticity index of the above material, as determined in accordance with ASTM D 4318, shall not exceed 18.

B. Some of the site soils resulting from the sub-excavation and excavation for new construction are deemed suitable for use as Structural Fill, and may be used only if all of the above criteria are met. Under no circumstances shall rubble material or clay materials be used to compromise any part of the Structural Fill. Undesirable materials encountered during excavation may be placed in the lower part of the yard and pavement fills, not closer than 2 foot from the bottom of the finish grades or the bottom of the pavement subgrade, and/or as directed by the Engineer. In no case will these materials be placed any closer than 10 foot from the edge of the foundations of structures. Borrow material except for materials resulting from sub-excavation and excavation may not be taken from the Owner's property. *During excavation the Contractor shall separate materials deemed unsuitable for structural fill from acceptable structural fill materials.*

C. Borrow: Suitable fill materials or Structural Fill borrow material other than acceptable excavated materials, required for Structural Fill are not available within the limits of the jobsite. Therefore, the Contractor shall provide sufficient materials as required for Structural Fill to construct embankments for the required Structural Fill to the lines, elevations and cross sections as shown on the drawings. Fill material shall be obtained from the same borrow source to provide consistency and eliminate different types of materials. If borrow areas change, the material change shall not occur within any single component. The Contractor shall obtain from owners of outside borrow areas the right to excavate material, shall pay all royalties and other charges involved, and shall pay all expenses in developing the source including but not limited to the cost of right-of-way required for hauling the material and at no cost to the Owner. All borrow material and excavated material proposed for fill or Structural Fill from site must satisfy the material specifications listed in paragraph 2.1 Material above.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing and grubbing is included as part of the work under this section, for which no separate payment will be made. As part of this work all trash, brush, vegetation or other unsuitable debris shall be removed and disposed of by the Contractor, in accordance with City of Amarillo requirements.

3.2 EXCAVATION AND FILLING SUBGRADE

A. General: The sub-grades of the Pump Station structure shall be improved as described in the Contract Drawings and as herein specified. All sub-excavation and excavation shall be made to the lines and grades as shown on the plans and established herein with provision, being made for forming each side of all walls. *Concrete for footings, unless otherwise shown, shall be formed and not placed against earth banks*. Excavation shall consist of the sub-excavation for the Pump Station foundation as shown on the drawings, removal of any unsuitable soils and stockpiling of the suitable soils for use as STRUCTURAL FILL, as well as satisfactory disposal of all vegetation, debris and deleterious or unsuitable materials encountered within the area to be graded. Any unsuitable materials or debris from the work shall be disposed of by the Contractor off site in accordance with the city of Amarillo requirements.

B. Area under structures shown to require Sub-Excavation and Structural Fill: Finer grained surface soils including clays and/or silty sands anticipated to be found in the soils below the area of Pump Station structure and building shall be excavated to at least the elevations

as shown on the drawings and any soft material replaced as specified in paragraph 3.3 – STRUCTURAL FILL AND EMBANKMENTS. If unsuitable soils are exposed at the depth(s) to which sub-excavation is required by the Contract Drawings; the unacceptable soils will be removed to depths as directed by the Engineer. The foundation sub grade materials shall be prepared by removing, processing, and compacting the material to achieve a density of 95% using modified proctor. Fill material is to be processed with moisture content that is within ± 2% of optimum moisture.

The subgrade area shall extend to a depth of two (2) feet below the bottom, and a minimum of two (2) feet beyond each edge of the foundation, or an elevation of 3466.25 for the lower foundation.

For the upper foundations the subgrade area shall extend to a depth of two (2) feet below the foundation bottom to and elevation of 3475.75, and include the entire area of the upper level building foot print to a distance of two (2) foot outside the edge of the footings.

C. Once the Contractor has excavated to the subgrade elevation, the Engineer in conjunction with the Geotechnical Engineer will review the excavation and may direct the Contractor to perform additional excavation to determine the suitability of the foundation subgrade material.

D. Soil improvements are not anticipated. However, should undesirable material be encountered in the construction operations, the undesirable materials shall be removed to a depth as directed by the Engineer.

E. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific written direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the expense of the Contractor.

F. Unacceptable soil or excess excavated materials if required to be taken off site shall be taken completely off the Owner's property including property which may occur outside the limits of the project site at no cost to the Owner.

3.3 STRUCTURAL FILL AND EMBANKMENTS:

A. General: Where Structural Fill is required as shown or indicated on the Contract Drawings, or where embankments below the structures are required, Structural Fill material shall be in accordance with the requirements as specified in Section 2.1,A – Materials.

3.4 EXCAVATION FOR STRUCTURAL FILL AND STRUCTURES:

A. Excavation walls should be suitably sloped or shored as required for trench or other excavations such that the requirements for slope stability will be maintained. The Contractor shall be responsible for maintaining safe stable embankment slopes during the work. Where excavation occurs adjacent to existing structures or facilities excavation shall proceed with care to remove only the necessary materials. Lateral Storing Systems designed by Contractor's Engineer shall be required as shown in the drawings.

B. The Contractor shall take special care during excavation, so as not to damage new or existing construction or to cause a loss of support to the structures, embankments or structure foundations, or to Structural Fill previously installed.

C. Prior to placement of any Structural Fill or backfill, all excavations and potential fill materials shall be inspected and approved by the Engineer. The surface of the excavation

shall generally be underlain by natural non-expansive soils and not by undesirable soil materials or clay soils as determined by the Engineer. Additional sub-excavation if deemed necessary by the Engineer is not anticipated to extend to a depth greater than five feet below the level of the sub-excavated surface indicated on the Drawings and/or these Specifications and as required by the Engineer.

3.5 COMPACTION

A. After sub-excavation, the exposed cut surface shall be compacted as described herein. *Use of vibratory rollers will not be allowed for the sub-excavation and subgrade preparation.*

B. The Contractor shall take special care when performing the Compaction effort, such as may be required to assure that damage is not done to adjacent or nearby structures, facilities, or work in progress.

C. Where vibratory compaction equipment is used, it shall be the Contractor's responsibility to insure that the vibrations do not cause damage to the new construction, existing adjacent to on site structures, or any other adjacent property. The Contractor shall remain responsible for any damage done to existing structures, roadways, embankments within the site, or any other facilities in the vicinity of the site. *Limited vibratory compaction may be used on the upper portion of the fill, subject to the written approval of the Engineer*.

3.6 FILLING

A. Fill material shall be placed in lifts not to exceed eight inches in loose depth and then compacted. Each layer of Structural Fill shall be laterally extended into the sub-excavation embankment so as to insure that the compaction operations properly compact all of the Structural Fill. The moisture content of the material shall be uniform and within, plus or minus, two (2%) percent of optimum, as determined by ASTM D 1557. Water shall not be pooled or jetted onto the in-place fill, but shall be distributed uniformly over the surface and processed into the soil material.

B. Compaction of fill material shall be by mechanical means only using approved types of power vibratory, pneumatic or tamping equipment. Each lift of fill material for the structure shall be compacted to a density of not less than 95% of maximum dry density as determined by ASTM D 1557 (Modified proctor). Optimum moisture content and maximum dry density for each soil type used shall be determined in accordance with ASTM D 1557.

3.7 CONTROL

A. Control of filling operations shall consist of field inspection and testing to determine that each lift of fill has been compacted to the required density. Should any lift or portion of a lift not conform to density requirements, it shall be scarified and recompacted until the required density is obtained at no cost to the Owner. The Contractor shall plan his backfill operations such that the structural fill is placed and compacted in uniform lifts at a constant elevation around the full perimeter of the lift station. Any proposed variance from this requirement shall be submitted to the Engineer for approval prior to the work.

Backfill placed adjacent to the structure shall be placed and compacted using small hand operated equipment. The Contractor shall not use or allow large equipment closer than three (3) feet of the structure, and then only with the approval of the Engineer.

3.8 WEATHER LIMITATIONS

A. Controlled fill shall not be constructed with the atmospheric temperature is below 35 degrees F. Frozen material shall not be placed at any time. Material shall not be placed and compacted during periods when freshly placed material would become frozen.

3.9 BACKFILLING

A. Backfill Material: Backfill materials shall conform to the requirements of Paragraph 2.1 A.
B. Backfilling: All backfilling shall be accomplished in accordance with paragraph 3.5 and 3.6.

3.10 EMBANKMENTS

A. The embankment material shall meet the specification requirements as defined in paragraphs 2.1 A Above and shall be placed in layers, approximately horizontal and not exceeding eight (8) inches, in thickness, loose measure. The embankment shall be constructed to elevations and slopes on the drawings.
B. No roots, trash debris will be permitted in the embankment. No frozen material shall be placed in embankments and no material shall be placed and compacted during periods when freshly placed material would become frozen.
C. The material in each layer shall be compacted while it contains the proper moisture for the required compaction. Supplementary wetting, or manipulation to promote drying, will be required if the excavated material does not contain the proper amount of moisture when placed in the embankment. The Contractor shall furnish all water, sprinkler trucks, sprinkler systems or other approved methods, for providing the proper moisture in the material. Each layer shall be compacted to the specified density before placement of an additional layer. Should the surface of any layer become hard and smooth before the next layer is placed, the surface of such layer shall be lightly scarified, and wetted, immediately prior to placement of the succeeding layer. Samples of embankment materials for testing will be taken both before and after compaction and correction, and corrections, adjustments and modifications of method, materials and moisture content will be made as indicated by the test results.
D. The Contractor shall, at all times, maintain and operate sufficient equipment of the proper types to diligently prosecute the work in a manner which will assure the specified results. As material is deposited or spread by transporting equipment, it shall be spread in approximately uniform layers and compacted, water being added as required. It shall be manipulated with blade graders, or other approved equipment, if mixing is required, and shall then be compacted. Compaction equipment shall consist of tamping type (sheepsfoot) rollers, pneumatic rollers of the small, two-axle type or large, single-axle type, self-propelled, smooth-wheeled rollers, vibrating rollers, or any combination of types which will secure the proper compaction.
E. Each embankment layer in areas outside the building areas shall be compacted to the maximum dry density specified in other sections of these specifications, obtained from ASTM D 1557.
F. Each embankment layer under the access roadway and the plan roads shall be compacted to the requirements as specified elsewhere in these specifications.

3.11 GRADING

A. All areas involved in the construction shall be graded as shown on the plan. All areas shall be shaped to drain away from structures and be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.12 PROTECTION

A. Settlement or washing that occurs in graded, topsoil, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes, at nor additional cost to the Owner.

PART 4 - PAYMENT

Payment for all work in this section will be included in the lump sum price the Pump Station as shown in the Proposal. Such Payment shall be complete compensation for the complete performance of the work including all subsidiary or incidental items necessary to complete the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 02230
BASE COURSE

SECTION 02230

BASE COURSE

PART 1 - SCOPE

The work covered by this section of the specifications consists of constructing the flexible base course at cut and removed portions of existing roadways. The Contractor shall furnish all materials, equipment, tools, labor, superintendence and incidentals for the complete construction of the base course in accordance with the drawings and these specifications.

PART 2 - FLEXIBLE BASE COURSE

2.1 GENERAL

The flexible base courses shall be constructed upon compacted subgrades specified in SECTION 02222 - EXCAVATING, BACKFILLING AND COMPACTING FOR PAVEMENT. The base courses shall provide foundation courses for Asphaltic Concrete Surface Courses and shall be constructed in one or more courses in conformity with the typical sections shown on the drawings and to the lines and grades established, compacted to not less than 98% per ASTM D-1557.

The base courses shall be constructed in the locations indicated on the drawings or as necessary to reconstruct or repair pavement damaged or removed during construction of the pipeline and its accessories.

2.2 MATERIAL

The material shall be crushed and shall consist of durable particles of stone mixed with approved binding material. The base material shall be screened or partially screened or otherwise manipulated, prior to crushing, in order that all soil, clay and other objectionable material will be removed. Samples for testing the material shall be taken prior to the compaction operations.

2.5 CONSTRUCTION METHODS

Construction methods shall be in accordance with NMDOT-Standard Specification Construction Methods.

PART 3 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price for base course as shown on the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 02600
SCHEDULE OF PIPE

SECTION 02600

SCHEDULE OF PIPE

PART 1 - GENERAL

Approved pipe shall be used in construction of all pipelines and connections. The only types of pipe which will be considered for use are those listed in this section. All pipe of like sizes shall be of the same type and class. Acceptable types and classes of pipe which may be approved for the various items of work are shown in the schedule below. See SECTION 02610 - PIPE, VALVES, AND FITTING MATERIALS of these specifications for other requirements.

PART 2 - SCHEDULE OF PIPE

WATER TRANSMISSION

Size and Use	Type and Class
6" and 8" Water Lines	HDPE EHMW PE 3608 Pipe Class 200 DR 9 DIPS

PART 3 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 02610
PIPE, VALVES & FITTING MATERIALS

SECTION 02610

PIPE, VALVES AND FITTING MATERIALS

PART 1 - SCOPE

The work covered by this section of the specifications consists of the materials for all piping, valves and fittings required for this project.

The Contractor shall furnish all materials, equipment, tools labor, superintendence and incidentals required for the complete construction of the work as shown on the drawings and as specified herein. All pipe and fittings used for this project are to be new. PVC and ductile iron pipe shall be properly restrained.

1.1 SUBMITTALS

Before beginning fabrication of the pipe, the Contractor shall furnish the Engineer with submittals which shall include a laying plan and details of a standard pipe section, special fittings, and bends for all pipe materials. The Contractor shall submit a minimum of six (6) copies of each submittal to be reviewed. The Engineer shall keep four (4) copies and return two (2) copies to the Contractor. Dimensions indicating wall thickness standard laying lengths as well as dimensions for all specials shall be included. Where applicable, information pertaining to special linings, coatings and joint bonding shall include the type of material being used, its application, method of installation and other information which relates to the manner in which it will be used. The laying plan shall show the location of each pipe section and each special length with each piece numbered or otherwise designated in sequence. All special fittings, bends, etc. shall be made up into special lengths so that, when installed, they will be located as indicated. Each pipe and fitting shall be marked on the outside to indicate the class of pipe and the location number on the laying plan. Pipe shall be furnished and installed in accordance with the approved laying plan. Where two or more classes or lengths of pipe of the same diameter are to be furnished, clearly mark each pipe section. All markings shall be coded to the shop drawings. The drawings shall be furnished in conformance with requirements of the General Conditions. Review of the drawings by the Engineer shall not relieve the Contractor of the responsibility for complying with all requirements of the Contract Documents.

1.2 CERTIFICATION

Certifications properly executed by the manufacturer shall be furnished to the Engineer showing compliance with the required specifications. All pipe and fittings must conform to ANSI/NSF standard 61 and must be certified by an organization accredited by ANSI. Data resulting from tests performed shall be provided by the Contractor as requested by the Engineer.

1.3 INSPECTION

The Engineer and his representatives shall have access to all phases of the work. The manufacturer and Contractor shall provide proper facilities for access and inspection. Materials, fabricated parts, and pipe which are discovered to be defective, or which do not conform to the requirements of this Specification, will be subject to rejection at any time prior to final acceptance of the pipe.

PART 2 - PIPE MATERIALS

The Contractor shall supply all pipe required for the project. Refer to Section 02600 - SCHEDULE OF PIPE for minimum pressure class and wall thickness to be provided for the various types of pipe materials acceptable. For design purposes all pipe for this project shall be of the sizes shown on the drawings, and shall be designed for a minimum rated working pressure of a minimum of **150 psi**, plus an additional surge pressure of **50 psi**. The force main pipe shall also be designed for the earth loads based upon a soil unit weight of 125 pounds per cubic foot and the depths of cover as indicated on the drawings. In addition, 16,000-lb. wheel load and a 1.5 impact factor, using a Type 5 laying condition as defined by AWWA C151 shall be used. Bedding constant shall be 0.1 and the deflection lag factor shall be 1.1. The modulus of soil reaction (E') for design purposes shall be 700 psi. Design calculations shall be submitted to the Engineer for approval prior to the fabrication of any pipe.

2.1 PVC GRAVITY SEWER PIPE

PVC Gravity Sewer Pipe shall be un-plasticized polyvinyl chloride plastic pipe conforming to ASTM F 679 with an integral bell, bell-and-spigot type rubber gasketed joint.

Fillers shall not exceed 22 parts by weight to 100 parts by weight resin as tested per the Ash Burn Test ASTM D-817. An Ash Burn Test per ASTM D-817 shall be conducted on material at the job site to verify the filler content. The test will be conducted by a testing lab retained by the Engineer. If the filler exceeds the above requirement the pipe will be rejected and removed at the Contractors cost.

The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B, 12454-C or 13364-B as defined in ASTM C 1784. Rubber gaskets for joints shall conform to ASTM F 477.
The spigot end of each length of pipe shall be tapered and shall have a painted mark indicating the proper depth of insertion into the bell. The joint shall be designed to avoid displacement of the gasket when installed in accordance with the manufacturer's recommendation.

The following physical and chemical tests shall be performed to demonstrate pipe quality and the manufacturer shall provide certified conformance test reports to the Engineer. Pipe shall be designed to pass all tests described herein at 73° F.

Determine the impact resistance of the pipe in accordance with ASTM Test Method D2444, using the 30 lb., Type B and flat plate holder B. Ten specimens shall be tested. Failure in the test specimens shall be any shattering or any crack or split extending through the wall of the pipe that was created by the impact and that can be seen by the naked eye. Nine out of ten specimens passing constitute an acceptable product. The impact strength shall not be less than 220 ft. lbs.

Determine the pipe stiffness at 5% deflection datum in accordance with ASTM Test Method D2412. Test three specimens, minimum 12 inches long and determine the average pipe stiffness at 5% deflection in accordance with Method D2412. The pipe stiffness shall equal or exceed 46 psi.

Two sections of pipe shall be assembled in accordance with the manufacturer's recommendation. Joint shall be assembled in accordance with ASTM D3212 "Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals".

Flatten three specimens of pipe, each a minimum of 6 inches long between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within 2 to 5 minutes. The specimen shall pass if no splitting, cracking, or breaking is observed under normal light with the unaided eye.

2.2 HIGH DENSITY POLYEHYLENE (HDPE) EXTRA HIGH MOLECULAR WEIGHT (EHMW) PIPE

See section 02732 – HDPE Water Pipe

2.3 PVC PRESSURE PIPE

PVC pressure pipe shall be unplasticized polyvinyl chloride plastic water pipe, blue in color, with integral bell and spigot joints. Pipe 12-inches in diameter and smaller shall meet the requirements of AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe", Pressure Class 150 (DR18). Pipe greater then 12- inches in diameter shall meet the requirements of AWWA C905, "Polyvinyl Chloride (PVC) Water Transmission Pipe", Pressure Rating 165(DR25). Provisions must be made for expansion and contraction at each joint with an elastomeric ring. The bell shall consist of an integral wall section with a locked in, solid cross section elastomeric ring, which meets the requirements of ASTM F477. The bell section shall be designed to be at least as hydrostatically strong as the pipe to meet AWWA C900/C905.

The pipe shall withstand a minimum quick burst pressure of 755 psi when tested in accordance with ASTM C1599. The pipe shall withstand, with no visible evidence of shattering or splitting, when subjected to the drop impact test, an impact of 120 ft./lbs. in accordance with ASTM D2444.

The PVC pressure pipe used to replace sanitary sewer lines shall meet the requirements of ANSI/AWWA C900-89 and shall be Class 150 (DR 18), and it shall be connected to existing sewer pipe at each end with adapter couplings having stainless steel hardware.

The PVC pressure pipe used to relocate and/or replace existing water lines shall be rated for minimum working pressure of 150 psi and shall meet the requirements of either ANSI/AWWA C900-89, minimum DR 18, blue in color, or ANSI/AWWA C905-88, minimum DR 18, blue in color, with cast iron pipe O.D.

The minimum length of restrained joints shall be as indicated in TABLE 1 at the end of these specifications. The procedure and materials used for restraining the joints shall be as recommended by the pipe manufacturer. The Contractor shall submit the recommended procedure with details to the Engineer for field inspection purposes.

PART 3 - PIPE FITTINGS:

3.1 POLYVINYL CHLORIDE PRESSURE (PVC) FITTINGS

The fittings for AWWA C900 and AWWA C905 PVC pipe shall be ductile or cast iron conforming to the requirements of ANSI/AWWA C110/A21.10-87, and shall be suitable for use with the specified PVC pipe with which they are used. For other classes and schedules of PVC pipe, the fittings shall have the same, or greater, respective class/schedule as that of the pipe with which they will be used. Fittings shall have elastomeric rings for sealing. Solvent welding will not to be acceptable. Where necessary, VINYL-iron PVC pipe to A/C pipe coupling adapter will be used for connecting to exiting A/C pipe.

A. Restrained Joints for PVC Pipe: Restrained joint devices for all PVC pipe shall incorporate a series of machined serrations (not "as cast") on the inside diameter to provide positive restraint, exact fit and 360 degree contact and support of the pipe wall. The solid back-up ring shall have a beveled leading edge to assure an exact fit behind the pipe bell. Restraint devices shall be of ductile iron, ASTM A536, Grade 65-45-12. Connecting bolts shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11.

   All restraint devices for PVC pipe shall have a working pressure rating equivalent to the full rated pressure of the PVC pipe on which they are installed, with a minimum 2:1 safety factor in any nominal pipe size. In addition, they shall meet or exceed the requirements of UNI-B-13-94. Notarized certification from the manufacturer of the joint restraint device shall be submitted. Restraint devices shall be Uni-Flange Block Buster Series 1300 manufactured by Ford or an Engineer approved equal.

3.2 DUCTILE IRON FITTINGS

Fittings for ductile iron pipe shall be cast iron or ductile iron and shall be end grooved, mechanical joint, flanged, or a combination as shown or required and shall conform to AWWA C110. In general, flange fittings shall be used on all exposed piping and all other fittings shall be mechanical joints. End grooved fittings shall only be used where shown on the drawings. All fittings or restrained joints shall be designed for a working pressure of a minimum of **150 psi** and an additional **50 psi** surge pressure.

All ductile iron fittings shall be cast from the same quality of metal used in casting ductile iron pipe and shall be subjected to the same test requirements. Marking and weighing shall be as required for the ductile iron pipe.

All flanged fittings shall be faced and drilled in accordance with the standard drilling for ANSI B16.1 Class 125 flanges.

Bolts shall be of the length and diameter required by the ANSI specification for Class 125 flanges. Bolts and nuts shall be of best quality mild steel and shall be provided with hexagonal heads, except where other types of bolts are specified. Ring gaskets shall be used in all flanged joints and shall be rubber composition sheet packing, Rainbow, Durable Barlock or equal.

PART 4 - VALVES

4.1 GENERAL

All valves shall be of the type shown or specified on the drawings and as specified herein. All valves shall either be flanged, or as shown on the drawings. All valves shall be complete with the required devices and appurtenances required for operation, and extension stems, as shown on the plans or as specified herein. All valves shall be for buried service operation.

4.2 GATE VALVES

A. General: gate valves shall be of the resilient wedge, tapered seat, iron body, bronze mounted type and shall comply with AWWA C-509. Gate valves shall be installed where shown on the plans. Gate valves shall be rated for a minimum of 200 psi working pressure. Gate valves shall be Kennedy C509 or approved equal.
Records of tests shall be furnished as specified in AWWA C509. Records of tests shall be submitted prior to approval of the valves.

B. Body: The valves shall have a ductile iron body, bonnet and O-ring plate.
Stems: Valves shall be non-rising stem, opening by turning in a counter clockwise direction **and provided with a 90-degree gear side operator**. The stems shall be bronze or copper alloy with integral collars. Stainless steel stems or stem nuts are not acceptable. Stems shall be sealed by three O-rings. Two O-rings shall be located above the collar and one O-ring below. The top two O-rings shall be replaceable with the valve fully open. All gaskets shall be O-ring seals. Flat gaskets shall not be allowed.

C. Wedge: The wedge shall be ductile iron, completely encapsulated with rubber. The wedge shall be symmetrical and seal equally well with flow in either direction.

D. Coating: Interior and Exterior ferrous metal surfaces shall be epoxy coated to comply with AWWA C550 standard.

E. Affidavit of Compliance: An affidavit of compliance as specified in AWWA C509 shall be furnished during the submittal phase prior to approval of the valves. Certified drawings and material specifications shall be furnished by the manufacturer through the Contractor covering all items included in AWWA C509. Manufacture of valves to the furnished shall commence only after the certified drawings have been accepted by the Engineer.

4.3 FIRE HYDRANTS

A. General: fire hydrants shall manufactured in accordance with AWWA C502 and be of break flange traffic model. Hydrant shall be rated for a minimum of 150 psi working pressure. Hydrants shall be Clow model F2500 or approved equal.

B. The hydrant shall be of dry top center stem construction with main valve opening against pressure.
Operating nut and thrust nut shall be bronze. Bearings shall be located both above and below thrust collar. A stop nut shall be provided to prevent over travel and compression of the stem. The main valve seat ring shall be bronze and screw into the bronze drain ring.

C. Split break away flange and stainless steel snap on ring shall allow 360 degree rotation of stand pipe.

D. Hydrant shall have a minimum valve opening of 5 ¼”.

E. Inlet connection shall be a 6” mechanical joint.

F. Hydrant shall have two 2 ½" hose nozzles and one pumper nozzle. Nozzle thread shall be National Standard. Operating nuts shall be National Standard.
G. Hydrant shall be suitable for installation in 3-ft depth of trench.
H. Hydrant shall turn counter clockwise to open and shall be painted yellow.

4.4 SADDLES FOR WATER SERVICES

Saddles shall be electrofusion saddles of the dimension ratio to match the pipe.

4.5 BALL VALVES FOR WATER SERVICES

Ball valves for service connections shall be fused polyethylene, full bore valve, suitable for use with HDPE pipe complying with AWWA C901 of the dimension ratio to match pipe. Threaded valves shall not be used on this project. Ball valves shall be rated for a maximum pressure of 200 psi. Corporation stops shall be of sizes and connections as shown on the drawings.

4.6 VALVE BOXES

All Valves installed underground that are 16-inch diameter and less shall be provided with a valve box accurately set over the operating nut. Valve boxes shall be of cast iron, complete with cover, and shall be of the extension type with screw-or-slide-type adjustment and flared base suitable for the particular valve on which it is installed. **Boxes shall be similar to Clow-National No. F-24.50**.

4.7 TAPPING SLEEVES

Tapping sleeves shall be model 622 when tapping to PVC, Steel or Ductile Iron as manufactured by Smith-Blair Inc., or equal. The body shall be a full circumference split-sleeve saddle with AWWA C207 Class D ANSI and 150 lb flanges, both made of ASTM A285 Grade A PVQ carbon steel. The body shall be coated with minimum 12-mil thick fusion bonded epoxy. Gasket shall be grade 60 concave wedge gasket, compounded to resist oil, alkalies, most (aliphatic) hydro-carbon fluids and water, and resist temperatures up to 212^{o}F. The tapping sleeves shall be fastened with 18-8 type 304 stainless steel heavy hex nuts and stud bolts. Nuts shall be Teflon coated to prevent galling, and washers should be the plastic lubricating type.

PART 5 - THRUST RESTRAINT

All underground pressure piping 12" diameter and less shall be provided with both mechanically restrained joints and concrete thrust blocking at all changes in direction and at the locations of valves, fittings, service stub-outs, and dead-ends in accordance with the drawing details. For pressure piping 16" diameter and larger restrained joints (mechanically and/or welded) shall be provided at the locations and for the minimum lengths shown in TABLE 1, and at all changes in direction, valves, fittings, and dead-ends. Additionally, thrust blocks shall be provided for pressure pipe 16" diameter and larger, where specifically called out in the drawings or where there is a dead-end. All pressure pipelines installed within casings shall have restrained joints throughout the entire length of casing plus a minimum of one additional joint length on both sides of casing. For specially fabricated pipe such as steel pipe, restrained length calculations from the manufacturer shall be submitted to the Engineer for review and approval, prior to pipe fabrication. Restrained lengths shall be designed to withstand 1.5 x (rated working pressure of

the pipeline); and shall be designed for the configuration and earth loads indicated on the drawings. The restrained lengths indicated in TABLE 1 are the minimum required to be provided and are considered to be in addition to what the pipe manufacturer recommends. The most conservative restrained lengths shall be used for this project, whether they are what are indicated in the plans or what the pipe manufacturer calculates.

TABLE 1 – MINIMUM RESTRAINED LENGTHS FOR PROJECT			
PIPE DESCRIPTION	FROM STATION	TO STATION	LENGTH (FT)
Project does not have lines greater than 16”			

PART 6 - PAYMENT

For all work covered in this section will be included in the unit price per unit for pipelines as shown in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 02730
PIPE INSTALLATION

SECTION 02730

PIPE INSTALLATION

PART 1 - SCOPE

The pipe, fittings, and accessories shall be inspected upon delivery and during the progress of the work. Any material found to be defective will be rejected by the Engineer and the Contractor shall remove such defective material from the site of the work.

The Contractor shall be responsible for all material furnished by him and he shall replace at his own expense all such material found to be defective in manufacture or damaged after delivery.

All pipe, fittings, and other accessories shall, unless otherwise authorized, be unloaded at the point of delivery, hauled to and distributed at the site of the work by the Contractor. In loading and unloading, the materials shall be lifted by hoists with slings, slid, or rolled on skidways, in such a manner as to avoid shock or damage to the materials. Under no circumstances shall the materials be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.

PART 2 - PIPE BEDDING

Pipe bedding and classes of bedding conditions shall be as indicated on the plans and as specified herein.

2.1 CLASS A PIPE BEDDING

A. Class A bedding shall be used for all pipe materials. Pipe bedding shall consist of soils that conform to the following physical characteristics:
   1. Percent Passing 3/8" sieve.....100
   2. Percent Passing No. 200 sieve.....0 -12

B. Bedding material shall be non plastic per ASTM D-4318 and placed from bottom of trench to 12” above top of pipe in 8” lifts. The bedding material shall have a moisture content within plus or minus (±) 2% of optimum moisture and be mechanically compacted to 90% ASTM D-1557. No water flooding will be allowed.

PART 3 - PIPE INSTALLATION IN TRENCH

3.1 GENERAL

A. After the trench has been excavated and the pipe bed properly fine graded, the pipe shall be laid in accordance with the manufacturer's recommendations and the following specifications. Each length of pipe shall be inspected for defects immediately before it is laid. Any defective pipe that has been damaged by mishandling or any other cause shall be replaced with satisfactory pipe by the Contractor at his expense.

B. Pipe shall be laid true to line and to a uniform grade with no sharp changes in grade. All pipe shall rest on the bottom of the trench or upon the prepared bedding throughout the

length of the pipe and bell holes shall be provided, where required, to assure this. All pipe shall be laid true to the lines and depths shown on the plans. Any pipe, which is not in true alignment or shows any undue settlement after laying shall be taken up and re-laid at the Contractor's expense.

C. Pipes shall be clean inside before they are joined and shall be maintained free of water, soil, and all other foreign matter. All openings to the pipe shall be closed by suitable means at all times except as the actual progress of the work may require the pipe to be open. A water tight seal shall be maintained on the open ends of installed pipe during non working hours.

D. The Contractor shall furnish watertight plugs for the pipe ends and/or other openings as may be required. These plugs shall be installed and maintained by the Contractor; during non-work hours, nighttime, weekends, and non-pipe laying operations, at each location where the pipe is being installed. The Contractor shall provide the temporary plugs for all pipe openings that would normally be left open during construction. The information on the proposed plugs to be furnished for use on the project shall be included as part of the information submitted for the pipe to be furnished on the project. At the completion of the work, the Contractor shall turn the plugs over to the Owner.

E. The work shall be watertight at all joints and any leaks or defects shall be immediately repaired. Any pipe which has been disturbed for any cause after being laid in its final position shall be taken up, the joint cleaned and the pipe properly re-laid.

F. The Contractor shall furnish a pipe inspection vehicle, adequate lighting and ventilation for inspection of the pipe.

The Contractor shall grout all joints for all Steel and SCCP pipe installed on a daily basis. As part of the inspection procedure, the RPR will inspect the grouted joints on a daily basis.

3.2 SPECIAL PROVISIONS FOR STEEL PIPE

Contractor shall strictly adhere to manufacturer's recommendations for installation of flexible coated steel pipe and the specifications herein.

A. Support stulls inside pipe shall remain in place until backfill is complete.

B. Just before each joint is lowered into the trench it is to be inspected and the coating "jeeped" for holidays (holiday testing). All holidays are to be repaired before pipe is lowered into the trench.

3.3 WELDING PROCEDURES FOR CARRIER PIPE

A. Carrier pipe shall be prepared for field lap welding in accordance with AWWA C-206. All lap welding shall be in accordance with ANSI /AWS D1.1 and the welders shall be certified for the 5F Pipe Fillet position.

1. Inspection and Testing of Welds: All production weld testing shall be witnessed by the Engineer. It shall be the responsibility of the Contractor to notify the Engineer sufficiently in advance of performing any welding work for the Engineer to prepare for witnessing the weld testing. The Contractor shall provide reasonable access to the Engineer, or his representative, for observation of the weld testing being performed by the Contractor. Acceptance of the weld test by the Engineer shall not relieve the Contractor of the responsibility for the quality of all welding performed or for performing the work as specified.

2. Acceptance Standards: The Engineer shall accept or reject any production weld in accordance with the criteria of ANSI/AWS D1.1.
3. Defective Welds: Any welds which inspection has determined to be defective shall be repaired or removed in accordance with the requirements of ANSI/AWS D1.1.

3.4 SHRINKAGE/EXPANSION CONTROL JOINTS:

A. Locations:
1. At intervals not exceeding 500 feet along welded reaches of the pipeline.
2. The first regular lap-welded field joints outside of each concrete encasement or structure.
3. Where the shrinkage/expansion control joints occur in a traveled roadway or other inconvenient location, the location of the joint may be adjusted to a convenient location.

B. Installation:
1. The pipe shall be laid within an initial lap of not less than 3 inches greater than the typical lap.
2. The welding of shrinkage control joints shall take place when:
a. The temperature is approximately the lowest during the work day, and
b. The pipe joints have been welded ahead of and in back of the shrinkage control joint, at least 500 feet in each direction, and
c. After backfill has been completed to at least 1 foot above the top of the pipe ahead and in back of the joint.

3.5 SAFETY

A. Confined Entry Safety Plan: See OSHA Standard at end of this Section.
B. AC Interference/Lightning: In the areas shared by overhead power cables, contractor should be aware of potential Safety Issues. Contractor shall conform with NACE Standard PR0177 Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems.

3.6 FIELD QUALITY CONTROL

A. Weld Testing: As soon as practicable after welding of each joint, all field-welded joints shall be tested by the liquid penetrant inspection procedure conforming to the requirements of ANSI/ASTM E 165 under Method “B” and “Leak Testing.” All defects shall be chipped out, rewelded, and retested. Upon retest, the repaired area shall show no leaks or other defects.
B. Holiday Detection Testing of Plastic Tape Wrap and Polyurethane Coatings on Steel Pipe:
1. Perform a complete high voltage electrical inspection (holiday detection testing) of all steel piping systems and fittings coated with plastic tape wrap or polyurethane prior to installing in trench.
a. Perform high voltage electrical inspection in strict accordance with NACE RP0188-99.
b. Test voltage used for the electrical inspection of the piping and fittings shall be in accordance with the recommendations given by the tape coating manufacturer in their published literature.
c. Repair all holidays and defects found in the coating system through the high voltage electrical inspection in strict accordance with the tape coating manufacturer’s recommendations.

d. Retest repaired areas in the coating prior to installation of the piping to ensure that all holidays and defects in the coating have been properly repaired.

2. Before conducting holiday detection testing on any piping systems, submit to the Engineer for review and approval of technical literature and data describing the testing instrumentation, equipment, electrodes, and other accessories that will be used. The literature and date shall include complete information covering the operation and use of the testing equipment, including operational voltage ranges.

3. All holiday detection testing and coating repair work shall be witnessed, inspected and approved by the Engineer or his representative.

C. Field Quality Control: Field densities shall be taken every 300 linear feet of pipe installation, in accordance with ASTM D2922, at the following depths:

- 1/3 pipe height
- Springline
- Top of pipe
- Every lift thereafter to ground surface

Additionally, one moisture density curve shall be obtained for each type of material used in accordance with ASTM D1557, and one sieve analysis and one plasticity index for each type of imported material used in accordance with ASTM C136 and D4318.

PART 4 - CASING INSTALLATION

Pipe installation in casing shall be in accordance with the recommendation of the pipe manufacturer, the details on the plans and as specified herein.

4.1 HANDLING CASING PIPE

A. All casing pipe delivered to the job site shall be unloaded at the point of delivery. The Contractor shall haul the materials to the site of the work, and the materials shall be distributed by the Contractor, unless otherwise specified. In loading and unloading, the casing pipe shall be lifted by hoists with slings or slid or rolled on skidways in such a manner as to avoid shock or damage to them. Under no circumstances shall the materials be dropped. Casing pipe handled on skidways must not be skidded or rolled against casing pipe already on the ground. The material shall be handled to avoid damage, and any damage caused to the material shall be repaired by the Contractor at his own expense.

4.2 WELDING PROCEDURES FOR CASING PIPE

A. Procedures for welding casing pipe joints shall be established in accordance with the requirements of the American Petroleum Institute, API Standard 1104, 19th Edition, September, 1999 Section 5 -Qualification of Welding Procedures for Welds Containing Filler-Metal Additives.

B. Qualifications of Welders: All welding of casing pipe on this project shall be performed by welders who have been qualified in accordance with the requirements of API Standard 1104, 19th Edition, September, 1999, Section 6 - Qualifications of Welders.

C. Welding of Casing Pipe: All design and preparation of casing pipe joints and all production welding of casing pipe joints shall meet the requirements of API Standard

1104, 19th Edition, September, 1999, Section 7 - Design and Preparation of a Joint for Production Welding.

D. Inspection and Testing of Welds: All production welds shall be observed and tested by the Engineer. It shall be the responsibility of the Contractor to notify the Engineer sufficiently in advance of performing any welding work for the Engineer to prepare for the observation and testing. The Contractor shall provide the Engineer's representative with free access to the work to be observed, and he shall also provide the representative with reasonable facilities and space for observing, testing, and obtaining information relative to the materials used and the progress and condition of the work.

The inspection and testing of welds shall be performed by visual examination in accordance with API Standard 1104, 19th Edition, September, 1999, Section 8 - Inspection and Testing of Production Welds, and Section 11 - Procedures for Nondestructive Testing.

Observation of the work by the Engineer shall not relieve the Contractor of the responsibility for the quality of all welding performed or for performing the work as specified.

1. Acceptance Standards: The Engineer shall accept or reject any production weld in accordance with the criteria of API Standard 1104, 19th Edition, September, 1999, Section 9 - Acceptance Standards for Nondestructive Testing.
2. Defective Welds: Any welds which have been determined to be defective shall be repaired or removed in accordance with the requirements of API Standard 1104, 19th Edition, September, 1999, Section 10 - Repair and Removal of Defects.

E. Casing Pipe Cutting: Casing pipe cutting, where indicated on the drawings or where approved or authorized by the Engineer, shall be performed without damaging the casing pipe. The cutting shall be carried out by means of an approved type of mechanical cutter. Wheel cutters shall be used where practicable.

PART 5 - INSTALLATION OF CARRIER PIPE THROUGH CASING OR TUNNEL

See Section 02300 – JACKING/BORING.

PART 6 - UTILITY RELOCATIONS

6.1 WATER AND SEWER

A. Existing water and sewer lines shall remain in service at all times during construction, unless otherwise noted on the plans. Existing utilities that will be exposed during construction shall be shored or otherwise supported so that no damage occurs to the exposed lines. If leaks develop in any existing, exposed, water or sewer line, those leaks shall be repaired immediately by the Contractor at no additional expense to the Owner. The Contractor shall not interrupt the service or function or disturb the support of any utility without written authority from the particular utility owner. Where protection is required to ensure support of utilities, the Contractor shall place and provide the necessary protection and all cost associated with such shall be included in the unit price bid for the various line items, unless a specific bid item is stated.

B. Any existing lines which will require relocation by the Contractor, shall be relocated in accordance with these specifications.

C. All temporary or permanent relocation, and alteration of utilities requested by the Contractor for its convenience shall be its responsibility and the Contractor shall make all arrangements and bear all associated costs.

6.2 SUBMITTAL OF BY-PASS PLANS

A. A by-pass plan for any and all utilities shall be submitted to the Engineer for review and approval 21 calendar days prior to the planned by-pass. Submittal shall include: the time the by-pass is planned; how it will be accomplished; materials to be used; contractor support personnel and equipment to be used for the by-pass; contractor contact during by-pass; time required for the by-pass; time of day the by-pass will be conducted; interruption time (if any); by-pass close down procedures; testing of bypass and disinfection procedures for water lines if applicable.

6.3 SUBMITTAL OF TIE-IN PLANS

A. Plans for tie-ins of new facilities to existing facilities or to other new facilities shall be submitted to the Engineer for review and approval 7 calendar days prior to the planned work unless indicated otherwise on the drawings. The plans shall include the time when the work will be performed; the methods and materials to be used; any interruption of service time required; and the testing and disinfection procedures to be followed, where applicable.

6.4 SEWER AND POTABLE WATER SEPARATION

When installed parallel to existing potable water lines, sewer lines shall be separated from the potable water lines by a distance of at least nine (9) feet. Where the nine foot separation distance cannot be achieved the following separation requirements shall be observed:

A. When installed parallel to an existing potable water line, the sewer piping shall be located lower than the potable water line with at least two (2) feet between outside diameters vertically, and at least four (4) feet between outside diameters horizontally.
B. When crossing an existing potable water line, a separation of six (6) inches between outside diameters of potable and sewer lines shall be achieved. Additionally, one length of sewer pipe shall be centered on the potable water line.

6.5 WATER AND SEWER SEPARATION

Per requirements of the Texas Commission on Environmental Quality (TCEQ), where water and sewer lines are parallel, a minimum separation (outside-to-outside) of 9 feet shall be maintained in all directions. Sewers that parallel water lines must be installed in separate trenches. Where the nine foot separation distance cannot be achieved, the following guidelines will apply:

A. The sewer need not be disturbed where a new waterline is to be installed parallel to an existing sewer that shows no evidence of leakage and the waterline is installed above the sewer a minimum of two feet vertically and four feet horizontally. Should excavation for the waterline produce evidence that the sewer is leaking, the sewer must be repaired or replaced as described in part (C).
B. The sewer need not be disturbed where a new waterline is to cross over (by two feet or more) existing sewer showing no evidence of leakage. Should excavation for the waterline

produce evidence that the sewer is leaking, then the sewer must be repaired or replaced as described in parts (D) or (E).

C. Where a sanitary sewer parallels a water line, the sewer shall be constructed of PVC meeting ASTM specifications with a pressure rating for both the pipe and joints of 150 psi. The vertical separation shall be a minimum of two feet between outside diameters and the horizontal separation shall be a minimum of four feet between outside diameters. The sewer shall be located below the water line.

D. Where a sewer crosses under a water line and the sewer is constructed of ABS truss pipe, similar semi-rigid plastic composite pipe, clay pipe or concrete pipe with gasketed joints, a minimum two foot separation distance shall be maintained. The initial backfill shall be cement stabilized sand (two or more bags of cement per cubic yard of sand) for all sections of sewer within nine feet of the water line. This initial backfill shall be from one quarter diameter below the centerline of the pipe to one pipe diameter (but not less than 12 inches) above the top of the pipe.

E. Where a sewer crosses over a water line all portions of the sewer within nine feet of the water line shall be constructed of PVC pipe with a pressure rating of at least 150 psi using appropriate adapters. In lieu of this procedure the new conveyance may be encased in a joint of 150 psi pressure class pipe at least 18 feet long and two nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at 5 feet intervals with spacers or be filled to the spring line with washed sand. The encasement pipe should be centered on the crossing and both ends sealed with cement grout or manufactured seal.

F. Where a sanitary sewer crosses a water line and the sewer is constructed of ductile iron or PVC with a minimum pressure rating of 150 psi, an absolute minimum distance of 6 inches between outside diameters shall be maintained. In addition, the sewer shall be located below the water line where possible and one length of the sewer pipe must be centered transversely on the water line.

6.6 WATERLINE/MANHOLE SEPARATION

Unless sanitary sewer manholes and the connecting sewer can be made watertight and tested for no leakage, they must be installed so as to provide a minimum of nine feet of horizontal clearance from an existing or proposed water line. Where the nine foot separation distance cannot be achieved, a carrier pipe as described previously in this section may be used where appropriate.

6.7 OTHER UTILITIES

A. The facilities of utilities, such as telephone, cable television, electric power, gas, etc., have been indicated as nearly as possible on the drawings.

B. It shall be the responsibility of the Contractor, however, to determine the locations of those, or any other facilities at the job site, and to arrange with the respective utility owners for any necessary relocation of conflicting facilities.

C. All utility owners shall be contacted by the Contractor so that the respective utilities can be located prior to any excavation by the Contractor.

D. It shall be the Contractor's responsibility to coordinate all locating efforts with the utility owners and to reflect such efforts in the construction schedule.

6.8 WATER AND NATURAL GAS RELOCATION AND/OR BY-PASS

A. All water and/or natural gas line relocation or by-pass work shall be coordinated with the owner of the particular line being relocated or by-passed and per the requirements of the contract specifications at no additional cost to the Owner. The design of relocated lines and by-pass lines shall be subject to the specific conditions of each location, and approval by the Engineer and the owner of the respective line.

6.9 MARKING TAPE

A. Any new or relocated sewer, potable water, natural gas, buried phone, reuse water line, or other utility shall be marked by installing the appropriate marking tape in the trench. Marking tape for water and sewer shall be 6-inch metallic. All other marking tape shall consist of a minimum of 4.0-mil inert polyethylene plastic. The tape shall be imprinted continuously over its entire length in permanent black ink to identify the type of line. The tape shall be 6 inches in width and colored High Visibility Safety Yellow for gas lines, High Visibility Blue for water lines, or High Visibility Brown for sewer lines.

PART 7 - TESTING

7.1 All lines shall be cleaned and tested. This work shall be performed by the Contractor on completed sections of lines in accordance with the procedures set forth herein. Prior to beginning testing, Contractor shall prepare and submit a testing plan and procedure to the Engineer for review and approval. The testing plan shall address the following items:

A. Locations and durations for filling and draining pipeline
B. Schedule for beginning and completing testing
C. Identify locations where water used for testing will be discharged
D. Disinfection procedure for water lines and the type and amount of disinfecting agent to be used
E. Identify locations where water used for testing and disinfection will be discharged

7.2 GRAVITY LINES

All gravity sewer mains and manholes shall be tested by the Contractor in accordance with procedures set forth herein. The tests shall be made on completed sections of pipeline between manholes.

A. Deflection Testing for Sewer Pipes: Deflection test shall be performed on all flexible sewer pipes. A rigid mandrel shall be used to measure deflection. Adjustable or flexible mandrels are prohibited.

The test shall be conducted after the final backfill has been in place a minimum of 30 days. No pipe shall exceed a deflection of 5%. If a pipe should fail to pass the deflection test, the problem shall be corrected, and a second test shall be conducted. The test shall be conducted without the use of a mechanical pulling device.

The mandrel shall be constructed of metal or of a rigid plastic that can withstand a 200-psi force without being deformed. The mandrel shall have at least nine runners or more, as

long as the number of runners is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each mandrel in use.

The rigid mandrel shall have an outside diameter equal to 95% of the measured inside diameter of the pipe. Statistical manufacturing tolerance methods shall not be considered in mandrel sizing.

B. Leakage Testing: Leakage testing for leakage out of all sewer lines shall be performed as set forth herein for areas above the groundwater table.

The upstream side of the lower manhole of the section being tested shall be plugged and the section of pipeline filled with water to a point two feet above the top of the pipe in the upper manhole of the section being tested.

The leakage in the section of pipeline being tested shall not exceed 50 gallons per inch of pipe diameter per 24 hours per mile of pipe at an internal head of 2 feet. An additional 10 percent of leakage shall be allowed for each additional 2 feet of head. The internal head used to calculate the allowable leakage shall be the difference in elevation from the invert of the downstream manhole to the water surface of the test water in the upstream manhole.

If leakage exceeds the allowable amount, the Contractor shall immediately determine the cause and repair the broken or faulty pipe in a manner satisfactory to the Engineer.

C. Infiltration Testing: Infiltration testing for groundwater entering all sewer lines below the groundwater table shall be performed as set forth herein. Infiltration testing of all gravity sewer lines installed below the groundwater level is mandatory and the Contractor shall conduct a Zero-Leakage test on those lines. There will be zero tolerance for any groundwater infiltration into the sewer lines and manholes. If the sewer line is beneath a roadway, the testing shall be conducted prior to resurfacing the roadway.

Prior to testing the sewer line for groundwater infiltration, all dewatering shall be discontinued in the area for a minimum of three days. Each section of sewer line to be tested shall be plugged sufficiently to prevent water from entering the line. The test shall be conducted for 48 hours. If at the end of that test period there is any evidence of infiltration into the sewer line, the Contractor shall correct the problem and conduct the test as many times as is necessary and shall continue to do so until the infiltration is eliminated.

D. Low Pressure Air Testing: The Contractor may elect to test the sewer lines using the low pressure air test as detailed by ASTM F1417-92 in lieu of the tests outlined in sections 7.2B and 7.2C of this specification.

The section of the line to be tested is plugged. Air, at low pressure is introduced into the plugged line to maximum pressure of 4 psig. The line passes the test if the rate of air loss, as measured by pressure drop does not exceed a specified amount in a specified time. The maximum pressure drop and the required test time shown in Table 1 and Table 2 for each diameter and length between manholes.

Table 1 Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe indicated for Q = 0.0015

Pipe Dia. (in)	Min Time (min:s)	Length for Min. Time (ft)	Time for Longer Length, (s)	Specification Time for Length (L) Shown (min:s)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102.33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86.32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	54:38	86:10	107:43	129:16	150:43	172.21	193.53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Table 2 Minimum Specified Time Required for a 0.5 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

Pipe Dia. (in)	Min Time (min:s)	Length for Min. Time (ft)	Time for Longer Length, (s)	Specification Time for Length (L) Shown (min:s)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.67L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30.32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32.19	43:56	53:52	64:38	75.24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102.34	115.23

All sewer lines tested in groundwater shall account for groundwater depth over the pipe during the air test. An additional 0.43 psi shall be added to the test pressure for each foot of groundwater above the pipe. If the groundwater is 2-feet or more above the upstream end or the air pressure is greater than 9 psi the air test shall not be used. The groundwater level shall be lowered by pumping or dewatering or the tests in sections 7.2B and 7.2C of this specification shall be used.

7.3 WATER LINES

A. All water lines shall be cleaned, sterilized and pressure tested. This work shall be performed by the Contractor on completed sections of lines in accordance with the procedures set forth herein.

B. Water for Testing: All water, within reason, which is needed for filling, flushing and testing water lines shall be furnished by the Owner to the Contractor at such points along the pipeline as water is available from the existing water system. Wasting of water will not be condoned and such actions may require the Owner to withdraw use of such water. The Contractor will be responsible for installation of a temporary backflow protected connection at all pipelines required from the supply point to the new waterline.

C. The Contractor shall make provisions to provide water, by tank truck or other means, to the points necessary to produce specified test pressure.

D. The Contractor shall take special care to keep the interior of all pipe clean during storing, handling, and laying operations in order to reduce the need for flushing to an absolute minimum. In addition, all open ends shall be tightly covered whenever unattended to prevent small animals and dirt from entering the pipeline after it is in place. Contractor shall submit pressure testing and disinfection plan to Engineer for review and approval 15 days prior to performing either.

1. Hydrostatic Pressure Testing: All valves shall be checked for proper operation and the completed section of pipeline shall be subjected to a hydrostatic pressure and leakage test. After completion of each valved section and following the filling of the section, the system shall be subjected to this test. The meter, pressure gauges, pump, small piping and hose connections, and all labor necessary for conducting the test, shall be furnished by the Contractor. The test procedure shall be as follows:

   After the section of pipeline has been filled, water shall be pumped into the section and the pressure raised to **150 psi**. This test pressure shall be maintained for a period of at least two (2) hours. The water required to maintain this pressure shall be delivered into the pipe through a water meter. The total leakage is defined as the amount of water registered on the meter at the end of the two-hour test period. The test pressure shall not vary plus or minus 5 psi for the duration of the test, if it does the test shall be repeated until this criteria is met. Should this leakage exceed the allowable amount, as specified herein, the Contractor shall make such repairs as may be required until the actual leakage, as determined by succeeding tests, is not greater than the allowable as determined by the formula:

$$L = \frac{S\,D\sqrt{P}}{148{,}000}$$

   in which:

   L = Allowable Leakage in gallons/hour.
   S = Length of pipe in feet.
   D = Inside diameter of pipe in inches.
   P = Average test pressure during the test, in pounds per square inch, gage; determined by computing the weighted average of actual pressures on various portions of the section.

After all sections of the pipeline have been pressure tested, as described above, all valves shall be closed and the line left full of the water for disinfection and testing. All testing of all lines, is to be done in the presence of the Engineer.

2. Disinfection: After the hydrostatic pressure test and before acceptance for operation, each unit of completed water system shall be sterilized as specified below or as prescribed by AWWA Standard C651-92. The unit to be sterilized shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine conforming to AWWA B-301 or hypochlorite conforming to AWWA B-300. The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the water line in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 p.p.m. of chlorine at the extreme end of the line at the end of the retention period. All valves on the lines being sterilized shall be opened and closed several times during the contact period.

   After sterilization, water mains shall be flushed and before being put into service shall be sampled for bacteriological analysis in accordance with Department of Health Standards. The Contractor shall provide the necessary means for flushing and for disposing of the water, at Contractor's expense. Disposing of water shall be done in a manner and at a time not to inconvenience the public.

PART 8 - PAYMENT

Payment will be made for all work covered in this section as a proportionate amount of the pipe line item. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 02732
HDPE PIPE

SECTION 02732

HDPE WATER PIPE

PART 1 - GENERAL

This section provides for the installation of HDPE pipe for potable water systems.

PART 2 - SUBMITTALS

The CONTRACTOR shall submit evidence acceptable to the ENGINEER, such as a certified copy of a license or agreement, that it has the authority from the patent owner to use and/or install patented equipment and materials. The CONTRACTOR agrees to defend, indemnify and hold harmless the OWNER and ENGINEER against all claims, suits, and actions brought because of any person or property arising out of patent infringement by the CONTRACTOR or his employees, agents, suppliers, or any tier of sub-contractor involved in the work.

All submittals required by these specifications shall meet the requirements as shown on the Plans and Specifications.

CONTRACTOR to provide test certifications by the manufacturer that pipe material complies with the Specification requirements for Chemical Resistance and Physical Testing in accordance with section 4.0 of this specification. The ENGINEER may require testing of the materials and methods prior to job commencement to verify manufacturing compliance with required quality control standards and that no damage occurred to the materials during shipment to the job site.

At the time of installation, materials shall not be more than 6 months old from the date of manufacture. Material safety data sheets (MSDS) shall be available at the project site.

PART 3 - MATERIALS

This specification covers requirements for AWWA PE 3408 High Density polyethylene pipe and fittings for drinking water lines underground.

3.1 STORAGE AND HANDLING

Pipe materials shall be properly stored and handled to prevent damage in accordance with the manufacturer recommendations and as approved by the Engineer. Damage is described as, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, or ultra-violet (UV) degradation. A thorough inspection of the pipe material shall be performed prior to installation. Criteria for acceptance/rejection shall be per Section 4.6. Wide belly band slings shall be used for lifting and moving pipe.

3.2 GENERAL

A. 2 Inches and Smaller –Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350-02 with a cell classification of PE:345464C. Pipe shall have a manufacturing

standard of ASTM D2737 (CTS). Pipe shall be DR 9 (200psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall be NSF 61 approved.

B. 3 Inches and Larger - Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of PE:345464C. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. sizes 4" to 12" shall be available ductile iron pipe sizes (DIPS). Pipe shall be DR 9 (200 psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61, and per AWWA C906 Pressure Class (PC) 200 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft/sec shall be used in the hydraulics engineering design.

C. Pipe Manufacturer's Quality Control. The pipe manufacturer shall have an ongoing Quality Control program for incoming and outgoing materials. High-density polyethylene (HDPE) resins for manufacturing of pipe shall be checked for density, melt flow rate, and contamination. The manufacturer of the HDPE resin shall certify the Cell Classification as indicated in section 3.4. These incoming resins shall be approved by plant Quality Control and verified to be approved by NSF before being converted to pipe. Pipe shall be checked for outside diameter, wall thickness, length, roundness, and surface finish on the inside and outside and end cut.

3.3 COMPOSITION

Pipe and fittings shall be made from HDPE compounds conforming with ASTM D 3350-02, Cell Classification 345464C.

Pipe and fittings shall be made from PE resins complying with ASTM D-1248, Type III, Class C, Category 5, Grade P-34, with a PPI rating of PE 3408 and ASTM D-3350-02, and which shall further meet the requirements as listed in the following table:

Property	**ASTM Test**	**Value**
Density (g/cm^3)	D-1505	0.947-0.955
Melt Index (g/10 minutes)	D-1238 cond E.	0.07 gm/10min
Flexural Modulus (psi)	D-790	136,000
Tensile strength at yield (psi)	D-638	3,500
Elongation at break (%)	D-638	>800 %
Brittleness temperature (°F)	D-746	<-180
Environmental Stress Crack Resistance F_0 (hrs)[1] Test condition "C"	D-1693	10,000

Additives and fillers including, but not limited to, stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed five parts by weight per 100 of PE resin in compound. CONTRACTOR to provide certifications by the manufacturer that the test results comply with the Specification requirements.

3.4 ACCEPTANCE

At the time of delivery, the pipe shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

3.5 MARKING

Pipe shall be marked in at 5 foot intervals or less with a coded number which identifies the manufacturer, DR, size, material, machine, date and shift on which the pipe was extruded.

3.6 FITTINGS

A. Butt Fusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
B. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
C. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

PART 4 - INSTALLATION

4.1 GENERAL

See Section 02730 – Pipe Installation for further requirements.

4.2 ASSEMBLY

A. Assemble and join sections of polyethylene carrier pipe on site, above ground. Plain end joints shall be made by heating and butt-fusion method in strict conformance to the manufacturer's instructions. The maximum length of continuous section assembled above ground and placed at any one time shall not exceed the length recommended by the manufacturer.
B. Use operators who are certified and experienced in butt-fusion field-jointing of HDPE pipe. Operators shall have been trained and certified in fusion polyethylene pipe with similar equipment using proper jigs, and tools in accordance with the pipe manufacturer's standard procedures. The fusion equipment shall be equipped with a Datalogger. Records of the welds (heater temperature, fusion pressure, and a graph of the fusion cycle) shall be maintained for five (5) years.

C. Form joints with smooth, uniform double-rolled back beads made while applying proper melt, pressure and alignment. Joints will be inspected by the ENGINEER prior to placement. Heat fusion shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion, hot gas fusion, threading, solvents, and epoxies shall not be used to join HDPE pipe.

D. Electrofusion couplings. Polyethylene pipe and fittings may be joined using approved electrofusion couplings. Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

E. Mechanical Joining. Polyethylene pipe and fittings may be joined together using Flanges or Mechanical Joint (MJ) adapters. These fittings shall be made from PE 3408 HDPE, with a Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and MJ adapters shall have a manufacturing standard of ASTM D3261. They shall have a pressure rating equal to the pipe unless otherwise specified on the plans

PART 5 - ELECTOFUSION PROCESSOR

The Contractor is to provide the Owner with one new electrofusion processor upon completion of the project. The processor shall be Frailen Universal Fusion Processor model number 613112 or approved equal. The Contractor shall provide the processor, readerwand, manual input, documentation feature, hand scraper with 5 spare blades and user manual. The cost for the processor shall be included in the cost for the pipeline items.

PART 6 - LEAK TESTING

Pressure testing shall be conducted in accordance with ASTM F2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. The HDPE pipe shall be filled with water, raised to test pressure and allowed to stabilize. The test pressure shall be 1.5 times the operating pressure at the lowest point in the system. The pipe shall pass if the final pressure is within 5% of the test pressure for 1 hour. For safety reasons, hydrostatic testing only will be used.

PART 7 - SAFETY

The CONTRACTOR shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving entering and working in confined spaces.

PART 8 - MEASUREMENT AND PAYMENT

Payment for all work covered in this section shall be at the unit price per unit for HDPE pipe as indicated in the Bid Proposal and shall be full compensation for all labor, materials, and equipment required for the satisfactory sewer line installation.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This section of the specifications covers all of the work required for constructing all concrete structures, including, but not limited to water containing structures, wet wells, buildings, curbs, headers, sidewalks, driveways, manhole bases, cast-in-place manholes, and other miscellaneous work.

B. Concrete for this project shall conform to the requirements of this section. The Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals necessary to perform all of the concrete work in accordance with the drawings and these specifications.

C. Excavation or filling for concrete structures and other miscellaneous concrete work shall conform to the lines and grades as shown on the plans or as established in the field and shall be as specified in Section 02223 – EXCAVATING, BACKFILLING AND COMPACTING STRUCTURAL FILL MATERIAL AND GRADING.

1.2 GOVERNING REFERENCE SPECIFICATIONS

The latest editions of the following specifications and references govern work of this section and constitute minimum requirements. Where specific requirements in this section of the Specifications are more stringent, they shall supersede the corresponding requirements of these Referenced Specifications.

1. American Concrete Institute (ACI):

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
ACI 221R	Guide for Use of Normal Weight and Heavyweight Aggregates in Concrete.
ACI 223	Standard Practice for the Use of Shrinkage Compensating Concrete.
ACI 301	Specifications for Structural Concrete Buildings.
ACI 302.1R	Guide for Concrete Floor and Slab Construction.
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete.
ACI 305	Hot Weather Concreting. Report by ACI Committee 305.
ACI 306	Cold Weather Concreting. Report by ACI Committee 306.
ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures.
ACI 318	Building Code Requirements for Reinforced Concrete.
ACI 347	Recommended Practice for Concrete Formwork.
ACI 350R	Environmental Engineering Concrete Structures.
SP-7	ACI Manual of Concrete Inspection.

2. American Society for Testing Materials (ASTM):

ASTM A 82	Cold Drawn Steel Wire for Concrete Reinforcement.
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM A 616	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
ASTM A 617	Axle-Steel Deformed Plain Bars for Concrete Reinforcement.
ASTM A 706	Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
ASTM C 31	Making & Curing Concrete Compression and Flexure Test Specimens in the Field.
ASTM C 33	Concrete Aggregates.
ASTM C 39	Compressive Strength of Molded Concrete Cylinders.
ASTM C 40	Organic Impurities in Fine Aggregates for Concrete.
ASTM C 42	Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 94	Standard Specification for Ready-Mixed Concrete.
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
ASTM C 138	Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
ASTM C 143	Standard Test Method for Slump of Hydraulic Cement Concrete.
ASTM C 150	Standard Specification for Portland Cement.
ASTM C 151	Autoclave Expansion of Portland Cement.
ASTM C 171	Sheet Material for Concrete Curing.
ASTM C 172	Standard Method of Sampling Freshly Mixed Concrete.
ASTM C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
ASTM C 192	Standard Method for Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C 260	Standard Specifications for Air-Entraining Admixture for Concrete.
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete.
ASTM C 618	Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
ASTM C 806	Standard Test Method for Restrained Expansion of Shrinkage – Compensating Concrete.
ASTM C 845	Expansive Hydraulic Cement.
ASTM C 878	Standard Test Method for Restrained Expansion of Expansive Cement Mortar.

3. Portland Cement Association (PCA):
   Design and Control for Concrete Mixtures.
4. American Welding Society (AWS):
   AWS D12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
5. U.S. Army Corps of Engineers:
   CRD C-572 Specification of Water Stops
6. Texas Department of Transportation:
   Standard Specifications for Construction of Highways, Streets and Bridges.

1.3 SUBMITTALS

Submit under provisions of Section 01300, Submittals.

A. Product Data – Submit manufacturer's product data with application and installation instructions for proprietary materials and items including reinforcement and forming accessories, admixtures, patching compounds, joint systems, bituminous dampproofing, curing compounds, waterstops and others as requested by the Engineer. Submit manufacturer's certificate of conformance with these Specifications for all proprietary materials and products.

B. Shop Drawings – Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete structures. Provide full wall and beam elevations of concrete and CMU walls showing all embedments, vertical and horizontal reinforcing and all special reinforcement. Reinforcing drawings shall also show the location and size of all sleeves, conduit blockouts, openings and penetrations. The Contractor shall coordinate all trades and shall indicate on the shop drawings the requirements of other trades. Fabrication, bar bending, cutting, etc., shall be in accordance with the requirements as specified herein.

The Contractor shall review the shop drawings for inclusion of all embeds, fittings, blockouts, etc. then submit one correctable translucent print and one blue or black-line copy for review. Upon completion of the review by the Engineer, the reproducible print will be returned to the Contractor. Upon receipt of the reproducible print, the Contractor shall immediately make sufficient copies of the Shop Drawings for job use and distribution, and will provide the Engineer with 4 blue or black-line copies with the Engineer's marks and comments.

1.4 TESTS

A. Preconstruction Tests – Test certificates from an approved commercial laboratory shall be furnished on all aggregates proposed for use in this work. Aggregate tests shall be performed in accordance with ASTM C 33 and results submitted for review and approval. Such tests shall be made no more than 45 days before beginning of concreting operations and the approval of the Engineer shall be secured before aggregates are ordered to be shipped. Tests made earlier than 45 days prior to the date of submission of the certificates will not be accepted.

Certificates from the approved commercial laboratory shall also be submitted on test cylinders from the concrete mixes proposed for use on the project. Tests shall be made on

six cylinders for at least three slumps for each mix. Three cylinders for each design shall be tested at 7 days and three at 28 days. Concrete shall not be placed prior to satisfactory results of test cylinders. The laboratory reports of each mix design shall state whether the items reported comply with the specifications and shall show (1) the specified strength, (2) corresponding slump, (3) expected drying shrinkage, (4) weights and test results of ingredients, and (5) other physical properties such as results of expansion tests per ASTM C 878.

The cost of all preconstruction tests shall be borne by the Contractor. Additional test certificates shall be furnished on both the aggregates and the concrete if the material source is changed or if construction tests indicate marked variations from the original tests.

B. Construction Tests – Tests of the aggregate and the concrete will be made by the Engineer during the construction to determine conformity with the specifications. Test cylinders will be made in accordance with the Method of Making and Curing Concrete Compression Test Specimens in the Field (ASTM Designation C 31). The specimens shall be cured under standard moisture and temperature conditions in accordance with the requirements of ASTM C 31.

C. Strength Tests – Shall be made, in general, for each day's run or for each 50 cubic yard increment of concrete if the day's run exceeds this amount. These tests will be made entirely at the discretion of the Engineer. The cost of all such testing will be borne by the Owner, but the Contractor shall cooperate in securing and storing samples and shall furnish all materials required for sampling. The cost of tests which indicate that the results do not meet the specified strengths shall be at the expense of the Contractor.

A strength test shall consist of four standard test cylinders made from a composite sample obtained in accordance with the requirements of ASTM Designation C 172. One of the cylinders shall be tested at seven days and three at 28 days. The strength test result shall be considered the average of the three 28 days specimens, except that, if one specimen in the test shows evidence of the improper sampling, molding, or testing, it shall be discarded and the remaining two strengths averaged. Should more than one specimen representing a given test show definite defects due to improper sampling, molding, or testing, the entire test shall be discarded.

The results of the 28 day strength tests shall be used as the basis for accepting or rejecting the concrete represented by the test. The results of the 7 day strength tests will be compared with the 7 day strength of the preconstruction test cylinders for the class and slump of the concrete being produced. Should the 7 day strengths indicate a deficiency in the 28 day strengths, the Engineer may require a temporary change in proportions to correct such deficiency. Such change shall remain in effect until the 28 day strength of the material in question is determined, at which time the change shall become permanent or shall be rescinded, depending upon the results of the 28 day test.

The Engineer shall record the delivery ticket number for the concrete and the exact location in the work where the concrete is deposited. Two copies of each separate delivery ticket shall be provided to the Engineer on the day of the concrete placement.

The Owner shall bear all cost of Air Content and Slump tests at the job site and shall make and break all test cylinders required to determine compliance with the strength requirements of these specifications. The Owner will not be responsible for any plant control required to produce concrete complying with these specifications.

1.5 GENERAL REQUIREMENTS

A. Embedded Items – Full cooperation shall be given to other trades to install embedded items. Before placing concrete, embedded items shall have been inspected, and tests for concrete or other materials shall have been completed and approved. Suitable templates or instructions shall be used for setting items not placed in the form.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement – Cement for structures, Class "A" shall be Type I or Type II Portland Cement as noted on the drawing and Class "B" shall be Type I or II Portland Cement conforming to ASTM Specification C 150 and shall be of a single source form an approved brand.

B. Fine Aggregate – Fine aggregate shall consist of hard, strong, durable and uncoated particles of natural sand, washed and screened. Grading of fine aggregate shall conform to the following.

No. 4	No. 8	No. 16	No. 30	No. 50	No. 100
95-100	80-100	50-85	25-60	10-30	2-10

1. Fineness modules shall not vary more than plus or minus 0.20 from that of approved sample, which shall be between 2.20 and 2.90.
2. Clay lumps shall not be present in a greater amount than 1% by weight and materials removed by decantation shall not exceed 3% by weight. Loss in soundness test shall not exceed the limits specified in ASTM Designation C 40, (latest revision), the resultant color shall not be darker than Fig. No. 2.

C. Coarse Aggregate – Coarse aggregate shall consist of hard, tough, durable and uncoated particles of washed and screened gravel or crushed stone. It shall contain no vegetable matter nor soft, friable, thin, or elongated particles in quantities considered detrimental by the Engineer and the following substances shall not be present in excess of the percentages (by weight) designated:

1. Soft Fragments – 5%; Clay Lumps – ¼%; Removed by decantation – 1%; Total deleterious matter shall not exceed 5% by weight. Loss in Abrasion and Soundness Tests – not greater than specified in ASTM Designation C 33. Aggregates which have not stood up under exposure conditions similar to those which will be encountered in this work shall not be used.
2. Maximum size of coarse aggregate shall be governed by the conditions of placement of the concrete and shall not be greater than ¾ of the distance between reinforcing bars except that 3/8"maximum size aggregate shall be used for concrete to be placed in the cells of CMU elements. In no case shall the maximum size be greater than 2 inches. The grading of the coarse aggregate shall conform to the following:

PERCENTAGE PASSING

Sieve Size Equal to Maximum Aggregate Size	Sieve Size Equal to ½ Maximum Aggregate Size	No. 4
95-100	35-70	0-5

D. Water – Water for washing aggregate, for mixing and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials and shall be from a potable water source. The water shall not contain more than 1000 mg/1 of TDS and 300 mg/1 of chlorides as C1, nor more than 300 mg/1 sulfates as $S0_4$; and shall not contain an amount of impurities that may cause a change of more than 25 percent in the setting time of the cement nor a reduction of more than 5 percent in the compressive strength of the concrete at 14 days when compared with the result obtained with distilled water. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete. Submit test results to conform all of the above.

E. Water-reducing Admixtures – A water-reducing admixture shall be used in all Class "A" concrete. The admixture used shall meet the requirements of ASTM Designation C 494 for Type A water-reducing admixture or Type D and containing not more than 0.1 percent chloride ions. The type of admixture to be used in the different parts of the project shall be as directed or approved by the Engineer, based on the concrete mix design submittals. The manufacturer shall furnish an affidavit certifying that the material furnished complies with this specification.

F. High Range Water Reducing Admixture (Super Plasticizer) – ASTM C 494, Type F or type G and containing not more than 0.1 percent chloride ions. The manufacturer shall furnish an affidavit certifying that the material furnished complies with these specifications and has no adverse effects on the specified concrete properties.

G. Air-entraining Admixture – An air-entraining admixture shall be used in all Class "A" concrete. The air-entraining admixture shall conform to the requirements of ASTM Designation C260. The air content of the concrete samples at the point of discharge from the transportation unit shall be between 3 and 6 percent. The manufacturer shall furnish an affidavit certifying that the material furnished complies with this specification.

H. Fly Ash – type F fly-ash complying with ASTM C-618 may be permitted in Class "A" and Class "B" concrete.

1. Use of fly-ash will be permitted only if concrete mix designs utilizing fly-ash are prepared by a Registered Professional Engineer, and maximum replacement does not exceed 20% (by weight of cement).
2. Strength, workability and appearance of concrete shall not be less than that resulting without the use of fly-ash. Admixtures proposed for use in conjunction with fly-ash shall be shown to be compatible with fly-ash concrete and mix designs shall include and incorporate fly-ash as recommended by the manufacturer.

I. Storage of Materials – Cement in sacks shall be stored off the ground in a dry, ventilated building. Bulk cement shall be stored in waterproof bins and shall be handled in a manner which will prevent accumulation of moisture. Cement which has hardened or partially set shall be removed from the site and is not to be used in work. Aggregates shall be stored separately and in such a manner as to prevent segregation of sizes and to avoid inclusion of dirt and other foreign materials in the concrete.

2.2 REINFORCING

A. Bar Reinforcing – Except where plain bars are specifically shown on the plans, all bar reinforcing shall be deformed bars. The deformed bar reinforcing and plain bars for spiral reinforcing shall conform to the requirements of ASTM A-615 Grade 60. Plain steel bars including ¼ inch diameter bars shall conform to the requirements of ASTM A 306, Grade 60. Weldable reinforcing bars shall conform to ASTM A 706, Grade 60.

B. Reinforcing Testing and Inspection – Three certified copies of mill reports for each heat or melt showing the heat number and the chemical and physical properties for all steel

reinforcement delivered at the project site shall be submitted by the Contractor, at the time the reinforcing steel is delivered.

C. Mechanical Reinforcing Bar Splice Assemblies (Bar splicers) – The mechanical bar splices for extension of the column reinforcing for, columns, future columns, and other reinforcing shall develop in both tension and compression at least 125 percent of the yield strength (fy) of the bars as shown on the Drawings. Stresses of transition splices between two reinforcing bar sizes shall be based on the area of the smaller bar. Mechanical splices shall be an approved tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field will not be permitted. Threaded splices assembly for future reinforcing bars shall be provided with threaded protector.

D. Storing Reinforcing – Reinforcing stored at the site shall be protected from accumulation of grease, mud, or other foreign matter and from rust producing conditions. Bars shall be free from loose flaky rust, scale, oil, mud or structural defects when incorporated in the structures.

2.3 FORMS

A. Forms for all concrete work shall be of wood or approved metal forms. Small panel type steel or plywood faced forms will not be permitted on exposed concrete. Wood forms shall be plywood or plywood lined of a quality to produce a smooth, even surface. Whatever material is used shall produce a sightly surface, free from excessive form marks and shall meet the approval of the Engineer before use. The same type of form shall be used for all exposed portions of the work unless specifically approved by the Engineer. A forming system and placing plan shall be designed by a registered professional engineer experienced in the design of Concrete Forming Systems, of the type required on this project, and shall be submitted to the Engineer for review and approval. Review of the forming system shall not relieve the Contractor of the responsibility for the design, construction, maintenance, etc. of the forms.

B. Form Ties – Snap tie type form ties approved by the Engineer shall be adjustable in length and of such type as to leave no metal within 1 inch of the surface, and shall not be fitted with lugs, cones, washers or other devices acting as a spreader which will leave a hole larger than 7/8-inch in diameter or a depression back of the exposed surface of the concrete. The tie section remaining within the concrete shall be manufactured with a waterstop device. Wire used as ties will not be permitted.

C. Tapered Ties which are to be pulled from the concrete may be used on walls subject to the written approval of the Engineer. Where such ties are used, they shall be single tapered and shall be coated with approved materials to facilitate removal. Single tapered ties shall be installed with the larger diameter to the wet or exterior side of the wall. Ties shall not be withdrawn, broken off or otherwise removed until the concrete has hardened sufficiently to avoid spalling or other damage to the concrete. Cutting ties back from the face of the concrete will not be permitted. Tie rod holes shall be plugged as specified in paragraph 3.12 C or 3.12 D as applicable.

2.4 CONCRETE

A. Classes of Concrete – All concrete, except as noted, shall be Class “A”, Class “B” or Class “C” as designated for the various parts of the work as noted on the plans.

Installation shall be as indicated on the Drawings. Pipe encasement, duct encasement, and other similar miscellaneous concrete not otherwise designated, shall be unclassified concrete containing not less than three (3) sacks of cement per cubic yard and not more than ten (10) gallons of water per sack of cement.

B. Strength – All mixes of all classes of concrete shall be designed to secure a dense, low-absorption concrete having not less than the following compressive strength in pounds per square inch, as determined by making and breaking standard 6-inch by 12-inch cylinders in accordance with the provisions of ASTM Designations C 31 and C 39. Concrete shall be designed with a water content **not to exceed** 5.00 gallons per sack of cement and shall have a minimum cement content of 5.5 sacks per cubic yard of concrete.

Class of Concrete	28 Days
Class "A"	4500 psi
Class "A1"	4000 psi
Class "B"	3000 psi
Class "C"	2500 psi

Any concrete failing to meet these strength requirements shall be removed and replaced as directed by the Engineer.

C. The Contractor shall submit Concrete Mix Designs prepared by a Licensed Professional Engineer, for each Class and use of concrete, i.e., foundations, walls, structural slabs and beams, fill for CMU masonry elements and concrete topping slabs.

D. Low Strength Concrete – Any Class 'A', 'B', or 'C' Concrete incorporated in any part of the project which does not meet the strength requirements specified above shall be considered low strength concrete . Low strength concrete shall be removed and replaced at the expense of the Contractor as determined by the Engineer.

1. It shall be assumed that each strength test (defined in paragraph 1.4 C. 2.) of each class of concrete represents an amount of concrete equal to the total amount of each class of concrete placed during a day's run divided by the number of strength tests made for the respective classes of concrete. If it is determined that Low Strength Concrete is to be removed and replaced by the Contractor, a deduction of monies due the Contractor will be withheld from the Contractor's monthly payment application under this contract.
2. The Engineer shall determine the exact limits of any low strength concrete required to be removed and replaced under the provisions of this paragraph. The methods to be used in removing and replacing such concrete shall be approved by the Engineer and shall be such that the surrounding structure that is adjacent to the portion or area of concrete to be removed, is not damaged and that the strength and water-tightness of the structure is not impaired. All tests required to determine the acceptance of low strength concrete as determined by the 28 day strength tests shall be done at the Contractor's expense.

2.5 WATERSTOPS

A. General – Where a waterstop is shown or required it shall be of the materials specified herein and of the dimension shown on the drawings. All installation of waterstop, including splicing at joints, and intersections, shall be in strict accordance with the manufacturer's recommendations, as approved by the Engineer.

B. Polyvinyl Chloride Waterstop – Polyvinyl Chloride (PVC) Waterstop shall be 6-inch, 2-bulb type with minimum thickness of 3/8-inch and minimum bulb diameter of ¾-inch or shall be of the serrated type, 6-inches wide, weighing not less than 110 pounds per one hundred linear feet.

1. Where specifically called out as three bulb type, waterstops shall be PVC waterstop, 9", three bulb type with a minimum thickness of 3/8" with 5/8" end bulbs and 1-1/8" center bulb at expansion joints.
2. The waterstop shall be fabricated from a plastic compound, the basic resin of which is polyvinyl chloride, with additional resins, plasticizers, stabilizers or other materials such that, when compounded, the materials shall conform to the requirements of Corps of Engineers Specifications CRD-C-572-63, and the following requirements:
    a. Tensile Strength: Not less than 1,700 psi, when tested in accordance with ASTM D 412-51T
    b. Ultimate Elongation: Not less than 300% when tested in accordance with ASTM D 412-51T
    c. Low Temp. Brittleness: No cracking, shipping or other sign of failure, when tested in accordance with ASTM D 746-55T, at 20 deg. F.
    d. Stability in "Effect of Alkalis" Test: No dimensional changed in excess of 1%; no weight increase of more than 0.40% at 30 days; no decrease in weight in 3 days, when tested in accordance with paragraph 18, D 2 of Corps of Engineers Specifications referenced above.
3. No reclaimed PVC, nor any PVC compound other than that specified herein shall be used. The manufacturer shall, with each shipment, furnish an affidavit certifying compliance with this specification.

2.6 COLD JOINT WATER STOPS

A. Cold-Joint Water Stops – Cold-joint water stops, as manufactured by American Colloid Company, Synkoflex Products, Inc., or approved equal.

B. Contractor shall submit manufacturer product information for approval. Installation shall be as per the maufacturer's instructions.

2.7 EXPANSION JOINT MATERIAL

A. Where premolded expansion joint material is shown on the plans such material, unless otherwise noted, shall be a nonextruding and resilient asphalt impregnated fiberboard joint filler composed of cellular fibers securely bonded together and uniformly saturated with asphalt meeting the requirements of ASTM Designation D 994.

2.8 JOINT SEALANT COMPOUND

A. Where expansion joints in concrete structures are shown to be sealed, two-components, elastomeric sealant, meeting the requirements of Sikaflex – 2C NS manufactured by the Sika Corporation or Dow Corning M 888 manufactured by the Dow Corning Corporation shall be used unless otherwise specifically shown on the drawings. The handling, mixing and placing of the material shall be in strict accordance with the recommendations of the manufacturer.

2.9 BEARING PADS

A. Provide elastomeric bearing pads at precast, prestress concrete elements, and cast-in-place concrete roof slabs and beams as indicated on the Contract Drawings.

B. Provide plain elastomeric bearing pads of durometer (hardness) of 70 minimum or as specified on Contract Drawings. The elastomeric bearing pads shall conform to the requirements of "Texas Department of Highways and Public Transportation" 1993, standard specifications.

C. Contractor shall submit the manufacturer's literature and samples of each Durometer elastomeric Pad. The installation of the Pads shall be to the correct elevations, and shall be set level as shown on the Contract Drawings.

D. Provide two-component epoxy bonding agent for bonding elastomeric bearing pads to the concrete surface or steel. The bonding agent shall be suitable weather-proof epoxy or adhesive that is not detrimental to the elastomeric material. Written acceptance of the adhesive will be provided by the manufacturer of the elastomeric pads. Contractor shall submit product information, including manufacturer's installation information.

2.10 BITUMINOUS DAMPPROOFING

A. Provide bituminous dampproofing materials in the areas and surfaces as indicated on the Contract Drawings and as described herein, which comply with the following requirements, or provide other similar products which are certified in writing by manufacturer of primary dampproofing materials to be superior in performance for application indicated.

B. The use of a manufacturer's name and catalog number is for the purpose of establishing the standard of quality desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

C. The dampproofing material shall consist of coatings specified in the Protective Coatings Specification Section 09905.

2.11 MOISTURE-RETAINING SHEETS (POLYETHYLENE SHEETS)

A. Provide polyethylene sheeting conforming to ASTM C171 "Sheet Materials for Curing Concrete." Polyethylene sheeting shall have a minimum thickness of 0.004 inch.

B. Other acceptable moisture retaining sheets include Waterproof paper and Polyethylene – coated burlap conforming to ASTM C 171.

2.12 ABSORPTIVE COVER

A. Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with ASSHTO M 182, Class 2.

2.13 WATER RESISTANT BARRIER PAPER

A. Water resistant barrier paper consisting of heavy kraft papers laminated together with glass fiber reinforcement and over-coated with black polyethylene on each side.

2.14 NON-SHRINK GROUT

A. Factory pre-mixed non-metallic grout, conforming to CRD-C 588
   1. "Set Grout"; Master Builders.
   2. "Sonogrout"; Sonneborn-Rexnord.
   3. "Supreme"; Gifford-Hill/American Admixtures.

4. "Crystex" L & M Cons. Chemical Co.
5. "Sure-Grip Grout", Dayton Superior Corp.
6. "Horngrout"' A.C. Horn, Inc.
7. "Five Star Grout"; U.S. Grout Corp.

B. Factory pre-mixed non-metallic, quick-set polymer-modified repair mortar conforming to ASTM C 109, ASTM C 190, & ASTM C 348 such as "Waterplug" by Thoro System Products, Inc. 7800 NW 38th St., Miami, Florida or equal.

2.15 BONDING COMPOUND

A. Polyvinyl Acetate or Acrylic Base
   1. Polyvinyl Acetate (Interior Only):
      a. "Euco Weld"; Euclid Chemical Co.
      b. "Weldcrete"; Larsen Products Corp.
   2. Acrylic or Styrene Butadiene
      a. "J-40 Bonding Agent"; Dayton Superior Corp.
      b. "Everbond"; L & M Construction Chemicals
      c. "Hornweld"; A.C. Horn, Inc.
      d. "Sonocrete"; Sonneborn-Rexnord
      e. "Acrylic Bondcrete"; The Burke Co.
      f. "SBR Latex"; Euclid Chemical Co.
      g. "Daraweld C"; W.R. Grace

2.16 EPOXY ADHESIVE

A. Two component material conforming to ASTM C 881 suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
   1. "Thiopoxy"; W.R. Grace
   2. "Epoxtite"; A.C. Horn, Inc.
   3. "Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
   4. "Sikadur Hi-Mod"; Sika Chemical Corp.
   5. "Euco Epoxy 452 or 620"; Euclid Chemical Co.
   6. "Patch and Bond Epoxy"; The Burke Co.
   7. "Concresive 1001"; Adhesive Engineering Co.
   8.

2.17 LIQUID MEMBRANE-FORMING CURING COMPOUND

A. Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at a rate of 150 sq. ft./gal.
   1. "Masterseal"; Master Builders.
   2. "A-H3 Way Sealer"; Anti-Hydro Waterproofing Co.
   3. "Clear Seal"; A.C. Horn, Inc.
   4. "Seals 309"; Gifford-Hill/American Admixtures
   5. "J-20 Acrylic Cure" Dayton Superior
   6. "Spartan-Cote"; The Burke Co.
   7. "Sealkure"; Toch Div – Carboline
   8. "Kure-N-Seal"; Sonneborn-Rexnord
   9. "LR-152"; Protex Industries
   10. "Hardtop"; Gifford-Hill

2.18 SURFACE HARDENER

A. Surface hardener and dust proof products shall be premixed, non-colored, nonmetallic hardener by W.R. Grace, Sonneborn, Dayton Superior, Burke Co., or equal applied in strict compliance with manufacturer's instructions. Must be compatible with air content of concrete.

2.19 EVAPORATION REDUCER

To prevent rapid drying, reduce surface evaporation, and aid in finishing. Acceptable products are Confilm by Master Builders or Sure Film by Dayton Superior; or equal.

2.20 BACKER ROD

Polyurethane foam.

2.21 BOND BREAKER TAPE:

PVC – backed adhesive tape matching joint width.

2.22 PRE-CAST CONCRETE SPLASH BLOCKS

When specified, precast concrete splash blocks shall be of the size as detailed on the drawings. Reinforcing shall be of the size indicated and concrete shall achieve a compressive strength of 2,500 pounds per square inch at 28 days.

PART 3 - PLACING CONCRETE

3.1 GENERAL

A. Materials in the concrete shall be so proportioned that workable mix, which will readily fill all form angles and properly embed the reinforcement without excessive manipulation, segregation, or water gain, resulting. The Contractor shall submit mix design and corresponding preconstruction test results as set forth in paragraph 1.4 above, for each class of concrete listed in paragraph 2.4 stating the slump and proportional weight of cement, saturated surface dry aggregates, and water. High density and low water absorption shall also be obtained with mixes proposed; and harsh mixes or those with which the required finishes cannot be obtained will not be approved. Adjustments in approved mixes shall be made during construction to compensate for variations in aggregates or whenever field tests indicate such adjustments are required. Changes in approved mixes required in order to bring the concrete into conformity with the specifications shall be made by the Contractor without additional compensation.

3.2 MEASUREMENT

A. Bulk cement shall be measured by weight to within 1% of the required amounts. Cement in standard sacks will be considered as weighing 94 pounds and need not be weighed. Water shall be measured by either weight or volume to within 1 ½% of the required amount. Water reducing admixtures and air-entraining admixtures shall be measured and dispensed by readily adjustable mechanical dispensing equipment capable of being set to deliver the

required amount and cut off the flow automatically. The equipment shall be of the type where the amount to be dispensed is visible in the container for ready check by the Engineer. All admixtures shall be measured and dispensed in the liquid state. Powdered admixtures shall be mixed with water in the proper amounts prior to use.

3.3 AGGREGATES

A. Aggregates shall be measured by weight on a scale separate from that use for weighing cement. The individual aggregates, as weighed, shall be within 2% of the required amount and the total weight of the combined aggregates shall be within 1% of the required weight.

Water shall be measured by volume or by weight. The device for measurement of the water shall be readily readjusted and, under all operating conditions, shall have accuracy within 1% of the required amount. The device shall be so arranged that the measurements will not be affected by variable pressures in the water supply line.

3.4 PLANT ASSEMBLY

A. The complete plant assembly shall meet the approval of the Engineer, shall utilize computerized batching acceptable to the engineer, and facilities shall be provided for ready adjustment of aggregate weights for varying moisture content; accurate proportioning of to cement to achieve the correct ratio; accurate control of all materials including positive shutoff where delivery to mixer is from bins; prompt removal of excess materials in hoppers; easy checking of weights of each separate aggregate; delivery to hopper of cement without waste; and for checking accuracy of measuring device. The plant shall have the capacity to produce, on a continuous basis as required, no less than 100 yards of concrete per hour.

3.5 PROPORTIONS

A. The actual quantities of materials used in each batch shall be in accordance with the approved mix design for the class and slump of concrete being produced. The amount of moisture in the aggregate shall be considered in determining the amount of water to be added to each batch. The total water content of any batch shall not exceed that of the approved mix design. Adequate means shall be furnished by the Contractor for determining and controlling the amount of water in the aggregate.
B. Placement of concrete shall be in accordance with the requirements for hot and cold weather placing as specified for regular concrete, i.e., cool aggregates, cool water, or use compatible retarder for placements in temperatures above 70ºF. For cold weather concrete placement, below 60º F, adhere to the requirements of ACI 306R.
C. Normal finishing techniques shall be used to produce the specified finish.
D. Concrete shall be cured using water cure (either flooding, fog spray or covering the concrete with wet burlap) for seven days.

3.6 CONTROL

The Engineer shall have free access to the plant at all times and the Contractor shall furnish materials for samples of all tests required to determine conformance with the specifications. Changes in the mix shall be made promptly whenever such tests indicate changes are required or whenever quality of concrete produced fails to meet the specification requirements. The batch plant shall be inspected and certified every three months during the progress of the concrete work.

3.7 CONCRETE SLUMP AND AIR CONTENT

A. General – Slump test and determination of air content shall be made by the testing laboratory as directed by, and subject to the acceptance by the Engineer. The number of frequency of such tests shall be entirely at the discretion of the Engineer. If the slump or air content fails outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered as not meeting the requirements of the specification.

B. Slump – The slump of all concrete shall be between 3-inches and 6-inches as per the table below with the conditions of placement governing the exact slump to be used. In all cases not shown, The Engineer shall specify the slump to be used. When a 3-inch slump is specified, the allowable tolerance shall be ½-inch. When the specified slump is greater than 3-inches, the allowable tolerance shall be 1-inch.

SLUMP TABLE
Flat Work……...3”-4”
Vertical Concrete Surfaces……5”
(walls, columns, etc.)
Reinforced Concrete Cells – CMU Construction……..6”

C. Air Content – The maximum air content for air-entrained mixes shall be 4.5 percent. The exact air content shall be as specified by the Engineer with a tolerance of 1½ percent except that the air content shall, in no case, be outside the range given above.

3.8 REINFORCING

A. Fabrication and Placing or Reinforcing Steel – Reinforcement shall be accurately fabricated to the dimensions and shapes shown on the plans in accordance with the ACI Manual of Standard Practice unless variations are specifically shown on the plans. Fabrication shop drawings shall be furnished to the Engineer in accordance with Section 01300 SUBMITTALS, and shall receive his approval before any reinforcing steel is fabricated.

1. Reinforcement shall be accurately placed and adequately supported by concrete, metal or other approved chairs, spacers, or ties and shall be secured against displacement. Bar supports coming into contact with forms shall be plastic, Class 2 stainless steel protected or attachable prefabricated concrete blocks for wall forms, footing and slabs. Plastic coated metal supports are not acceptable. Bar supports shall be located in accordance with CRSI MSP-1 and placed in accordance with CRSI PRB. Concrete block supports shall be provided for footing and slabs on grade. Reinforcement shall be placed in specified positions within the following tolerances:
    a. Depth in structural slabs, flexural members, walls and columns: ± ¼-inch.
    b. Longitudinal location of bends and ends of bars: ± 2-inches except that the required concrete cover at ends of members shall not be reduced.
    c. Unless noted otherwise on the Contract Drawings, the concrete cover for reinforcing shall be in accordance with the requirements of the ACI Building Code Requirements for Reinforced Concrete, (ACI 318).
2. Splices shall be made as shown on the Contract Drawings by lapping the bars the required amount and securely wiring them together. Where details of splices are not shown or where unanticipated splices are required, they shall be made in a location

approved by the Engineer and the length of lap shall be as required by the ACI Building Code Requirements for Reinforced Concrete (ACI 318).

3. Install welded wire fabrics in lengths as long as practical. Lap adjoining lengths at least one full mesh and lace splices with wire. Offset laps in adjacent widths to prevent continuous laps in either direction. Welded wire fabric shall be provided in flat sheets not in rolls.
4. Provide #4 by 2-foot long bars for each layer of reinforcement at re-entrant corners, or as may otherwise noted on the plans.
5. Reinforcing bars partially embedded in concrete shall not be field bent, except as indicated on the Contract Documents or permitted by the Engineer.

3.9 FORMS

A. Construction – Forms shall be constructed true to lines, grades and sections shown on the plans and shall be mortar tight and sufficiently rigid to prevent displacement or sagging between supports. All exposed edges on all structures, including edges at all joints, shall be chamfered ¾-inch unless otherwise noted on the plans. Column and wall forms shall be set plumb and true and rigidly braced to maintain them in correct position and alignment. Beam and slab centering shall be true and rigid and all spans shall be crowned 1/16-inch for each 4 feet of span length unless otherwise shown on the plans. This camber shall be maintained during concrete placement, to insure that the forms remain in proper position. Temporary openings for cleaning and inspection shall be provided at the base of vertical forms or other places where necessary. Such opening shall be neatly and securely closed before concrete is placed. The Contractor shall be responsible for the design of all forms, the bracing and guying of forms as required, and for proper bracing against the concrete pressure during placement.

B. Wetting and Oilings – the inside surface of forms shall be coated with a non-staining mineral oil or other approved coating and shall be cleaned and oiled after each use. Forms which have dried out between uses shall be recoated just prior to placing of concrete. Excess oil or grease shall be wiped from the form surface. If forms have dried out so that the joints have opened, they shall be thoroughly soaked with water prior to placing of concrete.

C. Removing Forms – forms may be removed only upon approval of such removal by the Engineer. In general, the removal of wall and column forms will not be permitted in less than 72 hours, unless approved by the Engineer and no further loads are to be placed on such members, and if removal of forms and ties will not damage the concrete. Forms for flexural members shall remain in place for 14 days. Adequate re-shoring shall be placed under such members when forms are removed and shall remain in place until twenty-eight (28) days after placement or until the concrete has attained its design strength, but in no case, less than 14 days. The design strength shall be determined from standard test cylinders molded, cured and broken in accordance with ASTM Designation C 31. the strength of the concrete in the structure at any age shall be assumed to equal to the average strength of two test cylinders of the same age, cured as specified in paragraph 9 of ASTM Designation C31. The strength of the concrete in the structure at any age shall be assumed to equal to the average strength of two test cylinders of the same age, cured as specified in paragraph 9 of ASTM Designation C 31. The Contractor shall bear all costs of molding, curing and breaking of those cylinders which are made for the purpose of determining form removal time. The Contractor may elect to not use concrete test cylinders to determine from removal time and, in this event, forms or shoring shall remain in place beneath flexural members for 28 days.

1. It shall be the responsibility of the Contractor, in all form removal, to prevent structural damage or marring of the concrete surfaces.

3.10 CONCRETE MIXING

A. Mixing Equipment – All mixing equipment shall meet the requirements of ASTM C 94. Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place, a metal plate on which are plainly marked, for the various uses for which the equipment is designed, the capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum, blades, or paddles. Stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. Truck mixers, shall be equipped with means by which the number of revolutions of the drum blades, or paddles may be readily verified.

1. When the concrete is truck mixed, the volume of the mixed concrete shall not exceed 65% of the total volume of the drum or container. When the concrete is central mixed, the volume of concrete in the truck mixer or agitator shall not exceed 85% of the total volume of the drum or container.
2. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. No mixer or agitator shall be used if the results of slump tests of individual samples taken at approximately the one quarter, and the three quarter points of the load differ by more than 2 inches. Mixers and agitators shall be inspected frequently for changes in condition due to accumulations of hardened concrete or mortar, or to wear of blades. When the wear of the blades exceeds 10% of their original dimension (blade portion) the blades shall be replaced with new blades of the proper dimension. A copy of the design, I., e., the size, configuration, slope of the blades as produced by the manufacturer shall be submitted to the Engineer in order to establish the control size for the blades. When any such change of conditions if found, the slump test described above shall be repeated.
3. Truck mixers shall have adequate water supply and metering devices. No water shall be added to the concrete after the initial mixing water without the permission of the Engineer. Water shall not be added to the concrete mix, unless authorized in writing by the Contractor's Superintendent and approved by the Engineer.

B. Mixing and Delivery – When a stationary mixer is used for the entire mixing of the concrete, the mixing time for one cubic yard of concrete shall be a minimum of 60 seconds, with an increased mixing time of 15 seconds for each additional cubic yard or portion thereof.

1. When a stationary mixer is used for partial mixing, the mixing time shall be a minimum of 30 seconds. Mixing shall be completed by truck mixer at mixing speed.
2. Mixing time shall be measured from the time all cement and aggregates are in the drum. The batch shall be so charged into the mixer so that some water will enter in advance of cement and aggregate, and all water shall be in the drum by the end of the first one fourth of the specified mixing time.
3. Mixing at mixing speed shall begin immediately after all ingredients are in the mixer. For complete mixing in the truck, each batch shall be mixed not less than 70 or more than 100 revolutions of the drum. For partial mixing in the truck each batch shall be mixed not less than 50 nor more than 100 revolutions of the drum. Mixing speed shall be as designated by the manufacturer. All revolutions after the

prescribed mixing time shall be at agitating speed. The agitating speed shall be not less than one nor more than four revolutions per minute. The drum shall be kept in continuous motion from the time mixing is started until the discharge is completed.

4. The maximum time interval between the introduction of the mixing water to the cement and aggregates, and the placing of the concrete in the forms shall not exceed the following:

AIR OR CONCRETE TEMPERATURE

(Whichever is Higher)	Maximum Time Class "A" or "A1" Concrete	Maximum Time All other Concrete
90º F or above (Air Temp. Only)	45 minutes	60 minutes
75º F to 89º F	60 minutes	75 minutes
35º F to 74º F	60 minutes	90 minutes

5. Concrete not placed within the time specified above will be cause for rejection of that load, at the sole discretion of the Engineer, and at no cost to the Owner.
6. Concrete shall not be placed when the ambient temperature is less than 40º F and falling but may be placed when the ambient temperature is 40º F or higher and rising. Concrete shall not be placed when the temperature will drop below 35º F within 24 hours after placement as projected by the National Weather Service unless properly protected. The temperature of the concrete at the time of placement in the forms shall be not less than 50º F. Use of blankets, insulated boards, heaters, etc., shall be in accordance with the requirements of ACI 306.
7. Concrete shall not be placed when the ambient temperature is more than 100º F. Concrete temperature shall not exceed 90º F at the time of placement of concrete into the forms. Use ice or chilled water, or other methods as per ACI 305, as may be required to maintain concrete temperature below 90º F. Concrete placement, curing and protection in hot weather shall be in accordance with ACI 305.
8. The Contractor shall furnish to the Engineer with each batch of concrete before unloading at the site, two copies of a delivery ticket (may be computer generated) on which is printed, information concerning the concrete in the delivery truck as follows: It is intended that water not be added to the concrete mix.
    a. IDENTIFICATION OF BATCH PLANT:
    b. SERIAL NUMBER OF TICKET:
    c. DATE:
    d. TRUCK NUMBER:
    e. SPECIFIC DESIGNATION OF JOB (Name & Location):
    f. SPECIFIC CLASS OR DESIGNATION OF THE CONCRETE:
    g. AMOUNT OF CONCRETE IN CUBIC YARDS:
    h. TIME LOADED OR OF FIRST MIXING OF CEMENT AND AGGREGATES:
    i. WATER ADDED BY RECEIVER OF CONCRETE (CONTRACTOR'S FIELD SUPERINTENDENT) AND HIS INITIALS:
    j. READING OF REVOLUTION OF COUNTER AT FIRST ADDITION OF WATER OR AT START OF MIXING IF PREMIXED:
    k. TYPE, BRAND, AND AMOUNT OF CEMENT:
    l. MAXIMUM AGGREGATE SIZE:
    m. WEIGHTS OF FINE AND COARSE AGGREGATE:

The two (2) copies of the delivery tickets shall be delivered to the Engineer at the end of each days placement.

9. The addition of High Range Water Reducer (Superplasticizer) to the mix shall be allowed only at the job site, just prior to placement. High Range Water Reducer (Superplasticizer) shall be added in the presence of the Engineer or his representative.

3.11 TRANSPORTING

A. Concrete shall be handled from the mixer to the place of final deposit in a manner which will prevent segregation and when practicable, shall be deposited in its final position without re-handling or flowing. All equipment used in transporting the concrete shall be maintained in a clean condition. Concrete shall not be delivered from hoists by spout or trough, nor dumped into carts, with a free fall of more than 4 feet. Every precaution shall be taken to prevent separation or loss of ingredients while transporting the concrete. Runways for carts or buggies shall not bear upon the reinforcing or fresh concrete. Pumping and conveying of concrete shall be done only after approval by the Engineer and with equipment which will insure a continuous flow without segregation.

3.12 PLACING

A. Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position. Form ties shall be checked and retightened where necessary. Forms and reinforcement shall be inspected and approved by the Engineer prior to closing and again before beginning placement of concrete. All embedded items shall be in place and anchored and the forms and reinforcement shall be cleaned and cleanout openings closed before such inspection. A procedure for inspection of forms, reinforcing, inserts, etc., prior to all concrete placement will be instituted and coordinated with the Engineer. ***At least twenty four hours prior to concrete placement, the Contractor shall submit an inspection sheet to the Engineer.*** The inspection sheet, to be developed, shall show the location and quantity of concrete to be placed, the time and date scheduled for placement and shall be signed by the Contractor's previously designated, representative. Signing of the sheet shall certify that all of the items necessary have been inspected, and that the area is ready for final review by the Engineer. The placement location shall be reviewed by the Engineer, who shall return a copy of the inspection sheet marked "no exceptions taken"; "make corrections noted"; listing the deficiencies; or "not approved for concrete placement", if the placement area has not been properly prepared and/or a significant delay would occur due to the time required to make extensive corrections of the listed deficiencies. If the Engineer determines that the corrections are excessive and will require and extensive amount of time, the placement shall be rescheduled, and the Engineer shall be notified 12 hours before scheduled placement, after the corrections are made. A representative of the Engineer will be on the job during placement of concrete and concrete shall not be placed unless the Engineer or his representative is present.

B. Concrete shall be placed in a manner which will prevent segregation, thoroughly embed all reinforcement and fixtures, fill all angles in the forms and prevent formation of aggregate pockets or honeycomb. Placement in walls, columns or other deep forms shall be done through openings in the forms, spaced at frequent intervals, or through tremies so that the free fall shall not exceed 4 feet. Points of depositing the concrete shall be spaced so that the concrete surfaces can be kept level without using vibrators or other equipment to cause it to flow into place. See paragraph 13.3E FINISHING for slab construction requirements.

C. Concrete shall be placed with the aid of approved mechanical vibrating equipment. Vibration shall be applied to the concrete and shall be of sufficient intensity and duration to cause flow or settlement of the concrete, thorough compacting, and complete embedment of reinforcement and fixtures. Supplemental forking and spading by hand may be required to secure dense uniform surfaces and complete filling of corners and angles. Vibration of concrete is to properly consolidate the concrete and shall not be used to move concrete horizontally.

D. Excessive spading or vibrating causing undue water gain or segregation will not be permitted. If moderate working causes excessive water gain the mix shall be adjusted. Excess water shall be removed when it appears. When concrete in floors or slabs is deposited on the ground, the sub-grade shall be thoroughly compacted and moistened before concrete is placed. Concrete shall not be placed in forms until they have been thoroughly moistened and reinforced steel has been cooled. A grill tamp shall be used on floor slabs. Completed sections shall conform to the details on the Contract Drawings and the concrete shall be dense, uniform and free of aggregate pockets or honeycomb.

E. Concrete in vertical walls shall be placed in continuous horizontal layers approximately 18 inches in depth. Not more than one hour shall elapse between the placing of successive layers of concrete in any portion of a structure included in a continuous placement

F. Concrete shall generally not be placed during high winds with blowing dust that will contaminate the surface and cause entrapment of sand and dust particles in the finished surfaces, and that will cause excessive moisture loss in the concrete.

3.13 INSTALLATION OF DAMPPROOFING

A. All external concrete surfaces that are to be backfilled, and are subject to contact with moisture either from normal hydrostatic moisture or are subject to being submerged in ground water, are to receive a 40 mil external bituminous coating. The proposed coating material shall be as specified herein and shall be submitted to the Engineer for approval. All surface voids shall be filled and surfaces prepared using approved methods prior to the application of the coating, as specified in this section and Section 09905.

B. Conditions: Do not start work until the following environmental requirements are met.
   1. Do not proceed with application of materials when ambient temperature is less than 50º F.
   2. Do no apply damp-proofing in rainy conditions or within 3 days after surface becomes wet from rainfall or other moisture unless permitted by the Engineer in writing.
   3. Do not apply materials when low temperature of 40º F or less is predicted within a period of 24 hours after application.

C. Inspection – Examine surface to receive damp-proofing, to assure that conditions have been properly prepared as described herein and per the manufacturers recommendations, and that the surfaces are satisfactory for application of materials.

D. Surface Preparation
   a. Clean surfaces to remove dust, dirt, oil, wax, efflorescence, and other foreign materials, in accordance with dam-proofing manufacturer's instructions.
   b. Remove efflorescence by scrubbing surface with muriatic acid and thoroughly rinsing with water.
   c. Allow 3 days drying time following washing down of substrate surfaces
   d. Fill all cracks, voids, and honeycombs with epoxy mortar to provide sound surface for damp-proofing.

E. Application
   1. The area to be coated shall extend from the bottom of the structure to an elevation of 6-inches below finished grade. This area is defined as any portion of the structure below elevation 3728.
   2. The Contractor shall apply the bituminous coating in accordance with the manufacturer's recommendations using a minimum coating thickness of 40 mils.
   3. Apply damp-proofing with a brush or with manufacturer-approved low pressure airless spray equipment with a coarse nozzle.
   4. Apply materials at rate and as recommended by the manufacturer and in a two coat application.
   5. Start application at top of wall and work down surface, keeping a wet edge at all times, forming a continuous, unbroken film, free from pinholes and other surface breaks.

F. The Contractor shall take the necessary precautions when backfilling the structure so as to no damage the coating. The Contractor shall use small compaction equipment and/or hand methods to compact the backfill material within five (5) feet of the structure.

G. Adjustment and Cleaning – Clean spillage and overspray from adjacent surfaces as recommended by manufacturer.

H. Field Quality Control
   1. After damp-proofing has dried, spray coat surfaces with water.
   2. Recoat surfaces that show water absorption, as recommended by manufacturer. To prevent blistering, protect surfaces from heat and direct sunlight until dried, then backfill.

I. Product Delivery, Storage, and Handling
   1. Deliver materials in original sealed containers, clearly marked with manufacturer's name, brand name, and type of material.
   2. Store materials in area where temperatures are not less than 50ºF or over 85º F., unless otherwise authorized by manufacturer.

J. Application Schedule
   1. Apply damp-proofing to the vertical, battered, or sloped exterior surfaces of cast-in-place concrete structures below finish ground level that enclose spaces that may be occupied, such as stairways, galleries, pump rooms, mechanical and electrical equipment rooms, and other areas indicated on Drawings; and include all below grade walls of water holding structures and basins including the tops and sides of formal footings.
   2. Apply damp-proofing to the vertical or battered surfaces of the walls from top of footings to 6 inches below finished grade.

3.14 INSTALLATION OF PRECAST CONCRETE SPLASH BLOCKS

Precast concrete splash blocks shall be fabricated as described in paragraph 2.22 of this section of the specifications. Splash blocks shall be placed and installed as indicated on the plant site plans.

3.15 JOINTS AND STOPPAGES

A. General – Construction and expansion joints shall be constructed at the locations and in accordance with the details shown on the drawings. If it becomes necessary to stop placement of concrete between joints, or if the Contractor desires for his own convenience to construct joints other than those shown, such joints shall be constructed in accordance with the details shown on the drawing subject to approval of the Engineer as to the location

of such joints. However, all vertical walls shall be constructed without horizontal construction joints except as specifically shown on the drawings. A waterstop, as specified herein and as generally detailed on the drawings, *shall be used in all joints in water containing structures and structures below ground water table except where it is specifically noted that waterstop is not required.* All construction joints for structures shall be constructed with a waterstop barrier for all positions of the waterstop and so that complete water tightness is secured, even if such details are not specifically shown on the drawings. Split tail waterstops will not be permitted.

B. Locate construction joints so as NOT to impair strength and appearance of the structure, as acceptable to Engineer.

C. All horizontal joints shown on the plans shall be made truly horizontal and chamfered. Vertical joints shall be truly vertical. Construction joints in the building floor slabs shall be made along lines where the slab is marked or shall be grooved as specified herein.

D. Provide keyways at least 1-1/2" deep in construction joints in walls, footings and between walls and footings; or as may otherwise be shown on the plans. Bulkheads designed for this purpose may be used for non-water bearing slabs, subject to the approval of the specific product by the Engineer.

E. Before concreting operations are resumed at any construction joint, or wherever fresh concrete is to be bonded to hardened concrete, the surface of the hardened concrete shall be cut or chipped or provided per the following procedures to remove laitance and exposed or loose aggregate.

1. A rough surface of exposed concrete aggregates may be produced using a surface retardant at construction joints, including joints between slab and topping concrete. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, retarded surface mortar shall be removed either by high pressure water jetting or stiff brushing or combination of both so as to expose coarse aggregates. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/8 inch of laitance film and shall expose coarse aggregate to insure adequate bond and water tightness at the construction joints.
2. The surface of the concrete shall be thoroughly cleaned, saturated, then slushed with a coating of neat cement grout against which the fresh concrete shall be placed before the grout has attained initial set. Care shall be taken to insure that the first layer of new concrete contains sufficient mortar for adequate bond.

F. All joints shall be constructed in a workman-like manner with joints truly vertical or horizontal, as required, and at right angles to the axis of the member in which the joint occurs. Waterstop and/or expansion joint material shall be accurately positioned and held in position during placement of concrete. Special care shall be exercised to hold the waterstop in proper position and to carefully place the concrete around the waterstop to insure proper embedment.

G. Construction joint locations shall be as shown on the Drawings or if not shown, as follows:

a. Walls exceed 50 feet in length shall be cast in panels not to exceed 30 feet in length. Where the number of panels is three or more, then panels shall be cast in an alternating pattern, unless five days have elapsed between casting of adjoining panels.
b. Joints in beams or girders shall be located at or near the midpoint between supports.
c. Joints in the members of a floor system shall be made at or near the center of the span.

d. Joints in walls and columns shall be at the underside of floors, slabs, beams or girders and at the tops of footings or floor slabs. Joints in columns shall be perpendicular to the axis.

e. Unless otherwise noted on the drawings, slabs-on-grade shall be cast in panels not to exceed 600 square feet in area. Panels shall be cast in checkerboard patterns. Minimum lapsed time between placing adjacent panels shall be 24 hours.

H. Vertical construction joints shall be grooved at exposed faces. Grooves subjected to wetting weather shall be caulked with joint sealer as specified.

I. Reinforcing steel and welded wire fabric shall be continuous across construction joints. The concrete for girders and floor slabs shall not be placed over columns or walls until at least four hours has elapsed to allow for shrinkage in the column or wall. No joint will be allowed between a slab and a beam or girder unless otherwise specified. Joints shall be perpendicular to the main slab reinforcement.

J. Isolation Joints in Slabs on Ground for non-watering bearing slabs. Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as columns, pedestals, foundation walls, grade beams and elsewhere as indicated.

3.16 WATERSTOP INSTALLATION

A. All installation of polyvinyl waterstops, including splicing, joints, and intersections, shall be in strict accordance with the manufacturer's recommendations, as approved by the Engineer. All splices must be made with electrical welding equipment specifically fabricated for use in the welding of PVC waterstop joints. Devices utilizing externally applied heat will not be permitted. Penetration of or puncturing of the waterstop will not be permitted (nailing, etc.). Prior to use in the structure, submit for approval a sample of welded joints including a straight and a right angle splice joints.

B. Waterstops shall be securely held in position during placing of concrete. If, after placing concrete, waterstops are materially out of position or shape, the surrounding concrete shall be removed, the waterstop reset, and concrete replaced using approved non-shrink grout.

C. Field splices are acceptable only in straight sections. Crosses, tees, and other shapes shall be fabricated prior to delivery to the site of the work.

D. Cold Joint Waterstops – Provide cold-joint water stops as shown on Contract Drawings.

3.17 PATCHING OF CONCRETE

A. Concrete work obviously out of horizontal or vertical alignment or which shows serious surface defects shall be removed and replaced by the Contractor at his expense. ***In no case will patching be started until the areas to be patched are reviewed and accepted for patching by the Engineer.*** Patching of minor defects will be permitted provided such patching removes the defect. Immediately after removing forms the concrete shall be inspected for defects. All cracks, defects, or other deficiencies permitted by the Engineer to be patched or repaired, and where possible, form tie holes shall be patched before concrete is thoroughly dry. Defective areas shall be stripped away to a depth of not less than one inch with edges perpendicular to the surface. Areas to be repaired shall be cleaned, sand blasted, etc., to provide a roughened profile with all loose and/or deteriorated concrete removed so as to assure a good bond. Pre-wet surfaces as required prior to application of repair material and cure as required. All repair procedures and completed repairs shall be subject to the approval of the Engineer. Undercut or low areas shall be prepared and

patched similar to defective areas subject to the approval of the Engineer. This and the surrounding area shall be wetted to prevent absorption of water from the patching mortar.

B. The patching mortar shall be an approved non-shrink, non-metallic, high strength grout of a minimum strength as used for the concrete with the coarse aggregate omitted and the amount of water used shall be as recommended by the approved grout manufacturer, as it is consistent for proper handling and placing. The mortar shall be thoroughly compacted into place, screeded off slightly higher than the surrounding surface and left undisturbed for a period of one or two hours. Final finishing shall conform to the finish of the surrounding areas subject to the approval of the Engineer.

C. Form tie holes of non-bearing water structures, shall be patched with this same mortar, the holes being completely filled and the mortar tightly packed into the hole. Holes passing entirely through the concrete shall be filled by forcing the mortar through from one side to the other. Mortar shall be struck off flush with burlap or canvas and the patch finally finished to conform to the surrounding surface.

D. Should structural repair require epoxy injection of cracks, the following criteria shall govern.

1. Epoxy used for crack injection process shall be a low viscosity expoxy material designed for pressure injection applications for crack repair in existing concrete. The system shall be capable of bonding to damp surfaces.
2. Epoxy injection material shall be NSF approved for potable water containers, where applied under submerged conditions.
3. Injection Resin must be one hundred percent solids material which cures with a minimum of shrinkage. It must have adequate wetting properties such that when applied to concrete, it must be capable of displacing water to provide adhesion to set concrete, and the capability of curing at sub-freezing temperatures.
4. All epoxy injection shall be in accordance with the requirements of ACI 503.

E. Form tie holes for all structures shall be patched with a "water plug" type grout, i.e., "Waterplug" by the Thoro System Products, Inc. 7800 N.W. 38th St, Miami, Florida 33166, subject to the approval of the Engineer. Prior to patching, the hole shall be thoroughly routed with a wire brush attached to a drill bit or other mechanical means, to insure removal of grease or other foreign material, then coated with an approved bonding agent. Holes passing entirely through the concrete wall or slab shall be filled by forcing the mortar through from one side to the other. Mortar shall be struck off flush with burlap or canvas and the patch finally finished to conform to the surrounding surface. The Contractor remains responsible to insure that all water bearing structures remain water tight.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

G. Repair finish unformed surfaces that contain defects which affect durability of concrete. Such surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

J. Grout material shall be certified to meet the requirements to be considered acceptable and approved for potable water by NSF.

3.18 FINISHING

A. Exposed Formed Surface – Exposed vertical formed surfaces include all exterior walls exposed to view, from top of wall to six inches below finished grade. All interior surfaces include walls, slabs and beams, and overhanging surfaces contiguous with the vertical wall surface.
   1. Exposed formed surfaces shall have all tie rod holes filled, fins and rough edges removed, and all defects removed or patched. These surfaces shall receive one coat of texture coating conforming to Federal Specification TT-C-555, Type 1, or as may otherwise be specified. Application shall be heavy-duty brushes, special spray equipment or rollers as specified in the manufacturer's printed directions, subject to the approval of the Engineer, at a rate of 45 to 55 square feet per gallon in one coat. Color shall be as selected by the Engineer. Where the surface produced is not dense, and smooth and/or is not to the satisfaction of the Engineer, these surfaces shall receive the "Smooth rubbed Finish" as specified below before application of the coating. The final surface shall be free of efflorescence, dirt, oil, unpaintable form treatment, and other foreign substances which may require brush-off sand blasting. All surfaces must be thoroughly cured. Prior to applying finish coating, surfaces shall be primed as recommended by the coating on unexposed concrete surfaces for inspection by the Engineer to establish the color and texture which will be required on the exposed surfaces.

B. Other Exposed, Formed Surfaces – For the purpose of this specification, other exposed, formed surfaces are defined as follows:
   1. Entire inside and outside surfaces of all troughs and channels except inside surfaces of channels which are to be covered with concrete slabs, surfaces covered by grating but which are still visible, and outside surfaces not normally exposed will not require finishing;
   2. All other exposed to view portions of water bearing structures contained wholly within the structure but not part of, or continuous with the exterior exposed to view walls;
   3. Sides of beams, underside of cast—in-place beams, and slabs, and concrete stairs.
   4. Other Exposed Formed Surfaces shall have all tie rod holes filled, fins and rough edges removed, and all defects removed or patched. These surfaces shall receive a "smooth rubbed finish". "Smooth rubbed finish" shall be produced on freshly hardened concrete. All necessary patching shall have been completed not later than the following day. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until a uniform color and texture are produced No cement paste shall be used other than the paste drawn from the green concrete itself by the rubbing process. Exposed cast-in-place surface of structures or pits within the buildings shall then receive the finish as specified in Division 9.

C. Unexposed Vertical Surfaces – For the purpose of this specification unexposed vertical surfaces are defined as follows:
   1. Those covered by earth fill six inches below the line of finished grade;
   2. Inside all water-containing structures not otherwise scheduled; and
   3. Inside wall surfaces of miscellaneous boxes covered by a roof slab or by checker plate.
   4. Unexposed vertical surfaces shall have all tie rod holes filled, fins, and rough edges removed and all defects removed or patched.

D. Floor, Roofs and Walkways of Plant Structures or Facilities – Special care shall be used in finishing these surfaces to obtain true plane surfaces with no pockets or depressions except

at floor drains. Where floor drains are shown, the floor shall be carefully graded to slope to the drain. Any such area which does not drain properly shall be corrected by removal and replacement of the concrete. The Contractor shall prepare and submit drainage shop drawings showing the location, elevation and type of floor drain to the Engineer for approval. Where hardener is specified, the hardener shall be applied as soon as required by the manufacturer's instructions. Floors of all water-containing structures, shall be finished with a woof float followed by a thorough troweling to obtain a dense, hard, smooth finish. Roofs not used as walkways, and on which no roofing is to be placed, shall be finished as described for building floors. Walkways shall be broomed or brushed as directed by the Engineer, after troweling, to provide a "non-skid" surface. The structural floor slabs of structural water-containing structures to receive additional grout toppings shall be accurately shaped, in accordance with the drawings, and floated to a uniform surface and given a "rough" finish which will provide proper bond with the group topping. See Section 03600 Grout for grout and grout installation requirements.

E. Monolithic Slab Finishes – The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Floors shall be sloped to drain uniformly as described above. Unless otherwise specified, slope shall be minimum 1/8 inch per foot towards nearest drain. Unless otherwise noted, slope top and bottom of slab to maintain constant thickness throughout. Where finish is not specified, floor slabs shall receive steel troweling. Dry cement shall not be used on new concrete surfaces to absorb excess moisture. Edges shall be rounded to a radius of ½ inch. Joints shall be grooved to a radius and depth of ¼ inch each. Finishes shall match the sample panels specified below. Rigid screed guides shall be used during placement of all slabs. "Wet" screeds are not acceptable. A sample concrete panel, 2 feet by 2 feet, 3 inches thick, representative of each specified finish shall be prepared for approval by the Engineer. The panels shall be representative of the workmanship and finishes required and shall include joints. Samples shall be approved in the field prior to the start of such work.

1. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerances for floor flatness (FF) of 22 and floor levelness (FL) of 18. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes. Those areas to receive concrete topping shall be left with an exposed aggregate surface.
2. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of FF25 and FL20. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surface to a uniform, smooth, granular texture.
3. Trowel Finish: Apply trowel finish to monolithic slab surfaces to exposed-to-view, all water bearing slabs and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 35 and FL 25. Grind smooth surface defects which would telegraph through applied floor covering system.

4. Trowel and Fine Broom Finish – Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel, finish specified, then immediately follow with slightly scarifying surface by fine brooming.
5. Non-Slip Broom Finish – Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated. Immediately after float finishing and one troweling pass, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the Engineer before application.
6. Topping Concrete – These requirements shall apply to the placement of normal concrete topping, with or without surface hardener, on a hardened base slab. Slabs to receive topping concrete shall have an exposed aggregate sub-floor finish as specified in paragraph "Scratch Finish". Dirt, laitance and loose aggregate shall be removed. The cleaned base shall be kept wet for a period of 24 hours prior to the application of topping. Excess water shall be removed, and a neat cement grout shall be applied and brushed into the surface of the base. The cement grout shall not be allowed to dry and shall be spread within 15 minutes of the topping placement. The topping shall then be placed to grade, compacted by rolling or tamping, and floated. The surface shall be tested with a straightedge to detect high and low spots of over 1/8 inch in 10 feet which shall be eliminated. Surface hardener shall be incorporated where specified. When the floor has hardened sufficiently, it shall receive a steel trowel finish. Finished surface shall be leveled to tolerances of FF 35 and FL 25 or as required to accommodate sweep arms of equipment if applicable.

F. Building Floors – The building floors shall be finished by carefully grading and sloping the slabs to the point of drainage, as shown on the plans, and then floating and troweling as described above, except as otherwise specified. Screeds shall be set as required using screed guides to insure that true surfaces, accurate to grade, are secured. "Wet" screeds will not be allowed. Floors shall be thoroughly troweled to produce a hard smooth finish which rings when struck with the trowel. Machine troweling will be permitted, but the final troweling shall be by hand. Platform and dock slabs, stairs and walks shall be troweled, after floating, and then lightly brushed to provide a "non-skid" surface. Floor slabs shall be placed to a tolerance of FF 50 and FL 36. All concrete floors in the building shall be treated with a liquid hardener and dust-proofer, applied in strict accordance with the manufacturer's instructions. Immediately prior to final completion of the projects, all such floors shall be also treated with one coat of hardener/dust-proofing, to harden seal and dust-proof the floors.

3.19 CURING AND PROTECTING

The purpose of curing procedures is to provide the most favorable conditions practicable for development of the strength of the concrete without the formation of cracks or other defects. Such favorable conditions include the maintenance of proper moisture conditions and protection from large changes in temperature. The procedures specified herein are designed to maintain these favorable conditions and will be strictly enforced to this end. The Contractor shall repair unsightly or leaking cracks, joints, or other defects in the concrete, subject to the approval of the Engineer, as soon as forms are stripped.

All concrete for structures shall be cured adequately and properly. Use of proposed curing methods or specific systems shall be submitted in writing and will be subject to the approval of the Engineer. No curing method shall be used until approved by the Engineer for that type of structure. Submittal of curing methods or procedures shall not relieve the Contractor from providing concrete in place which has been properly cured and meets the requirements of the specifications.

The Contractor shall inform the Engineer fully as to the methods and procedures proposed for curing and have approval of the methods, equipment, and materials prior to placing concrete. The Contractor shall have, at the site of the work, the proper equipment and material in adequate amounts to cure the concrete properly, prior to being given permission to place concrete.
Poor curing facilities or lack of attention to the proper curing of concrete shall be cause for the Engineer to stop all construction on the job until proper curing is provided. Any stoppage of the work by the Engineer for this cause will be the Contractor's responsibility, and any delay or additional costs are the responsibility of the Contractor. No additional compensation will be approved or granted for this delay (s).

The curing period for all concrete begins immediately after placing and/or finishing operations are completed. Delay in initiation or curing measures will not be tolerated. All concrete shall be kept wet, and shall be protected from large changes in temperatures, for a period of seven (7) days after placement. Curing measures shall consist of the procedures outlined below unless similar measures are demonstrated to achieve the same or better results are approved by the Engineer in writing.

A. Curing/Walls- forms shall remain in place 24 hours, but may be removed within 48 hours after placement of the concrete, or as may otherwise be determined for maintaining temperature and curing control for portions of the structure. Forms shall be kept wet at all times until they are removed. Immediately after removal of the forms, walls shall be patched and finished as specified then completely covered with mats, conforming to Federal Specification DD-M-148, Class 2. Mats shall cover the entire section being cured and shall be held in place at the bottom and ends of the section so that free air circulation between mat and wall is prevented. Mats shall be kept wet at all times.

B. Curing/Slabs – Beginning with and during the placement, screeding and finishing of concrete on slabs on grade, the concrete and area surrounding the concrete placement shall be fogged whenever the ambient temperature is 90ºF or higher, or when windy conditions accelerate drying. The fogging equipment shall be capable of applying water in the form of a fine atomizer mist, and not a spray. The equipment should be capable of preventing excessive wetting of the concrete. This process shall be subject to the final approval of the Engineer. Slabs may be cured by covering with mats of the type specified for the walls, with paper or polyethylene sheeting, or with water, depending on the type of slab and subject to the approval of the Engineer. All slabs shall be cured for a minimum period of seven (7) days with the curing method being that applicable to the location of the slab. Mats shall be kept continuously wet for the entire period. Polyethylene sheeting shall be at least 0.004-inch thick and shall be approved by the Engineer. Paper shall be water-proof conforming to ASTM Specifications C-171. Polyethylene sheeting and paper shall be so applied that all joints and laps are sealed and that the moisture will be retained in the concrete. Slabs shall be thoroughly wetted immediately prior to placement of the polyethylene sheeting or paper. Water ponding shall be used as the curing measure at all water containing structures and may be used at non-water containing structures at the Contractor's option. Minimum depth of two (2) inches of water shall be maintained throughout the curing period of 7 days. Whatever covering is used shall remain in place

until its removal is required by some succeeding construction operation, but in any case shall remain in place not less than seven (7) days.

C. Curing/Miscellaneous Structures – The requirements specified above apply to the major structures of the project. Small isolated structures and floors of the office building not scheduled to receive another finish floor may be cured by any of the methods specified above or by use of a membrane curing compound. However, curing by application of a membrane curing compound shall utilize pigmented type compound conforming to Corps of Engineers Specification CRD-C 300. Membrane shall be applied so that a continuous adherent film is formed with coverage of not more than 150 square feet per gallon. Membrane shall not be used on surfaces to which additional concrete is to be bonded nor to any surfaces which will receive floor covering or roofing. Membrane curing may be used for curing curb and gutter.

3.20 PROTECTION

Concrete shall be protected against all adverse conditions, including weather, and against mechanical damage, until completion of the project. Any such damage incurred shall be promptly repaired by the Contractor at his own expense, in a manner approved by the Engineer.

Concrete shall be protected against low and high temperatures in accordance with ACI 306 and 305 and by maintaining a placement temperature not less than 50º F and by maintaining a temperature of not less than 50º F for five (5) days after placement. Concrete shall also be protected against extremes of high temperature, low humidity and wind movement, by means of the curing methods specified herein or other methods approved by the Engineer. It shall be the responsibility of the contractor to anticipate, as nearly as possible, changes in weather conditions such as sudden changes in temperature of high winds which would affect the placement and protection of the concrete. The Contractor shall be prepared at all times with proper materials, equipment and personnel, to protect freshly placed concrete when sudden changes in the weather make such protection necessary. Failure to have available proper materials, equipment or personnel for expenditious placement and adequate protection of the concrete will be grounds for postponement of placing of concrete.

3.21 EMBEDDED ITEMS

All anchor bolts, pipe, pipe sleeves, conduit, manhole frames, grating angles, anchors, insets or other fixtures required by the Contract Drawings or these specifications to be embedded in the concrete shall be accurately set in place and securely maintained in such positions during placement of concrete. It shall be the responsibility of the Contractor to coordinate the work of all trades of sub-contractors to the end that such items are properly placed prior to placement of any concrete. All exposed embedded items shall have a tooled edge all around unless otherwise noted. Embeds, openings, etc., will also have tooled connecting joints in a pattern acceptable to the Engineer.

3.22 CLEANING OF STRUCTURES

A. Cleaning – Upon completion of the structures, the entire structure shall be thoroughly cleaned of all debris and dirt and the walls and floor washed down. The Contractor shall furnish all piping, hoses, pumps, and other equipment required to wash the structures and to pump the wash water from the structures.

PART 4 - PAYMENT

Payment for all work in this section will be included in the lump sum price as shown in the Proposal. Such Payment shall be complete compensation for the complete performance of the work including all subsidiary or incidental items necessary to complete the work in accordance with the drawings and specifications. No separate payment will be made for compliance with this section.

END OF SECTION

SECTION 03600
GROUT

SECTION 03600

GROUT

PART 1 - SCOPE

Grout is specified herein and shall be used where indicated in the Contract Documents as specified. The Contractor shall furnish all material and perform all operations in connection with the grouting of pump bases and other miscellaneous uses, such as concrete patching.

PART 2 - NON-SHRINK NON-METALLIC GROUT

Non-shrink non-metallic grout shall be used where indicated on the drawings. The grout shall be Masterflow 713 grout by Masterbuilder, Five Star, or approved equal.

The grouting as installed, shall be capable of developing a minimum compressive strength of 10,000 pound per square inch at twenty-eight days, when tested in the form of 2-inch cubes.

PART 3 - SAND CEMENT GROUT

Sand cement shall be used as indicated on the drawings. The grout shall contain 7-1/2 sacks of cement per cubic yard of grout and shall contain only sufficient water to provide required consistency. The sand shall be as specified for concrete in Section 03300. Curing requirements shall be as specified for concrete in Section 03300.

PART 4 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications.

END OF SECTION

SECTION 07210
BUILDING INSULATION

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Uniform General Conditions, Supplementary Conditions and Division 1 - General Requirements apply to the work of this Section.

1.2 SECTION INCLUDES

A. Batt insulation in exterior wall construction.
B. Batt insulation on top of lay-in acoustical and gypsum drywall ceilings.

1.3 RELATED SECTIONS

A. Section 09250 - Gypsum Board Systems: Vapor barrier and acoustical sealant. Supporting construction
B. Section 13121 - Pre-Engineered Buildings: Roof and wall insulation.

1.4 REFERENCES

A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
B. ASTM E 84-87 Test Method for Surface Burning Characteristics of Building Materials.
C. ASTM E 90-87 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
D. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
E. ASTM E 119-83 Fire Tests of Building Construction and Materials.
F. ASTM E 413-87 Determination of Sound Transmission Class.
G. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.
H. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.5 QUALITY ASSURANCE

A. Insulation k Values
    1. k values indicated are based on 75 deg. F.
    2. Where scheduled, provide insulations with conditioned k values complying with RIC/TIMA 281-1 Conditioning Procedure.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code as indicated on drawings for combustibility and smoke development requirements for materials as follows:
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 450 or less.
B. Identify insulation with appropriate markings of applicable testing and inspecting organization.

1.7 SUBMITTALS

A. Product Data
   1. Provide data on product characteristics, performance criteria, limitations.
B. Manufacturer's Certificate
   1. Certify that products meet or exceed specified requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect insulations from physical damage and from becoming wet or soiled. Comply with manufacturer's recommendations for handling, storage and protection.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flexible Insulation
   1. Owens/Corning Corporation
   2. CertainTeed
   3. Manville Corp.
   4. Substitutions: Under provisions of Section 01600
B. Accessories

2.2 MATERIALS

A. Flexible Thermal Insulation
   1. Conformance: ASTM C 665, Type II, glass fiber batt.
   2. Thermal Resistance: R19.
   3. Size: To fit framing spacing.
   4. Facing: Kraft faced.

2.3 ACCESSORIES

A. Adhesive: Type recommended by insulation manufacturer for application.
B. Impaling Clips: Unfinished with washer retainer, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate and adjacent materials are dry and ready to receive insulation.
B. Verify insulation is dry.

3.2 INSTALLATION

A. General
   1. Install insulation in accordance with insulation manufacturer's instructions.
   2. Install insulation without gaps or voids.
   3. Place insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
   4. Trim insulation neatly to fit spaces.
B. Flexible Thermal Insulation
   1. Place between and tight to framing members.
   2. Place insulation fasteners at 6 inches oc. Tape seal tears or cuts in vapor retarder.

3.3 SCHEDULES

A. Thermal Insulation
   1. Walls: Install in stud space from floor to bottom of roof deck above in all walls.
   2. Ceilings: Install over top of ceiling in all areas.

END OF SECTION

SECTION 07900
JOINT SEALERS

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to the work of this Section.

1.2 SECTION INCLUDES

A. Preparing sealant substrate surfaces.
B. Sealant and backing.

1.3 RELATED SECTIONS

A. Section 08110 – Steel Doors and Frames: Sealants used in conjunction with steel frames.
B. Section 08331 – Overhead Coiling Doors: Sealants used in conjunction with coiling doors.
C. Section 08700 – Hardware: Sealants used in conjunction with hardware.
D. Section 08800 - Glazing: Sealants used in conjunction with glazing methods.
E. Section 13121 – Pre-Engineered Buildings: Sealants used in conjunction with pre-engineered metal buildings.

1.4 REFERENCES

A. ASTM C719 - Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement.
B. ASTM C792 - Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants.
C. ASTM C920 - Elastomeric Joint Sealants.
D. ASTM C1311 - Solvent Release Sealants.
E. ASTM C1193 - Use of Joint Sealants.
F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
G. ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

1.5 SUBMITTALS

A. Product Data
    1. Submit product data indicating sealant chemical characteristics, performance criteria, limitations and color availability.
    2. Submit manufacturer's standard printed installation instructions.
B. Samples
    1. Submit two sample kits in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

C. Certificates
   1. Submit manufacturer's certificate that products meet or exceed specified requirements and are suitable for use indicated.
   2. Joint sealant manufacturer's certification that sealants, primers, and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.
B. Applicator: Company specializing in applying the work of this Section with minimum five years documented experience.
C. Conform to ASTM C1193 requirements for materials and installation.
   1. Obtain joint sealant materials from a single manufacturer for each different product required.
   2. Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
D. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Requirements
   1. Do not install solvent curing sealants in enclosed building spaces.
   2. Do not install sealants when joint substrates are wet.
   3. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with all Sections referencing this Section.

1.10 WARRANTY

A. Provide five year warranty.
B. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pecora Chemical Corporation
B. Sonneborn Building Products
C. W. R. Grace and Company
D. General Electric Company
E. Products Research and Chemical Corporation
F. Goal Chemical

2.2 MATERIALS

A. Elastomeric Sealants
   1. General: Manufacturer's standard chemically curing, urethane, polyurethane, or polysulfide polymer based elastomeric sealant complying with ASTM C 920.
   2. Types
      a. S-1: Type M, Grade P, Class 25.
      b. S-2: Type S, Grade P, Class 25.
      c. S-3: Type M, Grade NS, Class 25.
      d. S-4: Type S, Grade NS, Class 25.
   3. Color: As selected by Architect from manufacturer's full range of standard colors.
   4. Use Locations: As indicated in Schedule at end of this Section.

B. Latex Sealants
   1. General: Manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
   2. Types
      a. S-6; Silicone Emulsion Sealant
         1) Composition: Manufacturer's standard product that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.
         2) Conformance: ASTM C 834 and, except for weight loss measured per ASTM C 792, ASTM C 920.
         3) Special Properties: Fungus and mildew resistant.
   3. Color: As selected by Architect from manufacturer's full range of standard colors.
   4. Use Locations: As indicated in Schedule at end of this Section.

C. Type S-8; Butyl Sealant
   1. General: Manufacturer's standard one-part, nonsag, nonstaining, paintable, solvent-release-curing, polymerized butyl sealant formulated with minimum of 75 percent solids and tack-free time of 24 hours or less, complying with ASTM C 1311.
   2. Color: As selected by Architect from manufacturer's full range of standard colors.
   3. Use Locations: As indicated in Schedule at end of this Section.

D. Accessories
   1. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
   2. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

3. Joint Backing: ANSI/ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
4. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
5. Masking Tape: Non-staining, non-absorbing type as recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
B. Beginning of installation means installer accepts existing conditions and substrate.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.
B. Remove loose materials and foreign matter which might impair adhesion of sealant.
C. Verify that joint backing and release tapes are compatible with sealant.
D. Perform preparation in accordance with ASTM C1193.
E. Install masking tape where required to protect adjacent finished surfaces.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193 and manufacturer's written instructions.
B. Measure joint dimensions and size materials to achieve required width/depth ratios.
C. Install joint backing to achieve a neck dimension no greater than 1/2 the joint width.
D. Install bond breaker where joint backing is not used.
E. Remove and replace joint backing which has become wet, dirty, or exposed to weather for extended period of time.
F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
G. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
H. Tool joints concave in accordance with ASTM C1193 and manufacturer's written instructions.

3.4 CLEANING AND REPAIRING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
B. Repair or replace defaced or disfigured finishes caused by work of this Section.
C. Cut out and remove damaged or deteriorated joint sealants and repair so that repaired areas are indistinguishable from original work.

3.5 PROTECTION OF FINISHED WORK

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

3.6 SCHEDULE

A. Exterior Joints
   1. Horizontal traffic joints not exposed to fuel or gas spillage: Sealant types S-1 or S-2.
   2. Horizontal traffic joints exposed to fuel or gas spillage: Sealant types S-1 or S-2.
   3. Horizontal non-traffic joints not exposed to fuel or gas spillage: Sealant types S-1, S-2, S-3 or S-4.
   4. Vertical or inclined joints such as panel, coping and control: Sealant types S-3 or S-4.
   5. Vertical or inclined joints such as perimeters of doors, windows, wall penetrations: Sealant types S-3 or S-4.
   6. Threshold Bedding: Sealant type: S-8.

B. Interior Joints
   1. Horizontal traffic joints not exposed to fuel or gas spillage: Sealant types S-1, or S-2.
   2. Horizontal non-traffic joints not exposed to fuel or gas spillage: Sealant types S-1, S-2, S-3, or S-4.
   3. Vertical or inclined joints such as panel, coping and control: Sealant types S-3, S-4.
   4. Vertical or inclined joints such as perimeters of doors, windows, wall penetrations: Sealant types S-3, or S-4.
   5. Non-structural hollow metal doors and borrowed lites. Sealant types S-3 or S-4.
   6. Non-structural perimeter seals around plumbing fixtures: Sealant type S-6.

END OF SECTION

SECTION 08110
STEEL DOORS AND FRAMES

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 WORK INCLUDED

A. Standard non-rated steel doors, and frames.
B. Custom steel astragals on double doors.

1.3 RELATED WORK

A. Section 03300 - Cast-in-Place Concrete: Prepared openings.
B. Section 08700 - Hardware.
C. Section 08800 - Glazing.
D. Section 09250 - Gypsum Drywall: Prepared openings.
E. Section 09900 - Painting: Field painting of doors and frames; bituminous coating of frames in contact with cementitious materials.
F. Section 13121 - Pre-Engineering Buildings: Structural framing for hollow metal frames.

1.4 REFERENCES

A. Architectural and Transportation Barriers Compliance Board - 36 CFR Part 1191, Accessibility Guidelines for Buildings and Facilities.
B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
C. ANSI- A250.7 - Hardware on Standard Steel Doors (Reinforcement--Application).
D. ANSI A250.8/SDI-100 - Recommended Specifications for Standard Steel Doors & Frames.
E. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
F. ASTM A366 - Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
G. ASTM A568 – Carbon and High-Strength Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements.
H. ASTM A366 - Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
I. SDI-113 – Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies.
J. SDI-117 – Manufacturing Tolerances Standard Steel Doors and Frames.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Conform to requirements of 36 CFR Part 1191 and Texas Accessibility Standards (TAS).
B. Manufacturer
   1. Company specializing in manufacturing the Products specified with minimum three years documented experience.

1.6 SUBMITTALS

A. Shop Drawings and Product Data
   1. Indicate each type door and frame elevation, reinforcements, hardware locations, metal types and gauges, and finish. Use same numbering system as indicated on drawings.
   2. Indicate frame configuration, anchor spacings and anchor types.
   3. Indicate door core construction and door head and door sill closure method.
   4. Indicate cut outs for glazing and louvers, glazing stop and glazing frame profiles and methods of attachment.
   5. Manufacturer's standard printed installation instructions.
B. Certificates
   1. Manufacturer's Certificate certifying that Products and fabrications meet or exceed specified requirements.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Provide frames with manufacturer's standard sill spreader bar for all welded units.
B. Protect doors and frames with manufacturer's standard resilient packaging.
C. Break seal on-site to permit ventilation.

1.8 WARRANTY

A. Provide manufacturer's five year warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Doors, Frames and Glazing Frames.
   1. Stretcher level steel conforming to ASTM A366 and ASTM A568.
B. Exterior Doors, Frames and Glazing Frames.
   1. Stretcher level steel conforming to ASTM A366 or A620 and ASTM A568.
C. Protective Coatings
   1. Bituminous Coating: Specified in Section 09900 - Painting.
   2. Primer: Manufacturer's standard oven dried, gray alkyd enamel primer, complying with requirements of ANSI A250.10.
D. Accessories
   1. Jamb Anchors
      a. Concrete Construction: Expansion shield and flat head machine screw.
      b. Steel Stud Construction: Z type, same gage and material as frame.

2. Silencers: As specified in Section 08700 - Hardware.
3. Glazing Stops: Rolled steel, square profile, mitered corners; prepared for countersunk style flat head sheet metal screws.
4. Door Glazing Frames: Rolled steel, beveled profile as indicated on drawings, mitered corners; prepared for countersunk style flat head sheet metal screws.
5. Astragals: 18 gage stainless steel conforming to ASTM A167.

2.2 FABRICATION

A. General
1. Fabricate doors and frames to sizes and profiles indicated and in conformance with, except as otherwise specified, ANSI A250.4, ANSI A250.8, and SDI-113, for non-rated assemblies.
2. Fabricate doors and frames with hardware reinforcements in accordance with Table 4 of ANSI A250.8. Weld all hardware reinforcement plates in place.
3. Provide mortar guard boxes for frames set in concrete.
4. Provide face welded frames with temporary steel spreader bars.
5. Grind all welds smooth, fill all voids with body putty and seam filler and sand smooth. Welds and joints shall not be visible.

B. Doors
1. Exterior doors: Level 4, Model 1.
2. Interior doors: Level 3, Model 1.
3. Close top edge of doors with flush steel channel closure. Seal joints watertight.
4. Close bottom edge of doors with inverted steel channel closure.
5. Door Edges: Beveled Square Edge.
6. Core Construction, Exterior Doors
   a. Vertical steel stiffeners formed from not less than 16 gage steel, spaced not more than 6 inches apart, and securely attached to face sheets by spot welds, not more than 4 inches on center.
   b. Fill spaces between stiffeners full height of door with a minimum 0.6 pound density mineral fiber insulation.
   c. Thermal Value: Total insulation R-Value of 4.4 (RSI value of 0.7), measured in accordance with ASTM C236.
7. Core Construction, Interior Doors
   a. Vertical steel stiffeners formed from not less than 20 gage steel, spaced not more than 6 inches apart, and securely attached to face sheets by spot welds, not more than 6 inches on center.

C. Frames
1. Exterior Frames: Level 3, 14 gage.
2. Interior Frames: Level 2, 3, 16 gage.
3. Fabricate and assemble as complete welded unit.
4. Weld Z anchors to frame.
5. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
6. Prepare interior frame for silencers. Provide for three single silencers on strike side of single doors.
7. Provide minimum 14 gage steel floor angle clips welded to each jamb.
8. Removable Stops: Roll formed channel shape, mitered corners; prepared for countersunk style tamper proof screws.

2.3 FINISH

A. Finish: As Specified in SECTION - 09900.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Install frames in accordance with ANSI A250.11 and manufacturer's written instructions.
2. Coordinate with gypsum wallboard wall construction for anchor placement.
3. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch where in direct contact with concrete.
4. Coordinate installation of glass and glazing.
5. Install field applied hardware in accordance with SDI-109.
6. Touch-up damaged shop finishes, including primers.

3.2 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.3 ADJUSTING AND CLEANING

A. Remove temporary spreader bars and welds. Grind and repair frame as required to provide a smooth paint finish.
B. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08331
OVERHEAD COILING DOORS

SECTION 08331

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Insulated service doors.

1.3 RELATED SECTION

A. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
   1. Wind Loads: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

B. Windborne-Debris-Impact-Resistance Performance: Provide impact protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.
   1. Large Missile Test: For overhead coiling doors located within 30 feet of grade.

1.5 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Show locations of replaceable fusible links.
   3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance Data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
    1. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
    2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
B. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from metal to match curtain slats and finish.
C. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over-travel of curtain.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

2.3 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.4 CURTAIN ACCESSORIES

A. Weather seals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self lubricating graphite bearings for rotating members.

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 MANUAL DOOR OPERATORS

A. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 30 lbf EL BEE EFF force for door operation. Provide alloy-steel hand chain holder secured to operator guide.

2.7 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cookson Company.
      b. Overhead Door Corporation.
      c. Raynor.
      d. Southwestern Steel Rolling Door Co.
      e. Wayne-Dalton Corp.

B. Operation Cycles: Not less than 20,000.

C. Curtain R-Value: 5.0 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 3-1/4-inch center-to-center height.
   1. Insulated-Slat Interior Facing: Metal.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise**.**

G. Hood:
   1. Shape: Square.
   2. Mounting: Face of wall.

H. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.
   1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn.

I. Manual Door Operator: Chain-Hoist Operator.

J. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Engineer from manufacturer's full range.
   2. Factory Prime Finish: Manufacturer's standard color.
   3. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer. Adjust seals to provide weathertight fit around entire perimeter**.**

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08700
HARDWARE

SECTION 08700

HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 WORK INCLUDED

A. All finish hardware necessary for completion of project.

1.3 RELATED WORK

A. Section 08110 – Steel Doors and Frames.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications
   1. Companies specializing in manufacturing door hardware with minimum three years experience.

1.5 REFERENCES

A. National Electrical Manufacturer's Association (NEMA LB3-1995) - Performance Standards for High Pressure Decorative Laminate.
B. American National Standards Institute (ANSI)
   1. ANSI A117 Building and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
   2. ANSI A156.1 Butts and Hinges.
   3. ANSI A156.3 Exit Devices.
   4. ANSI A156.4 Door Controls - Closers.
   5. ANSI A156.6 Architectural Door Trim.
   6. ANSI A156.7 Template Hinge Dimensions.
   7. ANSI A156.16 Auxiliary Hardware.
   8. ANSI A156.18 Materials and Finishes.
   9. ANSI A156.21 Thresholds
   10. ANSI A156.22 Door Gasketing Systems
C. Builders Hardware Manufacturers Association (BHMA)
   1. BHMA Directory of Certified Door Closers.
   2. BHMA Directory of Certified Exit Devices.
D. Code of Federal Regulations (CFR)
   1. 36CFR Part 1191 - Americans With Disabilities Act (ADA)

E. Door and Hardware Institute (DHI)
   1. DHI-02 Installation Guide for Doors and Hardware.
   2. DHI-03 Keying Systems and Nomenclature.
   3. DHI-04 Recommended Locations for Builders' Hardware for Custom Steel Door and Frames.
   4. DHI-05 Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames.

F. Texas Civil Statutes, Article 9102, Architectural Barriers Act, Texas Accessibility Standards (TAS)
   1. TAS 4.13.8 Door Thresholds
   2. TAS 4.13.9 Door Hardware
   3. TAS 4.13.10 Door Closers

G. Underwriter’s Laboratories, Inc. (UL)
   1. Building Materials Directory.

1.6 SUBMITTALS

A. Product Data
   1. Provide product data on specified hardware.
   2. Submit manufacturer's parts lists, templates, and installation instructions.

B. Hardware Schedule
   1. Include for each item: Quantities; manufacturer's name and catalog numbers; sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification using same opening numbers as indicated on the drawings; lock trim material thicknesses; lock trim material evaluation test results; corresponding ANSI/ BHMA standard type number or function number from manufacturer's catalog if not covered by ANSI/ BHMA; and list of abbreviations.
   2. Indicate locations and mounting heights of each type of hardware.
   3. Indicate lock side of single cylinder doors.
   4. Include master cross-reference list indicating door numbers in numerical sequence and associated hardware set.
      a. If, for any reason, any door is moved from the hardware set indicated in the schedule at the end of this section, provide a master cross-reference list, in numerical sequence, indicating door number, original hardware set and new hardware set for every opening.

C. Keying Schedule
   1. Hold a keying conference with the Owner's representative to develop a keying schedule.
   2. Develop schedule in accordance with DHI-03.
   3. Obtain keying system approval before delivering hardware to project.
   4. Unless otherwise indicated or requested, provide keying as follows:
      a. Key all doors different and key all doors to the same room alike.
      b. Key all exterior doors alike.
      c. Master key all doors except mechanical room doors to one key.
      d. Key mechanical room doors to existing utilities master key system.

D. Certificates of Compliance
   1. Submit certificates of compliance attesting that hardware items conform to the, CFR and ANSI/ BHMA standards specified. In lieu of certificates, submit statement that proposed hardware items appear in current BHMA directories of certified products.

E. Closeout Submittals
   1. Submit in accordance with the provisions of Division 1 of the Specifications.
   2. Provide list of actual locations of installed cylinders and their master key code.
   3. Submit data on operating hardware, lubrication requirements adjustment methods and inspection procedures related to preventative maintenance.
   4. Furnish spare parts data, including a complete list of parts and supplies and source of supply, for locksets, exit devices, closers, electronic locking devices and electromagnetic closer holder release devices.
   5. Submit special tools required for hardware adjustment or control.
   6. Maintenance Instructions: Furnish 6 complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble shooting guides.

1.7 DELIVERY, STORAGE AND HANDLING

A. Individually package each article of hardware in manufacturer's standard commercial carton or container, and properly mark or label to be readily identifiable with approved hardware schedule.
B. Tag or otherwise identify each change key with door for which its cylinder is intended.

1.8 COORDINATION

A. Coordinate requirements for hardware to be mounted on fiberglass doors or fiberglass frames between hardware manufacturer and door or frame manufacturer to establish location, reinforcement required, size of holes, and similar details.

1.9 WARRANTY

A. Provide five year warranty for door closers.

1.10 EXTRA MATERIAL

A. Blank keys: Provide one for each lock scheduled.
B. Provide 5 extra cylinder cores for each master key group.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hinges
   1. Bommer; Landrum, SC
   2. Hager Hinge Co.; St. Louis, MO
   3. McKinney Manufacturing Co.; Scranton, PA
   4. Stanley Hardware Division, Stanley Works; New Britain, CT
B. Exit Devices
   1. Corbin/Russwin Architectural Hardware; Berlin, CT
   2. Norton Door Controls; Charlotte, NC

3. Sargent Division ESSEX Industries Inc.; New Haven, CT
4. Von Duprin, Inc.; Indianapolis, IN

C. Closers
1. Corbin/Russwin Architectural Hardware; Berlin, CT
2. LCN Closers Division, Schlage Lock Co.; Princeton, IL
3. Norton Door Controls; Charlotte, NC

D. Overhead Holders
1. Glynn-Johnson; Indianapolis, IN
2. Rixson Architectural Hardware; Charlotte, NC

E. Gasketing/Threshholds
1. Hager Companies; St. Louis, MO
2. Pemko Manufacturing Co.; Memphis, TN
3. Reese Enterprises, Inc.; Rosemount, MO
4. Zero International, Inc.; Bronx, NY

F. Substitutions: In accordance with the provisions of Division 1 of the Specifications.

2.2 COMPONENTS

A. General
1. Provide hardware components as indicated in paragraph HARDWARE SCHEDULE at the end of this section.
2. Schedule is based on products manufactured by Bommer, Corbin/Russwin, Glynn Johnson, Hager, Pemko, Richard Wilcox, Triangle Brass and Von Duprin. Components of other manufacturers will be acceptable provided they comply with the ANSI/BHMA standards for Grade 1 products and are listed in the latest edition of the BHMA Directories of certification.
3. Regardless of whether or not the HARDWARE SCHEDULE at the end of this section has every door and every component scheduled for each opening, provide all components required to make every opening functional based on hardware scheduled for similar openings and the referenced codes.

B. Exit Devices and Exit Device Accessories
1. General
a. Provide dust proof floor strikes for vertical rod devices.
b. Provide manufacturer’s standard filler to extend exit device beyond door lite frames where door lites extend below exit device. Factory cut or form filler to match profile of exit device trim.
c. Provide all exit devices with cylinder lock dogging devices.

C. Closers
1. Closers for outswinging exterior doors: Size one size larger than manufacturer's published recommendations, but not less than size 5.
2. Size requirements for other closers: Conform to manufacturer's published recommendations, except as specified otherwise.
3. Operating Pressure: Provide closers with maximum operating pressure as follows:
a. Interior Doors: Set closing force on doors accessible to the physically handicapped for a push-pull of 5 pounds applied at knob or handle.
b. Exterior Doors: Maximum 8.5 pounds.
c. Fire Rated Doors: Set to minimum required to relatch door.

D. Miscellaneous
1. Metal Thresholds
a. Conformance: ANSI A156.21.

b. Style: J32100.
c. Where required, modify thresholds to receive projecting bolts of flush bolts and exit devices.
d. Thresholds for doors accessible to handicapped: Raised thresholds, corrugated, beveled with slopes not exceeding 1:2, and with height not exceeding 1/2-inch. Bevel not required where height is less than 1/2-inch.

E. Accessories
1. Special Tools: Provide special tools such as spanner and socket wrenches and dogging keys, required to adjust hardware items.

F. Fastenings
1. Provide proper type, size, quantity, and finish with each article of hardware.
2. Concrete or Grout Filled Masonry: Provide machine screws and expansion shields.
3. Hollow Masonry: Provide resin filled screen anchors equal to Hilti C7 anchors.
4. Gypsum Wallboard: Provide nylon or derlin expansion anchors equal to Hilti "Togglers".
5. Fastenings exposed to weather and in finished work: brass, bronze, or stainless steel.
6. Provide one-way or tamperproof screws on exterior doors equipped with half or full surface hinges.

G. Finishes
1. Painting of primed surfaces: Specified in Section 09900 - Painting.
2. Plated or Exposed Metal: As indicated in HARDWARE SCHEDULE at end of this Section.
3. Plated or Exposed Metal: Conform to ANSI A156.18 as follows:
a. Hinges: BHMA 630.
b. Lock and door trim: BHMA 630.
c. Door closers: BHMA 630 or BHMA 689 painted.
d. Miscellaneous hardware: Finish appearance to match door hardware.
e. Aluminum housed weatherstripping: Finish appearance to match door hardware.
f. Thresholds: Finish appearance to match door hardware.

H. Keying
1. Provide an extension of the existing keying system that is currently in use at the existing Reaeration Facility located at the southeast corner of the plant facility.
2. Key locks in sets or subsets.
3. Furnish locks with the manufacturer's standard construction key system.
4. Send keys directly from lock manufacturer to Owner by registered mail or other approved means.
5. Supply keys in following quantities:
a. 2 keys for each lock
b. 3 master keys
c. 6 construction keys
d. 2 control keys.
6. Furnish keys to Owner arranged in a container for key control system storage in sets or subsets as scheduled.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
B. Verify that power supply is available to power operated devices.
C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. General
   1. Locate in accordance with DHI 04 and DHI 05 recommended Locations for Builders' Hardware for Standard Steel Doors and Frames and DHI Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
   2. Install in accordance with DHI-02.
   3. When approved, slight variations in locations or dimensions will be permitted.
   4. Attach door control devices for exterior doors such as closers and holders to doors with thru bolts such as sex bolts and nuts.
   5. Conform to 36CFR Part 1191 for positioning requirements for handicapped.

B. Door-Closing Device
   1. Install and adjust in accordance with templates and printed instructions supplied by manufacturer.
   2. Install on solid doors with thru bolts and grommet nuts.
   3. Insofar as practicable, mount closers as follows:
      a. Exterior Doors: Mount closer on interior side of all exterior doors. Provide parallel arms or top jam mount closers.
      b. Interior Doors
         1) Mount on room side of door for doors opening to or from halls and corridors.
         2) Where a door, in the open position, is too close to a wall to prevent the door from opening 90 degrees, or if the closer would hit the wall before contacting the door stop, provide a parallel arm closer.

C. Auxiliary Hardware
   1. Install dust-proof floor strike or threshold, cut-out for bottom bolt

D. Thresholds
   1. Install in a bed of sealant with stainless steel screws and expansion shields.
   2. Provide proper clearance and an effective seal with specified weather stripping.
   3. Minimum screw size: #10, length dependent on job conditions.

E. Weatherseals
   1. Locate as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted.
   2. Install to exclude light and air flow when door is in closed position.
   3. Screw spacing: as recommended by manufacturer.

F. Gasketing
   1. Install at inside edge of hinge, head and latch side of door frame.

3.3 HARDWARE SCHEDULE

HW-1 Door No. 101

2 ea	Dustproof strike	
1 ea	Threshold	J32100

Balance of door hardware provided by Industrial metal door manufacturer.

HW-2 Door No. 102 and 103

1 1/2 pr	Hinges	A5112
1 ea	Exit device	Type I – Function 08
1 ea	Cylinder	EO9211
1 ea	Closer	CO2061 with door arm stop and holder
1 set	Gasketing	Pemko 315CR
1 ea	Sill sweep	Pemko 315CN
1 ea	Overhead drip	Pemko 346C
1 ea	Threshold	J32100

HW-3 Door No. 201

1 ea	Door jamb strike	Provide a new door jamb strike for the existing modified door configuration.

Reuse the existing salvaged door hardware for the balance of the door hardware requirements.

HW-4 Door No. 202

No new door hardware

END OF SECTION

SECTION 08800
GLAZING

SECTION 08800

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 SECTION INCLUDES

A. Glass glazing for Sections referencing this Section for products and installation.
B. Glass for hollow metal frame work.

1.3 RELATED SECTIONS

A. Section 08110 - Steel Doors and Frames: Glazed doors.
B. Section 13121 - Pre-Engineered Buildings and Panels.

1.4 REFERENCES

A. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
B. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
C. ASCE 7-95 - Minimum Design Loads for Buildings and other Structures.
D. ASTM C864 - Dense Elastomeric Compression Seal, Gaskets, Setting Blocks and Spacers.
E. ASTM C920 - Elastomeric Joint Sealants.
F. ASTM C1036 - Flat Glass.
G. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
H. ASTM C1172 - Laminated Architecture Flat Glass.
I. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
J. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
K. ASTM E773 - Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
L. ASTM E774 – Classification of this Durability of Sealed Insulating Glass Units.
M. ASTM E4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
N. GANA - Glazing Manual.
O. GANA - Laminated Glass Design Guide.
P. GANA - Sealant Manual.
Q. FS TT-G-410 - Glazing Compound, Sash (Metal) for Back Bedding and Face Glazing (Not for Channel or Stop Glazing).
R. SIGMA - Sealed Insulated Glass Manufacturers Association.

1.5 PERFORMANCE REQUIREMENTS

A. Provide continuity of building enclosure vapor and air barrier:
   1. In conjunction with materials described in Section 07900.
   2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with ASCE 7-95 code to a design pressure of 25 lb/sq ft as measured in accordance with ANSI/ASTM E330.

C. Limit glass deflection to 1/200 flexure limit of glass with full recovery of glazing materials, whichever is less.

D. Provide wireless fire-rated glazing listed for use in non-impact safety-rated locations with fire rating specified to meet positive pressure test requirements of ASTM E2010.

1.6 SUBMITTALS

A. Product Data
   1. Glass:
      a. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
      b. Provide copy of manufacturer's sample warranty.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.

B. Manufacturer's Installation Instructions: Indicate special precautions required.

C. Samples:
   1. Submit four samples, minimum 6 x 6 inch in size, illustrating glass units. Mark each sample to match glazing legend.
   2. Submit 3 inch long bead of glazing sealant, color as scheduled.

D. Manufacturer's Certificates
   1. Certify that glass meets or exceeds requirements of CPSC 16 CFR Part 1201 for Category II materials.
   2. Certify that sealed insulating glass units meet or exceed specified requirements.
   3. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, SIGMA and GANA Laminators Safety Glass Association - Standards Manual for glazing installation methods.

B. Provide each lite of safety glazing with permanent marking indicating compliance with specified standard(s).

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Coordinate the Work with glazing frames, wall openings, and perimeter air and vapor seal to adjacent Work.

1.11 WARRANTY

A. Provide Warranties in accordance with Section 01700.
B. Ten year manufacturer's warranty:
   1. Include coverage for plastic film from coating failure, fading or cracking for 5 years.
   2. Include coverage for delamination of laminated glass and replacement of same.
   3. Include coverage for reflective coating on mirrors and replacement of same.
C. Five year manufacturer's warranty:
   1. Insulating Glass Units: Include coverage for from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flat Glass Materials
   1. Libbey-Owens-Ford Co.
   2. PPG Industries, Inc.
   3. Spectrum Glass Products, Inc.
   4. Viracon.
B. Glazing Compounds
   1. Dow Corning Corp.
   2. GE Silicones.
   3. Norton Co.
   4. Pecora Corp.
   5. Tremco Mfg. Co.
   6. VIP Enterprises, Inc.
C. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. Glazing
   1. G 1 - Clear Float Glass: ASTM C1036, Type I - Transparent Glass, Flat; Class 1 Clear; Quality q3 - Glazing select; thickness as scheduled on the drawings.
   2. G 2 - Safety Glass: 0.030 inch thick clear polyvinyl butyryl sandwiched between two 1/8 inch thick panes of glass conforming to ASTM C1036, Type I - Transparent Glass Flat; Class 1 Clear; Quality q3 - Glazing select.
   3. G 3 - Tempered Glass: ASTM C1048, Kind FT - Fully tempered with horizontal tempering; Condition A, uncoated; Type I - Transparent Glass, Flat; Class 1 clear;

Quality q3 glazing select; conforming to ANSI Z97.1; thickness as noted on drawings or, at Contractor's option, provide type 2 glazing.

4. G 4 - Tempered Insulating Glass Units: ASTM E774 and ASTM E773; double pane with butyl primary seal and silicone secondary edge seal. Interpane space purged dry (hermetic) air.
   a. Outer pane of Type G 3 glass.
   b. Inner pane of Type G 3 glass.
   c. Spacer: Dessicant filled mill finish aluminum with mitered and bent soldered corners.
   d. Total Unit Visible Light Transmittance: 85 percent minimum.
   e. Total Unit Thickness: 1 inch minimum.

B. Glazing Compounds
   1. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
      a. Color: As selected.

C. Glazing Accessories
   1. Setting Blocks: Type as recommended by glazing manufacturer for compatability with edge seal of insulating glazing units, 80 - 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
   2. Spacer Shims: Neoprene, 50 - 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant in accordance with sealant manufacturer's instructions.

3.3 INSTALLATION

A. General
   1. Comply with combined recommendations of manufacturers of glass, sealants, [gaskets], and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
   2. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
   3. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

4. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
    a. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
    b. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
5. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
6. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

3.4 CLEANING

A. Remove glazing materials from finish surfaces.
B. Remove labels after work is complete.
C. Clean glass and mirrors.

3.5 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09250
GYPSUM BOARD SYSTEMS

SECTION 09250

GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 SECTION INCLUDES

A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Framing accessories.
D. Acoustical insulation.
E. Acoustical sealant.
F. Gypsum board.
G. Gypsum Sheathing
H. Taped and sanded joint treatment.
I. Texture finish.

1.3 RELATED SECTIONS

A. Section 05400 - Cold Formed Metal Framing.
B. Section 06105 – Miscellaneous Carpentry: Wood blocking for support of surface mounted accessories specified in other sections.
C. Section 07210 - Building Insulation: Thermal insulation.
D. Section 08110 - Steel Doors and Frames.
E. Section 09900 - Painting: Surface finish.

1.4 REFERENCES

A. ASTM C36 - Gypsum Wallboard.
B. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
C. ASTM C645 – Nonstructural Steel Framing Members
D. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
E. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
F. ASTM C840 - Application and Finishing of Gypsum Board.
G. ASTM C919 - Use of Sealants in Acoustical Applications.
H. ASTM C954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inches to 0.112 inches in Thickness.
I. ASTM C1007 - Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
J. ASTM C1047 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.
K. ASTM C1177 – Glass Mat Gypsum Substrate for Use as Sheathing

L. ASTM C1280 – Application of Gypsum Sheathing
M. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
N. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
O. ASTM E96 – Water Vapor Transmission of Materials
P. ASTM E119 - Fire Tests of Building Construction and Materials.
Q. ASTM E1190 - Strength of Power-Actuated Fasteners Installed in Structural Members.
R. FS FF-P-395 (Rev. C) - Pin, Drive Guided and Pin Driver, Powder Actuated (Fasteners for Powder Actuated and Hand Actuated Fastening Tools).
S. GA-214 - Levels of Gypsum Board Finish.

1.5 SYSTEM DESCRIPTION AND PERFORMANCE

A. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
B. Partition Component Sizes and Spacings: Design and provide steel framing member sizes and spacing as indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:
    1. Interior Partitions
        a. Maximum Deflection: L/240 at 5 lbf per sq. ft.; maximum spacing of 16 inches on center unless otherwise indicated.
    2. Ceiling Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754, maximum deflection of L/240 and deadload of 5 lbf per sq. ft. minimum, maximum spacing of 16 inches on center for attachment of ceiling to sub-support and 48 inches on center for attachment of main support to sub-support and to structure unless otherwise indicated.

1.6 SUBMITTALS

A. Submit following in accordance with provisions of Section 01300:
    1. Shop Drawings
    2. Product Data: Provide data on metal framing, gypsum board, joint compounds; and moldings.
    3. Samples:
        a. Submit two samples 12 x 12 inch in size illustrating wall and ceiling texture.

1.7 QUALITY ASSURANCE

A. Qualifications
    1. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.
B. Field Samples
    1. On actual gypsum board assemblies, prepare field samples of at least 100 sq. ft. in surface area for the following applications. Simulate finished lighting conditions for review of in-place unit of Work.
        a. Wall surfaces indicated to receive non-textured paint finishes.
        b. Ceiling surfaces indicated to receive non-textured paint finishes.
        c. Surfaces indicated to receive textured finishes specified in this Section.

C. Material Compatibility
   1. Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials inside under cover and keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
C. Neatly stack gypsum panels flat to prevent sagging.
D. Handle gypsum board to prevent damage to edges, ends, and surfaces.
E. Do not bend or otherwise damage metal corner beads and trim.

1.9 PROJECT CONDITIONS

A. Environmental Conditions
   1. General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations.
   2. Room Temperatures
      a. For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F.
      b. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours prior to application and continuously after until dry.
      c. Do not exceed 95 deg F when using temporary heat sources.
   3. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

1.10 WARRANTY

A. Glass Mat Sheathing
   1. Provide twelve months of coverage against in-place exposure damage including delamination, deterioration and decay.
   2. Manufacturer’s Warranty:
      a. Five years against manufacturing defects.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Metal Studs
   1. Dale Industries
   2. Unitech
   3. Dietrich
   4. Alabama Metals Corp.
   5. Celotex Building Products

6. G-P Gypsum Corp.
7. National Gypsum Co.
8. United States Gypsum Co.

B. Gypsum Board
1. Celotex Building Products
2. G-P Gypsum Corp.
3. National Gypsum Co.
4. United States Gypsum Co.

C. Fiber Reinforced Gypsum Board
1. BPB America Inc.; Tampa, FL.
2. G-P Gypsum Corp.
3. National Gypsum Co.
4. United States Gypsum Co.

D. Insulation
1. Celotex Building Products
2. G-P Gypsum Corp.
3. National Gypsum Co.
4. United States Gypsum Co.

E. Accessories
1. Celotex Building Products
2. Fire Trak Corp.; Kimball, MN.
3. Flex-Ability Concepts; Edmond, OK.
4. G-P Gypsum Corp.
5. National Gypsum Co.
6. The Steel Network, Inc.; Raleigh NC.
7. United States Gypsum Co.

F. Substitutions: Section 01600 - Product Requirements.

2.2 MATERIALS

A. Interior Framing
1. Studs
a. To Receive Gypsum Board: ASTM C645; galvanized sheet steel, minimum 25 gage thick (unless otherwise specified or required by partition height for loading specified in “SYSTEM DESCRIPTION AND PERFORMANCE”), C shape, with knurled faces. Double 20 gage studs at door frame jambs.
2. Bottom Tracks: ASTM C645; galvanized sheet steel, same as studs, C shape, with knurled faces.
3. Top Tracks
a. Partitions Not Extending to Bottom of Deck or Structure: Same material and construction as bottom track.
b. Partitions Extending to Bottom of Deck or Structure: At contractor’s option, provide shop fabricated deflection track or deep leg track with deflection clips complying with the following;
1) Deflection Track: Galvanized sheet steel, same gage as metal studs, C shaped, with minimum 3 inch legs offset 5/8 inch at the midpoint. Track equal to "Shadowline" design by Fire Track.
2) Deep Leg Track: Stud manufacturer’s galvanized sheet steel, same gage as metal studs, C shaped, with minimum 3 inch legs.

3) Deflection Clips: Galvanized sheet steel, same gage as metal studs, L shaped, with 2 or 3 slots as required by stud depth with allowance for ¾ inch maximum vertical deflection. Clips equal to Steel Network SL or SLD series.

4. Furring, Framing and Accessories: ASTM C645.
5. Interior Channels: ASTM C645; Hot or Cold-rolled steel, rust inhibitive.
6. Grid Suspension System for Interior Ceilings: ASTM C645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

B. Gypsum Board
1. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch thick except where otherwise scheduled, maximum permissible length; ends square cut, tapered edges.
2. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X
   a. Thickness: 5/8 inch.
   b. Edges: Square.
   c. Surfacing: Coated fiberglass mat on face, back, and long edges.
   d. Racking Strength (Ultimate, not design value): ASTM E72, not less than 654 pounds per square foot, dry.
   e. Flexural Strength: ASTM C1177, 100 lbf. Parallel
   f. Humidified Deflection: ASTM C1177, Not more than 1/8 inch.
   g. Permeance: ASTM E96, not more than 12 perms.
   h. R-Value: ASTM C518, 0.67.
   i. Acceptable Products: 5/8 inch DensGlass Gold Fireguard, Georgia-Pacific Gypsum.

C. Accessories
1. Acoustical Sealant: ASTM C1311; Non-hardening, non-skinning, for use in conjunction with gypsum board; black in concealed locations; color as selected from manufacturer's standard in exposed locations.
2. Trim:
   a. Corner Beads: ASTM C1047; Galvanized steel with knurled faces, 1-1/4 inch wide flanges.
   b. Edge Trim: ASTM C1047; Galvanized steel with knurled faces, types as indicated.
3. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
4. Wall and Ceiling Texture: Latex based non-aggregated texturing material.
5. Fasteners
   a. Framing to Substrate: Tie wire, nails, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.
   b. Powder-Actuated Fasteners in Concrete: FS FF-P-395 (Rev. C), size and type recommended by framing manufacturer.
   c. Metal Framing to Metal Framing: Manufacturer's standard screw attachments.
   d. Gypsum Board to Metal Framing
      1) Screws complying with ASTM C1002; type as required for substrate indicated.
6. Tie and Hanger Wire: ASTM A 641, Class 1 zinc coating, soft temper, with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01300.
B. Verify that site conditions are ready to receive work and substrates to which gypsum board assemblies attach comply with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.
C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Metal Studs
   1. General
      a. Install studs in accordance with ASTM C754 and manufacturer's instructions.
      b. Metal Stud Spacing: Maximum of 16 inches on center or less as required to meet "SYSTEM DESCRIPTION AND PERFORMANCE" criteria (regardless of fire rated partition allowances for wider spacings).
   2. Form all corners and intersections using conventional three stud framing.
   3. Interior Partitions
      a. Refer to Drawings for indication of partitions extending through the ceiling bracing and for partitions extending through the ceiling structure above.
      b. Non-Fire Rated Partitions: Brace partitions, extending above ceiling only, with runner track running diagonally from top of partition to underside of roof deck above and space alternately at 4 feet on center maximum.
   4. Door Opening Framing: Install double studs at door frame jambs. [Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.]
   5. Blocking: Screw wood blocking to studs. Install blocking for support of plumbing fixtures, wall cabinets, toilet accessories, hardware, and other items indicated to be attached to stud walls.
   6. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
B. Ceiling Framing
   1. Install in accordance with ASTM C754 and manufacturer's instructions.
   2. Coordinate location of hangers with other work.
   3. Install ceiling framing independent of walls, columns, and above ceiling work.
   4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
   5. Laterally brace entire suspension system.
C. Gypsum Board
   1. Install gypsum board in accordance with ASTM C840 and manufacturer's instructions.
   2. Erect single layer fire rated gypsum board, with edges and ends occurring over firm bearing.
   3. Use screws when fastening gypsum board to metal furring or framing.
   4. Control Joints
      a. Place control joints consistent with lines of building spaces as required by ASTM C840.
      b. Install control joints centered above each jamb of all door frames. Extend control joint from top of frame head to top of partition.

5. Place corner beads at all exposed external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials at all exposed locations. Leave a 1/4 inch space between edge trim and dissimilar material. Seal joint with sealant specified in Section 07900.

D. Joint Treatment
   1. Gypsum Board: Install joint treatment in conformance with ASTM C840 and to level as defined by GA-214 and as scheduled at the end of this Section.
   2. Cementitous Backing Board: Tape joints and corners in accordance with manufacturer's written instructions.

E. Gypsum Sheathing
   1. Install gypsum sheathing horizontally, with edges butted tight and ends occurring over framing members.
   2. Stagger vertical joints.
   3. Install sheathing with minimum width of two framing spaces.

F. Texture Finish
   1. Walls: Spray apply light (orange peel) finish texture coating in accordance with manufacturer's instructions and approved sample, to all surfaces scheduled to receive paint.
   2. Ceilings: Spray apply light (orange peel) finish texture coating in accordance with manufacturer's instructions and approved samples.

3.3 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from plumb and true Flatness: 1/8 inch in 10 feet in any direction.

3.4 JOINT TREATMENT SCHEDULE

A. Level 1: All gypsum board surfaces concealed above ceilings.
B. Level 3: All gypsum board surfaces scheduled to receive spray applied texture and paint.

END OF SECTION

SECTION 09900
PAINT

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to Work of this Section.

1.2 SECTION INCLUDES

A. Surface preparation.
B. Surface finish schedule.

1.3 RELATED WORK

A. Section 08110 – Steel Doors and Frames: Finish coatings.
B. Section 09250 - Gypsum Board Systems: Texture on gypsum wallboard surfaces.
C. Section 09905 – Protective Coatings: Special preparation and application of protective coatings.
D. Section 13121 – Pre-Engineered Buildings: Touch-up painting.
E. Section 15391 - Marking and Identification: Color schedule for equipment and piping.

1.4 REFERENCES

A. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
B. ASTM D1546 - Method for Performance Tests of Clear Floor Sealers.
C. ASTM D2092 - Practice for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting.
D. ASTM D2486 - Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
E. ASTM D3730 - Guide for Testing High-Performance Interior Architectural Wall Coatings.
F. ASTM D4138 - Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.
G. ASTM D4258 - Surface Cleaning Concrete for Coating.
H. ASTM D4262 - Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
I. ASTM D4263 - Test Methods for Indicating Moisture in Concrete by the Plastic Sheet Method.
J. ASTM D4414 - Measurement of Wet Film Thickness by Notch Gages.
K. ASTM D4540 - Guide for Testing Interior Latex Semigloss and Gloss Paints.
L. ASTM D4541 - Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
M. Steel Structure Painting Council - Steel Structures Painting Manual

1.5 DEFINITIONS

A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

1.6 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.
B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.
C. Regulatory Requirements: Conform to UBC Class I and NFPA 101 Class A for flame spread/smoke development rating requirements for finishes of 0-25/0-450.

1.7 SUBMITTALS

A. Shop Drawings and Product Data
    1. Provide product data on all finishing products.
    2. Submit manufacturer's standard printed application instructions.
B. Samples
    1. Submit two samples 6 x 6 inch in size illustrating range of colors and textures available for each surface finishing product scheduled, for selection.
C. Certificates
    1. Submit paint manufacturer's certificate(s) stating the following:
        a. Paints for interior use contain no mercurial mildewcide.
        b. Paints for interior use contain no insecticide.
        c. Paints for interior use contain no more than 0.06 percent lead.
        d. Paints proposed for use meet the VOC regulations of the local Air pollution District having jurisdiction over the geographical area in which the project is located.
D. Field Samples
    1. Provide field sample panel, 48 inches long by 48 inches wide, illustrating special coating color, and finish.
    2. Locate where directed.
    3. Accepted sample may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.
B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
D. Store paint materials at minimum ambient temperature of 45 degrees F. and a maximum of 90 degrees F., in well ventilated area, unless required otherwise by manufacturer's instructions.
E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F. for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F. for interiors; 50 degrees F. for exterior; unless required otherwise by manufacturer's instructions.
D. Minimum Application Temperature for Varnish and Synthetic Finishes: 65 degrees F. for interior or exterior, unless required otherwise by manufacturer's instructions.
E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA STOCK

A. Provide a one gallon container of each color to Owner at location designated.
B. Label each container with color and room locations, in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Dunn-Edwards, Albuquerque, NM.
B. ICI Paint Stores, Cleveland, OH.
C. Kelly-Moore Paint Co., Inc., San Carlos, CA.
D. Kwall Paints, Denver, CO.
E. PPG Industries, Inc., Pittsburgh, PA.
F. Sherwin-Williams Company, Cleveland, OH.
G. Substitutions: In accordance with Section 01600.

2.2 MATERIALS

A. Coatings
   1. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
   2. Good flow and brushing properties; capable of drying or curing free of streaks or sags.
   3. Compatible with existing coatings in renovation areas.
B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified, of commercial quality.
C. Dry Film Thickness (DMFT): Indicated is minimum acceptable.

2.3 PAINT COORDINATION

A. Provide finish coats which are compatible with primers and under-coaters used. Review other sections of these specifications to insure compatibility of finish materials with pre-primed items. Provide barrier coats over incompatible primers to remove and re-prime as required. Notify the Architect in writing of any anticipated problems using the specified coating systems with substrates primed by others.
B. Finish coat material shall be the manufacturer’s standard best grade product, and containers shall so state. Use undercoat paint produced by the same manufacturer as finish material. Use only thinner approved by the paint manufacturer and only within recommended limits.

2.4 CONCRETE PATCHING

A. Use water base concrete patch to fill holes, rough surfaces and surface imperfections – Dap Elastomeric 01 Concrete Patch.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces are ready to receive work as instructed by product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
C. Moisture Content
    1. Measure moisture content of surfaces using an electronic moisture meter.
        a. Field test concrete in accordance with ASTM D4263.
        b. Test moisture content of wood in accordance with ASTM D2016.
    2. Do not apply finishes unless moisture content of surfaces are below following maximums:
        a. Concrete Floors: 7 percent.
        b. Vertical Concrete Surfaces: 12 percent.
D. Inspect surfaces and report unsatisfactory conditions and surfaces in writing. Beginning of installation means acceptance of existing surfaces.
E. Comply with manufacturer's instructions and recommendations for preparation, priming, and coating work unless more stringent requirements are required herein. Coordinate with work of other sections.

3.2 PREPARATION

A. Unpainted Surfaces
    1. General
        a. Prepare surface in accordance with paint manufacturer's recommended procedures unless higher level of preparation is specified.
        b. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
        c. Correct minor defects and clean surfaces which affect work of this Section.
        d. Paint interior surfaces of ducts where visible through registers or grilles with a flat, non-specular black paint.
    2. Impervious Surfaces
        a. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
        b. Rinse with clean water and allow surface to dry.
    3. Asphalt, Creosote, or Bituminous Surfaces
        a. Remove foreign particles to permit adhesion of finishing materials.
        b. Apply latex based compatible sealer or primer.
    4. Insulated Coverings
        a. Remove dirt, grease, and oil from canvas and cotton.
    5. Concrete Floors
        a. Clean in accordance with ASTM D4258.
        b. Remove contamination, acid etch, and rinse floors with clear water.
        c. Verify required acid-alkali balance is achieved in accordance with ASTM D4262.
        d. Allow to dry.
    6. Galvanized Surfaces
        a. Clean in accordance with ASTM D1730.
        b. Remove surface contamination and oils and wash with solvent.
        c. Apply coat of etching primer.

7. Aluminum Surfaces
    a. Clean in accordance with ASTM D1730.
    b. Remove surface contamination and oils and wash with solvent.
    c. Apply coat of etching primer.
8. Concrete Surfaces
    a. Clean concrete in accordance with ASTM D4258.
    b. Clean unit masonry in accordance with ASTM D4261.
    c. Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.
    d. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry.
    e. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
    f. Allow to dry.
9. Steel and Iron Surfaces
    a. Concealed Locations
        1) Remove all grease, dirt, mill scale, rust and weld slag in accordance with SSPC - SP1 - Solvent Cleaning and/or SSPC - SP2 - Hand Tool Cleaning or paint manufacturer's recommended level of preparation.
        2) Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.
    b. Exposed Locations
        1) Remove all grease, dirt, mill scale, rust and weld slag in accordance with SSPC - SP1 - Solvent Cleaning and/or SSPC - SP2 - Hand Tool Cleaning or paint manufacturer's recommended level of preparation.
        2) Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.

B. Primed Painted Surfaces
1. All Surfaces
    a. Thoroughly clean of all grease, dirt, dust or other foreign matter.
    b. Remove blistering, cracking, flaking, peeling or other deteriorated coating.
    c. Roughen slick/glossy surfaces.
    d. Repair damaged areas such as, but not limited to, nail holes, cracks, chips and spalls with suitable materials to match adjacent areas.
    e. Feather edges of chipped paint and sand smooth.
    f. Sand and scrape to remove loose primer.
    g. Feather edges to make touch-up patches inconspicuous.
    h. Clean surfaces with solvent.
    i. Prepare non-ferrous surfaces in accordance with paint manufacturer's recommended level of preparation.
2. New Shop Primed Steel Surfaces
    a. Where higher level of preparation is specified in this Section than in other Sections for unpainted steel, comply with requirements of this Section and following:
        1) At Contractor's option, either shop or field prepare steel in accordance with procedures specified in this Section.

2) If steel is shop prepared and primed in accordance with lesser requirements specified in other sections, it is considered a temporary protective coating only.
   (a) Remove temporary shop coatings and prepare steel in accordance with paint manufacturer's recommended level of preparation for unpainted surfaces.
3) If steel is shop prepared and primed in accordance with requirements specified in this Section, field prepare in accordance with paragraph "All Surfaces" above.
4) Prime coat specified under paragraph 3.9, SURFACE FINISH SCHEDULE, can be eliminated except for bare areas requiring touch-up.

3.3 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.
B. Repair damage to other surfaces caused by work of this Section.
C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
D. Remove empty paint containers from site.

3.4 APPLICATION

A. Paint and Coatings
   1. Apply products in accordance with manufacturer's instructions and to achieve the dry film thicknesses indicated.
   2. Do not apply finishes to surfaces that are not dry.
   3. Apply each coat to uniform finish, color appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections are not acceptable.
   4. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
   5. Sand lightly between coats to achieve required finish.
   6. Allow applied coat to dry before next coat is applied.
   7. Prime back surfaces of interior woodwork with primer paint.
B. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces unless otherwise indicated.
C. Concrete Sealer:
   1. Only apply to dry concrete surfaces on dry days.
   2. Do not thin the sealer.

3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section 15075 for schedule of color coding and identification banding of equipment, ductwork, piping, and conduit.
B. Prime and paint insulated and exposed pipes, insulated and exposed ducts, hangers, brackets, collars and supports, occurring in finished areas.
C. Replace identification markings on mechanical or electrical equipment when painted accidentally.
D. Paint interior surfaces of air ducts that are visible through grilles and louvers, all visible surfaces above or behind perforated return air grilles or other open spaced air outlet devices, and all visible pipes, conduits, ductwork and structural members with one coat of flat black

paint, to limit of sight line. Paint dampers exposed behind louvers and grilles to match face panels.

E. Paint exposed conduit, boxes and electrical equipment occurring in finished areas.

F. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

G. Color code equipment, plumbing piping, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows names and numbering.

H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

I. Shop Primed Equipment
   1. Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   2. Prepare and paint shop primed equipment as specified for base material and location.

J. Shop Painted Equipment
   1. Prepare and paint shop painted equipment as specified for base material and location as follows:
      a. Interior Finished Spaces (excluding mechanical and electrical rooms): Paint surfaces to match color of adjacent finish. This applies, but is not limited to, mechanical diffusers and electrical panels and covers.
      b. Exterior Equipment: Where noted on drawings, paint exposed mechanical and electrical equipment color as selected by Engineer.

3.6 PROTECTION OF DISSIMILAR METALS AND METALS IN CONCRETE

A. Where specified in other sections, protect dissimilar metals that are in direct contact and metals set on or filled with mortar or concrete with one coat of coal tar paint equal to Carboline Bitumastic Super Service Black.

3.7 FIELD QUALITY CONTROL

A. General
   1. When requested by Architect, provide verification of coating application and durability in accordance with specified requirements at no cost to the Owner.

B. Steel Surfaces
   1. Dry Film Thickness: Verify in accordance with SSPC-PA 2 - Measurement of Dry Paint Thickness with Magnetic Gages.
   2. Adhesion: Confirm adhesion of coating system to substrate in accordance with either ASTM D3359 (Method B) or ASTM D4541.

C. Concrete Floors
   1. Verify compliance in accordance with ASTM D1546.

D. Other Surfaces
   1. Film Thickness
      a. Measure wet film thickness in accordance with ASTM D4414 and convert to dry film thickness by multiplying wet film thickness by percent soilds and by percent solvent added.
      b. Measure dry film thickness in accordance with ASTM D4138.

E. Scrubbability
   1. Test interior flat latex paints in accordance with ASTM D2486.

F. Interior Latex Semigloss and Gloss Paints: Test in accordance with ASTM D4540.

G. High-Performance Interior Architectural Wall Coatings: Test in accordance with ASTM D3730.

3.8 ADJUSTING

A. Repair surfaces which have been destructively checked for dry film thickness.
B. Recoat surfaces determined not to be in conformance with dry film thicknesses specified.
C. Recoat in accordance with coating manufacturer's printed instructions.

3.9 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
D. Upon completion of painting work, clean window glass and other paint-splattered surfaces, using proper methods of washing and scraping.
E. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings for protection of other work after completion of painting operation.
F. At the completion of work by other trades, touch-up restore all damaged or defaced painted surfaces.

3.10 SCHEDULE OF PAINTING AND COATINGS

A. Products shown herein are those of Kwal Paints, Denver, Colorado. Equal products as manufactured by companies listed herein are also acceptable subject to the requirements specified.
B. Exterior Finishes:
    1. Exterior Concrete Walls: Two coats of a water repellant sealer.
        a. First Coat: OKON W-2 Water Repellant Sealer. Apply flood coat at 40-60 sq ft per gallon.
        b. Second Coat: OKON W-2 Water Repellant Sealer. Apply flood coat at 80-120 sq ft per gallon.
    2. Exterior Concrete Walls: Two coats of a hi-build exterior elastomeric coating over an acrylic emulsion sealer/bond coat.
        a. Prime/Seal Coat: 5755 Accu-Pro structural concrete clear bond coat/sealer.
        b. Second Coat: 57001 Hi-Build 100% Acrylic Elastomeric Coating. Applied at a DFT of not less than 1.5 mils.
        c. Third Coat: 57001 Hi-Build 100% Acrylic Elastomeric Coating. Applied at a DFT of not less than 1.5 mils.
    3. Exterior Ferrous Metal: Two finish coats of gloss urethane/alkyd enamel over a factory-formulated rust-inhibiting metal primer.
        a. Prime Coat: 35 Series Alkyd Metal Primer. Applied at a DFT of not less than 1.8 Mils.
        b. Second Coat: 31 Line Urethane/Alkyd Gloss Enamel. Applied at a DFT of not less than 1.5 mils.
        c. Third Coat: 31 Line Urethane/Alkyd Gloss Enamel. Applied at a DFT of not less than 1.5 mils.

4. Exterior Non-Ferrous Metal: Two finish coats of gloss urethane/alkyd enamel over a factory-formulated galvanized/aluminum primer.
    a. Prime Coat: 5810 G-Prime Premium 100% Acrylic Universal Primer. Applied at a DFT of not less than 1.6 mils.
    b. Second Coat: 31 Line Urethane/Alkyd Gloss Enamel. Applied at a DFT of not less than 1.5 mils.
    c. Third Coat: 31 Line Urethane/Alkyd Gloss Enamel. Applied at a DFT of not less than 1.5 mils.

C. Interior Finishes
1. Interior Ferrous Metal (HMF, Doors, Ceiling Joists and Deck): Two finish coats of hi-gloss water epoxy polyamide coating over a DTM primer.
    a. Prime Coat: 5821 Accu-Guard DTM Primer. Applied at a DFT of not less than 1.5 mils.
    b. Second Coat: 3160 Water Epoxy Polyamide High Gloss Coating. Applied at a DFT of not less than 1.5 mils.
    c. Third Coat: 3160 Water Epoxy Polyamide High Gloss Coating. Applied at a DFT of not less than 1.5 mils.
2. Interior Concrete Walls: Two finish coats of hi-gloss water epoxy polyamide coating over an epoxy block filler.
    a. Block Filler: 5940 100% Epoxy Filler Sealer. Applied at a DFT of not less than 15.0 mils.
    b. Second Coat: 3160 Water Epoxy Polyamide High Gloss Coating. Applied at a DFT of not less than 1.5 mils.
    c. Third Coat: 3160 Water Epoxy Polyamide High Gloss Coating. Applied at a DFT of not less than 1.5 mils.
3. Interior Gypsum Drywall: Two coats of water-based epoxy polyamide coating over an acrylic undercoat.
    a. Undercoat: 438JB Interior Acrylic Latex Enamel Undercoat. Applied at DFT of not less than 1.5 mils.
    b. Second Coat: 3165 Accu-Guard Water Epoxy Polyamide Coating. Applied at a DFT of not less than 1.5 mils for 495 sq ft per gallon.
    c. Second Coat: 3165 Accu-Guard Water Epoxy Polyamide Coating. Applied at a DFT of not less than 1.5 mils for 495 sq ft per gallon.

D. Interior Concrete Floor Sealer: One Coat of Low Gloss Clear Coating (water based) Follow Manufacturers Recommendation for Floor Preparation.
1. Seal Coat: OKON Seal & Finish. Applied at 300 to 400 Square Foot per Gallon.

END OF SECTION

SECTION 09915
COATING SYSTEMS FOR STEEL TANKS

SECTION 09915

COATING SYSTEMS FOR STEEL TANKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The following requirements apply to all exposed interior and exterior surfaces of the steel tank including accessories and appurtenances. Galvanized and stainless steel surfaces are not to be coated.

B. This section covers the furnishing of materials, the preparation of surfaces, the application and the testing of the coating systems and for the disinfection and leak testing of the tank interior after the interior coating is completed and accepted.

C. This section also covers the furnishing of materials, the preparation of surfaces, the application and the testing of the coating systems for piping, piping supports, ladders, and miscellaneous metals attached to the tank.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this section.

1. American Water Works Association (AWWA) Standards:
   - D102-97, AWWA Standard for Coating Steel Water –Storage Tanks, C210-97, AWWA Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines, and C652-92, AWWA Standard for Disinfection of Water-Storage Facilities.
   - C218-99, AWWA Standard for Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.
2. NSF International (NSF): 61, Drinking water System Components-Health Effects
3. Steel Structures Painting Council (SSPC) Surface Preparation

1.3 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils, or square feet per gallon.
2. MDFT: Mils Dry Film Thickness
3. MDFTPC: Mils Dry Film Thickness Per Coat
4. MSDS: Material Safety Data Sheet
5. PSDS: Paint System Data Sheet
6. Mil: Thousandth of an inch
7. SP: Surface Preparation

1.4 SUBMITTALS

A. Shop Drawings:

1. Data Sheets: For each paint system used, furnish a Paint System Data Sheet (PSDS), Material Safety Data Sheets (MSDS), and paint colors available (where applicable) for each product used in the paint system, except for products applied by equipment manufacturers. The PSDS form is appended to the end of this section. Submit required information on a system-by-system basis. Also provide copies of paint system submittals to the coating applicator.
2. Submittal shall include the coating product family, NSF listings, % solids, recommended surface preparation, application thickness and recoat window.

B. Quality Control Submittals:
   1. Anticipated tank coating sequence
   2. Applicator's experience: List of references substantiating experience
   3. Manufacturer's written instructions for applying each type of coating
   4. Field testing: Inspection and test reports
   5. Manufacturer's Certificate of Proper Installation

1.5 QUALITY ASSURANCE

A. Applicator's Experience: Minimum five years' experience in application of specified products.
B. Regulatory Requirement: Meet federal, state, and local requirements limiting the emission of volatile organic compounds.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in unopened containers labeled with designated name, date of manufacture, color, and manufacturer.
B. Store paints in a protected area that is heated or cooled as required to maintain temperatures within the range recommended by paint manufacturer.
C. Shipping:
   1. Protect pre-coated items from damage. Batten coated items to prevent abrasion.
   2. Use nonmetallic or padded slings and straps in handling.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply paint in temperatures outside of manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.
B. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dewpoint or ambient air.
C. Cap or seal all inlet, outlet, or overflow piping inside tanks to prevent entry of foreign material into the piping systems.
D. Contractor shall provide and operate dehumidification and air handling equipment to allow the entire surface of the interior shell and roof to be abrasive blast prepared as specified. Contractor shall size the equipment for the project and weather conditions to maintain humidity within the reservoir below the level that will cause cleaned metals surfaces to flash rust. Dehumidification air handling equipment shall operate continuously throughout surface preparation, coating application, and cure process. The air turn over rate shall be such as to allow the curing process to proceed at an exposed ambient rate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Acceptable coatings manufacturers include:

A. Carboline Coatings Co., St. Louis, MO.
B. Tnemec, North Kansas City, MO.
C. Alternate coating suppliers shall be approved by the Engineer. Contractor must submit all pertinent product documentation for review

2.2 MATERIALS

A. The paints and paint products listed below are as manufactured by Carboline or Tnemec Company, Inc. and are intended to establish a standard of quality. Paint products for this project shall be equal to the product listed. Paint systems that decrease the film thickness designated and/or the number of coats to be applied or which involve a change from the generic type of

coating specified shall not be used. All paint used on metal surfaces which are to be in contact with potable water shall be approved by NSF.

B. Quality: Manufacturer's highest quality products and suitable for intended use.
C. Materials Including Primer and Finish Coats: Produced by same paint manufacturer.
D. Thinners, Cleaners, Driers, and Other Additives: As recommended by paint manufacturer of the particular coating.
E. Polyamide Epoxy: Polyamide epoxy coatings approved for potable water contact conforming to NSF 61.
F. Polyurethane Enamel: Two-component, aliphatic or acrylic based polyurethane; high gloss finish.
G. Solids content shall not be less than 65% for every product.
H. Blasting media shall be iron or copper slag material or other material containing no silica sand or free silica. **Silica sand shall not be used at any phase of this project.**

2.3 COLORS

A. Formulate with colorants free of lead and lead compounds.
B. For tank interior, shop primer coat shall be beige color. Intermediate and top coat color shall be contrasting colors with tank white as the topcoat color.
C. For tank exterior, primer shall be gray color. Topcoat color will be determined by the Owner at a later date. Intermediate coat color shall be similar in color to the topcoat color, tinted slightly to allow identification of the underlying coating. Contractor shall submit color samples for Engineer's approval.
D. Proprietary identification of colors is for identification only; selected manufacturer may supply matches.

2.4 MIXING

A. Multiple-Component Coatings:
   1. Prepare using all the contents of the container for each component as packaged by the paint manufacturer.
   2. No partial batches will be permitted.
   3. Do not use multiple-component coatings that have been mixed beyond their pot life.
   4. Furnish small quantity kits for touchup painting and for painting other small areas.
   5. Mix only components specified and furnished by the paint manufacturer.
   6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.
B. Keep paint material containers sealed when not in use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Surface Preparation:
1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of the paint manufacturer whose product is to be applied.
2. Provide Engineer minimum three days' advanced notice of start of surface preparation work and coating application work.
3. Perform such work only in presence of Engineer, unless Engineer grants prior approval to perform such work in Engineer's absence.

3.2 PREPARATION

A. Notify Engineer at least seven days prior to start of shop blast cleaning to allow for inspection of the work during surface preparation and shop application of paints. Work shall be subject to Engineer's approval before shipment to site.
B. Items such as structural steel, metal floor, doors, manways, and frames, metal louvers, and similar fabricated items may be shop prepared and primed.
C. Remove, mask, or otherwise protect hardware, machined surfaces, nameplates and other surfaces not intended to be painted.

3.3 PREPARATION OF SURFACES

A. Metal Surfaces:
1. Meet requirements of the following SSPC Specifications:
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

2. Whenever the words "solvent cleaning", "hand-tool cleaning"' "wire brushing" or "blast cleaning" or similar words of equal intent are used in these Specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC Specifications listed above.

3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply.

4. Pre-blast cleaning requirements:
a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
b. Cleaning methods: Steam, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
c. Clean small isolated areas as above or solvent clean with suitable solvents and clean cloth.
d. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
e. Welds and adjacent areas: Prepare such that there is: No undercutting or reverse ridges on weld bead. No weld spatter on or adjacent to weld or other area to be painted. No sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of the weld.

5. Blast cleaning requirements:
a. Type of equipment and speed of travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.
b. Select type and size of abrasive to produce a surface profile that meets coating manufacturer's recommendations for particular primer to be used.
c. Use only dry blast-cleaning methods.
d. Do not reuse abrasive, except for designed, recyclable systems.
e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.

6. Post-blast cleaning and other cleaning requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blast cleaned. Reblast surfaces that have started to rust before they are coated.

B. Shop Primed Surfaces:
1. Notify the Engineer one week in advance of the start of shop blasing work.
2. Engineer shall coordinate shop inspection as required.
3. Blast interior surface to SSPC-SP10, Near-White Metal Blast to a surface profile of 2 mils. Area shall then be shot with a minimum of 4 mils primer coating to cover the profile. Primer shall match the coating system product.
4. Blast exterior surfaces to SSPC-SP6 Commercial Blast Cleaning to a surface profile of 2 mils. Area shall then be shot with a minimum of 4 mils primer coating to cover the profile. Primer shall match the coating system product.
5. Care shall be taken in handling and storage to minimize damage to the primer coating.

C. Stripe Coating:
1. Stripe coat all field welds, edges, angles, fasteners, and other irregular surfaces located inside and outside the tank.
2. Stripe coat shall consist of one coat, brush applied, to the coating thickness specified.
3. Apply stripe coat between intermediate and final coats.

D. Application
1. Paint application shall follow the manufacturer’s recommendations and instructions. Paint materials shall be delivered in original containers with seals unbroken and labels intact. The Contractor shall coordinate prime coat materials and finish coat materials to ensure that they are from the same manufacturer.
2. All paint shall be thoroughly agitated prior to use and shall be kept agitated while using. All ready-mixed paint shall be applied as received from the manufacturer, without addition of any kind of a drier or thinner except as permitted by the manufacturer. Paint shall be applied according to manufacturer's recommendations.
3. Each coating shall be applied at the rate specified and in the manner specified by the manufacturer. Deficiencies in tested dry film thickness shall be corrected by application of additional coat(s) of paint.
4. Paint application shall not proceed when the temperature is below 50° F., during precipitation or fog, or if there is moisture on the surfaces to be painted. Exceptions to the temperature limit will be allowed in accordance with the manufacturer's printed literature.
5. Each coat of paint shall dry thoroughly as specified by the manufacturer prior to application of successive coats. Do not immerse coating until appropriate dry film thickness has been obtained and finished coating system has been allowed to cure as recommended by the paint manufacturer.
6. All paint materials shall be evenly spread without runs, sags, skips or other faults. Finished surfaces shall be uniform in gloss, finish and color and shall be free from brush marks. All lines of demarcation between paints of different colors or shades shall be carefully drawn so as to be true and free from blurred edges.
7. Surface preparation blasting operations shall be separate from the coatings area. The coatings area shall have sufficient screens, partitions or physically separated such that freshly applied

coatings shall not be contaminated. Materials moved from the blasting area to the coating area shall be compressed air cleaned and shall not contaminate the coatings area.

E. Film Thickness:
   1. Number of coats: Minimum required without regard to coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
   2. Maximum film build per coat shall not exceed coating manufacturer's recommendations.
   3. Film thickness measurements and electrical inspection of coated surfaces: Perform with properly calibrated instruments. Recoat and repair as necessary for compliance with the Specifications. All coats are subject to inspection by Engineer and coating manufacturer's representative.
   4. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
   5. Thickness testing: After repaired and recoated areas have dried sufficiently, final tests will be conducted by the Engineer. Measure coating thickness specified in mils with a magnetic type dry film thickness gauge. Test finish coat for holidays and discontinuities with an electrical holiday detector, low voltage, wet sponge type. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

F. Damaged Coatings, Pinholes, and Holidays: Feather edges and repair in accordance with recommendations of paint manufacturer. Apply finish coats, including touchup and damage-repair coats in a manner, which will present a uniform texture and color-matched appearance.

G. Unsatisfactory Application: If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer. Hand or power-blast visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the Specifications. Depending on extent of repair and appearance, a finish sanding and topcoat may be required. Evidence of runs, bridges, shiners, laps, or other imperfections are cause for rejection. Repair defects in coating systems in accordance with written recommendations of the coating manufacturer. Leave all staging up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer.

H. Application Safety:
   1. Performed painting in accordance with recommendations of the following: Paint manufacturer's instructions. NACE recommended practices contained in the publication, Manual for Painter Safety. Federal, state, and local agencies having jurisdiction.
   2. Contractor will be solely and completely responsible for condition of the project site, including safety of all persons (including employees) and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions will conform to U.S. Department of Labor, Occupational Safety and Health Act, any equivalent state law, and all other applicable federal, state, county, and local laws, ordinances, and codes.
   3. Contractor will comply with all safety training requirements promulgated or required for this project.

3.4 FIELD QUALITY CONTROL

A. Testing Gauges:
   1. Adequate illumination shall be provided while work is in progress, including explosion proof lights and electrical equipment. Temporary ladders and scaffolds shall conform to applicable safety requirements. They shall be erected to facilitate inspection and moved by the Contractor as required.

2. Inspection and testing shall generally be in accordance with AWWA D102. The Contractor shall furnish inspection devices in good working condition for measurement of dry film thickness of coatings. Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test the accuracy of dry film thickness measurement device.
3. A nondestructive holiday detector shall be used for inspecting the interior coating below the overflow level. All holidays shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No holidays or other irregularities shall be permitted in the final coating
4. Provide a magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA; Mikrotest.
5. Provide an electrical holiday detector, low voltage, wet sponge type and galvanizing, for holidays and discontinuities as manufactured by Tinker and Rason, San Gabriel, CA; Model M-1.

3.5 MANUFACTURER'S SERVICES

A. The manufacturer's representative shall be available for installation assistance, inspection of surface preparation and coatings application, and to issue Manufacturer's Certificate of Proper Installation. Manufacturer's representative shall be on site and available at the following minimum points:
1. At the beginning of shop prime work
2. At a midpoint through the shop prime work
3. At beginning of interior field work to verify recoat window and primer surface preparation.
4. At a midpoint during interior field painting work.
5. At the completion of interior field painting to certify coating application.
6. At beginning of exterior field work to verify recoat window and primer surface preparation.
7. At a midpoint during exterior field painting work.
8. At the completion of exterior field painting to certify coating application and warranty.

3.6 CLEANUP

A. Place clothes and waste that might constitute a fire hazard in closed metal containers and remove from site at the end of each day.
B. Upon completion of the work, remove staging, scaffolding, and containers from the site. Dispose of trash and discard materials in a legal manner.
C. Completely remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.
D. Vacuum clean all blasting material and residue from the tank interior prior to beginning disinfection and testing.

3.7 PROTECTIVE COATINGS SYSTEMS

A. **System for Submerged Metal** – Potable Water: Manufacturer's recommendations for surface preparation and coating thickness shall govern. Interior tank coating systems shall conform to AWWA D102-97 – Coating Steel Water Storage Tanks, Inside Coating System No.2, ACS-2-W, with reference to AWWA C 210 -97 – Liquid –Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
1. After erection, all surfaces that have been welded, abraded or otherwise damaged shall be cleaned and primed in the field in accordance with the system requirements.
2. Primed components that are not be coated with successive coats within the manufacturer's recommended recoat cycle, shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning.

3. Application schedule: Use this system on all metal surfaces inside tanks, including, but not limited to, steel plates and structural steel; interior surfaces of the inlet, outlet, and overflow piping; manhole covers; non-galvanized ladders; landings; couplings; and vents.
4. Provide full coating thickness to the top of all structural steel that will be covered by the roof plates, or otherwise shielded from full coating thickness, before the structural steel members are installed. Remove coating in areas to be welded.
5. Total interior coating film thickness: 14 - 16 MDFT.

Application	Surface Preparation	Product	Coating, mils
Shop Prime	SSPC-SP-10, 2 mils profile	Tnemec Series N140 Carboguard 891	4 mils 4 mils
Intermediate and uncoated metal	SSPC-SP 10 SSPC-SP-7 Recoat profiling	Tnemec Series N140 Carboguard 891	6 mils total primer 6 mils total primer
Topcoat	SSPC-SP-7 as required to Recoat	Tnemec Series 141 Carboline 891	6 mils 4- 6 mils

B. **System for Exposed Metal**: Manufacturer's recommendations for surface preparation and coating thickness shall govern. Exterior tank coating systems shall conform to AWWA D102-97 – Coating Steel Water Storage Tanks, Outside Coating System No. 5, OCS-5-S, with reference to AWWA C 218-99 – Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.
1. After erection, all surfaces that have been welded, abraded or otherwise damaged shall be cleaned and primed in the field in accordance with the system requirements.
2. Shop primed components that are not painted with successive coats within the manufacturer's recommended recoat cycle, shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning.

Application	Surface Preparation	Product	Coating, mils
Shop Prime	SSPC-SP-6, 2 mils profile	Tnemec Series N69 Carboguard 890	4 - 6 mils 4 - 6 mils
Intermediate and uncoated metal	SSPC-SP 10 SSPC-SP-7 Recoat profiling	Tnemec Series N69 Carboguard 890	4 - 6 mils 4 - 6 mils
Topcoat	SSPC-SP-7 as required to Recoat	Tnemec Series 1074 Endura Shield II Carbothane 134 HG	2 - 3 mils 2.5 mils

3. Application schedule: Use this system on exposed exterior metal surfaces of tanks, and exposed piping exterior surfaces.
4. Tank coating sequence anticipated:
   a. Shop prime all surfaces of shell plates and roof and floor plates and structural steel associated with the exterior of the tank; hold back shop primer where required for field welding.
   b. Shop priming of galvanized steel surfaces is not required.
   c. After tank erection, abrasive blast welds (SSPC SP 6) and damaged areas; apply primer.
   d. Clean primed surfaces and brush blast.
   e. Apply finish coats.
   f. Touch up as required.
   g. Minimum total exterior coating film thickness: 12 MDFT.

C. **System for Structural Fabrications**: Manufacturer's recommendations for surface preparation and coating thickness shall govern. Two-coat epoxy primer and polyurethane topcoat system.
   1. After erection, all surfaces that have been welded, abraded or otherwise damaged shall be cleaned and primed in the field in accordance with the system requirements.
   2. Shop primed components that are not painted with successive coats within the manufacturer's recommended recoat cycle, shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning, in accordance with the manufacturer's recommendations.
   3. Application schedule: Use this system on all metal structural fabrications, including, but not limited to: electrical shelters, pipe supports, access gate and appurtenances, bollards, and other items not covered in the tank coating systems.

Application	Surface Preparation	Product	Coating, mils
Shop/ Field	SSPC-SP 10	Tnemec Series 66 H.B.	4 - 6 mils
Prime	SSPC-SP-7 Recoat profiling	Carboguard 890	4 - 6 mils
Topcoat	SSPC-SP-7 as required to Recoat	Tnemec Series 1074 Endura Shield II	2 - 3 mils
		Carbothane 134 HB	3 - 4 mils

D. **System for Galvanized Metal Conditioning**: Manufacturer's recommendations for surface preparation and coating thickness shall govern.

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Wash Primer	1 coat
Followed by Hand-tool (SP 2), or Power-tool (SP 3)	Finish Coats to Match Paint System Specified for Exposure	As specified for Paint System Finish Coats

   1. Application Schedule:
      a. Use this system on galvanized surfaces requiring painting.
      b. Finish coats and millage shall be as specified for the substrate exposure conditions.

(See PSDS form Attached)

3.8 WARRANTY

A. Project Warranty: The Contractor shall provide the Owner with a one (1) year unconditional, industry standard warranty for the interior and the exterior coating systems.

B Third Party Inspection: The Owner shall employ and pay for the services of an independent, third party, commercial testing/inspection agency, experienced in corrosion and coating testing and inspection, to monitor shop coating work and the interior and exterior coating of the tank and, upon proper completion of the coating operations, to certify to the Owner that all materials were provided and that all work was performed in full compliance with the Contract Documents. The work of the testing/inspection agency will be continuous throughout the coating operations, and it will be performed at all times by a person holding at least a Level III certification by the National Association of Corrosion Engineers (NACE).

The testing and inspection work will be performed by a completely independent agency which is

unassociated with the Owner, the coating supplier, the Contractor or the coating subcontractor.

3.9 FINAL ACCEPTANCE BY THE ENGINEER: Final approval of the coating systems by the Engineer will not be given until all repair, touch-ups, recoating, etc, of all parts of the reservoir is complete, and until the required warranties have been submitted and accepted by the Engineer. The Contractor shall inform the Engineer in writing when all of the coating is complete and ready for final review.

3.10 AIR POLLUTION CONTROL: In order to assure compliance with Texas Air Control Board regulations and to prevent the occurrence of air pollution nuisances during any abrasive blasting of the tank or other surfaces, the Contractor shall provide and use as necessary, shrouding or other emission control measures approved by the Texas Air Control Board.

PART 4 - PAYMENT

4.1 Payment for all work in this section will be included as part of the unit price or lump sum price for installation of facilities as indicated in the Proposal. Such Payment shall be complete compensation for the complete performance of the work in accordance with the drawings and specifications.

END OF SECTION

PAINT SYSTEM DATA SHEET

Complete and attach manufacturer's Technical Data Sheet to this PSDS for each coating system.

Paint System (from Spec.):
Paint System Title (from Spec.):
Coating Supplier:
Representative:
Surface Preparation:

Paint Material (Generic)	**Product Name/ Number (Proprietary)**	**Min. Coats, Coverage**

SECTION 11100
VERTICAL PRESSURE FILTERS W/ CATALYTIC FILTER MEDIA

SECTION 11100

VERTICAL PRESSURE FILTERS WITH CATALYTIC FILTER MEDIA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Three (3) vertical pressure vessels.
B. Filter internals.
C. Manganese Oxide filter media.
D. Face piping and valves.
E. Automatic backwash controls and equipment.
F. Chlorination System
G. Sequestering System

1.2 SUBMITTALS AND SHOP DRAWINGS

A. At a minimum, the following information shall be submitted by the filter manufacturer:
   1. List of ten (10) similar installations in conformance with section 2.1.d.
   2. ASME Section VIII, Division 1, Code calculations for pressure vessel(s).
   3. Catalog cut sheets for all filter internals including media.
   4. Elevation drawing for filter internals including media loading schedule.
   5. Catalog cut sheets for all control valves and actuators.
   6. Catalog cut sheets for all specified instrumentation and control components.
   7. Materials of construction for all major components.
   8. Elevation and plan views of the filter system including the location and orientation of all nozzles, manways, and connections.

1.3 OPERATION AND MAINTENANCE MANUALS

A. The filter manufacturer shall submit three (3) copies of Operation and Maintenance Manuals.
B. At a minimum, the following information shall be included:
   1. Manufacturer's instructions for equipment installation, startup, operation, preventative maintenance, servicing, and troubleshooting procedures.
   2. Filter system data sheets, and final as built drawings of all equipment.
   3. Name, address, and telephone number of factory trained service technician.

PART 2 - PRODUCTS

2.1 VERTICAL PRESSURE FILTRATION SYSTEM

A. In order to maintain the highest quality control, the supplier and manufacturer shall be one and the same. The pressure filtration system shall be manufactured by the supplier in his own manufacturing facilities.

B. Welding of the vessel and internals shall be performed by welders qualified in accordance with the latest ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

C. Due to the special nature of the equipment required for this site only those manufacturers who have been active in the manufacture of pressure filters for at least 10 years will be considered as suppliers. Each bidder must attach to his bid a list of at least 10 installations, 3' diameter or larger, approved for use in drinking water. This list shall also include location, customer with contact person and phone number, unit size, capacity in gpm, and year installed.

D. The equipment specified herein shall be provided as a package by a single manufacturer/supplier.

E. The pressure filtration system shall consist of three (3) 75 psi., 36-inch diameter Filter modules as manufactured by LAYNE CHRISTENSEN COMPANY, Water Treatment Division, 97 Chimney Rock Road, Bridgewater, NJ 08807, phone 800-269-4590 or approved equal.

F. Should the General Contractor choose an alternate pressure filter manufacturer, all pertinent information describing the proposed equipment must be submitted with the bid. Alternate manufacturers not providing all of the requested information will not be considered. This information shall include, but not be limited, to the following:

1. Name, address and phone number of proposed alternative manufacturer.
2. Model number of proposed vertical pressure filter and all other major system appurtenances.
3. Scaled drawings showing physical dimensions of all major system components.
4. A list of all deviations between the proposed equipment and the specified equipment.

2.2 OPERATING REQUIREMENTS

A. The filter battery shall consist of three (3) vertical pressure filters. The filters shall successfully achieve the following performance at a filter rate of 7 gpm/ft^2 when operated at the design water flow rate of 140 gpm.

Constituent	**Influent (mg/l)**	**Effluent (mg/l)**
Iron	1.00	<0.15
Manganese	0.09	<0.03

B. It is the responsibility of the system manufacturer to select and size all components of the treatment system. The component sizes shall meet or exceed those given herein.

2.3 PRESSURE VESSELS

A. The General Contractor shall provide and install three (3) complete vertical pressure filters as shown on the plans. Each filter shall be 3' - 0" diameter by 5' - 4" straight shell. The filter vessels shall be designed for a maximum allowable working pressure of 75 psig and a hydrostatic test pressure of 100 psig. All pressure retaining parts will be constructed of Pressure Vessel Quality materials.

B. The heads shall be Torispherical flanged and dished.

C. The tanks shall each be provided with all necessary piping connections, one (1) 10" x 14" access manway located on the top tank head, one (1) 10" x 14" access manway located on

the bottom tank head, lifting lugs, and structural steel legs with baseplates suitably sized and designed for bolting to the skid assembly.

D. One (1) standard nameplate containing vessel identification.

2.4 FILTER UNDERDRAIN SYSTEM

A. Each filter bottom shall be equipped with a hub-radial underdrain system consisting of cylindrical hub of proper radius with pipe laterals located radially extending over the entire bottom of the filter area. The underdrain shall be designed to withstand the loads imposed by filter operation and backwash. All components shall be constructed of 304 stainless steel with a minimum schedule 10S thickness. The hub shall be provided with threaded openings to accept the lateral pipes. Lateral pipes shall be perforated with openings located proportionally to serve equal areas of the filter bottom. The openings shall be protected with stainless steel wedge-wire tubular screens concentric with the distribution pipe. The quantity and spacing of the lateral openings shall be such as to limit the pressure drop across the lateral assembly to a maximum of 1.5 psi. The underdrain shall be so designed to reduce the water velocity, discharging the water horizontally without impeding its flow, thereby preventing channeling in the filter bed. The screen openings shall be wedge shaped with a knife edge at the outer face and opening wider away from the edge toward the center of the screen such that any particle passing the knife edge cannot become lodged in the opening. The underdrain hub and laterals shall be shop installed prior to shipment.

2.5 INFLUENT DISTRIBUTION AND WASH WATER COLLECTION

A. Raw water shall enter the pressure filter through the raw water influent distributor. The distributor shall be designed to distribute the raw water uniformly over the entire filter bed and also to uniformly collect the reverse flow of backwash water effluent while retaining media during the backwash process in a uniform process. The influent distributor shall be manufactured out of Sch 80 PVC and shall be of the header-lateral type with upturned elbows at the end of each lateral. The upper distributor shall be supported within the vessel through the use of steel support clips with stainless steel hardware.

B. The distribution and collection system of the filter shall be arranged to accommodate backwashing at a maximum rate of 25 gpm/ft^2 of filter surface area.

C. The arrangement of the collections systems shall provide for the proper backwashing of the filter beds without loss of filtering material. The distance from the surface of the bed to the wash water collector (freeboard) shall be not less than 40% of the depth of the filter bed.

2.6 FILTER MEDIA - CATALYTIC MEDIA

A. The filter bed shall consist of a 36” depth of manganese dioxide media. The manganese dioxide content of the media shall be not less than 80%. The media shall have an effective size of 1.07 mm and a uniformity coefficient of not more than 1.45 and be graded 20x40 mesh. The media shall be certified to meet NSF 61 Standards.

B. The filter media shall be shipped bagged for field installation by the General Contractor.

2.7 PIPING AND FITTINGS

A. The filter face piping shall be furnished by the equipment manufacturer. The face piping shall be arranged and adequately sized to carry out all the operations of filtering and backwashing.
B. All piping 3" diameter and larger shall be schedule 80 PVC. No threads are to be cut on pipe 3" diameter and larger. All pipe shall be in accordance with AWWA D1785.
C. All pipe 2 1/2" diameter and smaller shall be galvanized steel, threaded per ANSI B2.1. All pipe is to be schedule 40 or standard weight .
D. All piping 3" diameter or larger shall have schedule 80 PVC flanges. Piping 2-1/2" diameter and smaller shall have 150 lb. threaded malleable iron fittings.
E. Provide unions or flanged joints on all piping to allow disassembly as needed to service valves and equipment located in the piping. Unions less than 3" shall be standard three piece unions with o-ring seal.
F. All flanged joints shall be fastened with ASTM A307 Gr. B hot dipped galvanized fasteners and gasketed with 1/8" EPDM full-face gaskets.
G. Piping shall be labeled with service identifying line labels.

2.8 VALVES AND AUTOMATIC ACTUATORS

A. All valves necessary for the operation of the equipment shall be provided. These shall include all influent, effluent, backwash supply, backwash outlet, and rinse (optional) valves. All valves 3" diameter and larger shall be insert type butterfly valves. All valves 2" diameter and smaller shall be brass ball valves.
B. All necessary air release valves shall be furnished.
C. Automatic actuators shall be driven electrically. Each actuator shall be provided with a local position indicator. Provision shall be available to allow all automated valves to operate manually. Electric actuators in modulating service shall be capable of accepting a 4-20 mA DC command signal to position the valve.
D. All Valves shall be tagged with an identifying number using anodized aluminum tags with stainless steel bead chain.

2.9 AUTOMATIC CONTROL

A. A fully automated control system shall be furnished to control all the operations of filtering and backwash.
B. The filter control panel shall be provided by the filter manufacturer, who shall guarantee its successful operation.
C. The filter control panel shall provide all necessary logic and time sequences to backwash the filter system automatically without operator intervention.
D. The automated control system shall be PLC operated. The PLC shall be fully programmed with all timed cycle settings. System settings and operation shall be readable from a 4X16 character operator interface.
E. Backwash shall be initiated by one of three occurrences: differential pressure across the filter system, at a pre-selected time, or manually at the option of the operator. A selector switch shall be provided to allow the operator to choose initiation from any of these three (3) inputs; automatic when differential pressure reaches a predetermined set-point, automatic on timed intervals (optionally the timed intervals can be changed to run-time intervals) or semi-automatic initiation from a pushbutton (manual).
F. Once initiated the backwash sequence will backwash all vessels in the treatment train.

G. When one filter is backwashing, the other filters will be locked out of the backwash sequence.

H. When backwash water is produced from on-line filters, the filter backwash sequence shall be interlocked to the well pump controls so that backwash is only permitted when the well pumps are running.

I. Normally all the valves will be sequenced automatically through controls mounted on the control panel board. Provisions shall be made to manually sequence all automatically activated valves form the face of the panel.

J. The open or closed status of each valve will be indicated on the control panel face using status lights.

K. The filter manufacturer shall provide means to properly control the rate of flow during backwash periods, independent of changes in system operating pressure.

L. The filter control panel shall be housed in a NEMA 12 enclosure. The control panel shall be UL 508A listed.

2.10 DIFFERENTIAL PRESSURE INDICATING SWITCH

A. The filter system shall be equipped with a Dwyer differential pressure indicating switch to measure headloss across the filter system. The switch shall provide a contact closure to initiate backwash as well as local indication. The switch shall be mounted on the filter skid at approximate average eye level above the operating floor.

2.11 PRESSURE INDICATORS

A. Each filter shall be provided with two (2) Wika (or approved equal) 4-1/2" dial pressure gauges with copper alloy bourdon tube to measure filter influent and effluent pressure. The influent and effluent pressure gauges shall be mounted to a bracket welded to the vessel shell. An additional gauge shall be provided on the common inlet header. Each of the gauges shall be provided with a miniature Male x Barb PVC ball valve.

2.12 SAMPLING COCKS

A. Sampling cocks shall be provided so that representative water samples may be secured at the following points: raw water, filter influent and effluent (each filter), plant effluent, and backwash outlet. Sampling cocks shall be miniature Male x Barb PVC ball valves.

2.13 PAINTING

A. The interior and exterior of the filter tanks shall be thoroughly cleaned of loose mill scale, rust, weld slag, weld splatter and grease.

B. The exterior of the vessels shall be sandblasted to SSPC-SP6-63, Commercial Blast Cleaning and given a two (2) coat system consisting of one (1) primer coat of Tnemec Hi-Build Epoxoline II Series N69F Polyomidoamine epoxy (4-5 mils DFT.) Color: Tnemec Color 20GN (Meadow Green) and one (1) finish coat Tnemec Series 1074 Endura-Shield II Aliphatic Acrylic polyurethane (2-3 mils DFT), Color: Tnemec Color 21GN (Fairway Green), 6-8 mils total DFT. In two (2) prominent locations, shall be stenciled in 4" high, black, bold letters, "LINED VESSEL, DO NOT WELD OR BURN". The General Contractor shall touch up any damage occurring during shipment and installation.

C. The interior of the vessels shall be sandblasted to SSPC-SP10-63, Near White Metal Blast Cleaning and given a three (3) coat system consisting of one (1) primer coat of Tnemec Potapox Series FC20 Polyamide epoxy (3-4 mils DFT.) Color: Tnemec Color 44BR (Beige), one (1) intermediate coat of Tnemec Potapox Series FC20 Polyamide epoxy (4-5 mils DFT.) Color: Tnemec Color 11WH (White), and one (1) finish coat of Tnemec Potapox Series FC20 Polyamide epoxy (4-5 mils DFT.) Color: Tnemec Color 15BL (Tank White), 11-14 mils total DFT. Coating shall be applied and cured in strict accordance with the manufacturer's instructions. All interior surfaces of the vessels shall be primed and finish painted, including the interior side of the removable top head. The internal coating shall be carried through all vessel nozzles and penetrations and onto flange face.

D. All other equipment shall be furnished with the manufacturer's standard finish. Fabricated steel piping shall be furnished with one (1) coat of red oxide primer. PVC piping shall be furnished unpainted.

2.14 SKID ASSEMBLY

A. The filters, valves, piping, and controls shall be skid mounted and assembled in the manufacturer's shop to the maximum extent possible within shipping regulations. The structural steel skid shall be capable of supporting the weight of the entire assembly, less media, when lifted by the lift points provided. The skid shall be hot-dip galvanized after fabrication and prior to assembly of the components.

B. The assembly shall be tested in the shop prior to shipment to ensure that the control system is correctly installed and functioning.

PART 3 – EXECUTION

3.1 INSTALLATION AND STARTUP

A. The General Contractor shall provide all field labor and equipment for installation of the filter system on the General Contractor's concrete foundation. The General Contractor shall unload, assemble and install the complete filtration system including the filter vessel(s), media, piping, valves, and accessories. Electrical and mechanical connections to the equipment and any instruments or monitoring devices shall be provided by the Electrical Contractor as specified elsewhere.

B. The equipment manufacturer shall provide the services of a factory trained Field Representative for a period of three (3) consecutive days consisting of two (2) days for start-up and one (1) day for operator training. All laboratory analysis during the startup period will be provided by the Owner.

C. All startup and/or disinfection chemicals shall be provided and disposed of by the General Contractor.

D. Disinfection of the treatment plant equipment, piping and appurtenances shall be performed in accordance with the requirements of AWWA D653-92. The Contractor shall submit a disinfection plan for review and approval of the Engineer.

PART 4 - OPTIONS

4.1 BACKWASH RECOVERY SYSTEM AND FINISHED WATER TANK

4.2 BACKWASH HOLDING TANK

A. The treatment system shall be provided with a Backwash Holding Tank. The Backwash Holding Tank shall have sufficient capacity to contain the entire backwash water volume for one backwash sequence of all filters plus a 10% volumetric margin of safety (6,000 gallons minimum). The tank shall be manufactured by Chemtainer Industries or approved equal.

B. The backwash tank shall be shall be designed in accordance with applicable Seismic. The tank roof shall have a 12:1 slope. The tank floor shall have 12:1 slope leading to a 20" diameter sump integral to the tank floor.

C. All sidewall accessories will be bolted to sidewall using ½" diameter stainless steel bolts and gasket sets insuring a leak free condition.

4.3 CONNECTIONS AND ACCESSORIES

A. The Backwash Tank shall be provided with the following connections:

Qty	Size	Description
1	4"	Flanged water influent nozzle
1	2"	Flanged water effluent nozzle
1	4“	Spare
1	4”	Flanged Level Switch connection
1	2“	Flanged sludge removal nozzle
1	4“	Flanged drain connection
4	1”	Flanged sludge sample point connection
1	20"	Mushroom type free air vent
1	24"	Square hinged and lockable roof manway
1	36”x24”	Cleanout port
1	4"	Overflow with weir elbow and piping to ground

4.4 DECANTING EQUIPMENT

A. The Backwash Holding Tank shall be provided with a floating decant device. The floating decant shall remove liquid from the Backwash Holding Tank from near the water surface while not disturbing settled material.

B. The decant float shall be manufactured from aluminum, and have a connection for a 2" hose.

4.5 LIQUID LEVEL INDICATOR

A. Backwash Holding Tank shall be supplied with a liquid level float with external level indicator target gauge board.

4.6 LIQUID LEVEL FLOAT SWITCH

A. The Backwash Holding Tank shall be furnished with two Liquid Level Float Switches. The float switches shall be tilt actuated, hermetically sealed, wide angle mechanically actuated style. Each float switch constructed of polypropylene with PVC cord and a cable mounted 20 oz. float switch weight. Float switch shall be provided with a N.O. (normally open) contact arrangement. Switches shall be Magnetek (B/W Controls) model 7010-A-4-C-20 or approved equal.

4.7 LADDER AND PLATFORM ASSEMBLY

A. A caged safety ladder shall be provided to access the top of the Backwash and Finished Holding Tank. The ladder shall meet all OSHA requirements. The ladder is intended to provide reasonably easy access to the upper manway on the Backwash Holding Tank. The ladder should be constructed to bolt onto the floor. The ladder shall be provided as part of the Backwash Holding Tank by the Backwash Holding Tank manufacturer.

B. The ladder shall be made up of rungs a minimum of 3/4 inches in diameter and 16 inches long. The rungs shall have a textured non-slip surface. The distance between rungs shall not exceed 12 inches and shall be uniform throughout the length of the ladder. The distance from the rungs to the tower shall not be less than 7 inches.

C. The ladder shall be provided with a continuous cage beginning no more than 8 feet above the base of the tank and running to 3 feet 6 inches above the upper platform. The bottom of the cage shall be flared at least 4 inches. The cage shall extend 27 inches from the centerline of the rungs and shall not be less than 27 inches wide. Vertical bars shall be located at a maximum spacing of 40 degrees around the circumference of the cage. The cage shall be provided with a locking door to prevent unwarranted access.

D. A single 3 ft. square landing platform shall be provided at the eave of the tank. It shall be equipped with standard railings, toeboards, safety gates, and non slip gratings all meeting OSHA requirements and so arranged as to allow safe access to the ladder. The platform shall be a minimum of 3 feet wide. The step across distance from the ladder to the platform shall be between 3 and 12 inches.

E. The ladder and platform assembly shall be constructed of galvanized steel.

4.8 SLUDGE/DECANT PUMP SKID

A. The treatment system shall be provided with a Sludge/Decant pump skid. The Decant/Sludge pump skid shall be capable of evacuating the contents of the Backwash Tank within 24 hours.

4.9 SKID ASSEMBLY

A. The pumps, valves, piping, and controls shall be skid mounted and assembled in the manufacturer’s shop to the maximum extent possible within shipping regulations. The structural steel skid shall be capable of supporting the weight of the entire assembly when lifted by the lift points provided. The skid shall be hot-dip galvanized after fabrication and prior to assembly of the components.

B. The assembly shall be tested in the shop prior to shipment to ensure that the control system is correctly installed and functioning.

4.10 DECANT PUMP

A. One (1) Decant Pump shall be provided to deliver 10 gpm at 115 ft. TDH. The pump shall be centrifugal type. The pump(s) shall be furnished with a 0.5 HP, 120/240 volt, 1PH, TEFC motor and baseplate.

4.11 SLUDGE PUMP

A. One (1) Sludge Pump shall be provided to deliver 5 gpm at 50 ft. TDH. The pump shall be diaphrgam type. The pump(s) shall be furnished with a .25 HP, 120/240 volt, 1PH, TEFC motor and baseplate.

4.12 PIPE AND FITTINGS

A. The piping shall be arranged to carry out all the operations of the sludge/decant skid.
B. All piping 3" diameter and larger schedule 80 PVC. No threads are to be cut on pipe 3" diameter and larger. All pipe shall be in accordance with AWWA D1785.
C. All pipe 2 1/2" diameter and smaller shall be shall be butt weld carbon steel. All pipe is to be schedule 40 or standard weight.
D. All piping 3” diameter or larger shall have molded schedule 80 PVC fittings. Piping 2-1/2” diameter and smaller shall have butt weld carbon steel fittings.
E. Provide unions and flanged joints on all piping to allow disassembly as needed to service valves and equipment located in the piping. Unions less than 3” shall be standard three piece unions with o-ring seal.
F. All flanged joints shall be fastened with ASTM A307 Gr. B zinc plated fasteners and gasketed with
G. 1/8” EPDM full-face gaskets.

4.13 VALVES AND AUTOMATIC ACTUATORS

A. All valves necessary for the operation of the equipment shall be provided. All valves 2" diameter and larger shall be wafer type butterfly valves. All valves 1-1/2" diameter and smaller shall be brass ball valves.
B. Automatic actuators shall be driven electrically Provision shall be available to allow all automated valves to be operated manually. Electric actuators in modulating service shall be capable of accepting a 4-20 mA DC command signal to position the valve.

4.14 PRESSURE INDICATORS

A. The Sludge/Decant skid shall be provided with one (1) Wika 4-1/2” dial pressure gauges with copper alloy bourdon tube located on the discharge of the Decant pump. Each of the gauges shall be provided a diaphragm seal and brass isolation valves.

4.15 SIGHT FLOW INDICATOR

A. To enable visual inspection of the sludge and decant flow, the suction side of each pump shall incorporate a sight flow indicator. The sight flow indicator shall be either wafer style or 150# flanged.

4.16 FLOW METER

A. A decant water flowmeter shall be furnished and located in the discharge line of the decant pump. The flowmeter shall be an AWWA/NSF approved propeller type and suitable to dirty water flows so it can handle solids suspended in water without clogging. The flowmeter shall feature a mechanical instantaneous flowrate indicator and totalizer. Flowmeter shall be epoxy-coated carbon steel body.

4.17 PAINTING

A. All other equipment shall be furnished with the manufacturer's standard finish.

4.18 FINISHED WATER TANK

4.19 FINISH WATER HOLDING TANK

A. The treatment system shall be provided with a Finished Water Holding Tank. The Finished Water Holding Tank shall have a minimum capacity of 6,000 gallons. The tank shall be manufactured by Chemtainer Industries or approved equal.
B. The finished water tank shall be shall be designed in accordance with applicable Seismic. The tank roof shall have a 12:1 slope.
C. All sidewall accessories will be bolted to sidewall using ½" diameter stainless steel bolts and gasket sets insuring a leak free condition.

4.20 CONNECTIONS AND ACCESSORIES

A. The Finished Water Tank shall be provided with the following connections:

	Size	Description
1	4"	Flanged water influent nozzle
1	4"	Flanged water effluent nozzle
1	4“	Spare
1	4”	Flanged Level Switch connection
1	4“	Flanged drain connection
4	1”	Flanged sludge sample point connection
1	20"	Mushroom type free air vent
1	24"	Square hinged and lockable roof manway
1	36”x24”	Cleanout port
1	4"	Overflow with weir elbow and piping to ground

END OF SECTION 11100

SECTION 11600
PUMPS

SECTION 11600

PUMPS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

Contractor shall furnish all labor, materials, equipment, superintendence and incidentals to furnish and install booster pumps as specified.

Contractor shall furnish and install three (3) influent variable speed pumping units and three (3) variable speed finished water pumping units specified herein and as shown on the contract drawings.

The term "pumping unit" or "units" shall be defined as a pump complete with base plate, coupling, coupling guard, and motor.

The pump manufacturer shall be responsible for supplying the complete pumping unit as defined and shall assume complete system responsibility.

1.2 RELATED SECTIONS

A. Section 09900 Painting
B. Section 16481 Motor Control Center
C. Section 17000 General Requirements for Instrumentation

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME)
B. American National Standards Institute (ANSI)
C. ANSI/American Water Works Associations (ANSI/AWWA E101)
D. Anti-Friction Bearing Manufacturers Association (AFBMA)
E. ANSI/Hydraulic Institute (ANSI/HI): ANSI/HI 2.3, 9.6.3 and 9.6.4
F. American Welding Society (AWS)
G. NEMA MG 1 – Standard for Motors and Generators
H. NSF International/ANSI (NSF/ANSI) NSF/ANSI-61
I. NFPA 70 – National Electric Code
J. The Society for Protective Coatings (SSPC)

1.4 SUBMITTALS

Submit under provisions of Section 01300.

For Approval prior to beginning fabrication of products:

Pump Manufacturer's letter that products are in conformance with the specifications.

Outline drawings of assembled pump, base and motor, indicating parts and materials and seal arrangement. Drawings shall include project specific physical dimensions, weights, orientations, tapings, connections, suction inlet and discharge outlet, flanges, gaskets, seals, and other accessories.

Pump performance curves indicating operating points, efficiency, power and NPSH curves. Curves shall indicate manufacturers allowable operating range including: minimum continuous stable flow (MCSF) and run out limits.

Motor data sheet, motor outline drawing, nameplate data, performance data, wiring diagram, RTD wiring diagram, and accessories data.

A. Final Certified Drawings:
    1. Certified for construction outline drawings.
    2. Certified motor data.
B. For Record prior to shipment.
    1. Certified performance data and curves with operating points and NPSH curves.
    2. Certified hydrostatic test data.
    3. Certified motor test data.

Installation, Operations and Maintenance (O&M) manual: Furnish operation and maintenance manuals in conformance with the requirements of Section 01300 for material and equipment submittals and Operation and Maintenance Manuals.

Submit complete installation, operation and maintenance manuals including copies of all approved Shop Drawings, Certified test reports, maintenance data and schedules, description of operation and spare parts information.

Manufacturer's Warranties.

1.5 COORDINATION

A. Pump Manufacturer shall be responsible for coordination with motor manufacturer for equipment supplied under this section, including non-overloading power requirement.
B. Contractor shall verify the correct orientation and fitting of equipment, bolt-patterns and accessory devices.
C. Pump Manufacturer shall be responsible for coordination with General Contractor for work that supports the pump installation. Coordination shall include physical installation requirements, connections, instruments, and coordination with Engineer and Owner for pre-start up planning, loop testing, SCADA communications testing, and start up of the equipment.

1.6 QUALITY ASSURANCE

A. Products and workmanship shall be in conformance with the most rigid recommendations and requirements of the referenced standards and Codes.
B. Pumps must operate at specified conditions without vapor binding and cavitation. Pumps shall be selected that will operate, singularly or in any parallel pump combination, within the Allowable Operating Region as defined by Hydraulic Institute (ANSI/HI) 9.6.3 – for

Centrifugal and Vertical Pumps, within the pump manufacturer's recommended range of stable operation.

C. Motors shall be selected to be non-overloading, singularly or in any parallel pump combination, at any point on the pumps head-capacity curve.

D. If pumps fail to meet the requirements of these specifications, Contractor shall repair or replace pumps.

E. Manufacturer shall factory test pump units before shipping to Project. Contractor shall notify Engineer at least two weeks before manufacturer factory tests.

F. Name plates on pumps shall indicate manufacture's name, model number, serial number, pump rating: capacity, head and rpm, motor horsepower, rpm and frame size. Name plates shall be engraved metal.

G. As a precedent to Substantial Completion, pumps shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer.

1.7 FACTORY AND SHOP TESTS

A. Pump Shop Inspection and Tests:
   1. Non-witnessed performance test with performance certification report for all pumps.
   2. Non-witnessed hydrostatic test with hydrostatic test certification.

B. Motor Factory Inspection and Tests:
   1. Non-witnessed short commercial test with certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Pumps shall be completely assembled in the shop. Loose pump components shall be match marked to the pump unit before being disassembled for shipment, unless shipped completely assembled, to insure correct reassembly in the field. Pump components that are tested as a unit are to be installed as a matching unit in the final installation.

B. Contractor shall be solely responsible for timely delivery, proper handling and storage of all equipment.

C. Prior to shipping, all inlets and outlets shall be capped or sealed with a gasket and suitable cover plate.

1.9 WARRANTY

A. The term of warranties for pumps shall be one year commencing on the date Engineer certifies Substantial Completion of the Project.

B. Contractor shall provide a written warranty issued by the Pump Manufacturer that pumps, including but not limited to motor and other pump components and accessories are free of any defect in equipment, material, design, and fabrication workmanship. Pump Manufacturer's warranty shall identify its factory-authorized service representative. The factory-authorized service representative shall have an office within 250 miles of the plant site that is staffed with at least two full time employees who are factory-certified to service pumps.

1.10 EXTRA MATERIALS

A. Contractor shall furnish one set of replacement pump seals per pump.

PART 2 - PRODUCTS

2.1 PUMPS

A. Manufacturers:
1. ITT – Goulds Pumps.
2. Flowserve – Worthington Pump.
3. Pentair - Fairbanks Morse Pumps.
4. Patterson Pump Co.

B. Pumps shall be variable speed vertical turbine pumping units.

C. Pumping units within each type of service shall be identical in every respect with all parts being interchangeable.

D. Pump rotating assemblies shall be balanced in accordance with the requirements of ANSI S2.19, G6.3.

E. Vibration, when measured at the pump bearing housing shall not exceed the limitations specified by the Hydraulic Institute Standards (ANSI/HI) 9.6.4 for Centrifugal Pumps.

2.2 HYDRAULIC DESIGN CRITERIA

A. Rated Condition

Pump Tag	Capacity, Gpm	Total Head, ft.	Min. Pump Efficiency, %	Max. NPSHr, ft
P-711 IWP	120	80	85	15
P-721 FWP	120	148	85	15

B. Operating Characteristics P-711IWP
1. Shut-off Head = 20% Rise over Rated Head Minimum
2. Maximum Brake Horsepower = 3 BHp (Non-overloading)
3. Maximum Motor Horsepower = 5 Hp
4. Maximum Impeller Trim = 97%
5. Maximum Operating Speed = 1800 RPM
6. Pumpage = Well Water 60 to 85°F
7. Pumps installed under this contract shall operate in any combination of from one pump to three pumps. Pump Station firm rated capacity is 240 gpm with one pump on stand-by.
8. Pump unit location is indoors, north of Ruidoso, New Mexico. Equipment rating to be for nominal 7,500 foot elevation. Actual elevation is 7,450 foot MSL.

C. Operating Characteristics P-721FWP
1. Shut-off Head = 20% Rise over Rated Head Minimum
2. Maximum Brake Horsepower = 4.48 BHp (Non-overloading)
3. Maximum Motor Horsepower = 5 Hp
4. Maximum Impeller Trim = 97%
5. Maximum Operating Speed = 1800 RPM
6. Pumpage = Well Water 60 to 85°F
7. Pumps installed under this contract shall operate in any combination of from one pump to three pumps. Pump Station firm rated capacity is 240 gpm with one pump on stand-by.

8. Pump unit location is indoors, north of Ruidoso, New Mexico. Equipment rating to be for nominal 7,500 foot elevation. Actual elevation is 7,450 foot MSL.

2.3 DETAILS OF CONSTRUCTION

A. Pump Casing shall be of close grain cast iron type ASTM A48, class 40, designed for heavy duty service. The casing shall be horizontally split; single volute type with the suction and discharge flanges cast integrally with the lower half in order that the upper part may be removed for inspection of the rotating element without disturbing pipe connections or pump alignment. Pump mounting feet are to be cast integrally into the lower half casing with the mounting surface completely machined. The joint between halves of the casing shall be heavily flanged and bolted, and provided with dowel pins to assure accurate alignment. The upper half-casing flange shall have tapped holes for jackscrews. The interior shall be smooth and free from surface defects.

Thickness, diameter and drilling dimensions of suction flanges shall be Class 125 ANSI standard. Discharge flanges shall be Class 250 ANSI standard. Pump casings shall have minimum 14-inch suction and 10-inch discharge flanges. Casings shall be drilled and tapped for vertical priming, gauge, and drain connections. Suitable lifting lugs or eyebolts shall be provided.

B. Impeller shall be of the double suction enclosed type made entirely of ASTM B584-836 Bronze finished smooth all over and of ample strength and stiffness for maintaining the maximum capacity of the unit.

Impeller shall be statically and dynamically balanced and shall be keyed to the shaft and securely held in axial position on the shaft by means of ASTM B505-95 bronze sleeves extended through the stuffing box. Rotation of the shaft sleeves shall be prevented by the impeller key which shall extend beyond the impeller hub and into the shaft sleeve on both sides of the impeller. Shaft sleeves shall be held in position by a locking shaft sleeve nut located outside of the stuffing box and shall have an O-ring seal between the sleeve and the nut to prevent entrance of air or liquid between the shaft and sleeve. Sleeves, which are threaded onto the pump shaft are not acceptable.

C. Wear Rings
   1. At the running joint between the suction and discharge chambers, there shall be provided wear rings on both the casing and impeller.
   2. The casing rings shall be made of ASTM B505-927 bronze, positioned in the casing and locked against rotation by the upper half of the case.
   3. Impeller rings shall be made of ASTM B505-927 bronze, so fastened that they cannot rotate or become loose when the pump is subjected to reversed rotation. The rings shall be made to limit gauges, so that they may be renewed without fitting.

D. Pump Shaft
   1. The shaft shall be of AISI 1141 and of such dimensions that the maximum combined stress due to bending and tortion shall not exceed 8,000 pounds per square inch under the most severe conditions of operation.
   2. The shaft shall be accurately machined over its entire length. The first critical speed of the rotating assembly shall occur at not less than 150% of the rated speed.
   3. Threads on the pump shaft shall be located outside of the stuffing box.

E. Stuffing Boxes
   1. Stuffing boxes shall be provided with mechanical seals.

2. Stuffing boxes shall accept packing or mechanical seals without modification to the stuffing box.
3. Mechanical seals shall be furnished with a carbon seal ring, silicon carbide ceramic mating ring, fluorocarbon or Aflas elastomer and 316 stainless steel parts. Mechanical seals shall be Chesterton 155, or John Crane Type 8-1T single cartridge seal.
4. Mechanical seals shall be rated for 250 PSIG pressure. The elastomer shall be rated for temperatures ranging from -20 degrees F to 400 degrees F.
5. Pump shaft sleeves shall be furnished with a pre-machined groove designed to accept a setting ring, which shall eliminate the need for set collars or stop collars. Seals requiring stop or set-screws are not acceptable.
6. The rotating seal ring shall be provided with a 360 degree rubber encasement to provide a positive drive for the seal face without the need for metal drive notches which may cause face distortion or notch wear. The seal rings shall be permanently fixed in place and full flatness maintained by a precision crimp in the outer seal case.
7. The mechanical seal shall be of a convoluted design which permits free movements providing constant adjustment for shaft endplay and seal face wear. Positive face contact with the stationary seat shall be maintained at all times.
8. To ensure positive sealing by free movement of the seal head, the seal shall feature a hex style outer shell and drive band which shall absorb start-up and running torque and shall eliminate in stress on the diaphragm. Metal components shall freely engage and shall not be subject to lock down due to friction wear.
9. Suitable valved connecting lines or passages shall be provided on the upper half casing leading from the discharge to the stuffing box for lubricating the stuffing boxes with the liquid being pumped.

F. Bearings
1. Bearings shall be of the anti-friction type with ring oil lubrication.
2. The bearing configuration shall consist of one single row deep grooved anti-friction bearing on the inboard side and a double row deep grooved anti-friction bearing on the outboard side. The inboard bearing shall be designed to take the radial thrust loads. The outboard bearings shall be designed to take a combination of loads, both radial and axial; and hold the rotor in axial alignment.
3. Bearings shall have a minimum rated service life of 40,000 hours in accordance with the standards of the Bearing Manufacturers Association throughout the specified operating range. Bearings shall be mounted in dust tight housings shall be rigidly supported by suitable brackets, which shall be cast with integrity with the lower half or the pump casing. Bearing housings or bearing housing supports which are bolted to the side of the pump casing, are not acceptable.
4. A deflector made of aluminum shall be provided on the inboard and outboard ends of the pump shaft to prevent product from entering either bearing housing.

G. Pump Base
1. The pump and motor shall be mounted on a common base of fabricated ASTM A36 steel. Bent metal or formed bases are not acceptable.
2. The base shall be provided with a coupling guard, and ample grout holes.
3. A drip lip rim shall be provided with ¾-inch threaded connection.
4. All mounting surfaces shall have a machined finish.

H. Couplings

1. The coupling shall be Falk-Rexnord Steelflex T10 or TB Woods G-Flex, flexible type coupling.
2. Coupling size and rating shall transmit the maximum required horsepower with a 1.5 service factor.

2.4 FACTORY TESTING

A. Each pump shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.
B. A certified performance test shall be performed on each unit utilizing its specified drive.
C. All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps – 1.6.
D. Six evenly spaced test points shall be taken and shall include conditions at shut-off (zero flow) and the operating points specified herein. Preliminary test data must be submitted to the Owner seven days prior to the actual test date.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall assemble and install equipment in accordance to the instructions furnished by the Pump Manufacturer.
B. Contractor shall verify motor horsepower, mounting, leads and monitoring equipment matches the pump and drive equipment.
C. Install pump on formed concrete inertia block bases to elevations as indicated on the plans.
D. Contractor shall verify alignment with existing supply and discharge piping. No allowances shall be granted for correction of misalignment of piping.
E. Install vibration device and terminate all other monitoring devices.
Install motor leads.

3.2. TESTS

Contractor shall bump the motor to verify the direction of rotation. Initial and final tests of fully assembled equipment at the site in accordance with the requirements for each phase of testing as defined in Section 01010 – General. Tests shall comply with manufacturers' instructions for pre-start up, and operation of the equipment. Water pumped during the test operations must be of acceptable quality to be introduced into the potable water system.

Tests shall be performed while discharging to the water system. The Contractor shall coordinate with Operations for suction and discharge tank level monitoring during the test period.

A. Startup and Factory Field Service
1. The local representative of the pump manufacturer must be present during startup and testing.
2. Contractor shall secure from the Pump Manufacturer a startup checklist. Contractor shall provide a copy of the checklist to the Engineer prior to startup of pumps as part of the start-up procedures.

3. The Manufacturer of the pumping unit shall provide, at no additional cost to the Owner, the services of a field service representative for a period of four days.
4. The time specified shall require at least two trips to the project site. One trip for supervision during the installation of the units and one trip for operator training shall be provided.

B. Field Testing

1. Contractor in the presence of the Engineer shall conduct operational tests of the pump units as specified in Section 01010 - General.
2. Contractor shall furnish devices necessary to obtain the test data. These tests shall be recorded once the pump has stabilized at its operating condition, including test start and completion times, operator, valve position/setting data. Test data shall include the following:
   a. Full speed test:
      1) Flow meter reading
      2) 3 phase amperage readings
      3) RTD reading (requires meter to read temperature values)
      4) Tank elevation and Discharge header pressures
      5) Suction and Discharge pressure at the pump
      6) Vibration reading.
   b. Pumps shall operate within the allowable vibration limits shown in HI 9.6.4 – Standard for Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Values, for the Full Speed Test listed above. Vibration in excess of the allowable limits shall be corrected by the Contractor and tested to confirm compliance. Corrective action shall not include adding weights that can be removed or disassembled.

F. Final Documentation

After testing is completed, the local representative shall provide a certification affirming that the installation was successfully and correctly performed. Said certification shall contain all site test data and shall confirm that testing results satisfy all performance requirements stated herein.

END OF SECTION

SECTION 11960
CHLORINATION EQUIPMENT

SECTION 11960

CHLORINATION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Conditions of the Contract for Construction, Supplementary Conditions and Division 1 - General Requirements apply to work of this section.

1.2 SUMMARY

A. Contractor shall furnish the materials as specified herein; furnish labor, piping materials, equipment, superintendence and incidentals to install the complete chlorine feed system.
B. Scope:
   1. The scope of work associated with this section is shown on the Contract Drawings.
   2. Sodium Hypochlorite 12% solution complying with NSF/ANSI 60 and 61.
   3. Flow paced metering pumps complying with NSF/ANSI 60 and 61.

1.3 COORDINATION

A. Equipment and installation of the chemical metering pumps shall be coordinated with the filtration equipment supplier.
B. Electrical services required shall be coordinated with the electrical contractor.
C. Instrumentation for the chlorine metering pump control shall be coordinated with the Division 17 – Instrumentation.

1.4 RELATED SECTIONS

A. Section 15141 – Mechanical Piping
B. Section 16000 – General Requirements for Electrical
C. Section 17000 – General Requirements for Instrumentation.

1.5 SUBMITTALS

A. Furnish product data, shop drawings and closeout submittals as required in Section 01300 and shall include the following information.
B. Product literature: Dimensional cut sheets, installation instructions, power requirements, and instrumentation data for all devices furnished in this Section.
C. Sufficient information on each component to show that the equipment meets this specification.
D. Installation, operating and maintenance manuals for mechanical and process components.
E. Contractor shall provide a coordination drawing including the following: room layout including: piping, tubing, valve locations, devices, drains, electrical and instrumentation requirements and penetrations required.

1.6 QUALITY ASSURANCE

A. Supplier with a minimum of five (5) years' experience in chlorine equipment systems.
B. Components and installation shall comply with applicable OSHA and NEC code requirements.
C. Nameplates and ratings. Each component shall bear a nameplate or stamping indicating the pressure and temperature rating of the component.

1.7 WARRANTY

A. The components furnished under this section shall be warranted by the manufacture for full replacement for twelve months for the date of final acceptance of the facility by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM DESCRIPTION

A. The chlorination system consists of two chlorine metering pumps which are controlled via a proportioning flow controller tied the process flow meter.
B. The hypochlorite shall be contained in the 55 gallon container from the supplier.

2.2 ENVIRONMENT

The hypochlorite will be stored in a room with temperature controlled between 65 to 95°F and 15 to 98% RH.

2.3 METERING PUMPS

A. Manufacturer:
   1. Neptune Model PZi8 12CL – No other manufacturer or model will be accepted.
B. Design Criteria
   1. Control Range – 0 – 38 GPD Hypochlorite dose rate.
   2. System to include:
      a. Two (2) metering pumps pumping from two separate hypochlorite sources.

2.4 PIPE AND TUBING

A. Contractor shall furnish necessary service piping and interconnecting piping and tubing in accordance with Section 15140 – Mechanical Piping, for complete chlorine feed system. Piping shall be supported as specified.
B. Hyporchlorite solution: tubing (3/8" and ¼") - Polypropylene with threaded union ends to PVC piping.

2.5 LABELING AND SIGNAGE

A. Contractor shall identification nameplates for devices in accordance with Section 15075 – Mechanical Identification. Furnish nameplate of self-adhesive, embossed laminate, black lettering on white background:

B. For the metering pumps “CL-1” and “CL-2”.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall verify existing conditions and equipment furnished by other are ready to receive work.
B. Contractor shall install the hypochlorite feed devices and instrument loops as specified and as shown on the plans. Devices shall be installed in accordance with the manufacturers’ instructions.
C. Contractor shall install electrical service to the locations required for the devices.
D. Contractor shall install the piping systems: hypochlorite solution piping as shown on the plans. Piping and tubing shall be pressure tested. Water piping shall be disinfected prior to being placed in service. Test and disinfect in accordance with Section 15105 – Mechanical Piping.

3.2 MANUFACTURER’S SERVICE

A. Certify proper installation and operation devices furnished as a part of the completed chlorine feed system.
B. Verify proper operation of regulators.

END OF SECTION

SECTION 13121
PRE-ENGINEERED METAL BUILDINGS

SECTION 13121

PRE-ENGINEERED BUILDINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings, General Provisions including General Conditions, Supplementary General Conditions and Division 1 of the Specifications apply to the work of this section.

1.2 WORK INCLUDED

A. Pre-engineered and shop fabricated structural steel building frame, including canopy cover at chlorination bay.
B. Metal wall and sloped roof system including prefinished sheet metal flashing, and trim; roof and wall insulation; and glazed hollow metal frames.

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03300 - Concrete Work.

1.4 RELATED SECTIONS

A. Section 01600 - Product Requirements.
B. Section 03300 - Concrete.
C. Section 07900 - Joint Sealers.
D. Section 08110 - Doors and Frames.
E. Section 09900 - Painting.
F. Division 15 - Mechanical rough-in utilities.
G. Division 16 - Electrical rough-in utilities.

1.5 REFERENCES

A. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
B. ASTM A36 - Structural Steel.
C. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
D. ASTM A325 - High Strength Bolts for Structural Steel Joints.
E. AWS A2.0 - Standard Welding Symbols.
F. AWS D1.1 - Structural Welding Code.
G. FS HH-I-521 - Insulation Blankets, Thermal, Mineral Fiber.
H. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).
I. SSPC - Steel Structures Painting Council.

1.6 SYSTEM DESCRIPTION

A. Clear span rigid frame. Modular rigid frame.
B. Bay spacing as indicated on the drawings.

C. Primary Framing: Rigid frame of rafter beams and tapered columns, intermediate sidewall columns, braced endwall columns, and wind bracing.
D. Secondary Framing: Purlins, girts, eave struts, flange bracing, sill supports, clips, and other items detailed.
E. Wall and Roof System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, insulation, liner sheets, and accessory components.
F. Roof Slope: 4 inches in 12 inches or as indicated.
G. Endwalls are designed for future expansion.
H. Framing for overhead crane supports.

1.7 DESIGN REQUIREMENTS

A. Thermal resistance of Wall System: R-19.
B. Thermal Resistance of Roof System: One-layer R-19.
C. Members to withstand dead load, and design loads due to pressure and suction of wind calculated in accordance with INTERNATIONAL BUILDING CODE 2006 and design loads indicated on the drawings.
D. Exterior wall and roof system to withstand imposed loads with maximum allowable deflection of span: 1/180 of span under total load.
E. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
F. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature differential range of 70 degrees F.
G. Provide necessary support framing for all doors, windows, and canopy areas.
H. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
I. Roof system shall be designed to have a UL uplift rating of Class 90.
J. Design using ASCE 7-02 for wind velocity of 110 MPH, Exposure C, Importance Factor 1.0.
K. Live loads may not be reduced for design.
L. A collateral load of 7 pounds per square foot (psf) shall be included in the design.
M. Crane loads of 7.5 tons plus impact supported by rigid frame bents.

1.8 SUBMITTALS

A. Section 01330 - Submittal: Procedures for submittals.
B. Design Calculations: Submit design calculations prepared under the direction of and sealed by a Professional Engineer licensed in the State of New Mexico. Include data for all loading conditions. If computer programs are used, include input and output printouts.
C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections, attachments, openings, head and jamb framing and structure support for doors, windows, loads, wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage. Indicate framing anchor bolt settings, sizes, and locations from datum, and foundation loads. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths, provide professional seal and signature.
D. Product Data: Provide data on profiles, component dimensions, and fasteners.
E. Manufacturer's Installation Instructions: Indicate preparation requirements, and assembly sequence.

1.9 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 5 years documented experience.
B. Design structural components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located in the State of New Mexico.

1.11 REGULATORY REQUIREMENTS

A. Cooperate with regulatory agency or authority and provide data as requested.

1.12 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.13 WARRANTY

A. Provide five year warranty for labor and a twenty year on material under provisions of Section 01600. Roof and accessories to have a UL 90 rating.
B. Warranty: Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.
C. Warranty: Include coverage for weather tightness of building enclosure elements after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - BUILDING SYSTEM

A. Pre-Engineered Buildings.
B. Acceptable manufacturers offering equivalent systems:
    1. MBCI Metal Roof and Wall Systems
    2. Star Building Systems
    3. CECO Building Division
    4. Butler Manufacturing Company
    5. Freedom Steel Buildings.
C. Substitutions: Under provisions of Section 01600.

2.2 MANUFACTURERS - BUILDING COMPONENTS

A. Other Acceptable Manufacturer's of Pre-Engineered Building Components shall be:
   1. ECI Building Components
   2. Metal Building Components.
   3. Alpro Acoustics Division - Structural Systems Corp
B. Substitutions: Under provisions of Section 01600.

2.3 MATERIALS - FRAMING

A. Structural Steel Members: ASTM A36.
B. Plate or Bar Stock: ASTM A529.
C. Anchor Bolts: ASTM A307, unprimed.
D. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153, G60.
E. Welding Materials: AWS D1.1; type required for materials being welded.
F. Primer: SSPC 15, Type 1, Red Oxide.
G. Grout: Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2400 psi in two days and 7000 psi in 28 days.

2.4 MATERIALS - WALL AND ROOF SYSTEM

A. Sheet Steel Stock: ASTM A446 Grade galvanized to ASTM A525 G90 designation.
B. Joint Seal Gaskets: Manufacturer's standard type.
C. Fasteners: Manufacturer's standard type, galvanized to ASTM A386 2.0 oz/sq ft, finish to match adjacent surfaces color when exposed.
D. Bituminous Paint: Asphaltic type.
E. Sealant: Manufacturer's standard type, as specified in Section 07900, non-staining, elastomeric, skinning.
F. Roll Straps: (See paragraph 2.4.I).
G. Roof Insulation:
   1. Install 1 layer R-19 vinyl faced insulation between purlins.
      a. UL Flame Spread: 25 or less
      b. UL Smoke Developed: 50 or less.
      c. Meet ASTM E 84.
      d. Color: White Vinyl face.
H. Exterior Wall Insulation
   1. A thermal resistance R-19 white vinyl faced fiberglass batt insulation.
   2. UL Flame Spread: 25 or less
   3. UL Smoke Developed: 50 or less
   4. Acceptable Product: Certainteed flame resistant fiberglass insulation FSK 25 (ASTM 84) or approved equal.
I. Straps for roof insulation
   1. 3/8” galvanized steel straps. Match color of insulation.
   2. ¾” galvanized steel straps. Match color of insulation.

2.5 MATERIALS - DOORS AND FRAMES

A. Doors and Frames: Specified in Section 08110.

2.6 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.
B. Anchor Bolts: Formed with straight shank, assembled with template for casting into concrete.
C. Provide framing for all wall openings.

2.7 FABRICATION - WALL AND ROOF SYSTEMS

A. Exterior Siding: 22 gauge metal thickness, equal to MBCI FW-120-1 panel profile, approximately 1-1/2" deep, with one bead, concealed fastener, standard smooth finish, interlocked male/female edges, Signature® 300 finish.
B. Standing Seam Roof: 22 gauge roofing system panels, equal to MBCI LokSeam series panel profile, approximately 1-3/4" high ribs, 12" coverage width, standard surface texture, concealed fastening, Signature® 300 finish.
C. Canopy Roof System: 22 gauge roofing panels equal to MBCI Superlok Panel Series Profile, approximately 2" high ribs, 12" coverage width, standard surface texture; concealed fastening, Signature® 300 finish.
D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing, and liner sheets.
E. Internal and External Corners: Same material thickness and finish a adjacent material, profile brake-formed to required angles. Back-brace mitered internal corners with 22 gauge thick steel sheet.
F. Flashings, Closure pieces, Fascia, Infill pieces, and Caps: Same material and finish as adjacent material, profile formed as detailed.
G. Fasteners: To maintain load requirements and weather-tight installation, concealed from exposure, non-corrosive type.
H. Wall Louvers: Refer to Mechanical.
I. Interior Wall Panels: Minimum 26 gauge metal thickness, equal to MBCI PBU finish: Siliconized Polyester. Refer to drawings for locations and heights.

2.8 FINISHES

A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded. Apply finish paint on all exposed steel, color as selected.
B. Exterior Surfaces of Wall and Roof Components and Accessories: Prefinished with Kynar 500 Finish Color to be selected from standard manufacturer's colors. Engineer shall have option to select one color for roof panels, components and accessories and another color for wall panels and accessories.
C. Interior Surfaces of Wall and Roof Components and Accessories: Pre-coated enamel on steel of modified silicone resin finish, color as selected from manufacturer's standard range.
D. Interior Wall Panels: Siliconized Polyester.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.
B. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.

3.2 ERECTION - FRAMING

A. Erect framing in accordance with AISC Specification.
B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
C. Do not field cut or alter structural members without approval of Engineer.
D. After erection, prime welds, abrasions, and surfaces not shop primed.

3.3 ERECTION - WALL AND ROOFING SYSTEMS

A. Install in accordance with manufacturer's instructions.
B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
C. Fasten cladding system to structural supports, aligned level and plumb.
D. Locate end laps over supports. End laps minimum 2 inches. Place sidelaps over bearing.
E. Use concealed fasteners on roof and exposed on walls.
F. Install insulation and vapor barrier between the roof framing member and the exterior panel and attached insulation shall be compressed at the framing member by the exterior panel fasteners to the framing members. Place straps under vinyl for support of insulation between framing members.
G. Install sealant and gaskets to prevent weather penetration.
H. System: Free of rattles, noise due to thermal movement and wind whistles.
I. No roof penetrations will be permitted.

3.4 INSTALLATION OF ROOF INSULATION

A. Install R-19 vinyl faced insulation between purlins. Install 3/8” bands at 16” o.c. – parallel with purlins. Install 3/4” bands at 4’-0” o.c. Screw attach all bands to structure.

3.5 INSTALLATION - ACCESSORIES

A. Install door frame in accordance with manufacturer's instructions.
B. Seal wall and roof accessories watertight and weather tight with sealant in accordance with Section 07900.

3.6 TOLERANCES

A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

SECTION 13220
GROUND WATER STORAGE TANK

SECTION 13220

GROUND WATER STORAGE TANK

PART 1 - SCOPE

1.1 The work covered by this section of the specifications consists of furnishing all materials, tools, equipment, labor, supervision and incidentals necessary to design, manufacture, deliver, erect, inspect, coat, test, disinfect and protect against corrosion of the steel water storage tanks identified herein.

1.2 The tanks are to be of the height and capacity specified herein, and it shall be complete with all of the appurtenances and components as indicated on the drawings and in these specifications.

1.3 The tank shall be erected at the location indicated on the drawings upon ring beam foundations as designed and constructed by the tank contractor.

1.4 The project consists of erecting one (1) 60,000 gallon capacity tank located at the proposed water treatment plant site

1.5 Water treatment plant site electrical service will be installed under this contract. The electrical service will serve the tank and the plant. Electrical, instrumentation and controls to be provided for the tank will be paid under a separate bid item from the tank bid items.

1.6 An impressed current cathodic protection system for the tank shall be included in the tank bid item.

1.7 Copies of the Geotechnical Investigation of the storage tank sites are available at the office of the Engineer.

PART 2 - GOVERNING SPECIFICATIONS

The materials, design, welding, shop fabrication, erection, inspection and testing of the reservoirs, their foundations and their accessories shall conform to the latest editions of the following Standard Specifications, except as hereinafter stipulated.

2.1 AMERICAN WATER WORKS ASSOCIATION

A. AWWA D100 Welded Steel Tanks for Water Storage
B. AWWA D102 Coating Steel Water Storage Tanks
C. AWWA D652 Disinfection of Water Storage Facilities

2.2 AMERICAN CONCRETE INSTITUTE

A.	ACI 301	Specifications for Structural Concrete for Buildings
B.	ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete
C.	ACI 305	Hot Weather Concreting
D.	ACI 306	Cold Weather Concreting
E.	ACI 318	Building Code Requirements for Reinforced Concrete
F.	ACI 347	Guide to Formwork for Concrete

2.3 AMERICAN INSTITUTE OF STEEL CONSTRUCTION

A.	AISC S335	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

2.4 AMERICAN SOCIETY FOR TESTING AND MATERIALS

A.	A 36	Structural Steel
B.	A 53	Welded and Seamless Steel Pipe
C.	A 242	High Strength Low-Alloy Structural Steel
D.	A 307	Carbon Steel Externally and Internally Threaded Standard Fasteners
E.	A 325	High Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardener Washers
F.	A 440	High Strength Structural Steel
G.	A 441	High Strength Low-Alloy Structural Manganese-Vanadium Steel
H.	A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
I.	A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
J.	A 572	High-Strength Low-Alloy Colombian-Vanadium Steels of Structural Quality

2.5 AMERICAN WELDING SOCIETY

A.	ANSI/AWS D1.1-92	Structural Welding Code

2.6 NATIONAL ELECTRICAL CODE

2.7 NATIONAL SCIENCE FOUNDATION
NSF 61 Standard for Drinking Water System Components

2.8 STEEL STRUCTURES PAINTING COUNCIL

A.	SSPC VIS-89	Visual Standard for Abrasive Blast Cleaned Steel

2.9 REFERENCE SECTIONS

A. Section 02610 – Pipe, Valves and Fitting Materials for Potable and Reuse Water Pipelines
B. Section 03300 – Cast-in-Place Concrete

C. Section 09915 – Coating Systems for Steel Tanks
D. Section 16100 – Impressed Current Cathodic Protection System for Ground Storage Tanks.
E. Section 16101 – Sacrificial Anode Cathodic Protection System for Interior of Steel Tanks
F. Section 16102 – External Galvanic Cathodic Protection Systems for Steel Tank Bottoms
G. Section 17230 – Transmitters and Process Switches

PART 3 - DESIGN PARAMETERS

3.1 The following design parameters shall apply, and the structures shall safely withstand the following loads acting separately or in combination.

A. Weight of the structure
B. Weight of the water in the tank
C. Design Wind Speed 100 MPH 3 second burst
D. Snow Load 45 PSF
E. Seismic Zone One IBC 2004 and ASCE -7
F. Thermal:
   1. Seasonal change in temperature 100 degrees F.
   2. Differential with Ambient 40 degrees F.
G. Importance Factor, I 1.5
H. Site Classification, S C
I. Seismic:
   1. Short term Acceleration Factor, Ss = 0.37.
   2. Maximum Considered 1 Second Period Acceleration, S1 = 0.12.
   3. Use Group (essential facility) III
J. Recommended foundation bearing pressures are contained in the Geotechnical Report. The foundation design shown on the drawings is considered the minimum requirement for the concrete ring beam. As part of the tank manufactures design, the tank manufacture's structural engineer shall check the foundation design shown on the drawings. Based on these design calculations the foundation ring beam size and/or reinforcing may be increased as may be substantiated by the design. In no case shall the foundation ring beam and reinforcing be less that that shown on the drawings. The Contractor shall be responsible for securing any additional information, which he deems necessary to perform a complete design for the reservoir. Cost for the tank design shall be included in the bid price for the tank(s).

PART 4 - GENERAL TANK REQUIREMENTS

4.1 POTABLE WATER TANK REQUIREMENTS

A.	Potable Water Tank	60,000	gallons
B.	Minimum Operating Range	16	feet
C.	Maximum Fill Rate	700	gpm
D.	Maximum inlet/outlet air vent sizing based on 8-inch line break at 60 foot differential head, with air velocity exchange rate through vent not to exceed 20 feet per second.		

PART 5 - FOUNDATION

5.1 The steel water storage reservoir shall be supported on the foundation as indicated on the drawings, or as modified per the tank manufactures design.

5.2 The concrete shall conform to the requirements of SECTION 03300 – CAST IN PLACE CONCRETE of these specifications with a minimum compressive strength of concrete shall be 4000 psi at 28 days. Reinforcement shall comply with the latest revision of ASTM A615, Grade 60. Construction drawings shall be prepared by the Contractor and submitted to the Engineer for review and approval prior to constructing the foundation.

PART 6 - STEEL TANK

6.1 GENERAL

A. The steel tank shall be of all welded steel construction with an internally supported roof. The capacities and dimensions shall be as shown on the drawings and as specified herein; and they shall be designed as specified herein in full consideration of the GOVERNING SPECIFICATIONS, DESIGN PARAMETERS and GENERAL REQUIREMENTS as set forth in these specifications. The design, materials, fabrication, erection, inspection and testing of the steel tank and their appurtenances shall be in compliance with AWWA D100-96. The coating of the interior and exterior of the tanks and their appurtenances shall be in compliance with AWWA D102-97 and these specifications. The disinfection of the interior of the steel tanks shall be in compliance with AWWA D652-97 and these specifications.

B. All members shall be designed to safely withstand the maximum stress to which they may be subjected during erection and operation.

C. The minimum thickness of any steel plate in contact with water shall be 5/16 inch, including the steel floor plate. Other plates not subject to being submerged shall be a minimum thickness of 1/4-inch; unless the tank manufacture's structural design indicates a greater thickness.

D. Roof plates shall be fabricated and erected to provide the minimum and maximum lap lengths for welded lap joints required by Section 8.9 of AWWA D100, to provide the maximum separation between the two plates during lap joint welding required by Section 10.8 of AWWA D100; and to provide no separation of the two plates at the un-welded end of the bottom plate of the lap joint. A maximum of 6-inches overlap will be allowed without welding the underside of the roof plates. If roof plate laps exceed 6-inches the roof plates shall be welded on the underside.

E. The depth of the roof structure shall be designed such that it has a pitch of 1:12 minimum, and is above the overflow elevation and will not be in a submerged condition.

F. ALTERNATIVE DESIGN

1. The Tank designer has the option to employ AWWA Standard D-100-96, Section 14 – Alternative Design Basis for Standpipes and Reservoirs.
2. The requirements for materials, design minimum temperature, weld testing, and inspection requirements defined in Section 14, for the application shall be applied to

the design of the tank. Calculations submitted to the Engineer shall note compliance with each applicable section. In no case shall the furnished minimum plate thicknesses be less than the plate thicknesses specified in Part 6.1.C.

3. A schedule of shop and field testing shall be submitted to the Engineer prior to the start of shop fabrication.
4. Contractor shall install a nameplate identifying data specific to Section 14 design.
5. A Certificate of Compliance shall be submitted to the Engineer for approval.

6.2 INSPECTION

Inspection procedures for the steel tanks shall be in accordance with AWWA D100-96, Section 11, Inspection and Testing. Radiographic inspection of full penetration butt-welded joints shall be made by an independent testing company retained by the Contractor.

6.3 PAINTING

The interior and exterior of the steel tanks, including accessories and appurtenances, shall be cleaned, sandblasted and coated in accordance with the requirements of AWWA Standard D102-97 and SECTION 09915 - COATING SYSTEMS FOR STEEL TANKS of these specifications.

6.4 DISINFECTION

The interior of the steel tanks shall be cleaned of debris, cleaned, and disinfected in accordance with the requirements of AWWA D652-92, or following the procedures set forth in these specifications, whichever is more stringent. The Contractor shall submit a disinfection plan for review and approval of the Engineer.

6.5 LEAKAGE TESTING

The steel tanks shall be tested for leakage in accordance with the requirements of AWWA D100-96, or as specified in these specifications, whichever is more stringent. The contractor shall submit his plan for filling of the tank for review and approval of the Engineer. The plan shall include providing for an "air-gap" to prevent the possibility of cross contamination. This precludes the use of the inlet pipe to directly fill the tank.

PART 7 - ACCESSORIES:

7.1 GENERAL

The steel tank shall be of all welded steel construction with an internally supported roof. The capacities and dimensions shall be as shown on the drawings and as specified herein; and they shall be designed as specified herein in full consideration of the GOVERNING SPECIFICATIONS, DESIGN PARAMETERS and GENERAL REQUIREMENTS as set forth in these specifications. The design, materials, fabrication, erection, inspection and testing of the steel tank and their appurtenances shall be in compliance with AWWA D100-96.

7.2 Tank Openings: The following openings shall be provided in the tank shell and/or roof:

A. Shell: Two circular man-ways with hinged and bolted covers shall be provided for access at grade to the tank interior as indicated on the drawings. The man-ways shall be 36-inch diameter.

B. Shell: Inlet and outlet flanged connections as shown on the Drawings. The reuse water tank inlet shall have an internal deflector fitting to circulate tank volume. Fitting shall be gusseted to the tank wall, and supported from the tank floor.

C. Shell: two (2) – 2-inch half couplings for future disinfection, two (2) – ¾-inch full couplings for service connection, level gage, sample line and pressure transmitter.

D. Roof: (1) - 36-inch square roof hatch shall be provided as indicated on the drawings to provide access to the tank interior by means of the ladder from the tank roof to the tank floor. The opening shall have a raised curbing at least 4 inches in height with a cover that can be pad-locked, that overlaps the curbing at least two-inches in a downward direction. An EPDM gasket shall be used to make a positive seal when the hatch is closed. Provide a telescoping safety post for safe entry or exit from the roof hatch in an upright and balanced position.

E. Roof: One (1) 36-inch square roof hatch shall be provided as indicated on the drawings to provide access to the overflow weir box for inspection and maintenance. A removable fiberglass grating, load rated for minimum 300 PSF shall be installed in the hatch opening to restrict access except for maintenance. The opening shall have a raised curbing at least 4 inches in height with a cover that can be pad-locked, that overlaps the curbing at least two-inches in a downward direction. An EPDM gasket shall be used to make a positive seal when the hatch is closed. Provide a tie-off lug for safety harness equipment adjacent to the hatch.

F. Roof: one (1) flanged vent connection, matching the vent as specified.

G. Roof: hand holes with cover plates shall be provided as indicated per the direction of the Cathodic Protection Contractor, as specified, to install supports for anode string assemblies and instrumentation. Fasteners shall be captured to prevent loss into the tank.

H. Roof: 10-inch flanged connection with a 1/4-inch cover plate and gasket. Cover shall have a threaded coupling to accept the ultrasonic level instrument sensor specified in Section 17230. The Contractor is to locate the instrument in the roof, clear of any structural members, cathodic protection wires or any other obstruction. A minimum 3'-6" radius from the installed sensor shall be clear and unobstructed to the tank floor.

I. Floor: 8-inch drain, concrete encased, gate valve and blind flange as indicated on the drawings. The tank floor shall be reinforced internally at the floor penetration. The drain pipe shall be concrete encased in a 12-inch minimum radius from the tank to the valve box.

J. Ladders: Ladders shall be provided and installed as indicated on the drawings and as specified herein. The ladders shall comply with the standards set forth in Section 7.4 Ladders of AWWA D100-96 and shall conform to OSHA requirements for Fixed Ladders.

   1. Furnish an outside tank ladder as indicated on the drawings and conforming to the requirements of Section 7.4.1 of AWWA D100-96. Non-skid floor grating shall be furnished supported from the tank roof for access to the roof hatch, overflow access hatch and level instrument. The ladders shall extend a minimum of 48 inches beyond the upper platform elevation.
   2. Furnish an inside tank ladder extending to the bottom of the tank, accessible from the roof hatch and conforming to the requirements of Section 7.4.2 of AWWA D100-96.
   3. Interior and exterior ladders shall be equipped with a climbing rail system to be used with a fall prevention harness safety devices equal to Safe-T-Climb as manufactured by Air Spaces Devices, Inc. Two (2) complete safety harness assembly shall be furnished for each site. Furnish and install box for storage of the harness equipment.

Box shall be located at the electrical shelter and secured to the electrical mounting rail system. Box shall be have a hasp, and shall bear signage identifying contents.

Overflow weir: Weir box shall be fabricate steel, self draining to the overflow pipe. The weir shall be designed for the specified maximum fill rate with the water level creating a maximum of 4 inches of head above the overflow weir elevation. The entrance to the overflow line shall be reinforced with mitered bend to divert water to the overflow discharge box located at the tank base. The weir and discharge line shall be fully draining and allow no retention of water in any part of the interior. The overflow line shall terminate allowing a minimum on six-inches air gap to the discharge box. The pipe shall terminate with a cast iron flap gate. Flap gate shall be connected to the pipe with a flanged connection.

K. A tank vent shall be provided: Omega Vent Security Shroud as manufactured by Arc 3 Security Specialists. No substitutions are allowed. Vent shall be located centrally on the tank roof above the maximum weir crest elevation. It shall consist of a support frame, an steel cap and a screened open area. The support shall be fastened, including an insulating gasket, to a flanged opening in the tank roof. A minimum of 4 inches shall be provided between the roof surface and the vent cap.

The tank vent shall have an intake and relief capacity sized to prevent excessive pressure differential during the maximum flow rate of water either entering or leaving the tank. The overflow pipe shall not be considered as a vent. The maximum flow rate of water entering the tank shall be the maximum fill rate specified as listed under Part 4 above for each tank. The maximum flow rate of water leaving the tank shall be calculated by assuming a break in the inlet/outlet pipe at the differential head as listed above in Part 4, considering the tank is full. The vent shall be provided with a stainless steel bird screen mesh material, with an insect resistant fabric of 16-mesh stainless steel screen. The vent capacity shall be determined on the basis of the open area of the screen.

L. The tank level connection and associated gage and transmitter shall be protected by a vandal resistant fabricated steel box, welded to the tank shell and supported by the tank foundation. The box shall have a hinged cover that can be locked. The box shall be adequately sized to allow access to the piping for maintenance. The box shall have a window for viewing the level gage.

PART 8 - PIPE, FITTINGS AND VALVES

8.1 Pipe and fittings shall be provided and installed in accordance with the requirements of SECTION 02610 – Pipe, Valves and Fitting Materials of these specifications.

A. Inlet pipe shall be ANSI A53, Class B pipe, 0.250-inch wall thickness, mortar lined.
B. Outlet pipe shall be ANSI A53, Class B pipe, 0.250-inch wall thickness, mortar lined.
C. Buried pipe shall be wrapped as specified.
D. Exposed pipe to be painted in accordance with Section 09915 - Coatings Systems for Steel Tanks.
E. Install a vent valve at the high point of each inlet and outlet connection.

8.2 Pipe couplings shall be provided and installed in accordance with the requirements of SECTION 02610 – Pipe, Valves and Fitting Materials of these specifications.

A. Furnish a pipe coupling with pipe restraint for inlet and discharge pipe connections as shown on the drawings. Coupling shall be Dresser, Romac or Engineer approved equal. Pipe couplings and restraints shall be per the design pressure indicated on the drawings.

8.3 Valves shall be provided and installed in accordance with the requirements of SECTION 02610 – Pipe, Valves and Fitting Materials of these specifications.

A. Each tank inlet shall be equipped with a motor operated butterfly valve (MOV), as specified. A check valve and manual isolation butterfly valve shall be installed for one-way flow into the tank. Check valve shall be swing type with external weighted lever, as specified in Section 02610.

B. Tank outlet shall be equipped with a manual butterfly valve with operator and handwheel as specified.

C. Tank drain shall be equipped with a resilient seat gate valve, non-rising stem, with 2-inch operating nut and shaft extension and supports as shown on the drawings.

D. Tank valves 2-inches and smaller shall be full port, two-part ball valves, as specified.

PART 9 - ELECTRICAL

9.1 The following electrical devices and equipment shall be installed by the Contractor at each tank.

A. Conduit supports: coordinate size and placement of conduit supports, and weld Unistrut type mounting blocks for vertical and roof top support of electrical and instrument conduit as required for each tank. Conduit shall be grouped into a single vertical riser up the tank wall. Roof top conduit runs shall be located out of potential walk way areas. Vertical and horizontal support spacing shall not exceed 5-feet.

B. Cathodic Protection System: Refer to the applicable tank cathodic protection system section for the requirements of each tank. Contractor shall coordinate the conduit and power requirements for each system to ensure the complete electrical work.

C. Grounding: The tank shall be electrically grounded as shown on the plans and as specified in Section 16170 - GROUNDING AND BONDING. The tank shall have three connection lugs welded to the tank wall, suitable for connecting a #2 AWG grounding wire.

PART 10 - INSTRUMENTATION

10.1 The following fittings and equipment shall be installed by the Contractor at each tank for instrumentation use:

A. Pressure Gauge/ Sample: As indicated on the Drawings, a ¾-inch coupling is provided for attachment of the pressure gage, pressure transmitter, and sample line. Install a ¾" dielectric coupling, isolation ball valve, pipe fitting for ¾-inch sample line, gauge valve and pressure gauge conforming to ASME B40.1 Grade 2A. The gauge shall indicate a range of 0 – 35 feet of water. Gauge shall be 8-1/2 inch diameter dial by Trerice, Model 500XSS 85FSB500 or Engineer approved equal. Gauge shall be oriented and calibrated to indicate actual pressure/ water depth at the tank bottom. Gauge shall be supported from the tank foundation ring beam.

B. Sample line shall consist of ¾" CPVC schedule 80 pipe and fittings installed from the tanks sample connection to the residual analyzer device mounted as shown on the

drawings. Install a ¾" CPVC drain pipe and fittings from the residual analyzer drain connection to the tank overflow structure.

C. Level Sensor and Transmitter: A 10" flanged connection with a cover plate with an NPT coupling shall be provided in the tank roof for the mounting of an ultrasonic level sensor. Refer to Section 17230 for specification of the device to be furnished.

PART 11 - PAYMENT

Payment will be made for all work covered in this section at the contract lump, as shown in the proposal for designing, furnishing and constructing the 60,000 gallon steel reservoirs. Such payment will be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 15060
HANGERS AND SUPPORTS

SECTION 15060

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel pipe hangers and supports rods.
2. Equipment curbs and supports
3. Metal framing systems

1.2 RELATED SECTIONS

A. Specification sections that are related to the Work in this section.
1. Section 09900 – Painting
2. Section 15080 – Mechanical insulation
3. Section 15105 – Mechanical Piping

1.3 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.9 - Building Services Piping.
B. ASTM International:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.3 – Structural Welding Code – Sheet Steel
D. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
F. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL - Fire Resistance Directory.

1.4 SUBMITTALS

A. Submit in accordance with Section 01300.
B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

C. Welding certificates.
D. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with International Mechanical Code (IMC).
B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Plumbing Piping – DWV and Storm Drainage:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 or MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Vertical Support: Steel riser clamp.
   6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
B. Plumbing Piping - Water:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 or MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Vertical Support: Steel riser clamp.
   6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   7. Copper Pipe Support: Copper-plated, Carbon-steel ring.
C. Accessories
   1. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.2 EQUIPMENT CURBS AND SUPPORTS

A. Factory curb to match the equipment model.
B. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, tapered curb to match slope, and factory installed wood nailer.

2.3 METAL FRAMING SYSTEMS

A. Manufacturers:
   1. B-Line Systems.
   2. Unistrut Corp.
   3. Substitutions: Section 15000.
B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.
C. Metal Flashing: 26 gage thick galvanized steel.
D. Metal Counter flashing: 22 gage thick galvanized steel.
E. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft sheet lead.
   2. Soundproofing: 1 lb./sq. ft sheet lead.
F. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
G. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install backing materials to arrest liquid material leakage.
B. Do not drill or cut structural members.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9.
B. Support horizontal piping as scheduled.
C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
D. Place hangers within 12 inches of each horizontal elbow.
E. Use hangers with 1-1/2 inch minimum vertical adjustment.
F. Support vertical piping at every floor.
G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
H. Support riser piping independently of connected horizontal piping.
I. Provide copper plated hangers and supports for copper piping.
J. Design hangers for pipe movement without disengagement of supported pipe.
K. Prime coat exposed steel hangers and supports.
L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.

3.3 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24

inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Seal floor drains watertight to adjacent materials.

D. Provide curbs for mechanical roof installations. Flash and counter-flash with sheet metal; seal watertight. Attach Counter flashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.4 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.5 ROOF MOUNTED PIPING SUPPORT

A. Refer to Section 15050 for roof mounted piping supports.

PART 4 - PAYMENT

Payment for all work performed in this section will be included in the lump sum price for the Facility as shown in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 15075
MECHANICAL IDENTIFICATION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags
C. Stencils
D. Pipe Markers
E. Warning Signs

1.2 RELATED SECTIONS

A. Section 09900 - Painting

1.3 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.
B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Product Data: Provide manufacturers catalog literature for each product required.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.
B. Manufacturer's Instructions: Indicate installation instructions, special procedures, and installation.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturer:
   1. Seton Products.
   2. Lab Safety Supply.
B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Metal Tags:
   1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inch Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
   2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 inch high letters.
   3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
   4. Ductwork and Equipment: 1-3/4 inches high letters.
B. Stencil Paint: As specified in Section 09900, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.
B. Plastic Pipe Markers:
   1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
C. Plastic Tape Pipe Markers:
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 WARNING SIGNS

A. Manufacturer: Seton Products.
B. Other acceptable manufacturers offering equivalent products.
   1. Lab Safety Supply.
   2. Marking Services Incorporated.
   3. Substitutions: Refer to Section 15000 General Mechanical Requirements.
C. Description: Aluminum, size 14” high by 10” wide, aluminum per 29 CFR 1910.145.
D. Danger signs: Black lettering on white background, red “Danger”
E. Caution signs: Black lettering on yellow background

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with Section 09900 for painted pipe.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.
B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
C. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
D. Install tags using corrosion resistant chain. Number tags consecutively by location.
E. Apply stencil painting in accordance with Section 09900.
F. Identify control panels and major control components outside panels with plastic nameplates.
G. Identify valves in main and branch piping with tags.

H. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.3 SCHEDULES

A. Identification:
   1. Non-Potable Service Water, 3 and 4" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: 1 ¼ "-inch lettering with direction arrow
      c. Identification Type: Coiled plastic markers
      d. Identification: "Non-Potable Water"
      e. Color: White letters on Green background.
   2. Chlorine Gas, 1" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: ½"-inch lettering with direction arrow
      c. Identification pressurized chlorine gas: "Chlorine"
      d. Identification chlorine gas vacuum: "Chlorine" +"Vacuum"
      e. Color: Black letters on Yellow background.
   3. Sulfur Dioxide Gas, 1" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: ½"-inch lettering with direction arrow
      c. Identification pressurized chlorine gas: "SO2"
      d. Identification chlorine gas vacuum: "SO2" +"Vacuum"
      e. Color: Black letters on Yellow background.
   4. Solution Lines, 2" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: ¾ "-inch lettering with direction arrow
      c. Identification pressurized chlorine solution: "Chlorine"+"Solution"
      d. Identification pressurized sulfur dioxide solution: "SO2"+"Solution"
      e. Lettering Color: Black letters on Yellow background.
   5. Nitrogen Gas, 1" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: ½"-inch lettering with direction arrow
      c. Identification nitrogen gas: "Nitrogen"
      d. Color: White letters on Brown background.
   6. Gas Vent, 1" nominal pipe
      a. Label: self adhesive vinyl per ANSI A13.1-2007
      b. Identification Type: ½"-inch lettering with direction arrow
      c. Identification gas vent: "Vent"
      d. Color: Black letters on Yellow background.

B. Valve/ Operator Tags:
   1. Valves:
      a. Brass valve tags, 1½" diameter, ½" natural letters, brass jack chain
      b. Sequential numbering per mechanical valve list.

C. Signage Schedule:

1. Engraved laminate, adhesive backed, black capital gothic letters on white, wording centered.
2. Nameplate Schedule:
   a. Chlorine Facility

Size	Quantity	Line 1	Line 2
1” x 4”	2	Pump Station No. 1	
1” x 4”	2	Pump Station No. 2	
1” x 4”	2	Contact Basin	
1” x 4”	2	XCEL	
1” x 4”	1	Standby No. 1	
1” x 4”	1	Standby No. 2	
1” x 4”	2	Bank 1	
1” x 4”	2	Bank 2	
1” x 4”	2	Bank 3	
1” x 6”	1	Bank 1 Shut Off Valve	
1” x 6”	1	Bank 2 Shut Off Valve	
1” x 6”	1	Bank 3 Shut Off Valve	
1” x 6”	1	Vacuum Regulator No. 1	
1” x 6”	1	Vacuum Regulator No. 2	
1” x 6”	1	Vacuum Regulator No. 3	
1” x 6”	1	Vacuum Regulator No. 4	
1” x 6”	1	Bank 1 N2 Actuator	
1” x 6”	1	Bank 2 N2 Actuator	
1” x 6”	1	Bank 3 N2 Actuator	
1” x 6”	1	Bank 4 N2 Actuator	
1” x 6”	6	High / Low Vac. Switch	
1.5” x 6”	1	Gas Cabinet	Pump Station No. 1
1.5” x 6”	1	Gas Cabinet	Pump Station No. 2
1.5” x 6”	1	Gas Cabinet	Contact Basin
1.5” x 6”	1	Gas Cabinet	XCEL
1.5” x 6”	1	Gas Cabinet	Standby No. 1
1.5” x 6”	1	Gas Cabinet	Standby No. 2
3” x 8”	1	Bank 1 Weight	
3” x 8”	1	Bank 2 Weight	
3” x 8”	1	Bank 3 Weight	
4”x12”	1	Bank 1	
4”x12”	1	Bank 2	
4”x12”	1	Bank 3	

b.

c.

d. Sulfur Dioxide Facility

Size	Quantity	Line 1	Line 2
1” x 4”	2	Filter Complex	
e. 1” x 4”	2	Bank 1	
1” x 4”	2	Bank 2	
1” x 6”	1	Vacuum Regulator No. 1	
1” x 6”	1	Vacuum Regulator No. 2	
1” x 6”	1	N2 Actuator	
1” x 6”	1	High / Low Vac. Switch	
1.5” x 6”	1	Gas Cabinet	
3” x 8”	1	Bank 1 Weight	
3” x 8”	1	Bank 2 Weight	
Qt			

3. Warning Sign: Fiberglass sign, 14” x 10” x 0.1” thick, black letters on orange background
   a. “Warning” “Authorized Personnel Only”
4. Caution Sign: Fiberglass sign, 14” x 10” x 0.1” thick, black letters on yellow background
   a. “Caution” “Chlorine Area”
   b. “Caution” “Sulfur Dioxide Area”
5. NFPA Standard 704 Hazard sign, 10” x10”, 4” letters, for wall mounting.
   a. Chlorine: 3, 0, 1, OXY.
   b. Sulfur Dioxide, 3, 0, 0, COR

END OF SECTION

SECTION 15080
MECHANICAL INSULATION

SECTION 15080

MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Man Made Mineral Fiber
      b. Flexible elastomeric
   2. Adhesives
   3. Mastics
   4. Sealants
   5. Factory –applied Jackets
   6. Field-applied Jackets
   7. Tapes
   8. Securements

1.2 SUBMITTALS

A. Submit in accordance with Section 01300.
B. Product Data: Submit product description, thermal characteristics, thickness, and jacket, for each service, and location.
C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84. Factory label insulation, jacket and related materials with appropriate markings of applicable testing and inspection agency.
B. Insulation installed indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
C. Insulation installed outdoors: Flame-spread index of 7 or less, and smoke-developed index of 150 or less
D. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type, and grade, and maximum use temperature..
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Mineral-Fiber, Preformed Pipe Insulation
   1. Manufacturers:
      a. Knauf Insulation; 1000 (pipe insulation)
      b. Johns-Manville; Micro-Lok
      c. Owens Corning; Fiberglass Pipe Insulation
      d. Fibrex Insulations Inc.; Coreplus 1200
   2. Insulation: ASTM C547 Mineral or glass fiber bonded with thermosetting resin, Type I, grade A with factory-applied all service jacket (ASJ), 850 degrees F.

B. Mineral-Fiber Blanket Insulation
   1. Mineral or glass fibers bonded with a thermosetting resin, complying with ASTM C533, Type II and STM C1290, Type III with factory –applied foil, scrim, Kraft paper (FSK) jacket.
   2. Manufacturers:
      a. Knauf Insulation; Duct Wrap
      b. Johns-Manville; Microlite
      c. Owens Corning; All-Service Duct Wrap
      d. CertanTeed Corp.; Duct Wrap

C. Flexible Elastomeric
   1. Manufacturers:
      a. Aeroflex USA Inc.; Aerocel
      b. Armacell LLC; AP Armaflex
   2. Insulation: Closed cell, sponge or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.
B. Mineral Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A
   1. Manufacturers:
      a. Childers Products,; CP-82
      b. Foster Products Corp.; 85-20
      c. ITW TACC; S-90/80
      d. Marathon Industries, Inc.; 225
C. ASJ, and FSK Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
      a. Childers Products,; CP-82
      b. Foster Products Corp.; 85-20
      c. ITW TACC; S-90/80
      d. Marathon Industries, Inc.; 225
D. PVC Jacket Adhesive: Compatible with PVC jacket
      a. Dow Chemical Company; 739, Dow Silicone
      b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive

c. P.I.C Plastics, Inc.; Celulon Ultra Clear
d. Speedline Corporation; Speedline Vinyl Adhesive

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II
B. Vapor Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
   1. Available Products:
      a. Childers Products, Division of ITW; CP-35
      b. Foster Products Corporation, H.B. Fuller Co.; 30-90
      c. ITW TACC, Division of Illinois Tool Works; CB-50
      d. Marathon Industries, Inc.; 590
   2. Water-Vapor Permeance: ASTM E 96, procedure B, 0.00 perm at 43 mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
   5. Color: White.

2.4 SEALANTS

A. ASJ and PVC Flashing Sealants
   1. Manufacturers:
      a. Childers Products,; CP-76
   2. Materials shall be compatible with insulation materials, jackets and substrates.
   3. Color: White

2.5 FACTORY-APPLIED JACKETS

A. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
   2. ASJ-SSL ASJ with self sealing, pressure sensitive, acrylic-based adhesive covered bya removable protective strip; complying with ASTM C1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft paper backing; complying with ASTM C1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I.
   1. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
      a. Johns Manville; Zeston
      b. P..I.C. Plastics, Inc.; FG Series
      c. Speedline Corporation; SmokeSafe
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White
   4. Factory-fabricated fitting covers to match jacket if available; otherwise field fabricate.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136and UL Listed.
    a. Avery Dennison Corporation; Fasson 0835
    b. Ideal Tape Co; 428 AWF ASJ
    c. Venture Tape; 1540 CW Plus
    2. Width: 3-inches
    3. Thickness: 11.5 mils
    4. Adhesion: 90 ounces force/inch in width
    5. Elongation:2 percent

B. FSK Tape: Foil-faced, vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136and UL Listed.
    a. Avery Dennison Corporation; Fasson 0827
    b. Ideal Tape Co; 491 AWF FSK
    c. Venture Tape; 1525 CW
    2. Width: 3-inches
    3. Thickness: 6.5 mils
    4. Adhesion: 90 ounces force/inch in width
    5. Elongation:2 percent

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
    a. Avery Dennison Corporation; Fasson 0555
    b. Ideal Tape Co; 370 White PVC tape
    c. Venture Tape; 1506 CW NS
    2. Width: 2-inches
    3. Thickness: 6 mils
    4. Adhesion: 64 ounces force/inch in width
    5. Elongation:500 percent

2.8 SECUREMENTS

A. Bands:
    1. Available Products:
        a. Childers Products; Bands
        b. PABCO Metals Corp.; Bands
        c. RPR Products, Inc.; Bands
    2. Stainless Steel: ASTM A167 or ASTM A240, Type 316; 0.015 inch thick, ½ inch wide with wing seal.
    3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, ½ inch wide with wing seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
B. Verify surfaces are clean and dry, with foreign material removed.

3.2 PREPARATION

A. Coordinate insulation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
F. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Apply adhesives, mastics, and sealants ar manufacturer's recommended coverage rate and wet and dry film thicknesses.
I. Install insulation with factory-applied jackets as follows:
    1. Draw jacket tight and smooth.
    2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-inches on centers.
    3. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
J. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
K. Do not install insulation to the following:
    1. Vibration-control devices
    2. Testing agency labels and stamps.
    3. Nameplates and data plates.
    4. Manholes, handholes or cleanouts.
L. Factory Insulated Equipment: Do not insulate.
M. Finish insulation at supports, protrusions, and interruptions.
N. Nameplates: Bevel and seal insulation around; do not insulate over.
O. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
P. Maintain temperature during and after installation for minimum period of 24 hours.

3.4 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket insulation installation on Duct and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

B. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
5. RTUs: Return ductwork shall be internally lined only on the riser to the rooftop unit, and for 10'-0" horizontally each way from the return riser.

C. External Duct Insulation Application:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Insulation installation on fittings, valves, strainers, flanges and unions.
1. Install insulation with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using performed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

B. For services not specified to receive a field-applied jacket except for flexible elasometric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Inserts and Shields:
1. Application: All piping.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under finish jacket.

4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.

F. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Mineral fiber pipe insulation may be used in all areas of the building. Install mineral fiber pipe insulation in accordance with the following requirements.

B. Insulation installation on straight pipes and tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6-inches on centers.

C. Insulation installation on valves, pipe fittings and elbows, and specialties. Install preformed sections of same material as straight segments of pipe insulation when available. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjacent pipe insulation.

D. Blanket insulation installation on ducts and plenums: Secure with adhesive and insulation pins as specified.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

E. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2-inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with ½-inch outward-clinched staples, 1 –inch on centers. Install vapor barrier consisting of factory-applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Insulation Installation on Pipes and Tubes:
1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. For fittings and elbows, install mitered sections of pipe insulation.
3. For valves, install preformed valve covers. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings.
4. manufactured of same material as pipe insulation when available.

5. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.8 SCHEDULES

A. Plumbing Systems:
   1. Domestic Cold Water:
      a. Mineral Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch.
   2. Roof Drain Bodies and Roof Drainage Above Grade:
      a. Mineral Fiber Flexible:
         1) Pipe Size Range: All sizes.
         2) Thickness: 2 inch, .75 lb/cu.ft.
   3. Vents (Vents through roof shall be insulated 4'-0" down from roof line.)
      a. Manmade Mineral Fiber Insulation:
         1) Pipe sizes: All sizes.
         2) Thickness: 1/2 inch.

B. Supply Duct:
   1. Mineral Fiber Insulation
      a. Thickness: 1½" inch, .75 lb/cu.ft.

C. Return Duct:
   1. Mineral Fiber Insulation
      a. Duct liner, 1" fiberglass insulation.

D. Exhaust and Supply Fan Duct – None

PART 4 - PAYMENT

Payment for all work performed in this section will be included in the lump sum price for the Facility as shown in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 15141
MECHANICAL PIPING

SECTION 15141

MECHANICAL PIPING

PART 1 - PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section of the specifications provides for furnishing, installation, and testing of mechanical piping utilized for the chlorination and sequestering facilities, as specified and as shown on the drawings.
   1. Non-potable water piping
   2. Solution Piping
   3. Pipe painting
   4. Pipe identification
   5. Pipe unions

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

1.2 RELATED SECTIONS

A. Section 09900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
B. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports for placement by this section.
C. Section 15080 - Mechanical Insulation: Product requirements for piping insulation for placement by this section.
D. Section 15110 - Valves: Product requirements for valves for placement by this section.

1.3 REFERENCES

A. ASTM International:
   1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   2. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   3. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   4. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   6. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
   7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
   8. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

9. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
10. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
12. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
14. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

B. Chlorine Institute (CI)
1. Pamphlet #1 – The Chlorine Manual
2. Pamphlet #6 – Piping Systems for Dry Chlorine
3. Pamphlet #9 – Vaporizing Systems

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.
B. Water Samples: Specified in “Cleaning” Article.
C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system Protect.
B. Protect factory sealed piping until installed.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements.

2.2 WATER PIPING ABOVE GRADE

A. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.3 SOLUTION PIPING

A. CPVC Pipe: ASTM D1784, chlorinated polyvinyl chloride (CPVC) material.
   1. Fittings: ASTM D2846/D2846M, ASTM F437, ASTM F438, ASTM F439, or ASTM F441/F441M, CPVC.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.4 PRESSURIZED DRY GAS PIPING

A. Class 1 – Gas only, Vacuum to 150 psig, -20°F to 300°F. Steel Pipe: ASTM A-106 Grade B, seamless, Schedule 80, ASME B36.10. Pipe to be for gas service – factory cleaned, dried, and sealed.
   1. Fittings: ASTM A-105 forged steel, Class 3000 CWP, ASME B16.11.
   2. Gaskets: lead, 1/16" thick.

B. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.5 VACUUM DRY GAS PIPING

A. Class 1 – Gas only, Vacuum to 150 psig, -20°F to 300°F. PVC Pipe: ASTM D1785, Schedule 80, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

B. PE Tubing
   1. Polyethylene tubing: ¼ and 3/8 inch.

2.6 GAS VENTS

A. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2467, Schedule 80, PVC ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

B. PE Tubing
   1. Polyethylene tubing, ½ and 3/8 inch.

2.7 PIPE PAINTING

A. Refer to Section 09900 "Painting" for coating requirements for piping. Paint shall be suitable for application on PVC piping.

1.	Non potable	Blue
2.	Chlorine solution	Blue with green stripe
3.	Sulfur Dioxide solution	Blue with gray stripe
4.	Chlorine gas	Green
5.	Sulfur dioxide	Gray
6.	Vent	Gray

B. Apply paint after pipe is tested.

C. Apply gas reactive coating to pipe and equipment connections to signal gas leaks. ACW II, Inc., On Guard Acid/ Base Detecting Products, Represented by Ramco Manufacturing Co., Inc., www.ramco-safetyshields.com.

2.8 PIPE IDENTIFICATION

A. Apply pipe identification after painting is completed.

2.9 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. PVC Piping: PVC socket type, threaded connection with O-ring seal.
   2. CPVC Piping: CPVC type, threaded connection with O-ring seal.

B. Flanges for Pipe 3 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Gaskets: lead, 1/16" thick.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

D. **Elastomers:**
   1. Chlorine Gas – Viton
   2. Sulfur Dioxide - EPDM

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - GENERAL

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
G. Install non-conducting dielectric connections wherever jointing dissimilar metals.
H. Establish invert elevations, slopes for drainage as shown on drawings. Maintain gradients.
I. Slope piping and arrange systems to drain at low points.
J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
L. Install valves in accordance with Section 15110.
M. Install pipe identification in accordance with Section 15075.

3.4 INSTALLATION - WATER PIPING SYSTEMS

A. Install water piping system in accordance with ASME B31.9.

3.5 INSTALLATION – PRESSURIZED GAS PIPING SYSTEMS

A. Install piping systems piping in accordance with CI Pamphlet #6 – Piping Systems for Dry Chlorine.
B. Pipe and fittings shall be cleaned and dried and shall be free of grease, oil and dirt.
C. Pipe shall be supported to slope 1% toward the source of gas supply and to avoid possible liquid traps. Supports shall be spaced no more than 3-foot centers.
D. Prior to assembly, the threads shall be wrapped with Teflon tape or coated with Teflon based paste certified for gaseous service for a serviceable connection.
E. Install couplings and pressure gages where outlets are indicated as indicated on Drawings.
F. Cut pipe and tubing accurately and install without springing or forcing.
G. Install drip leg and trap heaters for any vertical pipe runs.
H. Exposed gas pipe shall be heat traced with a limiting temperature of 250°F.
I. Install a manifold valve for each container location. Install a flexible connector to connect the container supply to the manifold.
J. Install an in-line gas filter in the header pipe prior to the vacuum regulator.

3.6 INSTALLATION – VACUUM GAS PIPING SYSTEMS

A. Install piping systems piping in accordance with CI Pamphlet #6 – Piping Systems for Dry Chlorine.
B. Pipe and fittings shall be cleaned and dried and shall be free of grease, oil and dirt. Piping systems shall be cleaned and dried before being placed in service.
C. Pipe supports shall be spaced no more than 3-foot centers.
D. Pipe connections shall be solvent welded, utilizing threaded connections for removable assemblies only.

E. Prior to assembly, the threads shall be wrapped with Teflon tape or coated with Teflon based paste certified for gaseous service for a serviceable connection.
F. Install couplings and pressure gages where outlets are indicated as indicated on Drawings.
G. Cut pipe and tubing accurately and install without springing or forcing.
H. Sulfur dioxide gas pipe shall be heat traced.

3.7 FIELD QUALITY CONTROL

A. Test water piping system in accordance with applicable code.
B. Test for Pressurized Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9.
C. Gas piping systems: Pipe shall be tested before placing in service. Testing shall be done with dry air or nitrogen initially with a soap or commercial leak testing solution applied to all connections to test for leaks. Safety devices designed to protect the piping system shall be removed and connections capped prior to testing.
    1. Install piping supports and restraints prior to pressure testing.
    2. Test pressurized pipe to 200 psig with no loss of gauge pressure for a period of 15 minutes. During the pressure test, verify connections using soap or commercial leak testing solution.
    3. Test vacuum pipe to a pressure of 25 psig with no loss of gauge pressure for a period of 15 minutes. During the pressure test, verify connections using soap or commercial leak testing solution.
D. Following pressure test and application of pipe coatings and labels, apply On Guard Acid detecting paint.

3.8 CLEANING

A. Flush water piping systems to remove debris.
B. Gas piping systems shall be cleaned and dried before being placed in service. Flush pipe system with hot water, steam cleaned and dried to a dew point of -40°F. Protect processed pipe by closing valves, capping unconnected sections or sealing. Instruments and valves removed during cleaning operations shall be cleaned, reassembled and sealed.
C. Clean pipe systems as required for application of coatings and identification labeling.
D. Protect finished pipe systems throughout the duration of the project.

END OF SECTION

SECTION 16000
ELECTRICAL GENERAL PROVISIONS

SECTION 16000

ELECTRICAL GENERAL PROVISIONS

PART 1 - SCOPE

The requirements of the General Conditions, Special Conditions and General Requirements of these specifications are applicable and part of every section in Division 16 - Electrical. The Contractor shall furnish all labor, material, service, equipment, appliances and shall perform all operations in connection with the installation and testing of Electrical Work in accordance with contract drawings and specifications. Any material found to be defective will be rejected by the Engineer and the Contractor shall remove such defective material from the site of the work.

The Contractor shall be responsible for all such material furnished by him and he shall replace at his own expense all such materials found to be defective in manufacture or damaged after delivery.

It is anticipated that the interconnections between the various items of electrical equipment and the control system will require coordination and in some cases interface devices such as, but not limited to, couplings, flanges, reducers, converters, conduit, relays, terminal blocks, contacts, wiring etc…, will be required whether or not these items are shown on the drawings. It is the General Contractor's responsibility to provide the necessary coordination and interface devices at no additional cost to the Owner.

1.1 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the following:

A. National Electrical Code (NEC)
B. National Electrical Safety Code (NESC)
C. Terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required.

1.2 MODIFICATIONS

All modifications required by these applicable codes, rules, regulations and authorities shall be made by the Contractor; without additional charge to the Owner.

A. Underwriter's Laboratories (UL): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. The label of, or listing by, UL is required.
B. Standards: Where referenced in these specifications or on the drawings, the publications and standards of the following organization shall apply:
    1. American Society of Testing and Materials (ASTM)
    2. Institute of Electrical and Electronic Engineers (IEEE)
    3. Insulated Power Cable Engineers Association (IPCEA)
    4. National Electrical Manufacturers Association (NEMA)
    5. National Fire Protection Association (NFPA)
    6. American National Standards Institute (ANSI)
    7. Illuminating Engineering Society of North America (IESNA)

C. Should this Contractor observe any conflict or variation in the plans and specifications, he shall notify the Engineer in writing not later than ten (10) days prior to date of bid opening. Failure to clarify such variations will result in the Electrical Contractor bearing all costs arising from electrical work done contrary to either the specifications or drawings.

D. Electrical contractor shall coordinate all conduit runs, control wiring and electrical connections to equipment items furnished by Mechanical Contractor, General Contractor, Instrumentation Contractor, the Owner, and other contractors under other sections of these specifications.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval a minimum of five (5) copies plus those required for contractor use of all shop drawings after the material list has been approved and prior to ordering. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of a special nature or critical to the installation and pertinent data required for installation. All descriptive and technical data and shop drawings shall bear signed certification to the effect that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Where catalog data are submitted, the proposed items shall be clearly "flagged" or otherwise identified, so that no confusion exists. In addition to specific references or requests, submit shop drawings for the following applicable items: motor starters, switches, control devices, control systems and sensing equipment.

B. Substitutions: Proposed substitutions of electrical equipment, control devices, and other equipment shall be submitted with other submittal data. This request shall be accompanied by complete descriptions of the substitutes offered, including catalog cuts. The entire burden of proof of equality shall be placed on the Contractor and the decision of the Engineer shall be final.

C. Test Data: Provide 4 copies of all data obtained during tests required in Specifications. Data shall be organized in an orderly fashion, typed and indicate the result of each test.

PART 2 - PRODUCTS

The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make any required changes to wire and conduit size, controls, over current protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.1 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer unless specified otherwise. Where no specific material, apparatus or appliance is mentioned, any first-class product, with the approval of the Engineer may be used. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design. Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

PART 3 - EXECUTION

Fabrication, erection and installation of the complete electrical system shall be done in accordance with accepted good practice by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to impede the progress of the project. The Electrical Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.1 TEMPORARY POWER AND LIGHTING

A. Furnish and install temporary electrical facilities, if required, for construction and safety operations. No part of the permanent electrical systems or the existing electrical system may be used for temporary service unless approved by the Engineer. Provide separate electrical metering for temporary power.

3.2 PERFORMANCE TESTS

A. Thoroughly test all control circuits, fixtures, services and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances and devices shall be operated under load conditions. After the interior wiring system installation is complete and at such time as the Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these specifications.

B. Perform such tests as required by other sections of these specifications or as requested to prove acceptability. Furnish all instruments and labor for testing.

3.3 RECORD DRAWINGS

A. During progress of the work, maintain a clean full set of project plans to be used to record accurate red-lined changes to the installation of the system. Upon completion of the installation, submit the full set of red-lined drawings with all record data to the Engineer.

3.4 OPERATING INSTRUCTIONS AND MANUALS

A. Without additional charge to the Owner, furnish complete instruction to the Owner in the care, adjustment and operation of all parts of the electrical equipment and systems. Upon completion of the work, prepare and deliver to the Owner four (5) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating maintenance data.

B. The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

3.5 DRAWINGS

A. General: The electrical drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The structural drawings shall be considered as a part of the work insofar as these

drawings furnish the contractor with information relating to the design and construction of the building. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbows, pull boxes, and accessories as may be required to meet such conditions.

B. Field Measurements: The Contractor shall verify the dimensions governing the electrical work at the facility. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the drawings.

C. Coordination Drawings: In locations where several trades' work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation if deemed necessary by Engineer. Prepare and submit these coordination drawings, if required, prior to purchase-fabrication-installation of any of these elements involved in the coordination.

3.6 LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, conduits, controllers, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and detailed information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Engineer.

3.7 EXISTING ELECTRICAL

A. The existing electrical system information has been obtained from the most up-to-date source and documents; but their accuracy is not guaranteed. The Contractor shall familiarize himself with the existing conditions prior to preparing his bid.

B. Only the existing electrical affected by this Contract is shown on the drawings. Existing electrical not shown in the drawings is to remain in place and in operation. All existing electrical damaged during construction shall be repaired or replaced.

C. The Contractor shall be responsible for damage to existing walls or ceilings due to the electrical construction. Repairing of damage to the existing building shall be done by the proper trades involved.

3.8 ELECTRIC UTILITY SERVICE

A. Texas-New Mexico Power Company is the local electric utility company providing service to these facilities. The design and installation of Texas-New Mexico Power Company overhead and underground facilities will be done by Texas-New Mexico Power Company.

B. The contractor shall be familiar with and comply with the requirements of the latest version of the Texas-New Mexico Power Company Service Requirements book. Any equipment in the Service Requirements book that is stated to be provided or installed by the Customer shall be provided by and installed by the Contractor.

3.9 PAYMENT

A. Payment will be made for all work covered in this section at the contract lump sum price per job for items, as shown on the proposal. Such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16111
CONDUIT

SECTION 16111

CONDUIT

PART 1 - SCOPE

The conduit, fittings, conduit bodies, and accessories shall be inspected upon delivery and during the progress of the work. Any material found to be defective will be rejected by the Engineer and the Contractor shall remove such defective material from the site of the work.

The Contractor shall be responsible for all materials furnished by him and he shall replace at his own expense all such materials found to be defective in manufacture or damaged after delivery.

1.1 THIS SECTION INCLUDES THE FOLLOWING

A. Metal conduit.
B. Liquidtight flexible metal conduit.
C. Nonmetal conduit.
D. Fittings and conduit bodies.

1.2 RELATED SECTIONS

A. Section 16130 - Boxes.
B. Section 16190 – Supporting Devices.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable assemblies.
D. ANSI/NFPA 70 - National Electrical Code.
E. NECA "Standard of Installation."
F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01300. Accurately record actual routing of all conduits.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of General Conditions. Accept conduit on site and inspect for damage. Protect conduit from corrosion and entrance

of debris by storing above grade and providing appropriate covering. Protect PVC conduit from sunlight.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings. Verify routing and termination locations of conduit prior to rough-in. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Conduit Minimum Size: 3/4" unless otherwise specified.
B. Rigid Metallic Conduit (RMC): Galvanized Rigid Steel, ANSI C80.1.
C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.
D. Liquidtight Flexible Metal Conduit: Interlocked steel construction with PVC jacket. Flexible conduit shall be used only for connection to devices and structures subject to vibration. Maximum length of flexible conduit shall be 3 feet.
E. Rigid Nonmetallic Conduit: NEMA TC 2; Schedule 40 or 80 PVC. PVC Fittings and Conduit Bodies: NEMA TC
F. PVC Coated Rigid Metallic Conduit: NEMA RN1; PVC externally coated galvanized rigid steel conduit.

2.2 UNDERGROUND INSTALLATIONS

A. At 18" below grade and lower utilize Rigid Nonmetallic Conduit. If underground conduit run is not encased in concrete, place 4” of sand below and above conduit, and install a red plastic ribbon 8 inches below surface and above the top of the conduit for the entire length of the underground run.
B. Any conduit located less than 18” below grade shall PVC coated Rigid Metallic Conduit, or Rigid Nonmetallic Conduit encased in concrete.
C. When transferring from below grade to above grade, use PVC coated Rigid Metallic Conduit.

2.3 ABOVEGROUND INSTALLATIONS

A. Wet and Dry Locations: Use Rigid Metallic Conduit.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation". Install nonmetallic conduit in accordance with manufacturer's instructions. Arrange supports to prevent misalignment during wiring installation. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and splint hangers. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Fasten conduit supports to building structure and surfaces under provisions of Section 16190. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

B. Arrange conduit to maintain headroom and present neat appearance. Route exposed conduit parallel and perpendicular to walls. Maintain adequate clearance between conduit and piping. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C). All sharp edges shall be removed from ends after cutting. "Pipe" cutters shall not be used for cutting conduit. Bring conduit to shoulder of fittings; fasten securely.

C. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

D. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Conduit bends shall be made so as not to alter the cross-sectional area of the conduit.

E. Use suitable caps to protect installed conduit against entrance of dirt and moisture. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints. Provide suitable pull string in each empty conduit except sleeves and nipples.

F. All conduits identified on a conduit schedule shall be tagged at each end with metal tags engraved or stamped to identify the conduit according to the identification on the "schedule."

PART 4 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16123
WIRE AND CABLE

SECTION 16123

WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power wire and cable.
B. VFD cable.
C. Underground feeder and branch circuit cable.
D. Service entrance cable.
E. Control cable.
F. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 16111 - Conduit.
B. Section 16130 - Boxes.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of General Conditions.
B. Product Data: Provide for each cable assembly type.
C. Test Reports: Indicate procedures and values obtained.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.
B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wires and cables as required meeting Project Conditions.
C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.7 COORDINATION

A. Coordinate work with other trades.
B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Wire and Cable: Cable to be as manufactured by Carol Cable, Triangle PWC, Inc., Capital Wire & Cable Corp, or equal.
B. Control Cable: Belden, or equal

2.2 POWER WIRE AND CABLE

A. Description: Tray Cable Rated, multi-conductor, insulated wire.
B. Conductor: Copper.
C. Insulation Voltage Rating: 600 volts.
D. Insulation: ANSI/NFPA 70; Type THHN/THWN-2, 90 degrees C insulation for service entrance, feeders and branch circuits.

2.3 VFD CABLE

A. Description: Shielded motor supply cable for variable frequency drives. Materials used are designed to hold up to the non-linear power distortions associated with VFD drives.
B. Construction: Finely stranded tinned copper conductors; composite insulation; barrier tape; 100% shielding with foil tape and tinned copper braid, PVC black jacket, TC rated.
C. Nominal Voltage: 600V-UL, 1000V-UL AWM.
D. Color Code: Three black conductors with white numbers, plus green ground.
E. Temperature Rating: -25degrees C to +90 degrees C.

2.4 CONTROL CABLE

A. Analog I/O wiring shall be 16 AWG, twisted pair shielded, Belden 8719 or equal.
B. Discrete I/O wiring shall be 16AWG, 600V, stranded copper, THWN. Use multi-conductor cable when possible.

PART 3 - EXECUTION:

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.
B. Verify that mechanical work likely to damage wire has been completed.

3.2 INSTALLATION

A. Install products in accordance with manufacturer instructions.
B. Use copper conductor not smaller than 12 AWG for power and lighting circuits.
C. Use copper conductor not smaller than 16 AWG for control circuits.
D. Use 10 AWG copper conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
E. Use 10 AWG copper conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

F. Pull all conductors into raceway at same time.
G. Use suitable wire pulling lubricant for building wire 8 AWG and larger or runs longer than 50 feet.
H. Use suitable cable fittings and connectors.
I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
J. Clean conductor surfaces before installing lugs and connectors.
K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
L. Use split bolt connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
M. Use solderless pressure connectors with insulating covers or spring wire connectors for copper conductor splices and taps, 10 AWG and smaller.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Identify each conductor with its destination terminal block.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of General Conditions.
B. Inspect wire for physical damage and proper connection.
C. Measure tightness of bolted connections.
D. Utilize accurate torque wrench to tighten bolts and nuts on MCC.
E. Verify continuity of each branch circuit conductor.
F. Verify that all non-grounded conductors have an open circuit to ground.

PART 4 - PAYMENT

4.1 PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16130
BOXES

SECTION 16130

BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.
B. Pull and junction boxes.

1.2 RELATED SECTIONS

A. Section 16140: Wiring Devices: Wall plates in finished areas.
B. Section 16160: Cabinets and Enclosures.

1.3 REFERENCES

A. NECA: Standard of Installation.
B. NEMA FB 1: Fittings and Supports for Conduit and Cable Assemblies.
C. NEMA OS 1: Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
D. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
E. NFPA 70: National Electrical Code.

1.4 SUBMITTALS FOR CLOSEOUT

A. General Conditions: Contract Closeout: Submittals for Project closeout.
B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Farralloy Outlet Boxes: NEMA OS 1, galvanized.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.
C. Cast Boxes: NEMA FB 1, Type FD, and aluminum cast ferroalloy. Provide gasketed cover by box manufacturer.
D. Boxes and covers in Wet Well Locations shall be Cast Boxes with 40 mil gray PVC exterior coating, and 2 mil urethane interior coating.
E. Wall Plates for Finished Areas: As specified in Section 16140.

2.2 PULL AND JUNCTION BOXES

A. Surface Mounted Cast Metal Box: NEMA 250, Type 4 flat-flanged, surface mounted junction box, or as specified on drawings.
   1. Material: Galvanized cast iron, Cast aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
B. Boxes and covers in Wet Well Locations shall be Cast Boxes with 40 mil gray PVC exterior coating, and 2 mil urethane interior coating.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install boxes in accordance with NECA "Standard of Installation."
B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
D. Electrical boxes are shown on Drawings in approximate locations dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
E. Orient boxes to accommodate wiring devices as specified in Section 16140.
F. Maintain headroom and present neat mechanical appearance.
G. Install boxes to preserve fire resistance rating of partitions and other elements.
H. Locate outlet boxes to allow luminaires positioned as shown on plans.
I. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
J. Use adjustable steel channel fasteners for hung ceiling outlet box.
K. Support boxes independently of conduit.
L. Use gang box where more than one device is mounted together. Do not use sectional box.
M. Use cast aluminum outlet box in exterior locations and wet locations.
N. Large Pull Boxes: Use NEMA 4 enclosure.

3.2 INTERFACE WITH OTHER PRODUCTS
A. Coordinate installation of outlet box for equipment to be connected.

3.3 ADJUSTING
A. General Conditions - Contract Closeout: Adjusting installed work.
B. Install knockout closures in unused box openings.

3.4 CLEANING
A. General Conditions - Contract Closeout: Cleaning installed work.
B. Clean interior of boxes to remove dust, debris, and other material.
C. Clean exposed surfaces and restore finish.

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16140
WIRING DEVICES

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.
B. Receptacles.
C. Device plates.

1.2 RELATED SECTIONS

A. Section 16130 – Boxes.

1.3 REFERENCES

A. NECA – Standard of Installation
B. NEMA WD1 – General Requirements for Wiring Devices
C. NEMA WD 6 – Wiring Device – Dimensional Requirements
D. NFPA 70 – National Electric Code

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' documented experience.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements o9f NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
   1. General Electric Model 5951-2G
   2. Hubbell Model 1221-I
   3. P&S Model 20-AC-1-1
   4. Or approved equal.
B. Description: NEMA WD 1, Specification Grade, AC only general-use snap switch.
C. Body and Handle: Ivory plastic with toggle handle.
D. Ratings:
   1. Voltage 120/277 volts, AC
   2. Current: 20 amperes.

E. Wet Well Location: Switches in the wet-well area shall be explosion proof type, rated Class I, Division II, and Group D.

2.2 RECEPTACLES

A. Manufacturers:
   1. General Electric Model 5362-2
   2. Hubbel Model 5362-1
   3. P&S Model 5362-1
   4. Or approved equal.
B. Description: NEMA WD 1, Specification Grade general-use receptacle
C. Device Body: Ivory plastic.
D. Configuration: NEMA WD 6, type as specified and indicated.
E. Convenience Receptacle: Type 5-20.
F. GFCI Receptacle: 20 amp rated convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
G. Outdoor receptacles shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted.
H. Wet Well Location: Receptacles in the wet-well area shall be explosion proof type, rated Class I, Division II, and Group D. Contractor shall provide one attachment plug for each explosion proof receptacle.

2.3 WALL PLATES

A. General: Provide plates for each switch and receptacle device. Provide plates to match material of box to which it is attached.
B. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. Plates for cast type boxes shall be of the cast, vapor tight type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions – Instructions to Bidders: Verification of existing conditions prior to beginning work.
B. Verify that outlet boxes are installed at proper height.
C. Verify that wall openings if required are neatly cut and will be completely covered by wall plates.
D. Verify that branch circuit wiring installation is completed, tested and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install in accordance with NECA “Standard of Installation.”

B. Install devices plumb and level.
C. Install switches with OFF position down.
D. Install receptacles with grounding pole on bottom.
E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
F. Connect wiring devices by wrapping conductor around screw terminal.
G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights specified and indicated on drawings.
B. Install wall switch 44 inches above finished floor.
C. Install convenience receptacle 18 inches above finished floor.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.
B. Operate each wall switch with circuit energized and verify proper operation.
C. Verify that each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. General Conditions – Contract Closeout: Adjusting installed work.
B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. General Conditions – Contract Closeout: Cleaning installed work.
B. Clean exposed surfaces to remove splatters and restore finish.

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16170
GROUNDING AND BONDING

SECTION 16170

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.
B. Equipment grounding conductors.
C. Bonding.

1.2 RELATED SECTIONS

A. Section 02900 – Pipe Bonding and Test Stations
B. Section 03300 – Cast-In-Place Concrete.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe if available.
B. Metal frame of the building if available.
C. Concrete-encased electrode.
D. Rod electrode.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 1 ohm.

1.6 SUBMITTALS

A. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of General Conditions.
B. Accurately record actual locations of grounding electrodes.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper or Copper-clad steel.
B. Diameter: 3/4 inch.
C. Length: 10 feet.

2.2 EXOTHERMIC CONNECTIONS AND RELATED MATERIAL

A. Exothermic connectors, rod electrodes and other grounding related equipment shall be supplied by a manufacturer with 10 years experience in manufacturing

2.3 WIRE

A. Material: Stranded copper.
B. Foundation Electrodes: 2 AWG X 20 feet long.
C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements or as indicated on drawings or in specifications if larger.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions. Exothermically weld all connections.
B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
C. Provide grounding electrode conductor and connect to reinforcing steel at two locations in foundation footing. Bond steel together.
D. Provide foundation electrodes for all blowers, pumps and other skid mounted equipment with #4 CU ground wire from electrode to base. Exothermic weld at all connections.
E. Provide bonding to meet Regulatory Requirements.

3.3 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

SECTION 16190

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.
B. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.
B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Support devices located in Wet Well locations shall have 20 mil gray PVC exterior coating. Support devices in all other areas shall be hot-dipped galvanized for adequate corrosion resistance.
B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
C. Anchors and Fasteners:
    1. Concrete Structural Elements: Use expansion anchors, powder actuated anchors and preset inserts.
    2. Steel Structural Elements: Use beam clamps, spring steel clips and steel ramset fasteners.
    3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
    4. Sheet Metal: Use sheet metal screws.
    5. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
D. Obtain permission from Architect/Engineer before drilling or cutting structural members.
E. Fabricate supports from structural steel as indicated on drawings. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use lock washers under all nuts.
F. Install surface-mounted cabinets and panelboards with minimum of four anchors.
G. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
H. Install conduit supports a maximum spacing specified in the NEC.

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16265
VARIABLE FREQUENCY AC DRIVE

SECTION 16265

VARIABLE FREQUENCY AC DRIVE

PART 1 - GENERAL

1.1 SUMMARY

A. This section shall specify a variable frequency ac drive (VFD).

1.2 REFERENCES

A. IEEE C62.41 (Institute of Electrical and Electronics Engineers) - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
B. IEEE Standard 519-1992, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
C. NEMA FU 1 (National Electrical Manufacturers Association) - Fuses.
D. NEMA ICS 2 – Industrial Control Devices, Controllers and Assemblies.
E. NEMA ICS 3.1 (National Electrical Manufacturers Association) - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.
F. NEMA ICS 6 – Enclosures for Industrial Controls and Systems.
G. NEMA ICS 7 (National Electrical Manufacturers Association) - Industrial Control and Systems: Adjustable Speed Drives.
H. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum).
I. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Include a copy of this specification section with each paragraph checked with which the proposed unit fully complies. Paragraphs having requirements which are not met or where alternatives are proposed shall be numbered on the right hand side. A corresponding numbered paragraph shall be attached to the specification indicating equipment differences or proposed modifications. Submittal not having the above documentation will be rejected.
C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
D. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
E. Total Harmonic Distortion Calculation: These calculations shall be calculated under worst case conditions in accordance with the procedure outlined in IEEE standard 519-1992, and submitted with Shop Drawings and Product Data.
F. Test Reports: Indicate field test and inspection procedures and test results.
G. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 3.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.5 QUALITY ASSURANCE

A. All products shall be UL labeled and meet the requirements of UL-508C
B. Total harmonic distortion shall be calculated under worst case conditions in accordance with procedure outlined in IEEE Standard 519-1992.
C. The VFD shall be tested by the manufacturer before shipping. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions.
D. All optional features shall be functionally tested at the factory for proper operation.
E. Factory test documentation shall be available upon request.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience, and with representative capable of on-site assistance available on site within 24 hours of drive failure.
B. The manufacturer shall be both ISO-9001 and ISO14001 certified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 – Material and Equipment: Product storage and handling requirements.
B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

1.9 WARRANTY

A. Section 00700: Standard Conditions Of The Construction Contract
B. Furnish manufacturer extended warranty for variable frequency controllers for a period of two years after substantial completion certificate has been issued. This warranty as a minimum shall include parts and labor for any repairs within the warranty period.

1.10 MAINTENANCE SERVICE

A. The VFD manufacturer shall provide a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified technicians for VFD field repair shall not be acceptable as start-up agents.

1.11 MAINTENANCE MATERIALS

A. Manufacturer shall provide a recommended spare parts list.
B. Furnish two of each air filter.

PART 2 - PRODUCT

2.1 GENERAL

A. Furnish a complete VFD as specified herein for loads designated to be variable speed. The VFD and all required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and fused disconnect. Approved drive manufacturers and model series are as follows; no substitutions will be accepted.
   1. ABB – ACS 550
   2. Allen Bradley - PowerFlex
   3. Danfoss – VLT Aqua Drive
B. VFD capabilities listed in this specification are minimum requirements that are not necessarily all inclusive for manufacturers and/or models listed.
C. VFD dimensions indicated on drawings are based on information available at the time of design. Contractor shall verify that the VFDs submitted for this project will comply with NEC working space requirements, as well as its own spacing requirements for adequate air flow. If VFDs furnished for installation have dimensions other than indicated on drawings, the Contractor shall make any required changes to wire and conduit to accommodate the equipment supplied without additional charge to the Owner.
D. Maximum Dimensions of VFDs shall be as shown on the drawings.
E. VFD shall be bottom entry and bottom exit.

2.2 DISCONNECT

A. Combine VFD with a fused disconnect in common enclosure. Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified person. Include means to lock the disconnect in the OFF position.
B. Fuse size shall be as recommended by VFD manufacturer.

2.3 CAPABILITIES

A. VFD’s shall be variable torque rated.
B. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up 200 ft (unshielded) without tripping.
C. The VFD shall be capable of producing rated RMS fundamental output voltage without increasing the input voltage above motor nameplate value.
D. The VFD must be able to source the motor’s full load nameplate amperage on a continuous basis, and be capable of running the motor at it’s nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.
E. The VFD shall be able to provide full torque at any speed up to the base speed of the motor.
F. The VFD shall be able to provide it’s full rated output current continuously and 110% of rated current for 60 seconds.

G. VFD shall provide full torque to the motor given input voltage fluctuations of up to ± 10% of the rated input voltage. Line voltage reductions up to 15% shall not cause the VFD to trip.
H. The VFD shall have input surge protection to withstand surges of 2.3 times line voltage for 1.3 msec.
I. VFD shall be capable of detecting phase imbalance and phase loss on the input side of the VFD.
J. VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
K. VFD enclosures shall be made of metal to minimize RFI.
L. VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.
M. VFD shall provide 24VDC, 100VA Control Power.
N. The VFD shall have one 4-20mA analog input signal for remote speed setpoint.
O. The VFD shall have two 4-20mA analog output signals for motor speed and motor current.
P. When in AUTO mode, the VFD shall be capable of receiving discrete inputs from the PLC that initiate the following actions:
    1. Start
    2. Stop
    3. Fault Reset
Q. The drive shall provide 24VDC/2A rated dry contact relay outputs that indicate the following status':
    1. Drive in Manual
    2. Drive in Auto
    3. VFD Ready
    4. VFD Running
    5. VFD Fault
R. All motor and pump protection shall be independent of the Station controller. Protection devices that are required by the pump or motor, and are not covered in this section, shall be incorporated into the VFD control at no additional cost to the owner.

2.4 DESIGN

A. VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge. VFDs utilizing controlled SCR rectifiers shall not be acceptable.
B. The VFD shall maintain a displacement power factor of near unity regardless of speed and load.
C. The VFD shall provide dual built-in DC link reactors to minimize power line harmonics and to provide near unity power factor. VFD's without a DC link reactor shall provide a 5% impedance line side reactor, at a minimum.
D. The VFD shall have the option of an integral RFI filter.
E. Employ microprocessor-based inverter logic isolated from power circuits.
F. Employ pulse-width-modulated output design utilizing current IGBT inverter technology

2.5 COMMUNICATIONS CAPABILITY

A. The VFD shall have as standard a RJ-45 Ethernet port which allows Ethernet communication to the Human Machine Interface (HMI) computer.
B. The VFD shall have the capability of communicating the following through the Ethernet Communications:
    1. Line Fault

2. Ground Fault
3. Phase Reversal
4. Jam Fault
5. Stall
6. Overcurrent
7. Over Voltage
8. Under Voltage
9. Voltage Unbalance
10. Over Temperature
11. Overload
12. Excessive Starts Per Hour
13. Three Phase Currents
14. Three Phase Voltage
15. Power in KW
16. Power Usage in KWH
17. Power Factor
18. Elapsed Time
19. Motor Speed
20. Motor Start
21. Motor Stop

2.6 RATINGS

A. Rated Input Voltage: 480VAC, 3 phase, 60Hz.
B. Motor: Horsepower as shown on One-line drawings, 480 VAC, 3 phase, 60HZ.
C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
D. Operating Ambient: 0 degrees C to 50 degrees C.
E. Minimum Efficiency at Full Load: 95 percent.
F. Time to Stop: 0 to 3,600 seconds (field adjustable)

2.7 PRODUCT OPTIONS AND FEATURES

A. The VFD shall have a temperature controlled cooling fan for quiet operation.
B. Volts per Hertz Adjustment: Plus or minus 10 percent.
C. Current Limit Adjustment: 60-110 percent of rated current.
D. Acceleration Rate Adjustment: 0.5-600 seconds.
E. Deceleration Rate Adjustment: .05-600 seconds.
F. Include undervoltage release.
G. Safety Interlocks: Furnish terminals for an external fault to inhibit starting under manual, and automatic modes.
H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
I. Ground Fault Detection: Sense ground fault current and shuts down the drive.

2.8 FABRICATION

A. VFDs are to be floor-mounted, bottom entry and bottom exit.
B. Wiring Terminations: Input and output power cable connections shall accommodate the conductor materials and sizes indicated on drawings.

C. Enclosure: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises and accessible only to qualified personnel. Front cover to be solid.
D. Finish: Manufacturers standard enamel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify building environment is maintained within service conditions required by manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 3.1.
B. Tighten accessible connections and mechanical fasteners after placing controller.
C. Select and install overload heater elements in motor controllers to match installed motor characteristics.
D. Install white lettering on black background engraved plastic nameplates. Nameplate to be 2 inches in height.
E. Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
F. Ground and bond controller in accordance with Section 16170.
G. Install VFDs plumb. Provide supports in accordance with Section 16190.
H. Height: 5’ 6” maximum to all operating or monitoring devices.

3.3 STARTUP

A. Start-Up and programming of the VFD and any other supplied components, shall be done at project site by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified technicians for VFD field repair are not acceptable as start-up agents.
B. The manufacturer shall provide free 24-hr. customer technical support.

3.4 FIELD QUALITY CONTROL

A. Section 17000 – General Requirements For Instrumentation.
B. Inspect and test in accordance with other specification sections and NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 3.1.

3.5 DEMONSTRATION AND TRAINING

A. Furnish 4 hours of instruction for 4 persons. Training to be conducted at project site with authorized manufacturer's representative.

PART 4 - PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16441
ENCLOSED SWITCHES

SECTION 16441

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service Disconnect

1.2 REFERENCES

A. NEMA KS 1 - Enclosed Switches.
B. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of General Conditions.
B. Product Data: Provide switch ratings and enclosure dimensions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As specified on drawings, in specifications, or equal approved by Engineer.

2.2 SERVICE DISCONNECT

A. Disconnect shall be Service Entrance Rated, NEMA 3R.
B. Minimum integrated short circuit rating of 20,000 amperes RMS symmetrical at 480 VAC
C. Neutral shall be bonded to ground at this location per NEC recommendations.
D. Switching device shall be a thermal-magnetic molded case circuit breaker with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in ON and OFF positions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches and transfer switches where indicated.
B. Install fuses in fusible disconnect switches.
C. Provide adhesive label on inside door of each switch having fuses indicating UL fuse class and size for replacement.

PART 4 - PAYMENT

A. Payment will be made for all work covered in this section at the contract lump sum price as shown in the proposal. Such payment shall be complete compensation for the complete performance of the work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16470
PANELBOARDS

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. 120/208 VAC Distribution Panelboards

1.2 RELATED SECTION

A. Section 16190 - Supporting Devices

1.3 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."
B. NEMA AB 1 - Molded Case Circuit Breakers
C. NEMA PB 1 - Panelboards
D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
E. NFPA 70 - National Electrical Code

1.4 SUBMITTALS

A. Submit under provisions of General Conditions.
B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.5 MANUFACTURER'S INSTALLATION INSTRUCTIONS

A. Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of General Conditions. Record actual locations of Products; indicate actual branch circuit arrangement.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of General Conditions. Maintenance Data: Include spare parts data listing; and recommended maintenance procedures and intervals.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing of the Products specified in this section with minimum five years experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.11 GENERAL CONDITIONS

A. Provide two of each panelboard key if required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Independently mounted panelboards shall be manufactured by the following:
   1. Square D
   2. Cutler Hammer
   3. Or equal.

2.2 DISTRIBUTION PANELBOARDS

A. Panelboards 120/208 VAC, 1 phase, 3 wire, 60 Hertz
B. Service Conditions:
   1. Temperature: 105 degrees F
   2. Altitude: 4000 feet
C. Bus: Copper
D. Provide copper ground bus in each panelboard. Minimum integrated short circuit rating: 50k amperes RMS symmetrical at 208 VAC. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breaker accessory trip units and auxiliary switches as indicated.
E. Enclosure: NEMA 12 rated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install panelboards plumb. Provide supports in accordance with drawings and Section 16190. Height: 6 ft maximum to top of panelboard. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Spare slots shall be labeled as such in erasable pencil on directory. Provide black on white engraved plastic nameplates.

3.2 FIELD QUALITY CONTROL

A. Field inspection and test for grounds on each circuit after installation is completed. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16670
SURGE PROTECTIVE DEVICE

SECTION 16670

SURGE PROTECTIVE DEVICE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge Protective Device SPD, former Transient Voltage Surge Suppression devices, (abbreviated as TVSS) SPD will be used in this specification and on all drawings.

1.2 RELATED SECTIONS

A. Section 16123: Building Wire and Cable
B. Section 16170: Grounding and Bonding
C. Section 16160: Cabinets and Enclosures

1.3 REFERENCES

The specified system shall be designed, manufactured, tested and installed in compliance with:

A. Canadian Standards Association (CSA)
B. American National Standards Institute and
C. National Electrical Manufacturer Association (NEMA)
D. Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, and C62.45)
E. Federal Information Processing Standards Publication 94 (FIP PUB 94)
F. National Fire Protection Association (NFPA 20, 70, 75 and 780)
G. Underwriters Laboratories (UL 1449 3rd. Ed., UL 1283,) MIL-STD-220A

1.4 SYSTEM DESCRIPTION

A. Includes electrical and mechanical requirements for a high-energy transient voltage surge suppression system. Specified system shall provide effective high energy surge current diversion, sine wave tracking for electrical line noise filtering and be suitable for application in ANSI/IEEE C62.41 Category A, B, and C environments, as tested by ANSI/IEEE C62.11, C62.45 and MIL-STD-220A.
B. System shall be connected in parallel with the protected system; no series connected elements shall be used which limit load current or kVA capability.

1.5 SUBMITTALS FOR REVIEW

A. Submit under provisions of Section 1300
B. Provide dimensions and materials of each component. Include isolation switch data.
C. Documentation of specified system's UL 1449 Listing and clamping voltage ratings of all protection modes shall be included as required product data submittal information.
D. Documentation of the specified system's UL 1283 Complimentary Listing shall be included as required product data submittal information.
E. Independent fuse coordination tests from a nationally recognized independent testing laboratory.

1.6 PROJECT CLOSEOUT SUBMITTALS

A. Manufacturer shall furnish an installation manual with installation, start up, trouble-shooting guide and operating instructions for the specified system.
B. Electrical and mechanical drawings shall be provided by the manufacturer, which show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.
C. Record actual location of SPD.

1.7 QUALIFICATIONS

Manufacturer: Company specializing in the manufacture of SPD equipment for with minimum 5 years experience.

1.8 REGULATORY REQUIREMENTS

A. Product Listing: UL listed under UL 1449 (Rev 09/2009) Standard for Surge Protective Device (SPD) and the surge ratings shall be permanently affixed to the SPD.
B. Complimentary listed to UL 1283 Standard for EMI/RFI Facility Filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Phoenix Contact
B. Advanced Protection Technologies, Inc.
C. Approved equal.

2.2 OPTIONS

A. Unit shall provide a monitor with surge counter, status LEDs and audible alarm with remote monitor capability.
B. All manufacturers shall submit independent test data from a nationally recognized testing laboratory for overcurrent protection, protection modes, and compliance with UL 1449 ratings.
C. Unit shall be housed in a NEMA 4 wall mounted enclosure.

2.3 ENVIRONMENTAL REQUIREMENTS

A. Storage temperature range shall be -55 to +85 C (-67 to +187 F)
B. Operating temperature range shall be -40 to +50 C (-40 to +122 F)
C. Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.
D. SPD shall not generate any appreciable audible noise.
E. Unit shall not generate any appreciable magnetic fields and shall be suitable for use directly inside computer rooms.

2.4 ELECTRICAL REQUIREMENTS

A. Nominal system operating voltage shall be 120/208 three phase WYE, 4 wire plus ground.
B. Maximum Continuous Operating Voltage (MCOV) shall be greater than 115% of the nominal system operating voltage to ensure the ability of the system to withstand temporary RMS overvoltage (swell) conditions.
C. Operating frequency range of the system shall be at least 47 to 63 Hertz.
D. All protection modes (including Neutral to Ground) of the SPD shall be internally fused at the component level with the fuses IxIxT capability to allow the suppressor's maximum rated transient current to pass through the suppressor without fuse operation. If the rated IxIxT characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. The fusing shall be capable of interrupting up to 100-kA symmetrical fault current with 600 VAC applied. This overcurrent protection circuit shall be monitored and provide indication of suppression failure/operability. Conductor level fuses or circuit breakers internal or external to the SPD shall not be acceptable. Contractor to furnish submittal documentation of proper fuse coordination of actual fault tests from a nationally recognized testing laboratory for product approval.

2.5 PROTECTION MODES

A. Protection Modes:
   1. Line to Neutral Protection
   2. Neutral to Ground Protection
   3. Line to Ground Protection
   4. Line to Line Protection
B. SPD surge current capacity shall be 200 kA per phase.
C. SPD system shall provide a joule rating that meets or exceeds the requirements of ANSI/IEEE C62.41 Category C delivery capability.
D. Typical response time of all suppression components shall be less than 1 nanosecond.

2.6 SURGE SUPPRESSION COMPONENTS

A. The TVSS unit shall display the combined total number of transient voltage surges detected from L-N, L-G, N-G, and L-L since the counter was last reset.
B. Provide dry contacts to monitor ON/OFF and alarm status.
C. Alarm Silence, reset, and test functions.
D. Indication of full or partial loss of protection
E. Individually fused suppression modules.
F. AC Tracking Filter: EMI/RFI filtering up to –50dB from 100 kHz to 100 MHz.

PART 3 - EXECUTION

3.1 INSTALLATION
A. The SPD shall be installed outdoors adjacent to the main disconnect switch.
B. The contractor shall follow the SPD manufacturer's recommended installation practices and comply with all applicable codes.
C. Manufacturer shall furnish an installation manual with installation, start up, trouble-shooting guide and operating instructions for the specified system.

D. Electrical and mechanical drawings shall be provided by the manufacturer, which show unit dimensions, weights, component and connection locations, mounting provisions, connection details and wiring diagram.
E. No sharp bend will be allowed in wiring from SPD unit to ground.

3.2 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.
B. Verify that all connections a properly bonded.

3.3 WARRANTY

A. Manufacturer shall provide a full five year warranty from date of shipment against any failure when installed in compliance with manufacturer's written instructions, UL listing requirements, and any applicable national or local electrical codes.

PART 4 - PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 16990
ELECTRICAL SYSTEM TESTING AND START-UP

SECTION 16990

ELECTRICAL SYSTEM TESTING AND START-UP

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing procedures and methods required prior to acceptance of electrical systems by Owner. Electrical system start-up procedures.

1.2 RELATED SECTIONS

A. Section 16000: Electrical General Provisions
B. Section 16123: Building Wire And Cable
C. Section 16170: Bonding And Grounding
D. Section 16470: Panelboards
E. Section 17000: Instrumentation & Control Provisions

1.3 REFERENCES

A. National Electrical Code - NEC
B. National Electrical Manufacturer's Association - NEMA
C. American Society for Testing and Materials - ASTM
D. Institute of Electrical and Electronic Engineers - IEEE
E. American National Standards Institute - ANSI
F. ANSI C2 - National Electrical Safety Code
G. ANSI Z244-1 - American National Standard for Protection
H. Manufacturer's instruction manuals applicable to each particular apparatus.
I. ICEA – Insulated Cable Engineers Association

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01300. Calibration of all equipment utilized in electrical system tests must be documented and capable of being verified. Accuracy of test instruments shall be directly traceable to the National Bureau of Standards. Analog field instruments shall be calibrated within 6 months of use. Digital field instruments shall be calibrated within 12 months of use. Leased instruments shall be calibrated within 12 months of use where the accuracy is guaranteed by the lessor. Accurately record field data obtained during tests in a manner acceptable to Owner. Provide three copies of tests summary to Owner in a form acceptable to Owner.

PART 2 - TEST REQUIREMENTS

2.1 CABLE TESTS

A. Power Cable – 600V and Below:

1. All power cables shall meet or exceed the applicable ICEA test requirements for the type of insulation used and the application. Verification shall be provided by the manufacturer in the form of published literature or by submittal.
2. After installation and before rated voltage is applied to any power cable #8 AWG or larger, a DC insulation check shall be made for each cable with a megohmmeter. Applied potential shall be 1000 Volts DC for 1 minute. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable method. For any reading less than 100 megohms the cause of the low reading shall be corrected or the cable replaced.

2.2 GROUNDING SYSTEMS

A. Inspect ground system for compliance with plans and specifications. Perform three point fall-of-potential test per IEEE Standard No. 81, Section 9.04 on the main grounding electrode, Resistance to ground shall be no greater than one ohm. Contractor shall be responsible for installing additional electrodes as required to lower resistance to one ohm, if greater, at no additional expense to Owner.

2.3 FIELD DEVICE TESTS

A. Visually inspect all electrical equipment for physical damage and proper installation. Calibrate devices per manufacturer's recommendations. Verify proper operation of all field devices prior to Start-Up.

2.4 ELECTRICAL READINGS AND SETTINGS

A. After motor operation has been verified, voltage readings shall be taken at all panelboards and starters. Based on these readings, make final adjustments of primary taps on all transformers in the building as needed or coordinate with the electric utility for proper building voltage.
B. With all motors fully loaded and running at 100% speed, fully loaded and running at 85% speed, and with the motor drives off, the following readings shall be recorded on each phase of the load side of the service entrance main breaker and submitted to the Engineer.
   1. Voltage (phase to phase, and phase to neutral)
   2. Amperage
   3. Power Factor
   4. Frequency
   5. Total harmonic current distortion
   6. Total harmonic voltage distortion

PART 3 - ELECTRICAL START-UP PROCEDURES

3.1 GENERAL

A. The purpose of the start-up procedures is to assure that the equipment and systems utilized are ready for operation and use by the El Paso Water Utilities. Start-up will be performed by the Contractor with the Engineer and El Paso Water Utilities representative (if desired) present.

3.2 PROCEDURE

A. Field devices and other equipment utilized will be operated as required for efficient system operation. Contractor shall demonstrate that the field devices work as specified. Upon effectively demonstrating the satisfactory operation of all electrical systems, the contractor will energize all equipment that will not be adversely effected for a period of seven days. Any controls or other equipment found to be defective shall be replaced prior to acceptance by Owner.

3.3 Contractor shall provide "Certification of Proper Operation" to Engineer upon completion of Start-Up

PART 4 - PAYMENT

4.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 17000
GENERAL REQUIREMENTS FOR INSTRUMENTATION

SECTION 17000

GENERAL REQUIREMENTS FOR INSTRUMENTATION

PART 1 - GENERAL

The requirements of the General Conditions, Special Conditions and General Requirements of these specifications are applicable and part of every section in Division 17 - Instrumentation. The Contractor shall furnish all labor, material, service, equipment, appliances and shall perform all operations in connection with the installation and testing of Instrumentation in accordance with contract drawings and specifications. Any material found to be defective will be rejected by the Engineer and the Contractor shall remove such defective material from the site of the work.

It is anticipated that the interconnections between the various items of electrical and mechanical equipment and the control system will require coordination and in some cases interface devices such as, but not limited to, couplings, flanges, reducers, converters, conduit, relays, terminal blocks, contacts, wiring etc…, will be required whether or not these items are shown on the drawings. It is the General Contractor's responsibility to provide the necessary coordination and interface devices at no additional cost to the Owner.

1.1 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the following:
   1. National Fluid Power Association (NFPA)
   2. National Electrical Code (NEC)
   3. National Electrical Safety Code (NESC)

B. Should the Contractor observe any conflict or variation in the plans and specifications, he shall notify the Engineer in writing not later than ten (10) days prior to date of bid opening. Failure to clarify such variations will result in the Contractor bearing all costs arising from electrical work done contrary to either the specifications or drawings.

C. The Electrical Contractor shall coordinate all conduit runs, control wiring and electrical connections to equipment items furnished by Mechanical Contractor, General Contractor, Instrumentation Contractor, the Owner, and other contractors under other sections of these specifications.

1.2 RECORD DRAWINGS

A. During progress of the work, maintain a clean full set of project plans to be used to record accurate re-lined changes to the installation of the system. Upon completion of the installation, submit the full set of re-lined drawings with all record data to the Engineer.

1.3 SUBMITTALS

A. Materials List: Within 15 days after award of contract, the Contractor shall submit to the Engineer in seven (7) copies, a list of all equipment to be furnished. Where substitutions are proposed, complete data must be furnished showing performance, quality and dimensions. Written approval of Engineer must be obtained before purchasing any substitute equipment.

B. Shop Drawings: Submit for approval a minimum of seven (7) copies of all shop drawings after the material list has been approved and prior to ordering. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of a special nature or critical to the installation and pertinent data required for installation. All descriptive and technical data and shop drawings shall bear signed certification to the effect that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Where catalog data are submitted, the proposed items shall be clearly "flagged" or otherwise identified, so that no confusion exists. In addition to specific references or requests, submit shop drawings for the following applicable items: motor starters, switches, control devices, control systems and sensing equipment.

C. Substitutions: Proposed substitutions of electrical equipment, control devices, and other equipment shall be submitted with other submittal data. This request shall be accompanied by complete descriptions of the substitutes offered, including catalog cuts. The entire burden of proof of equality shall be placed on the Contractor and the decision of the Engineer shall be final.

D. Test Data: Provide 4 copies of all data obtained during tests required in Specifications. Data shall be organized in an orderly fashion, typed and indicate the result of each test.

1.4 OPERATING INSTRUCTIONS AND MANUALS

A. Without additional charge to the Owner, furnish complete instruction to the Owner in the care, adjustment and operation of all parts of the electrical equipment and systems. Upon completion of the work, prepare and deliver to the Owner four (4) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating maintenance data.

B. The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment

PART 2 - SCOPE

This section specifies general requirements, which are applicable to all process control, and instrumentation. The process instrumentation system consists of process sensors, monitoring, actuators, and accessories required to provide a complete and functional monitoring and control system.

Contractor shall provide the services of instrument technicians to implement the requirements of this section. Instrument technicians shall have a minimum of five years experience in controls, automation and/or system integration.

The Contractor shall examine the site, drawings and specifications to determine actual locations, sizes, materials and ratings of process connections. Process taps shall be indicated on piping shop drawings as specified.

The Contractor shall furnish and install a Station Control Panel as part of this project. This panel shall be custom built as per the drawings in a panel shop that has a minimum of 10 years experience in the manufacturing of similar station control panels.

The owner and engineer shall perform an acceptance test of the Station Control Panel at the panel shop prior to shipment. This test shall consist of a visual inspection for conformance with these specifications, powering up the panel, loading a test program into the PLC and testing all wiring and devices installed in the panel. Any corrections necessary for a fully functional Control Panel as detailed in the drawings and these specifications shall be made at the panel shop prior to shipment. Travel and expenses for one owner's representative and one engineer's representative to conduct the acceptance test shall be provided by the contractor at no additional cost to the owner.

PART 3 - SYSTEM RESPONSIBILITIES

3.1 OWNER'S RESPONSIBILITY

A. The owner or owner designated representative shall be responsible for writing and implementing the PLC program, and the Human Machine interface (HMI) program.
B. Owner shall conduct loop commissioning through the PLC after the Contractor has completed responsibilities in 3.2 below.

3.2 CONTRACTOR'S RESPONSIBILITY

A. Upon Notice of Award, the contractor shall purchase and provide to the engineer the HMI and PLC software as specified in Section 17235.
B. The contractor shall be responsible for furnishing and installing the Station Control panel as shown on the drawings.
C. The contractor shall be responsible for furnishing and installing all instrument devices as shown on the drawings and conduits and cabling to each instrument.
D. All field terminations shall be done on the left side of Station Control Panel terminal blocks and fuses.
E. The contractor shall be responsible for calibrating all field devices, performing individual loop tests and setting ranges, or other parameters, required for field devices. All calibration, loop tuning and other data sheets required in these specifications shall be the responsibility of the Contractor. Contractor shall conduct loop checks, calibration and tuning of devices from the field side of the Station Control Panel terminal blocks.
F. The Contractor shall provide the assistance of an Instrument Technician during loop commissioning and system start-up.

PART 4 - REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

REFERENCE	TITLE
API RP550-86	Manual of Installation of Refinery Instruments and Control Systems, Part I - Process Instrumentation and Control Sections 1 Through 13
ISA S51.1-79	Process Instrumentation Terminology

NEMA 250-85(1988)	Enclosures for Industrial Controls
NFPA 70	National Electric Code (NEC)
ANSI T2.24.1	Hydraulic Fluid Power – Systems standard for stationary industrial machinery.
NFPA T3.5.49	Recommended Practice – Hydraulic Fluid Power – Application guidelines for hydraulic valves.

PART 5 - MATERIALS AND QUALITY

Material shall be new, free from defects, and of the quality specified. Each type of instrument, instrument accessory, and device shall be by the same manufacturer throughout the work.

Electronic equipment shall be of solid state construction unless otherwise specified. Components of standard electronic assemblies shall not be replaced with components of different characteristics in order to meet the performance requirements of this specification. Parts shall be as shown in the instruction manuals and shall be replaceable with standard commercial components of the same description without degrading the performance of the completed assembly.

PART 6 - PRODUCT DATA

The following product data shall be provided under provisions of Section 01300:

6.1 CATALOG CUTS

A. The Contractor shall provide catalog cuts for equipment to be provided. Catalog information shall include technical specifications and application information for each piece of equipment. Catalog cuts shall be edited to indicate only those items, model or series of equipment which are being provided. All extraneous materials shall be crossed out or otherwise obliterated.

PART 7 - INSTALLATION

Installation and testing procedures shall be as specified in this and subsequent sections of this division. Equipment shall be located so that it is readily accessible for operation and maintenance.

Where instrumentation installation procedures are not specified herein, API RP550 shall be used as a guide. Final connections between rigid raceway systems and instruments shall be made with liquidtight flexible metal conduit with a maximum length of 2 feet.

Where stainless steel tubing installation procedures are not specified herein, Swagelok Tube Fitter's Manual shall be used as a guide.

7.1 FIELD EQUIPMENT

A. Equipment shall be provided as specified on the drawings such that ports and adjustments are accessible for in-place testing and calibration. Where possible, equipment shall be located

between 48 inches and 60 inches above the floor or a permanent work platform. Instrumentation equipment shall be mounted for unobstructed access, but mounting shall not obstruct walkways.

B. Equipment shall not be mounted where shock or vibration will impair its operation. Support systems shall not be attached to handrails, process piping or mechanical equipment except for measuring elements and valve positioners. Instruments and cabinets supported directly by concrete or concrete block walls shall be spaced out not less than 5/8 inch by framing channel between instrument and wall.

C. Steel used for support of equipment shall be hot-dip galvanized after fabrication. Support systems including panels shall be designed in accordance with SBC for seismic zone 1 and to prevent deformation greater than 1/8 inch under the attached equipment load and an external load 200 pounds in any direction.

7.2 ELECTRICAL POWER CONNECTIONS

A. Electric power wiring and equipment shall be in compliance with Division 16.

7.3 SIGNAL CONNECTIONS

A. Electric signal connections to equipment shall be made on terminal blocks or by locking plug and receptacle assemblies.

B. Liquidtight flexible metal conduit shall be used between equipment and rigid raceway systems except that flexible cable assemblies may be used where plug and receptacle assemblies are provided and the installation is not subject to mechanical damage in normal use.

C. The length of flexible conduit or cord assemblies shall not exceed 2 feet. Flexible cable, receptacle and plug assemblies shall be used only where specified. Wire splicing shall not be accepted.

D. All wires shall be labeled.
   1. Wire markers shall be Raychem Part No. RPS-1K-18-12/2.0-9 Heat Shrink wire markers.
   2. Wire markers shall be legible and properly aligned after heat shrinking.
   3. Finished markings shall be aligned and positioned so that they can be easily read without manipulation of the wire.
   4. Wire markers shall designate the termination point of the opposite end of the wire (i.e. “destination type wire tagging”).

7.4 STAINLESS STEEL TUBING

A. Bubbler tubing shall be Stainless Steel, high quality, fully annealed, seamless type 316 austenitic stainless steel hydraulic tubing ASTM A213, A269, A632 or equivalent. Hardness Rb80 or less.

B. Installed tubing is to be free of scratches, wrinkles, flattened bends, kinked bends or defects.

C. Tubing shall run clear of bolts and equipment that must have access for maintenance.

D. Tubing shall remain clear of controls and not prohibit the operator’s access to controls.

E. Long runs of tubing shall be supported to prevent sagging.

F. All fittings and valves shall be Swagelok Stainless Steel Tube Fittings.

PART 8 - TESTS AND INSPECTIONS

8.1 GENERAL

A. Materials, equipment, and construction included under this specification shall be inspected in accordance with this project manual. Testing shall be performed by the Contractor in accordance with this and subsequent sections or, if applicable, witnessing the test.
B. The Contractor shall notify the Engineer upon arrival of any material or equipment to be incorporated into the work and shall remove protective covers or otherwise provide access in order that the Construction Manager may inspect such items.
C. Stainless steel tubing and piping systems shall be tested for leaks.

8.2 TEST REPORTS

A. Test reports shall conform to the requirements of reference forms 17000A2 through 17000A4 and 17000B, included in specification Section 17030.

8.3 TESTING STAGES

A. Each instrument loop shall be tested in the following sequence:

TESTING SEQUENCE	FORM REFERENCE
Wiring	17000A2 – A4
Calibration Test Data/ Loop Commissioning	17000B

B. Testing of piping, wiring and individual components shall be completed with certified test reports provided to the Engineer prior to commencement of individual loop testing.

8.4 INDIVIDUAL COMPONENT CALIBRATION AND TEST

A. Each instrument and final element shall be field calibrated in accordance with the manufacturer's recommended procedure. Instruments shall then be tested in compliance with ISA S51.1 and the data entered on the applicable test form.
B. Any component, which fails to meet the required tolerances, shall be repaired by the manufacturer or replaced, and the above tests repeated until the component is within tolerance.

8.5 LOOP TEST

A. Each instrument loop shall be tested as an integrated system starting at the primary measuring element and ending at the PLC panel terminal blocks. The contractor shall provide power supplies, meters, signal generators and any other equipment necessary to accomplish loop tests.
B. If any output device fails to indicate properly, corrections to the loop circuitry shall be made as necessary and the test repeated until all instruments operate properly.

PART 9 - PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such

payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 17030
REFERENCE FORMS

SECTION 17030

REFERENCE FORMS

PART 1 - GENERAL

The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
17000A-2	Loop wiring and insulation resistance test data form; 2-wire
17000A-3	Loop wiring and insulation resistance test data form; 3-wire
17000A-4	Loop wiring and insulation resistance test data form; 4-wire
17000B-1	Field, Transmitter, Miscellaneous switch/instrument calibration test and Loop commissioning test data form

Reference Sheet 17000A-2

IDENTIFICATION		LOCATION			CONTINUITY RESISTANCE *A		INSULATION RESISTANCE *B		COMMENTS	CMPLT DATE
TAG#	DESCRIPTION	WIRE TAG	COLOR	FIELD TB LOCATION	COND/ COND	COND/ SHLD.	COND/ GND.	SHLD/ GND.		

CONTRACTORS' REP. ENGINGEERS' REP OWNERS' REP
DATE: DATE: DATE:

Reference Sheet 17000A-3

IDENTIFICATION		LOCATION			CONTINUITY RESISTANCE *A		INSULATION RESISTANCE *B		COMMENTS	CMPLT DATE
TAG#	DESCRIPTION	WIRE TAG	COLOR	FIELD TB LOCATION	COND/ COND	COND/ SHLD.	COND/ GND.	SHLD/ GND.		
CONTRACTORS' REP.				ENGINGEERS' REP					OWNERS' REP	
DATE:				DATE:					DATE:	

Reference Sheet 17000A-4

IDENTIFICATION		LOCATION			CONTINUITY RESISTANCE *A		INSULATION RESISTANCE *B		COMMENTS	CMPLT DATE
TAG#	DESCRIPTION	WIRE TAG	COLOR	FIELD TB LOCATION	COND/ COND	COND/ SHLD.	COND/ GND.	SHLD/ GND.		

CONTRACTORS' REP.	ENGINGEERS' REP	OWNERS' REP
DATE:	DATE:	DATE:

Reference Sheet 17000B

IDENTIFICATION		LOOP TEST						COMMENTS	CMPLT DATE
				DISCRETE		ANALOG			
TAG#	DESCRIPTION	PASSED	FAILED	N.C.	N.O.	SIGNAL	RANGE		

CONTRACTORS' REP.	ENGINEERS' REP.	OWNERS' REP
DATE:	DATE:	DATE:

PART 2 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 17160
CABINETS AND ENCLOSURES

SECTION 17160

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Station Control Panels.
B. Miscellaneous Cabinets.
C. Accessories.

1.2 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association).
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
C. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of General Conditions.
B. Provide manufacturer's standard data for enclosures and cabinets

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Materials and products to be listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated

PART 2 - PRODUCTS

Equipment model numbers for major equipment and accessories are detailed in these specifications and in the drawings. Any changes from manufacturers and model numbers listed must have prior approval from the engineer.

The panel manufacturer shall provide all equipment and materials necessary to construct the panels, whether or not such items are listed in the drawings.

2.1 STATION CONTROL PANEL & JUNCITON BOXES

A. Enclosure:
   1. The Station Control Panel enclosure shall be a Hoffman Model # A904820FSD, or equal.
   2. Enclosure body shall be constructed of 12 gauge steel; all welded construction and seams shall be continuously welded.
   3. All welds and seams shall be ground smooth.
   4. Door Handles shall be flush type.

5. All panel enclosures shall be equipped with a drawing pocket, 11 ½" wide by 15" high by ¾" deep, mounted on the door or side panel opposite that of the fold down shelf.
6. Station Control Panel Enclosures shall have a fold down shelf mounted on the inside of the right hand door, with shelf height at 40 inches above finished floor.
7. Panels shall have no screws or bolts protruding the outside of the cabinet.

B. Wiring:
1. Discrete I/O wiring from swing arm to terminal strip shall be 18 AWG, UL1007 rated, Belden #9918 or equal.
2. Analog I/O wiring from swing arm to terminal strip shall be 20 AWG, twisted pair shielded, Belen #8762 or equal.
3. Analog wiring shall be shielded with the shield extended up to the point of termination exposing just enough cable to adequately terminate the conductors. Heat shrink shall be used where the wire exits the cable jacket.
4. Power distribution wiring shall be 16 AWG unless noted otherwise on the drawings.
5. AC power wiring to devices inside panel shall be twisted pair shielded #16 AWG, unless noted otherwise on the drawings.
6. Wiring from the PLC I/O Card Swing Arms to the panduit shall be enclosed in a braided expandable wire sleeving, Thomas & Betts #S750PC-0.
7. Discrete I/O wiring from PLC swingarm to terminal strips shall be Slate Grey in color. All the panel wiring shall adhere to the following color code:
   a. 12VDC and 24VDC Slate Grey
   b. 120VAC Black
   c. 120VAC Neut. White
   d. Analog I/O (+) Black
   e. Analog I/O (-) White or Clear

C. Wire Markers:
1. Wire markers shall be seamless type Heat Shrink wire markers, Raychem Part No. RPS-1K-18-12/2.0-9.
2. Wire markers shall be legible and properly aligned after heat shrinking.
3. Finished markings shall be aligned and positioned so that they can be easily read without manipulation of the wire.
4. Wire markers shall designate the termination point of the opposite end of the wire.

D. Grounding:
1. Two ground busses shall be provided in the enclosure, one for isolated grounds and one for equipment grounds.
2. The isolated ground bus shall be isolated from the backpan and enclosure.
3. Shield wires shall be jumpered together on their respective terminal strips and routed to the isolated ground bus.
4. Equipment such as power supplies, PLCs, and enclosures shall be grounded to the equipment ground bus.

E. Terminal Blocks:
1. In order to provide easier access to terminations, all terminal blocks shall be mounted on elevated DIN type mounting rails, Allen Bradley #1492-DR6 or equal.
2. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 Volts.
3. Provide isolated ground bus terminal blocks for shield wires.
4. Feed thru terminal blocks shall be Phoenix Contact type UT 4-MTD or approved equal.
5. 24VDC fusible terminal blocks shall be Phoenix Contact type UT 4-HESILED 24 (5x20) or approved equal. 120VAC fusible terminal blocks shall be Phoenix Contact type UT 4-HESILA 250 (5x20) or approved equal.

6. Circuit breakers shall be Phoenix Contact type UK 6-FSI/C with either TCP 10A, TCP 3A, TCP 5A as indicated on project drawings or Sprecher & Schuh type L8-25/1/C as indicated on project drawings or approved equal.

F. All devices and terminal strips shall be labeled with white on black engraved name plates.

G. Wireways shall be made of a flame retardant, non-metallic material, which is gray in color. The wireway covers shall be single complete lengths between intersections.

H. Heat shrink shall be placed on all exposed shielding wires to protect from accidental shorting.

2.2 MISCELLANEOUS CABINETS

A. Boxes shall be NEMA 250, Type 4 steel enclosure.

B. Backpanel: Provide steel backpanel. Paint matte white.

C. Fronts: Steel, door with concealed hinge, and flush lock keyed to match branch circuit panel board. Finish with gray baked enamel.

D. Knockouts: Provide as necessary. Provide barriers to form separate compartments wiring of different systems and voltages. Provide accessory feet for free-standing equipment.

2.3 TESTING

A. The Owner and Engineer shall perform an acceptance test of the Station Control Panel at the panel shop prior to shipment. This test shall consist of a visual inspection for conformance with the drawings and these specifications, powering up the panel, loading a test program into the PLC and testing all wiring and devices installed in the panel. Any corrections necessary for a fully functional Control Panel as detailed in the drawings and these specifications shall be made at the panel shop prior to shipment. Travel and expenses for one owner's representative and one engineer's representative to conduct the acceptance test shall be provided by the contractor at no additional cost to the owner.

B. The Contractor shall notify the engineer two weeks prior to completion of the panel in order to schedule a date for the acceptance test.

C. Station Control Panels shipped to the site without having an acceptance test shall be rejected.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA "Standard of Installation." Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 16190. Install cabinet fronts plumb.

3.2 CLEANING: GENERAL CONDITIONS - CONTRACT CLOSEOUT

A. Cleaning installed work. Clean electrical parts to remove conductive and harmful materials. Remove dirt and debris from enclosure. Clean finishes and touch up damage.

PART 4 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall

be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 17230
TRANSMITTERS AND PROCESS SWITCHES

SECTION 17230

TRANSMITTERS and PROCESS SWITCHES

PART 1 - GENERAL

1.1 This section specifies requirements for transmitters, event switches, and the radio antennae.

1.2 REFERENCES

A. This section contains a reference to the following document. Additional references are listed in Section 17000. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.

B. NEMA 250-85 Enclosures for Electrical Equipment

1.3 GENERAL REQUIREMENTS

A. Unless otherwise specified, measuring elements, transmitters and process switches shall comply with the following requirements.

1. Transmitters shall be two-wire type with operating power derived from the signal transmission circuit, unless otherwise specified.
2. Transmitter output shall be 4 to 20 milliamperes, current regulated and shall drive any load between 0 and 550 ohms with the power supply at 23 volts DC.
3. Transmitters shall meet specified performance requirements with load variations within the range of 0 to 600 ohms with the power supply at 24 volts DC.
4. Transmitter output shall be galvanically isolated.
5. Transmitters output shall increase with increasing measurement.
6. Transmitters enclosures shall be rated NEMA 250, Type 4, unless otherwise specified
7. Transmitters located outdoors shall be provided with surge protectors: MTL Inc. SD series with replaceable fuse and disconnect features, or equal.
8. Where two-wire transmitter is located in an area classified as hazardous, it shall be made safe by means of an intrinsic safety barrier.
9. Where four-wire transmitters are permitted, they shall be provided with a loop powered signal current isolator connected in the output signal circuit.

PART 2 - PRODUCT

2.1 The following instrument specification sheets are included in this section:

INSTRUMENT SYMBOL	INSTRUMENT DESCRIPTION	INSTRUMENT FUNCTION
FIT	Vortex Shedding Flow Meter	Flow Measurement
LIT	Level Indicting Transmitter	Level Measurement
LSL	Level Switch Low	Level Measurement
PIT	Pressure Indicating Transmitter	Line Pressure
MS	Event Switch	Motion Sensing

DS	Event Switch	Door Switch

2.2 VORTEX SHEDDING FLOW METER

Identification:	FIT
Function:	Flow measurement
Description:	Vortex shedding flow meter
Power Supply:	115 VAC
Signal Input:	Process
Signal Output:	4 – 4-20 mA dc loop powered proportional to flow rate/RS-485 Communications port
Process Connection:	Not Applicable

A. Product Requirements
   1. The flow meter shall be a EMCO, Hydro-Flow Model 2000 12 01 2 1 1with RS 485 communications capability. No other meter will be accepted.
   2. The flow meter shall be constructed in a facility operating under a total quality control system to provide assurance of product quality.
   3. Completely microprocessor based utilizing the transit time flow measurement technique. Employ the vortex shedding principle to detect the frequency at which vorticies are alternately shed from a bluff body.
   4. Warranty: Manufacturer's two-year warranty.
   5. The accuracy of flowmeters shall be +/-1.0% of actual rate of meter, over a +/-40 fps flow range without the need for system calibration.
   6. Repeatability shall be 0.1% of flow with a flow sensitivity of 0.001 fps at any flow rate including no flow conditions.
   7. Provide ability to indicate flow rate, flow velocity, total flow, signal strength, liquid sonic velocity, Reynolds Number and liquid aeration level.
   8. Features:
      a. Equipped with an integral front panel keypad and multifunction 240 X 128 pixel LCD display computer, remotely mounted inside the booster station building.
      b. NEMA 4X enclosure
      c. Power 115 VAC, 60 Hz
      d. Four loop powered 4 to 20 mA DC outputs proportional to flow
      e. RS-485 communications capability
      f. Clamp on fittings and hardware
   9. Operating Specifications:
      a. 12-inch lined steel pipe application
      b. Potable Water
      c. Temperature Limit: 32 to 160 degrees F.
      d. Ambient Temperature Limit: -20 to 140 degrees F.
      e. Flow Units: Gallons
      f. Time Units: Minutes

B. Installation
   1. Install in accordance with manufacturer's recommendations at location as shown on the drawings.
   2. Provide the services of a manufacturer trained field representative to install and calibrate the meter and flow total display.

2.3 LIT – LEVEL INDICATING TRANSMITTER

Identification:	LIT
Function:	Level Indicating Transmitter
Description:	Pulse Burst Radar Level Measurement
Power Supply:	24VDC
Signal Input:	Process (Waste Water Surface, dielectric 1.7-100)
Signal Output:	4-20mA
	Range Analog: 3.8 – 20.5 mA
	Range Digital: 0 – 999”
Resolution:	Analog: 0.01mA
	Digital: 0.1”
Loop Resistance:	350Ω @ 24VDC/22mA
	400Ω @ 24VDC/20mA
Span:	0.5-65 Feet
Housing:	Cast 316 SS
Cable Entry:	¾” NPT
Operating Temp:	-40 to +175° F (-40 to +80° C)
Humidity:	0-99%, non-condensing
Shock Class:	ANSI/ISA-S71.03 Class SA1
Vibration Class:	ANSI/ISA-S71.03 Class VC2
Linearity:	±0.4 inch or 0.1% of install height (whichever is greater)
Measure Error:	±0.4 inch or 0.1% of install height (whichever is greater)
Resolution:	0.1 inch
Repeatability:	±0.2 inch or 0.05% or install height (whichever is greater)
Response Time:	< 1 second
Warm-up Time:	30 seconds
Ambient Temp.:	Temperature effect 0.05% per 10° C
Dielectric Effect:	< 0.3 inch within selected range
Rate of Change:	Maximum = 180 inches / minute
Level Units:	Feet
Antenna Model:	4” Horn
Antenna Material:	316 SS
Antenna O-Ring:	Viton® O-ring
Beam Angle:	17°
Process Connection:	4” ANSI Flanges
Antenna Max Temp:	+400° F @ 50psig
Antenna Max Press:	675psig @ +70° F
Minimum Dielectric:	1.7

A. Product Requirements

1. The level indicating transmitter (LIT) shall be a Magnetrol Pulsar, Pulse Burst Radar Level transmitter series with horn type antenna or approved equal.
2. The LIT shall be non-contact radar type, two-wire, 24VDC loop-powered level transmitter.
3. The LIT shall use pulse burst radar technology together with time sampling circuitry. The radar burst shall be short 6.3GHz microwave energy emitted and subsequently

reflected from the liquid level surface. Distance is calculated by the D = Transit time (round-trip)/2. Liquid level is then calculated by applying the span height value.

4. Performance of the LIT shall not be process dependent.
5. The LIT shall have a quick connect/ disconnect antenna coupling.
6. The antenna shall have an output value of: < 0.01 mW (avg), < 2mW (max)
7. The transmitter shall be explosion proof; Class I, Div. 1: Groups B, C & D
8. The transmitter shall a digital display and keyboard.
9. The transmitter shall be housed in a cast 316 SS, dual compartment 45° / NPT (IP66)
10. The radar antenna shall be a 316 SS 4" horn with a 4" 150# ANSI raised face flange and Viton® GFLT o-ring seal.

B. Installation:

1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements
2. The Contractor shall provide all necessary hardware for proper installation of the LIT.

2.4 LSL – LEVEL SWITCH LOW

Identification:	LSL
Function:	Low level indication
Type:	side mounted float level switch

Physical Specifications:

Physical Range (float):	Narrow differential, 0.50"
Minimum Specific Gravity:	0.40
Float and Trim Material:	316/316L stainless steel with 18-8 stainless steel pivot pin
Float stem:	standard length
Mounting Connection Material:	316/316L stainless steel
Process Connection:	2" 150# ANSI Flanges
Process temperature Range:	-40° to +300° F
Ambient Temperature Range:	-40° to +160° F
Maximum Process Pressure:	1500 psi

Electrical Specifications:

Type of contacts:	SPDT
Type of switch:	Hermetically sealed reed switch
Switch Rating:	30VA, 240VAC/VDC maximum
Enclosure Rating:	Type 4X with cast iron/aluminum junction box, FM XP
Enclosure Material:	316/316L stainless steel
Electrical Connection:	condulet box with ¾" NPT

A. Product Requirements:

1. The level switch shall be a Magnetrol side-mounted float level switch model TK1, model number TK1-002A-BSA or approved equal.
2. The transmitter shall be a two-wire, dry contact side mounted float level switch.
3. The transmitter's output shall be a dry contact spdt.

The transmitter shall be provided with optional manufacturer mounting hardware if deemed necessary for a properly functioning installation.

B. Installation:

1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware such as isolation valves and mounting brackets shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.5 PIT – PRESSURE INDICATING TRANSMITTER

Identification:	PIT
Function:	Pressure Indicating Transmitter
Description:	Gauge Pressure Measurement
Power supply:	24VDC 10.5 to 55 VDC, with no load
Signal Input:	Process
Pressure Range:	0-150 PSIG
Reference Accuracy:	±0.065% of span
Long Term Stability:	±0.125% of URL for 5 years
Signal Output:	4-20mA
Dynamic Performance:	Response time – 100ms for 4-20mA Dead time – 45ms (nominal) Update Rate – 22 times per second
Vibration Effect:	@ resonant frequency < ±0.1% of URL per g between 15 and 2000 Hz in any axis relative to pipe-mounted process conditions
Power Effect:	< ±0.005% of span per volt
RFI Effect:	±0.1% of span from 20 to 1000 MHz and field strength ≤ 30 V/m
Process Connection:	½-inch NPT Female
Isolating Diaphragm:	316L SST
Process Wetted Parts:	316L SST
Wetted O-Rings:	Glass-filled PTFE
Fill Fluid:	Silicone
Housing Material:	Polyurethane-covered Aluminum
Conduit Entry Size:	½" – 14 NPT
Indication:	5-digit LCD display
Overpressure Limit:	1500 PSI
Burst Pressure:	11000 PSI
Temperature Limit:	Process – -40 to +250 °F (-40 to 121 °C)

A. Product Requirements:
1. The transmitter shall be a Rosemount 3051TG series pressure transmitter or approved equal.
2. The transmitter shall be a two-wire, capacitance high-performance gage pressure transmitter.
3. The transmitter shall be configured assembled to an integral manifold of the same manufacturer. The manifold shall be made of 316L stainless steel and provide a ½" NPT male process connection and the proper manufacturer instrument connection. The manifold shall possess two valves; one for isolation of the transmitting instrument and one to allow for process isolation from the transmitter for calibration purposes.
4. The transmitter data shall be stored in nonvolatile EEPRM memory.

5. The transmitter's outputs shall be a 4-20mA analog signal, user-selectable linear or square root, with a superimposed digital signal. Analog output shall be adjustable remotely with a filed communicator or control system. Zero and span adjustments shall also be available on the transmitter.
6. The transmitter shall be provided with mounting optional manufacturer mounting hardware.

B. Installation:
1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Root valves shall be provided at all process pressure taps. Gage valves shall be provided at the instrument where the instrument is not within sight of the root valve or where two or more instruments are connected to a single tap. Safety instruments shall not be connected to the same process tap as instruments used for control, indication, or recording. Unless otherwise specified, pressure instruments shall be located as close as practical to the process tap but shall be positioned to permit observation and maintenance.
3. Pressure instruments shall not be supported from process piping.
4. Miscellaneous installation hardware such as isolation valves and mounting brackets shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.6 PRESSURE SWITCH

Identification:	PSL
Function:	Pressure Sensing Low
Description:	Industrial/ Outdoor Pressure Sensor

2.7 MOTION SENSOR

Identification:	MS
Function:	Area Motion Sensing
Description:	Industrial/ Outdoor Passive Infrared Motion Sensor

A. Product Requirements: The motion sensor shall be an OPTEX Model LX-402. The motion sensor shall be provided with a swivel bracket assembly.
B. Power Supply: 12 VDC
C. Signal Input: N/A
D. Signal Output: Discrete, Form C, Normally Closed and Open, SPDT
E. Cover Tamper Contacts: Normally Closed, 50mA rating
F. Pulse Count: Bi-directional, 1 event (2 pulses) or 2 events (4 pulses) with Motion Verification.
G. Range:
1. Standard wide Angle: 45ft. x 90 degrees
2. Long Range: 70ft. x 6 degrees
3. Vertical Barrier 40ft. x 6 degrees
H. Mounting: Swivel Bracket with bottom conduit entry
I. Service Temp: -40 to +120 degrees Fahrenheit
J. Enclosure: Dust Proof, water resistant.

K. Installation: Approximately 7 feet above finished floor. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.

2.8 DS – EVENT SWITCH (DOOR SWITCH)

Identification:	DS
Function:	Event Switch
Description:	Door Switch Close/Open indication
Electrical:	FormC, SPDT
	Voltage: 30VAC/DC max
	Current: 0.25A max
	Power: 3.0W max
	Loop Type: Open or Closed
Lead Type:	3' Stainless Steel Armored Cable
Lead Colors:	SPDT
	Common: Black
	N.O.: White
	N.C.: Red

A. Product Requirements
   1. The event switch shall be a GE Magnetic Contact series 2507A or approved equal.
   2. The contact shall be hermetically sealed reed switch nominally 3"L x 1"H x 0.50"D with matching actuating magnet.
   3. Mounting holes shall be on 2" centers.
   4. Contact and magnet shall be in brushed anodized aluminum tube housing.
   5. Contacts shall be sealed in polyurethane potting compound.
   6. Right angle mounting brackets shall be furnished with contact.
   7. Each contact shall connect to three feet of flex stainless steel conduit.

B. Installation
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements
   2. The Contractor shall provide all necessary hardware for proper installation of the magnetic contact.

PART 3 - PAYMENT

3.1 PAYMENT

A. Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION

SECTION 17235
SCADA EQUIPMENT

SECTION 17235

SCADA EQUIPMENT

PART 1 - GENERAL

This section specifies requirements for Supervisory Control and Data Acquisition (SCADA) equipment which consists of the PLC, HMI / computer hardware, radios, power supplies, uninterruptible power supplies, networking equipment, and process software.

PART 2 - PLC SPECIFICATION SHEETS

2.1 PLC CONTROLLER

Available User Memory Size:	750 KBytes
Nonvolatile Memory:	64 MBytes CompactFlash
Number of Concurrent tasks:	8
Communication Ports:	1 RS-232 port; 38.4 kbps max (DF1)
	1 Ethernet / IP port; 10/100 Mbps
Backplane Current @ 24V:	90 mA
Power Dissipation:	4.74 W
I/O Module Capacity:	16 1769 modules
I/O Banks Supported, Max:	3
PLC Power Supply distance rating:	4 modules
Controller Application:	general purpose
Controller tasks:	6, 1 continuous
Programming Languages:	Relay Ladder
	Function Block Diagram
	Structured Text
	Sequential function block
Serial port communication:	ASCII
	DF1 full/half duplex
	DF1 radio modem
	DH-485
	Modbus via logic

A. Product Requirements
   1. The PLC controller shall be an Allen Bradley CompactLogix model # 1769-L35E.
   2. The PLC controller shall have the ability to have its firmware updated with new releases of compatible firmware from the manufacturer.
   3. The memory possessed by the PLC controller, with the exception of memory set aside for by the manufacturer for internal controller use, shall be user configurable in like file types, with no exception as to what the undefined memory shall become.
   4. The PLC controller shall be able to perform complex math calculations without the need of changing stored information from type to type, i.e., integer values shall be able to be used in math calculations involving floating point values without the need of changing either the floating point to integer or integer to floating point and so forth.

5. The PLC shall have an integrated Ethernet communication module capable of being addressed using internet protocol.
6. The PLC shall have the ability to use its integrated serial communication port to communicate to other devices including SCADA systems using the Modbus RTU protocol.

B. Installation

1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.2 8 CHANNEL UNIVERSAL ISOLATED ANALOG INPUT MODULE

Inputs per module:	8 V,C,TC; 4 RTD, Resistance
Module Location:	CompactLogix 1769
Input Types:	
Thermocouple	J,K,T,B,E,R,S,N,C
RTD	PT385/3916, Ni618/672, NiFe518, Cu426
Resistance:	0-150, 0-1000, 0-3000 ohm
Current:	0-20mA, 4-20mA
Voltage:	±50mV, ±100mV, 0-5V, 1-5V, 0-10V, ±10V
Advanced Features:	6 filter frequenceis (individually selectable by channel); fully auto-calibration; on-board error checking; open circuit detection for most input types
Update Times w/ 8 channels enabled:	0.30 sec @ 10Hz 0.63 sec @ 50Hz 0.53 sec @ 60Hz 0.15 sec @ 250Hz 0.09 sec @ 500Hz 0.07 sec @ 1000Hz
Communication Formats:	16-bit two's complement, Engineering units, Engineering units x10, Scaled for PID, Porportional Count
Electrical Isolation (continuous):	±10 VDC channel-to-channel 500 VDC field-wiring-to-backplane 500 VDC field-wiring-to-chassis-ground
Input Impedance:	>10 Mohm thermocouple, Voltage, RTD <250 ohm, Current
Input Overvoltage Proteciton:	+30 VDC continuous
Input Overcurrent Protection:	28mA continuous
Common Mode rejection:	115dB @ 50/60Hz
Normal Mode rejection:	85 dB @ 50/60Hz
Backplane current required:	45mA @ 24V max 150mA @ 5V max
Thermal Dissipation:	3.00 Watts, max
Environmental Conditions:	
Operational Temperature:	0° to 60° C (32° to 140° F)

Storage Temperature:	-45° to 85° C (-49° to 185° F)
Relative Humidity:	5 to 95% (non-condensing)

A. Product Requirements:
   1. The 8 channel universal, isolated analog input module shall be a Spectrum Controls 1769sc-IF8u.
   2. The analog input module shall be a high resolution, isolated eight channel isolated analog input module capable of being placed within a bank of similar platform I/O and PLC controller module. The analog input module shall communicate with the PLC controller via a backplane connection made through each I/O module located within the bank.
   3. The analog input module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, no further from the power supply then recommended by the manufacturer and function as intended by the manufacturer.
   4. The analog input module shall possess a removable "swing arm."
   5. The analog input module shall have terminals located on its swing arm used to land field wiring.
   6. The analog input module shall be capable of receiving 4-20mA input signals from process devices and converting them for use by the PLC controller.
   7. The analog input module shall possess the capability of supplying power to 2-wire field devices via either its backplane power source or from an independent power source.

B. Installation:
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
   2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.3 4 CHANNEL ANALOG OUTPUT MODULE

Number of Outputs:	4 current, individually isolated
Resolution:	16 bits (unipolar)
Signal Range:	4-20mA
Backplane Current @ 24V:	140mA
Power supply Distance rating:	8 modules

A. Product Requirements
   1. The 4 channel analog output module shall be an Allen Bradley 1769-OF4CI.
   2. The analog output module shall be a 16 bit resolution, isolated four channel analog output module capable of being placed within a bank of similar platform I/O and PLC controller module. The analog output module shall communicate with the PLC controller via a backplane connection made through each I/O module located within the bank.
   3. The analog output module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, no further from the power supply then recommended by the manufacturer and function as intended by the manufacturer.

4. The analog output module shall possess a removable "swing arm."
5. The analog output module shall have terminals located on its swing arm used to land field wiring.
6. The analog output module shall be capable of sending 4-20mA output signals to process device(s).
7. The analog input module shall possess the capability of supplying power to 2-wire field devices via either its backplane power source or from an independent power source.

B. Installation
1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.4 MODBUS COMMUNICATION MODULE

A. Product Requirements
1. The MODBUS communication module shall be a ProSoft Technologies model MVI69-MCM.
2. The modbus communication module shall be capable of being placed within a bank of similar platform I/O and PLC controller module. The MODBUS communication module shall communicate with the PLC controller via a backplane connection made through each I/O module located within the bank.
3. The MODBUS communication module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, no further from the power supply then recommended by the manufacturer and function as intended by the manufacturer.
4. The MODBUS communication module shall posses two (2) MODBUS communication ports and one (1) configuration port.

B. Installation
1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.5 6 CHANNEL DISCRETE INPUT 4 CHANNEL CONTACT OUTPUT MODULE

Number of inputs:	6
Voltage Category/Type, Input:	24V DC, sinking or sourcing
Voltage range:	10 – 30 V DC @ 30 °C
	10 – 26.4 V DC @ 60 °C
Input Delay Time; On to Off:	8 ms
Current, On-state input, max.:	2 mA
Current, off-state input, max.:	1.5 mA
Backplane Current @ 5V:	115 mA
Power supply distance rating:	8 modules

Number of Outputs:	4
Voltage Category/Type, Output:	24V DC
Voltage Range:	5-165V AC 5-125V DC
Leakage Current, off-state output, max.:	0 mA
Current per output, max.:	2.5 A
Current per module, max.:	8.0 A
Backplane Current @ 24V:	50 mA
Power Supply Distance rating:	8 modules
Amperes Make:	1.2 A
Amperes Break:	1.2 A
Voltamperes Make:	28 VA
Voltamperes break:	28 VA

A. Product Requirements
   1. The 6 channel discrete input 4 channel contact output module shall be an Allen Bradley 1769-IQ6XOW4.
   2. The input/output module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, and function as intended by the manufacturer.
   3. The input/output module shall possess a removable "swing arm."
   4. The output module shall have terminals located on its swing arm used to land field wiring.

B. Installation
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
   2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.6 16 CHANNEL DISCRETE INPUT MODULE (24VDC)

Number of Inputs:	16
Voltage Category/Type Input:	24V DC, sinking or sourcing
Voltage Range:	10 – 30 V DC @ 30 °C 10 – 26.4 V DC @ 60 °C
Input Delay Time; On to Off:	8 ms
Current, On-state input, max.:	2 mA
Current, off-state input, max.:	1.5 mA
Backplane Current @ 5V:	115 mA
Power supply distance rating:	8 modules

A. Product Requirements
   1. The 16 channel 24VDC input module shall be an Allen Bradley 1769-IQ16.
   2. The 16 channel 24VDC input module shall be current sinking.
   3. The input module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, no further from the

power supply then recommended by the manufacturer and function as intended by the manufacturer.

4. The input module shall possess a removable "swing arm."
5. The input module shall have terminals located on its swing arm used to land field wiring.
6. The input module shall be capable of receiving discrete input signals from process devices and converting them for use by the PLC controller.

B. Installation

1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.7 8 CHANNEL CONTACT OUTPUT MODULE

Number of Outputs:	8 individually isolated
Voltage Category/Type, Output:	24VDC
Voltage Range:	5…264VAC 5…125VDC
Leakage Current, Off-State Output, max:	0 mA
Current per Output, max.:	0.5A @ 60°C (140°F) 1.0A @ 30°C (86°F)
Backplane Current (mA) @ 5V	125mA
Backplane Current (mA) @ 24V	100mA
Power Supply Distance Rating:	8 modules

A. Product Requirements

1. The 8 channel individually isolated contact output shall me an Allen Bradley 1769-OW8I.
2. The 8 channel output module shall be individually isolated from each output channel.
3. The output module shall possess the ability of being placed any where within the bank, with the exception of the space occupied by the PLC controller, no further from the power supply then recommended by the manufacturer and function as intended by the manufacturer.
4. The input module shall possess a removable "swing arm."
5. The input module shall have terminals located on its swing arm used to land field wiring.
6. The input module shall be capable of receiving discrete input signals from process devices and converting them for use by the PLC controller.

B. Installation

1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.8 8 CHANNEL ISOLATED DISCRETE INPUT MODULE (120VAC)

Number of Inputs:	8 individually isolated

Voltage Category/Type, Output:	120VAC
Voltage Range:	79…133VAC
Current, On-State Input, Min..:	5mA@ 79VAC
Current, Off-State Input, Max.:	2.5mA
Backplane Current (mA):	90mA
Power Supply Distance Rating:	8 modules

A. Product Requirements
   1. The 8 channel individually isolated discrete 120VAC input module shall me an Allen Bradley 1769-IA8I.
   2. The 8 channel inpute module shall be individually isolated from each input channel.
   3. The input module shall possess the ability of being placed anywhere within the bank, with the exception of the space occupied by the PLC controller, no further from the power supply then recommended by the manufacturer and function as intended by the manufacturer.
   4. The input module shall possess a removable "swing arm."
   5. The input module shall have terminals located on its swing arm used to land field wiring.
   6. The input module shall be capable of receiving discrete input signals from process devices and converting them for use by the PLC controller.

B. Installation
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
   2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

2.9 PLC BANK POWER SUPPLY

Description:	Compact 24V DC expansion power supply
Operating Voltage Range:	19.2 – 32 V DC
Power Consumption, max.:	100VA @ 24V DC
Current capacity:	2.0A @ 24V
Inrush Current. Max.:	30 A @ 31.2V DC
Line Loss Ride Through:	5ms – 10s
Overvoltage Protection:	yes
Power Supply Distance rating:	8 modules

A. Product Requirements
   1. The PLC bank power supply shall be an Allen Bradley 1769-PB4.
   2. The power supply shall be capable of being placed in the I/O bank as such to supply power to all I/O modules without exceeding the power supply's power supply distance rating as well as the I/O module's power supply distance rating.
   3. The PLC chassis power supply shall be directly connected to its adjacent I/O modules to form an "in-line" bank.

B. Installation
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.

2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

PART 3 - NETWORKING HARDWARE

3.1 NETWORK SWITCH

Supply Voltage:	24 VDC
Supply Voltage Range:	18.5 VDC – 30.2 VDC
Maximum Current Consumption:	Typical 510 mA
Interface:	Ethernet (RJ45)
Type of Connection:	16 ports 10/100BaseT(X), autonegotiation and autocrossing
Transmission Physics:	Ethernet in RJ45 twisted pair
Transmission Speed:	10/100 Mbit/s (RJ45)
Interface:	Potential-free signaling contact
Type of Connection:	Plug-in/Screw connection
Width:	205mm
Height:	94.3mm
Depth:	30mm
Degree of Protection:	IP20 in accordance with DIN 40050/IEC 60529
Operating Temperature:	0 °C – 55 °C
Storage Temperature:	-20 °C – 70 °C
Operating Humidity:	30% – 95% (non-condensing)
Mounting:	Din rail

A. Product Requirements
   1. The network switch shall be a Phoenix Contact FL SWITCH MCS 16TX or approved equal.
   2. The network switch shall automatically detect the data transmission speed or 10 or 100 Mbps.
   3. The network switch shall auto negotiate each port to establish a half or full duplex connection with 10 or 100 Mbps.
   4. The network switch shall be auto crossing to allow either 1:1 or crossover Ethernet copper cables.
   5. The network switch shall have a floating alarm output that can be used to monitor the redundant voltage supply.
   6. The network switch shall have local diagnostic and status indicators located on the outside cover of the network switch. The diagnostic and status indicators shall indicate (using differing LED colors and the combination of the LED being either on, off or flashing) the critical operational features of the item being monitored.

B. Installation
   1. Install in accordance with manufacturer's instructions and the recommendations of API RP550 to the specified requirements.
   2. Miscellaneous installation hardware shall be furnished and installed by the Contractor as indicated on drawings and as recommended by the manufacturer's installation instructions.

PART 4 - POWER SUPPLIES/UPS/BATTERY

4.1 24 VDC POWER SUPPLY

A. The 24 VDC Power Supply shall be a PULS Q series model number QS10.241..
B. Minimum requirements of the power supplies are as follows:
   1. Nominal Input Voltage: 120VAC
   2. Nominal Output Voltage: 24VDC
   3. Nominal Output Current: 10A
   4. AC Frequency Range: 45Hz to 65 Hz
   5. Screw type connections.
   6. Input fusing.
   7. Parallel connection capability.
   8. Ambient Operating Temperature: -25C to 70C.
   9. Humidity: 95% (at 25C no condensation).

4.2 24 VDC UNINTERRUPTIBLE POWER SUPPLY

A. The 24 VDC Uninterruptible Power Supply shall be a PULS U series model number UB10.245.
B. Minimum requirements of the power supplies are as follows:
   1. Nominal Input Voltage: 24VDC
   2. Nominal Output Voltage: 24VDC/12VDC
   3. Nominal Output Current: 10A
   4. Screw type connections.
   5. Input fusing.
   6. Parallel connection capability.
   7. Ambient Operating Temperature: -25C to 70C.
   8. Humidity: 95% (at 25C no condensation).

4.3 DC BATTERY

A. The DC Battery shall be a PULS U series 26Ah battery model UZK12.261.
B. Minimum requirements of the power supplies are as follows:
   1. Nominal Input Voltage: 24VDC
   2. Nominal Output Voltage: 24VDC/12VDC
   3. Nominal Output Current: 10A
   4. Screw type connections.
   5. Input fusing.
   6. Parallel connection capability.
   7. Ambient Operating Temperature: -25C to 70C.
   8. Humidity: 95% (at 25C no condensation).

PART 5 - PROCESS SOFTWARE

5.1 PLC CONTROLLER PROGRAMMING AND HMI SOFTWARE

A. Product Requirements

1. The PLC controller programming software shall be Rockwell Software RSLogix5000 Standard Edition model # 9324-RLD300ENE.
2. The PLC communication software shall be Rockwell Software RSLinx Professional.
3. The contractor shall procure one copy each of the previously listed software. The contractor shall coordinate with the owner or owner's representative for registration information of the procured software. The copy(s) shall be delivered to the owner or the owner's representative. The copy(s) shall be in the same condition as received by the contractor from the software selling agent upon delivery to the owner or owner's representative.

PART 6 - PAYMENT

Payment will be made for all work covered in this section at the contract unit price per unit or will be included in the lump sum price per job for items, as shown on the proposal. Either such payment shall be complete compensation for the complete performance of work in accordance with the drawings and the provisions of these specifications.

END OF SECTION