

NOTICE TO ALL BIDDERS

TO REPORT BID RIGGING ACTIVITIES, CALL: 1-800-424-9071

THE U.S. DEPARTMENT OF TRANSPORTATION (DOT) OPERATES THE ABOVE TOLL-FREE "HOTLINE" MONDAY THROUGH FRIDAY, 8:00 A.M. TO 5:00 P.M., EASTERN TIME. ANYONE WITH KNOWLEDGE OF POSSIBLE BID RIGGING, BIDDER COLLUSION, OR OTHER FRAUDULENT ACTIVITIES SHOULD USE THE "HOTLINE" TO REPORT SUCH ACTIVITIES.

THE "HOTLINE" IS PART OF THE DOT'S CONTINUING EFFORT TO IDENTIFY AND INVESTIGATE HIGHWAY CONSTRUCTION CONTRACT FRAUD AND ABUSE AND IS OPERATED UNDER THE DIRECTION OF THE DOT INSPECTOR GENERAL.

ALL INFORMATION WILL BE TREATED CONFIDENTIALLY AND CALLER ANONYMITY WILL BE RESPECTED.

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PLANS, PROPOSALS AND ADDENDA

AFTER AWARD OF CONTRACT, THE LOW BIDDER WILL RECEIVE TEN (10) COMPLIMENTARY SETS OF PLANS, PROPOSALS, PROJECT Q & A FORUM, AND ADDENDA FOR FIELD AND OFFICE USE. AN ELECTRONIC COPY WILL ALSO BE PROVIDED. ANY ADDITIONAL COPIES REQUIRED WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

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NOTICE TO CONTRACTORS

Bid proposals for this project will be received electronically by the South Dakota Department of Transportation (SDDOT) via the SDDOT secure bid submission site at <http://apps.sd.gov/hc65bidletting/bidsubmittallogin.aspx> until 10 A.M. Central time, on February 24, 2016, at which time the SDDOT will open bids. All bids will be checked for qualifications with results posted on the SDDOT website. The South Dakota Transportation Commission will consider all bids at a scheduled Commission meeting.

The work for which proposals are hereby requested is to be completed within the following requirement(s):

FIELD WORK COMPLETION: **NOVEMBER 4, 2017**

THE DBE GOAL FOR THIS PROJECT IS: **NOT SPECIFIED.**

WORK TYPE FOR THIS PROJECT IS: **Work Type 1 or Work Type 5.**

Bidding package for the work may be obtained at:
<http://apps.sd.gov/hc65bidletting/ebslettings1.aspx>

An electronic version of the most recent version of the South Dakota Standard Specifications for Roads and Bridges may be obtained at <http://www.sddot.com/business/contractors/specs/Default.aspx>

The electronic bid proposal must be submitted by a valid bidder as designated on the [Bidding Authorization Form](#). The Bidder ID and Password, coupled with a previously Department assigned Company ID, will serve as authentication that an individual is a valid bidder and will assure the secure electronic delivery of bid proposals to the Department. This authorization shall remain in full force and effect until written notice of termination of this authorization is sent by an Officer of the company and received by the Department.

PROPOSAL

Revised 8/10/11

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION, STATE OF SOUTH DAKOTA:

Ladies / Gentlemen:

The following proposal is made on behalf of the undersigned and no others. It is in all respects fair and is made without collusion on the part of any other person, firm or corporation not appearing in the signature to this proposal.

The undersigned certifies that she / he has carefully examined the plans listed herein, the Specifications hereinbefore referred to, the Special Provisions and the form of contract, both of which are attached hereto. The undersigned further certifies that she / he has personally inspected the actual location of the work, together with the local sources of supply and that she / he understands the conditions under which the work is to be performed, or, that if she / he has not so inspected the actual location of the work, that she / he waives all right to plea any misunderstanding regarding the location of the work or the conditions peculiar to the same.

On the basis of the plans, Specifications, Special Provisions and form of contract proposed for use, the undersigned proposes to furnish all necessary machinery, tools, apparatus and other means of construction, to do all the work and furnish all the materials in the manner specified, to finish the entire project **within the contract time specified** and to accept as full compensation therefore the amount of the summation of the products of the actual quantities, as finally determined, multiplied by the unit prices bid.

The undersigned understands that the quantities as shown in the Bid Schedule are subject to increase or decrease, and hereby proposes to perform all quantities of work, as increased or decreased, in accordance with the provisions of the specifications, and subject to any applicable special provisions, and at the unit prices bid.

The undersigned understands that the "Total or Gross Amount Bid" as immediately hereinbefore set forth is not the final amount which will be paid if this proposal is accepted and the work done, but that such amount is computed for the purpose of comparison of the bids submitted and the determination of the amount of the performance bond.

The undersigned further proposes to perform all extra work that may be required on the basis provided in the specifications, and to give such work personal attention in order to see that it is economically performed.

The undersigned further proposes to both execute the contract agreement and to furnish a satisfactory performance bond, in accordance with the terms of the specifications, within twenty (20) calendar days after the date of Notice of Award from the South Dakota Department of Transportation that this proposal has been accepted.

REV. 12/1/15

SPECIAL PROVISIONS

PROJECT NUMBER(S): 2246.029.08 () PCN: X03R

TYPE OF WORK: WATERLINE RELOCATION

COUNTY: ONGLALA LAKOTA

The following clauses have been prepared subsequent to the Standard Specifications for Roads and Bridges and refer only to the above described improvement, for which the following Proposal is made. In case of any discrepancy or conflict between said specifications and these Special Provisions, the latter are to govern.

The Contractor's attention is directed to the need for securing from the Department of Environment & Natural Resources, Foss Building, Pierre, South Dakota, permission to remove water from public sources (lakes, rivers, streams, etc.). The Contractor should make his request as early as possible after receiving his contract, and insofar as possible at least 30 days prior to the date that the water is to be used.

Penny Kutz is the official in charge of the Pine Ridge Career Center for Oglala Lakota County.

THE FOLLOWING ITEMS ARE INCLUDED IN THIS PROPOSAL FORM:

Special Provision Regarding Combination bids, dated 1/19/16.

Special Provision Regarding Subletting, dated 1/22/16.

Special Provision for Indian Employment and Contracting on the Pine Ridge Reservation, dated 1/8/16.

Contract Documents for Water Maintenance & Conservation Oglala Sioux Rural Water Supply System, dated January 2016.

Special Provision for Contractor Administered Preconstruction Meeting, dated 4/18/13.

Fuel Adjustment Affidavit, DOT form 208 dated 7/15.

Standard Title VI Assurance, dated 7/14/08.

Special Provision For Implementation of Clean Air Act & Federal Water Pollution Control Act, dated 9/1/97.

Special Provision Regarding Minimum Wage on Federal-Aid Projects, dated 4/30/13.

Wage and Hour Division US Department of Labor Washington DC.

- US Dept. of Labor Decision Number SD150001, dated 10/9/15.

Special Provision for Price Schedule for Miscellaneous Items, dated 10/14/15.

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**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION REGARDING
COMBINATION BIDS**

**2246.029.08 (), PCN X03R
WATERLINE RELOCATION
OGLALA LAKOTA COUNTY**

JANUARY 19, 2016

Bidders submitting a bid on this project **MUST ALSO** submit a bid on project:

NH-PH 0018(177)104, P 0391(06)0, PCN 02QC, 02NH
US HIGHWAY 18 & SD HIGHWAY 391
SHOULDER WIDENING , COLD MILLING ASPHALT CONCRETE, ASPHALT
CONCRETE RESURFACING, & REPLACE STR.S
OGLALA LAKOTA COUNTY

Award of both projects will be to the same bidder based on the total of the two projects.

Work on PCN (02QC & 02NH) CANNOT be used to meet the DBE Goal established for this project.

After award, the contracts will be administered as entirely separate contracts.

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**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION REGARDING
SUBLETTING**

**2246.029.08 (), PCN X03R
OGLALA LAKOTA COUNTY**

JANUARY 22, 2016

This project is let in combination with State Project Number NH-PH 0018(177)104, P 0391(06)0 PCN 02QC 02NH. The provisions of section 8.1 of the specifications requiring the Contractor to perform work amounting to not less than 50% of the total contract cost with the Contractor's own organization will not apply to the work on this contract.

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**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION FOR
INDIAN EMPLOYMENT AND CONTRACTING ON THE
PINE RIDGE RESERVATION**

**PROJECT NO. 2234.029.08(); PCN X03R
OGLALA LAKOTA COUNTY
JANUARY 8, 2016**

PURPOSE

The purpose of the Indian Employment and Contracting Special Provision is to establish the specifications for Indian preference and the responsibilities of contractor and subcontractors for this project.

All of this project is located within the exterior boundaries of the Pine Ridge Reservation.

Title 23 United States Code (USC), Section 140(d), recognizes and permits the preferential employment of Indians living on or near a reservation on projects and contracts on Indian reservations roads. The State of South Dakota and the Department of Transportation, consistent with the intent of Section 140(d), affirms that it is their policy to encourage employment of minorities.

DEFINITIONS

For the purposes of this Special Provision, the following definitions will apply:

- A. **Indian:** An enrolled member of a federally recognized Indian tribe.
- B. **Qualified Indian Applicant** is defined as one or more of the following:
 - 1) Applicants approved by the contractor based on job performance on other jobs.
 - 2) Applicants who have demonstrated or are presently demonstrating their work qualifications during a probationary work period on this project.
 - 3) Applicants certified by local referral agencies, including Tribal TERO offices, as having adequate skills and training necessary to perform the duties of the position.
- C. **Core Crew Employee:** A contractor's or subcontractor's core crew is composed of full time employed individuals necessary to satisfy his/her reasonable needs for supervisory or specially experienced personnel to assure an efficient execution of the contract work. Any Indian already employed by a contractor will be included in the core crew, regardless of job function, to avoid the unintended results of having a contractor lay-off or terminate an Indian employee to hire another under this provision.

- D. **Pre-Employment Standards:** Directly related job standards of fitness and ability which indicate that with a reasonable amount of job training a person would be capable of satisfactorily performing an entry level position as well as jobs at a higher level which, with a reasonable amount of training, are normally filled by progression from an entry-level position. This applies to those persons who, at the time of application for employment are not fully qualified for the available job but has general potential of becoming qualified through a reasonable amount of training.

DEPARTMENT RESPONSIBILITIES

The Department (Civil Rights Office or Area Office):

- A. Will monitor contractor and subcontractors for compliance with the requirements of this special provision and will perform necessary reviews of contractors and subcontractors to ensure compliance with the Special Provision.
- D. Will assist the contractor and subcontractor with any disputes with the TERO Office or other Tribal entity.
- E. Will establish on-the-job training opportunities as specified in the On-the-Job Training Special Provision.
- F. Will provide notification to the TERO Office of the name of the successful low bidder.
- G. Will provide notification to the successful low bidder regarding the TERO requirements.
- H. Will invite a representative of the TERO Office to attend the preconstruction meeting and provide a copy of the preconstruction meeting minutes to the TERO Office.
- I. Will not allow a contractor or subcontractor to commence work until the contractor's or subcontractor's compliance plan has been approved and the Department's Area Office has received a copy of the approved compliance plan or verbal or written notification of approval by the TERO Office.

CONTRACTOR RESPONSIBILITIES

- A. The contractor and subcontractor will give preference in employment opportunities under this Agreement to qualified Indian applicants who can perform the work required regardless of race, color, creed, age, sex, religion, national origin, disability, or tribal affiliation to the extent set out in the paragraphs below.
- B. The contractor and subcontractor will not use pre-employment standards, qualifications, criteria, or other personnel requirements as barriers to Indian employment except when such criteria or standards are required by business necessity. The contractor and subcontractor have the burden of showing that such criteria or standards are required by business necessity.
- C. The contractor and subcontractor agree that Indians will be given preference for at least eighty percent (80%) of the project work force provided that sufficient qualified Indian applicants are available. The phrase "work force" will not include "core crew employees".

- D. The contractor and subcontractor are required to complete a compliance plan and submit the compliance plan to the TERO Office at least two (2) weeks prior to beginning work. Prior to commencing work, contractors and subcontractors must contact the Oglala Sioux Tribe TERO Office concerning an identified core crew, project work force needs, and (sub)contractor/TERO interface. No contractor or subcontractor will begin work until the compliance plan has been approved by the TERO Office. The contractor and any subcontractor must submit a copy of the approved compliance plan to the Department's Area Office prior to commencing work unless arrangements are made for the TERO Office to provide the copy of the compliance plan directly to the Department's Area Office. In lieu of a copy of the approved compliance plan, the Department's Area Office may seek approval directly from the TERO Office.
- E. The contractor will provide the TERO Director at least forty-eight hours' notice to locate and refer a qualified Indian applicant for any vacancy or new position except when circumstances require that the position be filled within a shorter period of time. If the TERO Office is unable to fill the vacancy, the contractor and subcontractor may recruit and hire workers from whatever sources are available and by whatever process, provided that the contractor and subcontractor notifies the TERO Office of any job vacancies, positions, or any negotiated positions.
- F. The contractor and subcontractor will provide for maintenance of records and be prepared to furnish such periodic reports documenting compliance under this Special Provision as the Department determines necessary. The contractor and subcontractor will submit the following information on a weekly basis to the Tribal TERO Office:
1. Weekly TERO Employment Report which includes the following data (forms for the weekly TERO Employment Report available from the TERO Office):
 - a) Wage and hour reports
 - b) New hires or terminations, and disciplinary action taken
 - c) Promotions
 2. Copies of official payrolls.
- G. The contractor and subcontractor agree that all qualified Indian employees will be adequately trained for the position for which they are hired. The contractor and subcontractor will evaluate and pay all Indian employees in accordance with current company policies and contract provisions.
- H. Nothing in this Special Provision will be construed to interfere with the contractor's ability to dismiss any employee for cause including, but not limited to, lack of adequate skills or training, inability to perform by virtue of state or federal law, or breach of the contractor's standards of conduct.

OTHER PROVISIONS

This Special Provision supplements but does not replace the existing equal employment opportunity and disadvantaged business enterprise requirements, which may be included in this Agreement.

The Tribal TERO Office will maintain a Job Skills Bank, listing available Indians by job classification based on skill level as indicated on their TERO application. The contractor and all subcontractors agree to utilize the Tribal TERO Office to locate qualified applicants.

The contractor is authorized to include in the bid an amount necessary to cover the four percent (4%) employment rights fee, which is applicable to this project, based on the portion of the project located within the boundaries of the Pine Ridge Reservation. The Department has determined that one hundred percent (100%) of the project is within those boundaries; therefore the contractor is authorized to include a TERO fee amount based on 100% of the total contract dollar amount.

The contractor is authorized to include in the bid an amount necessary to cover the work permit fee of \$250.00 per employee based on the following criteria: 1) The Tribe has the right to dispute individuals listed as a core crew employee and require the prime contractor and subcontractor to provide evidence that the individual meets the definition of a core crew employee; 2) All approved core crew employees are exempt from work permit fees; and 3) All TERO Certified Tribal members are exempt from work permit fees whether considered a core crew employee or not. Contact the Tribal TERO Office for complete details at 605-867-5167.

The Department acknowledges that the Oglala Sioux Tribe issues a business license to contractors working on projects within the exterior boundaries of the Pine Ridge Reservation. For further information regarding the business license, contact the Tribal Revenue Office at 605-867-8432.

The Oglala Sioux Tribe has an Indian Preference Subcontracting goal, which has been established at the same level as the Department's DBE goal for this project and is concurrent with the Department's DBE goal. The Tribe recognizes that FHWA policy does not permit the Department to extend Indian preference in subcontracting for this project and is satisfied the Department and the contractor will seek qualified and DBE-certified Indian firms for this project. The contractor will make every reasonable effort to inform certified Indian DBE firms of the subcontracting opportunities of the project and to solicit bids from such firms. Contact the Tribal TERO Office at 605-867-5167 or the Department Civil Rights office at 605-773-3540 for assistance.

ENFORCEMENT

The contractor and all subcontractors are made aware that this Special Provision is made part of the contract requirements, and that the Department of Transportation will monitor and enforce these provisions in a manner similar to other special provisions, as outlined in Division I, General Provisions of the Standard Specifications for Roads and Bridges, 2015 edition.

The TERO Special Provision will apply to the entire project and not just the portion located within the boundaries of the Pine Ridge Reservation with the exception of the fees that are calculated based on the portion located within reservation boundaries.

It is the intent of all parties that this Special Provision be implemented on a cooperative basis without regard to jurisdictional issues. Nothing in this Agreement will prevent the Tribe, the Department, or any contractor from instituting any litigation pertaining to any jurisdictional issue with regard to the employment rights code or any other matter.

CONTRACT DOCUMENTS

for

**WATER MAINTENANCE & CONSERVATION
OGLALA SIOUX RURAL WATER
SUPPLY SYSTEM**

**US HIGHWAY 18 EAST WATER
PIPELINE REPLACEMENT
OGLALA LAKOTA COUNTY,
SOUTH DAKOTA**

PCN X03R



prepared by

**OGLALA SIOUX TRIBE
PINE RIDGE, SOUTH DAKOTA**

**DESIGN ASSISTANCE:
MORRISON-MAIERLE, INC.
PROJECT NO. 2246.029.08**

January 2016

APPROVED: _____

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US HIGHWAY 18 EAST WATER PIPELINE REPLACEMENT

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CONSTRUCTION DRAWINGS (Bound Separately)

PART 1 GENERAL

1.01 SCOPE

- A. This section describes the method of measurements and basis of payment for all work covered by the Contract Documents for the US Highway 18 East Water Pipeline Replacement project.

1.02 GENERAL

- A. The bid price for each item of the Contract shall cover all work shown on the Contract Documents and required by the specifications and other Contract Documents. All costs in connection with the work, including taxes and insurance, furnishing all materials, equipment, supplies and appurtenances; providing all required construction support plants, equipment, and tools; constructing and maintaining dewatering systems; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid in the Bid Proposal. The amounts shown on the Bid Proposal shall be the Contract price.
- B. No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Proposal shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

1.03 ESTIMATED QUANTITIES

- A. All estimated quantities stipulated in the Contract Documents are approximate and are to be used (1) only as a basis for estimating the probable cost of the work and (2) for the purpose of comparing the bids submitted for the work.
- B. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished to the paylines defined in this section.
- C. The Contractor agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amount of work actually performed and materials actually furnished and the estimated amounts herein except as allowed in the Supplementary Conditions.

1.04 SURVEYS AND MEASUREMENTS

- A. All quantity measurements shall be the responsibility of the Contractor, and will be checked by the Owner or Engineer.

1.05 BASIS OF PAYMENT

Item	Description
451E0506	<u>1.5" PVC Pipe</u> shall include excavation, bedding, backfill, testing, disinfection, and all fittings, measured in lineal feet of pipe installed. Payment will be at the contract unit price. A partial payment of 85 percent will be allowed for pipe installed but not yet tested and disinfected.
451E0512	<u>3" PVC Pipe</u> shall include excavation, bedding, backfill, testing, disinfection, and all fittings, measured in lineal feet of pipe installed. Payment will be at the contract unit price. A partial payment of 85 percent will be allowed for pipe installed but not yet tested and disinfected.
451E0606	<u>6" PVC Water Main</u> shall include excavation, bedding, backfill, pigging, testing, disinfection and all fittings, measured in lineal feet of pipe installed. Payment will be at the contract unit price. A partial payment of 85 percent will be allowed for pipe installed but not yet tested and disinfected.
451E0612	<u>12" PVC Water Main</u> shall include excavation, bedding, backfill, pigging, testing, disinfection and all fittings, measured in lineal feet of pipe installed. Payment will be at the contract unit price. A partial payment of 85 percent will be allowed for pipe installed but not yet tested and disinfected.
451E0614	<u>14" PVC Water Main</u> shall include excavation, bedding, backfill, pigging, testing, disinfection and all fittings, measured in lineal feet of pipe installed. Payment will be at the contract unit price. A partial payment of 85 percent will be allowed for pipe installed but not yet tested and disinfected.
451E1277	<u>1.5" Water Service</u> shall be measured in units each installed including the water main tap, service saddle, and corporation stop for taps on 6-inch and larger pipe; for service connections on 3-inch pipe, this item shall include the 3-inch tee. This item also includes the 1.5-inch curb stop. Payment will be at the contract unit price.
451E3902	<u>2" Air Release Valve Assembly</u> shall be measured in units each installed including the air valve vault assembly with lid, ring, cover, steps, and insulation; service saddle, ball valve, combination air valve, valve and air vent piping, fittings, and bracing; adjacent mainline couplings and joint restraints with cathodic protection; excavation, gravel and concrete footings; backfill and compaction; enclosure; and appurtenances required for complete installation. Payment will be at the contract unit price.

DIVISION 1 – GENERAL REQUIREMENTS**SECTION 01150
MEASUREMENT AND PAYMENT**

- 451E3903 3" Air Release Valve Assembly shall be measured in units each installed including the air valve vault assembly with lid, ring, cover, steps, and insulation; service saddle, ball valve, combination air valve, valve and air vent piping, fittings, and bracing; adjacent mainline couplings and joint restraints with cathodic protection; excavation, gravel and concrete footings; backfill and compaction; enclosure; and appurtenances required for complete installation. Payment will be at the contract unit price.
- 451E4112 12-Inch Butterfly Valve with Box shall be measured in units each installed including concrete thrust block, concrete pad, polyethylene encasement, and cathodic protection. Payment will be at contract unit price.
- 451E4114 14-Inch Butterfly Valve with Box shall be measured in units each installed including concrete thrust block, concrete pad, polyethylene encasement, and cathodic protection. Payment will be at contract unit price.
- 451E4203 3" Gate Valve with Box shall be measured in units each installed including concrete thrust block, concrete pad, polyethylene encasement, and cathodic protection. Payment will be at contract unit price.
- 451E4206 6" Gate Valve with Box shall be measured in units each installed including concrete thrust block, concrete pad, polyethylene encasement, and cathodic protection. Payment will be at contract unit price.
- 451E4380 Tracer Wire Access Box shall be measured in units each installed including all materials, labor, equipment, and other items to complete all work as specified. Payment will be at the contract unit price.
- 451E4400 Pipe Insulation shall be measured in square feet of insulation installed including excavation, installation of insulation, backfilling, all materials, labor, equipment, and all other items to complete all work as specified. Payment will be at the contractor unit price.
- 451E4918 Imported Trench Backfill shall be measured in cubic yards of loose (not compacted) material furnished, placed, compacted and graded, for the depth directed by the Engineer or Owner. Payment will be at the contract unit price.
- 451E5103 Bore and Jack 3" Pipe shall be measured lineal feet of casing pipe installed for 3" carrier pipe and shall include boring and receiving pits, dewatering, skids/casing chocks if required, and cathodic protection if required. Payment will be at the contract unit price.
- 451E5106 Bore and Jack 6" Pipe shall be measured lineal feet of casing pipe installed for 6" carrier pipe and shall include boring and receiving pits, dewatering, skids/casing chocks if required, and cathodic protection if required. Payment will be at the contract unit price.

DIVISION 1 – GENERAL REQUIREMENTS

**SECTION 01150
MEASUREMENT AND PAYMENT**

- 451E5114 Bore and Jack 14" Pipe shall be measured lineal feet of casing pipe installed for 14" carrier pipe and shall include boring and receiving pits, dewatering, skids/casing chocks if required, and cathodic protection if required. Payment will be at the contract unit price.
- 451E6105 Connect to Existing Water Main shall include connection of new water main piping to existing water main piping measured in units each connected and shall include excavation, cutting and removal of existing pipe, capping of the abandoned existing pipe, new coupling and fittings as required, cathodic protection, bedding, backfill, compaction, and other items necessary or incidental to making the connection. Payment will be at the contract unit price.
- 451E6515 Remove and Reset Fire Hydrant shall be measured in units each reset including removing and salvaging the existing hydrant and valve and reinstalling the hydrant and valve once the water main has been relocated including new fittings, pipe, cathodic protection, thrust blocking, drain gravel, and all other materials, labor, and equipment to complete all work as specified. Payment will be at the contract unit price.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 01150

PART 1 GENERAL**1.01 WORK INCLUDED**

- A. The work of this section covers all excavation, backfill, and embankment associated with the construction of combination air valve pit assemblies and any other structures included in this project.

1.02 CLASSIFICATION OF EXCAVATED MATERIAL

- A. **Unclassified Excavation:** Materials except those which fall within the classification of rock excavation encountered during the construction of the work regardless of their nature or the manner in which they are removed, will be considered unclassified excavation.
- B. **Rock Excavation:** Rock excavation shall include hard, solid rock in ledges, bedded deposits, unstratified masses and conglomerate deposits so firmly cemented as to present the characteristics of solid rock which must be removed by drilling and/or blasting. Shale, regardless of the nature of deposit, will not be considered rock excavation unless so designated in the Contract Documents. The responsibility and costs of satisfactorily demonstrating to the Owner that the materials being considered for rock excavation cannot be removed by means other than drilling and/or blasting shall be the obligation of the Contractor.

1.03 QUALITY ASSURANCE

- A. The Contractor shall perform earthwork operations in compliance with these specifications and within the applicable requirements of governing authorities having jurisdiction.
- B. Over-excavation made by the Contractor in earth or rock beyond the specified line and grade shall be corrected, at the expense of the Contractor, by filling with excavated soil and compacted to 95 percent of maximum density at optimum moisture as determined by AASHTO Method T99. Any other costs incurred by the Owner, or the Engineer as a result of the over-excavation, such as professional engineering or construction inspection services or additional materials, shall be the responsibility of the Contractor. If the over-excavation is directed by the Owner or Engineer, the excavation will be paid to the lines and grades specified by the Owner or Engineer.
- C. Under-compacted soil placed by the Contractor shall, at the expense of the Contractor, be corrected by additional compaction effort or excavation, replacement, and compaction. Any costs incurred by the Owner or the Engineer as a result of the under-compaction, such as additional professional engineering services, materials testing or construction inspection services, shall be the responsibility of the Contractor.
- D. Field density testing will be the responsibility of the Contractor and will be at the expense of the Contractor.

- E. **BRACING AND SHORING:** Safe temporary cut slopes are the responsibility of the Contractor who shall meet all appropriate O.S.H.A. regulations including but not limited to; "Constructions Standards for Excavations" (29 CFR Part 1926.650-.652) Subpart P, effective March 5, 1990.

PART 2 PRODUCTS**2.01 EQUIPMENT**

- A. The Contractor may use any type of earthmoving and compacting equipment he may choose; except only hand compaction equipment will be utilized within 5 feet of structure walls and provided the equipment is in satisfactory condition and of such capacity as to fulfill the requirements of this section.

2.02 MATERIAL

- A. **Suitability:** Backfill material shall be free of detrimental quantities of organic material, such as vegetation, roots, or peat. Rocks larger than 3-inches in average dimension shall not be used in backfill and structural embankment.
- B. **Gravel Backfill:** Where required by the Owner or Engineer, gravel fill shall be clean (less than 10 percent passing the 200 sieve) crushed rock or gravel graded from 1/2-inch to No. 4 sieve. Sand fill will not be permitted. Fill shall be free from dirt, clay balls, and organic material and shall be well graded from coarse to fine, containing sufficient finer material for proper compaction.
- C. **Riprap:** Hard and durable quarry stone with less than 35 percent wear when tested for resistance to abrasion in conformance to ASTM C 535. Bulk density shall not be less than 160 pounds per dry cubic foot. The least dimension of any one piece shall not be less than 1/3 the greatest dimension. A minimum of 50 percent of the volume shall be in pieces ranging in size from 1/2 cubic foot to 2 cubic feet. Smaller pieces will be allowed only to fill in the voids in the larger stone.

PART 3 EXECUTION**3.01 EXCAVATION**

- A. **General:** Excavation shall be performed to the lines, grades and elevations shown on the Drawings, Details, or in specific Work Delivery Orders. The Owner reserves the right to make minor adjustments or revisions in lines or grades. Perform all excavation regardless of the type, nature, or condition of the material encountered. The method of excavation used is optional; however, no equipment shall be operated within 5 feet of existing structures or newly completed construction. Excavation that cannot be accomplished without endangering the present or new structures shall be done with hand tools.
- B. **Limits of Excavation:** Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal and inspection of forms, except where the Contractor is authorized to place concrete directly against excavated surfaces. Undercutting will not be permitted. Where suitable bearing is not encountered at the

detailed elevation, the Owner or Engineer may direct that additional depth as required by excavated. Such authorized over-excavation shall be compensated for on a supplemental agreement or work order basis, if not specifically provided for in the Bid Proposal. Unauthorized over-excavation by the Contractor shall be corrected by the Contractor using approved materials as specified herein before at no cost to the Owner.

- C. Protection of Excavation: All necessary bailing, drainage, and sheeting shall be included as part of the excavation. Excavations over four feet in depth, unless in well compacted, stable material, shall be shored, sheeted and braced as may be necessary for the protection of the work and the safety of the personnel, or sloped to the angle of repose of the material when saturated per OSHA standards.
- D. Dewatering of Excavation: Adjacent areas shall be graded so that surface drainage is away from excavations. Any water accumulating within the excavation shall be promptly removed. No pumping will be allowed during the placing of concrete and for 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a water tight wall.
- E. Approval of Excavation By Owner: Prior to placing of concrete for footings, walls, or slabs the compacted excavation shall be inspected and approved by the Owner.

3.02 BACKFILLING

- A. General: Backfilling shall be performed where indicated to the grades and elevations shown on the Drawings, Details, or in specific Work Delivery Orders. No backfilling shall be commenced without approval of the Owner.
- B. Compaction: Backfill material shall be placed in continuous horizontal layers not to exceed 6-inches in thickness. Each layer shall be compacted to 95 percent of maximum density at optimum moisture as determined by AASHTO Method T99. Where backfill is placed on both sides of a wall or column, both sides shall be backfilled in such a manner so that the difference in compacted grade does not exceed 18 inches at any time.
- C. Watering: Water may be added only to bring the backfill material to optimum moisture content. Jetting or ponding of the backfill material will not be permitted.

3.03 CLEANUP

- A. All excess material not required for backfill, unsuitable material, waste sheeting or forming, and debris shall be removed from the site and disposed of in approved areas as directed by the Owner or Engineer. The area shall be graded to required elevations and all rocks and boulders bladed into a furrow and removed for disposal. Topsoil stripped during clearing and stockpiled shall be spread in such a manner as to restore the area surface to its original condition.

END OF SECTION 02220

DIVISION 2 – SITEWORK

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers excavation, trenching and backfilling for pipelines and appurtenances complete. This item shall consist of all necessary handling and storage of materials to be used for fill and backfill; all necessary bracing, shoring, and protection; pumping and dewatering as necessary; all backfill; preparation of subgrades; and final grading, dressing and cleanup of the site.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide all labor, materials, and equipment necessary to accomplish the work specified in this section.

2.02 CLASSIFICATION OF EXCAVATED MATERIAL

- A. Unclassified Excavation: Materials except those which fall within the classification of rock excavation encountered during the construction of the work regardless of their nature or the manner in which they are removed, will be considered unclassified excavation.
- B. Rock Excavation: Rock excavation shall include hard, solid rock in ledges, bedded deposits, unstratified masses and conglomerate deposits so firmly cemented as to present the characteristics of solid rock which must be removed by drilling and/or blasting. Shale, regardless of the nature of deposit, will not be considered rock excavation unless so designated in the Contract Documents. The responsibility and costs of satisfactorily demonstrating to the Engineer that the materials being considered for rock excavation cannot be removed by means other than drilling and/or blasting shall be the obligation of the Contractor.
- C. Suitable material from the onsite excavations may be processed to meet the requirements for trench backfill above pipe bedding.

2.03 PIPE BEDDING MATERIAL

- A. Imported Type 1 pipe bedding is generally not required for pipe unless specifically directed by the Engineer or where existing conditions consist of hard clay, shale, stones, rock or large gravel, and suitable excavated material is not available. No additional payment will be made for Type 1 bedding.
- B. Type 1 Pipe Bedding: Type 1 pipe bedding shall consist of the bedding material under the pipe and the bedding material around and over the pipe to a point 6 inches above the top of the pipe. It is recognized, in many soil conditions, that the excavation process with a chain trencher or a wheel trencher naturally deposits a layer of fine material in the trench bottom. This material may serve as bedding under the pipe if approved by the Owner and it is not comprised of the aforementioned hard clay, shale, stones, or rock. The same type and condition of spoil material is also

DIVISION 2 – SITEWORK

subject to approval for bedding over the pipe. If the excavated material is not suitable or made suitable, imported bedding material shall be used. This bedding material shall generally be described as consisting of sand, sandy gravel, or fine gravel having a maximum size of 3/4 inch and having a maximum plasticity index of 6 as determined by AASHTO Methods T89 and T90.

- C. Type 2 Pipe Bedding: Type 2 pipe bedding shall be used as directed by the Engineer to replace soft, spongy or other unsuitable material encountered in the trench bottom, and shall extend from the bottom of the Type 1 bedding material to the depth necessary to support the pipe. The Type 2 bedding material shall consist of suitable granular material meeting the following gradation, with a maximum plasticity index of 6.

Sieve Opening	% Passing
3 inch	100
Number 4	0 - 25
Number 8	0 - 10

2.04 PIPELINE WARNING TAPE

- A. Material: Non-detectable, inert polyethylene plastics impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
- B. Thickness: Minimum 4 mils.
- C. Width: 6 inches wide for pipe installations 3-inch through 10-inch, 12-inches for pipe installations 12-inch and larger.
- D. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Utility Locations.
- E. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length. Tape shall read “CAUTION: WATER LINE BURIED BELOW”.
- F. Manufacturer and Model:
 - 1. Reef Industries, Terra Tape.
 - 2. Allen Markline.

2.05 TRACER WIRE

- A. Provide in accordance with Section 13901, CORROSION PROTECTION PLASTIC PIPE.

DIVISION 2 – SITEWORK

2.06 TRENCH BACKFILL MATERIAL ABOVE PIPE BEDDING

- A. Backfill material from the top of pipe bedding to 1.5 feet above the top of the pipe shall be materials from the excavation containing no particles greater than 3-inches in diameter and free from roots, debris, organic material, cinders, ashes, frozen material, boulders and other unsuitable materials. Trench backfill from 1.5 feet above the top of the pipe to 6 inches below the ground surface may contain stones up to 8 inches in diameter.

- B. Imported Backfill Material: Imported backfill material shall be from borrow source(s) outside the project limits. Imported backfill material shall be used when, in the opinion of the Engineer or Owner, an adequate volume of suitable backfill material is not available within the project limits. This will generally be in improved areas such as driveways, residential yards, and parking areas. Imported Backfill Materials must comply with the requirements of Section 2.05 A., Trench Backfill Material Above Pipe Bedding. Imported Backfill Material will be used where directed by the Engineer or Owner. Separate payment will be made for this imported backfill.

2.07 WATER FOR COMPACTION

- A. Furnish as required.

2.08 COMPACTION EQUIPMENT

- A. Compaction equipment shall be of suitable type and adequate to obtain the densities specified, and shall provide satisfactory breakdown of materials to form a dense fill.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION:

- A. General:
 - 1. All excavation, trenching and shoring, and the like, under this Contract shall be performed in a manner that meets with the OSHA Department of Labor, Safety and Health Regulations for Construction.
 - 2. The Contractor shall excavate as necessary at the locations shown on the Drawings, staked in the field or otherwise specified for the installation of pipelines.
 - 3. The Contractor shall take precautions and protect all adjoining private and public property and facilities, including underground and overhead utilities, structures, and fences. Any disturbed or damaged facilities will be suitably restored or replaced at no cost to the Owner.
 - 4. Stream crossings shall be by open cut excavation unless noted otherwise. It shall be the Contractor's responsibility to develop the means and methods for the stream crossing as well as trench shoring and dewatering.

DIVISION 2 – SITEWORK

5. During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated material shall be piled on one side of the trench only. Surface drainage of adjoining areas shall be unobstructed.
 6. All excavated materials not required or suitable for backfill shall be removed and wasted at a site selected and secured by the Contractor at his expense. The disposal site shall be subject to the Owner's approval.
 7. Grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any other water accumulating therein shall be promptly removed. Under no circumstances shall water be permitted to rise in unbackfilled trenches until after the pipe has been placed, tested and covered with backfill. Any pipe having its alignment or grade changed as a result of a flooded trench shall be relaid at no additional cost to the Owner.
 8. The bottom of the trenches shall be accurately graded to provide required bury depth. Bedding material shall provide uniform bearing and support for each section of the pipe at every point along its entire length. Unauthorized over excavation shall be backfilled with bedding material at the Contractor's expense.
 9. Stream crossings, where constructed by open cut excavation, shall be constructed perpendicular to the axis of the stream channel. Stream crossings shall be selected at sites where the channel is relatively stable and not side-cutting. These sites generally occur at inflection points between meanders and along straight channel segments with vegetated banks. The Contractor shall be required to restore the original contours of the streambed and streambank. It shall be the Contractor's responsibility to develop the means and methods for the river crossing as well as trench shoring and dewatering. Instream flows shall be maintained during construction of stream crossings. Type 2 bedding shall be required along all crossings, below Type 1 bedding.
- B. Excavation: The sides of all trenches shall be benched, shored, and/or supported in accordance with OSHA Construction Standards for Excavation, Part 1926, Subpart P.
- C. Trench Dimensions: Trench dimensions shall be as specified below:
1. The width of the trench shall be such to provide adequate working room to install and join the pipe in the specified manner where workers must enter the trench. Where workers do not enter the trench, the width of that portion of the trench from the bottom of the trench to a maximum of 5 feet above the bottom of the shall be as follows:
 - a. A minimum of 4 inches for $\frac{3}{4}$ and 1-inch pipe.

DIVISION 2 – SITEWORK

- b. A minimum of 6 inches plus outside diameter for 1½ -inch to 3-inch pipe.
 - c. A minimum of 8 inches plus the outside diameter for 4-inch to 12-inch pipe or greater minimum width as specified by the pipe manufacturer.
 - d. A maximum of 2 feet plus the outside diameter of the pipe.
2. Trench depth shall be as required for 6 feet of cover in most areas, at least 6.5 feet of cover at road crossings, or as shown on the Drawings, plus the additional depth for Type 1 Pipe Bedding. Care shall be taken not to excavate below the required depth. If ledge rock, boulders or large stones are encountered at the bottom of the trench, excavating shall be carried a minimum of 6-inches below the bottom of the pipe for backfilling with Type 1 Pipe Bedding. When soft or unstable material is encountered at the subgrade which will not uniformly support the pipe, such material shall be excavated to an additional depth as directed by the Engineer and backfilled with Type 2 Pipe Bedding.
- D. Equipment: The use of trench digging machinery will be permitted except in places where its operation will cause damage to existing structures or features, in which case hand methods shall be employed. Any equipment operating on tracks, which is to be used on pavement, shall be equipped with suitable pads to prevent damage to the pavement. All pavement damaged during construction by the Contractor's equipment shall be restored to its original condition by the Contractor. No compensation will be allowed for pavement replacement.
- E. Dewatering: Where ground water is encountered in excavation, it shall be removed to prevent unstable trench conditions, laying of pipe in water, water entering the installed pipe, or any other interference with pipe laying and other construction operations. The cost of dewatering operations will not be paid for as a separate item, but shall be considered a part of the excavation cost.

3.02 TRENCH BACKFILL

- A. General: All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and approved by the Owner or Engineer. Leakage tests and pressure tests shall be performed after backfill. If any test fails, the Contractor shall be responsible for work required to correct the defects at no additional cost to the Owner.
- B. Pipe Bedding Material:
- 1. Bedding material under and around the pipe to 6 inches above the top of the pipe shall be placed by hand or other careful manner so as not to damage or disturb pipe. Depth of bedding material under the pipe shall be no less than three (3) inches for pipe 6 inch and larger and no less than two (2) inches for pipe smaller than 6 inch. Backfill material shall be placed in the trench for its full width on each side simultaneously.

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2. Water settling will not be allowed. The addition of water shall be limited to that required for optimum moisture for maximum compaction of the material.
- C. Trench Backfill Above Pipe Bedding:
1. Unimproved and Cultivated Areas: No special compaction will be required in unimproved and cultivated areas. Backfill material shall be placed in the trench and mounded neatly over the trench. Compaction shall be by wheel rolling a minimum of three passes with a rubber tired tractor over the full width of the trench. Backfilling shall be completed by grading a neatly ridged mound over the centerline of the trench. The mounds shall be measured from the original ground surface and be a minimum of 8 inches in height. Where backfill material is not available, the required material shall be obtained from a borrow area arranged for by the Contractor. No topsoil shall be stripped from the adjacent area of the trench. Any settlement of the trench surface below original surface grade during the warranty period shall be remedied by the Contractor at no additional cost to the Owner.
 2. In areas where the trench runs along a slope of 3H:1V or steeper for 50 feet or more, or where directed by the Owner, a runoff diversion berm will be required. A runoff diversion berm shall intersect the trench diagonally and extend 3 feet beyond both sides of the trench excavation. The berm shall also be a minimum of 8 inches in height as measured from the original ground surface. One diversion berm will be required for every 50 feet of excavation on sloped surfaces at no additional cost to the Owner.
 3. Improved Areas: Backfill material in improved areas such as roads, driveways, utility crossings, and where directed shall be carefully deposited in layers not to exceed 8-inches. Material shall be wetted to within 3 percent of optimum moisture content and compacted to at least 95 percent of maximum dry density as determined by AASHTO T99, or for material which does not exhibit a typical well defined moisture-density curve, 70 percent relative density as determined by ASTM D4253 and D4254. Backfilling shall be completed by replacing gravel surfacing or other site specific surface restoration. Any settlement of the trench surface below original surface grade during the warranty period shall be remedied by the Contractor at no additional cost to the Owner.
 4. Compaction by flooding will not be permitted. Wherever the trenches have not been properly filled, or if settlement below final grade occurs, they shall be reopened to the depth required for proper compaction, refilled and recompact.
 5. Trench excavation in improved areas where the native trench material consists of peat, soft clay, quicksand, or other material which, in the opinion of the Engineer, is unsuitable for use as backfill material or which cannot readily be conditioned or dried to be made suitable; such material shall be removed and disposed of by the Contractor. The material thus removed shall be replaced with suitable surplus material obtained from trench

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excavation materials from other areas within five miles and within the limits of the project at no additional cost. If suitable surplus material is not available within five miles and within the limits of the project, or when directed by the Engineer or Owner, the Contractor shall furnish suitable material from an approved borrow source as defined in Section 2.05 A., Trench Backfill Material Above Pipe Bedding. Separate payment will be made for this imported backfill.

- D. Backfilling For Appurtenances: Backfill around appurtenances shall be deposited in such a manner as not to disturb the appurtenance from its proper alignment, and then compacted to the finished grade. Material shall be wetted to within 3 percent of optimum moisture content and compacted to at least 95 percent of maximum dry density as determined by AASHTO T99, or for material which does not exhibit a typical well defined moisture-density curve, 70 percent relative density as determined by ASTM D4253 and D4254.
- E. Backfill Above Original Ground For Minimum Cover Requirements: Where shown on the Drawings, the Contractor shall provide embankment over the pipe, above the original ground surface, to a height which will satisfy the minimum depth of cover requirements. Such embankment shall be constructed to the cross section shown on the Drawings.
- F. Testing: Field density tests of the compacted backfill shall be performed at all levels. The Contractor shall be responsible for all laboratory and field density testing. No additional payment will be made for testing.
- G. Pipeline Warning Tape
 - 1. No pipeline warning tape is required for 1½ - and 2-inch buried pipe installations.
 - 2. Pipeline warning tape shall be provided for all buried 3-inch and larger pipe installations for this project. Bury tape over pipe between 18 and 36 inches below the original ground surface.
- H. Tracer Wire
 - 1. Tracer wire shall be provided for all buried 3-inch and larger pipe installations for this project.

3.03 CONTRACTOR'S SAFETY RESPONSIBILITIES

- A. Whether utilizing Type 1 or Type 2 Trench Excavation, the Contractor shall be responsible for enforcing safety and maintaining safe working conditions in all trenching and shoring operations to conform to OSHA regulations and any applicable local requirements.
- B. The Contractor shall employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches, and other operations involving safety procedures, as prescribed by OSHA.

DIVISION 2 – SITEWORK

3.04 TRAFFIC CONTROL AND WARNING DEVICES

- A. The Contractor shall construct the project in such a manner as to minimize the interruption of the use of roads, highways or streets involved and shall provide access for emergency vehicles at all times. School bus routes shall remain open as required so as not to delay buses.
- B. The Contractor is responsible for providing traffic control devices in adequate numbers and locations to alert the public, motorists and pedestrians of hazardous conditions. The Manual on Uniform Traffic Control Devices (MUTCD) shall be followed for use of traffic control.

3.05 PROTECTION OF EXISTING PROPERTIES

- A. Prior to beginning construction, the Contractor must contact all utility companies and/or public utilities having underground installations that may be encountered during the excavation. The Contractor must locate any underground installations and shall preserve intact any underground pipes or other utilities encountered during construction (except as hereinafter permitted) provided their location is such that they do not interfere with new pipelines or structures being installed. In case such utilities or other structures are accidentally broken, they shall be immediately replaced in the condition conforming to the standard repair practice of the utility, all at the Contractor's expense.
- B. Maintenance of Flows: Adequate provisions shall be made for maintaining the flow of drains and water courses encountered during construction. Culverts, ditches, fences, and structures which are disturbed by this construction shall be satisfactorily restored to their original condition upon completion of the work.
- C. Structures: The Contractor shall exercise every precaution to prevent damage to existing buildings or structures in the vicinity of his work. In the event of such damages, he shall repair them to the satisfaction of the owner of the damaged structure and at no cost to the Owner or the structure owner.
- D. Overhead Utilities: The Contractor shall use extreme caution to avoid a conflict, contact, or damage to overhead utilities, such as power lines, telephone lines, television lines, poles, or other appurtenances during the course of construction of this project.

3.06 CLEANUP

- A. As work progresses, that portion of the work completed shall be cleared of debris and brought to the finished grade. Upon completion of the work, the entire site shall be cleared of all debris and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. All rocks brought to the ground surface by excavation or backfilling operations shall be removed.

END OF SECTION 02221

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This item of work shall consist of furnishing all labor, materials, and equipment necessary to do all work and related items as shown on Drawings, herein specified, or incidental to proper execution of the work to complete the boring and jacking at the required locations.
- B. Areas requiring boring and jacking for water main and service line installation include:
 - 1. Paved roadway crossings.
 - 2. Graveled roadway crossings where specifically noted.

1.02 SUBMITTALS

- A. The Contractor shall submit for approval manufacturers' information on the type of casing pipe and skid units he proposes to use as well as a plan of construction methods proposed.

PART 2 PRODUCTS

2.01 CASING PIPE

- A. Casing pipe shall be either steel or high density polyethylene (HDPE) as specified herein. Casing pipe diameters shall be properly sized to allow installation of the carrier pipe with minimum nominal diameters as listed below:

Carrier Pipe	Steel Casing Pipe Nominal Diameter	HDPE Casing Pipe Nominal Diameter
3-inch (PVC)	8 inches	8 inches
6-inch (PVC)	12 inches	13 inches
14-inch (PVC)	26 inches	28 inches

- B. Steel Pipe. Steel casing pipe shall be smooth steel pipe, ASTM A570 Grade B, having a minimum yield strength of 35,000 PSI with a minimum wall thickness of 0.25-inches. Ends shall be beveled for field butt welding, and joints shall be welded around the entire circumference and ground smooth.
- C. HDPE Pipe. High density polyethylene casing pipe shall be IPS size and have a minimum pressure rating of 100 PSI, maximum of SDR 17. Joints shall be fusion welded.

2.02 PIPE SKIDS

- A. Pipe skids shall be installed on all carrier pipes. Pipe skids shall be of sufficient depth to prevent the bell end of the pipe from coming in contact with the casing pipe. Skid depth shall exceed the outermost edge of the pipe bell by a minimum of 3/4-

inch. Pipe skids shall be either wood skids or composite stainless steel/ polyethylene casing chocks as specified herein.

- B. Wood Skids. Redwood timber skids shall be required where wooden skids are used. Pipe 3-inch and smaller in size require two skids. Pipe 4-inch to 12-inch in size require four skids and pipe larger than 12-inch require six skids. Skids shall be evenly spaced and shall run the full length of the pipe except at pipe joints. Ends shall be notched for securing with stainless steel straps. Wooden skid materials shall not be treated with creosote in order to prevent damage to PVC pipe.
- C. Casing Chocks. Metal components of casing chocks shall be Type 304 (18-8) stainless steel. The liner shall be neoprene rubber or PVC, and the runners shall be UHMW polyethylene with a low friction factor. Casing chocks shall be designed for center restraint and maintain a minimum clearance of 1.0 inch between the casing ID and the carrier pipe bell OD. Casing chocks shall be CCI Pipeline Systems Model C558, Power Seal Model 4810, APS (Advance Products and Systems), or equal.

2.03 END SEALS

- A. End seals on casing pipes shall be 1/8-inch synthetic rubber, CCI pipeline Systems, Pipeline Seal and Insulator (PSI) or equal.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROCEDURES

- A. Casing Pipe: Casing pipe shall be so constructed as to prevent leakage from the casing throughout its entire length. Casing pipe shall be installed to prevent the formation of a waterway along its length. Casing shall have an even bearing on the surrounding soil throughout and shall have a slight slope to one end.
- B. Install the casing by jacking it through the earth, while excavating by boring or mining methods, to the lines and grades shown on the drawings, or as staked by the Engineer. No open excavation will be permitted where jacking or boring is specified and shown on the plans.
- C. Provide adequate equipment so as to insure a smooth, continuous and uniform operation leaving no exterior voids along the casing pipe.
- D. As pipe is jacked forward, excavate and remove soil through the pipe. Do not allow excavation to precede jacking operation.
- E. If voids occur, provide grout holes and fill with pressure grout before installing the carrier pipe.
- F. After each section of casing pipe has been jacked to the limits, the following section shall be connected to the preceding by a full penetration butt weld or in the case of HDPE by a full circumference butt fusion weld around the entire circumference of the joint.

- G. The Contractor may elect to provide a casing pipe larger than that shown on the plans to facilitate his excavation. However, the thickness of the casing actually used must meet the approval of the Engineer. No additional payment shall be made for any increase in the size of the casing pipe.

3.02 HIGHWAY ROAD CROSSINGS

- A. General Guidelines: In addition to the requirements specified herein, the Contractor shall conform to the following provisions for boring and jacking and pipe installation on highway road right of ways.
1. Roadway Crossings: The top of the casing pipe shall be installed at sufficient depth to provide a minimum of 6.5 feet of cover in roadways. A minimum of 6.0 feet of pipe cover is required in adjacent areas. The boring and jacking operation shall be perpendicular to the roadway. No portion of the excavated pit shall be closer than a point 15 feet measured horizontally outside the shoulder line or the toe of the inslope whichever is greater. Traffic signage shall be erected in accordance with the respective highway authority. Crossing permits will be obtained by the Owner.
 2. Protection to the free and safe flow of the highway traffic shall be required in accordance with the "Manual on Uniform Traffic Control Devices", current edition. During construction, a flag person will be on site for safety and to assist in traffic control whenever men and equipment are working closer than 45 feet to the roadway centerline and if directed by the Engineer.
 3. Vehicles and other work equipment used to install or maintain said facilities within the highway right of way shall use established access points, service roads, driveways and approaches to enter and leave the right of way for the performance of necessary work. Vehicles and work equipment shall not be parked on the through-traffic lanes or shoulders of the highway during construction or maintenance of said facilities.
 4. Trenches and pits opened within the highway right of way shall be of a minimum width necessary to accommodate installation of said facilities. Any open trench or pit left unattended shall be properly marked and barricaded.
 5. Trenches and pits opened within the highway right of way shall be backfilled, compacted to a density equal to that of the adjacent undisturbed soil and restored to the original profile. The backfill, for all work on the inslope or closer than 45 feet to centerline, shall be tamped and tested for 95 percent compaction in accordance with American Association of State Highway and Transportation Officials (AASHTO) test procedure T99, latest edition. Consolidation of the backfill by saturation or ponding water is not permissible.
 6. The top of manholes, valve boxes, or service boxes installed within the highway right of way shall be flush with the existing ground line of the ditch section, highway or surface of the street or approach.

7. Waste or unused excavated material shall not be placed on the road, shoulder, or inslope of the highway where it could interfere with traffic. Unused excavated material will be graded to match existing slopes on the rights of way or removed. In areas where bench cuts are made, the original profile shall be restored.
8. All areas disturbed by construction of facilities shall be restored to the original profile and reseeded with a blend of natural grasses as soon as practicable following the grading. Mulch and fertilizer shall be applied uniformly to insure proper growth in all areas disturbed by construction.
9. Jacking and boring pits shall be located twice the depth of the waterline measured perpendicular from the roadway shoulder. No hydraulic excavation will be permitted.
10. No uncased pipeline or portion of the pipeline shall be closer than the toe of inslope or 45 feet whichever is greater, measured perpendicular to the road centerline.
11. The Contractor shall be responsible for all coordination with the appropriate highway agency.
12. The Contractor shall be responsible for all cost related to damage of the right-of-way or road due to construction of the facilities. Method of repairs shall be settled with the appropriate highway agency representative.

3.03 PIPE SKIDS

- A. Wood Skids. Wood skids shall be evenly spaced around the pipe perimeter. Skids shall be secured with 2-3/4 inch stainless steel straps at each end. Skids shall be sized to fit snugly against the casing pipe interior. If not sized for a snug fit, the annulus between the casing and carrier pipes shall be hydraulically or pneumatically filled with sand after the carrier pipe has been installed.
- B. Casing Chocks. Casing chocks shall be installed in accordance with the manufacturer's recommendations. Chock spacing shall also be in accordance with the manufacturer's recommendations. Filling of the annulus is not required if casing chocks are installed.

3.04 END SEALS

- A. Install end seals on each end of the casing pipe per manufacturer's recommendations.

END OF SECTION 02225

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This item of work shall consist of furnishing all labor, materials, and equipment necessary to do all work and related items as shown on Drawings, herein specified, or incidental to proper execution of the work to complete the directional drilling at the required locations.
- B. Areas requiring directional drilling for water main and service line installation include:
 - 1. Paved roadway crossings as an option to boring and jacking, where Engineer approved.
 - 2. Graveled roadway crossings where specifically noted as an option to boring and jacking, where Engineer approved.
 - 3. Stream crossings as an option to open cut excavation, where Engineer approved or where specifically noted.

1.02 SUBMITTALS

- A. The Contractor shall submit manufacturers' information on the casing pipe, if required, and carrier pipe he proposes to use. Included in this information shall be the maximum bending radius allowable as recommended by the manufacturer. Manufacturer's literature on pipe couplings shall also be submitted.
- B. The Contractor shall submit shop drawings showing the proposed alignment of the pipeline to be installed by directional drilling methods. Included in these shop drawings shall be a plan view showing the site location, pipeline alignment, work area for drill rig, and work area for pipeline string; and a profile of the alignment showing key elevations, entry and exit locations, and the maximum radius of curvature at the entry/exit and crossing of the carrier pipe.

PART 2 PRODUCTS

2.01 CARRIER PIPE AND FITTINGS

- A. Carrier Pipe. Carrier pipe installed with directional drilling shall be high density polyethylene pipe as specified in Section 15060, PIPE AND PIPE FITTINGS.
- B. Couplings. Couplings to connect PVC and polyethylene pipe shall be mechanical joint couplings a minimum of 12 inches in length, except for 2-inch pipe for which couplings shall be a minimum of 8-inches in length.

2.02 CASING PIPE

- A. Casing pipes are only required on road crossings unless otherwise noted. Casing pipe shall be high density polyethylene (HDPE) as specified herein. Casing pipe diameters shall be properly sized to allow installation of the carrier pipe with minimal inside diameters as listed below:

CARRIER PIPE		HDPE CASING PIPE	
DIAMETER	SDR	DIAMETER	SDR
3-inch	11/9/7	6-inch	17
6-inch	11/9/7	10-inch	17
14-inch	11/9/7	18-inch	17

- B. HDPE Pipe. High density polyethylene casing pipe shall be manufactured from high density, very high molecular weight (VHMW) pipe resin designated by PPI as PE3408. Casing pipe shall have a minimum pressure rating of 100 PSI and a maximum SDR of 17. Joints shall be fusion welded.
- C. End Seals. End seals on casing pipes shall be 1/8-inch synthetic rubber, Pipeline Seal and Insulator (PSI) or equivalent.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROCEDURES

- A. Casing Pipe: Casing pipes are only required on road crossings unless otherwise noted. Casing pipe shall be so constructed as to prevent leakage from the casing throughout its entire length. Casing pipe shall be installed to prevent the formation of a waterway along its length. Casing shall have an even bearing on the surrounding soil throughout. Each end of the casing pipe shall be sealed with an end seal to prevent entrance of backfill material.
- B. Roadway Crossings: The top of the casing pipe shall be installed at sufficient depth to provide a minimum of 6.5 feet of cover in roadways. A minimum of 6.0 feet of pipe cover is required in adjacent areas. The directional drilling operation shall be perpendicular to the roadway. No portion of the drill rig shall be closer than a point 15 feet measured horizontally outside the shoulder line or the toe of the inslope whichever is greater. Traffic signage shall be erected in accordance with the respective highway authority. Crossing permits will be obtained by the Owner.
- C. Stream and River Crossings: The top of the carrier pipe shall be installed at sufficient depth to provide a minimum of 6.0 feet of cover in stream and river beds. A minimum of 6.0 feet of pipe cover is required in adjacent areas. The directional drilling operation shall be perpendicular to the stream.
- D. Specific details of the drilling operation shall be left to the discretion of the Contractor.

- E. The location of the exit point of the drill bit shall be accurate within 2-percent of the length of the drill hole (i.e. if the length of the drill hole is 500 feet, the exit point of the drill bit shall be within 10 feet of the targeted exit location). In addition, accuracies of 2-percent of the total length of the drill hole are required along the drill hole alignment. The onsite inspector will review the acceptability of the pilot hole alignment and profile with the Contractor. If unacceptable, the Contractor will be instructed to correct alignment/profile.
- F. Contractor shall utilize surface locators during the drilling operation to ensure that location and alignment of drill holes stay within specified tolerances. Surface locators shall be utilized on land, so the drilling assembly can be located as it passes under the stream bank.
- G. Final diameter of reamed hole shall be no more than 4-inches larger than the outside diameter of the pipe to be installed. Drill mud shall be left in the hole to fill all voids around the pipe.
- H. Several passes with the reamer may be required to enlarge the hole to final size. The type and size of reamer used, and the number of passes required shall be at the Contractors discretion.
- I. The pipe pullback operation shall be carried out as soon as possible following the final preream.
- J. Any excess drilling mud shall be disposed of by the Contractor at his own expense in a matter consistent with local environmental regulations.

3.02 HIGHWAY CROSSINGS

- A. General Guidelines: In addition to the requirements specified herein, the Contractor shall conform to the following provisions for pipe installation on highway road right of ways.
 - 1. Protection to the free and safe flow of the highway traffic shall be required in accordance with the "Manual on Uniform Traffic Control Devices", current edition. During construction, a flag person shall be on site for safety and to assist in traffic control whenever men and equipment are working closer than 45 feet to the roadway centerline and if directed by the Owner.
 - 2. Vehicles and other work equipment used to install or maintain said facilities within the highway right of way shall use established access points, service roads, driveways and approaches to enter and leave the right of way for the performance of necessary work. Vehicles and work equipment shall not be parked on the through-traffic lanes or shoulders of the highway during construction or maintenance of said facilities.
 - 3. Trenches and pits opened within the highway right of way shall be of a minimum width necessary to accommodate installation of said facilities.

Any open trench or pit left unattended shall be properly marked and barricaded.

4. Trenches and pits opened within the highway right of way shall be backfilled, compacted to a density equal to that of the adjacent undisturbed soil and restored to the original profile. The backfill, for all work on the inslope or closer than 45 feet to centerline, shall be tamped and tested for 95 percent compaction in accordance with American Association of State Highway and Transportation Officials (AASHTO) test procedure T99, latest edition. Consolidation of the backfill by saturation or ponding water is not permissible.
5. The top of manholes, valve boxes, or service boxes installed within the highway right of way shall be flush with the existing ground line of the ditch section, highway or surface of the street or approach.
6. Waste or unused excavated material shall not be placed on the road, shoulder, or inslope of the highway where it could interfere with traffic. Unused excavated material will be graded to match existing slopes on the rights of way or removed. In areas where bench cuts are made, the original profile shall be restored.
7. All areas disturbed by construction of facilities shall be restored to the original profile and reseeded with a blend of natural grasses as soon as practicable following the grading. Mulch and fertilizer shall be applied uniformly to insure proper growth in all areas disturbed by construction.
8. Where water lines cross under state or BIA roads, they shall be installed inside a casing pipe that is placed by jacking or boring or directional drilling. Jacking and boring pits or drill rig shall be located twice the depth of the waterline measured perpendicular from the roadway shoulder. No hydraulic excavation will be permitted.
9. No pipeline or portion of the pipeline shall be closer than 45 feet, measured perpendicular, to the road centerline.
10. The Contractor shall be responsible for all coordination with the appropriate highway agency.
11. The Contractor shall be responsible for all cost related to damage of the right-of-way or road due to construction of the facilities. Method of repairs shall be settled at the field level with the appropriate highway agency representative

END OF SECTION 02226

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This item of work shall consist of tree planting and final grading, spreading topsoil over, and seeding disturbed areas.
- B. Areas requiring restoration and seeding are described as follows but not limited to:
 - 1. Pipe trenches and excavations
 - 2. Boring pits/excavations within Highway right-of-ways
 - 3. Borrow and stockpile areas
 - 4. Haul and access roads and staging areas developed by the Contractor.

1.02 SUBMITTALS

- A. The Contractor shall submit a description of the fertilizer and the seed mix he plans to use and the methods he intends to use to do the finish grading, prepare the seed-bed, and apply the seed.

1.03 PAYMENT

- A. Surface restoration is incidental to the water line work. Payment will be made through the applicable water line bid items.

PART 2 PRODUCTS

2.01 TOPSOIL

- A. The topsoil shall be obtained from that stockpiled during the clearing and grubbing and excavation activities. The topsoil shall not contain gravel pieces larger than 3-inches.

2.02 SEED

- A. The seed shall be a mixture of grass seed applied at the rate given below. Application rate is for drilling. Rates for broadcasting or hydro-seeding shall be twice the given rate. Seeding mixture shall be applied at the rates specified for Rangeland or Conservation Reserve Program (CRP) land, whichever is applicable.

RANGELAND	
Type of Seed	Pounds/Acre
Western Wheatgrass	4.0
Green Needlegrass	1.5
Big Blue Stem	1.0
Little Blue Stem	0.8
TOTAL	7.3 pounds/acre

CONSERVATION RESERVE PROGRAM	
Type of Seed	Pounds/Acre
Intermediate Wheatgrass	12.5
TOTAL	12.5 pounds/acre

- B. Calculations of pure live seed may be made on the basis of either a germination test or a tetrazolium test in addition to the purity analysis. Seed shall be applied on a pure "live seed" basis. The quantity of pure "live seed" in a 100-pound container shall be determined by the formula:

$$100 \times (\% \text{ Germination} \times \% \text{ Purity})$$

For example, if the seed is 85 percent pure and test 90 percent germination, then a 100-pound container would contain 76.5 pounds of pure "live seed".

- C. All seed must be adapted to the central plains of South Dakota. Grass seed shall contain no prohibited noxious weed seeds as defined by the South Dakota State Department of Agriculture.

2.03 FERTILIZER

- A. The following commercial fertilizer application rates shall apply:

Type of Fertilizer	Pounds/Acre
Nitrogen	40
Phosphate	40
TOTAL	80 pounds/acre

2.04 MULCH

- A. Mulch shall consist of pliable grass hay having a minimum length of 8-inches. Chopped or ground material is not acceptable. Mulch material is not acceptable if it is musty, moldy, or rotted, or if it contains seed bearing stalks of noxious weeds or grasses. It shall be free of stones, dirt, or other foreign material.

PART 3 EXECUTION

3.01 FINISH GRADING

- A. The Contractor shall finish grade all disturbed areas. The finish grading shall leave the graded areas relatively smooth and suitable for reseeding. The finish graded surface shall blend with adjacent contours.

3.02 PLACING TOPSOIL

- A. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation. After placement is

completed, the surface of the topsoil shall be finished to a reasonably smooth surface.

3.03 SEEDING

- A. Applications: Previously grassed areas designated in the field or specified herein shall be seeded with grasses. All access roads developed by the Contractor shall be seeded and fertilized. Contractor staging areas shall also be reseeded but at no additional cost to the Owner. The seed shall be drilled by no-till, mechanical seeding equipment approved by the Engineer. Areas that are too steep to drill shall be broadcast seeded with a mechanical seeder or hydro-seeded.
- B. Seed Cover: After broadcast application, the seed shall be covered with 1/2 to 3/4-inch of soil. The seed may be covered by dragging or by other appropriate mechanical means.
- C. Seeding shall be done at times of the year when climatic conditions including temperature and soil moisture are conducive to growth. These periods occur in the spring of the year after the frost leaves the ground and until May 31st; and in the period of approximately September 1 through October 15. These periods vary depending on the climatic conditions and are subject to approval by the Engineer.
- D. Maintenance: Any portion of the ground surface on which the expected stand of seed has not produced within the first year shall be restored to a satisfactory condition and reseeded with the same seed and procedures as originally specified.

3.04 FERTILIZER

- A. The fertilizer shall be applied separately from the seed at the rates given herein.
- B. If the fertilizer is spread dry, it shall be spread uniformly and worked into the soil immediately.

3.05 MULCHING

- A. Mulch application rate shall be 4000 pounds per acre. Mulching shall not be done during adverse weather conditions or when wind prevents uniform application. Application shall be in a manner to not seriously disturb the seed bed. Mulch shall not be applied in the presence of free water, but may be applied to damp ground. Mulch shall be crimped into the top three inches of soil material using a mulch tiller or other implement approved by the Owner or Engineer. Mulching is required only in those areas where the ground surface exceeds a 3:1 slope.

3.06 CLEANUP OF AREA

- A. Upon completion of the work, the entire project site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat, workmanlike appearance. Any existing utilities, structures, landscaping, grass areas, etc. which are damaged due to negligence of the Contractor shall be repaired or replaced at the Contractor's expense and as directed by the Owner or Engineer.

END OF SECTION 02575

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section includes the work necessary to furnish and install, complete, fabricated metalwork and castings as shown or as required to secure various parts together and provide a complete installation.

1.02 GENERAL

- A. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

1.03 STANDARDS

- A. "Code for Welding in Building Construction," American Welding Society.
- B. "Fastener Standards," Industrial Fastener Institute.
- C. "Code and Specifications" of the American Institute of Steel Construction.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Shipment:
 - 1. Insofar as practical, factory assemble items specified herein.
 - 2. Package and clearly tag parts and assemblies that are of necessity shipped unassembled, in a manner that will protect materials from damage, and facilitate identification and field assembly.

1.05 GENERAL FABRICATION

- A. Fabrication shall be coordinated with connecting work.
- B. The fabrication shall be done in units as large as practicable for finishing, handling and installation.
- C. All welding shall conform to the requirements of the American Welding Society.
- D. Connections:
 - 1. Shop connections shall be welded after removing all scale, and ground smooth.
 - 2. Field connections shall be bolted, unless otherwise specified or detailed.
 - 3. Punch or drill holes shall not be cut with a torch.
 - 4. Joints exposed to weather shall be formed so as not to trap water.

- 5. Butt joints shall use the mill square end and be smoothed.
- 6. Corners shall use a cope and weld technique.

PART 2 PRODUCTS

2.01 GENERAL

- A. Like Items of Materials: End products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. Where applicable, the structure and appurtenant facilities have been designed around the first named manufacturer's equipment. Metalwork furnished by all qualified interested manufacturers will be considered, provided that necessary structural, electrical, and mechanical changes required are submitted in conformance with the requirements of CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS. The Contractor shall bear all costs for necessary changes for a complete and satisfactory installation.
- C. Furnish miscellaneous items:
 - 1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
 - 2. Items specified herein are not intended to be all inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.
- D. Unless otherwise indicated, materials shall meet the latest issue of ASTM Specifications as follows:

<u>Item</u>	<u>ASTM Specification</u>
Steel Shapes & Plates:	A36
Steel Pipe Columns:	A501 or A53, Type EDRS, Grade B
Structural Steel Tubing:	A500, Grade B
Stainless Steel:	
Bars & Shapes:	A276, Type 316
Steelplate, Sheet & Strip:	A167, Type 316
Bolts:	A193, Type 316, B8MN, B8M2 or B8M3
Nuts:	A194, Type 316, B8MN, B8M2 or B8M3
Aluminum, Structural Shapes and Plates:	Alloy 6061-T6, meeting referenced specifications and ASTM sections found in Aluminum Association Construction Manual Series

DIVISION 5 – METALS**SECTION 05500
MISCELLANEOUS METAL ITEMS**

Connection Bolts for Steel Members; Use Compressible-Washer Type Direct Tension Indicators @ All Connections; Use Hardened Washers also Under Head and Nut: A325-F, F959-85, F436 (Washers)

Anchor Bolts & Nuts:
Carbon Steel: A307 or A36
Stainless: A193, Type 316
Galvanized Steel Bolts and Nuts: A153, Zinc Coating for A307, or A36
Flat Washers (Unhardened) F844, Use A153 for Zinc Coating
Threaded Bars: A36

Connection Bolts for Wood Members:
Dry Environment: A307 Uncoated
Wet Use or Exterior Use: A307 w/A153 Galvanizing

Connection Bolts for Aluminum: A2024-T4; or use appropriate Stainless Steel
Cast Iron: A48, Class 30

2.02 ANCHOR BOLTS

- A. Anchor bolts for equipment and machinery, where permanently anchored into concrete (nonsubmerged use), shall be galvanized steel, unless otherwise shown. The diameter, length, and any bend dimensions shall be as required by the equipment or machinery manufacturer. Unless otherwise required, use 3/4-inch minimum diameter and other geometry shown on the Drawings. Furnish a minimum of two nuts and a washer of the same material for each bolt. Provide sleeves as required or as shown for location adjustment.
- B. Anchor bolts for equipment, as hereinafter defined, machinery or other connections that are to be for submerged use shall be as specified for nonsubmerged use except that the bolts shall be Type 316 stainless steel.
- C. Submerged use is defined as any connection to concrete from a point 1 foot 6-inches above the maximum water surface and any connections below that point.
- D. Anchor bolts for other uses to anchor fabricated metal-work or structural building columns, or other components where the connections will be protected or dry, shall be galvanized steel. Minimum size shall be 3/4-inch diameter by 12-inches long, unless otherwise shown. Furnish two nuts and one washer per bolt of the same material as the bolt, unless otherwise shown.
- E. Anchor bolts for other uses to anchor fabricated metalwork or structural building, or structural frame components in areas of wet use, washdown areas, or areas outside

heated buildings, shall be galvanized steel. Minimum size shall be 3/4-inch diameter by 12-inches long, unless otherwise shown. Furnish two nuts and one washer per bolt of the same material as the bolt, unless otherwise shown.

2.03 STAINLESS STEEL FASTENERS LUBRICANT (ANTI-SEIZING)

- A. Where stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners are used, Contractor shall apply an anti-seizing lubricant to the threads prior to making up the connections. The lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talic, or copper, as manufactured by Lot Tite Co., Permatex, or approved equal.

2.04 ANCHORING SYSTEMS FOR CONCRETE**A. Wedge Anchors:**

1. Wedge anchors shall be 100 percent 316 stainless steel and shall not be used below a point of 1-foot 6-inches above the peak (maximum) water surface. See epoxy anchors or coated anchor bolts specified elsewhere in this Specification.
2. Wedge anchors shall be 316 stainless steel, manufactured by ITT Philips Drill Division, Michigan City, IN; Hilti Kwik-Bolt, stud type, manufactured by Hilti, Inc., Tulsa, OK; Parabol Concrete Anchors, manufactured by Molly Division of Emhart Corp., Temple, PA; or equal. Furnish sizes shown on Drawings. Provide ICBO (International Conference of Building Officials) or other similar building code organization recommendations regarding safe allowable design loads.

B. Expansion Anchors:

1. Expansion anchors shall not be used except in dry areas where future corrosion is not a problem.
2. Self-drilling anchors, snap-off type or flush type. Provide anchors for use with hot-dipped galvanized bolts. Nondrilling anchors shall be flush type for use with a bolt or stud type with projecting threaded stud. Provide ICBO or other similar code organizations' recommendation regarding safe allowable design loads. ITT Phillips Drill Division, Michigan City, IN; Hilti HDI Drop-In anchors, Hilti, Inc., Tulsa, OK; or approved equal.

C. Epoxy Anchors:

1. Provide for anchoring metal components at or below a point 1-foot 6-inches above maximum water surface elevation or buried in earth conditions.
2. Anchor rod shall be 316 stainless steel threaded rod free of grease, oil, or other deleterious material with a 45-degree chisel point.
3. Epoxy Adhesive:

- a. Meet ASTM C881, Type 1, Grade 3, Class A, B, or C.
 - b. Two-component, 100 percent solids, nonsag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments and gray in color.
 - c. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
4. Mixed Epoxy Adhesive:
- a. Nonsag paste consistency with ability to remain in a 1-inch diameter overhead drilled hole without runout, holding the following properties:
 - i. Slant Shear Strength, ASTM C881/882, No Failure In Bond Line, Dry/Moist Conditions: 5,000 psi.
 - ii. Compressive Strength, ASTM D695: 14,000 psi minimum.
 - iii. Tensile Strength, ASTM D695: 4,500 psi.
 - iv. Heat Deflection Temperature, ASTM D648: 135 degrees F, minimum.
5. Epoxy Adhesive Packaging:
- a. Disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun.
 - b. Dispense components through a mixing nozzle that thoroughly mixes components and places epoxy at base of predrilled hole.
 - c. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate sizes of anchor rods.
6. Manufacturers:
- a. Adhesives Technology Corp., 21850 88th Place South, Kent, WA, 98031, Anchor-It Fastening Systems, HS 200 Epoxy Resin.
 - b. ITW Ramset/Red Head, P.O. Box 90, Paris, KY 40361, Epcon Ceramic 6 Epoxy Anchor System.
 - c. Or Equal.

2.05 MISCELLANEOUS STRUCTURAL STEEL SUPPORTS

- A. Provide all structural steel supports of the sizes and weights shown. All connections shall be welded, unless otherwise shown.

2.06 BOLTS AND FASTENERS

- A. Bolts and fasteners not permanently embedded in concrete, but located outdoors in areas subject to the weather; equipment rooms subject to drainage and leakage, and in galleries and trenches, shall be Type 316 stainless steel as hereinbefore specified.
- B. Bolts and fasteners not permanently embedded in concrete, not used for structural steel or piping, but located indoors where leakage and drainage are not likely to occur may be ASTM A 307 or A 36 with ASTM A 153 Galvanized.
- C. Bolts for flanges of piping, valves, and other similar connections shall be as specified in other sections or as shown on the Drawings.

2.07 PIPE SLEEVES

- A. Provide hot-dip galvanized, Schedule 40 steel pipe sleeves where shown for piping passing through concrete or masonry. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls.
- B. Support pipe sleeves by formwork to prevent contact with reinforcing steel. Do not weld reinforcing to pipe sleeves.

2.08 ALUMINUM ITEMS

- A. General: Aluminum 6063 alloy extruded bar, rod, shapes, type and wire shall conform to Federal Specification QQ-A-200. Aluminum 6061 alloy seamless drawn tubing shall conform to Federal Specification WW-T-700.
- B. Anchor Bolts, Nuts and Washers: Aluminum anchor bolts, nuts and washers shall conform to the applicable requirements of Section 5 of the Aluminum Association Specifications for Aluminum Structures. Where aluminum anchor bolts are embedded into the concrete, use stainless steel bolts as specified hereinbefore.

2.09 MISCELLANEOUS FABRICATED METALS

- A. The following additional items are listed as a guide. Some items on the list may not be required, and list may not be all-inclusive. Submittal data for materials and products must be approved before they are incorporated in the work.
 - 1. Vents with screens.
 - 2. Pipe Supports.
 - 3. Pump Motor Platforms.
 - 4. Steel Bases and Anchors.

2.10 SHOP PAINTING

- A. Clean ferrous metal items not galvanized and apply shop coat of metal primer.

PART 3 EXECUTION**3.01 GENERAL**

- A. Workmanship and finish of all metalwork specified under this section shall be the highest grade and equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the work can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate materials as specified. Weld connections, except where bolting is directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses and as directed by the Engineer.
- B. Grind all exposed edges of welds smooth. All sharp edges shall be rounded to a 1/8-inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
- C. Welds and adjacent areas shall be prepared such that there is (1) no undercutting or reverse ridges on the weld bead, (2) no weld spatter on or adjacent to the weld or any other area to be painted, and (3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.
- D. Aluminum: Fabricate aluminum as shown, and in accordance with the Aluminum Association Standards and the manufacturer's recommendations as approved. Grind smooth sheared edges exposed in the finished work.

3.02 WELDING

- A. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale which will withstand vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. No welding shall be done when the temperature of the base metal is lower than zero degrees F. Finished members shall be true to line and free from twists.
- B. Aluminum: Aluminum shall be welded with Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with the manufacturer's recommendations as approved, and in accordance with the recommendations of the American Welding Society contained in the Welding Handbook, as last revised. Grind smooth all exposed aluminum welds.

3.03 INSTALLATION OF FABRICATED METALWORK

- A. Install in accordance with the shop drawings, the Drawings and these Specifications. Perform field welding and erection work by skilled mechanics. Install fabricated

metalwork plumb or level as applicable. The completed installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of Standard Practice, except as modified. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

- B. Aluminum: Erection of aluminum shall be in accordance with the Aluminum Association. Mill markings shall not be removed from concealed surfaces. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after the material has been inspected and approved by the Engineer.

3.04 ANCHOR BOLTS

- A. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.

3.05 CONCRETE ANCHORS

- A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. Anchor shall not be installed closer than six times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict conformance with manufacturers written instructions. Use manufacturer's recommended drills and equipment.

3.06 GALVANIZING AND REPAIR

- A. Galvanizing of steel plates, shapes, bars (and products fabricated from these items), and strip 1/8-inch thick or thicker, shall conform to ASTM A 123. Pipe, welded or seamless steel, shall conform to ASTM A 120. Material thinner than 1/8-inch shall either be galvanized before fabrication in conformance with the requirements of ASTM A 525, Coating Designation G 210; or after fabrication, in conformance with the requirements of ASTM A 123, except that the weight of zinc coating shall average not less than 1.2 ounces per square foot of actual surface area with no individual specimen having a weight of less than 1.0 ounce. Unless otherwise provided, galvanizing shall be done before or after fabrication, for material which is thinner than 1/8-inch, at the option of the Contractor. Galvanizing will not be required for stainless steel, monel metal, and similar corrosion-resistant parts.
- B. All welded areas shall be thoroughly cleaned prior to galvanizing to remove all slag or other material that would interfere with the adherence of the zinc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating.
- C. Galvanizing of chain link fence fabric, when specified or shown on the Drawings, shall conform to ASTM A-392. In like manner, galvanizing of iron and steel hardware, and nuts and bolts, shall conform to ASTM A 153. Galvanizing shall be performed after fabrication. Galvanizing of tapped holes will not be required.
- D. Fabrication shall include all operations such as shearing, cutting, punching, forming, drilling, milling, bending, welding, and riveting.

- E. Components of bolted assemblies shall be galvanized separately before assembly.
- F. The minimum pitch diameter of the threaded portion of all bolts, anchor bars, or studs shall conform to ANSI B1.1, having a Class 2A tolerance before galvanizing. After galvanizing, the pitch diameter of the nuts or other internally threaded parts may be tapped over ANSI B1.1, Class 2B tolerance, by the following maximum amounts:
- | | |
|----------------------------|---------------------|
| 3/8-inch through 9/16-inch | 0.016-inch oversize |
| 5/8-inch through 1-inch | 0.023-inch oversize |
| 1-1/8-inch and larger | 0.033-inch oversize |
- G. All edges of tightly contacting surfaces, where galvanized is required, shall be completely sealed by welding before galvanizing.
- H. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by solvent cleaning the damaged area (Steel Structures Painting Council SP 1) and hand or power tool (Steel Structures Painting Council SP 2 or SP 3) the damaged areas removing all loose and cracked coating; after which the cleaned areas shall be painted with one of the following coatings:
1. One coat of Inorganic Zinc Silicate (MPL-P-23236, Class 3).
 2. Two coats of Galvanizing Repair Paint (MIL-P-21035).
 3. Two coats of Zinc Dust Paint (MIL-E-15145, Formula 102).
- I. Paint should be applied to a cleaned surface. Abrasive blasting is required for inorganic zinc silicate.

3.07 ELECTROLYTIC PROTECTION

- A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry or concrete, protect surfaces in accordance with System No. 6 of Section 09900, PAINTING. Allow paint to dry before installation of the material. Protect painted surfaces during installation; should coating become marred, prepare and touch up surface per paint manufacturer's instructions.

3.08 PAINTING

- A. Thoroughly clean all ferrous metal items not galvanized and give a shop coat of metal primer. Preparation of surfaces and application of primer shall be in accordance with the paint manufacturer's printed directions and recommendations as approved; utilizing the appropriate painting system.

END OF SECTION 05500

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The contractor shall furnish and install fiber optic cable as shown on the Drawings or specified herein.

1.02 QUALITY ASSURANCE

- A. All materials and equipment shall be new and of best quality, of the type best suited for the purpose intended, and be made by nationally recognized and substantially established manufacturers. The type and weight of material used for each purpose shall be as herein specified, and all material shall conform with the requirements of the latest standard specifications of ASTM for that particular material.
- B. Where such listing is provided, all electrical materials used in this work shall be listed by the Underwriters Laboratories, Inc. (UL), or another Nationally Recognized Testing Laboratory (NRTL), and shall bear their label.
- C. Where the notation of NEMA is indicated, the equipment shall conform to National Electrical Manufacturers Association Standards.

1.03 SHOP DRAWINGS

- A. Shop drawings shall include catalog cuts for the Fiber Optic Cable.

PART 2 PRODUCTS

2.01 FIBER OPTIC CABLE

- A. Fiber optic cable shall be crush resistant with double corrugated steel armor and central anti-buckling member, suitable for direct bury installation. Cable shall be gel filled, loose tube construction, with polyethylene jackets.
- B. Cable shall contain twelve (12) individual fibers, 8.3 micron diameter each, single mode, non-zero dispersion-shifted for operation at 1310 nm at 0.40 dB, or better, and 1550 nm at 0.30 dB, or better, per kilometer loss per individual fiber per reel length.
- C. Attenuation shall not exceed 0.5 dB/km. Cabled fiber cutoff wavelength shall not exceed 1470 nm.
- D. Fiber optic cable shall be of, Double Armor AT-3BEG2YT-012, or equivalent.
- E. Cable reels shall be tested before installation with an OTDR before installation and results shall be provided to the Owner.
- F. Duct where required, shall be PVC Schedule 40. Casing pipe for boring and jacking installations shall be as specified in Section 02225, Boring and Jacking;

casing for directional drilling installations shall be as specified in Section 02226, Directional Drilling.

2.02 ELECTRONIC MARKER

- A. Underground electronic markers shall be Tempo Omni Marker, Model 163 (orange), or approved equivalent.

PART 3 EXECUTION**3.01 FIBER OPTIC CABLE INSTALLATION**

- A. Maintain approximately one foot of horizontal separation between the cable and the outermost edge of the pipe. To protect cable, install during water line backfill operations. Minimum cable depth shall be in accordance with the Drawings and these Specifications.
- B. All cable shall be supplied on new full-length reels to keep splices to a minimum. Cable shall not be cut then spliced at road crossings and stream crossings where trenchless construction is required for casing installation.
- C. All fiber optic cable installation shall be according to manufacturer's recommendations and NEC Article 770. All work shall be performed by a certified fiber optic installer that has a minimum of two years experience in fiber optic installation and termination. **CABLE SHALL NOT BE CRUSHED OR SHARPLY BENT DURING INSTALLATION.** The minimum allowable bending radius shall be 20 times the cable diameter during installation and upon final installation.
- D. Splices shall be direct bury, fusion-type. Place underground electronic marker directly above each splice and record GPS coordinates. Use UTM NAD 27 Zone 13. Submit GPS coordinates of splice to Owner.
- E. Upon completion of installation, entire fiber optic cable shall be tested to verify fiber and splice integrity. A written report including a plot of the measured attenuation shall be submitted to the Owner upon completion. Cable not meeting manufacturer's specifications shall be replaced or repaired at no additional expense to the Owner.

3.02 ELECTRONIC MARKER

- A. Place electronic markers at cable splices as noted above and at specific points where the cable does not parallel the pipeline such as deflections and road crossings (both sides).

3.03 GUARANTEE

- A. Contractor shall assume the responsibility for any defects which may develop in any part of his work caused by faulty workmanship, material, or equipment and agrees to replace, repair, or alter, at his expense, any such faulty workmanship,

material, or equipment that has been brought to his attention during a period of three years from the date of the final certificate for payment or acceptance by the Engineer, whichever is longer. Acceptance of the work shall not waive this guarantee.

END OF SECTION 13700

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PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide coatings and cathodic protect all buried, submerged, or immersed ferrous metal (steel, ductile iron, and cast iron) piping and fittings used in conjunction with plastic pipe sections.
- B. Install tracer wire and tracer wire access boxes on all non-metallic pipe sections. Install test and tracer wires for test stations and tracer wire access boxes only during pipe construction at time pipe is being installed. Install test station or tracer wire access box type at location as shown on the Drawings and/or listed on Test Station Schedule. Install pipe marker signs next to test station or tracer wire box locations as specified.
- C. Buried stainless steel appurtenances shall be cathodic protected. Connections to stainless steel components shall only be by silver solder or physically with a ring tongue terminal under a bolted location per Engineer's approval.
- D. The select backfill used around metallic pipe, valves, fittings, appurtenances, etc. shall be non-angular with no sharp edges and shall be non-corrosive with no concentrations of chloride or sulfate salts. The select backfill shall have a minimum soil resistivity of 5,000 ohm-cm or greater, when tested in accordance with ASTM G57. This select backfill requirement shall also be for metallic fittings on non-metallic pipe.
- E. Coat, then concrete encase buried metallic pipe sections next to or under pump stations, reservoirs, vaults, buildings, or tanks or as required to provide protection between dielectric coated pipe electrical insulator and building, pump station, tank, vault, or concrete pipeline connections as shown on Drawings.

1.02 COATING AND LINING OF MISCELLANEOUS METALLIC PIPE PIECES AND FITTINGS

- A. Below Grade Fittings and Appurtenances Coating:
 - 1. Where coating and lining specified for main pipeline is not feasible, coat and line all buried metallic (steel, ductile iron, and cast iron) valves, fittings, flexible couplings, incidental metallic piping, glands, blow-offs, and hydrants etc. internally and externally with liquid epoxy or fusion bonded epoxy coating in accordance with AWWA C116 or AWWA C550 and this specification. All internal coating and lining materials shall be NSF approved for potable water service.
 - 2. Provide Series 300 stainless steel materials or coat all other miscellaneous buried metallic items, (tie rods, thrust restraints, tapping saddles, harnesses, etc.). Coat tie rods and rebar when directly exposed to soil. Provide with factory applied epoxy coating, fusion bonded epoxy coating, thermo-plastic coating, heat shrink sleeves, or with coating

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recommended by coating manufacturer for buried application and approved by Engineer for intended exposure.

- B. Coat above-grade piping, vent pipe, bollards, etc. exposed to atmospheric conditions with two coats of polyamide epoxy and one top coat of polyurethane enamel or with a fusion bonded epoxy coating system. Color as selected by Owner.

1.03 RELATED WORK

- A. Section 02221: Trench Excavation and Backfill
- B. Section 15060: Pipe and Pipe Fittings.
- C. Section 15160: Valves

1.04 GENERAL

- A. Like items of materials provided hereunder shall be the end product of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. Materials and workmanship as specified in this section shall be coordinated and completed in conjunction with other applicable sections. Coordinate all work specified herein with other crafts and related sections.
- C. The Contractor shall make a careful examination of the nature and location of the project, the Contract Documents, and the applicable permits and regulation requirements before submitting a bid. Bid submission shall act as conclusive evidence that the Contractor has investigated and is fully aware of the local conditions and difficulties to be encountered and of the character, quality, and quantities of the work to be performed.

1.05 REFERENCE STANDARDS

- A. General: The latest revision of the following minimum standards shall apply to the materials and installation included in this specification, except where more stringent standards are applicable. In case of conflict, the most stringent requirements shall apply.
 - 1. American National Standards Institute (ANSI):
 - a. C80.1-90, Rigid Steel Conduit-Zinc Coated.
 - b. ANSI/NSF Standard 61 Drinking Water System Components – Health Effects
 - 2. American Society for Testing and Materials (ASTM):

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- a. ASTM -A380, Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems
 - b. ASTM -A967 Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
 - c. ASTM B418, Standard Specification for Cast and Wrought Galvanic Zinc Anodes.
 - d. ASTM C94, Standard Specification for Ready-Mixed Concrete.
3. American Society of Mechanical Engineers (ASME):
- a. ANSI/ASME B31.8, Gas Transmission and Distribution Piping Systems.
 - b. ANSI/ASME B31.4, Liquid Petroleum Transportation Piping Systems.
4. American Water Works Association (AWWA):
- a. AWWA C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
 - b. AWWA C210, Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines.
 - c. AWWA C213, Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 - d. AWWA C217, Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
 - e. AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants.
5. American Wood Preservers Association (AWPA):
- a. C2, Commodity Standards for Lumber and Timber
 - b. P5, Waterborne Preservatives
6. National Association of Corrosion Engineers International (NACE),
- a. Recommended Practice SP0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
7. National Electrical Manufacturers Association (NEMA):

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- a. I-10, Type R and 4X Enclosures
 - b. TC 2-83, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
 - c. WC 3-80, Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (R 1986).
 - d. WC 5-73, Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (R 1985).
 - e. WC 7-88, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
8. National Fire Protection Association, National Electrical Code (NEC), NFPA 70.
 9. Occupational Safety and Health Administration (OSHA)
 10. Underwriters Laboratories (UL) ANSI/UL 467 “Grounding and Bonding Equipment”.

1.06 DEFINITIONS

- A. Anode: The electrode or metallic surface location where DC current is discharged into a surrounding electrolyte and corrosion (oxidation with a loss of electrons) occurs in a corrosion cell. The opposite of a cathode.
- B. Appurtenances or Fittings: Items including but not limited to valves, fittings, elbows, tees, glands, angles, bends, blow offs, restrained joints, flanges, couplings, spool pieces, miscellaneous piping, tapping saddles, blow-offs, or hydrants, including metallic glands, etc.
- C. Cathode: The electrode or metallic surface location where DC current is received or collected from a surrounding electrolyte and protection (reduction with a gain of electrons) occurs in a corrosion cell. The opposite of an anode.
- D. Cathodic Protection, (Cathodic Protect, Cathodically Protected, etc.): An electrical method of reducing or eliminating corrosion by making previous anodic areas on a structure surface, turn into a cathode by creating a DC current flow to the structure surface.
- E. Cathodic Protection System: Two common cathodic protection methods are galvanic anodes and impressed current cathodic protection systems. A galvanic anode system consists of galvanic anode materials (usually magnesium or zinc) that naturally corrodes or sacrifices itself and does not require an outside power source. An impressed current type system utilizes an outside power source usually a rectifier (that converts AC to DC current) and forces (impresses) current

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from a number of anodes (or groundbed) through the environment to the structure to be protected.

- F. Electrically Continuous Wire: A wire that demonstrates the ability to conduct current and that has a linear resistance (ohms) equal to or less than printed literature values for the different wire gauges and wire types. Resistance of 1,000 feet of stranded copper wire at 77 degrees F for No. 12 AWG wire is 1.65 ohms and for No. 10 AWG wire is 1.04 ohms.
- G. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings, etc.) and the environment as defined in NACE PR0286, The Electrical Isolation of Cathodically Protected Pipelines.
- H. Exothermic (Thermite) Welds: A metallurgical method of making electrical connections based on an exothermic reaction, which turns a mixture of copper oxide and aluminum into molten copper using specially designed graphite molds, steel or cast iron (ductile iron) charges, and wire sleeves.
- I. Ferrous or Metallic Pipe: Any pipe or fitting made of steel or iron, or pipe containing steel or iron as a principal structural material (such as steel, ductile iron, and cast iron), except reinforced concrete pipe or stainless steel.
- J. Fasteners: To include but not be limited to bolts, nuts, washers, tee-bolts, tie-rods, restraining devices, etc.
- K. Foreign Owned: Any buried pipe or cable not specifically owned or operated by the Owner.
- L. Functional and Performance Testing: Tests necessary to demonstrate that installed equipment and systems function as specified and operate in the manner intended. Functional testing is a prerequisite to performance testing for equipment and systems specified to have a performance test.
- M. Joint Bonds: A method of making the pipeline electrically continuous by connecting insulated copper wire(s) or strap(s) across each side of the pipe joint or fitting.
- N. Lead, Lead Wire, Joint Bonds, Pipe Connecting Wires, Cable: Insulated copper conductor; the same as wire.
- O. Manufacturer's Representative: Employee of manufacturer who is factory trained and knowledgeable in technical aspects of their products and systems.
- P. Petrolatum: A purified mixture of semisolid hydrocarbons obtained from petroleum jelly.

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- Q. Petroleum Wax: A refined mixture of solid hydrocarbons, paraffin in nature, obtained from petroleum. Provided as a refined paraffin wax or microcrystalline wax forms.
- R. Pin Brazing: A metallurgical method of making electrical connections based on an electric-arc silver solder brazing method using a specially designed portable brazing unit and gun with a hollow brazing pin containing silver solder and flux.
- S. Plastic Reference Pipe: Plastic conduit or pipe placed in soil next to structure to allow a portable reference electrode to be inserted into for structure-to-reference electrode potential measurements.
- T. Potential, Structure-to-Reference Electrode Potential (also structure-to-reference electrode voltage): Common method to determine corrosion protection levels by measuring the difference in voltage (potential) between the subject metallic structure and the electrolyte in which it is buried or submerged, as measured to the standard specified reference electrode (usually a copper/copper sulfate reference electrode) placed in contact with the electrolyte.
- U. Raceways: Conduit, sheath, plastic or metal pipe, or electrical metallic conduit (EMT) for casing of electrical or cathodic protection cables.
- V. Test Station: Insulated lead wire connections to the structure, which are brought to a test station terminal board or box in order to allow an electrical connection to be made to the structure for location, and corrosion and cathodic protection testing.
- W. Tight Bonded Coatings: A dielectric coating that is bonded or physically attached to the pipe surface. Ductile iron pipe bituminous asphaltic shop coating does not qualify as an approved factory or shop applied tight bonded coating.

1.07 SUBMITTALS DURING CONSTRUCTION

- A. Provide catalog cuts and other information for all proposed products proposed for use that shows compliance of those materials with these Specifications. Contractor submittals shall be made in accordance with General Conditions of these Specifications. In addition the following specific information shall be provided.
- B. Submittal information shall clearly show manufacturer name and model number of specified item to be provided, not just supplier name, if only supplier name is provided, then entire submittal shall be rejected and a new resubmittal will be required. Materials provided with only supplier's name shall be relabeled with original manufacturer's name, model number, etc., or be returned at Engineer's discretion at no additional cost to Owner.
- C. Submit required information on a system-by-system basis with items clearly marked for specific products or models to be used. Indiscriminate submittal of manufacturer's literature only is not acceptable.

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- D. Installation, material, and safety requirements for thermite weld wire connections.
- E. Quality Assurance Submittals:
 - 1. Manufacturer's Certificates of Compliance.
 - 2. Field Test Reports.
 - 3. Certificate of Compliance with independent laboratory analysis stating that galvanic anode and backfill material supplied meets the requirements of this Specification.
- F. Certificate of Compliance with independent laboratory analysis stating that galvanic anode and backfill material supplied meets the requirements of this Specification.
- G. Certificate of Compliance from fitting and appurtenance manufacturer and supplier verifying that bolting, fasteners, nuts, and washers were provided with stainless steel Series 300 materials as specified.
- H. Submit as-built and field test report information to Engineer at end of project as one condition to be received and accepted by Engineer prior to application for substantial completion.
- I. Contract Closeout Submittals: Special guarantees as specified hereinafter.
 - 1. Submit record drawings and field test report information to Engineer at end of project as one condition to be received and accepted by Engineer prior to application for substantial completion.
 - 2. The cathodic protection system and corrosion control monitoring systems including tracer wire and access tracer wire boxes, joint bonding, test stations, insulators, etc. shall be fully operational and a functional test performed prior to acceptance of and issuing substantial completion of the corrosion protection portions of the project.

1.08 QUALITY ASSURANCE

- A. Contractor's Competency: Contractor shall have a minimum of two (2) years of practical experience in the type of work called for in this specification, and shall have knowledge about soil conditions in the local area. Contractor may be required to show proof and furnish a list of references substantiating this requirement to the satisfaction of the Engineer and Owner.
- B. The Contractor shall provide at all times a thoroughly experienced and competent field foreman, who will be present to supervise this portion of construction at the site. This person shall be responsible for the field test reports and have the authority to represent the Contractor and shall be the point of contact with the Engineer for this section of the specifications.

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- C. Functional testing shall be completed by the Contractor only in the Engineer's representative's presence on the installed cathodic protection and corrosion protection items.
- D. The final testing shall be completed by the Engineer's representative.
- E. At Engineer's option, Engineer may randomly select one of each type of anode supplied, for Contractor to obtain independent laboratory analysis on.

1.09 OBSERVATION OF WORK

- A. Provide access to the project site for Owner, Engineer, and manufacturer at all times during installation and to observe finished work.
- B. The Contractor shall give the Engineer a minimum of twenty-one (21) days advance notice of the start of any work to allow scheduling for field observation of the construction.
- C. All materials and installations shall be subject to observation for suitability as the Engineer may elect, prior to, during, or after incorporation into the work. Observation or testing by the Engineer or the waiver of observation or testing of any particular portion of the work shall not be construed to relieve the Contractor of his responsibility to correctly perform the work and testing required in accordance with these specifications and the product manufacturer's recommendations.
- D. The Contractor is in charge of and solely responsible for all of the quality control and final inspections required. Observation of or spot testing by the Engineer or product manufacturer does not meet the quality control inspection requirement or relieve the Contractor from doing the quality control testing required by the product manufacturer, this specification, or the Contractor's quality control program.
- E. The Engineer reserves the right to reject all work that does not meet the minimum requirement of this specification. This may be done either during or after completion of the work, during subsequent observations or testing, warranty inspection testing, or at anytime when discovered during the warranty period.

1.10 RECORD DRAWINGS

- A. Contractor shall maintain an accurate record of the construction and a marked-up drawing of all construction modifications. Drawings shall show actual number of pipe or fitting joints per each test span, and installed location of corrosion control items as specified. At completion of project, the Contractor shall provide a copy of the record drawings of the corrosion control installations to the Engineer.

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1.11 SPECIAL GUARANTEE

- A. The Contractor, Corrosion Sub-Contractor, and Product Manufacturer shall jointly and severally warrant to the Owner and guarantee the work under this section against defective workmanship and materials for a period of one (1) year(s) or longer if required by the General Conditions commencing on the date of final acceptance of the work.
1. Functional and final testing and warranty inspection(s) of the corrosion protection systems shall be made at the end of the project and within the warranty period, respectively. The Contractor, Sub-Contractor, and/or Product Manufacturer Representatives at their option if desired may be present during the functional or final testing or warranty inspections by the Engineer and Owner.
 2. Any construction defects identified by the Engineer during energizing and testing or during warranty inspections shall be located and corrected by the Contractor at his sole expense including all additional Engineering time, full time inspection, and re-testing time.
 3. Any defects in the corrosion protection system discovered at or during the functional, final, and/or warranty inspection(s) shall immediately be repaired and retested in a timely manner (repairs starting within 30 days and completely completed, tested, and approved within 60 days of notice) by the Contractor. All repairs shall be in accordance with the written product manufacturer's instructions as reviewed and approved by the Engineer. Provide the Engineer with a minimum of 14 days' advance notice before beginning repairs.
 4. For all repairs, the Contractor shall provide an extended warranty (equal to the original warranty period length) of one (1) year(s) or longer if required by the General Conditions commencing on the date of final acceptance of the repair work.
 5. All repairs or any damage to other work caused by such defects or repairing of the defects including additional Engineering, full-time observation during repairs, and retesting or re-warranty inspections shall be at sole cost to Contractor.

PART 2 PRODUCTS

2.01 GENERAL

- A. Unless otherwise indicated, provide all first-quality, new materials, free from defects, in first class condition suitable for the intended use. Provide materials and equipment, which are the standard products of manufacturers regularly engaged in the production of such materials and equipment for a minimum of three (3) years on a full time basis. Provide the manufacturer's latest standard design that conforms to these specifications.

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- B. All materials and equipment shall show evidence of U.L. approval where U.L. standards exist and product listings are available. All materials, equipment, and installations shall conform to National Electrical Code (NEC), and all applicable federal, state, and local laws, codes, and regulations.
- C. Provide new materials intended for this type of service in accordance with this specification and the referenced standards. Whenever the requirements of the Specifications or Drawings exceed those of the codes or manufacturer's instructions, the requirements of the Specifications or Drawings shall prevail. Where a larger size, higher quality, or better grade of material or a higher standard of workmanship is required, the most stringent requirement shall apply.
- D. The use of a manufacturer's name and model or catalog number is solely for the purpose of establishing the standard of quality and general configuration desired. Products of other manufacturers of equal standard and quality will be considered in accordance with the General Conditions.

2.02 MATERIAL SUPPLIERS

- A. Suppliers listed below can usually supply the types of materials specified in this section. Alternate suppliers will be considered, subject to approval of the Engineer. Address given is that of offices in the Western United States; contact these offices for information regarding the location of their representative nearest the project site:
 - 1. Farwest Corrosion Control, Denver, CO (888-532-7937).
 - 2. Goudy Engineering, Tucson, AZ (520-298-1104)
 - 3. Hoff Company, Denver CO (800-736-4546)
 - 4. MESA Products, Inc., Tulsa, OK (918-627-3188).
 - 5. Total Corrosion Services, TCS, Billings, MT (406-248-6985).

2.03 WIRES

- A. General: All cathodic protection wires, joint bond wires, bonding cables, leads, and cables provided shall be insulated **STRANDED** copper wire. Wire size, type, and insulation type as specified in this section. Wire shall conform to applicable requirements of NEMA WC 3-80, WC 5-73, and WC 7-88.
- B. Joint Bonds:
 - 1. General: Type of joint bonds shall depend on pipe joint coating and shall be either:
 - a. Bare copper straps for pipe joint bond locations only where installed under pipe joint heat shrink sleeves.

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- b. Insulated copper joint bond wires or insulated copper bond straps for all other pipe joint bond locations.
 - c. Metallic Fitting Pig Tail Bond Wires: Provide No. 12 AWG metallic fitting bonding wires shall be single-conductor, stranded copper wire with 600-volt, TW, THWN, THHN or HMWPE insulation. Provide with a sleeve on each end of No. 12 AWG metallic fitting pig tail bonding wire used for bonding of metallic fittings including but not limited to fittings, valves, couplings, mega-lugs, metallic fitting glands or restraint rings, etc. for metallic and plastic pipe.
2. Insulated Joint Bond Wires: Provide joint bond wires consisting of single-conductor, stranded insulated copper wire. Supply all joint bonds complete with a formed copper sleeve on each end of the wire. Wire conductor for field-applied sleeves shall extend 1/4 inch beyond end of copper sleeve. End of factory formed copper sleeves shall be angled so as to allow end of wire to be exposed to thermite weld material.
- a. Wires equal to or smaller than No. 10 AWG shall be provided with 600-volt, TW, THWN, THHN or HMWPE insulation.
 - b. All other joint bond wires larger than No. 10 AWG wire shall be provided with 600-volt high molecular weight polyethylene (HMWPE) insulation.
3. Bond Lengths: Length of bond strap and joint bond wire may have to be increased for different pipe size and joint type per pipe manufacturer's recommendations so as to provide sufficient slack (one (1)-inch minimum on each end or two (2)-inches total) for pipe or joint movement between each thermite weld connection. Larger couplings than for 36-inch OD pipe may require longer strap or wire bond lengths.
- a. Generally the minimum bond length for different type of bond and joint and fitting types shall be as listed below.
 - b. For Pipe 16-inch or Larger Diameter:
 - i. For Push-on, Mechanical, or Flanged Joints: No. 2 AWG wires, 18-inches long minimum.
 - ii. For Flexible Coupling Joints: No. 2 AWG wires, 24-inches long minimum, with two 12-inch long minimum insulated No. 12 AWG wire pigtails. Smaller couplings than 24-inch OD pipe may allow shorter lengths. Larger couplings than for 36-inch OD pipe may require longer bond wire lengths. Confirm that bond wire length supplied provides a minimum of 1-inch slack on each end (2-inch total).

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- a) Bond wires with pig-tail wires can be utilized at not only flexible couplings, but at fitting or valve locations, where it is easier to bond over the fitting or valve with the larger bond wire. At these locations, the pig tail wires shall be bonded to the fitting or valve body.
- b) For multiple piece fittings, No. 12 AWG pig tail wires shall be utilized to bond different pieces to pipe. Pig tail wire length as required.
- iii. For Insulated Flexible Coupling Joints: No. 2 AWG insulated copper wire, 18-inch long minimum, with one 12-inch long minimum No. 12 AWG wire pigtail.
- c. For pipe smaller than 15-inch diameter, Contractor can utilize No. 4 AWG wire size instead of No. 2 AWG wire size, if desired.
- d. Acceptable pre-made insulated copper joint bond wires are available from:
 - i. J-Four Pipeline Products (Hoff Company), (800-331-3404), Broken Arrow, OK;
 - ii. Erico Products Inc. (Cadweld - 800-248-9356) Cleveland, OH;
 - iii. Continental Industries, Inc. (Thermoweld – 800-558-1373), Tulsa, OK;
 - iv. Or approved equal.
- 4. Cathodic Protection Bond Wires or Bonding Straps shall be continuous. Bolted, inline sleeve, or compression type connections are **NOT** acceptable.
- C. Pump Station, Vaults, Test Station, and Cross Bond Pipe Connecting Wires:
 - 1. Single-conductor, No 2 AWG, No. 4 AWG, No. 6 AWG, and No. 8 AWG cathodic protection cables shall be single-conductor, stranded copper wire with 600-volt high molecular weight polyethylene (HMWPE) insulation. Insulation shall be 7/64-inch (110 mils) minimum thickness in accordance with ASTM D 1248, Class C, Grade 5.
 - 2. Bonding of buried and abovegrade appurtenances may be required to minimize stray current, safety hazardous, and corrosion effects.
- D. Test Wires:

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1. No. 12 AWG wire for prepackaged galvanic anode and No. 12 AWG test leads and No. 12 AWG and No. 14 AWG reference electrode lead wires shall be single-conductor, stranded copper wire with 600-volt, TW, THWN, THHN or HMWPE insulation.
2. No. 2, No. 4, No. 6, or No. 8 AWG leads shall be single-conductor, stranded copper wire with 600-volt, HMWPE insulation.

E. Wire Identification:

1. Wire insulation color shall indicate the function of each wire and shall be as shown on the Drawings and as follows:
 - a. Pipeline test wires:
 - i. Water Pipeline: Blue.
 - ii. Waste Water Pipelines: Green or Purple if Reuse
 - iii. Foreign Pipeline: White or as requested by Foreign pipeline company.
 - iv. Unprotected Pipe: Black.
 - b. Anode lead wires: Black.
 - c. Reference electrode wires: Yellow.
 - d. Tracer wires on plastic, concrete, or non-metallic pipe: Green with two strips of black tape.
2. Identify north (1 strip) or west (2 strips) structures or parallel pipelines of purple tape and south (1 strip) or east (2 strips) structures or parallel pipelines of gray tape.

2.04 EXOTHERMIC THERMITE WELD MATERIALS

- A. Electrical connection of copper wire or copper strap to metallic (steel, ductile iron, and cast iron) fittings, pipe, and structures shall be by the thermite weld, (exothermic) method. The thermite weld materials shall be UL listed to ANSI/UL 467 "Grounding and Bonding Equipment".
- B. The thermite weld metal shall consist of a mixture of copper oxide and aluminum material ignited by magnesium starting powder with a spark or by an electronic type ignition. Thermite weld materials shall be designed for connection of copper to steel or ductile iron and cast iron surfaces. The materials and exothermic process shall provide a completed permanent type connection that will not loosen or develop high resistant connection points and have a resistance equal to or

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lower than the strap or wire, be durable, be corrosion resistant, and have a high adhesion connection to both the surface and strap or wire.

- C. Supply the proper size and type of wire sleeves, cartridges, and welder molds as required for each type of connection and pipe material in accordance with the thermite weld manufacturer's written recommendations. Material and equipment shall be from the same manufacturer and utilized throughout the entire project. Weld materials from different manufacturers shall not be interchanged.
- D. The individual thermite weld metal charges shall be sealed in a moisture-resistant plastic container (tube or cartridge) with tight fitting caps with the separate steel disks or in a prepackaged sealed container. The starting (ignition) material shall be packed in the bottom of the tube with the weld material on top or for the electrical ignition type intermixed as required. The individual plastic containers shall be packed in sealed boxes so as to protect the individual containers and keep their contents dry. The size (weight in grams) and type of the charge shall be clearly marked on the plastic package and individual sealed containers.
- E. Provide type of charges required for each pipe, fitting, or structure base material.
 - 1. Provide steel charges for steel materials. Charge (cartridge) size shall be minimum of 15 grams and maximum of 25-grams for steel materials.
 - a. Cadweld F-33 (Green Top) or Thermoweld P Standard Powder,
 - b. Electronic ignition materials, Cadweld Plus CA15PLUS33 with black top or CA25PLUS33 with red top,
 - c. Or approved equal.
 - 2. Provide cast iron charges for all ductile iron and cast iron materials. Charge (cartridge) size shall be a minimum of 25 grams and maximum of 32-grams for ductile and cast iron materials.
 - a. Cadweld XF-19 (Orange top) or Thermoweld CI Cast Iron Powder,
 - b. Electronic ignition materials, Cadweld Plus CA25PLUSXF19 with red top or CA32PLUSXF19 with white top,
 - c. Or approved equal.
 - 3. Maximum cartridge size for natural gas and petroleum pipelines and structures shall be 15-grams.
 - 4. Minimum cartridge size for strap bonds shall be 25 grams for ½-inch and 5/8-inch diameter hole sizes to steel and 32-grams for 5/8-inch diameter holes for ductile iron pipe per manufacturer recommendations.

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- F. Welder molds shall be graphite molds sized for each type and size of charge and pipe size and type to be used as recommended by the cadweld manufacturer. Each mold shall have permanent identification showing manufacturer name, mold part number, wire size, and weld metal type and size.
1. Ceramic "One-Shot" molds will not be acceptable.
 2. Special welders and materials are required for copper strap, formed joint bond wires, and flexible coupling bonds.
 3. Vertical type connections require special welders and materials as recommended by the weld manufacturer.
- G. For horizontal type connections to smaller pipe sizes, different molds to match the different pipe curvature are required according to the manufacturer's recommendations. These molds for small pipe sizes shall be identified by each pipe size (PS).
1. For steel pipe or fittings, different molds are required for pipe up to 3-1/2-inch diameter. Different steel mold sizes are required for 4-inch and 6-inch to 8-inch pipe sizes. For steel pipe ten-inch (10") or larger, flat steel molds can be used or for other flat surfaces.
 2. For ductile iron pipe or fittings, different size of molds are required for different pipe sizes (PS) up to 24-inch and they have to be obtained for each pipe size to be welded. The same welder for flat surfaces can be used for all ductile iron pipe or fitting sizes 30-inch or larger or flat structures.
- H. Electronic Ignition - Cadweld Plus Exothermic or ThermOwelds EZ Lite Remote: - Connections with prepackaged containers with electronic type ignition can be substituted for standard cadweld spark type ignition connections provided that equal or better low resistance, durability, adhesion, and performance characteristics are proven. Electronic type ignition materials shall be able to be used in standard graphite molds for wire and strap type connections for each structure type and size. Electronic ignition material manufacturer shall provide independent test results that show performance characteristics are equal or better than standard type thermite connection. Manufacturer shall provide a reference table with corresponding molds and charge sizes and types. Spark type and electronic ignition type materials from different manufacturers shall not be intermixed.
- I. Weld Mold Sealer shall be heavy duty, clay-like, mold sealer putty material, specially designed for that use such as Electrical Duct Seal as manufactured by Ideal Industries, Duct Seal Compound from Gardner Bender, Cadweld Mold Sealer as manufactured by Erico Products, Inc. or approved equal.
- J. Cleaning Wheels shall be self-cleaning and leave no resin or residue on surface to be bonded to as recommended by the weld manufacturer. The use of resin,

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rubber, or shellac-impregnated type grinding wheels are not recommended by the weld material manufacturers and shall not be used. Weld manufacturer approved vitrified type-grinding wheels, ERICO's organic cleaning wheels, or approved equal.

- K. Mold cleaner shall be type and size recommended by weld manufacturer for each type of graphite weld mold being used.
- L. Adapter Sleeves:
1. Install adapter sleeves (Cadweld CAB 1331H, Thermoweld A200, or approved equal) for all No. 12 AWG wires. Provide sleeve type as recommended by thermite weld manufacturer and attach in the field.
 2. Install adapter sleeves for all No. 4 AWG and No. 2 AWG wires. Either premade factory sleeved wires or wires with sleeves made in the field with the appropriate sized sleeves and hammer die are acceptable.
 - a. Factory formed sleeves shall be beveled to allow molten thermite weld material to directly contact wire.
 - b. Field formed sleeves shall be attached with the appropriate sized and type of hammer die and method as recommended by the thermite weld manufacturer. Wire conductor for field installed adapter sleeves shall extend 1/4 inch beyond end of the sleeve to allow molten thermite weld material to directly contact wire.
- M. Thermite weld materials are available as specified from:
1. Erico Products Inc. (Cadweld - 800-248-9353) Cleveland, OH;
 2. Continental Industries, Inc. (Thermoweld – 800-558-1373), Tulsa, OK;
 3. Or approved equal
- N. Acceptable Materials:
1. Thermite weld materials for **STRANDED** copper wire test leads and joint bonds with factory and field formed sleeves and copper bond straps are given below for reference:

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FORMED JOINT BOND OR SLEEVED WIRE THERMITE WELD MATERIALS HORIZONTAL TYPE CONNECTIONS				
STRANDED TEST LEAD OR BOND WIRE SIZE (AWG)	CADWELD		THERMOWELD	
	SLEEVE MODEL No.	HAMMER DIE MODEL No.	SLEEVE MODEL No.	HAMMER DIE MODEL No.
No. 12 AWG	CAB-1331H	Crimped	A-200	Crimped
No. 10 AWG	CAB-1331H	Crimped	A-201	38-6019-00
No. 4 AWG	CAS-20-F	CAD-11	A-204	38-4859-00
No. 2 AWG	CAS-09-F	CAD-09	A-203	38-0310-00

**SECTION 13901
CORROSION PROTECTION
PLASTIC PIPE**

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Welder Part Mold Number for Pipe Larger Than 10-Inches	CADWELD		THERMOWELD	
	MOLD >10-Inch Diameter Pipe Surface	MAX. SIZE CHARGE & TYPE	MOLD >10- Inch Diameter Pipe Surface	MAX. SIZE CHARGE & TYPE
INSULATED STRANDED COPPER WIRE:				
No.12 AWG w/sleeve to Steel	With Sleeve CAB 1331H Mold No. CAHAA-1G	15 gram F-33 with green caps	With Sleeve No. A-200, Mold No. 100	15 gram P
No.12 AWG w/sleeve to Ductile Iron and Cast Iron	With Sleeve CAB 1331H Mold No. CAHBA-1G-PS Above 30" pipe size use Mold CAHBA-1G	25 gram XF-19 with orange caps	With Sleeve No. A- 200, Mold No. 156 per each pipe size	25 gram CI
No. 4 AWG w/sleeve to Steel	With Sleeve CAS-20-F Mold No. CAFSA-1L	25 gram F-33 with green caps	With Sleeve No. A- 204 Mold No. 7345	25 gram P
No. 4 AWG w/sleeve to Ductile Iron and Cast Iron	With Sleeve CAS-20-F Mold No. CAFCA-1L- PS Above 30" pipe size use Mold CAHBA-1G	32 gram XF-19 with orange caps	With Sleeve No. A- 204 Mold No. 154	32 gram CI
No. 2 AWG w/sleeve to Steel	With Sleeve CAS-09-F Mold No. CAFSA-1V	25 gram F-33 with green caps	With Sleeve No. A- 203 Mold No. 129	25 gram P
No. 2 AWG w/sleeve to Ductile Iron and Cast Iron	With Sleeve CAS-09-F Mold No. CAFCA-1V- PS Above 30" pipe size use Mold CAHBA-1G	32 gram XF-19 with orange caps	With Sleeve No. A- 203 Mold No. 175	32 gram CI
<p>P.S. = Note Pipe Size at end of Mold Number per each pipe size for steel up to 3 1/2" diameter pipe size and for ductile iron for 4" to 24" diameter pipe size for each mold.</p> <p>Utilize Molds for sleeved wire per specifications.</p> <p>Mold sizes for small diameter ductile iron and cast iron shall be adjusted based on actual pipe type and pipe diameter per manufacturer recommendations.</p>				

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2.05 THERMITE WELD CAPS

- A. Primerless Weld Caps: Thermite weld caps shall consist of a minimum 4-inch by 4-inch size prefabricated weld cap filled with elastomeric mastic coating and a layer of protective adhesive with an integrated primer.
 - 1. Primerless thermite weld cap materials for No. 10 AWG and smaller wire connections shall be Handy Cap IP available from Chase Tapecoat/Royston Laboratories, thermOcap “PC” Primed Cap from ThermOweld, or approved equal.
 - 2. Larger sized primerless thermite weld caps shall be utilized for No. 8 and larger wire and Pin Weld type connections such as the Handy Cap XL IP (extra large) available from Chase Tapecoat/Royston Laboratories, or approved equal.

- B. One Hundred Percent (100%) Epoxy Repair Coating
 - 1. Locations where thermite weld caps are not suitable for use due to physical constraints (i.e. too small of flat area for thermite weld cap) such as on sleeve-type coupling rings, mechanical joint follower gland rings, or bolted restraint joint rings, will require an 100-percent fast cure epoxy, polyurethane, or polyurea type pipe repair coatings. Field repair material shall be fast cure, high build, low temperature (cure down to 0° F.), moisture tolerant (cure underwater), one-hundred percent material that can be distributed in a two component repair cartridge tubes with a dispensing gun. Repair coating shall be compatible with original pipe or fitting coating and exhibit minimum 2,000 psi adhesion values. Acceptable field epoxy repair type coating is Denso North America Protal 7125 Repair Cartridge, or approved equal.

2.06 GALVANIC ANODES

- A. Zinc Anode:
 - 1. Zinc anodes for buried soil conditions shall meet the requirements of ASTM B 418, Type II, composition as follows:

ELEMENT	CONTENT
Aluminum (Al)	0.0050% maximum
Cadmium (Ca)	0.0030% maximum
Iron (Fe)	0.0014% maximum
Lead (Pb)	0.0030% maximum
Copper (Cu)	0.0020% maximum

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Zinc (Zn)	Remainder
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2. Prepackaged Zinc Anode Dimensions

- a. The anode size and weight may differ slightly because of variations in casting and mold shapes, but shall be the manufacturer's standard and should approximate the following:

BARE ANODE SIZE	5 POUND ANODE	18 POUND ANODE
Shape	ZUR-5	ZUR-18
Bare Anode Nominal Dimensions	1.4 inches by 9 inches long minimum	1.4 inches by 36 inches long minimum
Nominal Package Dimensions	4.5 inch diameter by 12 inches long minimum	5 inch diameter by 42 inches long minimum
Packaged Weight	16 pounds minimum	70 pounds minimum

B. Prepackaged Galvanic Anode General Requirements:

1. Anode Wire: Supply each anode with No. 12 AWG **STRANDED** copper wire with TW, THWN, THHN or HMWPE TW, THWN, THHN or HMWPE insulation, 10 feet long minimum. Provide longer anode leads as required for test stations to extend splice free from anode to test station location. Lead wire shall be coiled and bound.
2. Wire-to-Anode Connection: The anode connection shall be stronger than the wire. The galvanic anode material shall be cast around a galvanized steel wire, strap, or pipe core. The anode connection to the steel core shall silver-soldered (45% silver) by the manufacturer's standard process and be stronger than the wire. Connection of lead wire to anode shall be electrically insulated with manufacturer's standard waterproof epoxy or electrical potting compound type insulation.
3. Prepackaged Anode Backfill: Backfill shall have a grain size so that 100 percent is capable of passing through a 20-mesh screen and 50-percent will be retained by a 100-mesh screen. The backfill mixture shall be thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration. The complete packaged galvanic anode shall weigh a minimum of 2.0 times

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the bare anode weight. The quantity of backfill shall be sufficient to cover all surfaces of the anode to a depth of 1-inch.

4. Packaging and Shipping: Bare anodes shall be centered in cotton bag filled with specified backfill. Provide anode packaged in and shipped and stored in waterproof plastic or heavy multi-walled paper bag of sufficient thickness to protect the anode, wire, backfill, and cloth bag.
5. Compliance Statement: Furnish an independent laboratory analysis certifying that all anode and backfill material supplied meets the requirements of this Specification and specified laboratory testing.
6. Field Verification: At Engineer’s option, a galvanic anode may be selected at random for Contractor to provide an independent laboratory analysis on to demonstrate that both anode and backfill material supplied meets the requirements of this Specification.
7. Prepackaged Galvanic Anode Backfill Composition:

ELEMENT		CONTENT
Ground Gypsum	Hydrated	75 Percent
Powdered Bentonite	Wyoming	20 Percent
Anhydrous Sulfate	Sodium	5 Percent

2.07 CATHODIC PROTECTION TEST STATIONS/JUNCTION BOXES

A. Post Mounted Test Stations:

1. Test stations shall be a molded polycarbonate or cast aluminum boxes and shall be the standard product of a recognized manufacturer. Minimum test station size shall be 4-inches by 8-inches by 2-inches deep for rectangular shaped test.
2. Test stations shall be provided with a minimum of seven (7) terminals mounted on a plastic- or glass-reinforced laminate terminal block. Terminal nuts and studs shall be 1/4-inch with double nuts for securing the studs to the terminal board. Terminal nuts, studs, flat and lock washers shall be Series 300 stainless steel, nickel- plated brass, or bronze.
3. Test station boxes shall be suitable for mounting on a minimum five foot (5') long threaded one and one quarter-inch (1 1/4") or larger rigid

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galvanized steel conduit. Test stations shall be provided with all mounting hardware and conduit bushing necessary to provide a rigid support to specified type of support. Conduit straps or supports shall be installed at maximum 1 foot 6-inch (1' 6") spacing.

a. Wood Support: Provide necessary mounting hardware (galvanized two-hole conduit straps, wood screws or wood lag bolts, conduit bushing, etc.) for mounting of test station box and conduit to wood post or rectifier pole. Two-hole conduit straps and wood screws or wood lag bolts size and type as required to securely fasten test box and conduit to center of wood post or rectifier pole. Wood post test station support shall be a minimum 4-inch by 4-inch by 6-foot (4"x4"x6') long pressure-treated wood post. Wood post shall be pressure treated with a waterborne preservative intended for fresh water or soil (burial) contact to a retention of 0.40 pounds per cubic foot (6.4 kilograms per cubic meter) in accordance with AWPA Standard C2 for Lumber and Timber and AWPA Standard P5 for Waterborne Preservatives.

4. Rectangular shaped test stations shall be provided with a removable lid and stainless steel lid-locking nut. Acceptable rectangular test stations are the Testox 700 Series (1 1/4-inch threaded) as manufactured by Gerome Manufacturing Company, Uniontown PA; or approved equal.

B. Flush Mounted Test Stations

1. Test Box: Traffic H-10 load rated concrete body cast with a cast iron ring, with a minimum weight of 55 pounds and minimum dimensions of 10-inch inside diameter and 12-inches long. Furnish with locking metallic ring extensions as required to penetrate concrete or pavement surfaces by 4-inches minimum. Furnish with a minimum 12-pound cast iron lid with the letters "TS" or words "CP Test", "Test Station" or similar words cast into the lid.

2. Concrete Box Manufacturer and Products:

a. Minimum 10-inch by 12 inch size: Brooks Products Model 3RT Traffic Valve Box; Christy Concrete Products Model G3 Traffic Valve Box or approved equal.

3. Terminal Block: Plastic or glass-reinforced, 1/4-inch thick laminate terminal board with minimum dimensions of 3-inches by 4-inches. Furnish terminal block with a minimum of seven (7) terminals. Terminal nuts and studs shall be 1/4-inch with double nuts for securing the studs to the terminal board. Terminal nuts, studs, flat and lock washers shall be nickel-plated brass, bronze, or Series 300 stainless steel. Manufactured terminal boards such as CP Test NM-7 or approved equal are acceptable.

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- C. Shunts:
 - 1. Shunts for test stations and junction boxes shall be:
 - a. Test Station shunts shall be 0.01-ohm, minimum 6 amp capacity: Holloway Type RS 0.01 ohm manganin wire shunt with 6 amp capacity or MCM Miller 0.01-ohm shunt, COTT or T and R (Yellow) 0.01-ohm shunt with 8 amp capacity, or approved equal.
 - b. As shown on Drawings.

2.08 MISCELLANEOUS REFERENCE MONITORING EQUIPMENT AND MATERIALS

- A. Plastic Reference Monitoring Pipe: A three-inch (3") minimum diameter Schedule 40 PVC plastic pipe with a threaded pipe cap shall be provided at test stations as shown on the Drawings or called out in the test station schedule. Plastic reference monitoring pipe at flush test stations shall not require a threaded cap.
- B. Prepackaged Copper/Copper Sulfate Reference Electrodes:
 - 1. General: Permanent reference electrode for buried piping locations shall be a copper/copper sulfate reference electrode. Reference electrode dimensions shall be approximately 2-inches in diameter by 7-inches long. Reference electrode shall be suitable for permanent installation and designed for a 15-year minimum life expectancy with an accuracy of plus or minus 5-millivolts.
 - 2. Electrode manufacturer shall warrant electrode for 15-year design life and provide both labor and material replacement, if electrode becomes unstable by more than 20 millivolts during design life.
 - 3. Prepackaging and backfill: Electrodes shall be supplied prepackaged in a permeable cloth bag containing manufacturer's special low-resistivity backfill mixture formulated to retain moisture and maintain electrode stability. Outside dimensions of electrode package shall be approximately 6-inches in diameter by 14-inches long.
 - 4. Lead wire: Supply electrode with a lead wire attached and electrically insulated with the manufacturer's standard connection. The connection shall be stronger than the wire. Lead wire shall be single conductor No. 14 AWG or larger stranded copper wire insulated as specified under WIRE, this section. Lead wire shall be of sufficient length (minimum 50') or longer as required to reach splice free from reference electrode to test station. Lead wire shall be coiled and bound.
 - 5. Packaging: Package cloth bag with reference electrode in and shipped and stored in waterproof plastic or heavy paper bag of sufficient mil thickness to protect the electrode, wire, backfill, and cloth bag.

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6. Acceptable CU/CUSO₄ reference electrodes are Farwest Corrosion FWCC Series SP-150; GMC STAPERM Model CU-1-UG; Electrochemical Devices, Inc. Model US CUG LongLife Reference Electrode or approved equal.

2.09 CONDUIT, LOCKNUTS, AND STRAPS

- A. The minimum conduit size shall be 1-inch diameter unless otherwise indicated on Drawings or specified.
- B. Use intermediate metal conduit, including couplings, elbows, nipples, and other fittings, hot-dipped galvanized and meeting the requirements of UL and the NEC. Do not use setscrew type couplings, elbows, and nipples unless approved by the Engineer.
- C. Heavy wall rigid PVC conduit shall be Schedule 40, UL listed for concrete-encasement, underground direct burial, concealed and direct sunlight exposed use. Use conduits, couplings, elbows, nipples, and other fittings meeting the requirements of NEMA TC and TC 3, Federal Specification W-C-1094, UL, NEC, and ASTM specified tests for the intended use.
- D. Flexible metal conduit shall be UL listed, liquid-tight flexible metal conduit consisting of galvanized steel flexible conduit covered with an extruded PVC jacket and terminated with nylon bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.
- E. Locknuts, two-hole straps, and other miscellaneous hardware shall be galvanized steel. Galvanized items shall be hot-dipped galvanized in accordance with ASTM A153. Galvanized hardware shall not be used underground or in immersion service.
- F. Conduit bushings shall be threaded plastic or plastic-throated galvanized steel fittings.

2.10 WIRE CONNECTIONS AND SPLICE MATERIALS

- A. Compression Connectors: Compression connectors for in-line, multi-splices, and tap splices shall be "C" taps made of conductive wrought copper, sized to fit the wires being spliced. Compression connectors shall be applied with the crimp tool and die recommended by the manufacturer for the wire and tap connector size. Acceptable Type "YC" wire compression connectors as manufactured by Burndy Co., or approved equal. Inline "butt" type wire splice connectors or wire nuts are **NOT** acceptable. Split bolts are **NOT** acceptable unless silver soldered after a physical connection is made and both the wires are equal to or smaller than No. 10 AWG size.
- B. Silver Brazing Alloy: Brazing Alloy with minimum 15 percent silver content, 1185 to 1300 degrees F melting range. Provide suitable silver brazing alloy and flux

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recommended by manufacturer for materials being connected (i.e. copper to stainless steel, copper to steel, and/or copper to copper, etc.).

- C. Epoxy Splice Kits: Epoxy splice kit shall be type suitable for abovegrade and buried applications and rated for non-shielded cables up to 5 kV and multi-conductor cables through 1,000 volts. Splice kit shall consist of snap together plastic mold sized to fit around splice, funnels, tape for sealing ends of mold, and two-part epoxy resin in a single pouch for mixing. Epoxy resin shall be electrical insulating low viscosity type that will harden (cure) quickly with time. In-Line splice insulating kit for insulation repair shall be epoxy resin, 3M Company Scotchcast Series 82; Plymouth Bishop Plycast Splicing Kit 2638; or approved equal.
- D. Electrical Splicing Tapes and Sealers: Tape for wire splice insulation shall be UL and CSA approved, cold and weather resistant, highly elastic, with a high dielectric strength and highly resistant to sun, water, oil, acids, alkalies, and corrosive chemicals. Tapes and electrical sealers shall be suitable for moist or wet environments and shall include the following:
1. Rubber High Voltage Electrical Tape: Linerless 30 mil rubber high voltage splicing tape suitable for splicing cables through 69kV, Scotch Professional Grade Linerless Rubber Splicing Tape 130C as manufactured by 3M Products; L969 Plyvolt Linerless EPR High Voltage Tape as manufactured by Plymouth Bishop; or approved equal.
 2. High Voltage Vinyl Electrical Tape: All weather, minimum 7 mil thick, vinyl electrical tape suitable for cable splices up to 600 volts, Scotch Super 33+ Vinyl Electrical Tape as manufactured by 3M Products; Premium 111 Black Vinyl Plastic Electrical Tape as manufactured by Plymouth Bishop; or approved equal.
 3. Filler Tapes: Low voltage rubber filler tapes or putties that can be wrapped, stretched or molded around irregular shapes for quick, smooth insulation build-up to insulate connections up to 600 volts for topcoating with vinyl electrical tapes, Scotchfill as manufactured by 3M Products; 125 Electrical Filler Tape as manufactured by Plymouth Bishop, or approved equal.
 4. Electrical Coating Sealer: Electrical coating for sealing tape insulation on splices in severe conditions, suitable for direct burial, direct water immersion, and above grade applications, Scotchkote Electrical Coating as manufactured by 3M Company, or approved equal.
- E. Terminal and Connection Coating and Electrical Sealers
1. Electrical Insulating Spray: Electrical insulating spray for sealing terminals to minimize external corrosion; Scotch 1601 Insulating Spray as

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manufactured by 3M Company, Royston Protective Coating Product No. 614 from Royston Laboratories, or approved equal.

2. Oxidation Inhibiting Compound: - Oxidation inhibiting compound shall be non-water soluble, non-petroleum based and suitable for aluminum, copper, steel and rubber and polyethylene type insulating materials, Penetrox A-13 available from Burndy Products, Contax Inhibiting Compound Type CTB available from Thomas and Betts (T&B), or approved equal.
- F. Wire Connector Terminals: A ring tongue terminal or single hole solderless lug (Lug-it) type connector shall be installed on the end of all stranded wire before connecting it to test station, terminal box, or junction box terminal studs.
1. Wire connector terminals shall be sized to fit wire and stud size and be suitable for use with copper conductors.
 2. One-piece heavy duty, tin-plated copper crimp-on ring tongue terminal. Acceptable ring tongue wire connectors are manufactured by Anderson, Blackburn, Burndy Co., 3M, Panduit, Thomas and Betts (T and B), IDEAL, or approved equal.
 3. Single hole seamless copper Lug-it type connector rated shall be UL listed for 600 volt service with off-set tongue suitable for wire size being terminated.
 - a. Acceptable No. 4 and No. 2 AWG wire single hole solderless lugs Burndy L125, Thomas and Betts BTCO208-B2, or approved equal)
 - b. As manufactured by Anderson, Blackburn, Burndy, Thomas and Betts (T and B), or approved equal.
 4. Wire forked end type terminals are **NOT** acceptable.
 5. Acceptable one hole non-insulated copper crimp wire lug terminals sizes for ¼-inch stud sizes are listed below or approved equal:

STRANDED COPPER WIRE RING TONGUE TERMINAL CONNECTORS					
Stranded Cable Size	Bolt or Stud Size	MANUFACTURER AND MODEL			
		Anderson	Blackburn	Burndy	T and B
No. 14 to 20 AWG	1/4"	-----	-----	YAV14 Box	Series 54100 Model C10-14
No. 10 or 12 AWG	1/4"	-----	-----	YAV10 Box	Series 54100 Model C10-14

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STRANDED COPPER WIRE RING TONGUE TERMINAL CONNECTORS					
Stranded Cable Size	Bolt or Stud Size	MANUFACTURER AND MODEL			
		Anderson	Blackburn	Burndy	T and B
No. 8 AWG	1/4"	-----	CTL8-14	YA8C-L Box	54130
No. 6 AWG	1/4"	VHCS-6-14	CTL6-14	YA6C-L Box	54105
No. 4 AWG	1/4"	VHCS-4-14	CTL4-14	YA4C-L Box	54106
No. 2 AWG	1/4"	VHCS-2-14	CTL2-14	YA2C-L2 Box	54107

- G. Electrical Connectors: Hardware used in electrical connections including bolts, studs, nuts, washers, and lock-washers shall be tin or nickel plated copper, brass, bronze, or 300 series stainless steel for electrical conductivity and atmospheric corrosion resistance.

2.11 PLASTIC CONDUIT SHEATHING

- A. Plastic conduit for cathodic protection cable sheathing for cathodic protection cables or wires shall be 1-inch minimum diameter Schedule 40 polyethylene (PE) or polyvinyl chloride (PVC) plastic pipe.

2.12 LOCATION MARKING TAGS

- A. Test station locations shall be identified with stamped brass or aluminum marking tags. Minimum tag size shall be 2-inch diameter. Stamped letters and numbers shall be 1/8-inch minimum size. Marking tags are available from Calpico, Inc. South San Francisco, CA (650-588-2241) or approved equal.

2.13 WARNING TAPE

- A. Warning tape shall be heavy-gauge, 4 mil minimum thickness, plastic tape for use in trenches.
1. Warning tape shall be non-traceable type. Warning tape shall be resistant to corrosive soil and intended for extended direct burial service.
 2. Tape shall meet A.P.W.A. national color code and shall be imprinted with an appropriate legend to define the type of utility. Tape shall be labeled with bold black letters for full length of tape.

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3. Warning tape for buried cathodic protection cables and conduits shall be yellow and labeled "CAUTION: CABLES BURIED BELOW" and a minimum of 3-inch width.
4. Warning tape for plastic and metallic water pipelines below 12-inch size shall be a minimum of 6-inch width. Warning tape for pipe equal to or larger than 12-inch shall be a minimum of 12-inch width. Warning tape shall be blue and labeled "CAUTION: WATER LINE BURIED BELOW".
5. Acceptable products are available from ITT Blackburn; Allen Systems, Inc.; Griffolyn Co.; or approved equal.

2.14 PIPELINE REFERENCE MARKER POSTS

- A. Pipeline reference marker posts shall consist of a pre-manufactured double-sided flat or three sided utility marker post in accordance with these specifications and the following.
 1. Pipeline/appurtenance reference marker posts shall consist of a pre-manufactured three-sided utility marker post. Posts shall be three rail type that allows decals or markings on both side of post.
 2. Post shall be minimum 3.75-inches in width and a minimum 6-foot long with a pointed tip. Posts shall be of a dimensionally stable composite plastic or fiberglass core with a coating that blocks UV light for 20 years. They shall be resistant to bending, impact, UV, and high temperature changes with a minimum 15-year warranty. The post shall be able to withstand vehicle impacts and still snap back to their original position.
 3. Post shall have permanent background color that meet A.P.W.A. standard color depending on pipe type. Post colors shall be stabilized against UV to not fade. Color shall be as selected by Owner. The markers shall be colored blue for water pipelines.
 4. The marker post shall be appropriately labeled for water line, valve, hydrant, air/vacuum valve, etc. Along with the name of the Owner and contact phone numbers.
 5. Decals shall be non-reflective, standard two color, factory applied decal. Decal graphics and printing shall be made of materials resistant to fading, bleaching out, chalking, or coming loose from post. Decals that bleach, chalk, fade, or come loose shall be replaced with different products that will not fade, bleach, chalk, or come loose. Printing and graphics, color, style, and information included shall be as selected by Owner.
 6. The marker post shall be designed for driving into the ground. A driving cap shall be used for driving. Pipeline reference marker posts shall be provided with the necessary recommended tools/equipment for

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installation. One set of the marker post installation tools shall be turned over to the Owner at the completion of the project

7. Where pipeline marker is offset from pipeline on parallel fence lines or out of streets, then standard manufactured decals shall be provided to state offset direction and distance in feet.

B. Acceptable pipeline marker post products are:

1. Carsonite CIB-380 or CUM-752 available from Carsonite International;
2. CottMark 511 or 512 available from Cott Manufacturing;
3. Or approved equal.

2.15 TRACER WIRE

A. Tracer Wire:

1. No. 10 AWG wire for tracer wire shall be single-conductor, stranded copper wire with 600-volt, TW, THWN, THHN or HMWPE insulation.
2. Tracer wire will only be required for non-metallic pipe sections.
3. Tracer wire insulation shall be resistant to corrosive soil and intended for extended direct burial service with color as specified under "Wires" this section.
4. Tracer wire tape for attachment of tracer wire to pipe shall be 1-inch minimum width polyethylene tape intended for direct burial service.

B. Tracer Wire Access Boxes:

1. Flush Mounted Access Terminal Box:
 - a. Plastic flush terminal box body (12" long, 2 ½" diameter minimum size) with cast iron collar and lockable cast iron lid. Minimum four (4) wire non-conductive terminal board with stainless steel, nickel-plated brass, or bronze hardware for wire terminations.
 - b. Acceptable flush mounted tracer wire access boxes are:
 - i. Valvco Pipe Tracer Wire Terminal Box available from Sioux Pipe, Sioux Falls, South Dakota.
 - ii. C.P. Mini Box available from C.P. Test Services, Inc.
 - iii. T2 Cathodic Test Station available from Handley Industries, Inc.

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- iv. Or approved Equal
- 2. Post Mounted Tracer Wire Access Terminal Box:
 - a. Condulet style terminal box with a minimum four (4) wire terminal board. Terminal board shall be non-conductive material suitable for outdoor exposure (Lexan, UV protected polycarbonate plastic, etc.). Terminal hardware for wire terminations shall be Series 300 stainless steel, nickel-plated brass, or bronze.
 - b. Condulet style terminal box shall be suitable for mounting on a threaded one-inch (1") or larger rigid galvanized steel conduit. Terminal box shall be provided with all mounting hardware (conduit straps, wood screws, conduit bushing, etc.) necessary to provide a rigid support to a 4-inch by 4-inch by 6-foot long pressure-treated wood post. Wood post shall be pressure treated with a waterborne preservative intended for fresh water or soil (burial) contact to a retention of 0.40 pounds per cubic foot (6.4 kilograms per cubic meter) in accordance with AWWA Standard C2 for Lumber and Timber and AWWA Standard P9 for Waterborne Preservatives.
 - c. Acceptable post mounted tracer wire access boxes are:
 - i. T-4 Condulet Style Test Heads available from Tinker and Rasor.
 - ii. Finklet Test Station or Finkplate Condulet Four Terminal Board available from COTT Manufacturing Company.
 - iii. Four wire condulet test station head available from Agra Equipment Company.
 - iv. Or approved Equal

2.16 FITTINGS LINING AND COATING

- A. Supply pipe and fittings with linings and coatings of the same type as adjacent pipe, except where shown on the Drawings. Coat pipe and fittings installed as specified herein.
- B. Coat metallic pipe and fittings installed above-grade as specified herein. Provide exterior coating for all above-grade piping, fittings, bollards, and vent pipes with two coats of polyamide epoxy coats at 2.5 to 3.5 mils dry film thickness per coat (MDFTPC) and with one top coat of polyurethane enamel at 3 to 4 MDFT or with a 10 to 12-mil fusion bonded epoxy coating system. Minimum surface preparation shall be near-white metal blast (SSPC SP-10) for external surfaces. Color as selected by Owner.

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- C. Coat and line all buried metallic (steel, ductile iron, and cast iron) valves, fittings, miscellaneous piping, and hydrants internally and externally. Supply factory coated valves and fittings with linings and coatings of the same type as adjacent abovegrade pipe, except where shown on the Drawings or where coating or lining specified for buried main pipeline is not feasible for fabricated items or special pipe pieces (such as incidental metallic piping, valves, fittings, tees, flexible couplings, glands, hydrants, etc.).
- D. Factory coat or line the incidental piping, valves, or fittings with liquid epoxy or with fusion-bonded epoxy coating in accordance with AWWA C210, AWWA C213, AWWA C116, or AWWA C550. Internal coatings shall be NSF approved for potable water service. Bolts, nuts, and washers, (including in valve bonnet and stuffing box) shall be fusion-bonded epoxy coated or Series 300 stainless steel.
- E. Internal linings and coatings in contact with water shall be NSF approved for potable water service.
- F. All ferrous interior mounting faces/surfaces shall be prepared and shop primed with a suitable rust-inhibitive holding primer applied in accordance with this specification and the coating manufacturer's recommendations. Holding rust-inhibitive primer shall be compatible with specified top coats. Apply per coating manufacturer's recommendations to a thickness that will not impair the clearances required for proper installation of the joint or fitting (valve) operation.
- G. Ductile Iron and Cast Iron Factory Coating Surface Preparation: Use SSPC SP grades as surface preparation guide only as it applies to cast iron or ductile iron in percentage cleanliness required and surface contaminants removed, not the color of the metal. The abrasive blast cleaning operation shall remove the same percentage of all surface contaminants (including tightly adhered annealing scale) as the SSPC SP grade referenced. The entire surface area shall be abrasive blasted. No tight rust stains shall be allowed. Avoid overblasting, high nozzle velocities, and excessive blast times. Cast iron and ductile iron attain a gray color when abrasive blasted due to the higher carbon content compared to steel. For example if a SSPC SP-10 Near White Grade is specified for cast iron or ductile iron, the degree of surface cleanliness is comparable to a near white blast for steel and requires 95 percent removal of all surface contaminants including tightly adhered annealing scale. The one exception is that the ductile or cast iron will not be required to be near-white but will only be required to be a near-gray color.
- H. Liquid Epoxy: Provide factory applied liquid epoxy lining and coating in accordance with AWWA C210 and AWWA C550 and these specifications. Epoxy material shall meet the performance requirements of the referenced AWWA standards. Epoxy material shall be the product of a coating manufacturer normally engaged in production of such material and shall be for intended service conditions. The liquid epoxy coating shall be a two part chemically cured coating or 100-percent material. Coating shall be mixed and applied per coating

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manufacturer's directions. Liquid-epoxy lining of metallic pipe and fittings shall be potable grade epoxy coating approved for potable water contact and this type of intended service. Abrasive blast with material and in manner as recommended by coating manufacturer to produce surface profile depth and angular shape needed. Surface preparation shall be a minimum of SSPC SP-5 (White) for immersion service and SSPC SP10 (Near White) or better for external service. Coating shall be a minimum of two or more coat system with a minimum thickness of 14 to 16 mils dry film thickness (MDFT). Minimum adhesion to prepared steel shall be 400 psi per ASTM D1002 or per coating manufacturer's printed literature, whichever is higher.

Liquid Epoxy	ICI Devoe	Sherwin-Williams	Tnemec
Liquid Epoxy AWWA C210 and AWWA C550 (Coating in contact with potable water surfaces shall be approved for potable water contact and conforming to NSF Standard 61)	Bar-Rust 233 H	4.53 Macropoxy 646	Pota Pox Series 20 or Pota-Pox Plus Series N140F Or Pota-Pox Plus 80 Series N141
Abovegrade Structures Only - Polyurethane Enamel Top Coat Two-component, aliphatic or acrylic based polyurethane; high gloss finish suitable for the intended service, Color by Owner	Devthane 379 UVA Polyurethane Enamel	5.21 Hi-Solids Polyurethane Enamel	Series 1074 U Endura-Shield Aliphatic Acrylic Polyurethane

- I. Fusion-Bonded Epoxy: Provide factory applied fusion-bonded epoxy lining and coating in accordance with AWWA C213, AWWA C116, and AWWA C550, and these specifications. Fusion-bonded epoxy material shall meet the performance requirements of the referenced AWWA standards. Fusion-bonded epoxy material shall be the product of a coating manufacturer normally engaged in production of such resin and shall be for intended service conditions. The fusion bonded epoxy coating shall be a 100 percent powder epoxy based thermosetting coating. Coating shall be applied by flocking, fluidized bed, or electrostatic method per coating manufacturer's directions. Fusion-bonded epoxy lining of metallic pipe and fittings shall be potable grade epoxy coating approved for potable water contact and this type of intended service. Abrasive blast with material and in manner as recommended by coating manufacturer to produce surface profile depth and angular shape needed. Surface preparation shall be a minimum of SSPC SP-5 (White) for immersion service and SSPC SP10 (Near White) or better for external service. Fusion bonded epoxy coating shall be one

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or two-coat system with a minimum thickness of 8 to 10 mils dry film thickness (MDFT). Minimum adhesion to prepared steel shall be 3,000 psi per ASTM D1002 or per coating manufacturer's printed literature, whichever is higher.

Fusion-Bonded Epoxy	3M Scotch Coat	Herberts O'Brien Nap Gard DuPont Powder Coatings	Valspar (formally Lilly Industries)
Fusion Bonded Epoxy AWWA C213, AWWA C116, and AWWA C550 (Coating in contact with potable water surfaces shall be approved for potable water contact and conforming to NSF Standard 61)	Scotchkote 206N (NSF 61 Internal and External) or Scotchkote 6233 for pipe	Nap-Gard 7 -2500 Pipe Coating (NSF 61 Internal and External)	Pipeclad 3100 Red (NSF 61 Internal and External) or Pipeclad 2000 Green (External Only)

- J. Coating for valves, fittings and fire hydrant legs shall consist of one of the following:
 - 1. Liquid epoxy coating shall be a minimum of two coats or more for a 14 to 16 MDFT minimum coating thickness.
 - 2. Fusion bonded epoxy coating shall be one or more coats for a minimum coating thickness of 8 to 12 MDFT.
 - 3. Nylon coating shall be one or more coats for a minimum coating thickness of 10 to 12 MDFT applied in a fluidized bed.
 - 4. Polyurethane coating (40 MDFT minimum coating thickness) for ductile iron valves and fire hydrant legs and stub pieces (American AVK fusion bonded epoxy interior with polyurethane coated exterior or approved equal).
- K. Maximum coating thickness shall be as recommended by fitting manufacturer so as to not impair engagement of joint or function of fitting.
- L. Conduct dry film thickness measurements and 100-percent holiday inspection of all epoxy factory coated items prior to shipment. Conduct dry film thickness measurements in accordance with SSPC PA-2 with exception that the specified thickness is the absolute minimum. A minimum of two dry film thickness measurements shall be completed for each fitting or appurtenance. Repair all defects with approved repair material according to coating manufacturer's directions prior to shipment.
- M. Provide repair kits for coated materials.

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- N. Provide stainless steel materials or coat all other miscellaneous buried metallic items, (tie rods, thrust restraints, tapping saddles, harnesses, etc.). Coat tie rods and rebar when directly exposed to soil. Provide with factory applied epoxy coating, fusion bonded epoxy coating, heat shrink sleeves, or with coating recommended by coating manufacture for buried application and approved by Engineer for intended exposure.
- O. Bolts, nuts, and washers, for valves (including in valve bonnet and stuffing box) shall be Series 300 stainless steel.
- P. Galvanized or black steel materials (piping, nipples, unions, fittings etc.) shall not be used in wet, immersed, or buried locations or vaults unless tight bonded coated as specified.
- Q. Restraint Fitting Coating System
 - 1. Restrained fittings (casting bodies, wedge assemblies, and related parts, etc.) shall be abrasive blasted followed by a phosphate wash, rinse, and drying pretreatment process just prior to coating.
 - 2. Restrained fittings (casting bodies, etc.) shall be coated immediately following the pretreatment process. The coatings shall be electrostatically applied and heat cured. Acceptable casting body coating systems shall consist of:
 - a) A sealer prior to pretreatment drying and one or two coats of a thermosetting powder coating at minimum 3 to 6 mils dry film thickness (MDFT) with EBAA Iron Mega-Bond Restraint Coating System or Star-Bond TGIC Polyester Coating for Joint Restraint Products.
 - b) A fusion bonded epoxy coating at a minimum 8 to 10 MDFT Romacote Colvel Black.
 - c) Or approved equal.
 - 3. Wedge assemblies and related parts (threaded components, etc.) shall be coated immediately following the pretreatment process with a thermoplastic flouropolymer type fastener coatings specifically designed for that type of application at approximately minimum 1 to 2 MDFT or with a fusion bonded epoxy coating system at 6 to 8 MDFT. Thermoplastic flouropolymer coating system shall consist of two or more coats of liquid thermoset epoxy coating with heat cure following each coat (EBAA Iron Mega-Bond Restraint Coating System or Star-Bond TGIC Polyester Coating for Joint Restraint Products.). Fusion bonded coating system shall consist of one or more coats of fusion bonded epoxy electrostatically applied and heat cured following each coat.

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2.17 FASTENERS (BOLTS, NUTS, WASHERS)

- A. All fasteners (bolts, nuts, tee bolts, and washers) type, size, and strength shall be as designed for the application. All nuts shall be fully seated. Nuts shall be compatible with the bolts and have a proof stress equal or greater than the tensile strength of the bolts. Minimum bolt size, lengths, and tensile shall be as designed for the application.

- B. All fasteners installed below-grade (either buried, submerged, or immersed in vaults) shall either be Stainless Steel Series 300 or coated with an approved fastener coating system. Series 300 stainless steel materials shall be provided in place of coated items, where specifically called out as being required in specific specification sections or applications.
 - 1. All fasteners (bolts, nuts, tee bolts, and washers) installed below-grade (either buried, submerged, or immersed in vaults) shall be Stainless Steel Series 300, unless specified otherwise.

 - 2. Coated fasteners (bolts, nuts, tee bolts, and washers) shall not be installed unless specifically called out as being required or allowed in specific specification sections or applications. Only where specifically allowed, coated fasteners may be provided and shall meet the following requirements:
 - a) The coated bolts shall be undersized or the nuts oversized as required to minimize damage to coatings, however, size shall still satisfy design and manufacturer's requirements for bolt strength and size in the particular application. Provide with applicator name, coating manufacturer and product number, and certification that coating was applied as specified.

 - b) Bolts, nuts, and washers for ductile iron pipe and fittings shall be low carbon weathering steel meeting the strength, physical, marking, traceability, and chemical requirements of AWWA C111 and coated with an approved fastener coating system.

 - c) Bolts, washers, nuts, and T-bolts shall be pretreated and coated with a thermosetting powder coating or fusion bonded epoxy type fastener coating system.
 - 1) Thermosetting powder coatings shall be at a minimum of approximately 1 to 2 mils (MDFT) with COR-BLUE, Xylan, Type E, Flour Kote #1, or thermoplastic fluoropolymer type fastener coatings specifically designed for that type of application if approved by the Owner's representative.

 - 2) Fusion bonded coated steel bolts, nuts, and washers, fittings, and bodies shall be coated with 6 to 8 mils

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minimum epoxy coating per AWWA C213. Surface preparation shall be SSPC SP-10 (near white).

2.18 STAINLESS STEEL FABRICATION AND PASSIVATION

- A. Utilize Type L grade stainless steel for all items to be welded.
- B. During fabrication, handling, and installation take necessary precautions to prevent mild carbon steel impregnation of stainless steel members.
- C. Utilize brushes (stainless steel, non-metallic), grinding wheels (aluminum oxide discs), and tools intended for stainless steel and not used previously for carbon steel work.
- D. Degrease and clean prior to welding with non-chlorinated solvents.
- E. Weld stainless steel with approved materials and techniques.
- F. Clean and remove contamination, remove weld heat tint, and repassivate welds per ASTM A 380 and ASTM A967.
- G. After treatment visually inspect surfaces for compliance.
- H. Pack stainless steel parts and pad mild steel fork lift forks and use straps instead of metal chains to handle stainless steel parts to avoid iron contamination of stainless steel.
- I. After installation, visually inspect stainless steel surfaces for evidence of iron cross contamination, rust, oil, paint, and other forms of contamination. Repair as required and reinspect.

2.19 PIPE AND FITTING FIELD COATING REPAIR MATERIALS

- A. Field repair coating shall be compatible with factory coating and linings and be approved by factory coating manufacturer for repair on their products.
- B. Field Coating Repair Materials:
 - 1. Heat Shrink Sleeve and Sleeve Repair Materials: Heat shrink sleeve repair materials shall consist of either heat shrink sleeve in tube form or heat shrink patch kit depending on size and shape of repair. Acceptable heat shrink products are Raychem WaterWrap sleeve or PERP Repair Patch Kit available from Tyco Adhesive (Polyken Kendall) Mansfield, MA.; CANUSA Aqua-Shield Aqua-Sleeve or CANUSA CRPK Repair Patch Kit available from CANUSA, Inc., The Woodlands, TX.; or approved equal.
 - 2. Epoxy Coatings: Provide acceptable a high or 100 percent epoxy coatings that can cure under wet or dry conditions are "A-788 Splash Zone Compound" by Koppers, Pittsburgh, PA; "Aquata Poxy" by Raven

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(King Adhesive Corporation), St. Louis, MO; "Concresive No. 1438 or No. 1170" by Adhesive Engineering Company, San Carlos, CA; Protal 7125 Repair Coating by Denso North America, or approved equal.

3. Buried Insulated Coupling Top Coating System at Concrete Encasement Locations: Provide heat shrink top coating system for buried insulators and concrete encase up to insulator location as shown on the drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. All materials and equipment associated with pipe connecting wires, joint bonding, test stations, reference electrodes, galvanic anodes, insulating joints, and casing insulators as shown and specified herein shall be furnished and installed by the Contractor.
- B. Coordinate installation of the specified work as necessary such that installation of the items herein specified can be completed concurrently with pipeline installation. Test leads shall be installed only during pipe installation. Items not installed before backfilling of the pipe shall be installed at the Contractor's sole expense. Additional excavation of pipe after backfilling shall be minimized to protect pipe and coating from possible damage. Galvanic anodes shall be only installed at same time as metallic pipe or metallic fitting installation.
- C. Nothing included or omitted in this specification shall relieve the Contractor of the obligation of providing a complete and satisfactory pipeline that is electrically continuous, electrically isolated, and provided with a functioning cathodic protection system with test stations as specified.
- D. The Contractor shall examine all Drawings and coordinate his work so as to avoid conflicts, errors, delays, and unnecessary interference with construction of the facilities and to avoid duplication of the work such as excavation, backfilling, etc.
- E. All work shall present a neat and finished appearance. Any changes in the design or method of installation of an item as specified shall be reviewed and approved by Engineer prior to installation.
- F. In the event of any conflicts in the Drawings or Specifications, the Engineer shall be consulted. If departures from the Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer in writing for review as soon as practical, but not later than 30 days before installation.
- G. Weather Conditions:
 1. Work shall be accomplished only during daylight hours (sun up to sun down).

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2. Installation of the corrosion protection system components, such as splices, bonds, and wire installation shall only be allowed when ambient temperature are above ten degrees (10°) F. (-12° C.) and rising to minimize wire and insulation damage.
 3. Materials can be stored in covered and heated storage units to maintain minimum temperatures above restricted temperature limits.
- H. Do not thermite (exothermic) weld, pin braze, weld or utilize open flame or torches in areas of flammable vapors or air borne particles, where a fire or explosion could result.
- I. Install and work around abovegrade and buried AC powerlines and oil and gas pipelines with extreme care, follow minimum separation distances per foreign company requirements and regulations. Do not work next to powerlines during times of high lightning activity.
- J. Installations shall be completed per the National Electrical Code (NEC), and as specified in this section.

3.02 MATERIAL STORAGE AND HANDLING

- A. Store materials in secure, protected location in accordance with material manufacturer's recommendations. Store coating and lining, thermite weld or pin brazing materials, reference electrodes and prepackaged galvanic anodes off the ground and keep them dry at all times. Protect against weather, condensation, and mechanical damage. Handle with care to prevent damage. Wire shall not be sharply bent or tightly coiled to minimize possibility of damage to the wire insulation during manufacture, shipment, or installation. Equipment or materials damaged in shipment or in the course of installation shall be replaced. Immediately remove from site all mechanically damaged materials. Prepackaged corrosion control items shall be handled with care to prevent loss of backfill material. Do not lift, lower, or hold anodes and reference electrodes by the lead wire.
- B. Do not allow reference electrodes to freeze. Store in protected area, off the ground. Utilize before shelf life expired.

3.03 PIPE JOINT AND FITTING BONDING

- A. To form an electrically continuous pipeline and associated appurtenances; the joints of all buried metallic pipe, vault, and manhole piping; and all appurtenances, tees, elbows, restrained joints, valves, and fittings including hydrant and blow-off piping; shall be electrically joint bonded. All joints including all bolted and restrained joints shall be joint bonded, except those joints specified to be threaded, welded, or insulated. Blow off and hydrant pipe and fittings shall also be bonded. Do **NOT** joint bond across insulating joints.

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- B. Various components of metallic fittings (thrust restraint devices, follower rings or glands, etc.) on plastic or ductile iron pipelines shall be bonded together to provide an electrically continuous fitting or appurtenance.
- C. Install a minimum of two or more insulated No. 12 AWG stranded copper metallic fitting joint bond wires for all metallic fittings or appurtenances on plastic or metallic pipelines for electrical continuity redundancy. Place metallic fitting bond wires on top quadrant of pipe or fitting to bolt pattern area or where flange edges are to minimize damage to internal coating or joint materials. Bonding can be completed abovegrade prior to fitting assembly.
- D. Wire connections to pipes or fittings shall be as specified under WIRE CONNECTIONS.
- E. Install one insulated joint bond wire or bond strap per joint on all pipe or fittings 10 inches in diameter or smaller. Install a minimum of two or more insulated joint bond wires or bond straps per joint on all pipe or fittings 12 inches in diameter or larger for redundancy. Bond wire size may be No. 4 AWG on pipe sizes equal to or smaller than 15-inch diameter. Insulated joint bond wires or coated or bare copper straps may be utilized depending on joint coating type. Place bond wires on top quadrant of pipe.
- F. Minimum number of bond wires or straps per pipe size is as follows:

Metallic Pipe Size (Diameter Inches)	STRANDED COPPER INSULATED JOINT BOND WIRES		COPPER BONDING STRAPS
	Minimum No. of Joint Bond Wires Required	Minimum Joint Bond Wire Size Required	Minimum No. of Joint Bond Straps Required
10-Inches or Smaller	1 Bond Wires	No. 4 AWG	1 Strap Bond
12-Inches to 15-Inches	2 Bond Wires	No. 4 AWG	2 Strap Bonds
Bonding 16-Inch or Smaller Size Fittings Together (less than ten-feet 10' apart).	2 Bond Wires	No. 12 AWG Between Isolated Fittings (Maximum 10' apart) on Galvanic Anode Systems ONLY	
Note: For larger pipe sizes additional bond wires or straps will be			

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Metallic Pipe Size (Diameter Inches)	STRANDED COPPER INSULATED JOINT BOND WIRES		COPPER BONDING STRAPS
	Minimum No. of Joint Bond Wires Required	Minimum Joint Bond Wire Size Required	Minimum No. of Joint Bond Straps Required
required as calculated by the Engineer.			

- G. Bond bolted restrained type joints, multiple segmented fitting sections, and metallic gland connection pieces on fittings on plastic pipe, and metallic pipe into cathodic protected metallic fittings or pipe with single No. 12 AWG stranded insulated copper wires with sleeves. Length of pig tail bond wire as required. Bond across the joint with the specified number and larger sized bonds listed above based on pipe size and material.
- H. Joint bonding of cast iron soil pipe not required unless specifically shown on Drawings. Joint bonds for cast iron soil pipe and fittings and high silicon cast iron pipe and fittings shall be in accordance with the manufacturer's recommendations.
- I. Bronze wedges, restrained joints, bolted or compression sleeved wires or copper straps, thrust restraints, or welded "Z" bars are **NOT** acceptable methods of achieving electrical continuity.

3.04 WIRE CONNECTIONS

- A. The electrical connection of copper wire or copper strap to metallic (steel, cast iron, and ductile iron) surfaces shall be by the thermite weld or pin brazing method. Prepare surface and make connections in accordance with the thermite weld or pin brazing manufacturer's recommended procedures and these specifications, whichever one is more stringent.
- B. Provide adequate ventilation and safety equipment (gloves, safety glasses, etc.) and follow safety and training requirements as recommended by the thermite weld or pin brazing material manufacturer. Avoid contact with hot materials. Remove or protect fire hazards in the area during the thermite welding operations.
- C. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way. Do not use on Cast Iron Soil Pipe (ASTM 74-93)
- D. Complete thermite or pin brazing weld connections at locations and in a manner that does not damage sealing materials, gaskets, plastic pipe, and/or coatings

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and/or polyethylene encasement. Maintain minimum two-inch (2") separation from the pipe or fitting O-ring gasket.

- E. Complete thermite weld wire connections on horizontal surfaces, if at all possible. Connections to vertical surfaces should be minimized and only if approved by Engineer. Conduct horizontal type installation to fire hydrant risers and pipe stubs in horizontal positions abovegrade prior to installation in excavations.
- F. All connections to stainless steel materials, copper, and light wall steel tubing (0.035-inch or less), shall be either with a silver soldered connection (silver brazing) or a physical type connection.
 - 1. Connections to stainless steel fittings and appurtenances can be made with a ring tongue terminal placed under a bolt or a soldered connection as approved by the Engineer. Thermite weld or pin brazing type connections to stainless steel are NOT allowed.
- G. Thermite Weld or Exothermic Method.
 - 1. The Contractor is responsible for repair of any damage to pipe, fitting, lining, or coating as a result of the thermite weld process.
 - 2. Make thermite weld connections at locations as directed by the pipe or fitting manufacturer so as to not damage pipe gasket or internal linings exposed to liquid.
 - 3. On foreign pipelines, the Contractor shall notify foreign pipeline owner and the foreign owned pipe owner shall only attach wires to their own pipelines, unless the foreign pipeline owner grants permission to the Contractor in writing. In that case, the Contractor shall strictly follow foreign-pipeline owner written recommendations and procedures.
 - 4. For connections to gas and petroleum piping systems, the connections are extremely critical and shall only be made according to ANSI/ASME B31.8 and ANSI/ASME B31.4 codes, the specific pipeline owner's recommended procedures, and applicable state and federal regulations. Maximum charge size shall be 15 grams. Crows foot (separate) larger wire per specific pipeline recommended procedures. State and federal regulations require specific training be completed prior to making connections to gas and petroleum pipelines. If the Contractor is to make connections to gas or petroleum piping, they shall provide copies of certification of training of personnel, prior to making any wire connections.
 - 5. The electrical quality and resistance of the connection is dependent on proper adhesion of the welded connection to the pipe or fitting surface. Observe proper thermite weld material selection, safety precautions, surface preparation, and welding procedures as recommended by the material manufacturer.

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6. Use cast iron type charges for all cast iron and ductile iron pipe and fitting thermite weld connections. Use steel type charges for all steel pipe and fitting thermite weld connections. Utilize correct sized mold (as shown on metal tag on graphite mold) based on wire and pipe or fitting size and type. Utilize correct type and size of charges for each connection based on wire and pipe or fitting size and type. Cartridge charge type and size in grams is shown on box and charge tube.
7. The wire and cable to be cadwelded shall be clean, bright, and dry. Clean all wire that is contaminated with oil and grease in accordance with the thermite weld manufacturer's recommendations. Remove all corroded cable including the individual strands.
8. Before the connection is made, clean the surface to bare metal by making a two-inch (2") by two-inch (2") window in the coating, and then filing or grinding the surface with a grinding wheel to produce a bright (white) metal finish.
9. All power grinding shall be with a vitrified type-grinding wheel. The use of resin, rubber, or shellac-impregnated type grinding wheels is not recommended by the thermite weld manufacturer and will not be acceptable.
10. Contractor shall take appropriate actions for existing coatings with asbestos to minimize worker exposure and to contain, handle, and dispose of asbestos per regulations.
11. After the surface is cleaned to a smooth, white metal finish, lightly tap the pipe surface with a sharp tool (back of claw hammer or metal chisel edge, etc.) so as to produce dimples to improve surface profile and adhesion for the weld material.
12. In certain high humidity conditions, cold weather, or on cold or wet surfaces, preheating of the metal surface and/or molds may be required to improve successful connections and minimize porous welds.
13. Exothermic welding should be completed immediately following preparation of the metal surface before surface flash rusting or oxidation can occur.
14. Where specified wire sleeves shall be firmly attached to the end of the wire before thermite welding to the metal surface. Wire and sleeve shall be clean and dry. Wire shall extend 1/4-inch out of field formed sleeves. Factory formed sleeves shall be provided with end of sleeve beveled or angled so that wire is exposed to thermite weld material.
15. Utilize exothermic weld packing compound around mold as required on irregular or small weld surface areas to seal bottom of welder mold to prevent molten metal leakage.

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16. Replace worn molds at intervals as recommended by the thermite weld manufacturer to minimize the possibility of molten metal leakage during the thermite welding process.
 17. The mold and base metal should always be clean and dry. Avoid moisture and contaminants in mold and materials being welded as this may result in spewing of hot molten material.
 18. Place a metal disk in the bottom of the graphite mold and then pour in the weld material or place the prepackaged weld material cartridge in mold. Be sure to squeeze the plastic cylinder to get all of the starting powder out. Close the mold body lid.
 19. Place the graphite mold on the prepared pipe surface and install the wire in the slot at the bottom of the mold. Confirm that the mold and wire provide a proper fit and that the mold is in intimate contact on all sides with the surface being welded to. Hold the wire and mold steady and firm on the pipeline or fitting surface.
 20. Ignite the weld material with the spark gun or electrical starter depending on type of charge. Lightly tap the mold body during the ignition fusion process. Carefully remove the graphite mold after the exothermic fusion process is completed approximately 15 to 20 seconds later.
 21. Care should be taken during the thermite welding process, as the exothermic process produces a molten liquid metal that is extremely hot, 2,500° F (1,400° C) and will result in a local release of smoke. Do not watch the bright light (flash) or breathe the fumes from the thermite welding process. Do NOT sharply hit or move the graphite mold body during the cadweld process to minimize expelling the molten metal out of the graphite mold.
 22. The graphite mold should not be touched or allowed to come in contact with the pipe coating or other flammable or meltable materials, as it is extremely hot. Carefully clean the slag out of the graphite mold body with the mold cleaner intended for that mold size and type.
- H. After the weld connection has cooled, remove slag, visually and physically test quality of connection by tapping with a hammer and lightly pulling on the wire. The completed weld should visually present a good appearance of a well-formed connection with a minimum loss of weld material or splatter. All portions of the wire and sleeve shall be covered with the weld material. Remove and replace all visually defective, porous, or poor welds.
- I. Narrow or Small Fitting Attachment Locations: Thermite weld connections on metallic fittings, restraint devices, sleeve type coupling rings, mechanical joint follower gland rings, or bolted restraint joint ring type joints, and couplings where only a small or narrow metallic surface is available shall be carefully done so as

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to not damage the internal lining, O-ring, or damage the fitting. Two or more wires can be attached under the same thermite weld connection as long as the bond or pig-tail wires are not being connected to the same structure under the same thermite weld. Apply approved mastic packing material around mold to keep molten thermite material in place. Do not hold mastic packing material in-place with bare or gloved hands. Completing connections prior to complete fitting assembly and installation of the fitting into the trench so as to allow the thermite weld connection to be made to a level surface on top of the fitting is the preferred method. Vertical connections after the fitting is assembled and in the trench is a more difficult type connection to make. If the area of the thermite weld connection and the geometric arrangement of the fitting (too narrow, sharp angle, edge of lip, etc.) does not allow a tight seal to be made by the prefabricated cap type materials, then coat with an approved 100-percent moisture tolerant cold weather cure type epoxy.

- J. Silver Solder:
1. Use for electrical connection of copper wire to thin-wall steel tubing (0.035-inch wall or less), copper, or stainless steel pipe connectors.
 2. Silver solder connections shall be made at locations on the edge of the fitting lip at a location that will not damage the rubber gaskets.
 3. Before the connection is made, clean and flux the area around the connection with a suitable flux as recommended by the pipe manufacturer for the materials being soldered.
 4. Weld the copper sleeved wire to the fluxed area with the suitable silver brazing alloy in such a manner that the completed connection is free of cracks or crevices in accordance with the solder manufacturer's recommendations.
 5. After the connection is completed, allow to cool, and remove the remaining flux by wire brush and solvent clean (SSPC-SP-1).
 6. Clean and coat silver soldered connections on copper and steel appurtenances with prefabricated thermite weld cap or epoxy repair coating. Stainless steel connections do not require coating.
- K. Plastic pipe and fittings and metallic pipe and fittings coatings and linings shall be protected during thermite welding or soldering procedures. Plastic pipe or fittings and/or coating damaged by welding or weld splatter shall be repaired per this specification. Welded area shall be allowed to cool to "warm to touch" condition prior to application of primer and field coating.
- L. After the weld connection has cooled, remove slag, visually and physically test quality of connection by tapping with a hammer and lightly pulling on the wire. The completed weld should visually present a good appearance of a well-formed connection with a minimum loss of weld material or splatter. All portions of the

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wire and sleeve shall be covered with the weld material. Remove and replace all visually defective, porous, or poor welds.

- M. Each joint bond shall be both visually inspected and physically tested before coating according to the coating manufacturer's recommendations. Remove, replace or install additional joint bonds at all locations not passing electrical or physical tests.
- N. All damage to pipe or fitting coatings or linings, gaskets or O-rings, and/or plastic pipe or fittings, etc., shall be repaired by the Contractor at his sole expense.

3.05 WIRE CONNECTION COATING

- A. Clean weld area and install a prefabricated thermite weld cap or liquid epoxy repair coating per manufacturer's directions over each completed connection after testing, unless to be coated by heat shrink joint coating. Type and size of prefabricated thermite weld cap shall be determined by type of connection and size of wires.
 - 1. Utilize standard prefabricated thermite weld caps with integrated primer on all No. 10 AWG and smaller wires.
 - 2. Liquid Epoxy Coating - Wire connection at pipe joints where prefabricated caps are too large to fit or as required for factory coating repairs, shall be completed with a liquid repair type coatings. On mechanical joints, restrained rings, and metallic glands, apply liquid repair coating material to thermite weld connection area, where the area of the thermite weld connection and the geometric arrangement of the fitting (too narrow, sharp angle, edge of lip, etc.) is too small to successful installation and adhesion so as to not allow a tight seal to be made by the prefabricated Handy Cap type materials, then coat with a 100-percent moisture tolerant cold weather cure epoxy (Protal 7125 or equal)..
- B. In cold weather, store prefabricated cadweld caps, and coating repair materials in a heated location and keep warm until installation.
- C. The pipe and factory-coating surface shall be clean and dry before application of cap.
- D. Prefabricated cadweld cap shall be applied at connection according to manufacturer's directions. The filler material shall be placed over the thermite weld connection and worked around and under the wire and connection. Apply pressure to the prefabricated cadweld cap to assure good adhesion.
- E. Completed prefabricated thermite weld cap assembly shall adhere tightly to pipe and wire connection with no voids or gaps. Inadequate adhesion is demonstrated if there are visible gaps or voids under the cap or if the cap can be easily removed from the pipe surface by pulling with fingertip pressure. At all locations where inadequate adhesion is evident, reprime and replace cap or

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prime and apply either a minimum six-inch (6”) by six-inch (6”) square of field repair tape, a 55-mil thick Tapecoat Gray “Pads”, or heat shrink repair material over existing cadweld cap. Apply per tape coating or heat shrink manufacturer’s directions.

- F. Liquid Repair Epoxy Coating Application - Wire connection at pipe joints where prefabricated thermite weld caps are too large to fit or as required for factory coating repairs, shall be completed with a liquid one hundred repair type coatings. Complete surface preparation and apply one hundred percent (100%) solids, low temperature epoxy repair coating in accordance with coating manufacturer directions. Total minimum dry film thickness shall be 20-mils, apply in multiple coats if required by manufacturer of specific coating utilized. Allow coating to cure to sufficient degree to prevent damage to coating, prior to handling and backfilling. Strictly follow minimum cure time recommended by coating manufacturer based on surface and ambient temperatures.
- G. All exposed metallic surfaces not covered by the thermite weld cap, 100-percent moisture cure liquid epoxy repair coating, shall be repaired per PIPE AND FITTING COATING REPAIR.

3.06 PREPACKAGED GALVANIC ANODE INSTALLATION

A. General:

- 1. Remove plastic or paper shipping wrap from prepackaged anode prior to placement. Galvanic anodes packaged in cardboard type chip-tube shall be thoroughly perforated just prior to installation.
- 2. Install galvanic anodes a minimum of 1-foot below the pipe invert and 3 to 5-feet from buried metallic piping or 3-feet from metallic fittings to be protected. Space galvanic anodes equally around the fitting, pipe section, or appurtenance. Locate at bottom edge of pipe trench as shown on the Drawings or as specified. Alternate anode placement on opposite sides of the pipe. If two or more anodes installed at the same location, place on opposite side of the pipe or fitting. Provide a minimum anode spacing of 5-feet from other unprotected pipelines.
- 3. Handle prepackaged anode with care. Damage to the anode, anode to wire connection, or prepackaged backfill bag will require replacement of the entire assembly.
- 4. Place anode in native earth backfill do not use pipe zone bedding material.
- 5. Earth backfill around each anode shall be thoroughly compacted to a point 1-foot above the anode. Backfill material around each anode shall be native soil free of roots, organic matter, trash, and rocks. Stop backfill at specified grade to allow for placing of topsoil, pavement, or concrete, when required.

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6. All anode wires shall be buried a minimum of 36-inches below finish grade. Wires shall be handled with care. Splices or damage to the insulation on any wire shall be repaired in accordance with WIRE INSULATION REPAIR and be approved by Engineer.
7. Electrical connection of the anode wire to steel, cast or ductile iron metallic pipe or fittings shall either be directly to the pipe or fitting by the thermite weld or pin brazing method or through a test station with shunt as shown on the Drawings.
8. Electrical connection of the anode wire to stainless steel fittings shall either be directly to the stainless steel fitting with a silver solder or ring tongue terminal physical type connection or through a test station with shunt as shown on the Drawings.

B. Installation:

1. Each buried or submerged metallic (steel, ductile, or cast iron) pipeline section, appurtenance, valve, or fitting shall receive a minimum of one galvanic anode unless already protected by an impressed current cathodic protection system.
2. All metallic valves, blow-offs, air valves, or fittings located in vaults on plastic pipeline, which will be either continuously or intermittently under the water table shall be cathodic protected as if buried. Place galvanic anode inside vault and attach directly to metallic fitting.
3. Install a minimum of one each or more 17 or 18-pound galvanic anode for each concrete encased metal pipe section (stub piece) under or next to pump stations, buildings, or tanks as shown on the drawings.
4. Type of Prepackaged Anodes is project specific. For this project utilize:
 - a. Prepackaged zinc galvanic anodes for protection of metallic pipe and fittings in lower resistivity soils (1,500 ohm-cm or below).
5. Where two or more metallic fittings are adjacent to each other, install joint bonds as specified in PIPE CONNECTING WIRES, and install the specified quantity of galvanic anodes for each metallic pipe section, appurtenance, valve, or fitting used in conjunction with nonmetallic pipe.
6. At the Contractor's option, larger anodes may be used in place of multiple smaller anodes for a group of bonded metallic components on non-metallic piping provided the same total bare weight of galvanic anode is used. Maximum separation distance shall be 10-feet on fittings to be protected with one anode, if multiple fittings are bonded together.
7. For ductile iron and cast iron fittings, where specified coating thickness is not provided or specified holiday testing and/or 100% holiday free

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coatings are not completed by the fitting manufacturer, or bare fitting is coated with petrolatum tape type coating system; then install one specified size larger anode or double the number of anodes for each fitting than listed on the following table. For example, if a 5 pound anode is listed and a fitting does not meet coating thickness specified or is not 100% holiday free then install a 17 or 18 pound anode instead. If one 17 or 18 pound anode is required per the following table and coating thickness is not as specified, then at Contractor's option, install either a 30-pound anode or two 17 or 18 pound anodes. Existing fittings that are exposed and coated with a four layer petrolatum tape type coating system, shall receive double the number of anodes specified or the next largest anode size shown in these specifications. For example, if a bare fitting (16-inch or less) is exposed and petrolatum tape coated, it shall receive a 17 or 18 pound size anode instead of the 5-pound size anode required for a factory coated fitting.

8. The minimum number of anodes to be installed on buried or submerged factory coated metallic fittings, pipeline sections, or appurtenances with non-metallic pipelines shall be:

MINIMUM PREPACKAGED ANODE SPACING FOR COATED METALLIC FITTINGS FOR DIFFERENT NON-METALLIC PIPE SIZES				
	16" or less	18" to 30"	32" to 46"	48" or larger
ITEM	MINIMUM NUMBER OF AND MINIMUM BARE ANODE SIZE (Reference Type of Anode Required For Project Per Specification)			
Single Coated Metallic Fitting	1 - 5 pd Magnesium or Zinc anode	1 - 17 pd Magnesium or 18 pd Zinc anode	2 - 17 pd Magnesium or 2 - 18 pd Zinc anodes	3- 17 pd Magnesium or 3 - 18 pd Zinc anodes
Multiple (2 to 3) Coated Metallic Fittings (Maximum of 10 feet apart)	1 - 17 pd Magnesium or 18 pd Zinc anode	2 - 17 pd Magnesium or 2 - 18 pd Zinc anodes	3 - 17 pd Magnesium or 3 - 18 pd Zinc anodes	4 - 17 pd Magnesium or 4 - 18 pd Zinc anodes
Coated Fire Hydrant or Blow-off Assembly (including tee, valve, and hydrant) with plastic pipe main and 6-inch pipe leg (less than plastic 10 foot leg).	1 - 17 pd Magnesium or 1 - 18 pd Zinc anodes	1 - 17 pd Magnesium or 1 - 18 pd Zinc anodes	1 - 17 pd Magnesium or 1 - 18 pd Zinc anodes	1 - 17 pd Magnesium or 1 - 18 pd Zinc anodes
Coated Fire Hydrant or	2 - 17 pd	2 - 17 pd	2 - 17 pd	2 - 17 pd

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Blow-off Assembly (including tee, valve, and hydrant) with plastic pipe main and 6-inch coated metallic pipe leg (less than 10 foot leg) or plastic leg with petrolatum tape coated hydrant barrel.	Magnesium or 2 - 18 pd Zinc anodes	Magnesium or 2 - 18 pd Zinc anodes	Magnesium or 2 - 18 pd Zinc anodes	Magnesium or 2 - 18 pd Zinc anodes
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3.07 TEST STATION AND/OR TRACER WIRE ACCESS BOX INSTALLATION

- A. Cathodic protection test stations and tracer wire access boxes of the types indicated shall be installed and located as specified herein and as shown on the Drawings. Current span wires, reference electrode, coupon, plastic reference pipe, or resistance probe shall be installed only at test station locations indicated on test station schedule.
- B. Install tracer wires and test wires to pipe and coat only during pipe construction at time of pipe installation along with the necessary reference electrode, coupons (minimum of two each), plastic reference monitoring pipe, drain/ground anode, or resistance probes if required before the pipe is backfilled and compacted around. Install sufficient wire to reach test station or tracer wire access box final location. Test station or tracer wire access boxes and support posts can be completed at a later date. Take actions to protect wires from damage if not terminated in test station or junction box at this time.
 - 1. Test station or tracer box types shall be installed on metallic pipelines or fittings or plastic pipelines as shown on test station and tracer wire access box schedule or drawings per the following
 - a. Install a Type A test stations at specified galvanic anode installation locations on metallic fittings on plastic lines or on galvanic protected metal pipeline sections.
 - b. Install tracer wire access boxes at locations shown on test station and tracer wire access box schedule or drawings at maximum two thousand foot (2,000') spacing for cross-country transmission type pipelines and five hundred feet (500') for in-town transmission or distribution type pipelines or shorter spans if required by City or Owner standards.
- C. Color-code wires per specifications, before installation of wires in conduit or backfilling of the test station wires.
- D. Wherever possible test stations or access boxes shall be located directly over the centerline of the pipeline. In locations, where pipe is in field and parallels a fence, install test station or access box next to and on parallel fence line. Desired maximum offset distance from pipe centerline shall be 15 feet or at edge

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of right-of-way which may be up to 50-feet as directed by Engineer for future physical protection of test station.

- E. Locate next to other above-grade facilities and structures for protection, where possible. Install in protected locations, so as to not restrict intended use of the land, outside roadways, cultivated fields, and irrigation facilities.
- F. Install at protected locations such as next to pipeline structures, fences, road crossings, and edges of cultivated fields. The Engineer shall determine the final location . Changes in the location of any test station or tracer wire access box shall be reviewed and approved by Engineer prior to installation.
- G. Post-mounted test station and tracer wire access boxes support posts shall be set in firmly compacted soil backfill at height shown on Drawings. Test station or tracer wire access box body shall be positioned so as to allow easy access for future testing.
 - 1. Test station box and access box and rigid conduit shall be securely fastened to center of wood post or rectifier pole or galvanized steel channel with galvanized fastening devices per the Drawings.
 - 2. Install insulated bushings and insulated throat connectors on ends of all rigid metallic conduits as shown on Drawings.
 - 3. Top of test station head shall be located flush with or a maximum of 1-inch below top of post.
 - 4. Type of support post shall be as specified and may include treated wood post, rectifier pole, galvanized steel channel, metallic pipe, or plastic support pipe with bollard.
- H. Flush mounted test stations and tracer wire access boxes shall be located directly over pipeline, except in areas of heavy traffic conditions. Where heavy traffic conditions exist, locate to the side of the street.
 - 1. Compact under, and install flat support blocking or brick under test station or access box bodies for support. Install supports and concrete collar around flush test station and or access boxes so as to prevent settlement.
 - 2. Install a minimum 6-inch thick concrete collar either in a minimum 2-foot square pad or 3-foot diameter round concrete pad shape around flush mounted test station body as shown on Drawings. Shape as selected by Owner.
 - 3. Rotate flush mounted test station or tracer wire access box square concrete slabs so that slab points toward traffic flow.
 - 4. Concrete collar and test station lid shall be set level and flush with the top of curb, sidewalk or roadway. Concrete collar and test station or tracer

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wire access box lid shall be set level and ½ to 1-inch higher than finished grade in open dirt and lawn areas. Test stations and tracer wire box collars that settle or are set too low or high shall be replaced at Contractor's sole cost.

5. Provide sufficient slack in test wires to allow terminal block to extend a minimum 18-inches out of test station or tracer wire access box body.
 - I. Test wires shall be provided with sufficient slack and looped or coiled at the test station and pipeline to prevent the wire from being unduly stressed or broken during backfilling operations. Install test wires to top test station terminals. Wires shall be installed in a continuous length.
 - J. Where post mounted test station posts are located at the edge of the highway or road right-of-way, the wires shall be run from the pipeline to the test station inside a protective plastic conduit sheath with marking tape above the plastic conduit.
 - K. All cathodic protection and test wires shall be buried a minimum of 36-inches below finished grade.
 - L. Test stations shall be located and identified by test station location tags. Tags shall be stamped with stationing of test station location. Tag shall be permanently attached in a visible location on inside of test station box.
 - M. Wire connections to test station terminals shall be with crimp-on ring tongue terminals, or lug-it connectors, except where terminal strips with tubular clamps are used.
 - N. Connect wires to test station terminals as shown on Drawings. Wire type, color code, and marker tag designations as shown on Drawings and specified under PRODUCTS, this section, shall be maintained throughout project.
 - O. Seal completed wire connection test lead terminals with electrical sealer for all buried flush mounted test stations and at above grade test station locations where high atmospheric corrosion may occur. Clean surface of all dirt, wax, grease and other surface contaminants. Protect or mask other areas from spray application, vigorously shake aerosol can before and during spray application. Apply 2 to 3 mil layer from a 12 to 15-inch distance in light even coats. Allow to dry and close up test station.
 - P. Install a pipe marking location post (reference marker) at each test station location as directed by Engineer (unless test station is already located in a street or next to an abovegrade appurtenance with a barrier or marker post).

3.08 PLASTIC PIPE TRACING WIRE

- A. Insulated stranded copper tracer wire shall be installed on all non-metallic pipe sections.

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- B. Pipe tracing wire shall be taped to top of the plastic or non-metallic pipeline at a maximum distance of every 10 feet with polyethylene tape.
- C. For short section of plastic pipe (if less than 50-feet), where two No. 12 AWG wires are already used to bond the metallic fittings to the metallic main line, the No. 12 AWG bond wires can be utilized in place of the tracer wire for these locations.
- D. Do not attach tracing wire directly to metallic fittings or appurtenances.
- E. Maximum tracer wire span distance shall two thousand feet (2,000') for cross-country type pipelines. If no existing pipe appurtenances are available for a distance up to four thousand feet (4,000'), then install either a post or flush type tracer wire access boxes. Equally divide span distance and install a tracer wire access box or test station at mid-point in a protected location. For in-town transmission or distribution type pipelines, the maximum span distance shall be five hundred feet (500') or less if required by City or Owner standards.
- F. Install tracer wire access boxes and terminate tracer wires at fire hydrant assemblies, each end of all casings, bores, building or tank walls, and each end of a pipe run.
- G. Selection of type and location of tracer wire terminal access box will depend on field conditions and shall be in accordance with Engineer's directions.
- H. Field terminate tracer wires in accordance with the Drawings by:
 - 1. Bring end of tracing wire leg from each pipe direction to above grade surface elevation by installing a tracer wire flush or abovegrade access box or test station. One tracer wire end shall come from each pipe direction.
 - 2. Terminate tracing wire abovegrade at flush or abovegrade test access boxes or test stations located next to pipe appurtenances (vaults, valves, vent pipes, blow-offs, or at fire hydrant bases) as directed by Engineer or Owner.
 - 3. Tracer wire shall be electrically continuous between individual tracer wire access boxes and/or test station locations. Tracer wires shall not be terminated in valve boxes or below grade.
 - 4. Make tee or inline splices and insulate as specified under section "Wire Insulation Repair" only when observed by Engineer.
 - 5. Tracing wire shall be terminated inside test stations where available on a separate terminal from anode or pipe/fitting leads.
 - 6. Terminate in a flush or abovegrade access boxes per test station schedule in accordance with Engineer direction.

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7. Abovegrade terminations next to abovegrade appurtenances shall consist of a minimum 3/4-inch diameter, 3-foot long rigid galvanized steel conduit terminated approximately 6-inch above grade in an abovegrade access box.
 8. Install access boxes in accordance with test station installation procedures and terminate in box with ring tongue terminals.
 9. If tracer wires is in vault, drill vault wall or roof above maximum waterline and terminate outside vault in an access box next to the vault or vent pipe (if present). Seal so as to minimize entry of liquid in the conduit or vault structure. Terminate tracer were in vaults next to ladder to allow easy access for attachment only if approved by Engineer.
- I. Test tracer wire for continuity with an approved method in accordance with the specified functional testing per this section, prior to final acceptance of the pipeline installation.
1. Test tracer wire prior to placement of curb and gutter.
 2. In roads and streets, test tracer wire after placement of road base but prior to placement of pavement.

3.09 WIRE INSULATION REPAIR

- A. Wire splices shall be made with suitably sized Type C compression connectors as specified or mechanically secured and silver soldered. Inline type butt connectors or wire nuts are **NOT** allowed. Split bolts are **NOT** allowed unless silver soldered and both wires are No. 10 AWG wire or smaller.
- B. Minor insulation damage to small cathodic protection wires (equal to or smaller than No. 8 AWG) shall be repaired by spirally wrapping (minimum of 50 percent overlap) with two layers of high voltage rubber splicing tape and two layers of vinyl electrical tape and then coated with an approved electrical seal coat in accordance with the product manufacturer's installation instructions.
- C. Insulation damage or splices to large cathodic protection cables (No. 4 AWG or larger) shall be made with epoxy insulated splice kits (3M Scotchcast 90-B1 or 82-A1 or approved equal). Allow epoxy splice kits to cool and set before moving.
- D. All wire splices and wire insulation repair locations shall be approved by Engineer.

3.10 CONCRETE

- A. Place and finish concrete in accordance with ACI requirements. Maintain concrete at temperatures and cure times within acceptable environmental parameters as required per ACI recommendations. Smooth and finish concrete in a workmanlike manner. Remove forms when concrete has cured adequately.

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3.11 REFERENCE MONITORING DEVICES

- A. Plastic Reference Monitoring Pipe:
 - 1. Place 3-inch-diameter plastic reference monitoring pipe with a threaded pipe cap next to test station for IR drop free potential measurements at locations as shown on Drawings.
 - 2. If plastic reference pipe is utilized at flush mounted test stations do not install threaded pipe cap.
- B. Prepackaged Reference Electrodes:
 - 1. Remove reference electrode and cloth bag from the shipping bag and place 6 inches from the pipe below the centerline of the pipe in a horizontal position, perpendicular to pipe in accordance with manufacturer's directions. Presoak the reference electrode if recommended by the reference electrode manufacturer prior to burial. Do not hold or lower the reference electrode by the wire lead. Prepackaged reference electrode shall be backfilled with clean native soil. Do not allow reference electrode to freeze, place below frost line. Connect reference electrode lead to separate terminal than pipe lead in test station. Do not connect to pipe leads or directly to pipe. Terminate wire leads in test station as shown on Drawings.

3.12 WARNING TAPE

- A. Bury warning tape above all underground cathodic protection cable, conduit, and/or all pipelines. Warning tape shall be placed approximately 12-inches above pipe or at specified depths as required in other sections of this contract document or shown on the details. Align parallel to and within 2 inches of the centerline of conduit, cable, or pipe run.

3.13 PIPELINE REFERENCE MARKER POSTS

- A. Install pipeline reference marker posts at locations listed, as shown on the Drawings, and as marked in the field in accordance with these specifications and the following:
- B. Install pipeline reference marker posts at locations listed, as shown on the Drawings, and as marked in the field. This should consist of but not be limited to specified locations along the length of the pipeline (not exceeding a 1,000 to 1,500 foot maximum spacing) and at all railroad and highway crossings, existing utility crossings, fence lines, air valve manholes, blow off valves, buried vaults, tracer wire access boxes, and cathodic protection test station locations.
- C. Pipeline marker posts shall be driven into the ground with pipeline marker post manufacturer recommended and supplied tools/equipment to a minimum depth of 18-inches.

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- D. Pipeline marker posts shall be installed directly over the pipeline or next to test station, tracer wire access boxes, or valve boxes and appurtenances in a vertical position in accordance with utility post manufacturer's recommendations.
- E. Pipeline markers shall be offset in street locations and as required to not interfere with farming or grass cutting operations as approved by the Engineer. In these locations, offset the pipeline marker post to a protected location, such as a parallel fence line and install a decal with the offset distance to the pipe centerline clearly identified.
- F. Provide one set of marker post manufacturer installation tools/equipment to Owner at end of project.

3.14 COATING FOR METALLIC PIPING, FITTINGS AND ACCESSORIES

- A. Miscellaneous Metallic Pipe, Fitting, and Appurtenance Coating Field Quality Control Testing
 - 1. Conduct quality control testing in the field on miscellaneous factory coated fittings and appurtenance in accordance with this specification. Conduct dry film measurements and holiday test to confirm conformance with specifications and referenced standards.
 - 2. Conduct dry film thickness measurements in accordance with SSPC PA-2 with exception that the specified thickness is the absolute minimum. A minimum of 10 dry film thickness measurements shall be completed on each 40 foot length of pipe. A minimum of two dry film thickness measurements shall be completed for each fitting or appurtenance.
 - 3. Conduct 100-percent holiday inspection of all factory-applied coatings.
 - 4. Repair only with approved repair kits or repair materials provided for repair of the specific coated material types in accordance with coating repair material manufacturers recommendations.
- B. Install coated valves, fittings, and miscellaneous metallic pieces so as to not damage coating or lining.
- C. Provide corrosion protection for ferrous metal piping appurtenances such as tie-rods, thrust restraints, tapping saddles and bands, harnesses, and similar items: Stainless steel, fusion bonded epoxy coated, or heat shrink tube wrapped.
- D. Coat rebar or tie-rods where utilized as tie-downs or thrust restraints and exposed to soil or liquid with fusion bonded epoxy, heat shrink tube, or four layer petrolatum tape system.
- E. Flange bolts, Nuts, and Similar Items: Series 300 stainless steel or fusion bonded epoxy coated.

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- F. Conduct testing of Series 300 stainless steel materials with magnet to confirm stainless steel provided prior to installation.
- G. If approved by Engineer, coat miscellaneous hard to coat items with four layer petrolatum tape system or heat shrink repair coating.

3.15 PIPE AND FITTING COATING REPAIR

- A. Inspect and repair any coating or lining damage with original manufacturer's approved repair kit. Follow coating manufacturer's written directions for surface preparation and repair coating application. Utilize potable water approved materials for coatings and linings in contact with potable water.
- B. Complete surface preparation and field repairs of coatings and linings in accordance with coating manufacturer written directions. Observe environmental (weather and surface temperature) requirements. Allow to cure in strict accordance with coating manufacturers based on surface and weather conditions prior to handling, burial, or exposure to liquids.
- C. External pipe and fitting repair coatings shall consist of external coating materials and repair procedures as recommended by the pipe or fitting coating manufacturer.
 - 1. Fusion-bonded epoxy coated items shall be repaired with liquid epoxy repair kits provided by the fusion-bonded coating manufacturer.
 - 2. Epoxy coated items shall be repaired with repair coating from the original coating manufacturer.
 - 3. Spot coating damage at thermite weld connections not covered by standard thermite weld cap coating repair procedure shall be repaired with a field applied 6-inch minimum piece of tape coating, 6-inch minimum size of heat shrink repair material, or a 100 percent solids epoxy repair coating that can cure in either wet or dry conditions.

3.16 FUNCTIONAL AND PERFORMANCE TESTING

- A. Functional Testing: Provide the Engineer with a minimum of twenty one (21) days' advance notice before beginning functional testing unless the Engineer is already scheduled to or already onsite doing construction observations (services during construction). At such a time as the Engineer may indicate, the Contractor, in the presence of the Engineer shall conduct the following functional testing.
- B. Test Stations:
 - 1. Test each test station wire for continuity, correct termination, and proper connection and color code to the designated structure. Test each wire for continuity with potential measurements to a copper/copper sulfate

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reference electrode and with an ohm-meter between wires prior to connecting together on the terminal board.

2. Test the buried permanent reference electrode test leads and potentials to confirm correct operation. If the reference electrode does not provide equal or near equal potential measurements to a portable copper/copper sulfate reference electrode (convert if required depending on buried reference electrode type), then saturate the buried reference electrode by pouring water down the plastic monitoring pipe. Retest the buried reference electrode again several days later after the buried reference electrode is moist.
3. Do not connect reference electrodes to pipe test lead terminals.

C. Tracer Wires:

1. Demonstrate correct installation of tracer wire access boxes and tracer wire continuity by field functional tests. Acceptable tracer wire continuity testing methods shall consist of electrical continuity (four wire) type testing, demonstrating voltage (potential) changes at end of line from temporary connection to a DC current source at far end of the tracer wire, verification of a voltage measurement to a test battery with the tracer wire as one side of the two wire circuit, and/or use of commercially available cable continuity verification testing equipment utilized in accordance with the test equipment manufacturer's written instructions. Use of typical pipe locating type equipment may walk through tracer wire breaks and is not an acceptable continuity verification test method. Provide test data to Engineer for review and approval prior to acceptance of tracer wires and access boxes.

D. Galvanic Anode Energizing and Testing:

1. Some of the galvanic anodes will be connected to the pipe or the fittings in the anode test stations with calibrated shunts after the installation of the galvanic anode cathodic protection system is completed.
2. Test continuity of each anode lead wires and to confirm correct type of anode with potential measurements prior to connecting to test station terminal board. Zinc anodes should read a minimum of -1.0 volt and high potential magnesium anodes shall read a minimum of -1.6 volt to a copper/copper sulfate reference electrode
3. Do not connect anode and pipe leads together in test stations until Engineer is present.

3.17 FINAL TESTING

A. General:

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1. After construction is complete and all of the individual functional tests have been completed by the Contractor, the Engineer shall conduct final testing on the pipeline to ensure proper installation of the specified corrosion protection items. At Contractor's option, he may be present during this final testing if desired.

- B. Galvanic Anodes Cathodic Protection System: he Engineer shall make sufficient tests throughout the network of galvanic anode cathodic protected metallic pipe and fittings to determine proper installation of the galvanic anode cathodic protection system.

- C. Any construction defects or incomplete work identified by the Engineer during functional or final testing or during warranty inspections shall be located and corrected by the Contractor at his sole expense including additional Engineering, retesting, and inspection time.

- D. Any defects in the corrosion protection system, (including but not limited to coating or lining, pipeline continuity, pipeline electrical isolation, cathodic protection system, test stations, etc.) when discovered shall immediately be repaired and retested in a timely manner (warranty work shall be completed within 60 days of notice) by the Contractor in accordance with this specification and the written product manufacturer's instructions as reviewed and approved by the Engineer. Provide the Engineer with a minimum of 14 days' advance notice before beginning warranty repairs.

END OF SECTION 13901

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**OGLALA SIOUX RURAL WATER SUPPLY SYSTEM PINE RIDGE BYPASS
TEST STATION /TRACER WIRE ACCESS BOX SCHEDULE METALLIC FITTINGS ON PLASTIC PIPELINES**

APPROX. PIPELINE STATION	SHEET NUMBER	TEST STATION OR TRACER WIRE ACCESS BOX TYPE/DETAIL No.		REMARKS
		TEST STATION TYPE	DETAIL No.	
596+50	C-4	P-TW	13947B	Post Tracer Wire Access Box in Protected Location
718+50	C-5	P-TW	13947B	Post Tracer Wire Access Box at CARV in Protected Location
895+95	C-6	P-TW	13947B	Post Tracer Wire Access Box at CARV in Protected Location

NOTES:

1. Install test station and tracer wire access box type at locations as called out on test station schedule unless location or type modified by Engineer based on field locations. Install post mounted type in protected location as first choice for test station and tracer wire access box type, unless flush type test station or tracer wire access box specifically called out on schedule. Offset if required and allowed by Engineer to locate in protected locations. Utilize flush type as second choice if approved by Engineer and no protected location available for post type.
2. Locate adjacent to other above-ground facilities and structures for protection, where possible. Install test stations and tracer wire access boxes in protected locations so as to not restrict intended use of the land, outside roadways, cultivated fields, and irrigation facilities.
3. Provide galvanic anodes and install at specified number, type, size, and spacing directly to metallic pipe and metallic fittings or through test station or junction boxes at locations shown. Connect anodes to metallic pipeline and fittings in test stations and junction boxes with shunt(s) only after Engineer had conducted preliminary (static potential) testing during final corrosion protection system testing.
4. Terminate tracer wires in test stations or tracer wire access boxes. Do not connect tracer wires to same terminals as metallic pipe or fittings and galvanic anode(s).
5. Install pipeline reference markers at test station and tracer wire access box locations.
6. Install post mounted test stations and tracer wire access boxes at height shown.
7. Install plastic monitoring pipe, reference electrodes, coupons, etc.; only at locations noted on test station schedule or plan drawings.
8. Install tracer wire access boxes at end of all pipe runs, all fire hydrants, each end of casings, and next to pipeline appurtenances (such as ARV vaults, blow-offs, valve vaults, fencelines, building and tank walls, etc or other structures for protection.), so that maximum 2,000 foot spacing between test station or tracer wire access boxes are not exceeded. Install and terminate tracer wires in test stations if a test station is already specified for that location. Do not connect tracer wire to belowgrade or abovegrade structures, keep electrically isolated from metallic fittings and metallic piping.
9. Where pipeline and test wire connections are located in paved streets locate flush test stations or tracer wire access boxes to side of street out of traffic flow areas as directed by Engineer. If installed with plastic reference pipe. angle from test station back to pipe location. Terminate plastic reference pipe in bottom of flush test station and within 6-inches of pipeline, do not install cap on plastic reference pipe in flush test station.

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary for furnishing and installing combination air valve pit assemblies.

1.02 SUBMITTALS

- 1. The Contractor shall submit product information for all materials being provided for the project for approval by the Engineer.

PART 2 PRODUCTS

2.01 MANHOLES - AIR RELEASE VALVES

- A. General: Combination air release valve manholes shall be constructed of precast concrete sections with rings, covers, and steps in accordance with the Drawings.
- B. Precast Concrete Sections: Manholes shall conform to ASTM C478, Precast Manhole Sections, including mandatory rejection requirements. Manholes shall have precast, flat tops, with steel reinforcement designed for AASHTO HS-20 Highway Loading. All joints, including top joint, shall be sealed with butyl rubber joint sealant.
- C. Steps: Steps shall be non-corrosive steps, 12-inches wide, consisting of ½-inch steel rod encased with polypropylene. Steps shall withstand vertical loads of 400 pounds and pull-out resistance of 1000 pounds. Steps shall be in accordance with ASTM C478.
- D. Rings and Covers: Concrete manhole rings and covers shall be Neenah R-1755-G, or R-1755-E as shown on the Drawings with Type G locking Device and pentagon bolt locks or equivalent. The inner lid shall be solid aluminum with two handles for easy removal. A 4-inch polystyrene insulation layer shall be bolted to the underside of the inner aluminum lid.

2.02 INSULATION

- A. The exterior of manholes shall be coated with blown on urethane insulation as shown on the drawings. Insulation shall be a minimum of 3-inches thick on top of manholes and 4-inches thick on side of the manholes after curing. Blown on urethane insulation shall be as supplied by Urethane Contractors and Supply, Rosewell, New Mexico, or approved equivalent.
- B. Exercise care while installing manholes, pipe, and exterior piping fittings to avoid damage to the insulation.
- C. Conduct backfill operations around and near the manholes so as not to damage insulation.
- D. Replace any damaged insulation by field repair methods approved by insulation manufacturer.

PART 3 EXECUTION**3.01 MANHOLES**

- A. Excavation: See Section 02220, EARTHWORK FOR STRUCTURES, for excavation and backfill requirements.
- B. Construction: Manholes shall be constructed and installed according to the dimensions, lines, and grades shown on the Drawings. Water main openings shall be cast smooth to form the openings to the size shown. The annulus around the water main and other penetrations shall be grouted with non-shrink cement grout or filled with silicon rubber sealants. An option to cement grout or rubber sealant around water piping penetrations is a PSX press seal manhole boot manufactured by Press Seal Gasket Corporation. Manhole boot shall meet the requirements of ASTM C-923.
- C. Placement: The precast sections shall be carefully placed and set plumb and vertical. The precast concrete top shall be placed with the opening as noted on the Drawings. All joints shall be sealed.

3.02 AIR VALVE PITS

- A. Placement: The air valve pits shall be carefully placed and set plumb and vertical. The connection piping from water main to the pit assembly shall have a constant grade to prevent trapping of air.

3.03 CLEANUP

- A. The backfilled excavation shall be graded smooth and left in a neat condition. Construction debris and materials shall be removed from the site.

END OF SECTION 15005

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The work of this section covers the material specification for all pipe, pipe fittings, and pipe accessories to be utilized, including methods of pipe jointing and general installation guidelines.

1.02 SUBMITTALS

- 1. The Contractor shall submit product information for all materials being provided for the project for approval by the Engineer.

PART 2 PRODUCTS

2.01 GENERAL

- A. The materials to be used for the piping systems shown on the Drawings are listed by service in the Piping Schedule shown at the end of this section.
- B. Specific note is made of the EPA Lead in Drinking Water Act regarding requirements for no lead in brass and bronze fittings.

2.02 PIPE ENDS FOR BURIED PIPING

- A. Push-on joint pipe ends shall be used for PVC pipe buried below ground surfaces unless directed otherwise.

2.03 JOINTS FOR PVC/PE CONNECTIONS

- A. Joints for pipe 3 inches in size and larger shall be made with mechanical joint, 12-inch minimum long ductile iron sleeves with a minimum pressure rating of 350 PSI, joint restraints, PE pipe stiffening insert, and be coated and protected as specified in Section 13901, CORROSION PROTECTION.

2.04 POLYETHYLENE BAGGING

- A. Polyethylene bagging for valve boxes shall be 4-mil cross laminated high density polyethylene manufactured in accordance with the latest edition of ANSI/AWWA C105/A21.5, ASTM D 1248-89.

2.05 CORROSION PROTECTION

- A. As specified in Section 13901 CORROSION PROTECTION PLASTIC PIPE and in PART 3 EXECUTION of this section.

2.06 POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe: PVC shall be fabricated of materials which conform to ASTM D 1784. The different pipe designations shall meet the following requirements:

1. CL160 ASTM Pipe: Class 160 ASTM pressure pipe shall have a maximum SDR of 26 per ASTM D 2241.
 2. CL200 ASTM Pipe: Class 200 ASTM pressure pipe shall have a maximum SDR of 21 per ASTM D 2241.
 3. CL165 C905 Pipe: Class 165 C905 pipe shall have a maximum DR of 25 per AWWA C905.
 4. Schedule 40 Pipe and Fittings: Schedule 40 pipe and fittings shall meet the requirements of ASTM D 1784, ASTM D 1785, and ASTM D 2466.
 5. Schedule 80 Pipe and Fittings: Schedule 80 pipe and fittings shall meet the requirements of ASTM D 1784, ASTM D 1785, and ASTM D 2426.
- B. Joints:
1. A rubber-ring gasketed push-on style bell and spigot joint providing a positive seal against pressure or vacuum shall be provided. Joint and gasket dimensions shall comply with the manufacturers' production standards and those dimensions shall be made available to the Owner on request. The bell sections shall be designed to be at least as hydrostatically strong as the pipe wall. Joints shall meet the requirements of ASTM D 3139. The gaskets shall be reinforced with a steel band conforming to the requirements of ASTM F-477. Gaskets shall be installed, or anchored, in the pipe at the factory.
 2. Pipe ends shall be square cut and beveled for insertion into a bell. The spigot end shall be marked to show the point of correct insertion. Each length shall be marked as to Class, Type, and Grade.
 3. Restrained-joint PVC for use in stream crossings, casing pipe, and pipe slopes greater than 15% grade shall be joined using non-metallic couplings to form an integral system. High-strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360° restraint.
- C. Fittings:
1. Pipe fittings for 8-inch and smaller PVC ASTM CL160 and CL200 pressure pipe shall be of PVC construction with push-on gasketed fittings and a minimum pressure rating of 200 PSI. Fittings shall meet the requirements of ASTM D-1784, ASTM D-3139, and ASTM F-477. Solvent welded fittings are allowable only where specifically shown.
 2. Pipe fittings for all classes of 10-inch and larger pipe, all PVC ASTM CL250 pressure pipe, and AWWA C900 PVC pipe shall be of ductile iron with push-on or mechanical joints where specifically noted and a minimum pressure rating of 350 PSI. Fittings shall meet the requirements of ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 (current revisions).

- a. Ductile iron fittings shall be coated and protected in accordance with Section 13901, CORROSION PROTECTION.

2.07 POLYETHYLENE PIPE

- A. Service Connections and Air Valve Connections: Polyethylene pipe shall be PE 3608 high density polyethylene pipe (HDPE) meeting the requirements of ASTM D 3350 cell classification PE 345464C. HDPE shall be manufactured in accordance with AWWA C901 and be iron pipe size (IPS).
 1. 200 PSI Pipe: PE pressure pipe specified to have a minimum pressure rating of 200 PSI shall have a maximum SDR of 9.
 2. Joints: Polyethylene pipe shall be of continuous construction in rolls of the manufacturer's standard length. Pipe rolls shall be joined with couplings. Pipe ends shall be cut square and joined in accordance with the manufacturer's recommendations.
 3. Fittings: Fittings for connecting to polyethylene pipe shall be pack joint compression type fittings as recommended by the manufacturer.
- B. Stream and Road Crossings: PE pressure pipe installed at stream or road crossings with trenchless construction methods shall be PE 3608/3408 high density polyethylene pipe (HDPE) meeting the requirements of ASTM D 3350 cell classification PE 345464C/345444C. HDPE shall be manufactured in accordance with AWWA C901 for pipe 3-inch and smaller and AWWA C906 for pipe 4-inch and larger. Pipe shall be same size as adjoining pipe (iron pipe size, or ductile iron pipe size).
 1. 200 PSI Pipe: PE pressure pipe specified to have a minimum pressure rating of 200 PSI shall have a maximum SDR of 9.
 2. 160 PSI Pipe: PE pressure pipe specified to have a minimum pressure rating of 160 PSI shall have a maximum SDR of 11.
 3. Joints: Pipe shall be provided in the manufacturer's standard lengths. Lengths shall be joined by heat fusion in accordance with manufacturer's recommendations.
 4. Fittings: Fittings for connecting to polyethylene pipe 2 inch and smaller shall be pack joint compression type fittings as recommended by the manufacturer. Fittings for connecting to polyethylene pipe 3 inch to 12 inch in size shall be made with mechanical joint, 12-inch minimum long ductile iron sleeves with a minimum pressure rating of 350 PSI, joint restraints, PE pipe stiffening insert, and be coated and protected as specified in Section 13901, CORROSION PROTECTION.

2.08 GALVANIZED STEEL (GS) PIPE

- A. Pipe: Carbon steel, galvanized, seamless or electric resistance welded, ASTM A 53, Grade B or ASTM A 106, Grade B, Schedule 40.

- B. Joints: Screwed or flanged as specified on the plans.
- C. Fittings: Screwed, 150-pound malleable iron, galvanized, ASTM A 197 or ASTM A 47, dimensions conforming to ANSI B16.3; unions, 300-pound malleable iron, galvanized, ASTM A 197 or ASTM A 47, dimensions conforming to ANSI B16.3, brass to iron seat.
- D. Branch Connections: Screwed tees or flanged tees, where specified on the plans, as specified under FITTINGS.
- E. Thread Lubricant: Teflon tape or joint compound that is insoluble in water.
- F. Flanges:
1. Forged steel, galvanized, ASTM A 181, Grade 1, slip-on type, faced and drilled 150-pound, 1/16-inch raised face, ANSI B16.5 standard, or AWWA C207, Class D hub type, faced and drilled 125-pound flat face, ANSI B16.1 standard.
 2. The raised face of steel flange shall be machined off when mating with a cast iron flat faced flange.
- G. Bolting:
1. 150-pound RF Flanges Carbon steel, galvanized, ASTM A307, Grade A hex head bolts & ASTM A563, Grade A hex head nuts

125-pound FF AWWA Carbon Steel, galvanized, ASTM A307,
Class D Flanges Grade A hex head bolts & ASTM A563, Grade A hex head nuts
 2. When mating flange on equipment is cast iron and gasket is flat ring type, use ASTM A 307, Grade B, galvanized, square head bolts and ASTM A 563, Grade A, galvanized heavy hex head nuts.
 3. When 1/8-inch undersize bolting material is used for steel insulating flanges, use ASTM A 193, galvanized, Grade B7 alloy stud bolts and ASTM A 194, galvanized, Grade 2H carbon steel heavy hex nuts.
- H. Gaskets for Flanged Joints: One-and-one-half-inch thick Teflon composition flat ring type with 150-pound RF flanges; 1/16-inch thick full face type with 125-pound FF flanges; John-Crane; Garlock; or equivalent.

2.09 JOINT RESTRAINTS

- A. General: Joint restraints shall be provided were called for on the Drawings, where pipe slopes are greater than 15%, on either side of blow off valves, and air release valves as called for on the detail drawings. Restrained - joint PVC, specified hereinafter, may be provided in lieu of joint restraints.

1. Joint restraints shall be coated and protected in accordance with Section 13901, CORROSION PROTECTION
- B. Joint restraints for mechanical joint connections to PVC pipe shall be Series 2000PV or Series 2200 retainer gland as manufactured by EBAA Iron, GripRing pipe restrainer as manufactured by ROMAC Industries, or equivalent.
- C. Joint Restraints for PVC bell and spigot pipe connections shall be Series 6500, 1600, or 2800 retainers as manufactured by EBBA Iron or equivalent.
- D. Joint Restraints for push-on connections to PVC fittings shall be Series 7500 as manufactured by EBBA Iron or equivalent.
- E. Joint Restraints for push-on connections to DI fittings shall be Series 15PF00 as manufactured by EBBA Iron or equivalent.

2.10 PIPE COUPLINGS

- A. General: Flexible couplings and transition couplings shall be provided where shown on the Drawings. Size shall be compatible with the outside diameter of pipe(s) on which the coupling is installed.
 1. Couplings shall be coated and protected in accordance with Section 13901, CORROSION PROTECTION
- B. Flexible Couplings: Flexible couplings for use with PVC pipe shall be Smith-Blair Omni 441, or equivalent. Flexible couplings for steel pipe shall be Dresser Style 38 or Smith-Blair Style 411, or equivalent, with steel bolts.
- C. Transition Couplings: Transition couplings shall be installed to connect pipes with small outside diameter differences such as different pipe types of the same nominal size. Different couplings shall be installed depending on type of pipe.
 1. Where one of the pipes being joined is ASTM CL160 or CL200 PVC pipe, or specifically the 2-inch transition, transition coupling shall be Smith-Blair Omni 441, or equivalent. Gaskets and follower flanges shall be appropriately sized for the type of pipes being joined.
- D. Flanged Coupling Adapters: Flanged coupling adapters shall be Series 912 for ductile iron piping and Series 913 for steel piping, as manufactured by Smith-Blair, Style 127 for ductile iron piping and Style 128 for steel piping, as manufactured by Dresser Industries, Inc., RFCA for PVC as manufactured by Romac Industries, Inc. Series 2100 as manufactured by EBBA Iron or equal. Minimum working pressure shall be 150 psi.

2.11 SERVICE SADDLES AND TAPPING SLEEVES

- A. General: Service saddles shall be installed for air valves and service connections on 4-inch and larger PVC pipelines. Tapping sleeves shall be installed for connections to existing piping. Saddles and sleeves shall be sized for the appropriate pipe and tap size as shown on the Drawings. Saddles and sleeves shall be manufactured

specifically for the type of pipe being tapped (PVC, cast iron, ductile iron, or asbestos – cement).

1. Corrosion protection shall be in accordance with Section 13901, CORROSION PROTECTION.
- B. Saddle for 4-inch and Larger Pipe. Service saddles for 4-inch and larger CL160/CL200 ASTM D2241 PVC pipe shall provide full-circumferential support of the pipe. Service saddles shall be one of stainless steel construction as specified below.
1. Stainless steel saddles shall be of type 304 stainless steel construction. Saddles shall be minimum 5 inches wide for 4-inch and larger pipe. Outlet taps shall be stainless steel with FIPT connections sized as required. Saddles shall have Buna-N rubber gaskets. Nuts and bolts shall be type 304 stainless steel with bolts an integral part of the saddle such that only one nut per bolt is required. A minimum of one bolt for saddles with outlet taps 1 inch and smaller and two bolts for saddles with taps 1-1/2 or 2 inches is required. Saddles shall be Ford Style FS313 for pipe 3 inches and larger in size, or Power Seal Model 3412, Smith-Blair Models 371 and 372 for pipe 4 inches and larger in size, or equivalent.
- C. Tapping Sleeves shall be constructed of stainless steel with stainless steel nuts and bolts. Outlet gasket shall be Buna-N and the sleeve gasket shall be gridded virgin GPR. Outlet shall be standard flange connection. Tapping sleeve shall be a Ford style FAST or approved equivalent sized for the specific size and type of pipe.
- D. Service saddles for pressure gauge assemblies shall be installed in the vaults where shown on the drawings. Service saddles shall be brass alloy conforming to ASTM B-62 and AWWA C800 for standard PVC pipe; shall have a hinge pin body and strap design; and have a tap size of 3/4-inch. Service saddles for these assemblies shall be Ford style S70 with a hinged design or approved equivalent.

2.12 SAMPLE TAP

- A. A single, right angle outlet, smooth nose, brass sample tap shall be affixed to the manual vent ball valve for the sample tap assembly.

2.13 MARKER POSTS

- A. Marker posts shall be one piece, self-locking posts with locking tabs to anchor the post. Posts shall be constructed of ultraviolet light resistant, coextruded polymer material with a round shaft and flat top. Posts shall be blue in color with a decal affixed to the flat top with words "Warning, Water Pipeline". Marker posts shall be Sentry Posts, manufactured by Safe-Hit Corporation, Hayward California; Carsonite Utility Marker posts, manufactured by Carsonite International Corporation; or equivalent.

2.14 PIPE INSULATION

- A. Insulation shall be 2" polystyrene board.

PART 3 EXECUTION**3.01 PIPE PREPARATION AND HANDLING**

- A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed or the pipe or fitting is lowered into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying. A maximum of 1000 feet of pipe may be distributed along the pipe route, on the ground surface, ahead of the trenching and excavation operation.
- B. Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.
- C. Pipe Cutting: Cutting for closure or other reasons shall be done neatly by methods which will not damage pipe. Plastic pipe shall be cut with fine tooth saw, cutter, or knife designed for use with plastic pipe. Burrs shall be removed by smoothing edges with a knife, file or sandpaper. Spigot end shall be beveled.

3.02 INSTALLATION OF BURIED PIPING

- A. Preparation of Trench: Trench Excavation and Backfill and Stabilization shall be in accordance with Section 02221, TRENCH EXCAVATION AND BACKFILL.
- B. Polyvinyl Chloride Pipe:
 - 1. Join pipe in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutions will be permitted under any circumstances.
 - 2. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. Make joint assembly in accordance with the manufacturer's recommendations. Provide all special tools and appliances required for the jointing assembly.
- C. Thrust Blocking: Provide thrust blocking at all bends, tees, reducers and other similar locations. Place thrust block concrete against undisturbed earth. Construct suitable forms to obtain shapes that will provide full bearing surfaces against undisturbed earth, as indicated. Cure thrust blocks before conducting hydrostatic tests. Take care not to over excavate in the areas where thrust blocks are to be placed. The blocking shall be so placed, unless specifically shown otherwise, so that pipe and fitting joints will be accessible for repairs. Thrust blocks shall be sized for hydrostatic test pressure.

- D. Connecting Dissimilar Pipe Materials: Connect dissimilar pipe materials by means of a flexible coupling, specified herein. Install fittings in strict conformance with the manufacturer's recommendations.

3.03 WATER AND SEWER MAIN CROSSINGS

- A. Where water piping crosses over or under existing sewer piping, modifications to the water pipe and/or associated trench backfill shall be made depending on the size and type of sewer main being crossed. For any crossing, regardless of sewer size, water piping shall be installed to provide a minimum of 18 inches of separation between the water pipe and the sewer pipe wherever possible. Water piping shall be installed to provide for a 20-foot length of pipe centered at the sewer pipe crossing.
1. If water piping crosses over or under existing 6-inch and larger gravity pipe or any force main piping, modifications to the associated trench backfill shall be made as detailed hereafter.
 - a. If the water pipe crosses under the existing sewer gravity or force main, the water pipe shall be encased with concrete as described below and shown on the detail drawing.
 - b. If the water pipe crosses over the existing sewer gravity or force main, the existing sewer pipe shall be encased with concrete as described below and shown on the detail drawing.
 - c. Piping shall be encased with lean concrete for 10 feet on both sides of the crossing. Concrete shall have a compressive strength of 1000 PSI, with encasement dimensions of the pipe OD plus 16 inches, centered on the encased pipe. Place a polyethylene layer around the pipe prior to concrete placement.
 2. If water piping crosses over or under existing 4-inch and smaller gravity sewer piping, modifications to the water main piping installation shall be made. Water main shall be encased in casing pipe per applicable portions of Section 02225, BORING AND JACKING. Casing piping shall be a 20-foot length of pipe centered at the sewer pipe crossing. Casing pipe shall not be in contact with any portion of the existing sewer pipe. In no case shall water piping cross perforated sewer pipe (eg. Septic tank drainfield).

3.04 INSTALLATION OF FLEXIBLE COUPLINGS, FLANGED COUPLING ADAPTERS, AND TRANSITION COUPLINGS

- A. Prior to installation, thoroughly clean oil, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. Flexible couplings, flanged coupling adapters, and transition coupling gaskets shall be lubricated with manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides until all bolts have a uniform tightness. Workmen tightening bolts shall use torque-limiting wrenches.

3.05 INSTALLATION OF EXPOSED PIPING

- A. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipes. All bolt holes in flanges shall straddle vertical centerline of pipes.
- B. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.
- C. Where valve handwheels are not shown, valves shall be oriented so that the valve stem is vertical.

3.06 FABRICATION OF FLANGED PIPE

- A. Flanged pipe may be fabricated in the shop or in the field. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer. Flanges shall be faced after fabrication in accordance with ANSI A21.15/AWWA C115. A sufficient number of selected flange-to-pipe threaded joints shall be hydrostatically shop tested to ensure joint integrity.

3.07 CORROSION PROTECTION

- A. General:
 - 1. Protect all pipe and piping accessories from corrosion and adverse environmental conditions. Protection shall include lining and coatings of pipe, material selection, joint bonding and cathodic protection, and/or coatings of supports, tie rods, expansion joints, and all other piping accessories and appurtenances.
 - 2. Not all corrosion protection details are included, either on the Drawings or in the Specifications. The absence of specific details on corrosion and environmental protection measures shall not relieve the Contractor of the responsibility of providing them, all as part of the Contract price.
 - 3. Additional requirements for protection to those specified below in Section 13901, CORROSION PROTECTION.
- B. Buried Pipe Coatings:
 - 1. Steel Pipe: As specified in Section 13901, CORROSION PROTECTION.
 - 2. Ductile Iron Pipe: As specified in Section 13901, CORROSION PROTECTION for tight bonded or tape wrap coating systems.
 - 3. Buried Valves, Fittings, and Similar Elements:
 - a. On Coated Ferrous Metallic Pipelines: Provide and coat in accordance with Section 13901, CORROSION PROTECTION.

- b. On Nonmetallic Pipelines: Coat valves and fittings in accordance with 13901, CORROSION PROTECTION, and as specified elsewhere.
- c. On Cement-Coated Pipelines: Cement-coat appurtenances.
- 4. Piping Accessories:
 - a. Provide corrosion protection for ferrous metal piping appurtenances in accordance Section 13901, CORROSION PROTECTION and as specified elsewhere.
 - b. Tie-rods and similar items: Heat shrink tube wrapped.
 - c. Flange bolts, nuts, and similar items: Fusion bonded coated, or Series 300 stainless steel in accordance with Section 13901, CORROSION PROTECTION.
 - d. Flexible couplings, grooved couplings, and similar items: Heat shrink wrapped or cement-coated, and as shown.
- C. Atmospheric Exposed Pipe Coatings:
 - 1. Paint pipe as specified in Section 13900, CORROSION PROTECTION.
 - 2. Piping Accessories:
 - a. Paint atmospheric exposed surfaces piping components as specified in Section 13901, CORROSION PROTECTION.
 - b. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.
- D. Submerged or Embedded Pipe:
 - 1. Carbon Steel Piping: Coat exterior of submerged or embedded carbon steel piping as specified in Section 13901, CORROSION PROTECTION
 - 2. Ductile Iron and Cast Iron Soil Pipe: Coat as specified in Section 13901, CORROSION PROTECTION
- E. Pipeline Linings:
 - 1. Buried steel piping and all ductile iron piping shall be cement mortar lined as specified in this section. Section 13901, CORROSION PROTECTION, and the Detail Piping Specifications.
 - 2. Exposed or submerged steel pipe shall be epoxy lined per Section 13901, CORROSION PROTECTION General:

3.08 TESTING

- A. General: Conduct pressure and leakage tests concurrently on all newly installed pipelines. Furnish all necessary equipment and material and make all taps in the pipe, as required. The Owner will monitor the tests. Test pressures shall be as specified. New pipelines which are to be connected to existing pipelines shall be tested by isolating the new pipe with grooved end pipe caps, spectacle blinds, or blind flanges, plugs or other fittings as appropriate for the pipe type.
- B. Preparation and Execution: Conduct hydrostatic and leakage tests on piping after the trench has been adequately backfilled. The Contractor may, if field conditions permit, as determined by the Engineer, partially backfill the trench and leave the joints open for inspection and conduct an initial service leak test. The acceptance test shall not, however, be conducted until all backfilling has been completed. Conduct the tests on exposed piping after the piping has been completely installed, including all supports and anchors.
- C. Hydrostatic Leak Test:
1. Water: Water for flushing and testing shall be clean and will be provided to the Contractor from the Water Maintenance and Conservation Department (WM&C) or the local utility company. Coordinate flushing and testing with the WM&C or the local utility company. Contact the WM&C (605-867-1999) or the local utility company for water use rates and payment terms.
 2. Water may be limited or not available for testing, cleaning, and disinfection when needed. The Contractor shall schedule these activities as appropriate to utilize available water without depleting supplies for existing users. Reasonable time extensions will be granted for delays directly attributable to limited or unavailable water, as determined by the Owner.
 3. Procedure: Slowly fill the test section with water to expel air from the pipeline. Temporary vent outlets with valves shall be installed as required for complete venting of the pipeline during filling.
 4. Testing Equipment: The Contractor shall provide all necessary piping connections together with test pumping equipment, water meters, pressure gauges, and other materials, equipment, facilities, and labor required for the tests. Water meters and pressure gauges shall be accurately calibrated and shall be subject to inspection by the Engineer. Test pressures shall be applied by means of a force of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test.
 5. Test Pressures and Limitations:
 - a. Sections shall be tested at 1.5 times the working pressure at the lowest elevation point of the section being tested.
 - b. Test pressure shall be greater than 1.25 times the normal working pressure at the highest point along the test section.

- c. Test pressures shall not exceed pipe, fitting, valves, or thrust block design pressures.
 - d. Test duration shall be at least two hours.
 - e. Pressures shall not vary by more than 5 PSI.
6. Leakage: The pump suction shall be in a barrel or metered so that the amount of water required to maintain the test pressure may be accurately measured. This measurement represents the leakage which is defined as the quantity of water necessary to maintain the specified test pressure for the test duration. The pipeline will not be accepted if the leakage is greater than the allowable leakage defined as follows:

$$L = \frac{SD(P)^{\frac{1}{2}}}{133,200}$$

where: L = Allowable leakage in gallons per hour
 S = Length of pipe tested in feet
 D = Nominal pipe diameter in inches
 P = Average test pressure in PSI

- 7. Leakage Repair: The Contractor shall repair any leakage at his own expense and retest the pipeline until allowable leakage is achieved.

3.09 CLEANING WATER MAINS

- A. Prior to chlorination the service lines shall be flushed thoroughly after the pressure test and leakage test are completed.
- B. It must be understood that such flushing removes only the lighter solids and cannot be relied upon to remove heavy materials allowed to get into the pipe during laying. If heavier materials and debris are observed in the line during construction the Contractor shall also clean pipelines 3 inches in size and larger by pigging with a flexible pig made specifically for this purpose. The flushing velocity in the main shall be not less than 2.5 feet per second. If no blow-off valve is installed at the end of the main, a tap shall be provided to achieve a velocity in the main of at least 2.5 feet per second. The following table shows the rates of flow required to produce a velocity of 2.5 feet per second in pipes of various sizes.

Pipe Diameter (Inches)	Required Flow (GPM)	Minimum No. of Taps/Size
1 ½	14	1 Each 1-inch
3	55	1 Each 1¼-inch
6	220	1 Each 1 3/8-inch
12	880	2 Each 2 1/2-inch
14	1200	2 Each 3-inch

3.10 DISINFECTING WATER MAINS

- A. General. All water main, service pipe and appurtenances installed under this project shall be disinfected in accordance with AWWA C651 prior to being placed in service. The pipelines shall be kept as free as possible of dirt and other foreign matter. Water used for disinfection shall be wasted. Extreme care shall be taken to prevent wastewater from passing into the water system.
- B. Forms of Chlorine. Two different forms of chlorine may be used for water line disinfection: 100 percent liquid chlorine and sodium hypochlorite.
1. Liquid chlorine containing 100 percent available chlorine under pressure in steel containers shall conform to AWWA B301 and shall be used only in combination with appropriate gas-flow chlorinators and ejectors.
 2. Sodium hypochlorite in liquid form containing approximately 5 to 15 percent available chlorine shall conform to AWWA B300.
- C. Methods of Chlorination. Two different chlorination methods may be used: continuous feed method and slug method. Hypochlorite tablets or powder will not be allowed. The Engineer may be consulted for assistance in determining chlorine concentrations for the different methods and forms of chlorine.
1. The continuous feed method requires a chlorine solution of 50 mg/l being fed into the pipe and retained for 24 hours. The residual chlorine concentration at the end of 24 hours shall be 25 mg/l or more, or the process must be repeated.
 2. The slug method requires that a chlorine concentration of 100 mg/l or more be retained for a minimum of three hours.
 3. In situations where new piping, fittings, or appurtenances cannot be disinfected along with other piping, the interior of the item shall be swabbed or sprayed with a 1 percent solution of hypochlorite.
- D. Operate all valves, hydrants, and other appurtenances during disinfection to assure that the disinfection mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the treated water.
- E. Do not place concentrated quantities of commercial disinfectants in the line before it is filled with water.
- F. Final Flushing. After the applicable retention period, the heavily chlorinated water shall be flushed from the pipe until the chlorine concentration is less than 0.7 mg/l or the concentration normally in the system, whichever is higher. Dispose of disinfection water in an approved manner. Do not allow disinfection water to flow into a waterway without adequate dilution or other satisfactory method of reducing chlorine concentrations to a safe level.

- G. Bacteriological Testing. After final flushing, two samples shall be collected at least 24 hours apart and tested for turbidity and bacteriological quality. Testing shall show the absence of coliform bacteria and turbidity less than or equal to 1.0 NTU.
- H. Redisinfection. If the testing fails to meet the bacteriological or turbidity requirements, the piping may be reflushed and resampled for testing. If subsequent testing still shows noncompliance, the piping shall be re-flushed and disinfected until satisfactory results are obtained.
- I. Contractor's Responsibility. The Contractor shall be responsible for all labor, equipment, and materials for flushing, cleaning, testing, and disinfecting the water lines and appurtenances. The Contractor shall also be responsible for sampling as well as bacteriological and turbidity testing.

PIPING SCHEDULE		
Service	Size	Material
Service	1.5"	CL200 ASTM 2241 PVC Pipe
Distribution/Service	3"	CL200 ASTM 2241 PVC Pipe
Distribution/Service	6"	CL160 ASTM 2241 PVC Pipe
Distribution	12"	CL160 and CL200 ASTM PVC Pipe
Distribution	14"	CL165 AWWA C905 PVC Pipe
Stream and Road Crossings - Trenchless Construction	1½" thru 14"	160 PSI and 200 PSI Polyethylene (HDPE) Pipe

3.11 SERVICE INTERRUPTIONS AND SHUT DOWNS

- A. Residents must be informed of service interruptions and shut downs at least 72 hours in advance. Shut downs can be for a maximum period of 16 hours without providing temporary water service. If shut downs last longer than 16 hours Contractor shall provide affected residents with sanitary services including bathing facilities, dining facilities, bottled drinking water, and meet any reasonable needs of those residents until service is restored.

3.12 INSTALLING PIPE INSULATION

- A. Contractor shall excavate to the limits and depths shown in detail drawing 02224. Care shall be taken when backfilling around the insulation to avoid damage or displacement.

3.13 SEQUENCE OF WORK

- A. Sequence of Water Line Replacement Activities: In order to meet the overall objectives of the project, certain elements of work must be completed or substantially completed within the following sequence constraints. The following sequence of construction is meant to be a guideline for the Contractor presenting one method of accomplishing desired results and includes only major items of work. It is the responsibility of the Contractor to review these items and the work to be done, and determine the methods that will be used to accomplish the tasks. The Contractor

shall also submit proposed methods to the Owner and Engineer for review prior to commencing work. The Contractor is still responsible for the methods used to accomplish the project objectives and all safety requirements.

1. Install new water main adjacent to existing main to be replaced. The existing main is to remain active until the entire replacement length is installed and tested.
2. Leak test, flush, and disinfect new water main.
3. Shut down existing water main and cut in new water main using couplers at both tie in points.
4. Cap abandoned main and complete all backfilling and restoration.

END OF SECTION 15060

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary for furnishing and installing the various gate valves, air valves, curb stop valves, and special valves in the distribution system.

1.02 GENERAL

- A. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

1.03 SUBMITTALS

1. The Contractor shall submit product information for all materials being provided for the project for approval by the Engineer.

PART 2 PRODUCTS

2.01 GENERAL

- A. All valves shall be complete with all necessary operating extension stems, valve boxes, worm and gear operators, operating nuts, lever operators, and wrenches which are required for the proper completion of the work included under this section. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.
- B. Valves and operators shall be suitable for the exposure they are subject to: buried, interior, exterior, as applicable. They shall have all safety features required by OSHA. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
- C. Buried service operators on valves larger than 2½-inches shall have a 2-inch AWWA operating nut. Valves shall be installed with valve boxes. All moving parts of valve and operator shall be enclosed in a housing to prevent contact with the soil.
- D. For the purpose of designating the type and grade of valve desired, manufacturers' name is given in the following specifications. Valves of equivalent quality by other manufacturers will be considered in accordance with the General Conditions.

2.02 VALVE BOXES

- A. Valve Boxes: Boxes for gate and butterfly valves shall be cast iron, 5¼-inch diameter, adjustable valve boxes with base as required for the valve size used. Valve boxes shall be of the screw type and of sufficient length for the specified pipe bury. The cast iron cover of the valve box shall be a locking lid type with a pentagon-head bolt. Valve boxes shall be Star Pipe Product, Tyler or equivalent.

1. Valve boxes shall include extension rods with 2-inch operating nut 1'-0" below grade. Extension rods shall be Fab Pipe Model #320, or equivalent.

2.03 GATE VALVES

- A. Gate Valves: Gate valves 3-inches through 10-inches for buried water service shall be iron body, bronze-mounted valves with push-on joints or restrained mechanical joints (M-J), or flanged joints if specifically shown, sized to fit the adjoining pipe, resilient seated gate, nonrising bronze stem, O-ring sealed stuffing box, and 2-inch square wrench nut conforming to AWWA C509. Valves shall be rated 250-PSI minimum, and shall be American Flow Control, Mueller, Kennedy, Waterous, or equal resilient seated gate valves, to fit the specified pipe.
- B. Coatings and corrosion protection systems shall be as specified hereinafter in Part 3 EXECUTION.

2.04 BUTTERFLY VALVES

- A. General
 1. Butterfly valves specified as AWWA C504 shall be in full compliance with AWWA C504 and the following requirements:
 - a. Valves shall be suitable for throttling operations and for very infrequent operation after extended periods of inactivity.
 - b. Elastomer seats that are bonded or vulcanized to the body shall have the adhesive integrity of the bond between seat and body assured by sample testing with a minimum 75-pound pull in accordance with ASTM D429, Method B.
 - c. Inside diameter at seat shall not be less than the inside diameter of the connecting pipe by more than 1 inch.
 - d. Valves shall be bubble-tight with rated pressure applied from either side of the valve disc.
 - e. There shall be no travel stops for the disc on the interior of the body.
 - f. Shaft seals shall be self-adjusting split-V type.
 - g. Thrust bearing surfaces of metal-to-metal shall not be exposed in the flowstream of the valve.
 - h. An affidavit shall be furnished from the manufacturer certifying that the valves are in full compliance with AWWA C504.
 2. Coatings and corrosion protection systems shall be as specified hereinafter in Part 3 EXECUTION.

DIVISION 15 – MECHANICAL

- B. V501: Standard service butterfly valves, 12 inches inclusive, for operating pressures less than 150 psi shall be restrained mechanical joint or flanged end if specifically shown, short body type, AWWA Class 150B equipped with AWWA C504 operating nut for buried applications and totally enclosed geared type manual handwheel operators for exposed applications unless otherwise shown on the Drawings. Valves shall have ASTM A126, Class B cast iron valve body with mechanical joint meeting ANSI/AWWA C111/A21.11 or 125-pound full-faced flanges drilled in accordance with ANSI B16.1. Valve disc shall be contoured ASTM A436, Type 1 Ni-resist cast iron with maximum lead content of 0.003%; ASTM A48, Class 40 cast iron; or ASTM A536, Grade 65-45-12 ductile iron. Valve shaft shall be type 304 stainless steel with self lubricating, corrosion resistant sleeve type bearings. Valve seat shall be attached to the valve body and shall be acrylonitrile-butadiene. Valves shall be Henry Pratt Company Model 2FII, Dezurik AWWA Class 150B, or equivalent.

2.05 CORPORATION STOPS

- A. Corporation Stops - Service Lines
 - 1. Corporation stops for 1½ and 2-inch, PVC or polyethylene (PE) service lines shall have male iron pipe thread by compression-type connections. The corporation stop manufacturer shall provide a certification stating that the corporation stops are rated for 250 PSI water pressure. Corp stops for service lines shall be Ford Ballcorp Corporation Stops, Series FB1102 (PVC pipe) or FB1101 (PE pipe) or equal.

2.06 MISCELLANEOUS VALVES

- A. Ball Valves: Valves for use with air valves, or similar, specified exposed installations shall be bronze ball valves with female iron pipe threads and shall have a minimum pressure rating of 400 PSI. Valves ½-inch - 3-inch shall be Hammond 8901, Watts Series B-6080, or approved equivalent with lever operators.

2.07 AIR VALVES - WATER PIPING

- A. Combination Air Valves: Combination air valves shall be single body, double orifice and shall allow large volumes of air to escape out the large orifice when filling a pipeline and close when liquid enters the valve. During large orifice closure, the small air release orifice shall open to allow small pockets of air to escape automatically and independently of the large orifice. The large orifice shall also allow large volumes of air to enter during pipeline drainage to break the vacuum. The body inlet must be baffled to protect the lower float from direct forces of rushing air and water to prevent premature valve shut-off. The top large orifice plug or float must be protected in similar manner for the same purpose. A Buna-N seat must be fastened to the valve cover, without distortion, for drip tight shut-off. The floats shall be heavy stainless steel, hermetically sealed; designed to withstand 1000 PSI. The top plug or float shall be center guided through hex bushings for positive shut-off. Combination air valves shall be APCO Series 140C, or approved equivalent.

DIVISION 15 – MECHANICAL

- B. Coatings and corrosion protection systems shall be as specified hereinafter in Part 3, EXECUTION.

2.08 6-INCH BLOW OFF HYDRANT

- A. 6-Inch Blow off hydrants shall be fire hydrants conforming to AWWA C502 with a 250 PSI design rating. Hydrant inlet shall be a 6-inch push-on inlet. Hydrant outlets shall consist of one pumper connection and two 2 ½-inch hose connections. Hose nozzle threads shall be in accordance with ASA Specification B26 for National Standard Fire Hose Coupling Screw Threads, 7 ½ threads per inch. Color shall be Tan. Hydrants shall be American Flow Control Waterous Pacer, or approved equivalent.
- B. 6-Inch Blow off hydrant assembly shall include a restrained mechanical joint tee on the water main with a foster adaptor between the tee and 6-inch mechanical joint by push-on auxiliary gate valve. Pipe between the auxiliary gate valve and fire hydrant shall be CL 200 AWWA C900 PVC pipe.

2.09 GEOTEXTILE FABRIC

- A. Geotextile fabric for placement over gravel at the base of hydrants shall be a non-woven fabric such as CONTECH C80NW or approved equivalent.

PART 3 EXECUTION

3.01 GENERAL

- A. Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall be watertight at test pressures before acceptance. The Contractor will be held liable for any damage caused by the testing.
- B. Thoroughly clean threads or screwed joints by wire brushing, swabbing, or other approved methods. Apply joint compound or Teflon tape to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.
- C. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseal or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints. Joints shall be watertight at test pressures before acceptance.

3.02 BURIED VALVES

- A. Gate valves shall be set with the operating nut vertical. A concrete thrust block shall be placed under the valve for support. The valve shall be protected from corrosion as specified in Section 13901, CORROSION PROTECTION. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve.

- B. Curb stop type valves shall be joined to the adjoining pipe with integral compression fittings for PVC pipe or threaded insert fittings for polyethylene pipe. A 4 by 6 by 2-inch concrete block shall be placed under the valve for support. The curb box shall be threaded onto the curb stop and shall be set vertical. The stationary rod shall be secured to the curb stop and installed in the curb box.

3.03 BLOWOFF HYDRANTS

- A. Blowoff hydrants shall be installed plumb with the pumper connection facing away from the water main. Back of hydrant base shall be braced with a concrete block placed against undisturbed earth. Hydrant shall also be set on concrete blocking. Place ½ cubic yard of 3/8-inch pea gravel around hydrant base for drainage. Cover the pea gravel with geotextile fabric. Hydrant shall be wrapped with polyethylene encasement, securely taped to form a tight wrap.
- B. Blowoff hydrants shall be coated and cathodically protected in accordance with Section 13901, CORROSION PROTECTION.

3.04 EXPOSED VALVES

- A. Ball Valves, Butterfly Valves, and Gate Valves. Teflon tape or joint compound shall be applied to the male end of threaded joints. Tape or compound shall be used only on metal pipe or fittings. Gaskets approved by the valve manufacturer shall be installed with flanged valves. Gate valves and butterfly valves shall be installed with the stem plumb and vertical.

3.05 AIR VALVES

- A. Air valves shall be installed as shown on the Drawings in accordance with the manufacturer's recommendations. Teflon tape or joint compound shall be applied to the male end of threaded joints.

3.06 CERTIFICATION

- A. If requested by the Engineer, the valve manufacturer shall furnish an affidavit stating the materials options furnished have complied with these and other referenced specifications.

END OF SECTION 15160

**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION
FOR
CONTRACTOR ADMINISTERED PRECONSTRUCTION MEETING**

APRIL 18, 2013

I. DESCRIPTION

This work consists of the Contractor scheduling and conducting a preconstruction meeting prior to beginning work on this contract. Additionally this work consists of the Contractor providing the Area Engineer a completed list of required submittals.

II. MATERIALS (Not Specified)

III. CONSTRUCTION REQUIREMENTS

For the purposes of this special provision, a business day is any calendar day except Saturdays, holidays, and days designated by the Governor of this State as an administrative leave day for state employees.

The Department will provide the Contractor a list of required submittals and the Authorization Form for Preconstruction Meeting (Form DOT-270) within five (5) business days of the date of the Notice to Proceed.

The Contractor's Required Submittals Form (Form DOT-272) is a document outlining information required prior to the completion of the project. This list will include two types of submittals; 1) information required before scheduling a preconstruction meeting and 2) information required before the Contractor begins related work. The Department reserves the right to request additional information not included in the original list of required submittals. The list of required submittals will include, but is not limited to, proposed sequence changes, shop drawings, permits, certifications, mix designs, labor compliance, equal employment opportunity, and disadvantaged business enterprise documents.

Prior to scheduling the preconstruction meeting, the Contractor will complete and provide the Area Engineer all items on the list of required submittals that are required as described in 1) above. If the Contractor cannot complete and provide a submittal item required prior to scheduling the preconstruction meeting, the Contractor will contact the Area Engineer to establish a mutually agreed upon

date when the required submittal will be completed and provided to the Area office.

The Contractor will not begin work on an item until the Contractor has provided the Area Engineer with all required information for the applicable work item and the appropriate office has approved the information, if necessary. The Contractor will make every reasonable effort to deliver the required submittals at the earliest possible time.

The Contractor's authorized representative as indicated on the Signature Authorization Form (Form DOT-209) will complete, in its entirety, the first page of the Authorization Form for Preconstruction Meeting and will initial each proceeding section. By initialing each section, the Contractor is confirming comprehension of each section.

When the Contractor has provided the Area Engineer all required submittals, unless the Contractor and Department have established an agreement in writing providing future dates of outstanding required submittal items, the Contractor will schedule a preconstruction meeting with the Area Engineer.

Within two (2) business days following the Contractor scheduling the preconstruction meeting, the Area Engineer will prepare and send the Contractor a meeting confirmation and the Preconstruction Meeting Outline (Form DOT-271) of discussion items including specific Department items.

The Contractor will complete the Contractor's portion of the Preconstruction Meeting Outline and will add additional discussion items as needed. The Contractor will send the meeting notice and final Preconstruction Meeting Outline to the Area Engineer, all subcontractors, utility companies, and all suppliers at least five (5) business days prior to the preconstruction meeting.

The Area Engineer will send the notice of the meeting and the final Preconstruction Meeting Outline of discussion items to any other government entities and other principle stakeholders involved in the project at least three (3) business days prior to the preconstruction meeting.

At the discretion of the Area Engineer, the preconstruction meeting may be held in person, videoconference, or over the phone. The Contractor's competent superintendent, as required by Section 5.5, who will be working on this project, is required to attend the preconstruction meeting.

The Contractor will lead the meeting discussion as described in the Preconstruction Meeting Outline. The Area Engineer will prepare the meeting minutes including any unresolved items and distribute them to all attendees and principle stakeholders within five (5) business days following the preconstruction meeting.

IV. METHOD OF MEASUREMENT

The Department will not make a separate measurement for the preconstruction meeting.

V. BASIS OF PAYMENT

The Department will not make a separate payment for the preconstruction meeting. All costs associated with the preconstruction meeting will be incidental to other contract items.

* * * * *

FUEL ADJUSTMENT AFFIDAVIT

Project Number _____
PCN _____
County _____

For project let using the SDEBS) and in accordance with Section 9.12, the bidder is not required to notify the Department at the time of submitting bids whether the Contractor will or will not participate in the fuel cost adjustment program. Prior to execution of the contract, the successful bidder must submit this completed form to the Department for approval. The Fuel Adjustment Affidavit shall include the anticipated fuel cost of subcontractors.

Does your company elect to participate in a fuel adjustment for this contract for the fuels that do not have a fixed price? No adjustments in fuel prices will be made if "No" is checked.

Yes No

If yes, provide the total dollars for each of the applicable fuels. No adjustments in fuel price will be made for the fuel types that are left blank or completed with a \$0.00 value.

Diesel (x) \$ _____

Unleaded (y) \$ _____

Burner Fuel (z) \$ _____ Type of Burner Fuel Used: _____

Sum (x + y + z) = \$ _____

Note: The sum of the x, y, and z may not exceed 15% of the original contract amount.

The following must be completed regardless of whether the Contractor elects to participate in the fuel adjustment affidavit

Under the penalty of law for perjury or falsification, the undersigned, _____,
(Printed Name)
_____ of _____,
(Title) *(Contractor)*

hereby certifies that the documentation is submitted in good faith, that the information provided is accurate and complete to the best of their knowledge and belief, and that the monetary amount identified accurately reflects the cost for fuel, and that they are duly authorized to certify the above documentation on behalf of the company.

I hereby agree that the Department or its authorized representative shall have the right to examine and copy all Contractor records, documents, work sheets, bid sheets, and other data pertinent to the justification of the fuel costs shown above.

Dated _____ Signature _____

Notarization is required only when the Contractor elects to participate in the fuel adjustment affidavit

Subscribed and sworn before me this _____ day of _____, 20____.

Notary Public

My Commission Expires

**STATE OF SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION
TITLE VI AND NONDISCRIMINATION ASSURANCE
JULY 14, 2008**

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

- (1) Compliance with Regulations: The contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended (hereinafter referred to as the "Regulations"), incorporated by reference and made a part of this contract.
- (2) Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, religion, national origin, sex, age or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.
- (3) Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, religion, national original, sex, age or disability.
- (4) Information and Reports: The contractor shall provide all information and reports required by the Regulations, or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the South Dakota Department of Transportation or the Federal Highway Administration to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the South Dakota Department of Transportation, or the Federal Highway Administration as appropriate, and shall set forth what efforts it has made to obtain this information.
- (5) Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the South Dakota Department of Transportation shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including but not limited to:
 - (a) withholding of payments to the contractor under the contract until the contractor complies, and/or
 - (b) cancellation, termination or suspension of the contract, in whole or in part.
- (6) Incorporation of Provisions: The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives pursuant thereto.

The contractor shall take such action with respect to any subcontract or procurement as the South Dakota Department of Transportation or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for non-compliance. Provided, however, that, in the event of a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the South Dakota Department of Transportation to enter into such litigation to protect the interest of the State, and, in addition, the contractor may request the United States to enter such litigation to protect the interests of the United States.

**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION FOR
IMPLEMENTATION OF CLEAN AIR ACT
AND
FEDERAL WATER POLLUTION CONTROL ACT**

SEPTEMBER 1, 1997

By signing this bid, the bidder will be deemed to have stipulated as follows:

- a) That any facility to be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub. L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub. L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR, Part 15), is not listed on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.
- b) That the State Transportation Department shall be promptly notified prior to contract award of the receipt by the bidder of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility to be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

* * * *

**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION REGARDING
MINIMUM WAGE ON FEDERAL-AID PROJECTS**

APRIL 30, 2013

This proposal contains a copy of the most recent United States Department of Labor (USDOL) Davis-Bacon Act Wage Decision.

The Contractor and each related subcontractor will pay their respective employees not less than the USDOL minimum wage for each work classification an employee actually performs at the site of the work.

The Contractor and each related subcontractor must submit weekly, for each week in which any contract work is performed, a copy of a completed certified weekly payroll report to the South Dakota Department of Transportation (SDDOT) Labor Compliance Officer (LCO) within fourteen (14) calendar days of the end of the workweek.

Each certified weekly payroll report must include the most recent [SDDOT Statement of Compliance Form](#). The Department will not accept any payroll report which does not include the most recent [SDDOT Statement of Compliance Form](#).

* * * * *

**Wage and Hour Division
U.S. Department of Labor (DOL)
200 Constitution Avenue, N.W.
Washington, DC 20210**

Davis-Bacon Act Wage Decisions
State: South Dakota
Construction Types: Heavy and Highway
Counties: South Dakota Statewide

Agency: U.S. DOL
Wage Decision Number: **SD150001** SD1
Counties: SD Statewide
Wage Decision Date: **10/09/2015**

***SUSD2015-001 08-13-2015**

LABORERS

GROUP GL1

Air Tool Operator; Common Laborer; Landscape Worker; Flagger; Pilot Car Driver;
Trucks under 26,000 GVW; Blue-top Checker; Materials Checker

GROUP GL2

Mechanic Tender (Helper); Pipe Layer (except culvert); Form Builder Tender;
Special Surface Finish Applicator; Striping

GROUP GL3

Asphalt Plant Tender; Pile Driver Leadsman; Form Setter; Oiler/Greaser

GROUP GL5

Carpenter; Form Builder

GROUP GL6

Concrete Finisher; Painter; Grade Checker

POWER EQUIPMENT OPERATORS

GROUP G01

Concrete Paving Cure Machine; Concrete Paving Joint Sealer; Conveyor; Tractor (farm type with
attachments); Self Propelled Broom; Concrete Routing Machine; Paver Feeder; Pugmill; Skid Steer

GROUP G02

Bull Dozer 80 HP or less; Front End Loader 1.25 CY or less; Self Propelled Roller (except Hot Mix);
Sheepsfoot/50Ton Pneumatic Roller; Pneumatic Tired Tractor or Crawler (includes Water Wagon and
Power Spray units); Wagon Drill; Air Trac; Truck Type Auger; Concrete Paving Saw

GROUP G03

Asphalt Distributor; Bull Dozer over 80 HP; Concrete Paving Finishing Machine; Backhoes/ Excavators
20 tons or less; Crusher (may include internal screening plant); Front End Loader over 1.25 CY;
Rough Motor Grader; Self Propelled Hot Mix Roller; Push Tractor; Euclid or Dumpster; Material Spreader;
Rumble Strip Machine

GROUP G04

Asphalt Paving Machine Screed; Asphalt Paving Machine; Cranes/Derricks/Draglines/Pile Drivers/Shovels
30 to 50 tons; Backhoes/Excavators 21 to 40 tons; Maintenance Mechanic; Scrapers; Concrete Pump Truck

GROUP G05

Asphalt Plant; Concrete Batch Plant; Backhoes/Excavators over 40 Tons; Cranes/ Derricks/Draglines/Pile
Drivers/Shovels over 50 tons; Heavy Duty Mechanic; Finish Motor Grader; Automatic Fine Grader;
Milling Machine; Bridge Welder

TRUCK DRIVERS

GROUP GT1

Tandem Truck without trailer or pup; Single Axle Truck over 26,000 GVW with Trailer

GROUP GT2

Semi-Tractor and Trailer; Tandem Truck with Pup

ELECTRICIANS

GROUP E01

Electrician

<u>Rates</u>	<u>Fringes</u>
15.74	0.00
17.51	0.00
18.95	0.00
22.77	0.00
21.41	0.00
16.85	0.00
18.13	0.00
19.89	0.00
20.30	0.00
22.75	0.00
16.57	0.00
18.82	0.00
22.79	0.00

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

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award, pursuant to 29 CFR 5.5(a)(1)(ii); contractors are responsible for requesting SDDOT to secure necessary additional work classifications and rates.

*Classifications listed under an "SU" identifier were derived from survey data and the published rate is the weighted average rate of all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates.

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

A COPY OF THIS DOCUMENT, COLORED TURQUOISE, MUST BE CONSPICUOUSLY POSTED AT THE PROJECT SITE

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

**Davis-Bacon Act Wage Decisions
State: South Dakota
Construction Types: Heavy and Highway
Counties: South Dakota Statewide**

=====

In the listing above, the "SU" identifier indicates the rates were derived from survey data. As these weighted average rates include all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of the survey on which these classifications and rates are based. The next number, 007 in this example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates.

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

For SDDOT Defined Work Classifications, please visit: <http://www.sddot.com/business/contractors/labor/wcwr/Default.aspx>

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

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

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

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

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

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

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

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

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END OF GENERAL DECISION

**STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION
FOR
PRICE SCHEDULE FOR MISCELLANEOUS ITEMS**

OCTOBER 14, 2015

The following unit bid prices have been established by the South Dakota Department of Transportation Commission.

These prices will be pre-entered in the bidding package for each project or will establish a standard price to be used whenever no project contract unit price exists for that item.

Each unit price listed is considered full compensation for the cost of labor, material, and equipment to provide the item of work and/or material, complete in place, including (but not limited to) royalty, waste of unsuitable materials, equipment rental, overhead, profit, and incidentals.

Items specified in this document may be paid for on progressive estimates without the benefit of a prior approved Construction Change Order.

Specification Section Number	Specification Section Name	Item Name	Price per Item
5.8	Construction Stakes, Lines and Grades	Three-Man Survey Crew	\$160.00/hour
7.7	Public Convenience and Safety	Water	\$15.00/M.Gal
9.3	Payment for extra haul of Materials	Extra Haul	\$0.15/ton mile
120.5 A.5.	Roadway and Drainage Exc. & Emb.	Unclassified Excavation Digouts	\$8.00/cu.yd.
120.5 H.	Roadway and Drainage Exc. & Emb.	Extra Haul	\$0.05/cu.yd. station
120.5 I.	Roadway and Drainage Exc. & Emb.	Water for Embankment	\$15.00/M.Gal
421.5	Undercutting Pipe & Plate Pipe	Undercutting Culverts	\$12.00/cu.yd.
510.5 D.	Timber, Prestressed, and Steel Piles	Timber Pile Splice	\$550.00/each

		Steel Pile Splices (*All Weights)	Splice made after one of the pieces has been driven.
		8 HP*	\$220.00/each
		10 HP*	\$300.00/each
		12 HP*	\$360.00/each
		14 HP*	\$420.00/each
			Splice made before either of the pieces has been driven.
		8 HP*	\$105.00/each
		10 HP*	\$125.00/each
		12 HP*	\$140.00/each
		14 HP*	\$160.00/each
510.5 E	Timber, Prestressed, and Steel Piles	Pile Shoes (Timber Pile)	\$110.00/each
510.5.H	Timber, Prestressed, and Steel Piles	Pile Tip Reinforcement (Steel Pile)	
		10" HP Tip Reinforced	\$120.00/each
		12" HP Tip Reinforced	\$140.00/each
		14" HP Tip Reinforced	\$170.00/each
601.5	Haul Roads	Granular Material	\$12.00/ton
601.5	Haul Roads	Asphalt Concrete (including asphalt)	\$80.00/ton
601.5	Haul Roads	Cover Aggregate	\$25.00/ton
601.5	Haul Roads	Asphalt for Prime	\$700.00/ton
601.5	Haul Roads	Asphalt (Tack, Flush & Surface Treatment)	\$450.00/ton
601.5	Haul Roads	Water	\$15.00/M.Gal
601.5	Haul Roads	Dust Control Chlorides	\$0.35/lb
634.5	Temporary Traffic Control	Flagging	\$24.19/hour
634.5	Temporary Traffic Control	Pilot Car	\$38.35/hour

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