CITY OF RAPID CITY
RAPID CITY, SOUTH DAKOTA

2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

INFORMAL QUOTE OPENING DATE & TIME
SEPTEMBER 2, 2021
2:00 P.M.

CITY OF RAPID CITY
PROJECT MANAGER
MIKE WILKENING - DESIGN
ROGER HALL, PE - CONSTRUCTION

APPROVED AS TO FORM
CITY ATTORNEY'S OFFICE

Attorney 9/3/21
<table>
<thead>
<tr>
<th>Section Title</th>
<th>Section No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notice for Informal Quote</td>
<td>1</td>
</tr>
<tr>
<td>Information and Instructions</td>
<td>2</td>
</tr>
<tr>
<td>Certificate of Liability Insurance</td>
<td>3</td>
</tr>
<tr>
<td>Contractors Proposal</td>
<td>4</td>
</tr>
<tr>
<td>Contract Document</td>
<td>5</td>
</tr>
<tr>
<td>Water Piping Systems</td>
<td>8A</td>
</tr>
<tr>
<td>Corrosion Protection – Plastic Pipe Systems</td>
<td>8B</td>
</tr>
<tr>
<td>Plan Sheets</td>
<td>Attached</td>
</tr>
</tbody>
</table>
SECTION 1
NOTICE FOR INFORMAL QUOTE FOR THE FOLLOWING ITEMS

Notice is hereby given that quotes for furnishing materials, equipment, labor, and performing all the work for the construction of

2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

in accordance with the specifications prepared by the Engineering Services, will be received by Engineering Services, Rapid City, South Dakota, until 2:00 P.M., September 2, 2021. Quotes shall be filed at the City of Rapid City Public Works Engineering Services, 300 Sixth Street, Rapid City, South Dakota 57701.

The quote envelope shall contain only one (1) Quote and shall be marked with the words:

“Informal Quote: 2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
Project No. 21-2678 / CIP No 50808.”

Plans and specifications are on file and may be obtained at the Public Works, Engineering Services office, 300 6th Street, Rapid City, South Dakota, upon payment of Zero and No/100 Dollars (-$0.00-) for each set. Plan and specifications may also be obtained through the website https://www.publicpurchase.com.

Payment for the work will be made to the Contractor, by check, within a reasonable time after the completion of the contracted work, receipt of a signed voucher, and approval by the Council.

The City reserves the right to reject any or all quotes, to waive all informalities, and to accept the quote that is to the advantage of and is in the best interest of the City of Rapid City.
SECTION 2
INFORMATION AND INSTRUCTIONS

2.1 QUOTE REQUIREMENTS

All proposals must be made on the forms provided in the bound copy of the Specifications and Contract Stipulations hereto attached. All proposals must be legibly written in ink, with all prices given in words and figures. The written words shall govern. No alterations in proposals or in the printed forms will be permitted by erasures or interlineation. Each quote, in its bound form as furnished by the City, shall be, addressed to the project manager, Rapid City, South Dakota, and endorsed on the outside with the contractors name and with the words:

Informal Quote 2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
Project No. 21-2678 / CIP No. 50808

and filed at the City of Rapid City Engineering Services Division office prior to the hour set for opening of the quotes. Proposals carrying riders for qualifications of the quote submitted may be rejected. The proposals shall be based on the Contractor furnishing all of the necessary labor, tools, materials, and equipment to fully construct the work in accordance with the detailed plans and specifications covering the work.

The Contractor may attach a substitute Proposal generated by computer in lieu of completing the bound Proposal in ink. All of the provisions of this section must be fully complied with, with the exception that the unit bid prices on a computer-printed substitute Proposal need not be written in words. If a substitute Proposal is used, it shall be attached to the back side of the last page of the bound Proposal. The format of a substitute Proposal shall be similar to the bound Proposal.

2.2 ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications, or other quote documents will be made to any contractor orally. Every request for such interpretation shall be in writing and addressed to Mike Wilkening, at mike.wilkening@rcgov.org or by mail at 300 Sixth Street, Rapid City, South Dakota, 57701, and must be received at least two (2) working days prior to the date fixed for the opening of quotes in order for the City Project Manager to give it appropriate consideration. The preferred communication method is by email. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be made to all prospective contractors by electronic mail to an email address if furnished by the prospective contractor. All addenda so issued shall become part of the contract documents. Acknowledge receipt of addendum(s) in Section 4.

2.3 TIME OF COMPLETION

The time of completion of the work is of vital importance, and the Contractor will be required to complete the work within the time stipulated in the Quote. It will be necessary for the Contractor to satisfy the Owner of his ability to execute the work within the stipulated time.
2.4 **MODIFICATION OF QUOTES**

No modification of quotes can be made once the contract is signed.

2.5 **QUALIFICATIONS OF CONTRACTOR**

To demonstrate that the Contractor has the financial responsibility, experience, capacity, ability, and integrity to perform the work in accordance with the contract documents, each Contractor must be prepared to submit, within five (5) days of Owner’s request, written evidence of data as may be requested by the Owner. The following elements will be considered to determine the selected quote:

Whether the Contractor involved:

- maintains a permanent place of business;
- has adequate plant and equipment to do the work properly and expeditiously;
- has suitable financial status to meet obligations incidental to the work;
- has appropriate technical experience in the areas required by the work; and/or
- has been declared non-responsive by Council action.

No quote will be acceptable if Contractor is engaged in any other work which impairs his ability to meet all requirements herein stipulated.

2.6 **REJECTION OF QUOTES**

The Owner reserves the right to reject any or all quotes.

2.7 **CONTRACT AWARD**

Award of the contract will be to the quote determined to be in the best interests of the City. Owner reserves the right to reject any and all quotes, to waive any and all informalities, and to disregard all non-conforming, non-responsive, or conditional quotes.

In the case of an error in extension of a unit price to an item total, the unit price in written words shall govern, and the corrected item total used in evaluating quotes. In case of an error in summation of quote item totals for a total quote, the corrected summation will govern over the incorrect quote total shown. When the quote includes discrepancies or apparent errors in bid amounts, City may resolve the discrepancy or error in the way the City determines to be most reasonable and/or the most beneficial to the City.

In quote evaluation, Owner shall consider the qualifications of the contractors, whether or not the quotes comply with the prescribed requirements, and alternates and unit prices if requested in the quote forms. It is the Owner’s intent to accept alternates (if any are accepted) in the order in which they are listed in the quote forms, but the Owner may accept them in any order or combination.

Owner may consider the qualifications and experience of subcontractors and other persons and organizations (including those who are to furnish the principal items of material or equipment)
proposed for those portions of the work as to which the identity of subcontractors and other persons and organizations must be submitted as provided herein. Operating costs, maintenance considerations, performance data, and guarantees of materials and equipment may also be considered by Owner.

Owner may conduct such investigations as he deems necessary to assist in the evaluation of any quote and to establish the responsibility, qualifications, financial ability, and technical expertise of the contractor, proposed subcontractors, and other persons and organizations to do the work in accordance with the contract documents to Owner’s satisfaction within the prescribed time.

Owner reserves the right to reject the quote of any contractor who does not pass any such evaluation to the Owner's satisfaction.

If the contract is to be awarded, it will be awarded to the contractor whose evaluation by Owner indicates to Owner that the award will be in the best interests of the Owner.

If the contract is to be awarded, Owner will give the successful contractor a Notice of Award within thirty (30) days after the day of the quote opening.

The Owner reserves the right to cancel the award of any contract at any time before the complete execution of said contract by all parties without any liability against the Owner.

No contract or other contract documents shall be executed until the proposal and qualifications of contractor have been examined, the Contractor has provided his South Dakota Sales & Use Tax License Number and South Dakota Contractor's Excise Tax License Number and the award of the Contract is authorized by the Owner. No such document shall be effective until it has been approved by the Owner as to final execution.

2.8 CONTRACT SPECIFICATIONS

Specifications to be followed under this contract are the City of Rapid City Standard Specifications for Public Works Construction (2007 Edition), as currently revised, and any Special Provisions, Special Conditions, and/or Detailed Specifications pertaining to this contract.

2.9 EXAMINATION OF PROJECT SITE

The Contractor shall be responsible for examination of the site of the project. This includes the soil and water conditions to be encountered, improvements and private property to be protected, disposal sites for surplus material other than sites designated, and as to methods of ingress and egress to private properties and methods of handling traffic during construction of the entire project.

2.10 INSURANCE INFORMATION

Without limiting any of the other obligations or liabilities of the Contractor and until the work is completed and accepted by the Owner, the Contractor shall provide and maintain minimum insurance coverages in accordance with requirements as shown in Section 3 – Insurance Requirements.
The Contractor’s insurance carrier or agent shall complete and deliver two (2) copies of the required insurance documents to the City in sufficient time to allow for review and approval by the City Attorney prior to the actual start of work by the Contractor. The City of Rapid City shall be listed as an additional insured and shall be given thirty (30) days written notice of cancellation or change to the policy. If work is to extend beyond the expiration date of coverages, the Contractor shall submit renewal forms for approval by the City Attorney.

2.11 BASIS OF PAYMENT

Method of payment for the work will be as outlined in Sections 2.12, 2.13 and 2.14. Method of payment under this contract will be as checked below:

(a) Partial Payments Project
(b) Single Payment Project

For partial payments projects, this statement modifies Section 7.59 of the Standard Specifications for Public Works Construction to allow payments as often as twice per month at the Contractor’s option. Contractor shall notify the City of its election regarding payment frequency at the Pre-construction Conference. If the Contractor does not notify the City of its election, the Contractor shall be paid no more often than once per month.

2.12 PAYMENT FOR MATERIALS ON SITE

Consideration of partial or full payments of materials on site under this contract will be as indicated and checked below:

(a) Yes – Payments will be considered
(b) No – Payments will not be considered

No payment on stockpiled materials as specified herein shall be made on fuel, hardware (bolts, plates, etc.), supplies, form lumber, false work, perishable materials, or on temporary structures of any kind which will not become an integral part of the finished construction nor on items when unit prices are obviously unbalanced as compared to the Engineer’s estimated unit prices prepared prior to the letting.

No payment shall be made on stockpiled material until it has been tested and approved for use.

All material for which an allowance is requested shall be stored in an approved manner in areas where damage from floodwaters is not likely to occur. If, at any time, stored materials are lost or become damaged by floods or in any other manner, the Contractor will be responsible for repair and replacement of such damaged materials. If payment has been made prior to such damage, the amount so allowed, or a proportionate part thereof, shall be deducted from the next partial payment and withheld until satisfactory repairs or replacements have been made.

Progress payments for stockpiled materials will be made on the basis of the quantities determined by actual measurement as placed in storage in accordance with the stipulations in these specifications and percentages of Contract unit prices listed.
2.13 USE TAX LIABILITY

The Contractor shall be liable to pay the use tax on tangible personal property that is supplied by the City to the Contractor for performance of the Contractor. The value of said personal property is estimated to be $0.00, which value shall be used for determining the Contractor’s liability for tax. The Contractor shall be liable to pay all Federal, State, County, or local taxes required for labor and/or materials included in this Contract.

2.14 EXCISE TAX LIABILITY

The Contractor or Subcontractors shall be liable for payment of any state excise tax required for realty improvements under SDCL 10-46A. Pursuant to SDCL 5-18B-17 the City of Rapid City may not award a contract for the construction of a public improvement unless the City of Rapid City has verified that the Contractor has a South Dakota Contractor’s Excise Tax License pursuant to SDCL Chapter 10-46A or 10-46B.

2.15 NON-DISCRIMINATION IN EMPLOYMENT

Contracts for work described in these Quote Documents obligate the Contractor and Subcontractors to be non-discriminatory in their employment practices.

2.16 CITY OF RAPID CITY NONDISCRIMINATION POLICY STATEMENT

In compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the rehabilitation act of 1973, the age discrimination act of 1975, the Americans with disabilities act of 1990, and other nondiscrimination authorities it is the policy of

City of Rapid City
300 Sixth Street
Rapid City, SD 57701-5035

...to provide benefits, services, and employment to all persons without regard to race, color, national origin, sex, disabilities/handicaps, age, or income status. No distinction is made among any persons in eligibility for the reception of benefits and services provided by or through the auspices of the City of Rapid City.

If you have any concerns regarding the provisions of services or employment on the basis of disability/handicap you may contact our ADA/Section 504 coordinator at telephone no. (605) 394-4136.

2.17 FEES, PERMITS AND TAXES

The Contractor shall obtain all applicable permits associated with the project. Building Permit Fees, Erosion and Sediment Control Permit Fees, Air Quality Permit Fees, and Inspection and Permit Fees (as covered under Section 13.04.100 for excavations, driveways and patching etc.) shall be borne by the owner. All other fees, taxes and costs shall be borne by the Contractor.
**Certificate of Liability Insurance**

**This Certificate is Issued as a Matter of Information Only and Confers No Rights Upon the Certificate Holder. This Certificate Does Not Affirmatively or Negatively Amend, Extend or Alter the Coverage Afforded by the Policies Below. This Certificate of Insurance Does Not Constitute a Contract Between the Issuing Insurer(s), Authorized Representative or Producer, and the Certificate Holder.**

**Important:** If the certificate holder is an Additional Insured, the policy(ies) must have Additional Insured provisions or be endorsed. If Subrogation is waived, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

**Producer:** Black Hills Insurance Agency, Inc.
820 St. Joseph
PO Box 3330
Rapid City, SD 57709

**Contact:** Miranda Conklin
(605) 342-5555
mirandaconklin@blackhillsagency.com

**Insured:**
Prime Excavation, LLC
5155 Haines Ave
Rapid City, SD 57701

**Insurer(s) Affording Coverage:**
- **Insurer A:** Western National Insurance Group
- **Insurer B:** Technology Insurance Company, Inc.

**Certificate Number:** CL214290837

**Date (MM/DD/YYYY):** 09/07/2021

**Coverages**

<table>
<thead>
<tr>
<th>INSURER</th>
<th>CERTIFICATE NUMBER</th>
<th>CERTIFICATEHOLDER</th>
<th>COVERAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CPP 126478400</td>
<td>Y</td>
<td>XCU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GENL AGGREGATE LIMIT APPLIES PER:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POLICY:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OTHER:</td>
</tr>
<tr>
<td>AUTOMOBILE LIABILITY</td>
<td>CPP 126436500</td>
<td>Y</td>
<td>XCU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GENL AGGREGATE LIMIT APPLIES PER:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POLICY:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OTHER:</td>
</tr>
<tr>
<td>EXCESS LIAB</td>
<td>OCCUR</td>
<td>N/A</td>
<td>CLAIMS-MADE</td>
</tr>
<tr>
<td></td>
<td>DED</td>
<td>RETENTION $</td>
<td></td>
</tr>
<tr>
<td>WORKERS COMPENSATION</td>
<td>N/A</td>
<td>Y/N</td>
<td>Y</td>
</tr>
<tr>
<td>ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)</td>
<td>N/A</td>
<td>Y/N</td>
<td>Y</td>
</tr>
<tr>
<td>DESCRIPTION OF OPERATIONS below</td>
<td>N/A</td>
<td>Y/N</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Description of Operations / Locations / Vehicles (ACORD 101, Additional Remarks Schedule, may be attached if more space is required):**

Project No. 21-2678/CIP No 50808, Hall Street Water Main Abandonment and Fire Hydrant Installation. Certificate holder is named as an additional insured as required by written contract. 30 day notice of cancellation applies.

**Certificate Holder**

CITY OF RAPID CITY
300 SIXTH STREET

**CANCELLATION**

Should any of the above described policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the policy provisions.

**Authorized Representative**

[Signature]

© 1988-2015 ACORD CORPORATION. All rights reserved.
SECTION 4
CONTRACTOR’S PROPOSAL
FOR
FURNISHING LABOR AND MATERIALS
FOR THE CONSTRUCTION OF

2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

PLACE: Public Works – Engineering Services in City Hall
Rapid City, South Dakota

DATE & TIME: September 2, 2021 at 2:00 P.M.

TO: Public Works Director
Rapid City, South Dakota

In compliance with your invitation for quotes to furnish all necessary labor, tools, materials, and equipment to construct complete in all detail,

2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

complete and ready for use as shown on the detailed plans and specifications as prepared by the Engineering Services, Rapid City, South Dakota, the undersigned Contractor:

(1) A Corporation organized and existing under the laws of the State of ______________________.

(2) A Partnership consisting of Jason Brewer, Stanley Petrik, Tyson Petrik

(3) An Individual trading as ________________________________

Of the City of ____________________________, State of ______________________.

Having examined the detailed plans and specifications, and being fully advised of the materials to be furnished and the work to be done in the construction of said

2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

does hereby propose to furnish all necessary labor, tools, materials, and equipment and do all the work as specified to fully complete said work as shown by said plans and specifications, and as shown in said Contractor’s Proposal.
The within Contractor's Proposal is based upon conditions and stipulations within the Contract Documents and shall be considered a part of this Contract as if written herein at length.

All work shall be completed in accordance with the completion date set forth in the Special Bid Conditions and Explanation of Quote Schedule Documents on Page 4.3. Liquidated damages, as specified in the Standard Specifications, will be charged for failure to complete the project on or before the completion date.

The contract award will be based on the quote price arrived at in accordance with the Bid Schedule set forth and Section 2.7.

The said Contractor further agrees and states that he has studied the Informal Quote Package, is familiar with the terms and conditions stipulated therein, agrees to enter into the attached Contract, and acknowledges the receipt of the following Addenda:

Addenda No. Dated


Name of Company
(Party of the Second Part)

Authorized Representative
(Please Print)

Authorized Signature Date

Partner

Title

Address 5155 Haines Ave
Rapid City, SD 57701

Phone No. 605-209-0897

FAX No.

E-Mail primeexcavation11c@gmail.com

SD Sales & Use Tax License No. 1037-2903-ET

SD Contractor's Excise Tax License No. 910-3394-855
1. Section 7.38 of the General Conditions of the City of Rapid City Standard Specifications for Public Works Construction is hereby deleted from the contract. Contractor may not demand arbitration or otherwise claim any rights or privileges discussed in Section 7.38 of the General Conditions.

2. All work shall be complete by OCTOBER 29, 2021. The contractor will have 15 working days complete ALL WORK once notice to proceed is issued. The watering of sod will not be included in the 15 working days. Liquidated damages, as specified in the Rapid City Standard Specifications, will be charged for failure to complete the project on or before the completion date.

3. Quotes shall include sales tax and all other applicable taxes and fees.

4. Quotes over $100,000 will not be considered.

5. Quote quantities for unit price contract items are approximate, and are being used to canvass quotes only. Payment will be made for actual work completed in accordance with payment conditions explained in the specifications.

6. In the case of an error in extension of a unit price to an item total, the unit price in written words shall govern, and the corrected item total used in evaluating quotes. In case of an error in summation of quote item totals for a total quote, the corrected summation will govern over the incorrect quote total shown.

7. Weather days shall not be considered for completion date extensions.

8. Quote award on the basis of the total quote for the Base.

9. Section 5 contains the standard agreement which must be signed upon project award.

10. 2-year warranty shall be per Section 7 of Standard Specifications, but a warranty bond will not be required.
<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT</th>
<th>QTY</th>
<th>UNIT PRICE IN WORDS</th>
<th>UNIT COST</th>
<th>EXTENDED COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MOBILIZATION</td>
<td>LS</td>
<td>1</td>
<td>Eight thousand dollars</td>
<td>8000.00</td>
<td>8000.00</td>
</tr>
<tr>
<td>2</td>
<td>INCIDENTAL WORK</td>
<td>LS</td>
<td>1</td>
<td>Twelve thousand four hundred fifty dollars</td>
<td>12450.00</td>
<td>12450.00</td>
</tr>
<tr>
<td>3</td>
<td>AASHTO T-180 SOIL TEST</td>
<td>EA</td>
<td>1</td>
<td>Four hundred fifty dollars</td>
<td>450.00</td>
<td>450.00</td>
</tr>
<tr>
<td>4</td>
<td>EXCAVATION, EXPLORATORY</td>
<td>HR</td>
<td>6</td>
<td>Five hundred dollars</td>
<td>500.00</td>
<td>3000.00</td>
</tr>
<tr>
<td>5</td>
<td>SODDING</td>
<td>SY</td>
<td>85</td>
<td>Twenty eight dollars and twenty eight cents</td>
<td>28.78</td>
<td>2403.80</td>
</tr>
<tr>
<td>6</td>
<td>6&quot; PVC WATER MAIN C-900, DR 18</td>
<td>LF</td>
<td>13</td>
<td>One hundred fifty dollars</td>
<td>150.00</td>
<td>1950.00</td>
</tr>
<tr>
<td>7</td>
<td>6&quot; 45 DEGREE BEND</td>
<td>EA</td>
<td>2</td>
<td>One thousand thirty one dollars and twenty five cents</td>
<td>1031.25</td>
<td>2062.50</td>
</tr>
<tr>
<td>8</td>
<td>8&quot; X 6&quot; REDUCER</td>
<td>EA</td>
<td>1</td>
<td>One thousand thirty one dollars and twenty five cents</td>
<td>1031.25</td>
<td>1031.25</td>
</tr>
<tr>
<td>9</td>
<td>FIRE HYDRANT W/AUX VALVE BOX</td>
<td>EA</td>
<td>1</td>
<td>Ten thousand five hundred dollars and forty eight cents</td>
<td>10500.48</td>
<td>10500.48</td>
</tr>
<tr>
<td>10</td>
<td>1&quot; COPPER SERVICE (TRENCHLESS)</td>
<td>LF</td>
<td>90</td>
<td>One hundred sixty seven dollars</td>
<td>167.00</td>
<td>15030.00</td>
</tr>
<tr>
<td>11</td>
<td>1&quot; TAPPING SADDLE</td>
<td>EA</td>
<td>1</td>
<td>Three hundred seventy dollars and thirty five cents</td>
<td>370.35</td>
<td>370.35</td>
</tr>
<tr>
<td>12</td>
<td>1&quot; CURB STOP AND BOX</td>
<td>EA</td>
<td>1</td>
<td>One thousand fifty dollars</td>
<td>1050.00</td>
<td>1050.00</td>
</tr>
<tr>
<td>13</td>
<td>ABANDON VALVE BOX</td>
<td>EA</td>
<td>1</td>
<td>Three hundred fifty dollars</td>
<td>350.00</td>
<td>350.00</td>
</tr>
<tr>
<td>14</td>
<td>ABANDON CURB STOP</td>
<td>EA</td>
<td>1</td>
<td>Three hundred fifty dollars</td>
<td>350.00</td>
<td>350.00</td>
</tr>
<tr>
<td>15</td>
<td>CONNECT TO EXISTING WATER MAIN</td>
<td>EA</td>
<td>1</td>
<td>Three thousand six hundred dollars</td>
<td>3100.00</td>
<td>3100.00</td>
</tr>
<tr>
<td>ITEM NO.</td>
<td>DESCRIPTION OF ITEM</td>
<td>QTY</td>
<td>UNIT</td>
<td>PRICE IN WORDS</td>
<td>EXTENDED COST</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------</td>
<td>-----</td>
<td>------</td>
<td>------------------------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>RECONNECT WATER SERVICE</td>
<td>1</td>
<td>EA</td>
<td>Four thousand dollars</td>
<td>4000.00</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>CATHODIC CONTROL TEST STATION</td>
<td>1</td>
<td>EA</td>
<td>Four hundred dollars and eighty</td>
<td>400.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>sixty-six cents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>TRACER WIRE ACCESS BOX, 2-WIRE</td>
<td>1</td>
<td>EA</td>
<td>Sixteen dollars and eighty</td>
<td>162.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>twenty-eight cents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>SILT FENCE, HIGH FLOW</td>
<td>45</td>
<td>LF</td>
<td>Twelve dollars and eight</td>
<td>578.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>twenty-eight cents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>9&quot; WATTLIES</td>
<td>45</td>
<td>LF</td>
<td>Nine dollars and eighty</td>
<td>411.90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>eighty-eight cents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>EROSION CONTROL, INLET PROTECTION</td>
<td>2</td>
<td>EA</td>
<td>One hundred dollars</td>
<td>200.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>one hundred dollars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>TRAFFIC CONTROL</td>
<td>1</td>
<td>LS</td>
<td>Two thousand dollars</td>
<td>2500.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>seven hundred and eighty</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>eight cents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL (WORDS AND FIGURES):**

Prime Erection LLC

Name of Company

Authorized Signature

Authorized Representative (Please Print)

Date: 9/2/21
SECTION 5
AGREEMENT BETWEEN THE CITY OF RAPID CITY
AND PRIME EXCAVATION, LLC
FOR
2021 HALL STREET WATER MAIN ABANDONMENT AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 / CIP NO. 50808

1) This Agreement is entered into this 2nd day of September, 2021 by and between the City of Rapid City, 300 Sixth Street, Rapid City, SD 57701, a municipal corporation organized under the laws of the state of South Dakota, hereinafter referred to as the “City,” and Prime Excavation, LLC (Contractor), 5155 Haines Avenue, Rapid City, SD 57701 (Contractor Address), hereinafter referred to as the “Contractor.”

2) Specifications to be followed under this contract are the City of Rapid City Standard Specifications for Public Works Construction (Current Edition) and any Special Provisions, Special Conditions, and/or Detailed Specifications pertaining to this contract.

3) The Contractor agrees to perform the work described in the Detailed Specifications for the 2021 Hall Street Water Main Abandonment and Fire Hydrant Installation, Project No. 21-2678, CIP No. 50808. In exchange, Contractor shall be compensated in an amount not to exceed $70,781.78. The Contractor will only be paid for work actually performed. This Agreement along with attached Informal Quotations and Detailed Specifications constitutes the entire agreement between the City and Contractor and supersedes all prior written or oral communications. In the event any terms of this agreement conflict with the attached quote, this agreement shall control.

4) The Contractor agrees to indemnify, defend and hold the City harmless against all liability, loss, damage, costs, and expenses including, but not limited to, costs of defense and reasonable attorney’s fees, which the City may hereafter suffer itself or pay to another party by reason of any claim, action, or right of action, at law or in equity, arising out of willful misconduct, error, omission or negligent act of the Contractor and resulting in injury (including death) to any person or damage to any property to the extent such are caused by or are alleged to be caused by the Contractor or its employees, any subcontractor or its employees, or any person, firm, partnership, or corporation employed or engaged by the Contractor.

5) Payment for the work will be made to the Contractor by check after the completion of the contracted work, receipt of a signed voucher, and approval by the Council. Payment shall be made within 45 days after receipt of a signed voucher.

6) The Contractor is an independent entity and not an employee, agent, or partner of the City.

7) The Contractor shall obtain and maintain at its expense the following minimum limits of occurrence-based insurance coverage for the duration of this Agreement.

<table>
<thead>
<tr>
<th>Type of Coverage</th>
<th>Minimum Limits of Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Workers’ Compensation</td>
<td>Statutory $500,000/$500,000/$500,000</td>
</tr>
<tr>
<td>Employer’s Liability</td>
<td></td>
</tr>
<tr>
<td>B. Comprehensive General</td>
<td>Minimum Limits of Coverage</td>
</tr>
<tr>
<td>Liability (Including</td>
<td>$1,000,000 each occurrence</td>
</tr>
<tr>
<td>Contractual Liability</td>
<td></td>
</tr>
<tr>
<td>and Completed Operations</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Bodily Injury and Property</td>
<td>$1,000,000 combined single limit</td>
</tr>
<tr>
<td>Damage</td>
<td>Revised 3/21/2013</td>
</tr>
<tr>
<td>General Aggregate</td>
<td></td>
</tr>
<tr>
<td>C. Commercial Automobile</td>
<td></td>
</tr>
<tr>
<td>Liability</td>
<td></td>
</tr>
</tbody>
</table>

Form 810 Informal Quote Agreement for Projects
Such insurance policies shall name the City of Rapid City as an additional insured with respect to all activities arising out of the performance of the work and/or services under this Agreement. Acceptable Certificates of Insurance and Endorsements confirming the above coverage shall be filed with the City before commencing any work and/or services. Such Certificates shall afford the City thirty (30) days written notice of cancellation or of a material change in coverage. The City's failure to obtain from the Contractor a Certificate of Insurance conforming to the foregoing requirements shall not be deemed a waiver of any of the foregoing requirements. This paragraph shall in no way limit the provisions of the indemnity section.

8) This Agreement is made and entered into by the Director of Public Works pursuant to the authority granted by SDCL 9-1-5 and Section 3.04.090 of the Rapid City Municipal Code.

9) The parties agree that the terms of this Agreement shall be governed by the laws of the State of South Dakota. In the event of any conflict of laws, the law of the State of South Dakota shall be controlling. Any legal action arising out of or relating to this agreement shall be brought only in the Circuit Court of the State of South Dakota, Seventh Judicial Circuit, located in Rapid City, Pennington County, South Dakota.

10) The provisions of this Agreement shall be deemed severable, and the invalidity or unenforceability of any provision shall not affect the validity and enforceability of the other provisions hereof. If any portion of this Agreement is unenforceable for any reason whatsoever, such provision shall be appropriately limited and given effect to the extent that it may be enforceable.

Dated this ___ day of, _______ 2021.

PRIME EXCAVATION, LLC

By: _____________________________

SIGNATURE

______________________________

PRINTED NAME

Its: Partner

THE CITY OF RAPID CITY, SOUTH DAKOTA

BY _____________________________

MAYOR (printed name)

______________________________

MAYOR (signature)
Party of the First Part

ATTEST _____________________________

City Finance Director (SEAL)
SECTION 8A
WATER PIPING SYSTEMS

This specification section replaces Section 8 of the City of Rapid City Standard Specifications for Public Works Construction. However, the current Section 8 details are still valid and shall be utilized in conjunction with this specification section.

8A.1 DESCRIPTION

A. General:

This work consists of furnishing and installing water mains, service lines, and appurtenances. This includes all equipment, tools, materials, labor, and other incidentals to provide water mains and service lines complete and ready for immediate and continuous use. The work includes, but is not limited to, all necessary excavation, backfilling, compaction, testing, clean up, and restoration required for a complete installation of water mains, service lines, and appurtenances.

Standard specifications for corrosion protection of metallic fittings, valves, hydrants and other miscellaneous metallic pieces associated with the installation of plastic pipe are provided in Section 8B Corrosion Protection – Plastic Pipe Systems. Specifications regarding tracer wire, coatings for metallic pieces, for fasteners and for field coating repairs are included in Section 8B.

B. Definitions:

1. Distribution main means a water main that supplies one or more branch mains.

2. Fire Service Line means pipe and appurtenances delivering water from the City water distribution system to a building fire extinguishing system. Fire service lines may be located on private property or in public ROW and are owned, operated, and maintained by the property being served.

3. Fire hydrant lead means that portion of the fire hydrant branch line from the main to the fire hydrant auxiliary valve.

4. “L” length for Joint restraining devices means the length of pipe from a fitting, valve, or feature that needs to have each pipe joint within that length restrained.

5. Private Fire Protection System means hydrants, valves, water pipes, and appurtenances, sprinkler systems, hose connections, and other equipment constructed for the purpose of providing fire protection for a building or group of buildings and supplied with water from a public water supply system. Private Fire Protection Systems are located on private
property, although some components may be located in public ROW, and are owned, operated, and maintained by the property being served.

6. Transmission Main means a water main that supplies many tributary branches, serves a large area, and has few taps.

7. Water mains are those pipes of at least six (6) inches in diameter, which will be installed in public right-of-way or easements and will become a part of the City water distribution system and which will be owned, operated, and maintained by the CITY OF RAPID CITY.

8. Water service line shall mean the line from the main to within five (5) feet of the building and is owned and maintained by the owner of the property being served. The service line then connects to the Property Water Distributing System. For purposes of this definition, it is understood that the building or premises “Property Water Distributing System” begins 5 feet outside of the building and will usually be the same pipe material as the water service line up to where it actually enters the building.

9. Property Water Distributing System is those pipes within the building or the premises, which convey water from the water service pipe to the point of use. For purposes of this definition, the Property Water Distributing System begins 5 feet outside of the building and will usually be the same pipe material as the Water Service Line up to where it actually enters the building.

C. Related Work:

Section 7   - General Conditions
Section 8B – Corrosion Protection – Plastic Pipe Systems
Section 9   - Sanitary Sewer
Section 11 - Utility Excavation and Backfill
Section 41 - Utility Trench Resurfacing
Section 56 - Concrete for Incidental Construction (Class M)
Section 90 - Traffic Control
Section 112 - Select Granular Backfill
Section 200 - Controlled Low Strength Material

D. License and Permit Requirements:

Refer to Section 11.

E. Submittals:

Submittals shall be required unless otherwise specified in the Detailed Specifications or Special Provisions. The term "Submittals" includes, but is not necessarily limited to, manufacturer’s product data sheets of pipe, appurtenances, and fittings. Submittals shall be submitted for, but not limited to, the following items:
Fire hydrants, pipe, pipe fittings and their appurtenances including T-bolts, joint restraints, polyethylene encasement, and any other pertinent information concerning construction materials that the Engineer deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

All submittals shall be made in accordance with Section 01330.

Resubmittals shall be made in the same manner as submittals, with changes clearly shown.

8A.2 MATERIALS

A. Pipe:

General: Pipe for water mains shall be Polyvinyl Chloride (PVC) or ductile iron with push on joints as specified on the plans or in the Detailed Specifications. Water pipe larger than 20-inches in diameter shall be ductile iron pipe unless indicated otherwise on the drawings or in the specifications.

1. PVC pressure pipe, 4 inches through 12 inches, shall conform to the requirements of AWWA Specification C900, DR25 or DR18, (C.I.O.D.) and meet one of the below standards.
   a. PVC pipe shall have bell ends with elastometric gaskets. Pipe joints shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process. Installation procedures shall conform to AWWA C-605 Standards, or
   b. PVC pipe shall be Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by North American Specialty Products or equal. Pipe joints shall utilize non-metallic couplings with locking splines. High strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360° restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139. Every pipe and coupling shall pass the AWWA C900 hydrostatic proof test requirements of 4 times the pressure class for 5 seconds. Pipe and Couplings shall meet all approvals per Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation and all pipe and couplings shall be marked in accordance with the requirements established for Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by North American Specialty Products, or
2. PVC pressure pipe, 14 inches through 24 inches, shall conform to the requirements of AWWA Specification C905, DR18 (C.I.O.D.) and meet one of the following standards:

a. PVC pipe shall conform to the requirements of AWWA Specification C905, DR 25 (C.I.O.D), DR 18 (C.I.O.D), or as otherwise specified. PVC pipe shall have bell ends with elastometric gaskets. Pipe joints shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process, or

b. 16-inch PVC pressure pipe shall be Certa-Lok C905/RJ Restrained Joint PVC pipe manufactured by North American Specialty Products or equal. Pipe joints shall utilize non-metallic couplings with locking splines. High strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full $360^\circ$ restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139. Every pipe and coupling shall pass the AWWA C905 hydrostatic proof test requirements of 4 times the pressure class for 5 seconds. Pipe and Couplings shall meet all approvals per Certa-Lok C905/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation and all pipe and couplings shall be marked in accordance with the requirements established for Certa-Lok C905/RJ Restrained Joint PVC Pipe manufactured by North American Specialty Products. Installation procedures shall conform to AWWA C605.

3. Ductile iron pipe shall conform to the requirements of AWWA Specifications C150 and C151, Pressure Class 350 for 3 inches through 12 inches diameter, Pressure Class 250, or greater for 14 inches through 20 inches diameter, and Pressure Class 200, or greater for 24 inches and larger diameter, unless specified otherwise on the plans or Detailed Specifications. Ductile iron pipe shall be coated on the outside with a minimum bituminous coating thickness of 1-mil unless coating or thickness is otherwise specified within the contract documents. Ductile iron pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be full thickness to the end of the spigot and to the seat of the bell, or shall be tapered for a length of not more than two inches.

a. Bituminous coating is not corrosion protection coating.

Rubber gasket joints for all Ductile Iron pipe shall meet the requirements of AWWA C111. Installation procedures shall conform to AWWA C600 Standards.
4. **Water service pipe** 1 inch through 2 inches diameter shall be Type "K" soft copper tubing; 4 inches and larger service pipe shall be PVC or ductile iron pressure pipe as specified for water pipes, above.

Type K soft copper tubing shall be US Government Type K Soft Tubing in 60 – foot single or double pancake coils for 1 inch and 1½ inch diameter material. The minimum center coil diameter shall not be less than 16 inches.

Tubing material for 2 inches material shall be supplied in 20 – foot lengths with ends of tubing to be cut off evenly. Two (2) Inches coiled material will not be accepted.

Water service pipe larger than 2 inches shall meet the specifications above for PVC pressure pipe or ductile iron pipe.

B. **Fittings:**

1. **Water main fittings:**

   **General:** Fittings used with ductile iron pipe shall be ductile iron. Fittings 12 inches and smaller, used with PVC pipe shall be ductile iron or PVC.

   Fitting types applicable to this specification consist of bends, crosses, tees, reducers/increasers, plugs, caps, couplings, and sleeves.

   a. **Ductile Iron water main fittings:** Fittings shall be ductile-iron with 350-psi pressure rating and rubber gasket joints meeting all applicable requirements of the latest edition of AWWA C110, C111, and/or C153. All internal and external ferrous surfaces shall be coated per Section 8B.

      Unless specified otherwise in the plans or Detailed Specifications the following fitting joint shall be provided:

      - Fittings 8 inches and smaller shall be push-on joint.
      - Fittings 10 inch and 12 inch shall be push-on joint or mechanical joint. If the fitting is going to be restrained then it shall be a mechanical joint.
      - Fittings 14 inches and larger shall be mechanical joint.

      Push-on joint fittings shall be furnished with restraining lugs. The lug pattern for all sizes shall accommodate gripper-type restrainers.

   b. **PVC water main fittings:** PVC fittings maybe used in-lieu of ductile iron fittings for PVC pipe installations 12 inches and smaller. PVC fittings shall meet all applicable requirements of the latest edition of AWWA C900 DR25 and AWWA C907. The PVC fitting bell ends shall have elastometric gaskets. Installation procedures shall conform to AWWA C605 Standards.
c. **Couplings:** Straight and transition couplings shall be Romac Style 501 as manufactured by Romac Industries, Inc., or equal and shall have ductile iron center rings and end rings meeting ASTM A536-80, Grade 65-45-12. Center rings shall be epoxy coated per Section 8B of the standard specifications. Gaskets shall be SBR compounded for water service. Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation or equal shall use non-metallic couplings specifically designed by the manufacturer for use with their pipe. Couplings for 12-inch and larger pipe shall be a minimum 12 inches in length.

d. **Tapping Sleeves** shall be ductile iron or stainless steel, flanged branch ends, with test plugs for pressure testing. The Sleeve shall be approved for use at pressures equaling or exceeding those of the pipe classification being installed. Ductile iron tapping sleeves shall be mechanical joint with totally confined end gaskets. Stainless steel tapping sleeves shall have a 304 stainless steel shell with SBR gaskets compounded for water service, a stainless steel flange, and shall have 304 stainless steel nuts, bolts, and washers.

C. **Valves:**

**General:** Valves 16 inches and smaller shall be gate valves and valves 18 inches and larger shall be butterfly type or gate valves as specified on the plans or Detailed Specifications. All internal and external ferrous surfaces shall be coated per Section 8B.

1. **Gate Valves** shall conform to the requirements of AWWA Standard C509 and C515 with a 250-psi pressure rating and shall have a ductile iron-body and bonnet, be resilient seated, utilize mechanical joints including gaskets and bolts, and include all accessories. Gate valves shall have ductile iron wedge fully encapsulated with a SBR rubber or Nitrile elastomer coating. Stems shall be non-rising; one piece cast, forged or rolled bronze. Valves shall have 2-inch ductile iron operating nuts and shall open left, counterclockwise. Bonnet bolts and nuts shall be Series 300 stainless steel and shall be rust proofed after threading and final tightening.

2. **Butterfly Valves** shall conform to the requirements of AWWA C504, Class 150B for buried installation. Butterfly valve box body and disk shall be ductile iron ASTM A-536. Shaft shall be stainless steel. Seat shall be Buna-N, field replaceable without special tools and shall provide tight shutoff as required by AWWA C504. Mating surfaces shall be stainless steel. Bearings shall be self-lubricating, corrosion-resistant, and shall be designed for horizontal and/or vertical shaft loading. Shaft seals shall be designed for the use of bi-directional, self-adjusting packing, replaceable without removing the valve shaft.

Actuator shall be designed for buried service and shall be grease-packed, totally sealed. Actuator shall be equipped with a mechanical stop-limiting
device to prevent over-travel of the valve disc in the open and closed positions. Actuator shall be equipped with 2-inch operating nut, which is hex-mated to the input stem and shall open by turning counterclockwise.

D. Valve Boxes:

1. Gate Valves 10 inches and smaller and Butterfly Valves:

   Valve Boxes shall be Mueller 666-S or equal and shall be a 2-piece screw-type construction with five and one-fourth (5 1/4) inches riser and shall be adjustable from four and one half (4 1/2) feet to six (6) feet, with the top section to be at least 24 inches in length. Drop lids shall be marked "Water" and are to be of all-metal construction.

2. Gate Valves: 12 through 20 inches.

   Valve Boxes shall be Mueller 666-S or equal and shall be a 2-piece screw-type construction with five and one-fourth (5 1/4) inches riser and shall be adjustable from three (3) feet to four and one half (4 1/2) feet, with the top section at least 24 inches in length. Drop lids shall be marked "Water" and are to be of all-metal construction.

3. Valve Box Adaptor:

   A valve box adaptor shall be installed on the valve bonnet prior to installing the valve box. The valve box adaptor eliminates shifting of the valve box, protects the coatings, centers the valve box, and seals the valve box with a resilient material. The adaptor shall be installed in lieu of hardwood blocking and shall be incidental to the valve box. The valve box adaptor shall be installed per the manufacturer’s recommendations. The valve box adaptor shall be a “Valve Box Adaptor II” as manufactured by Adaptor Inc., a “Valve Box Self-Centering Alignment Ring” as manufactured by American Flow Control, or an approved equal.

E. Fire Hydrants:

   Fire hydrants shall meet AWWA C502 and shall be Mueller A-423, American Darling B84B, American AVK Series 27, or Waterous WB-67 Pacer, traffic model with 6 ft. bury and 6 inches mechanical joint inlets. Hydrants shall have 5 ¼ inches minimum valve openings, having O-ring packings and oil chamber to hold soft oil for stem thread lubrication, and shall have all operating parts, including valve seat, removable through the barrel. Barrel and upper standpipe shall be ductile iron with breaker flange and operating stem at ground level. A steel breakaway coupling shall be installed on the operating stem so that in case of breakage, no damage will result to the fire hydrant other than safety breakers.

   All internal and external ferrous surfaces shall be coated per Section 8B of the Standard Specifications.
All hydrants shall be capable of being extended in six (6) inches increments. However, the minimum hydrant adjustment shall be 12 inches.

Hydrants shall be constructed so that they will close with the existing water pressure acting on the hydrant. Drain valves shall be bronze and shall be positively operated by the main operating rod. All threads shall be National Standard threads. Operating nuts shall be 1 ½ inches point-to-flat, pentagon (National Standard). Hydrants shall open left, counterclockwise. Fire Hydrants shall have an internal travel stop nut.

Hydrants are to have two (2), two and one-half (2 1/2) inches nozzles and one (1) four and one-half- (4 1/2) inches steamer nozzle, all with National Standard threads. The minimum distance from the hydrant breaker flange to the centerline of the lower nozzle shall be sixteen (16) inches. Caps shall be nut type and shall be provided with chains. Hydrants shall be painted fire hydrant red.

All Fire Hydrants are to be ordered with barrel lengths of six (6) to eight (8) feet to facilitate their installation per the grades and lines shown on the drawings. Adjustments greater than eight (8) feet shall be accomplished using vertical bends (45, 22½, or 11¼) along the hydrant lead. The use of a Fire Hydrant Extension will not be an acceptable method of adjustment for a new Fire Hydrant, provided the necessary information was communicated on the drawings or Detailed Specifications. If this information was communicated and the hydrant requires adjustment for final grade, then the Contractor shall replace the Fire Hydrant with a new Fire Hydrant with the correct barrel length or install the appropriate vertical bends on the hydrant lead.

In cases where a Fire Hydrant Extension will be installed, the Contractor shall furnish the appropriate extension and notify the City Utility Maintenance Department for installation. City crews shall install all Fire Hydrant Extensions.

F. Service Line Valves and Fittings:

General: Service line valves and fittings shall meet AWWA Standard C800 and ASTM B26. All castings shall be 85/5/5/5 copper alloy.

1. Service line copper splicing couplings shall be flared or compression type such as Mueller 110 Conductive Compression, Hayes-Tite, or equal. Soldered joints shall not be used for service lines installed underground.

2. Curb stop valves shall be a “ball valve” type with a 300-psig working pressure rating. A double O-ring port seal shall be provided in the stem and the O-rings shall be supported in precision-machined grooves. The end pieces shall be O-ring sealed to provide additional protection against leaking. 90-degree valve operation, with internal movement restraint, is required. Drains are not permitted on valves. Buffalo type valve boxes are required and therefore the Minneapolis Pattern threads on the valve are not a requirement.
Copper pipe connections shall be Mueller 110 Conductive Compression, A. Y. McDonald McQuick Compression – Q Series, Hayes-Tite, or equal.

Curb stop valves shall be:

- “Mueller 300 Ball Curb Valve” with “Mueller 110 Conductive Compression Connection”; model B-25155,
- “A. Y. McDonald Minneapolis Pattern Ball Valves – 300 PSIG Water”; model 6104Q or 6100Q,
- Ford B44 Series,
- Or equal.

3. Corporation stops shall be a “ball valve” type with a 300 psig working pressure rating. The inlet shall have a taper thread (AWWA Standard) and the outlet shall be a conductive compression connection for type "K" copper. Copper pipe connections shall be Mueller 110 Conductive Compression, A. Y. McDonald McQuick Compression – Q Series, Hayes-Tite, or equal.

Corporation stops shall be:

- “Mueller 300 Ball” with “Mueller 110 Conductive Compression Connection”; model B-25008,
- “A. Y. McDonald Ball Valves – 300 PSIG Water”; model 4701BQ,
- Ford FB1000 Series,
- Or equal.

Corporation stops that are used to connect copper water services to metallic water mains shall be the isolator style or insulated corporation ball valve.

4. Service Saddles: Service saddles for 1 inch through 2 inches copper service pipe shall utilize a wide band/strap with a minimum of two (2) bolts and nuts, per width of the band/strap, for securing the band/strap to the main. The saddle shall provide full support around the circumference of the pipe. Nuts and bolts shall be rolled thread stainless steel or silicon bronze. Gaskets shall be neoprene or NBR compounded for water service.

a. It shall be the Contractor’s responsibility to ensure that saddles and corporation stops are compatible with the pipe on which they are to be installed. If a compatibility question arises, the Contractor shall inform the Engineer and provide him with a recommended substitution.

b. Saddles for 6 inch – 12 inch mains:

Saddles 6 inches – 12 inches mains shall utilize a stainless steel, cast brass per ASTM B62, bronze, or a high strength ductile iron body with
a minimum 12 mils of fusion applied epoxy or Nylon 11 coating and a stainless steel band.

Saddles shall be pre-sized if required or recommended by the saddle or pipe manufacturer. Pre-sized saddles will conform to the pipe O.D. without placing undue stress on the PVC pipe. Not all of the following indicated saddles are presized and it is the responsibility of the Contractor and supplier to ensure that the saddle is presized if required or recommended by the saddle or pipe supplier.

Saddles for 6 inch – 12 inch mains shall be:

- **1 inch Service Taps:**
  
  Provide a minimum total band/strap width of 2 inches along the axis of the pipe. Saddles for 1 inch taps on 6 inch – 12 inch mains shall be:
  
  1) Ford Style FS303 or FC202,
  2) Romac Style 306, Style 202N and 202BS with stainless steel straps,
  3) A.Y. McDonald Model 3845,
  4) Mueller DR2S series with double studs,
  5) Or approved equal.

- **1½ inches & 2 inches Service Taps:**
  
  Provide a minimum total band/strap width of 3¼ inches along the axis of the pipe. Saddles for 1½ inches & 2 inches taps on 6 inches – 12 inch pipe shall be:
  
  1) Ford Style FS303 or FC202,
  2) Romac Style 306, Style 202N and 202BS with stainless steel straps,
  3) A. Y. McDonald Model 3845,
  4) Mueller DR2S series with double studs,
  5) Or approved equal.

**c. Saddles for 14 inch and larger mains:**

Saddles for 14 inches and larger mains shall utilize a stainless steel, cast brass per ASTM B62, bronze, or a high strength ductile iron body with a minimum 12 mils of fusion applied epoxy or Nylon 11 coating and a stainless steel band.

Saddles shall be pre-sized if required or recommended by the saddle or pipe manufacturer. Pre-sized saddles will conform to the pipe O.D. without placing undue stress on the PVC pipe. Not all of the following indicated saddles are presized and it is the responsibility of the Contractor and manufacturer to ensure that the saddle is presized if required or recommended by the saddle or pipe supplier.
Saddles for 14 inch and larger mains shall be:

- 1 inch Service Taps:
  
  Provide a minimum total band/strap width of 2 inches along the axis of the pipe. Saddles for 1 inch taps on 14 inches and larger pipe shall be:
  
  1) Ford Style FC202,  
  2) Romac Style 202N and 202BS, and  
  3) Mueller DR2S with SS straps,  
  4) Or approved equal.

- 1½ inches & 2 inches Service Taps:
  
  Provide a minimum total band/strap width of 3 inches along the axis of the pipe. Saddles for 1½ inches & 2 inches taps on 14 inches and larger pipe shall be:
  
  1) Ford Style FC202,  
  2) Romac Style 202N and 202BS,  
  3) Mueller DR2S with SS straps,  
  4) Or approved equal.

5. Curb boxes shall be Tyler 6500 series, Mueller H-10350, Buffalo type, or equal and shall be cast-iron. The box shall be capable of telescoping, at a minimum, from five (5) feet to a length of six (6) feet. Lid shall be marked “water” and have a 13/16 inches (point to flat) pentagon brass nut. Risers shall be a minimum of two-and-one-half- (2 ½) inches in diameter.

6. Tapping sleeves and valves shall be used for service lines larger than 2 inches.

G. Concrete Thrust Blocks:

   Thrust blocks shall be M-6 (4000 psi) concrete as specified in Section 56 of the Standard Specifications.

H. Joint Restraining Devices

   1. Joint Restraint Devices at Fittings shall meet the following requirements:

      In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application.

      a. For DI pipe to DI push-on fittings

         Fitting Joint Restraints shall be EBAA Series 1100HD, or equal.
b. For DI pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA MEGALUG Series 1100, Series 1100SD, or equal.

c. For PVC pipe to DI push-on fittings:

Fitting Joint Restraints shall be EBAA Series 15PF00, or equal.

d. For PVC pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA Series 2000PV, Series 2000SV, Series 15PF00, or equal.

e. For PVC pipe to PVC push-on fittings:

Fitting Joint Restraints shall be EBAA Series 2500, or equal.

2. Joint Restraint Devices at pipe bells shall meet the following requirements:

In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application.

a. For ductile iron pipe:

The bell restraint shall be EBAA Series 1700, or equal.

In lieu of bell restraint devices, push on joints with the American Fastite Joint system with Fast Grip Gasket, or equal may be used when approved by the Engineer.

b. For PVC C-900 pipe the bell restraint shall be EBAA Series 1600, or equal.

c. For PVC C-905 pipe The bell restraint shall be EBAA Series 2800, or equal.

I. Polyethylene Encasement:

Polyethylene Encasement (poly-wrap) shall meet AWWA C105.

For ductile iron pipe, the encasement shall be 8-mil thickness, seamless tube, black ASTM D1248, Type 1, Class C, Grade G-1. Joint tape for encasement shall be 3M Scotchwrap 50, or equal.

For fittings and joint restraining devices, which are not epoxy coated, the encasement shall be 8-mil thickness sheet polyethylene meeting AWWA C105. Joint tape for encasement shall be 3M Scotchwrap 50, or equal.
J. Pipeline Insulation:

Pipeline insulation shall be Type IV Styrofoam Brand—“Square Edge” or “Score Edge” as manufactured by Dow Chemical Company or approved equal shall be used for insulating water pipes where required. The total thickness and dimensions shall be specified on the drawings or in the Specifications. The minimum insulation thickness however shall be 2 inches.

Approved equal products from other manufacturer’s shall be Extruded-Polystyrene Board Insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C578, Type IV, with 1.60 lb./cu. Ft. minimum density and a compressive strength of 25 lb./ sq. in as specified in ASTM D1622 and ASTM D1621 respectively. The maximum thermal conductivity of the insulation shall conform to ASTM C518, C177, and C578. The maximum water absorption percentage by volume shall be 1% in accordance with ASTM D2842. The range of water vapor permeance shall be 0.4 to 1.0 perm in accordance with ASTM E96.

K. Meter, Air Release, and Valve Pits:

Meter, air release, and valve pits shall be constructed in accordance with the detailed drawings and unless specified otherwise on the Drawings or Detailed Specifications, the pits shall be constructed in accordance with precast concrete manholes as specified in Section 9, Sanitary Sewer and modified as follows.

Meter, air release, and valve pits shall be provided with steps. Flat cover slabs, when required, shall be designed for HS-20 loading and shall have an offset 27-inch diameter hole in line with the manhole steps. Cones shall have an offset 27-inch diameter hole in line with the manhole steps. Standard frames and covers shall be “Neenah 1758 – E Frost – Retardant Frame and Lid w/ Inner Lid”, or equal unless otherwise indicated on the drawings or specifications. The Lid shall be a diamond top design “Neenah Type C” un-marked.

Otherwise, the pit and casting shall meet the requirements of Section 9, Sanitary Sewer.

8A.3 CONSTRUCTION REQUIREMENTS

A. Materials Handling and Storage:

The Contractor shall be responsible for the safe handling and storage of all materials furnished by them and shall replace, at their expense, all such materials found defective in manufacture or damaged in transportation, handling, or storage.

Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall
such materials be dropped. All material shall be stored in a neat and orderly manner. Pipe shall be stored, to the greatest extent possible, in unit packages or bundles and shall be handled to prevent stress to bell joints and prevent damage to bevel ends. In addition, materials shall be handled and stored in accordance with manufacturer’s recommendations.

If in the opinion of the Engineer damage or defects to the factory applied external coatings on steel or ductile iron pipe and fittings (including fire hydrants) cannot be repaired, then the Contractor shall replace the damaged items with new materials.

If in the opinion of the Engineer damage or defects to the factory applied external coatings on steel or ductile iron pipe and fittings (including fire hydrants) can be repaired, then the Contractor shall make repairs to damaged coating per Section 8B – Corrosion Protection – Plastic Pipe Systems.

B. Alignment and Grade:

Pipe shall be laid true to the line and grade established on the Drawings. Where the Drawings indicate that the finished ground surface elevations are to be modified from the existing elevations by this or future construction, the Contractor shall exercise care to ensure that pipe, fittings, hydrants, valves and valve boxes are placed to the elevations indicated on the plans.

C. Underground Obstructions:

The Contractor shall expose existing underground obstructions shown on the plans or located in the field and shall determine their elevations far enough in advance of pipe laying that the proposed water main can be installed without the use of fittings at or near the points of crossing. Wherever obstructions not shown on the plans are encountered during the progress of the work and interfere with the proposed horizontal or vertical alignment of the pipeline, the Engineer will change the plans and order a deviation in the line and/or grade, or may arrange for the removal or relocation of the obstructions. The Contractor shall not deviate from plan line or grade without the Engineer’s approval.

D. Water Main and Sewer Main/Storm Sewer Separation:

1. **Vertical Separation at Crossings:**

   Water mains may cross above sanitary and storm sewers with a minimum vertical distance of eighteen (18) inches between the invert of the water main and the top of the sewer. In these cases where the water main is above the sewer and there is at least 18 in. of separation, then at the crossings one full 20 ft. length of water pipe shall be centered on the crossing.
The following installation requires Engineer’s approval and is appropriate for installations where the water main cannot be constructed (18) inches above the sewer.

A water main may cross above a sewer main with a vertical separation of less than eighteen (18) inches or below the sewer main if either the water or sewer main is encased in PVC, ductile iron, or six (6) inches of “Controlled Low Strength Material” for at least ten (10) feet each side of the crossing. If PVC or ductile iron is utilized as encasement material, the ends shall be sealed with six (6) inches of Class M5 concrete.

The 10 feet each side of the crossing shall be measured from the outside wall of the sewer to the end of the encasement and is not measured from the centerline of the sewer main.

2. Water Main and Sewer Main/Storm Sewer Horizontal Separation:

Water mains shall be constructed with a minimum of 10 feet of horizontal separation from any existing sanitary or storm sewer or proposed sanitary or storm sewer. The 10 feet horizontal separation shall be the clear distance (water pipe sidewall to sewer pipe sidewall) and not the centerline distance between the utilities.

The following installation requires Engineer’s approval and is appropriate for installations where the 10 feet separation physically is not possible.

A water main may be constructed closer than 10 feet to a Sanitary or Storm sewer if it is laid in a separate trench or it is laid in the same trench and the water main is located on the opposite side on a bench of undisturbed earth. In both cases, the elevation of the crown of the sewer has to be at least 18 inches below the invert of the water main. The sewer main shall be constructed of water main pipe (pressure class pipe) meeting the requirements of Section 8.2 and pressure tested for water tightness in accordance with AWWA standards for leakage testing.

As an alternative to constructing the sewer with water main pipe (pressure class pipe) and pressure testing the sewer, it would also be acceptable to either encase the water or sewer main with 6 inches of “Controlled Low Strength Material” or to encase either the water or sewer within a PVC or cast iron casing.

3. Manholes and Storm Sewers:

Sanitary Sewer Manholes and Storm Sewer Pipes and Inlets are considered to be sewers in regards to the above separation requirements.

A water main may be constructed below, within 10 ft. horizontally, and within 18” above a Storm Sewer pipe or Storm Sewer Inlet provided that the Storm Sewer pipe is constructed with sealed joints and passes a low-pressure (5psi) pressure test. The pressure test shall be maintained for a minimum of 30 minutes. The pressure test shall otherwise comply with
the requirements of the “Low Pressure Air Test” in Section 9.3.H.4.a Sanitary Sewer.

The “Low Pressure Air Test” may be waived by the Engineer for round RCP storm sewer utilizing O-ring gasketed joints as manufactured by South Dakota Concrete Products.

E. Installation:

1. **Trenching** shall comply with the requirements of Section 11, Utility Excavation and Backfill.

2. **Minimum Cover** depth from top of pipe to finished grade shall be as follows:

<table>
<thead>
<tr>
<th>Size of Pipe (In.)</th>
<th>Minimum Cover (Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 or less</td>
<td>6</td>
</tr>
<tr>
<td>14 to 18</td>
<td>5 ½</td>
</tr>
<tr>
<td>20 or larger</td>
<td>5</td>
</tr>
</tbody>
</table>

In the event adequate cover cannot be achieved by alignment or grade adjustment then, with prior approval of the Engineer, the water pipe may be insulated. Refer to the Insulation Standard Detail in cases where minimum cover cannot be provided. Insulation may also be required if adequate separation between a storm sewer or culvert and the water pipe cannot be achieved.

3. **Cleaning** shall be done as necessary so that the interior of all water pipe and fittings is free from all dirt, cement, or other foreign material before installation. Contact surfaces shall be wire brushed immediately prior to jointing.

4. **Pipe Cutting** shall be done without damage to the pipe with saw or abrasive wheel and shall be smooth, straight, and at right angles to the pipe axis. Ends of pipe shall be dressed and beveled to remove roughness and sharp corners.

5. **Laying and Joining** of PVC pipe shall be in accordance with AWWA C900, AWWA C905, and AWWA C605, and with the pipe manufacturer’s instructions. Laying and joining of ductile iron pipe shall be in accordance with AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances, and with the pipe manufacturer’s instructions, unless specifically required otherwise by these Specifications. All Ductile Iron Water Mains shall be constructed with a Polyethylene Encasement tube as specified herein. The polyethylene encasement tube shall be secured circumferentially at 2 feet horizontal intervals with tape during installation.

Pipe shall be laid with bell ends facing in the direction of laying. Each pipe length shall be inspected for defects prior to being lowered into the trench. All pipe and fittings shall be carefully lowered into the trench.
piece by piece by means of pipe slings to prevent damage to the pipe and/or coating. Full lengths of pipe shall be installed except where connecting to appurtenances and fittings. The Contractor shall leave an appurtenance or fitting with a full length of pipe whenever possible.

Water main pipe shall not be installed in frozen ground or in water, and no water shall be allowed to run into or through the pipe.

During the course of construction, a suitable stopper shall be kept in the end of the pipe so as to prevent any dirt and or water from entering during the progress of the work at all times. Any dirt, loose material or cement mortar, which may accumulate in the pipe, shall be removed as the work progresses.

a. Push-on Joints: The spigot end of field cut piping shall be cut square and then beveled. Joint surfaces shall be cleaned and lubricated immediately before completing the joint.

b. Certa-Lok C900/RJ Coupling: Certa-Lok C900/RJ grooved end pipe shall be inserted into Certa-Lok C900/RJ couplings only. For use with PVC integral bells, push on fittings, or mechanical joint bells the pipe end shall be cut off at the groove and the pipe end beveled. Only insert plain end pipe into Certa-Lok C900/RJ couplings outside of the restrained "L" length for the pipe system or utilize thrust blocking or other approved joint restraint devices.

c. Mechanical Joints: Joints shall not be over-tightened; if an effective seal is not obtained the joint shall be disassembled, cleaned thoroughly and reassembled. Where joint restraint devices are used with a mechanical joint, the holes shall be carefully aligned to permit installation of harness bolts. At mechanical joints, a beveled PVC spigot may not be used. Rather a non-beveled spigot shall be used for insertion into mechanical joint.

6. Protection of the Work: Once in place, the pipe shall have its open end plugged to prevent soil, water, or other matter from entering the pipe.

7. Pipe Deflection: Deflection or bending of the pipe or deflection of the pipe joint (bell and spigot) shall not be permitted except as approved by the Engineer. Changes in horizontal and vertical direction shall be achieved using standard fittings, fabricated fittings, Couplings, and/or high deflection pipe couplings specifically designed and approved for use in joint deflection.

The Engineer may approve deflection of 12 inch diameter or smaller pipe or pipe joints if the "Engineer of Record" specifically designed for the deflection and the deflection is approved in writing by the pipe manufacturer specifically for the project. A condition of approval is the City of Rapid City receiving a letter from the pipe manufacturer stating they have reviewed the proposed pipe or pipe joint deflections for (state the project name and City tracking number) and they approve and
warranty the pipe for the proposed deflections. Deflection of pipe or pipe joints for diameters greater than 12 inch is strictly prohibited.

Restrained joint pipe and couplings maybe deflected in accordance with the manufacturer’s written recommendations. The “Engineer of Record” shall specifically indicate the use of restrained joint pipe and indicate the designed deflections on the drawings.

8. **Fittings:** Bends and tees shall be placed on a stable foundation, which may require the use of concrete pads of equal size or larger than specified for valves. Fittings shall be provided with thrust blocks, joint restraining devices, and polyethylene encasement (where fittings which are not epoxy coated) as specified herein.

9. **Couplings:** Couplings shall be placed on a stable foundation and shall be wrapped in polyethylene encasement as specified herein. Couplings shall be approved by the pipe manufacturer for the use with the pipe and shall be installed according to the coupling manufacturer’s recommendations.

10. **Thrust Blocks:** Concrete thrust blocks shall be provided at tees, crosses, horizontal bends, plugs, caps, fire hydrants, and similar locations whether specifically indicated on the Drawings or not. Refer to the subsection “Joint Restraining Device Installations” for situations and fittings that require the use of joint restraints in-lieu of concrete thrust blocks.

Concrete thrust blocks shall have a thickness at the fitting equal to at least half the diameter of the pipe being installed but shall not be less than six (6) inches thick under any circumstances. They shall extend from the fitting to the undisturbed wall of the excavation. The Contractor shall insure that the concrete does not cover or render inoperable nuts or bolts on the fittings. All metal fittings, valves, or appurtenances shall be wrapped in polyethylene prior to pouring thrust blocks.

Concrete Thrust blocks shall be allowed to cure for 48 hours prior to activating the water main. If the water main needs to be activated prior to the concrete curing (48 hours) then the water main shall be restrained using joint restraining devices. Prior to backfilling, thrust blocks shall cure for a minimum of four hours.

Thrust Blocks shall be installed as shown on the drawings and shall meet or exceed the minimum volume or bearing area requirements as specified on the drawings or specifications for the water pressures and soil conditions.

In muck, peat, or similar weak soils, thrust loads shall be resisted by using joint restraining devices or by removal of the soil and replacement with a material of sufficient stability to resist thrust loads as determined by the Engineer.
The use of Thrust Blocks, as specified above, is required when using restrained joint pipe and couplings.

Where prior approval of the Engineer is obtained, the Contractor may be able to substitute acceptable joint restraining devices for concrete thrust blocking. A condition of approval will be to address the potential corrosion issues associated with the use of joint restraints. The approval to substitute joint restraints is the Engineers decision and approval may or may not necessarily be granted even if the potential corrosion issues are addressed.

11. Joint Restraining Device Installations: Joint Restraining Devices are required for the following installations: Refer to Section 8A.1 for the definition of “L” length for Joint restraining devices.

   a. All Valves 12 inches and larger and pipe joints within their corresponding “L” lengths shall be restrained,

   b. All High Pressure Valves (working pressures greater than 110 psi) and pipe joints within their corresponding “L” lengths shall be restrained,

   c. Valves 10 in. and smaller placed on dead-end mains with less than 71 feet of pipe downstream of the valve shall be restrained using the appropriate “joint restraining devices” for a dead end. Both the upstream and downstream pipe joints within their corresponding “L” lengths shall be restrained.

   d. All Reducers/Increasers and their corresponding “L” lengths shall be restrained,

   e. All Vertical Bends and pipe joints within their corresponding “L” lengths shall be restrained, and

   f. All Water Main Lowering and pipe joints shall be restrained. Water Main Lowering restraint shall include restraining all joints within the fitting’s corresponding “L” length plus restraining all pipe joints which lie between the start of the lowering and the end of the lowering, regardless whether or not the pipe joint is located within the fitting’s “L” length.

Joint Restraining Devices shall be installed per the manufacturer’s recommendations and for the appropriate water pressures and soil conditions as shown on the drawings or Detailed Specifications.

13. Insulation: Insulation shall be placed where noted on the plans. Insulation board shall be placed on a smooth and level cushion, minimum of 2 inches, of fine concrete aggregate (sand) and shall be covered with a minimum of 2 inches of the same material before placing bedding or backfill material on the insulation. The build-up of insulation sheeting shall be done by staggering the joints. An acceptable adhesive
may be used to retain the individual sheets in the final specified dimensions. The Engineer of Record or Contractor shall request to use insulation and obtain approval for use from the Engineer.

14. Fire Hydrants and Auxiliary Valves: Fire Hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the street, with the pumper nozzle facing the street. At intersections, the pumper nozzle shall face the higher classification street. Hydrants shall be set with the bottom of the breaker flange 2 inches above the finished ground elevation as shown on the Standard Details, resulting in the centerline of the lowest nozzle being at least 18 inches above finished grade. In no case shall hydrants be set closer than 4 feet from curb or edge of pavement, measured from outside of hydrant barrel to back of curb or edge of pavement. In cases where a fire hydrant needs to be rotated or an extension needs to be installed, City Utility maintenance staff shall perform the work.

The Contractor shall set each fire hydrant on a 8 inch x 12 inch precast concrete pad with a 4 inch thickness and shall place a minimum of 1/3 cubic yard of Type 2 Foundation Material around the lower part of the hydrant to at least six (6) in. above the drain port to provide a drainage area for the hydrant barrel. The Contractor shall insure that the drain port at the base of the hydrant is open to allow for the hydrant to drain properly when closed. Cast in place concrete may be used in lieu of the pre-cast pad if the hydrant lead is not charged for at least 48 hours and the drainage ports are maintained.

The hydrant barrel shall be poly wrapped to the ground surface and the poly wrap shall not cover up the weep holes.

An appropriately sized thrust block shall be installed between the hydrant valve chamber and the undisturbed trench wall. The thrust block shall meet the thrust block specifications herein.

An auxiliary valve matching the size of the fire hydrant lead and a valve box shall be installed on the fire hydrant lead. Auxiliary valves shall be installed as detailed on the standard plate and shall be placed on a precast concrete block, or shall be fitted with a joint restraining device as approved by the Engineer. Cast in place concrete may be used in lieu of the pre-cast pad if the hydrant and hydrant lead are not charged for 48 hours, and 4 hours cure time is allowed before backfilling. If the auxiliary valve needs to be moved away from the fire hydrant to avoid a conflict it may be moved up to five (5) feet away from the hydrant.

Tracer wire conduit shall be attached to the fire hydrant barrel section prior to backfill. The tracer wire access box may be installed after initial backfill. Refer to Section 8B for tracer wire installation requirements.

Refer to Section 8A.2 "Materials" for further information regarding the use of hydrant extensions.
Fire hydrant lead shall mean that portion of the hydrant branch line from the main to the auxiliary valve.

15. **Valves:** Valve interiors and adjacent piping shall be cleaned of foreign material prior to making valve to pipe connection. Pipe/valve joints shall be straight and without deflection. All valves shall be placed on a precast concrete anchor block and centered on the valve. Valves shall be backfilled with Type 1 bedding material to one (1) foot above the valve. The Contractor shall check all operating mechanisms for proper functioning; valves, which do not operate easily or are otherwise defective, shall be replaced at the Contractor’s expense.

Valves placed on dead-ends of mains with less than the required “L” length of pipe extending beyond the valve shall be restrained using the appropriate “joint restraining devices”.

16. **Valve Boxes:** Valve boxes shall be installed straight and plumb directly over the valve stem and shall not be placed in direct contact with the valve. The top of the valve box shall be placed flush to ¼ inches below flush with the surfacing in paved or graveled areas and 1 inch - 2 inches above finished grade in grass surfaced areas. Where the Drawings indicate that the future grade at the valve location will be higher or lower than the existing grade at the time of valve installation, the Contractor shall provide the correct combination of extension pieces so that the valve box can be adjusted to the future finished grade without replacing the valve box.

A Valve Box Adaptor shall be installed on the valve bonnet prior to installing the valve box.

17. **Tapping Tees for taps 4 inches and larger:** Where new 4 inch or larger service lines or mains are to be connected to a main, the Contractor shall furnish all material necessary for connection to the water main, as specified herein. The tapping tee shall be assembled in accordance with the manufacturer’s instructions. Tapping sleeves shall be supported independently from the pipe prior to tapping and shall be provided with thrust restraint as specified for other fittings. All tapping tees, which are not epoxy coated or non-corrosive material, shall be poly wrapped.

City Utility maintenance will perform all taps and the Contractor shall schedule all 4 inch and larger taps between 7:30 AM and 12:30 PM, Monday through Thursday, or as alternately scheduled by the City Utility Maintenance Department.

The Contractor shall obtain and pay for all applicable permits and tapping fees. If a tap is for a 4 inch or larger service line reconnection, then the new account set-up fee will be waived.

18. **Corrosion Protection:** shall be completed per Section 8B – Corrosion Protection for Plastic Pipe Systems or as outlined in the Detailed Specifications.
19. **Dewatering:** Shall be accomplished per Section 11 Utility Excavation and Backfill.

F. **Disinfection:**

1. **General:**

   Disinfection shall comply with the requirements of AWWA C600, C605, and C651. All new water mains and appurtenances shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination shall be disinfected before they are returned to service.

2. **Preventative Methods:**

   The tablet method specified below may be used only if the pipes and appurtenances are kept clean and dry during construction. Therefore, the Contractor shall take precautions to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material.

   If dirt enters the pipe, it shall be removed and the interior of the pipe surface swabbed with a 1%-5% hypochlorite disinfecting solution. If, in the opinion of the Engineer, the dirt remaining in the pipe will not be removed by flushing, the Contractor shall clean the interior of the pipe by mechanical means, such as a hydraulically propelled foam pig. Following mechanical cleaning the Contractor shall flush the line achieving minimum flushing velocities of at least 3.0 ft/s and shall then disinfect the pipe using either the continuous-feed or the slug method. Flushing a completed main will not be allowed as a method of cleaning sediment allowed to enter the pipe during construction.

   All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. If water accumulates in the trench, the plugs shall remain in place until the trench is dry. If, for any reason, the water main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to floodwater shall then be filled with chlorinated potable water that, at the end of a 24-hour holding period, will have a free chlorine residual of not less than 25 mg/l. The chlorinated water shall then be flushed from the main and after construction is completed, the main shall be disinfected using the continuous-feed or slug method.

3. **Disinfectant:**

   Unless specified otherwise in the Detailed Specifications or on the Drawings, or required by other provisions of this specification, disinfection shall be accomplished by the tablet method. The Contractor shall obtain
the Engineer’s approval prior to using a method other than the tablet method.

This method requires that the pipes and appurtenances be kept clean and dry. This method may not be used if the pipes and appurtenances are not kept clean and dry and in the event this happens, the Engineer must be contacted.

Tablets shall be 5-gram calcium hypochlorite tablets conforming to AWWA B300 and shall contain between 65 and 70 per cent available chlorine. Tablets shall be fresh and shall be stored in a cool, dry, and dark environment to prevent loss of strength, which occurs upon exposure to the atmosphere.

Do not use calcium hypochlorite intended for swimming pool disinfection, as this material has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time has been achieved.

4. Dosage:

Unless otherwise specified, the Contractor shall place hypochlorite tablets in each section of water pipe installed, including the hydrant branch, according to Table 8-1, below.

Table 8A-1

NUMBER OF 5-GRAM CALCIUM HYPOCHLORITE TABLETS REQUIRED

(50 mg/l Dose)

<table>
<thead>
<tr>
<th>Length of Pipe Section (Ft.)</th>
<th>Diameter of Pipe (In.)</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 or less</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>13 - 18</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>18 - 20</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>20 - 30</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>30 - 40</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>14</td>
<td>18</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

For Pipes 18 inches and larger refer to drawings or detailed specifications for disinfection requirements. The Engineer of Record is responsible for establishing the disinfection requirements for pipes 19 inches and larger.

5. Placing Tablets:

Tablets shall be adhered to the inside top section of each pipe length using a food-grade adhesive. Adhesives shall meet the requirements of a food-grade adhesive per either NSF/ANSI 51-2005: Food Equipment Materials or NSF/ANSI 61-2005: Drinking Water System Components –
Health Effects. NSF/ANSI 61 lists several adhesives that are approved for drinking water contact. It is recommended to use an adhesive that sets quickly and isn’t reactive with the water main’s composition or with the disinfectant tablet. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the pipe section to indicate the pipe has been installed with the tablets at the top.

6. Filling and Contact:

The water main shall be filled slowly so that the water velocity is no greater than one foot per second. Precautions shall be taken to assure that air pockets are eliminated. The water shall be allowed to stand in the pipe for at least 24 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service. The chlorinated water shall remain in the pipe for at least 24 hours. The Contractor shall notify the Engineer at the end of the 24-hour retention period prior to flushing to allow the Engineer to check the chlorine residual in the pipe. If the chlorine residual is less than 25 mg/l, the Contractor shall, at his expense, disinfect the water main again by the continuous-feed method or the slug method, as approved by the Engineer.

7. Flushing:

Within 48 hours of the end of the 24-hour retention period, the Contractor shall flush the heavily-chlorinated water from the main until the chlorine concentration in the water leaving the main is no higher than that prevailing in the system or is less than 1 ppm as determined by the Engineer. In addition to the above requirements, a minimum flushing velocity of 3 feet per second and flushing duration of one minute per 100 feet of pipe being flushed shall be achieved per Table 8.2.

Flushing shall be done in accordance with AWWA C651. Flushing shall be accomplished through use of hydrants or temporary fittings installed for the purpose; flushing through corporations and/or water service lines is prohibited. The Contractor shall obtain the Engineer's approval prior to installing special fittings for flushing.

Flushing shall be conducted in such a way as to prevent contamination of existing water mains and/or water service lines and to minimize traffic and pedestrian hazards and nuisance conditions. When possible, flushing shall be to the nearest storm sewer or drainage way. Flushing to the sanitary sewer is prohibited.

The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact SD DENR Surface Water Quality Program at (605) 773-3351. Refer to section below, “Disposal of
Chlorinated Water” for additional information regarding neutralizing chlorine residual.

A velocity in the main of at least 3.0 fps shall be attained during flushing. The flushing shall proceed until the chlorine concentration in the water leaving the main is no higher than that prevailing in the system or is less than 1 ppm as determined by the Engineer. In no case shall the flushing duration be less than that indicated in Table 8A.2.

Table 8A-2

REQUIRED FLOW AND MINIMUM FLOW DURATION TO FLUSH PIPELINES

<table>
<thead>
<tr>
<th>Pipe Diameter (In.)</th>
<th>Flow required to produce 3.0 fps Velocity in Main*</th>
<th>Fire Hydrants</th>
<th>Minimum Flushing Duration (minutes per 100 feet of pipe)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gpm</td>
<td>Number of Fire Hydrants</td>
<td>Outlet Size (In.)</td>
</tr>
<tr>
<td>4</td>
<td>120</td>
<td>1</td>
<td>2-1/2</td>
</tr>
<tr>
<td>6</td>
<td>280</td>
<td>1</td>
<td>2-1/2</td>
</tr>
<tr>
<td>8</td>
<td>480</td>
<td>1</td>
<td>2-1/2</td>
</tr>
<tr>
<td>10</td>
<td>740</td>
<td>1</td>
<td>2-1/2</td>
</tr>
<tr>
<td>12</td>
<td>1100</td>
<td>2</td>
<td>2-1/2</td>
</tr>
<tr>
<td>14</td>
<td>1450</td>
<td>2</td>
<td>2-1/2</td>
</tr>
<tr>
<td>16</td>
<td>1950</td>
<td>3</td>
<td>2-1/2</td>
</tr>
</tbody>
</table>

Table 8A-2 shows the rates of flow required to produce a velocity of 3.0 fps in pipes of various sizes and the minimum flushing duration per 100 feet of pipe length.

For pipes 18 inches and larger refer to drawings or detailed specifications for flushing requirements.

* Requires a minimum 40-psi pressure in the main and the hydrant flowing to atmosphere.

** Assumes that the corresponding flow rate is being met.

Per AWWA C651, the Contractor shall sample for coliform bacteria contamination. After the water lines have been flushed, the contractor shall sample the lines. Two consecutive samples of water from the end of the disinfected/flushed line must be collected at least 24 hours apart. These samples must be submitted to the State Health Laboratory in Pierre, or other laboratory acceptable to the SD DENR and the Engineer. The samples must show the absence of coliform bacteria contamination before any taps may be made to the main or the main is activated and placed into service. Copies of all sample results shall be submitted to the Engineer within 48 hours of receipt thereof.
Because of the high risk of contamination during sampling, the Contractor shall use certified lab personnel or a trained sampler to collect all samples submitted for testing.

8. Disposal of Chlorinated Water:

When, in the opinion of the Engineer or Contractor, the potential exists for chlorinated water to reach a stream, river, or waterway, the Contractor shall apply a neutralizing chemical to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water as listed in Appendix B of AWWA C651. The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact SD DENR Surface Water Quality Program at (605) 773-3351.

G. Pressure and Leakage Test for Mains and service lines 4 inches or larger:

1. General:

Pressure and leakage tests shall be performed on all newly installed water mains. The “Simultaneous Pressure and Leakage Tests” will be used unless otherwise specified. The testing methods specified in this section are specific for water pressure testing only; air pressure testing is prohibited due to the catastrophic nature of failure should failure occur.

Refer to Section 8A.3.D “Water Main and Sewer Main/Storm Sewer Separation” for air testing requirements for Sewers when a Sewer test is required because of horizontal separation requirements.

2. Test Restrictions:

The pressure shall be 150% of the working pressure at the point of test, but not less than 125% of normal working pressure at the highest elevation, whichever is greater. Test pressure shall not exceed pipe, valve, or thrust-restraint design pressures and shall not vary by more than 5 psi (plus or minus) for the duration of the test. The duration of the hydrostatic test shall be a minimum of two (2) hours.

The Contractor shall anticipate the need to conduct multiple tests in areas of varying topography and shall conduct testing in such a manner and sequence that the pressure requirements indicated above are achieved.

3. Pressurization:

Before applying the specified test pressure, each valved section of pipe to be tested shall be slowly filled with potable water and all air expelled from the pipe, valves, fittings, and hydrants. Where City water is not available, the Contractor shall furnish sufficient potable water to fill and test the pipe. The specified test pressure, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test
gauge, shall then be applied by means of a suitable pump connected to the pipe in a manner satisfactory to the Engineer and shall be sustained for the specified time.

The test pump shall be equipped with two (2) accurate pressure gauges, between the pump shut-off valve and water main being tested, both to show the line pressure reading during testing. When hydrants are in the test section, the test shall be made against closed hydrant valves. Pressure gauges shall have graduation marks, at minimum, for every 2 psi and be capable of interpreting pressure readings within 1 psi. The pressure reading deviation between the two pressure gauges shall not be greater than 2.0 psi. During the pressure test the pressure loss indicated between the two gauges shall not deviate more than 0.5 psi between the two gauges.

4. **Leakage** shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within five (5) psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by the drop in pressure for a test section over a period of time.

5. **Allowable Leakage for PVC Pipe and Ductile Iron Pipe:**

The PVC pipe shall be pressure and leakage tested in accordance with AWWA C605. The Ductile Iron pipe shall be pressure and leakage tested in accordance with AWWA C600. No pipe installation, PVC pipe or ductile iron pipe will be accepted if the leakage is greater than that indicated in Table 8A-3.

<table>
<thead>
<tr>
<th>Pipe Dia. (in.)</th>
<th>50 psi (gph)</th>
<th>Average Test Pressure (PSI)</th>
<th>100 psi (gph)</th>
<th>150 psi (gph)</th>
<th>200 psi (gph)</th>
<th>250 psi (gph)</th>
<th>300 psi (gph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.19</td>
<td>0.27</td>
<td>0.33</td>
<td>0.38</td>
<td>0.43</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.29</td>
<td>0.41</td>
<td>0.50</td>
<td>0.57</td>
<td>0.64</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.38</td>
<td>0.54</td>
<td>0.66</td>
<td>0.76</td>
<td>0.85</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.48</td>
<td>0.68</td>
<td>0.83</td>
<td>0.96</td>
<td>1.07</td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.57</td>
<td>0.81</td>
<td>0.99</td>
<td>1.15</td>
<td>1.28</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>0.67</td>
<td>0.95</td>
<td>1.16</td>
<td>1.34</td>
<td>1.50</td>
<td>1.64</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.76</td>
<td>1.08</td>
<td>1.32</td>
<td>1.53</td>
<td>1.71</td>
<td>1.87</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.86</td>
<td>1.22</td>
<td>1.49</td>
<td>1.72</td>
<td>1.92</td>
<td>2.11</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.96</td>
<td>1.35</td>
<td>1.66</td>
<td>1.91</td>
<td>2.14</td>
<td>2.34</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1.15</td>
<td>1.62</td>
<td>1.99</td>
<td>2.29</td>
<td>2.56</td>
<td>2.81</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>1.43</td>
<td>2.03</td>
<td>2.48</td>
<td>2.87</td>
<td>3.21</td>
<td>3.51</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>1.72</td>
<td>2.43</td>
<td>2.98</td>
<td>3.44</td>
<td>3.85</td>
<td>4.21</td>
<td></td>
</tr>
</tbody>
</table>

6. **Acceptance** shall be determined on the basis of allowable leakage. If any test of installed pipe discloses leakage greater than that specified in Table
8A-3, the Contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance. All visible leaks shall be repaired, regardless of the amount of leakage.

Any damaged or defective pipe, fittings, valves, hydrants, or joints discovered following the pressure test shall be repaired or replaced with approved material at the Contractor's expense, and the test shall be repeated until it is within the specified allowance.

7. **Example** - A pipe segment is required to be tested at 140 psi. At the start of the test, pressure gauge #1 indicates an initial pressure of 141 psi and pressure gauge #2 indicates an initial pressure of 143 psi. Both gauges are recording the test pressure within 2 psi and therefore the test may proceed. After completing the two-hour test duration, pressure gauge #1 indicates a pressure of 134 psi and pressure gauge #2 indicates a pressure of 136.5 psi. The pressure drop for pressure gauge #1 is 7 psi and the drop for pressure gauge #2 is 6.5 psi. The two gauges record a pressure drop within 0.5 psi of each other therefore the deviation of the pressure reading between the two gauges is acceptable.

If the pressure test had indicated a pressure loss of less than 5 psi then the "Pressure and Leakage Test" would have been considered as passing. Because in this example, the pressure loss is more than 5 psi, the Contractor may elect to re-pressurize the system and repeat the two-hour test or the Contractor may elect to measure the quantity of water required to pressurize the pipe segment so that the pressure loss is less than 5 psi. For this example if the quantity of water required to pressurize the pipe segment so that pressure gauge #1 indicates a pressure of 137 psi (loss of 4 psi) and pressure gauge #2 indicates a pressure of 137.5 psi (loss of 4.5 psi), is within the quantity of water allowed per Table 8A-3 then the test would be considered as passing without having to repeat pressure test for two-hours.

H. **Pressure and Leakage Test for Service Lines less than 4 inches:**

Pressure and leakage tests shall be performed on all newly installed copper water service lines if the service line has one or more couplings installed between the corporation and the curb stop and/or one or more couplings installed between the curb stop and the Property Water Distributing System. The testing method shall be as specified in the National Standard Plumbing Code with the exception that air pressure testing is prohibited.
I. Water Main Closures and Temporary Service:

1. Water Main Closures shall be scheduled to minimize the inconvenience to the public. Consequently, water main closures shall be scheduled, between 8:00 A.M. and 4:00 P.M. Monday through Thursday, when possible. Short duration closures (closures scheduled to last no longer than two hours) may be scheduled on Friday between the hours of 8:00 AM and 11:30 AM. Water main closures scheduled to begin prior to or continue beyond those times listed above, will require approval from the Engineer. In any case, water main closures will not be allowed until the Engineer gives his approval.

The Contractor shall obtain notification of closure cards from the Engineer and shall hand-deliver the closure cards to affected properties at least 48 hours prior to closure of any water main, unless a shorter time of notice is approved by the Engineer.

2. Operation of Valves: Only City personnel shall operate valves on existing water mains. The Contractor may operate valves on newly installed water mains that are under his control, until such time as, they are accepted by the City for operation and maintenance.

3. Temporary water service for private residences affected shall be provided by the Contractor when the water main closure will exceed eight (8) hours. The Contractor shall provide temporary water service for businesses upon request, regardless of the length of closure. When temporary service is to be provided to businesses, the Contractor shall obtain the name and phone number of a responsible contact person at each affected business and submit the information to the Engineer at least 48 hours prior to closure.

J. Abandonment and/or Salvage of Water Main and Appurtenances:

1. Water Mains:

The Contractor shall seal all open ends of water mains to be abandoned with a concrete plug having a length equal to the diameter of the pipe being plugged.

2. Fire Hydrants:

Fire hydrants and auxiliary valves are to be removed and salvaged, unless indicated otherwise on the drawings or Detailed Specifications, and shall be delivered by the Contractor to the City Utility Maintenance Shop on Steele Avenue in good working condition. Any damage to the hydrant and/or appurtenances as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.
3. **Valves:**

Unless indicated otherwise on the drawings or Detailed Specifications, valves are to be removed, salvaged, and delivered by the Contractor to the City Utility Maintenance Shop on Steele Avenue in good working condition. Any damage to the valve as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

4. **Valve Boxes:**

The Contractor shall close the valve, remove and salvage the top sections of those water main valve boxes marked on the plans to be abandoned and shall deliver them to the City Utility Maintenance Shop on Steele Avenue. The resulting holes shall be backfilled and compacted to meet the requirements of these specifications and shall be resurfaced with the appropriate material; i.e. seed, sod, asphalt, concrete, etc.

5. **Others:**

When the drawings indicate items are to be removed or salvaged, the Contractor shall deliver the items to the City Utility Maintenance Shop on Steel Avenue in good working condition. Any damage to the items as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City. Unless an item is indicated as salvaged, the item will be considered a Contractor obligation to remove and dispose of.

K. **Service Lines and Fittings:**

1. **Permits,** obtainable from the City Utility Maintenance Division, will be required for all connections to the Rapid City water system.

2. **Service pipe:** Copper pipe shall be laid with sufficient waving as to prevent rupture in settlement. A "goose-neck" shape shall be constructed in the copper pipe leading from the corporation stop. Copper splicing couplings shall be as described in this specification. PVC and ductile iron service pipe shall be laid as specified herein for water mains. Minimum cover depth for water service lines shall be six (6) feet. A ten (10) foot horizontal separation shall be maintained between water service and sewer service lines.

3. **Service saddles** shall be installed for all connections to water mains. Unless specified otherwise on the Drawings or Detailed Specifications, the Contractor shall furnish and install all service saddles.

4. **Corporation stops** shall be provided by the Contractor, except for 1 inch corporation stops, which the City provides. The Contractor shall communicate the water main material type to Utility Maintenance at the time a tap is requested. Corporation stops that are used to connect copper water services to metallic water mains shall be the isolator style.
City personnel, in all cases will tap the main and install all corporation stops. If a Contractor is installing a copper water service on private property but is not replacing the service to the main and the copper water services connects to a metallic water main then an insulating union for copper water services shall be installed near the curb stop or at the location where the new copper connects to the existing copper. This is only required for copper water services connecting to metallic mains.

5. **Service lines larger than 2 inches diameter shall be connected to the main with either an appropriately sized tapping sleeve and valve or a ductile iron tee as specified for water main fittings elsewhere in these specifications.**

6. **Curb stops and boxes shall be installed on all service lines and shall be located entirely within the public Right of Way.** The curb stop and box shall be located between one and seven feet from the property line, unless otherwise approved by the Engineer. If any curb box is closer to the property line than 0.9 feet or farther from the property line than 7.1 feet, measured to the center of the box, then the box shall be reset to within the allowable tolerance. Curb boxes shall be installed straight and plumb directly over the curb stop. The top of the curb box shall be placed flush to ¼ inch below flush with the surfacing in paved or graveled areas and 1 - 2 inches above finished grade in grass surfaced areas. Where the Drawings indicate that the future grade at the curb box will be higher or lower than the existing grade at the time of installation, the Contractor shall provide a curb box that is applicable for the future finished grade without having to replace the curb box.

7. **Water Service New Connections:** Where new service lines are to be installed for undeveloped property or future buildings or additional services added to an existing building, the Contractor shall furnish all materials necessary for connection of new service lines to the water main, except 1 inch corporation stops, as specified herein and shall obtain and pay permits and tapping fees as established by Ordinance.

   Where the new service line is terminated, the service line shall be capped and plugged water tight to prevent leakage if the curb stop is inadvertently opened. New service connections shall have curb stops left turned off at the time of installation and the termination point shall be marked with a minimum three (3) foot long steel fence post. The steel post shall be buried below the surface at least eight (8) inches. The post needs to be steel to facilitate location by magnetic locators.

   City personnel shall tap all city water mains, the Contractor shall schedule all service taps between 7:30 AM to 3:00 PM, Monday through Friday.

   Water Service New Connections for service lines 4 inches or larger shall be made as described in the section for tapping tees.

   8. **Water Service Reconnections:** The Contractor shall furnish all materials necessary for reconnecting service lines existing prior to reconstruction of
a water main, except 1 inch corporation stops as specified herein. On City projects, all permits and tapping fees will be waived; however, the Contractor shall obtain a no-charge permit to work in the right-of-way from the City Utility Maintenance Group.

On non-City projects, the new account set-up / inspection permit (tap permit) will be waived. However, the Right-to-Work permit and tapping fees are still applicable.

City personnel shall tap all city water mains, the Contractor shall schedule all service taps between 7:30 AM to 3:00 PM, Monday through Friday.

Water service reconnections for service lines 4 inches or larger shall be made as described in the section for tapping tees.

9. Inspection: All water service installations, regardless of whether or not the service is located on private property or in public ROW, shall be inspected by the City Utility Maintenance Group prior to the Contractor backfilling the trench. The Contractor shall notify the City Utility Maintenance Group a minimum of four (4) hours prior to the time he needs the inspection. Any trench backfilled without being inspected and approved by authorized City personnel shall be re-excavated by the Contractor to expose the work for the required inspection. Discrepancies shall be corrected by the Contractor and re-inspected by City personnel.

L. Acceptance of Curb Stops and Main Valves:

As a condition for project acceptance, all curb stops and water main valves within the project boundaries shall be in proper operating condition. City personnel will inspect and operate each curb stop and water main valve as part of the final inspection. The Contractor shall correct any deficiencies discovered during the inspection.

8A.4 METHOD OF MEASUREMENT

A. Water Main and Service Line Pipe:

Installed pipe quantities shall be determined by measuring from centerline to centerline of all pipe and fittings. Measurements shall be to the nearest whole foot.

a. Water Main Fittings and Couplings:

Fittings furnished and installed shall be counted on a per each basis. Measurement for concrete thrust blocks, cable and rods, and other thrust restraint will not be made; such work shall be incidental to the respective work item.

C. Valves:
Valves shall be counted on a per each basis. Valve boxes shall be included with the valves as a complete unit.

D. Fire Hydrant and Auxiliary Valve:

Fire hydrants will be counted on a per each basis. Auxiliary valve, valve box and pipe between the auxiliary valve and hydrant shall be included with the hydrant as a complete unit; no separate measurement and payment will be made for pipe between the auxiliary valve and the hydrant and for auxiliary valves and boxes.

E. Fire Hydrant Lead:

The water main pipe for the hydrant lead (branch) from the main to the Auxiliary Valve shall be paid for at the unit price bid for the appropriate size pipe.

F. Fire Hydrant Extensions:

Fire hydrant extension quantities shall be determined by measuring the vertical length of the extension. Measurement shall be to the nearest half foot.

G. Abandonments:

No separate measurement will be made for abandonment of water mains, valves and boxes, or salvaging hydrants, auxiliary valves and boxes; such work will be incidental to the project unless otherwise specified.

H. Water Service New Connections and Reconnections:

Water service reconnections and new water service connections will be counted on a per each basis.

The pipe used for reconnections and connections shall be measured and paid for under the bid item for water service pipe.

I. Service Saddles:

Service saddles furnished and installed will be counted on a per each basis.

J. Service Corporation Stops:

Service corporation stops furnished by the Contractor will be counted on a per each basis. No measurement will be made for service corporation stops furnished by the City.
K. Curb Stops and Boxes Installed, Adjusted or Abandoned:

Curb stops and boxes furnished and installed, adjusted, or abandoned will be counted on a per each basis.

L. Water Main Insulation:

Measurement for water main insulation will be made on a square foot basis to the nearest square foot.

M. Water Main Encasement:

Measurement for water main encasement will be made on a per each basis, furnished and installed, for each encased crossing with lengths as noted on the Drawings.

N. Thrust Blocks and Joint Restraints:

No separate measurement will be made for thrust blocks or joint restraint devices, such work will be incidental to the pipe.

O. Polyethylene Encasement:

No separate measurement will be made for polyethylene encasement such work will be incidental to the pipe and fittings.

P. Water meter pits:

Water pits furnished and installed will be counted on a per each basis.

Q. Tapping Tee (Includes sleeve and valve):

Tapping tees furnished and installed will be counted on a per each basis.

S. Water Main Lowering:

Water main lowerings including, all materials, restraints, and low strength concrete for the complete installation shall be included in the bid item for water main lowering. Water main lowerings shall be counted on a per each basis.

T. Abandon valve:

Abandon valve shall be counted on a per each basis.

U. Adjust Valve Box:

Adjust valve box shall be counted on a per each basis.
V. New Water Main Connections:

New water main connections shall be counted on a per each basis. The bid item, New Water Main Connections, is intended for use where a tapping tee cannot be used and where an in-line tee must be cut into an existing main or where a cap/plug with thrust block must be removed prior to connecting.

8A.5 BASIS OF PAYMENT

A. Water Main Pipe:

Payment will be at the unit price bid for the appropriate size of water pipe, furnished and installed, including trenching, excavation, Type 1 bedding material, compacting, backfilling, dewatering, sheeting or shoring, pressure and leakage testing, disinfection, and, for ductile iron pipe, polyethylene encasement. Unless otherwise specified, no extra payment will be made for excavation deeper than that required to provide minimum specified cover. The cost of providing temporary water service and plugging abandoned water mains shall be incidental to the project.

B. Water Main Fittings and Couplings:

Payment will be made at the unit price bid for the appropriate fitting, furnished and installed, including polyethylene encasement, and thrust blocks and/or restraints.

C. Valves:

Payment will be made at the unit price bid for the appropriately sized valve, furnished and installed, including valve box, polyethylene encasement, concrete pad, and thrust restraint.

D. Fire Hydrant and Auxiliary Valve:

Payment will be made at the unit bid price, complete, furnished and installed, including trenching, excavation and backfilling, dewatering, sheeting or shoring, and disinfection. The bid price shall include the auxiliary valve and box.

E. Fire Hydrant Extension:

When a fire hydrant extension is necessary due to no fault of the Contractor, as specified herein, payment will be made under the bid item for the fire hydrant extension per price bid. City personnel shall install all Fire Hydrant Extensions.

However, if the hydrant could have been installed or ordered with the correct barrel length such that an extension was not necessary, the Contractor shall furnish and install a new Fire Hydrant with the correct barrel length. Hydrant Extensions in these cases will not be permitted.
F. Abandonments:

No separate measurement will be made for abandonment of water mains, valves and boxes, or salvaging hydrants, auxiliary valves and boxes; such work will be incidental to the project.

G. Water Service Lines:

Payment will be made at the unit price bid for the appropriately sized pipe, furnished and installed, including trenching, excavation and backfilling, compacting, dewatering, and sheeting or shoring. The cost for any connections between the new service line and existing service lines shall be included in the unit price bid for the appropriate sized pipe.

H. Service Saddles:

Payment will be made at the unit price bid for the appropriately sized service saddle, furnished and installed.

J. Service Corporation Stops:

Payment for Contractor furnished corporation stops will be made at the unit price bid for the appropriately sized corporation stops. No payment will be made for one inch corporation stops, which shall be furnished by the City Utility Maintenance Group. The Utility Maintenance Group will also furnish one-inch isolator/insulated corporation ball valves when required.

J. Curb Stops and Boxes:

Payment will be made at the unit price bid for the appropriately sized curb stop and box, complete, furnished and installed.

K. Water Service New Connection:

Payment will be made at the unit price bid for connecting new water services up to two (2) inches in diameter to the new water main, including fittings necessary to connect the service line to the corporation stop. The cost of connecting water service lines two (2) inches or greater shall be included in the unit price bid for the fitting required to connect the service lines to the water main. Payment for Water Service New Connection shall include Right to Work permit, New Account Setup/Inspection permit (tap permit) and tapping fees, unless otherwise specified in the Detailed Specifications.

L. Water Service Reconnection:

Payment will be made at the unit price bid for reconnecting existing water services up to two (2) inches in diameter to the new water main, including fittings necessary to reconnect the service line to the corporation stop. The cost of reconnecting water service lines two (2) inches or greater shall be included in the unit price bid for the fitting required to connect the service
lines to the water main. On City projects, all permits and tapping fees will be waived. On non-City projects the New Account Setup/Inspection permit will be waived, however the Right-to-Work permit and tapping fees are still applicable.

M. Water Main Lowering:

Payment will be made at the unit price bid for lowering water main, including appropriate size pipe restraints, fittings, low strength concrete, and incidentals necessary to complete the work. Water main lowering shall be that, which is physically lowered vertically with the horizontal location not changed more than five (5) feet from original.

N. Water Main Encasement:

Payment will be made at the bid price, furnished and installed, including materials, temporary blocking and restraint of the pipe, and incidentals necessary to complete the work.

O. Water Main Insulation:

Payment will be at the bid price for water main insulation furnished and installed, including cushion material.

P. Meter Pit:

Payment for meter pits will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials, including castings, precast or cast-in-place floors, precast manhole sections, and incidentals necessary to complete the item.

Q. Tapping Tees:

Payment for tapping tees will be at the bid price per each including sleeve and valve, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item. The Contractor shall include payment for the “right to work” Permit, (tap permit), if applicable, and tapping fees in this bid item.

R. Abandon Valve:

Payment for abandoned valve will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.
S. Adjust Valve:

Payment for adjusted valve will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.

T. New Water Main Connection:

Payment for new water main connection will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.

END OF SECTION
# RAPID CITY STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

## SECTION 8B - CORROSION PROTECTION - PLASTIC PIPE SYSTEMS

### INDEX OF OCTOBER 2016 SPECIFICATION REVISIONS

<table>
<thead>
<tr>
<th>Section #</th>
<th>Section Title</th>
<th>Original Section Starting Page #</th>
<th>2016 Section Starting Page #</th>
<th>Revision Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>Work Included</td>
<td>8B.1</td>
<td>8B.1</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>1.02</td>
<td>Related Work</td>
<td>8B.1</td>
<td>8B.1</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>1.03</td>
<td>Reference Standards</td>
<td>8B.1</td>
<td>8B.1</td>
<td>Updated References</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Removed References NEMA WC 3-80, WC 5-73 and WC 7-88 and Replaced with NEMA WC 70-09 / ICEA S-95-658-09</td>
</tr>
<tr>
<td>1.04</td>
<td>Definitions</td>
<td>8B.3</td>
<td>8B.3</td>
<td>Added Mechanical Damage Protection</td>
</tr>
<tr>
<td>1.05</td>
<td>Submittals</td>
<td>8B.5</td>
<td>8B.6</td>
<td>Added Item G.4.a) as-constructed location requirement for record drawings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added Item I.4. as-constructed wire labeling, color coding and functional test results submittal to Engineer</td>
</tr>
<tr>
<td>1.06</td>
<td>Quality Assurance</td>
<td>8B.7</td>
<td>8B.7</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>1.07</td>
<td>Observation of Work</td>
<td>8B.7</td>
<td>8B.8</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>1.08</td>
<td>Record Drawings</td>
<td>8B.7</td>
<td>8B.8</td>
<td>Added Item A.4. as-constructed location requirement for record drawings.</td>
</tr>
<tr>
<td>1.09</td>
<td>Special Guarantee</td>
<td>8B.8</td>
<td>8B.9</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.01</td>
<td>General</td>
<td>8B.9</td>
<td>8B.10</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.02</td>
<td>Material Suppliers</td>
<td>8B.9</td>
<td>8B.10</td>
<td>Revised supplier information</td>
</tr>
<tr>
<td>2.03</td>
<td>Wires</td>
<td>8B.9</td>
<td>8B.10</td>
<td>Added Item A.2 to generally state wire insulation type and voltage rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Revised wire insulation type throughout Section 2.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>Section #</td>
<td>Section Title</td>
<td>Original Section Starting Page #</td>
<td>2016 Section Starting Page #</td>
<td>Revision Description</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------------</td>
<td>----------------------------------</td>
<td>------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2.04</td>
<td>Thermite Weld Materials</td>
<td>8B.12</td>
<td>8B.14</td>
<td>Modified Item E.2 to allow 15 gram charges</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.05</td>
<td>Thermite Weld Repair Coating</td>
<td>8B.16</td>
<td>8B.18</td>
<td>Revised Item M. weld material suppliers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Table B.2 modified materials</td>
</tr>
<tr>
<td>2.06</td>
<td>Easy Bond Pin Brazing</td>
<td>8B.17</td>
<td>8B.18</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.07</td>
<td>Ground Clamps</td>
<td>8B.17</td>
<td>8B.19</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.08</td>
<td>Galvanic Anodes</td>
<td>8B.18</td>
<td>8B.19</td>
<td>Item A.4 modified materials supplier information</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Item C.1. removed reference to 10-foot anode lead and revised text to &quot;provide anode lead lengths as required...&quot;</td>
</tr>
<tr>
<td>2.09</td>
<td>Cathodic Protection Test Stations</td>
<td>8B.21</td>
<td>8B.23</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.10</td>
<td>Miscellaneous Reference Monitoring Equipment and Materials</td>
<td>8B.22</td>
<td>8B.24</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.11</td>
<td>Conduit, Locknuts and Straps</td>
<td>8B.23</td>
<td>8B.25</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.12</td>
<td>Wire Connections and Splice Materials</td>
<td>8B.24</td>
<td>8B.26</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.13</td>
<td>Plastic Conduit Sheathing</td>
<td>8B.27</td>
<td>8B.30</td>
<td>No Change</td>
</tr>
<tr>
<td>2.14</td>
<td>Location Marking Tags</td>
<td>8B.28</td>
<td>8B.31</td>
<td>No Change</td>
</tr>
<tr>
<td>2.15</td>
<td>Warning Tape</td>
<td>8B.28</td>
<td>8B.31</td>
<td>Inserted Item A. stating that warning tape is to be used on projects where Plan Notes specifically require it.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Item B.3. inserted to provide specifics for water main including labeling and required width</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Item B.3. inserted to provide specifics for cathodic protection cables including labeling and width.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.16</td>
<td>Tracer Wire</td>
<td>8B.29</td>
<td>8B.32</td>
<td>Revised wire insulation type throughout Section 2.16</td>
</tr>
</tbody>
</table>

Revisions Completed 10/2016
Page 2 of 6
## INDEX OF OCTOBER 2016 SPECIFICATION REVISIONS

<table>
<thead>
<tr>
<th>Section #</th>
<th>Section Title</th>
<th>Original Section Starting Page #</th>
<th>2016 Section Starting Page #</th>
<th>Revision Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.17</td>
<td>Insulating Joints</td>
<td>8B.31</td>
<td>8B.37</td>
<td>Added additional information for Bi-metallic Tracer Wire</td>
</tr>
<tr>
<td>2.18</td>
<td>Insulating Floor and Wall Sleeves and Modular Seals</td>
<td>8B.37</td>
<td>8B.42</td>
<td>Revised Item A.5. to provide specifics for tape allowable for attachment of tracer wire to pipe during installation</td>
</tr>
<tr>
<td>2.19</td>
<td>Coating and Lining for Fittings, Incidental Piping and Valves</td>
<td>8B.38</td>
<td>8B.44</td>
<td>Revised Item A.6. for in-line splices only</td>
</tr>
<tr>
<td>2.20</td>
<td>Fasteners (Bolts, Nuts, Washers, etc.)</td>
<td>8B.44</td>
<td>8B.50</td>
<td>Added B.1.a) stating that two different sizes of TWAB may be found on a project</td>
</tr>
<tr>
<td>2.21</td>
<td>Stainless Steel Fabrication and Passivation</td>
<td>8B.46</td>
<td>8B.52</td>
<td>Revised B.1.b) to allow 4-inch flush mounted TWAB for 2-wire (45-mil insulation ) ONLY</td>
</tr>
<tr>
<td>2.17</td>
<td>Insulating Joints</td>
<td>8B.31</td>
<td>8B.37</td>
<td>Revised Item B.1.b(2) added requirement that if colored lids are supplied that they meet APWA standard colors</td>
</tr>
<tr>
<td>2.18</td>
<td>Insulating Floor and Wall Sleeves and Modular Seals</td>
<td>8B.37</td>
<td>8B.42</td>
<td>Added Item B.1.b3) for tracer wire access box acceptable labeling</td>
</tr>
<tr>
<td>2.20</td>
<td>Fasteners (Bolts, Nuts, Washers, etc.)</td>
<td>8B.44</td>
<td>8B.50</td>
<td>Added Item B.1.b(6) for acceptable TWABs</td>
</tr>
<tr>
<td>2.19</td>
<td>Coating and Lining for Fittings, Incidental Piping and Valves</td>
<td>8B.38</td>
<td>8B.44</td>
<td>Added Item B.1.c) TWAB for more than two 45-mil insulation thickness tracer wires OR tracer wire with 100 mil+ insulation</td>
</tr>
<tr>
<td>2.21</td>
<td>Stainless Steel Fabrication and Passivation</td>
<td>8B.46</td>
<td>8B.52</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>Section #</td>
<td>Section Title</td>
<td>Original Section Starting Page #</td>
<td>2016 Section Starting Page #</td>
<td>Revision Description</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------</td>
<td>----------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>2.22</td>
<td>Pipe and Fitting Field Coating Repair Materials</td>
<td>8B.46</td>
<td>8B.52</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.23</td>
<td>Corrosion Test Equipment</td>
<td>8B.48</td>
<td>8B.54</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.24</td>
<td>Manufacturer’s Certifications</td>
<td>8B.49</td>
<td>8B.55</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>2.25</td>
<td>Corrosion Protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.26</td>
<td>Plastic Pipe Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.01</td>
<td>General</td>
<td>8B.49</td>
<td>8B.56</td>
<td>Revised Item D.2. for material storage temperature</td>
</tr>
<tr>
<td>3.02</td>
<td>Material Storage and Handling</td>
<td>8B.50</td>
<td>8B.57</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.03</td>
<td>Pipe Joint and Fitting Bonding</td>
<td>8B.50</td>
<td>8B.57</td>
<td>Removed unnecessary text and made minor typographical</td>
</tr>
<tr>
<td>3.04</td>
<td>Wire Connections</td>
<td>8B.51</td>
<td>8B.58</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.05</td>
<td>Wire Connection Coating</td>
<td>8B.56</td>
<td>8B.63</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.06</td>
<td>Prepackaged Galvanic Anode Installation</td>
<td>8B.56</td>
<td>8B.64</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.07</td>
<td>Test Station and/or Tracer Wire Access Box</td>
<td>8B.59</td>
<td>8B.68</td>
<td>Table 8B.9 Removed 16&quot; to 30&quot; Diameter column and</td>
</tr>
<tr>
<td>3.08</td>
<td>Wire Insulation Repair</td>
<td>8B.63</td>
<td>8B.71</td>
<td>Revised Item E. to provide specifics regarding as</td>
</tr>
</tbody>
</table>

**8B.3 EXECUTION**

- Revised Item D.2. for material storage temperature requirements.
- Minor typographical edits.
- Removed unnecessary text and made minor typographical edits.
- Added Item H.22.a) regarding thermite weld visual inspection and use of different weld batch materials.
- Minor typographical edits.
- Revised Item B.2. tracer wire access box locations to remove 2000' spacing reference.
- Added Item C. as-constructed installation location requirements.
- Minor typographical edits.
- Revised Item E. to provide specifics regarding as-constructed location(s) of wire splices and wire insulation repair.
### RAPID CITY STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

### SECTION 8B - CORROSION PROTECTION - PLASTIC PIPE SYSTEMS

### INDEX OF OCTOBER 2016 SPECIFICATION REVISIONS

<table>
<thead>
<tr>
<th>Section #</th>
<th>Section Title</th>
<th>Original Section Starting Page #</th>
<th>2016 Section Starting Page #</th>
<th>Revision Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.09</td>
<td>Warning Tape</td>
<td>8B.63</td>
<td>8B.71</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.10</td>
<td>Plastic Pipe Tracing Wire</td>
<td>8B.63</td>
<td>8B.72</td>
<td>Added Item B. stipulating electrically continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Revised Item C. (previously Item B.) regarding tracer wire taping.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added Items C.1 and C.2 to provide narrative for taping tracer wire to top of pipe.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Revised Item I. (previously Item H) regarding maximum tracer wire span</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added Item K.4 to clarify tracer wire placement on terminal board</td>
</tr>
<tr>
<td>3.11</td>
<td>Insulated Joints</td>
<td>8B.65</td>
<td>8B.74</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.12</td>
<td>Insulating Wall and Floor Sleeves</td>
<td>8B.69</td>
<td>8B.78</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.13</td>
<td>Electrical Shields</td>
<td>8B.69</td>
<td>8B.79</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.14</td>
<td>Factory and Field Repair Coatings for Piping, Fittings and Accessories</td>
<td>8B.70</td>
<td>8B.79</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.15</td>
<td>Field Coating for Incidental Steel and Ductile Iron Pipe Stub Pieces and Fittings</td>
<td>8B.72</td>
<td>8B.81</td>
<td>Minor typographical edits</td>
</tr>
<tr>
<td>3.16</td>
<td>Functional and Performance Testing</td>
<td>8B.74</td>
<td>8B.84</td>
<td>Revised Item C.3 to update NACE reference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added Item D.4 Potential functional test outcomes to define continuity</td>
</tr>
<tr>
<td>3.17</td>
<td>Final Testing</td>
<td>8B.76</td>
<td>8B.87</td>
<td>Added Item C. Tracer Wire and Access Boxes</td>
</tr>
</tbody>
</table>

### 8B.4 METHOD OF MEASUREMENT

Revisions Completed 10/2016
Page 5 of 6
### INDEX OF OCTOBER 2016 SPECIFICATION REVISIONS

<table>
<thead>
<tr>
<th>Section #</th>
<th>Section Title</th>
<th>Original Section Starting Page #</th>
<th>2016 Section Starting Page #</th>
<th>Revision Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.03</td>
<td>Tracer Wire and Tracer Wire Boxes</td>
<td>8B.77</td>
<td>8B.88</td>
<td>Revised B. &quot;Tracer Wire Access Box - 2-wire&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added C. &quot;Tracer Wire Access Box - Large&quot;</td>
</tr>
<tr>
<td>5.03</td>
<td>Tracer Wire and Tracer Wire Boxes</td>
<td>8B.78</td>
<td>8B.89</td>
<td>Revised B. &quot;Tracer Wire Access Box - 2-wire&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Added C. &quot;Tracer Wire Access Box - Large&quot;</td>
</tr>
</tbody>
</table>

### 8B.5 BASIS OF PAYMENT (No Changes)

This Index of Revisions is provided as a courtesy and is only a general summary of modifications made to Section 8B Corrosion Protection - Plastic Pipe Systems. Users are encouraged to review the complete Section 8B specification section to understand the modifications made with this October 2016 revision.
SECTION 8B
CORROSION PROTECTION – PLASTIC PIPE SYSTEMS

8B.1 GENERAL

1.01 WORK INCLUDED

A. This work consists of furnishing and installing cathodic protection for all water mains, service lines and appurtenances. This includes all equipment, tools, materials, labor and other incidentals to provide a complete system ready for immediate and continuous use. The work includes, but is not limited to the following:

1. Coatings on all ferrous metal (steel, ductile iron, cast iron) piping and fittings;
2. Galvanic anodes, joint bonds, insulating joints, test stations, and tracer wire to form an electrically continuous piping network;
3. Labeling, marking, and testing of cathodic protection system.

1.02 RELATED WORK

A. Not all sections listed in Related Work may be applicable to this contract:

1. Section 7 – General Conditions
2. Section 8A – Water Piping Systems
3. Section 9 – Sanitary Sewer
4. Section 11 – Utility Excavation and Backfill
5. Section 41 – Utility Trench Resurfacing
6. Section 56 – Concrete for Incidental Construction (Class M)
7. Section 90 – Traffic Control
8. Section 112 – Select Granular Backfill
9. Section 200 – Controlled Low Strength Material

1.03 REFERENCE STANDARDS

A. 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
   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
   d) ASTM B843, Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
   e) ASTM G97, Laboratory Evaluation of Magnesium Anode Test Specimens for Underground Application

3. American Water Works Association (AWWA):
   b) AWWA C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
   c) AWWA C210, Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines
   d) AWWA C213, Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
   e) AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines
   f) AWWA C216, Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
   g) AWWA C217, Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
   h) AWWA C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe
   i) AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants
   a) Standard Practice, SP0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   b) Standard Practice, SP0286, Electrical Isolation of Cathodically Protected Pipelines

5. National Electrical Manufacturers Association (NEMA):
   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 70-09 / ICEA S-95-658-09, Power Cables Rated 2000V or Less for the Distribution of Electrical Energy


7. Occupational Safety and Health Administration (OSHA)

8. Underwriters Laboratories (UL) ANSI/UL 467 “Grounding and Bonding Equipment.”

1.04 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, 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 Criteria**: The NACE criteria for protected cathodic protection levels of a minimum of -0.85 volt to a copper/copper-sulfate reference electrode or a 100-millivolt polarization shift or more negative (instant off or IR
accounted for) in accordance with NACE Standard SP0169. Selection of protective criteria per NACE Standard SP0169 to be at Engineer’s discretion.

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

G. **Cathodic Protection Station (CPS):** An impressed current cathodic protection installation location usually consisting of a rectifier and groundbed.

H. **Drain Anode:** A galvanic anode that is installed at foreign pipeline crossing locations with the intent that any interference current be discharged or drained from the affected pipeline by the drain anode.

I. **Electrically Continuous Pipeline:** A pipeline which has a linear electrical resistance equal to or less than the sum of the resistance (ohms) of the pipe plus the maximum allowable bond resistance for each joint as specified in this section.

J. **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°F for No. 12 AWG wire is 1.65 ohms and for No. 10 AWG wire is 1.04 ohms.

K. **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 SP0286.

L. **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.

M. **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.

N. **Fasteners:** To include but not be limited to bolts, nuts, washers, T-bolts, tie-rods, restraining devices, etc.
O. **Foreign Owned:** Any buried pipe or cable not specifically owned or operated by the Owner.

P. **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.

Q. **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.

R. **Lead, Lead Wire, Joint Bonds, Pipe Connecting Wires, Cable:** Insulated copper conductor; the same as wire.

S. **Manufacturer's Representative:** Employee of manufacturer who is factory trained and knowledgeable in technical aspects of their products and systems.

T. **Mechanical Damage Protection:** Any material or equipment used to eliminate or minimize damage to the piping system (as might be caused from soil stresses and damage caused from rocks, debris, or other outside forces) without inhibiting or interfering with cathodic protection. (e.g., rock shield / rock guard materials are typically protective polyethylene mesh that protects pipeline and fitting coatings from rock backfill, intrusions and abrasions without interfering with the protection system.)

U. **Mils Dry Film Thickness (MDFT):** The thickness, expressed in mils, of an applied and cured coating or mastic. Mil is equivalent to 0.001 inch.

V. **Petrolatum:** A purified mixture of semisolid hydrocarbons obtained from petroleum jelly.

W. **Petroleum Wax:** A refined mixture of solid hydrocarbons, paraffin in nature, obtained from petroleum. Provided as a refined paraffin wax or microcrystalline wax forms.

X. **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.

Y. **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.

Z. **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.

AA. **Polyethylene Encasement:** A flat sheet or tube of polyethylene plastic that is typically 4- or 8-mils thick and meets the requirements of AWWA C105. The polyethylene encasement is a type of loose bonded coating that is wrapped around a ductile iron pipe, fitting, or valve box riser for corrosion protection.

BB. **Raceways:** Conduit, sheath, plastic or metal pipe, or electrical metallic conduit (EMT) for casing of electrical or cathodic protection cables.

CC. **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.

DD. **Tight Bonded Coatings:** A dielectric coating that is bonded or physically attached to the pipe surface.

   1. Ductile iron pipe bituminous asphaltic shop coating does not qualify as an approved factory or shop applied tight bonded coating.

1.05 SUBMITTALS

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 Section 7 - General Conditions. In addition, the following specific information shall be provided.

B. Submittal information shall clearly show manufacturer's 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. Contractor shall 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.

D. Contractor shall submit installation, material, and safety requirements for thermite weld wire or pin brazing type connections.

E. Contractor shall submit a list of test equipment (make and model) to be provided. Test equipment shall be approved and at project site prior to start of pipe installation.
F. Contractor shall submit tracer wire continuity test equipment (make and model) and proposed tracer wire continuity test procedure.

G. Quality Assurance Submittals:

1. Manufacturer’s Certificates of Compliance

2. Field Test Reports

3. Certificate of Compliance for Galvanic Anodes (Independent laboratory analysis required.)

4. Record Drawings.
   a) Record drawings shall include RECORD location of all cathodic protection test stations and tracer wire access box locations moved during construction and buried wire splices in either Station-Offset or x- and y- coordinates consistent with the project horizontal datum.

H. Submit Certificate of Compliance from fitting and appurtenance manufacturer and supplier verifying that bolting, fasteners, nuts, and washers proposed for the project meet the specifications provided herein.

I. Contract Closeout Submittals: Special guarantees as specified hereinafter

1. Submit record drawings and field test report information to Engineer at end of project.

2. The cathodic protection system and corrosion control monitoring systems including but not limited to joint bonding, test stations, insulators, galvanic anodes, etc. shall be fully operational upon completion of pipe installation and a functional test performed prior to acceptance of the project.

3. The tracer wire system including tracer wire access boxes and continuity testing shall be fully operational upon completion of pipe installation. A functional test shall be performed prior to acceptance of the project.

4. Test station and junction box wire labeling, color coding and Contractor functional testing results shall be submitted to Engineer upon completion of functional testing and prior to acceptance of the project.

1.06 QUALITY ASSURANCE

A. 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.
B. Functional testing shall be completed by the Contractor only in the Engineer representative's presence on the installed cathodic protection, corrosion protection items and tracer wire continuity.

C. The final testing shall be completed by the Engineer.

1.07 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. 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.

C. 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.

D. 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 any time when discovered during the warranty period.

1.08 RECORD DRAWINGS

A. Contractor shall maintain an accurate record of the cathodic protection devices, tracer wire access boxes, and field-coated and/or repair coated pipe segments in redline fashion on a project plan set. Items on redline plans shall include, but are not limited to:

1. Galvanic anode type, size and as-constructed location to each fitting, valve or other metallic pieces;

2. Test station and tracer wire access box locations;

3. Tracer wire color coding for each wire segment within the project if different than that provided in this Specification;
4. Record drawings shall include RECORD location of all cathodic protection test stations and tracer wire access box locations moved during construction and buried wire splices in either Station-Offset or x- and y-coordinates consistent with the project horizontal datum.

1.09 SPECIAL GUARANTEE

A. The Contractor, corrosion subcontractor, 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 two (2) years 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, subcontractor, and/or product manufacturer’s 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 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 five 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 two (2) years 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.
8B.2 MATERIALS

2.01 GENERAL

A. All materials specified within this specification shall meet the requirements of this specification section as well as Section 8A. Materials referenced within Specification Section 8B do not necessarily imply that the stock material item is in compliance with Section 8A. The supplier and contractor are responsible for complying with Specifications 8A and 8B collectively and in their entirety unless modified by project specific requirements.

B. 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) www.farwestcorrosion.com
2. Hoff Company, Denver CO (800-736-4546) www.pipelinesupplies.com
3. MESA Products, Inc., Tulsa, OK (888-800-6372) www.mesaproducts.com
4. Total Corrosion Solutions, Inc., TCS, Billings, MT (406-248-6985)

2.03 WIRES

A. 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 ANSI/NEMA WC 70-09 / ICEA S-95-658-09.

1. Tracer wire materials specification is included under TRACER WIRE.

2. All wire, including test leads, anode leads, joint pigtail bond wires, etc associated with the cathodic protection system outlined in these specifications shall have a high molecular weight polyethylene (HWMPE) insulation rated for 600 volts. Minimum thickness shall be 45-mil for No. 10 AWG and smaller wires and 110-mil for No. 8 AWG and larger wires, as outlined in this specification.
B. Joint Bonds:

1. General: Type of joint bonds shall depend on pipe joint coating and shall be either:
   
a) Insulated copper joint bond wires for all pipe joint bond locations.
   
b) Metallic Fitting Pigtail Bond Wires shall be No. 12 AWG single conductor, stranded copper wire with 600-volt rated HMWPE insulation.

   1) Provide with a sleeve on each end of No. 12 AWG metallic fitting pigtail 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 to allow end of wire to be exposed to thermite weld material.

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 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.

   a) For Pipe Diameters larger than 16-inch:

      1) For Push-on, Mechanical, or Flanged Joints: No. 2 AWG wires, 18-inches long minimum.

      2) For Flexible Coupling Joints: No. 2 AWG wires, 24-inches long minimum, with two 12-inch long minimum insulated No. 12 AWG wire pigtails.

      3) Smaller couplings than 24-inch OD pipe may allow shorter lengths. Contractor shall confirm that bond wire length supplied provides a minimum of one-inch of slack on each end for a total of two inches of slack.

      A) Bond wires with pigtail wires can be utilized at flexible couplings, fitting or valve locations. The pigtail wires shall be bonded to the fitting or valve body.
B) For multiple piece fittings, No. 12 AWG pigtail wires shall be utilized to bond different pieces to pipe. Pigtail wire length shall be as required.

4) 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.

b) For pipe smaller than 15-inch diameter, Contractor may utilize No. 4 AWG wire size instead of No. 2 AWG wire size.

c) Acceptable pre-made insulated copper joint bond wires are available from:


2) Pentair Engineered Electrical and Fastening Solutions (formerly Erico® Products Inc. (CADWELD®)) 800-248-9353, Cleveland, OH;

3) Burndy (formerly Continental Industries, Inc. (ThermOweld®)), 800-558-1373, Tulsa, OK;

4) Or approved equal.

C. Pump Station, Vault, 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.

   a) Insulation shall be 7/64-inch (110-mil) minimum thickness in accordance with ASTM D 1248, Class C, Grade 5.

2. Bonding of buried and above grade appurtenances may be required to minimize stray current, safety hazards, and corrosion effects (e.g., bonding through a vault).

D. Test Wires:

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 rated HMWPE insulation.

2. No. 2, No. 4, No. 6, or No. 8 AWG leads shall be single-conductor, stranded copper wire with 600-volt rated HMWPE insulation.
E. Wire Identification:

1. Wire insulation color shall indicate the function of each wire and shall be as follows:

   a) Pipeline test wires:

      1) Water Pipeline: Blue.

         A) Test wires for water systems of different pressure zones shall be uniquely identified by the following color combinations on transmission mains and at zone separation valves only:

            i. High Level: Blue with 1 strip of Blue tape
            ii. Low Level: Blue with 1 strip of White tape.

      2) Foreign Pipeline: White or as requested by Foreign pipeline company.

      3) Unprotected Pipe (not cathodically protected): Black. (e.g., pump station side of metallic pipe).

   b) Casings: Orange.

   c) Anode lead wires: Black.

   d) Reference electrode wires: Yellow.

   e) Coupon wires: Green

      1) Pair of leads to protected coupon (one strip of white tape)
      2) Pair of leads to unprotected coupon (one strip of black tape)

   f) Tracer wires on plastic, concrete, or non-metallic pipe:

      1) Blue with two strips of black tape.
      2) Color code tracer wire by project pressures and direction with tape strip(s) as noted below:

         A) Project Pressures (for transmission main projects and at zone separation valves only):

            i. Higher pressure – one strip of BLUE tape
            ii. Lower pressure – one strip of WHITE tape
iii. Or as directed in the plans.

B) Direction:

i. North (1 Strip) and West (2 Strips) PURPLE tape.

ii. South (1 Strip) and East (2 Strips) GRAY tape.

2.04 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 method. The thermite weld materials shall be UL listed to ANSI/UL 467.

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 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.

   1. Material and equipment shall be from the same manufacturer and utilized throughout the entire project.

   2. 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 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 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.


      a) Cadweld F-33 (Green Top) or Thermoweld P Standard Powder;
b) Electronic ignition materials:

1) Cadweld Plus CA15PLUS33 with black top or CA25PLUS33 with red top, or

2) ThermOweld EZ Lite Remote with suitably sized Thermoweld P Standard Powder Charges;

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 15- or 25-grams and maximum of 32-grams for ductile and cast iron materials.

a) Cadweld XF-19 or Thermoweld CI Cast Iron Powder;

b) Electronic ignition materials:

1) Cadweld Plus CA15XF19, CA25PLUSXF19 or CA32PLUSXF19;

2) ThermOweld EZ Lite Remote with suitably sized Thermoweld CI Cast Iron Powder Charges;

3) Or approved equal.

3. Minimum cartridge size for strap bonds shall be 25 grams for 1/2-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’s recommendations.

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 thermite weld manufacturer. Each mold shall have permanent identification showing manufacturer’s 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 and fitting 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 diameter.
1. For steel pipe and 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 10-inch or larger, flat steel molds can be used.

2. For ductile iron or cast iron pipe and fittings, different size of molds are required for different pipe diameters up to 24-inch. The molds must be obtained for each pipe size to be welded.

H. Electronic Ignition Connections

1. Cadweld Plus Exothermic or ThermOweld’s EZ Lite Remote: Connections with prepackaged containers with electronic type ignition can be substituted for standard thermite weld spark type ignition connections provided that equal or better low resistance, durability, adhesion, and performance characteristics are proven.

2. 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.

3. Manufacturer shall provide a reference table with corresponding molds and charge sizes and types.

4. 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.

1. Acceptable sealer putty brands include:
   a) Electrical Duct Seal manufactured by Ideal Industries;
   b) Duct Seal Compound manufactured by Gardner Bender;
   c) CADWELD® Mold Sealer by Erico® Products, Inc.;
   d) 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.

1. The use of resin, rubber, or shellac-impregnated type grinding wheels are not recommended by the weld material manufacturers and shall not be used.

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 for all No. 10 AWG and 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. 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 with method as recommended by the thermite weld manufacturer. Wire conductor for field installed adapter sleeves shall extend ¼-inch beyond end of the sleeve to allow molten thermite weld material to directly contact wire.

3. Table 8B.1 presents sleeve and hammer die information for Cadweld® and ThermOweld® products.

M. Thermite weld materials are available as specified from:

1. Pentair Engineered Electrical and Fastening Solutions (formerly Erico® Products Inc. (CADWELD®)) 800-248-9353, Cleveland, OH;
2. Burndy (formerly Continental Industries, Inc. (ThermOweld®)) 800-558-1373, Tulsa, OK;
3. Or approved equal.

N. Thermite Weld Mold, Charge and Size for pipes LARGER than 8-inches in diameter are provided in Table 8B.2.

<table>
<thead>
<tr>
<th>STRANDED TEST LEAD OR BOND WIRE SIZE</th>
<th>CADWELD®</th>
<th>ThermOweld®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SLEEVE MODEL No.</td>
<td>HAMMER DIE MODEL No.</td>
</tr>
<tr>
<td>No. 12 AWG</td>
<td>CAB-133-1H</td>
<td>Crimped</td>
</tr>
<tr>
<td>No. 10 AWG</td>
<td>CAB-133-1K</td>
<td>Crimped</td>
</tr>
<tr>
<td>No. 4 AWG</td>
<td>CAS-20-F</td>
<td>CAD-11</td>
</tr>
<tr>
<td>No. 2 AWG</td>
<td>CAS-09-F</td>
<td>CAD-09</td>
</tr>
</tbody>
</table>
Table 8B.2. Thermite Weld Mold, Maximum Charge Size and Type for Diameters Greater than 8 Inches

<table>
<thead>
<tr>
<th>CONDUCTOR SIZE</th>
<th>SLEEVE #</th>
<th>MOLD #</th>
<th>CADWELD® CHARGE TYPE AND SIZE</th>
<th>SLEEVE #</th>
<th>MOLD #</th>
<th>ThermOweld® CHARGE TYPE AND SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 12 AWG</td>
<td>CAB-133-1H</td>
<td>CAHBA-1G-PS</td>
<td>CA15XF-19 CA25XF-19</td>
<td>38-0200-00</td>
<td>M-156</td>
<td>15CI or 25CI</td>
</tr>
<tr>
<td>No. 10 AWG</td>
<td>CAB-133-1H</td>
<td>CAHBA-1G-PS</td>
<td>CA25XF-19</td>
<td>38-0201-00</td>
<td>M-7351-PS</td>
<td>25CI</td>
</tr>
<tr>
<td>No. 8 AWG</td>
<td>N/A</td>
<td>CAHBA-1G-PS</td>
<td>CA25XF-19</td>
<td>38-0201-00</td>
<td>M-7351-PS</td>
<td>25CI</td>
</tr>
<tr>
<td>No. 6 AWG</td>
<td>N/A</td>
<td>CAHBA-1G-PS</td>
<td>CA25XF-19</td>
<td>38-0202-00</td>
<td>M-7352-PS</td>
<td>25CI</td>
</tr>
<tr>
<td>No. 4 AWG</td>
<td>CAS-20-F</td>
<td>CAFCA-1L-PS</td>
<td>CA32XF-19</td>
<td>38-0204-00</td>
<td>M-154-PS</td>
<td>32CI</td>
</tr>
<tr>
<td>No. 2 AWG</td>
<td>CAS-09-F</td>
<td>CAFCA-1V-PS</td>
<td>CA32XF-19</td>
<td>38-0203-00</td>
<td>M-175-PS</td>
<td>32CI</td>
</tr>
</tbody>
</table>

2.05 THERMITE WELD REPAIR COATING

A. One Hundred Percent (100%) Epoxy Repair Coating

1. Field repair material shall be fast cure, high build, low temperature (cure down to 0° F), moisture tolerant (cure underwater), 100-percent epoxy material that can be distributed in a two component repair cartridge tubes with a dispensing gun.

2. Repair coating shall be compatible with original pipe or fitting coating and exhibit minimum 2,000 psi adhesion values.

3. Acceptable field epoxy repair type coatings are:
   a) Denso North America Protal 7125 Repair Cartridge;
   b) CANUSA-CPS HBE-95 WG high build epoxy;
   c) Or approved equal.

2.06 EASY BOND PIN BRAZING

A. Pin Brazing for joint bond and test wire connection to dielectric lined pipe offers lower temperature, less weather restrictions, and greater versatility in connection locations.
1. Only direct type pin brazing connections to pipe or fitting shall be utilized, no threaded bolt and nut type connections shall be allowed. Direct type pin brazing connection shall be sized as required to meet specified test wire or joint bond wire and strap size. Consult pin brazing manufacturer for recommended direct metal type connection sizes.

B. Wire ring tongue terminal pin brazing connectors to bond or test lead wires shall be crimped and silver-soldered for all pin brazing type wire connections.

C. Pin brazing connections can be made directly to suitable sized punched copper straps.

D. Pin brazing system for cathodic protection connections shall consist of direct type pin brazing pins connected with a BAC pin brazing system are available from:

1. Farwest Corrosion Control Company;
2. GMC Electrical, Inc.;
3. Hoff Company, Inc.;
4. Mesa Products;
5. Or approved equal.

2.07 GROUND CLAMPS

A. Heavy duty all bronze ground clamps for wire connections to copper service pipe shall be sized to fit the pipe and wire and UL 467 listed for direct burial in earth or concrete. All parts of the clamp shall be bronze including bolts and nuts, as manufactured by:

1. Burndy, LLC;
2. EMERSON Industrial Automation (formerly O. Z. Gedney);
3. Thomas and Betts;
4. Or approved equal.

2.08 GALVANIC ANODES

A. Magnesium Anode:

1. High-Potential Magnesium Composition for buried soil applications shall be cast of primary magnesium and meet or exceed ASTM B843 Grade with Alloy M1C chemical requirements as shown in Table 8B.3.
Table 8B.3 High-Potential Magnesium Anode Composition

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum (Al)</td>
<td>0.010% maximum</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>0.500% to 1.300%</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.020% maximum</td>
</tr>
<tr>
<td>Silicon (Si)</td>
<td>0.050% maximum</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.030% maximum</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>0.001% maximum</td>
</tr>
<tr>
<td>Total Others</td>
<td>0.050% each or 0.300% maximum total</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>Remainder</td>
</tr>
</tbody>
</table>

2. Prepackaged Magnesium 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 characteristics in Table 8B.4.

Table 8B.4 High-Potential Magnesium Anode Dimension Characteristics

<table>
<thead>
<tr>
<th>BARE ANODE SIZE</th>
<th>17 POUND ANODE</th>
<th>32 POUND ANODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>17D3</td>
<td>32D5</td>
</tr>
<tr>
<td>Bare Anode Nominal Dimensions</td>
<td>3 inches by 25 inches long minimum</td>
<td>5 inches by 20 inches long minimum</td>
</tr>
<tr>
<td>Packaged Weight</td>
<td>42 pounds minimum</td>
<td>68 pounds minimum</td>
</tr>
<tr>
<td>Nominal Package Size</td>
<td>6 inch diameter by 29 inches long minimum</td>
<td>7 inches by 28 inches long minimum</td>
</tr>
</tbody>
</table>

3. Magnesium anodes shall be verified with a third party ASTM G97 tests for quality control and meet the following minimum requirements:
   a) Minimum Open Circuit Potential shall be -1.7 volts or more negative to a copper/copper sulfate reference electrode.
   b) Minimum current efficiency shall be 50-percent (50%) efficiency or higher or a minimum 500 amp hours or higher.
   c) Anode suppliers (distributors) shall provide anode manufacturing certificates, manufacturing quality control testing results, and
supplier’s own third party ASTM G97 test results for each batch of anodes supplied for project.

d) If any anodes provided for the project do not pass the minimum criteria specified ASTM G97 requirements, then all anodes supplied in that batch or lot shall be rejected and replaced at no cost to the Owner.

4. Acceptable High Potential Magnesium Anodes are:
   a) MAXMAG by Interprovincial Corrosion Control Company (ICCC), Lewiston, NY, 800-699-8771, www.rustrol.com;
   b) MESA High Potential Magnesium Anodes, MESA Products, 888-800-6372, www.mesaproducts.com;
   c) UltraMag High Potential Magnesium Anode, Farwest Corrosion Control Company, 888-532-7937, www.farwestcorrosion.com;
   d) Or approved equal.

B. Zinc Anode:

1. Zinc anodes for buried soil conditions shall meet the requirements of ASTM B 418, Type II, as shown in Table 8B.5.

   Table 8B.5 Zinc Anode Composition

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum (Al)</td>
<td>0.0050% maximum</td>
</tr>
<tr>
<td>Cadmium (Ca)</td>
<td>0.0030% maximum</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.0014% maximum</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>0.0030% maximum</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.0020% maximum</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>Remainder</td>
</tr>
</tbody>
</table>

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 characteristics provided in Table 8B.6.
Table 8B.6 Zinc Anode Dimension Characteristics

<table>
<thead>
<tr>
<th>BARE ANODE SIZE</th>
<th>18 POUND ANODE</th>
<th>30 POUND ANODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ZUR-18</td>
<td>ZUR-30</td>
</tr>
<tr>
<td>Shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bare Anode Nominal Dimensions</td>
<td>1.4 inches by 36 inches long minimum</td>
<td>2 inches by 30 inches long minimum</td>
</tr>
<tr>
<td>Nominal Package Dimensions</td>
<td>5 inch diameter by 42 inches long minimum</td>
<td>5 inches by 38 inches long minimum</td>
</tr>
<tr>
<td>Packaged Weight</td>
<td>70 pounds minimum</td>
<td>70 pounds minimum</td>
</tr>
</tbody>
</table>

C. Prepackaged Galvanic Anode General Requirements:

1. Anode Wire: Supply each anode with No. 12 AWG stranded copper wire with HMWPE insulation.
   a) Provide anode lead lengths as required for test stations to extend splice free from anode to test station location.
   1) 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 lead wire connection to the steel core shall be 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 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 is provided in Table 8B.7.

Table 8B.7 Prepackaged Galvanic Anode Backfill Composition

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Hydrated Gypsum</td>
<td>75 Percent</td>
</tr>
<tr>
<td>Powdered Wyoming Bentonite</td>
<td>20 Percent</td>
</tr>
<tr>
<td>Anhydrous Sodium Sulfate</td>
<td>5 Percent</td>
</tr>
</tbody>
</table>

2.09 CATHODIC PROTECTION TEST STATIONS

A. Flush Mounted Test Stations

1. Flush mounted test stations shall be standard unless specifically indicated on the plans.

2. Test Station 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.

   a) Furnish with locking metallic ring extensions as required to penetrate concrete or pavement surfaces by 4-inches minimum.

   b) 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.

   c) Test Boxes shall be:

      1) Model 3RT Traffic Valve Box by Brooks Products, www.brooksproducts.com;

      2) Model G3 Traffic Valve Box by Christy Concrete Products, www.oldcastleprecast.com;

      3) Or approved equal.
3. Terminal Block: Plastic or glass-reinforced, ¼-inch thick laminate terminal board with minimum dimensions of 3-inches by 4-inches.
   a) Furnish terminal block with a minimum of seven (7) terminals. Terminal nuts and studs shall be ¼-inch with double nuts for securing the studs to the terminal board.
   b) Terminal nuts, studs, flat and lock washers shall be nickel plated brass, bronze, or Series 300 stainless steel.
   c) Terminal block shall not be connected to flush test station cap or be constructed in a manner that will accidently allow wires to be shorted together through terminal board.
   d) Manufactured seven terminal test boards shall be:
      1) CP Test NM-7 by Bingham & Taylor;
      2) Flush Fink 7 by COTT Manufacturing;
      3) Or approved equal.

B. Shunts:
   1. Shunts for test stations shall be:
      a) Holloway Type RS 0.01 ohm manganin wire shunt with 6-amp capacity by Holloway Shunts;
      b) Yellow CP Shunt (0.01-ohm shunt with 8-amp capacity) by M.C. Miller Company;
      c) Yellow CP Shunt (0.01-ohm shunt with 8-amp capacity) by COTT Manufacturing;
      d) Or approved equal.

2.10 MISCELLANEOUS REFERENCE MONITORING EQUIPMENT AND MATERIALS

A. Reference electrodes shall only be used at locations specifically indicated in the plans or as directed by the Engineer.

B. Prepackaged Copper/Copper Sulfate (CU/CUSO4) Reference Electrodes:
   1. Permanent reference electrode for buried piping locations shall be a copper/copper sulfate reference electrode. Reference electrode dimensions shall be approximately 1.5-inches in diameter by 6-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. 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. 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 feet) or longer as required to reach splice free from reference electrode to test station. Lead wire shall be coiled and bound.

5. 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.

6. Acceptable CU/CUSO4 reference electrodes can be obtained from:
   a) FWCC Series SP-150 by Farwest Corrosion Control Company;
   b) STAPERM Model CU-1-UGPC by GMC Electrical, Inc.;
   c) Model UL CUG LongLife Reference Electrode by Electrochemical Devices, Inc.;
   d) Or approved equal.

C. Plastic Reference Monitoring Pipe shall be a 3-inch minimum diameter Schedule 40 PVC plastic pipe with a threaded pipe cap 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.

2.11 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.

1. 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.

1. 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.

1. Galvanized items shall be hot dipped galvanized in accordance with ASTM A153.

2. Galvanized hardware shall not be used underground or in immersion service.

F. Conduit bushings shall be threaded plastic or plastic-throated galvanized steel fittings.

2.12 WIRE CONNECTIONS AND SPLICE MATERIALS

A. Compression Connectors:

1. 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.

2. Compression connectors shall be applied with the crimp tool and die recommended by the manufacturer for the wire and tap connector size.

3. Acceptable Type "YC" wire compression connectors as manufactured by:

   a) Burndy, LLC;

   b) Thomas and Betts;
c) Or approved equal.

4. Inline “butt” type wire splice connectors or wire nuts are NOT acceptable.

5. Split bolts are acceptable only if silver soldered after a physical connection is made and both the wires are equal to or smaller than No. 10 AWG size.

6. Silver Brazing Alloy:
   a) Brazing Alloy with minimum 15-percent silver content, 1185° to 1300° F melting range.
   b) Provide suitable silver brazing alloy and flux recommended by manufacturer for materials being connected (i.e. copper to stainless steel, copper to steel, and/or copper to copper, etc.).

B. Splices shall be made with suitably sized copper compression connectors and insulated with either a hand tape system, with a specially formulated splicing kit, or with an epoxy splice kit depending on wire size.

1. Smaller wires (equal to or smaller than No. 8 AWG) can be repaired with tape, or insulated with a specially fabricated splicing kit, or made with an approved epoxy insulated splice kits.

2. Insulation damage or splices to large cathodic protection cables (No. 4 AWG or larger) shall only be made with an approved epoxy type splice kit.

3. 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, alkalis, and corrosive chemicals.

4. Tapes and electrical sealers shall be suitable for moist or wet environments and may include the following:
   a) Rubber High Voltage Electrical Tape: Linerless 30-mil rubber high voltage splicing tape suitable for splicing cables through 69kV
      1) Scotch Professional Grade Linerless Rubber Splicing Tape 130C by 3M Products;
      2) Plymouth L969 Plyvolt Linerless EPR High Voltage Tape by Plymouth Bishop;
      3) Or approved equal.
   b) High Voltage Vinyl Electrical Tape: All weather, minimum 7-mil thick, vinyl electrical tape suitable for cable splices up to 600 volts.
1) Scotch Super 33+ Vinyl Electrical Tape as 3M Products;
2) Plymouth Premium 111 Black Vinyl Plastic Electrical Tape by Plymouth Bishop;
3) Or approved equal.

c) 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
1) Scotchfill by 3M Products;
2) Plymouth 125 Electrical Filler Tape by Plymouth Bishop;
3) Or approved equal.

d) 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
1) Scotchkote Electrical Coating by 3M Company;
2) Or approved equal.

5. Specially formulated splicing kit shall consist of an elastomeric insulating compound that seals and waterproofs connection area with a resin-impregnated, moisture-cured fabric bandage shell such as Royston SpliceRight Splicing Kit available from Chase Industries.

6. 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.
   a) 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.
   b) Epoxy resin shall be electrical insulating low viscosity type that will harden (cure) quickly with time.
   c) In-Line type 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) Wye type splice insulating kit for insulation repair shall be epoxy resin, 3M Company Scotchcast Series 90B1; Plymouth Bishop Plycast Splicing Kit 2636; or approved equal.
C. Terminal and Connection Coating and Electrical Sealers:

1. Electrical Insulating Spray: Electrical insulating spray for sealing tape insulation on splices, or on terminals to minimize external corrosion
   a) Scotch 1601 Insulating Spray by 3M Company;
   b) Royston Protective Coating Product Data No. 614 Royston Laboratories;
   c) 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
   a) Penetrox A-13 by Burndy Products;
   b) Contax Inhibiting Compound Type CTB by Thomas and Betts (T&B);
   c) Or approved equal.

D. Wire Connector Terminals: A ring tongue terminal or single hole solderless lug 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:
   a) Burndy LLC;
   b) 3M;
   c) Thomas and Betts;
   d) 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 are
      1) L125 by Burndy;
      2) BTCO208-B2 by Thomas and Betts;
3) 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 in Table 8B.8.

E. 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.

2.13 PLASTIC CONDUIT SHEATHING

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

Table 8B.8 Stranded Copper Wire Ring Tongue Terminal Connectors

<table>
<thead>
<tr>
<th>Stranded Cable Size (AWG)</th>
<th>Bolt or Stud Size</th>
<th>MANUFACTURER AND MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Anderson</td>
</tr>
<tr>
<td>No. 14 to 20</td>
<td>1/4&quot;</td>
<td>-----</td>
</tr>
<tr>
<td>No. 10 to 12</td>
<td>1/4&quot;</td>
<td>-----</td>
</tr>
<tr>
<td>No. 8</td>
<td>1/4&quot;</td>
<td>-----</td>
</tr>
<tr>
<td>No. 6</td>
<td>1/4&quot;</td>
<td>VHCS-6-14</td>
</tr>
<tr>
<td>No. 4</td>
<td>1/4&quot;</td>
<td>VHCS-4-14</td>
</tr>
<tr>
<td>No. 2</td>
<td>1/4&quot;</td>
<td>VHCS-2-14</td>
</tr>
</tbody>
</table>
2.14 LOCATION MARKING TAGS

A. Test station locations shall be identified with stamped brass or aluminum marking tags.
   1. Minimum tag size shall be 2-inch diameter.
   2. Marking tags are available from:
      a) Western Electromarker, Edmonton, Alberta, Canada (866-486-4250);
      b) Or approved equal.

B. Contractor shall supply the type and number of location marking tags sufficient for the number of test stations listed in the Test Station Schedule for the project.
   1. One UNSTAMPED tag shall be left in each test station.
   2. City personnel or Engineer will stamp the tags with appropriate identification at the time of final acceptance testing.

2.15 WARNING TAPE

A. Warning tape shall be used on all projects where specifically called out in the Plan General Notes.

B. 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.
   3. Warning tape for water mains shall be blue and labeled “CAUTION: WATER LINE BURIED BELOW”.
      a) For pipe lines of 10-inch diameter and less, the warning tape shall be 6-inches in width.
      b) For pipe lines of 12-inches and greater, the warning tape shall be 12-inches in width.
   4. 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.
5. Acceptable products are available from:
   a) ITT Blackburn;
   b) Allen Systems, Inc.;
   c) Reef Industries;
   d) Or approved equal.

2.16 TRACER WIRE

A. Tracer Wire:
   1. Tracer Wire
      a) Copper Tracer Wire: No. 10 AWG wire for tracer wire shall be UL listed single conductor, stranded copper wire with 600-volt HMWPE insulation. Acceptable single-conductor copper wire for open cut pipe trench and in-conduit type installations are:
         1) Agave Copper PE Tracer Wire 45-mil (APUT-1019) from Agave Wire, LTD;
         2) 45-mil HMWPE Copper Tracer Wire from Kris-Tech (K-T) Wire;
         3) Pro-Trace Type CU HDPE Copper Tracer Wire 45-mil (Copper PE45-Stranded) from Pro-Line Safety Products;
         4) Or approved equal
      b) Bi-metallic Tracer Wire: No. 10 AWG wire for tracer wire may be a hard-drawn, copper-clad steel conductor wire with a 45-mil high density HWMPE insulation. Acceptable bi-metallic tracer wire is:
         1) Agave APCU 1001 from Agave Wire, LTD;
         2) Pro-Trace (HDD-CCS PE45) as manufactured by Pro-Line Safety Products;
         3) Copperhead High Strength Tracer Wire (1030B-HS-xx) as manufactured by Copperhead Industries, LLC;
         4) Copper-Clad Steel (CCS) Tracer Wire from Kris-Tech (K-T) Wire;
         5) Or approved equal.

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.

4. Tracer wire color and tape markings shall be in accordance with other sections of this Specification.

5. Tape for attachment of tracer wire to pipe shall have an aggressive adhesive intended for direct burial service. **Standard-duty Duct Tape is not an acceptable product.** Minimum tape requirements are:
   
a) Adhesive PVC/butyl rubber (polyethylene) tape materials minimum 1-\(\frac{1}{2}\) to 2-inch wide 6- to 10-mil nominal thickness shall be provided to securely hold tracer wire in place on top of pipe.

   b) Adhesive PVC/butyl rubber (polyethylene) tape materials and adhesion to bare metal surface and to backing shall be a minimum of 22 grams per ounce/inch and meet AWWA C105 requirements.

   c) Acceptable products are:
      1) Gorilla Tape available from Gorilla Glue Company,
      2) No. 140 Black Pipe Wrap Tape available from Sigma (formerly Fulton Enterprises),
      3) UPC Pipe Tape available from Northtown Company,
      4) Or approved equal.

6. Tracer Wire Splices

   a) Compression connectors for in-line splices shall be "C" taps made of conductive wrought copper, sized to fit the wires being spliced in accordance with "Wire Connections and Splice Materials" this section. Wire compression connectors shall be supplied with tape or epoxy resin type splice insulation kits.

   b) Acceptable Type "YC" wire compression connectors as manufactured by:
      1) Burndy LLC;
      2) Thomas and Betts (T and B);
      3) Or approved equal.

   c) Electrical Spring Connector (Wire Nut) Pigtail Wire Type Connectors with silicone gel insulation filled resin tube.
1) The electrical spring connector shall consist of a steel spring, metal shell, with a flame-retardant PVC insulator outer covering.

2) The plastic tube assembly shall consist of a polypropylene tube with locking fingers to hold the electrical spring connector in the bottom portion of the tube and a plastic cap.

3) The tube shall be prefilled with non-hardening silicone electrical insulating gel sealant.

4) The electrical spring connector and plastic tube assembly shall be UL listed and CS Certified for 600 volts direct bury and submersible applications.

5) The electrical spring connector is suitable for copper wires only and shall be sized to fit three No. 10 AWG tracer wires.

6) Suitable tracer wire splice kits are:
   A) 3M Direct Bury Splice Kit (DBR/Y-6);
   B) Dryconn Waterproof Connectors Direct Bury Twist-On with Strain Relief (DBSR Aqua) from King Innovation;
   C) Or approved equal.

d) Compression Connectors or split bolts with silver solder and specially formulated splicing kit shall consist of an elastomeric insulating compound that seals and waterproofs connection area with a resin-impregnated, moisture-cured fabric bandage shell

   1) Royston SpliceRight Splicing Kit available from Chase Industries;

   2) Or approved equal.

B. Tracer Wire Access Boxes:

1. Flush Mounted Tracer Wire Access Box:
   a) Two different sizes of tracer wire access boxes may be used on a project. The difference in sizes is described within this specification section.

   b) For two wire, 45-mil insulation, tracer wire access, 4-inch flush mounted tracer wire access boxes may be used unless specifically indicated on the Plans.
1) Plastic flush terminal box body (18" long shaft, 4" diameter minimum size) with cast iron collar and lockable cast iron lid, suitable for traffic conditions.

2) Lids, if colored, shall meet APWA standard color for utility.

3) Tracer wire access boxes shall be furnished with a lock-down lid and marked “Test”, “TW”, “Tracer”, “TWAB” or other label approved by Engineer. Markings shall allow easy differentiation between tracer wire access boxes and cathodic protection test stations.

4) Minimum four (4) wire non-conductive terminal board with ¼-inch diameter stainless steel, nickel plated brass, or bronze hardware for wire terminations.

5) Terminal board shall not be connected to flush tracer wire access box cap or be constructed in a manner that will accidently allow wires to be shorted together through terminal board.

6) Acceptable 2-wire, 45-mil insulation, flush mounted tracer wire access boxes are:

   A) Model No. P445 DT Test 4" Shaft Cathodic Protection Test Boxes by Bingham and Taylor;

   B) Model NM-7 5" ID 18" Shaft Cathodic Protection Test Station by C.P. Test Services – Valvco, Inc;

   C) Model T4 4" ID 18" Shaft Cathodic Test Stations by Handley Industries;

   D) Model TWAB4PT 4" Tracer Wire Access Box by Drainage and Water Solutions, Inc.

   c) For more than two tracer wires of 45-mil insulation thickness or two or more 100-mil+ insulation thickness tracer wire, concrete tracer wire access boxes with separate terminal board shall be utilized and shall have H-10 rated concrete body with a cast iron ring and lid.

   1) The concrete tracer wire access boxes shall have a minimum weight of 55-pounds and minimum dimension of 10-inch inside diameter and shall be a minimum of 12-inches long.

   2) Tracer wire access boxes shall be furnished with locking metallic ring extensions as required to extend to surface of pavement greater than four inches in thickness.
3) Tracer wire access boxes shall be furnished with a 12-pound minimum cast iron, bolt down lid marked “Test”, “TW”, “Tracer”, “TWAB” or other label approved by Engineer. Markings shall allow easy differentiation between tracer wire access boxes and cathodic protection test stations.

4) Acceptable concrete tracer wire access box manufacturers are:
   A) Brooks Products Model 3RT Traffic Valve Box;
   B) Christy Concrete Products Model G3 Valve Box;
   C) Or approved equal.

5) Tracer Wire Terminal Board
   A) Plastic or glass-reinforced, non-conductive, ¼-inch thick laminate terminal board with 3-inch by 4-inch minimum dimensions;
   B) Terminal board shall be furnished with a minimum of four (4) terminals.
   C) Terminal nuts and studs shall be ¼-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.
   D) Terminal board shall not be constructed in a manner that will accidently allow wires to be shorted together through terminal board.
   E) Acceptable manufactured terminal boards are:
      i. CP Test NM-4 Terminal Test Board;
      ii. Bingham & Taylor 4 Terminal Test Board;
      iii. Flush Fink 4 Terminal Test Board;
      iv. Handley Industries 4 Terminal Test Board;
      v. Or approved equal.
2.17 INSULATING JOINTS

A. General:

1. Insulating joints shall be dielectric unions, flanges, or couplings. The complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline. All materials shall be resistant for the intended exposure, operating temperatures, and products in the pipeline.

2. No size restrictions for monolithic type insulators in buried, submerged or abovegrade locations.

3. No size restrictions for insulated flange or insulated couplings in abovegrade or vault type locations.

B. Flange Insulating Kits for Flanges and Restrained Rod Harness Sets:

1. Gaskets:
   a) Low Pressure (Less than 150 psi) or Small Pipe Diameter (Less than 22-inch) - Provide full-face Type E with O-ring seal, style as recommended by manufacturer for flange face type. The 1/8-inch minimum thick flanged gasket shall be supplemented with a neoprene facing on each side to accomplish a seal. Sealing element shall be designed to seal either flat, raised face, or RTJ flanges.

   b) High Pressure (150 psi or greater) or Large Pipe Diameter (22-inch or larger) - Provide full-face Type E with O-ring seal, style as recommended by manufacturer for flange face type. The 1/8-inch minimum thick flanged gasket shall be supplemented with a Nitrile (240° F maximum operating temperature) O-ring seal and a phenolic or G-10 (Pyrox) retainer facing on each side to accomplish a seal. Sealing element shall be designed to seal either flat, raised face, or RTJ flanges.

2. Insulating Sleeves: Individual full-length fiberglass reinforced epoxy, NEMA G-10 Grade material (Glass Reinforced Epoxy, Pyrox) or NEMA G-11 Grade material (Glass Reinforced Epoxy). Tube shall be 1/32-inch thick and extend one-half way into both of the inner steel washers next to the flange. Sleeve shall be a length sufficient to provide a small air gap between sleeve and nut when flange is tightened down in accordance with the manufacturer’s recommendations.

3. Insulating Washers: Individual high-strength fiberglass reinforced epoxy NEMA G-10 Grade material (Glass Reinforced Epoxy, Pyrox) or NEMA G-11 Grade material (Glass Reinforced Epoxy). Size shall be 1/8-inch thick, standard SAE washer dimension.
4. Steel or Stainless Steel Washers: Plated, hot-rolled steel, Minimum 1/8-inch thick. If in area where stainless steel bolts and nuts required, provide Series 300 stainless steel materials or coated washers.

   a) Provide two washers per bolt for flange diameters less than 36-inch diameter.

5. Flange Holes and Fasteners (Bolting)

   a) For steel pipe flange, oversize bolt holes as recommended by insulated sleeve manufacturer. For ductile iron provide standard bolt hole size as recommended by sleeve manufacturer.

   b) Fasteners in accordance with AWWA C207 for steel and AWWA C110 for ductile iron and the following:

   c) Minimum bolt length shall be a minimum 1/8-inch to ¼-inch longer (before torquing or tightening down) than the sum of all of the materials being jointed together. This would include but not be limited to the maximum thicknesses of the mating flanges surfaces, the sealing gasket, the insulating and metal washer thicknesses, and the depth of the nut.

   d) Provide bolts with full thread cut lengths or threaded rod as required to meet inside diameter dimension requirements of insulating sleeves. Insulated sleeves may not fit over unthreaded portions of the bolt body.

   e) Coordinate bolt length and diameter with flange, bolt, and insulating sleeve manufacturers.


7. Provide Double Insulating Washer Set Kits for Above Grade Applications.

8. Acceptable flange insulating kits are available from:

   a) Trojan Sealing Insulating Gaskets by Advance Products and Systems, Inc., Lafayette, LA (800-335-6009), www.apsonline.com;

   b) Type E Jock by Central Plastics Co., Shawnee, OK (800-654-3872), www.centralplastics.com;

   c) Low Pressure Linebacker Type E Sealing Gasket and High Pressure GasketSeal Type E Sealing Gasket by GPT Industries (formerly Pacific Seal and Insulator, Inc. (PSI) and Pikotek) Houston, TX (800-423-2410), www.gptindustries.com;
d) Or approved equal.

C. Flexible Insulated Couplings:

1. Insulating Couplings shall meet AWWA C219 Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe. The coupling type, size, and clearance shall be style intended by coupling manufacturer to be utilized with two insulating boots (sleeves, bands, etc.) with a small lip that fits over pipe end to keep pipe separated.

   a) Insulated couplings shall be factory provided by coupling manufacturer and not be made with field conversion kits.

2. Coupling Coating and Linings: Insulated fittings shall be steel and externally coated and lined with factory epoxy coating internally and externally in accordance with AWWA C210, AWWA C213, or AWWA C550.

   a) Minimum surface preparation shall be white metal blast (SSPC SP-5) for internal surfaces and near white blast (SSPC SP-10) or better for external surfaces.

   b) Liquid epoxy coating shall be a minimum of two coats for 14 MDFT.

   c) Fusion-bonded epoxy coating shall be a minimum of 10 MDFT.

   d) Provide repair kits for epoxy-coated materials.

   e) Provide a manufacturing affidavit or certification that all coating furnished complies with AWWA standards and that all AWWA standard’s inspection and tests have been completed.

3. Buried, submerged, or immersed insulating couplings bolts, nuts, and washers shall either be Series 300 stainless steel or fusion-bonded steel coupling bolts, nuts, and washers per requirements of this specification. CorTen® bolts are not acceptable for buried, submerged, or immersed fitting or piping locations.

4. Insulating boots shall be type and thickness as recommended by coupling manufacturer for intended service including products carried and pipe temperature. The insulating boots shall be factory fabricated and provided by coupling manufacturer. Insulating boots shall be size and type that do not interfere with correct installation and operation of the coupling.

   a) Two insulating boots shall be provided for each coupling. Insulating boot shall be one-piece type and have an insulating shape with a lip or edge that fits over the end of the pipe. Boot shall be long enough to extend past end of coupling assembly body and be visible when coupling is assembled.
b) Insulating boot material shall be neoprene, nitrile, or EPDM or approved equal per coupling manufacturer’s recommendation depending on pipe size and type of service.

c) Minimum insulating boot thickness shall be:
   1) 1/8-inch for pipe up to 60-inch size,

5. Insulated couplings at restrained joints shall be provided with the necessary supplemental insulated restrained joint harness assemblies as described below.

   a) The use of field conversion kits will not be allowed except to insulate the restrained joint harness assembly.

   b) Insulated Flexible Coupling Restrained Harness Assembly: Where shown on the Drawings and/or as required and specified provide insulated restraint/harness assembly at insulated couplings on metallic pipelines. Harness bolts shall be of sufficient length, with harness lugs placed so that coupling can be slipped at least in one direction to clear joint.

   c) Provide an insulating flange conversion kit consisting of individual one-piece flange insulating sleeves and insulating washers to electrically isolate restraint harnessing assembly on both ends of harness rod.

   1) Insulating sleeves shall be individual full-length 1/32-inch thick fiberglass reinforced epoxy, NEMA G-10 Grade material (Glass Reinforced Epoxy, Pyrox) sleeves of sufficient length to extend completely through harness lug assembly.

   2) Insulating washers shall be 1/8-inch thick individual high-strength fiberglass reinforced epoxy NEMA G-10 Grade material (Glass Reinforced Epoxy, Pyrox) with a metallic washer at standard SAE washer dimension.

   3) G-10 One-Piece Sleeve and Washer from PSI;

   4) Or approved equal.

   d) Harness lugs and harness bolts shall be sized as required to allow easy installation of insulating sleeves.

   1) Harness assembly rods and bolts shall be stainless steel (Series 300) for buried or submerged locations, fusion-bonded epoxy coated for dry abovegrade conditions,
2) Individual rods or entire assemble shall be heat shrink coated, coated with a 100-percent moisture cure epoxy repair coating at 20-mil thickness,

3) Petrolatum tape coated after assembly and insulator testing,

4) Bitumastic type coatings are not an acceptable option for coating of restraining rods.

6. Insulating Flexible Couplings shall be F x E Type 1 insulated style that is electrically insulating type with two insulated boots (or bands) to be installed on the pipe under the coupling. Acceptable insulating flexible couplings are:

   a) Series 216 by Baker Couplings, Los Angeles, CA (800-247-7164);
   b) Dresser Style 39 by Dresser Industries, Inc., Bradford, PA (814-368-3131);
   c) Style 416 by Smith-Blair, Inc., Texarkana, AR (501-773-5127);
   d) Depend-O-Lok by Victaulic, Inc., Atlanta, GA (800-841-6624);
   e) Series 200 couplings by Baker Coupling Company, Los Angeles (323-583-3444);
   f) Or approved equal.

7. All buried or submerged flexible coupling fasteners shall be Series 300 stainless steel.

D. Copper Service Line Insulators:

1. Insulated service fittings shall consist of brass union body that encapsulates a nylon insulator specially designed to provide electrical isolation for this type of intended use:

   a) Insulated corporation ball valves, insulated curb ball valves, and service line insulators shall be provided to insulate copper or metallic service lines.

2. Acceptable service line insulators are available from:

   a) Mueller Co., Decatur, IL (800-423-1323);
   b) Or approved equal.

3. Consult manufacturer for model number and installation procedures for each application.
2.18 INSULATING FLOOR AND WALL SLEEVES AND MODULAR SEALS

A. Wall Sleeves: Pipe wall sleeves or cored openings shall be provided at all wall and floor locations in accordance with pipe and sleeve manufacturer’s recommendations.

1. The pipe wall sleeves shall be of sufficient thickness to resist any deformation. The pipe wall sleeves shall be round with a maximum +/- 1/8-inch variation in diameter allowed. The wall sleeve shall be a minimum wall thickness of 0.375-inch or standard wall thickness. The minimum width of the wall sleeve shall be per the modular seal manufacturer’s recommendations to meet minimum width requirements based on seal type and pipe diameter and weight.

2. Pipe wall sleeves shall be provided with a minimum 3-inch water stop collar that evenly contacts the wall or floor opening all the way around for a minimum length of 1-inch or more if recommended by the sleeve manufacturer. The water stop (collar) shall be of the same type of material as the wall sleeve. The wall sleeve shall have a smooth continuous weld with no welding slag or rough or high welds. The water stop collar shall be continuously welded on both sides of the collar for the entire circumference of the wall sleeve.

3. The wall sleeve and the water stop collar shall be positioned such that it is located in the center of the structure wall or floor, when the wall sleeve is positioned in place. Steel wall sleeves and water stop collars shall be coated. The wall or floor penetration diameter and width shall be sized sufficiently to allow correct installation of the wall sleeve and water stop.

4. Wall penetrations and wall sleeves types and sizes shall be coordinated with sleeve manufacturer, modular seal manufacturer, and pipe manufacturer to provide proper type of opening to provide a liquid tight connection.

5. Wall pipe sleeves placed around pipe and grouted in place in accordance with sleeve and pipe manufacturer’s recommendations are an acceptable method of wall openings.

6. Coordinate wall sleeve type, model, size, and location with modular seal and pipe manufacturers.

7. Prefabricated Coated Steel Pipe Wall Sleeves shall be pre-primed or coated minimum Schedule 40 wall thickness with standard 12-inch length, centered type with a minimum 3-inch water stop sized to fit pipe size.

   a) Depending on location, wall size, and pipe size prefabricated steel pipe wall sleeves are available from:
1) Model WS Steel Wall Sleeves (coated steel with a welded water stop) by GPT Industries (formerly PSI), Houston, TX (800-423-2410);

2) Model SWS (primed steel with a welded water stop), or Model GWS (steel with a welded water stop and Galvo-Plast coating) by Advance Products and Systems, Inc., Lafayette, LA (800-335-6009);

3) Or approved equal.

b) Consult manufacturer for specific model required.

B. Insulating Wall or Floor Modular Seals. Insulating wall and floor seals shall be adjustable modular mechanical type seals able to provide a positive seal (liquid tight) and long lasting electrical insulation for wall or floor penetrations for pressures up to 40 feet of static head. Coordinate with and provide pipe and modular seal manufacturer’s recommended modular seal type and size for pipe type, pipe diameter, casing or hole opening size, environmental exposure, operating temperature, and intended installation conditions.

1. The modular seals shall consist of synthetic rubber-bolted links, heavy duty reinforced high density nylon polymer plastic pressure plates, and Type 316 stainless steel hardware (bolts, nuts, washers, etc.) for adjustment. The modular seals shall be manufactured at a plant with a current ISO-9001 registration which shall be included as part of the submittal.

2. The rubber links shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the opening. The individual links shall be colored and permanently identified with the manufacturer’s name and model number. The link shall be sized per the manufacturer’s recommendations. The links shall have the following properties per ASTM standards for standard type applications (-40 degrees to 250 degrees F) Model C EPDM = ASTM D2000 M3 BA510 Black.

3. The pressure plates shall be molded glass reinforced nylon polymer with an integrally molded compression assist boss on pressure plated top side (bolt entry side). The pressure plate shall incorporate an integral recess (“Hex Nut Interlock”) to accommodate commercially available fasteners. The individual pressure plates shall be colored and permanently identified with the manufacturer’s name. The pressure plate shall be sized per the manufacturer’s recommendations. The links shall have the following properties per ASTM standards for standard type applications:

   a) ASTM D-256 Izod Impact = Minimum 2.05 foot-pound/inch

   b) ASTM D-790 Flexure Strength at Yield = Minimum 30,750 PSI
c) ASTM D-790 Flexure Modulus = Minimum 1,124,000 PSI
d) ASTM D-638 Elongation Break = Minimum 11.07%
e) ASTM D-792 Specific Gravity = Minimum 1.38

4. The modular seal hardware shall be sized according to the seal manufacturer’s recommendations depending on the size and type of modular seal. The 316 Stainless Steel hardware shall have the following properties per ASTM standards for standard type applications including ASTM F593 with an average tensile strength of a minimum 85,000 PSI.

5. Modular Wall Seals: Acceptable modular wall seal insulators for pipe diameters equal to or smaller than 24-inch diameter are:

a) Thunderline Link-Seal Model LS-300 or LS-400 by GPT Industries (formerly Pacific Seal and Insulator, Inc. PSI) Houston, TX. (800-423-2410);

b) Pipe Linx Model PL-300 or PL-400 by Calpico, Inc. South San Francisco, CA. (650-588-2241);

c) Innerlynx Model IP-300 or IP-400 by Advance Products and Systems, Inc., Lafayette, LA (800-315-6009);

d) Or approved equal.

6. Wall sleeves passing through walls of structures containing liquids shall be provided with double sets of modular wall seals to provide pipe support at the penetration and protection against leakage.

2.19 COATING AND LINING FOR FITTINGS, INCIDENTAL PIPING AND VALVES

A. Supply incidental pipe, valves, fire hydrants and fittings with linings and coatings of the same type as adjacent pipe, except where shown on the Drawings. Coat incidental pipe and fittings installed as specified in this specification section.

B. 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.).

1. Internal linings and coatings exposed to water shall be NSF approved for potable water service.
2. Minimum surface preparation shall be white metal blast (SSPC SP-5) for internal surfaces and near white blast (SSPC SP-10) or better for external surfaces.

3. Provide tight bonded coating and lining of pipe and fitting joints at maximum thicknesses shall be as recommended by the pipe or fitting manufacturer and shall not impair engagement of pipe or fitting joint or function of fitting.

4. 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, coupling, flange, etc.) operation.

5. Valve bolts, nuts, and washers, (including in valve bonnet and stuffing box) shall be Series 300 stainless steel.

C. Ductile Iron and Cast Iron Factory Coating Surface Preparation:

1. 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.

2. 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.

3. The entire surface area shall be abrasive blasted. No tight rust stains shall be allowed.

4. Avoid overblasting, high nozzle velocities, and excessive blast times.

5. Cast iron and ductile iron attain a gray color when abrasive blasted due to the higher carbon content compared to steel

6. 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. Ductile or cast iron will not be required to be near-white but will only be required to be a near-gray color.

D. At Contractor’s option, factory coat or line the incidental piping, valves, or fittings with liquid epoxy or with fusion-bonded epoxy coating in accordance with these specifications and AWWA C210, AWWA C213, AWWA C116, or AWWA C550.
Coating shall meet all AWWA standard requirements and tests and this specification section.

E. Liquid Epoxy:

1. 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.

2. Coating in contact with potable water shall conform to NSF Standard 61.

3. The liquid epoxy coating shall be a two part chemically cured coating or 100-percent material. Coating shall be mixed and applied per coating 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.

4. 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.

5. Coating shall be a minimum of two or more coat system with a minimum thickness of 14 MDFT.

6. Minimum adhesion to prepared steel shall be 400 psi per ASTM D1002 or per coating manufacturer’s printed literature, whichever is higher.

7. Acceptable liquid epoxy materials for linings in contact with potable water or buried-service metallic fittings, valves, etc. are:
   a) Carboguard as manufactured by Carboline®;
   b) Bar-Rust 233H as manufactured by ICI Devoe;
   c) SherPlate PW Epoxy B62 as manufactured by Sherwin-Williams;
   d) PotaPox Plus Series N140 or L140 manufactured by Tnemec;
   e) Or approved equal.

8. Acceptable liquid epoxy materials for abovegrade structures are:
   a) Carbothane 133 LH as manufactured by Carboline®;
b) Devthane 379 UVA Polyurethane Enamel as manufactured by ICI Devoe;

c) Hi-Solids Polyurethane Enamel B65 by Sherwin-Williams;

d) Series 1074U Endura-Shield II Aliphatic Acrylic Polyurethane;

e) Or approved equal.

9. Finish for abovegrade structures shall be high gloss with color selected by the Owner for the intended service.

F. Fusion-Bonded Epoxy:

1. Provide factory applied fusion-bonded epoxy lining and coating in accordance with AWWA C213, AWWA C116, and AWWA C550, and these specifications.

2. Fusion-bonded epoxy material shall meet the performance requirements of the referenced AWWA standards.

3. Coating in contact with potable water shall conform to NSF Standard 61.

4. 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.

5. 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.

6. 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.

7. 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.

8. Fusion-bonded epoxy coating shall be one or two-coat system with a minimum thickness of 8 MDFT.

9. Minimum adhesion to prepared steel shall be 3,000 psi per ASTM D1002 or per coating manufacturer’s printed literature, whichever is higher.

10. Acceptable fusion-bonded epoxy materials are listed below:
a) Scotchkote 206N, 323 or 162 as manufactured by 3M™;

b) Nap-Gard® 7-2500 pipe coating as manufactured by DuPont;

c) Nap-Gard 7-4500 (CV Red FBE) for valves and fittings as manufactured by DuPont;

d) Valspar 1F1947T as manufactured by Valspar General Industrial;

e) Or approved equal.

G. Conduct dry film thickness measurements and 100-percent holiday inspection of all factory epoxy-coated items prior to shipment.

1. Conduct dry film thickness measurements in accordance with SSPC PA-2 with exception that the specified thickness is the absolute minimum.

2. A minimum of two dry film thickness measurements shall be completed for each fitting or appurtenance.

3. Repair all defects with approved repair material according to original coating manufacturer's directions prior to shipment.

H. Provide field repair kits for all types of coated materials.

I. Provide exterior coating for all above-grade piping, fittings, and vent pipes with two coats of polyamide epoxy coats at a minimum 2.5 MDFT per coat (MDFTPC) and with one top coat of polyurethane enamel at a minimum 3 MDFT or with a minimum 10 MDFT fusion-bonded epoxy coating system. Minimum surface preparation shall be near-white metal blast (SSPC SP-10) for external surfaces. Color specified by Engineer.

1. Hot dipped galvanized or plastic (PVC) type vent pipes do not require epoxy/polyurethane coating system.

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 minimum 14 MDFT coating thickness.

2. Fusion-bonded epoxy coating shall be one or more coats for a minimum coating thickness of 8 MDFT.

3. Nylon coating shall be one or more coats for a minimum coating thickness of 10 MDFT applied in a fluidized bed.
4. Polyurethane coating shall be a minimum 40 MDFT for ductile iron valves and fire hydrant legs and stub pieces (American AVK fusion-bonded epoxy interior with polyurethane coated exterior or approved equal).

5. Maximum coating thickness shall be as recommended by fitting manufacturer to not impair engagement of joint or function of fitting.

K. Provide a manufacturing affidavit for all factory epoxy coated or stainless steel items that list:

1. Applicator of coating including name, address, phone number and date of Application

2. Coating Material Manufacturer and Product Designation with a product data sheet.

3. Certification that all coating furnished complies with AWWA standards and these specification requirements and that all AWWA standard’s inspection and tests have been completed and were met.

4. Certification that stainless steel items are provided as specified including name of stainless steel manufacturer and Series 300 grade provided.

L. 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 two coats of a thermosetting powder coating at minimum 3 to 6 MDFT.

   b) Acceptable TGIC polyester powder coatings for restrained fittings (casting bodies) are:

      1) EBAA Iron Mega-Bond Restraint Coating System;

      2) Star-Bond Coating System;

      3) Or approved equal.

   c) A fusion-bonded epoxy coating at a minimum 8 MDFT, Romac Industries Romacote Corvel Black;
d) A nylon coating system at minimum 10 MDFT Romac Industries Romac Nylon Coating;

e) Or approved equal.

3. Wedge assemblies and related parts shall be coated immediately following the pretreatment process with an approved coating system consisting of either:

a) A thermoplastic fluoropolymer type fastener coating specifically designed for that type of application at a minimum 1 to 2 MDFT.

b) The thermoplastic fluoropolymer coating system shall consist of two or more coats of liquid thermoset epoxy coating with heat cure following each coat.

c) Acceptable fluoropolymer coatings for the wedges and wedge actuators are:

1) EBAA Iron Mega-Bond Restraint Coating System;

2) Star-Bond Coating System;

3) Or approved equal.

M. A fusion-bonded coating system consisting of one or more coats of fusion-bonded epoxy electrostatically applied and heat cured following each coat with a total fusion-bonded epoxy coating system minimum thickness of 6 MDFT.

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 manufacturer 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.

2.20 FASTENERS (BOLTS, NUTS, WASHERS, ETC.)

A. All fasteners (bolts, nuts, tee bolts, and washers) type, size, and strength shall conform to this specification unless other design information is provided in the plans or detailed specifications. 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. Coated fasteners (bolts, nuts, tee bolts, and washers) are allowed. Coated fasteners shall meet the following requirements:

1. 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.

2. Coated 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.

3. Bolts, washers, nuts, and T-bolts shall be pretreated and coated with a thermosetting powder coating or fusion-bonded epoxy type fastener coating system.
   a) Thermosetting powder coatings shall be at a minimum 1 MDFT with Xylan, Type E, Flour Kote #1, or thermoplastic fluropolymer type fastener coatings specifically designed for that type of application.
   b) Fusion-bonded coated steel bolts, nuts, and washers, fittings, and bodies shall be coated with a minimum 6 MDFT epoxy coating per AWWA C213. Surface preparation shall be SSPC SP-10 (near white).

C. Stainless Steel Fasteners (bolts, nuts, T-bolts, washers, etc.)

1. Stainless steel bolts, tee bolts, nuts, and washers shall be Series 304 or Series 316 for the specific environment of use.

2. Stainless steel bolts and nuts shall be provided with an anti-galling lubricating compound or coated with a 1-mil fluorpolymer or equal fastener coating system to aid in preventing galling.

D. CorTen® bolts are not acceptable for buried, submerged, or immersed fitting or piping locations.

E. Bolts and nuts shall be adequately labeled to provide traceability of the material and producer.

1. The identification mark shall be cast, forged or stamped on the bolt and nut. Painted markings are not acceptable.
2. The bolt and nut manufacturer shall provide information on the type of material provided and corresponding identification mark, and country of origin.

3. Markings and traceability requirements shall be in accordance with the Industrial Fasteners Institute and AWWA C111.

F. All bolts and nuts shall be installed according to manufacturer's requirements including the use of anti-galling lubricant compound or use of a thermosetting fluoropolymer type coating for stainless steel materials.

1. If galling or seizing of the nut and bolt occurs they shall be cut off and replaced with a new nut and bolt.

2.21 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 A380 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.

2.22 PIPE AND FITTING FIELD COATING REPAIR MATERIALS

A. Field repair incidental pipe and fitting coatings and linings in accordance with this specification section.

B. Field repair coating shall be compatible with factory coating and linings and be approved by factory coating manufacturer for repair on their products.
C. 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:
   a) Raychem WaterWrap sleeve or PERP Repair Patch Kit available from Tyco Adhesive (Polyken Kendall) Mansfield, MA.;
   b) CANUSA Aqua-Shield Aqua-Sleeve or CANUSA CRPK Repair Patch Kit available from CANUSA, Inc., The Woodlands, TX.;
   c) Or approved equal.

2. Tape: Cold-applied field repair polyethylene repair type coatings shall consist of suitable primer and minimum 35-mil thick patch/repair/joint tape with aggressive adhesive and release liner, 4- or 6- inch width. Suitable primer shall be provided with the repair coatings as recommended by the repair-coating manufacturer. Acceptable products are:
   a) Tapecoat H35 Gray by The TAPECOAT Company, Evanston, IL.;
   b) Polyken 1027 primer and Polyken 934-35 tape by Tyco Adhesive (Polyken Kendall) Mansfield, MA.;
   c) Tek-Rap 200-23 Series primer and Tek-Rap 280 tape by Tek-Rap, Inc., Houston, TX.;
   d) Or approved equal.

3. Epoxy Repair Coatings: Provide 100-percent epoxy coatings that can cure under wet or dry conditions. Acceptable products are:
   a) A 788 Splash Zone Compound by Koppers, Pittsburgh, PA;
   b) Aquata Poxy by Raven (King Adhesive Corporation), St. Louis, MO;
   c) Concresive No. 1438 or No. 1170 by Adhesive Engineering Company, San Carlos, CA;
   d) Protal 7125 Repair Coating by Denso North America;
   e) Tnemec FC 22 Epoxoline by Tnemec Company Incorporated, Kansas City, Missouri;
   f) HBE-95 WG High Build Epoxy, CANUSA-CPS, Inc., The Woodlands, TX;
g) Or approved equal.

4. Four-layer petrolatum wax-tape system (AWWA C-217) intended for burial conditions.

a) Completed buried system shall consist of a minimum four-layer system consisting of a primer, mastic filler, petrolatum wax tape and an outerwrap.

b) Acceptable petrolatum coating systems are:

1) STAC Coating System by Central Plastics Company, Shawnee, OK.;

2) Denso Pipe and Fittings Petrolatum System by Denso Products, Houston, TX.;

3) No. 1 Wax-tape Coating Systems for buried locations by The Trenton Corporation, Ann Arbor, MI;

4) No. 2 Wax-tape Coating Systems for above grade and vault applications by The Trenton Corporation, Ann Arbor, MI;

5) Or approved equal.

2.23 CORROSION TEST EQUIPMENT

A. Obtain and furnish the following equipment and materials for corrosion and tracer wire functional testing. Arrange and have test equipment at project site before construction begins:

1. One Heavy Duty, Digital Multimeter, with case and test leads. Instrument shall be suitable for field conditions, be sealed to meet IP 67 waterproof and dust conditions, meet CAT IV minimum 600-volt rating, and comply with IEC and ANSI electrical safety standards. Acceptable digital multimeters are:

a) Model No. 27 II or Fluke 28 II by John Fluke Mfg. Co., Inc. Everett, WA;

b) Amprobe Model HD-160C by Amprobe Test Tools (formerly Wavetek Instruments, Beckman) Everett, WA;

c) Or approved equal.

2. Two Copper-Copper Sulfate Reference Electrodes with cone shaped tip:

a) Model 6B by Tinker and Rasor, San Gabriel, CA;
b) Model RE-5C by M C MILLER Co., Vero Beach, FL;

c) Or approved equal.

3. One 32-oz. bottle of Copper-Copper Sulfate Anti-Freeze Solution as manufactured by Tinker and Rasor, San Gabriel, CA; M C MILLER Co., Vero Beach, FL; or approved equal.

4. One ¾-pound bottle of Copper-Copper Sulfate Crystals as manufactured by Tinker and Rasor, San Gabriel, CA; M C MILLER Co., Vero Beach, FL; or approved equal.

5. The test equipment shall be stored at the project site and shall be maintained in accurate, working condition. The test equipment shall be available to Engineer and Owner for testing purposes.

6. For projects with a combined pipe length of two miles or more, Contractor shall obtain and furnish new equipment outlined above. At the completion of the project, the equipment shall be turned over to the Rapid City Utility Maintenance Department.

2.24 MANUFACTURER’S CERTIFICATIONS

A. Manufacturer's certifications of materials and installation are provided at the end of this specification section. Attachments A, B and C shall be completed and submitted as outlined in the attachments.
8B.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 the same time as metallic fitting installations are being constructed.

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. Weather Conditions:

1. 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.

2. Materials shall be stored in covered and heated storage units to maintain minimum temperatures above restricted minimum temperatures stipulated by material manufacturer.

E. 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.

F. Install and work around abovegrade and buried AC powerlines 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.

G. 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 thermite weld materials, reference electrodes and prepackaged galvanic anodes off the ground and keep them dry at all times.

B. 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.

C. Do not allow reference electrodes to freeze. Store in protected area, off the ground. Utilize before expiration of shelf life.

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.

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. 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 per joint on all pipe or fittings 12-inches in diameter or larger for redundancy.

F. Bond wire size may be No. 4 AWG on pipe sizes equal to or smaller than 15-inch diameter. Place bond wires on top quadrant of pipe.
G. Factory Coated or Tape Coated Pipe Joints: Use insulated stranded copper joint bond wires or insulated copper strap bonds for bell and spigot locations where heat shrink sleeves are not used.

1. Use insulated stranded copper joint bond wires or insulated strap bonds for all other locations where joints or fittings are already coated such as for factory coated bolted fittings, where a heat shrink sleeve is not specified.

H. 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 pigtail bond wire as required. Bond across the joint with the specified number and larger sized bonds listed above based on pipe size and material.

I. 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.

J. 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 method. Prepare surface and make connections in accordance with the thermite weld manufacturer’s recommended procedures and these specifications, which ever 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 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, and/or polyethylene encasement. Maintain minimum 2-inch separation from pipe O-ring gasket in accordance with the pipe or fitting manufacturer recommendations.
E. Complete thermite weld wire connections on horizontal surfaces, if at all possible. Thermite weld connections to vertical surfaces should be minimized and only completed if approved by Engineer. Conduct horizontal type thermite weld wire connections to fire hydrant risers and pipe stubs in horizontal positions abovegrade prior to installation in excavations. Pin brazing type connections can be completed in horizontal or vertical positions.

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.

G. 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 connections to stainless steel are NOT allowed.

H. Exothermic Thermite Weld Method.
   1. The Contractor is responsible for repair of any damage to pipe, fitting, lining, or coating that is a result of the thermite weld process.
   2. Make thermite weld connections at locations that will not damage pipe gasket or internal linings exposed to liquid.
   3. 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.
   4. 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.
   5. The wire and cable to be exothermically welded 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.
   6. 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.
7. 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.

8. Contractor shall take appropriate actions for existing coatings with asbestos to minimize worker exposure and to contain, handle, and dispose of asbestos per regulations.

9. 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.) to produce dimples to improve surface profile and adhesion for the weld material.

10. 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.

11. Exothermic welding should be completed immediately following preparation of the metal surface before surface flash rusting or oxidation can occur.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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. Squeeze the plastic cylinder to get all of the starting powder out. Close the mold body lid.

17. 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.

18. 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.

19. 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.

20. Do NOT sharply hit or move the graphite mold body during the thermite weld process to minimize expelling the molten metal out of the graphite mold.

21. 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.

22. 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.

   a) Completed thermite welds shall visually not demonstrate a porous or honeycombed appearance or have lava tubes or holes. They shall not be easy to physically remove from the pipe or fitting surface. If any of these conditions occur, Contractor shall use charges from a different batch of materials and contact the exothermic materials manufacturer immediately.

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 to not damage the internal lining, O-ring, or damage the fitting.

   1. Two or more wires can be attached under the same thermite weld connection as long as the bond or pigtail wires are not being connected to the same structure under the same thermite weld.
2. 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.

3. Completing connections prior to complete fitting assembly and installation of the fitting into the trench in a manner to allow the thermite weld connection to be made to a level surface on top of the fitting is the preferred method.

4. Vertical connections after the fitting is assembled and in the trench are a more difficult type connection to make.

5. Coat with epoxy repair coating as provided in these specifications.

J. Pin Brazing Method:

1. Authorized BAC pin brazing manufacturer technical representative shall demonstrate and observe proper connection procedures for a minimum of ten (10) connections for each type of joint bond and test wire size and type utilized on project.
   a) Weld connection shall be cleaned to bare white metal similar to that for thermite weld type connections.
   b) Load pin brazing gun with proper sized and type of pin and ferrule. Only direct to metal type connections are allowed. No threaded bolts or nuts are allowed.
   c) Activate pin brazing unit to braze the cable and lug to the pipe or fitting surface.
   d) Visually inspect, physically test with hammer, and conduct digital low resistance ohmmeter (DLRO) electrical test of completed connection.
   e) Repair coat similar to thermite weld type connections.

K. 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 and pin brazing 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 epoxy repair coating. Stainless steel connections do not require coating.

L. Ground Clamps:

1. Wire connections to copper service pipe shall be made with a bronze clamp. Clean service pipe and wire and attach to service pipe in accordance with ground clamp manufacturer’s recommendations.

M. Pipe coating shall be protected during thermite welding or soldering procedures. Coating damaged by welding or weld splatter shall be repaired per this specification section. Welded area shall be allowed to cool to "warm to touch" condition prior to application of primer and field coating.

N. Each bond wire shall be visually and physically tested before coating according to the "Electrical Continuity Testing" section of this specification. Remove, replace or install additional joint bonds at all locations not passing electrical or physical tests.

O. 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 coat with epoxy repair coating per manufacturer's directions over each completed connection after testing.

B. In cold weather, store coating repair materials in a heated location and keep warm until use.

C. The pipe and factory-coating surface shall be clean and dry before application of epoxy repair coating.

D. Liquid Repair Epoxy Coating Application - Wire connection shall be completed with a liquid one hundred percent repair type coatings. All bare surfaces, including exposed wire shall be coated.
1. Complete surface preparation and apply one hundred percent (100%) solids, low temperature epoxy repair coating in accordance with coating manufacturer’s directions.

2. Total minimum dry film thickness shall be 20-mil, apply in multiple coats if required by manufacturer of specific coating utilized.

3. Allow coating to cure to sufficient degree to prevent damage to coating, prior to handling and backfilling.

4. Strictly follow minimum cure time recommended by coating manufacturer based on surface and ambient temperatures.

E. All exposed metallic surfaces not covered by the 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 fitting invert and 3- to 5-feet from buried metallic piping or 3-feet from metallic fittings to be protected.

   a) 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.

   b) If two or more anodes installed at the same location, place on opposite sides of the pipe or fitting.

   c) Provide a minimum anode spacing of 5-feet from other unprotected pipelines.

   d) In general, the standard location for galvanic anodes shall be on the north or east side of the fitting, valve or other metallic appurtenance being protected. However, it may be necessary to adjust the location dependent upon underground obstructions. The installed location of the anodes shall be marked on the Contractor’s red line drawings.

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.

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 type method or through a test station with shunt as shown on the Standard Details.

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 a shunt as shown on the Standard Details.

9. Electrical connection of the anode wire to copper services shall either be directly to the copper service by a ground clamp or through a test station with a shunt as shown on the Standard Details.

B. Installation:

1. Each buried or submerged metallic (steel, ductile, or cast iron) pipeline section, appurtenance, intermediate pipe restraint, valve, or fitting shall receive a minimum of one galvanic anode of size necessary to comply with these specifications.

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-pound or 18-pound galvanic anode for each copper service line on each side of the curb stop or insulated coupling at the tie-in to the existing service line.

4. Install a minimum of one each or more 17-pound or 18-pound galvanic anode for each connection to existing ductile, cast iron, steel, or
prestressed concrete cylinder pipe (PCCP) piping. Type of prepackaged anodes is project specific and is specified in the general notes of the plans.

a) Prepackaged zinc galvanic anodes for protection of metallic pipe and fittings in lower resistivity soils (1,500 ohm-cm or below).

b) Prepackaged magnesium galvanic anodes for protection of metallic pipe and fittings in soils with higher resistivity soils (1,501 ohm-cm or above).

5. Where two or more metallic fittings are adjacent to each other, install joint bonds as specified in WIRE CONNECTIONS, 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 with Engineer's approval, 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 5-feet on fittings to be protected with one anode, if multiple fittings are bonded together.

7. For metallic (steel, ductile iron and cast iron) fittings, where specified coating thickness is not provided or specified holiday testing and/or 100-percent holiday free coatings are not completed by the fitting manufacturer, or bare fitting is coated with petrolatum tape type coating system, Contractor with Engineer's approval shall install one specified size larger anode or double the number of anodes for each fitting as listed in Table 8B.9.

a) If one 17- or 18-pound anode is required per Table 8B.9 and coating thickness is not as specified nor has the fitting been certified 100% holiday free, then at Contractor's option, install either a 30- or 32-pound anode or two 17- or 18-pound anodes.

1) 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 larger anode size shown in these specifications.

2) For example, if a bare fitting (16-inch or less) is exposed and petrolatum tape coated, it shall receive two 17- or 18-pound size or one 30- or 32-pound anode.

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 in accordance with Table 8B.9.
Table 8B.9 Minimum Quantity and Size of Galvanic Anodes

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>0&quot; TO 30&quot; DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Coated Metallic Fitting</td>
<td></td>
</tr>
<tr>
<td>1-17# Mg or 1-18# Zn Anode (Certified)</td>
<td></td>
</tr>
<tr>
<td>2-17# Mg or 2-18# Zn Anode (Noncertified)</td>
<td></td>
</tr>
<tr>
<td>Two (2) Metallic Fittings (5-foot separation MAX)</td>
<td></td>
</tr>
<tr>
<td>1-17# Mg or 1-18# Zn Anode (Certified)</td>
<td></td>
</tr>
<tr>
<td>2-17# Mg or 2-18# Zn Anode (Noncertified)</td>
<td></td>
</tr>
<tr>
<td>COATED Fire Hydrant or Blowoff Assembly (coated tee, valve and hydrant)</td>
<td></td>
</tr>
<tr>
<td>with PVC main and 6-inch PVC lead less than 10 feet long</td>
<td></td>
</tr>
<tr>
<td>1-17# Mg or 1-18# Zn Anode (Certified)</td>
<td></td>
</tr>
<tr>
<td>2-17# Mg or 2-18# Zn Anode (Noncertified)</td>
<td></td>
</tr>
<tr>
<td>COATED Fire Hydrant or Blowoff Assembly (coated tee, valve and hydrant)</td>
<td></td>
</tr>
<tr>
<td>with PVC main and 6-inch METALLIC lead less than 10 feet long</td>
<td></td>
</tr>
<tr>
<td>2-17# Mg or 2-18# Zn Anode</td>
<td></td>
</tr>
<tr>
<td>1-inch thru 2-inch copper service line</td>
<td></td>
</tr>
<tr>
<td>1-17# Mg or 1-18# Zn Anode</td>
<td></td>
</tr>
<tr>
<td>Existing metallic pipe tie-in, concrete encased stub piece or on existing metallic main at new service tap</td>
<td>1-17# Mg or 1-18# Zn Anode</td>
</tr>
<tr>
<td>Existing metallic pipe LEAK location</td>
<td>2-17# Mg or 2-18# Zn Anode</td>
</tr>
</tbody>
</table>

Notes: 1) **Certified** – Coating meets specified minimum thickness, has been 100% holiday tested and certified by manufacturer; 2) **Noncertified** – Coating meets specified minimum thickness, but has not been 100% holiday tested and has not been certified by manufacturer; 3) 1-30# Mg or 32# Zn anode may be utilized in lieu of 2-17# Mg or 2-18# Zn anodes.
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 test wires to pipe and tracer wires only 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 final location. Test station boxes can be completed at a later date. Contractor shall protect wires from damage if not terminated in test station or junction box at the time of pipe installation.

1. Test station or tracer wire access box types shall be installed on metallic pipelines or fittings as shown on test station schedule or drawings per the test station types as follows:

   a) Install flush-mounted test stations at specified galvanic anode installation locations on metallic fittings on plastic pipeline sections.

2. Tracer Wire Access Boxes

   a) Install flush-mounted tracer wire access boxes at each end of all plastic pipe runs and at specified locations on plastic pipeline sections.

   1) Install tracer wire access boxes at each end of all plastic pipe runs whether shown on the test station and tracer wire access box schedule or drawings or not.

      A) This includes plastic water services between the curb stop and the building being served.

      B) In the instance of private plastic water services, the tracer wire access box shall be placed within the street right-of-way adjacent to the curb stop or within a utility easement.

   2) Install tracer wire access boxes at locations shown on test station and tracer wire access box schedule found in drawings at maximum of five hundred feet (500') for in-town transmission or distribution type pipelines or shorter spans.
b) Cased Crossings

1) Install flush-mounted tracer wire access boxes on each side of cased crossings, if specified in the plans.

2) Install flush-mounted tracer wire access boxes on each side of cased crossings where anodes connected directly to casings, if specified in the plans.

C. If test stations or tracer wire access boxes are installed in locations other than those called out in the plans or if locations change, the Contractor shall record the location in the as-constructed plans using station-offset or coordinates relative to the project horizontal datum. Recorded location shall be within 0.5 feet of true location of test station or tracer wire access box.

D. Color-code wires per specifications before installation of wires in conduit or backfilling of the test station wires.

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

F. Locate next to other above-grade facilities and structures for protection, where possible. Install in protected locations that does not restrict intended use of the land, outside roadways, cultivated fields, and irrigation facilities.

G. Install at protected locations such as next to pipeline structures, fences and road crossings. The Engineer shall determine the final location. Changes in the location of any test station shall be reviewed and approved by Engineer prior to installation.

H. At test stations, where multiple metallic fittings are bonded together by No. 12 AWG bond wires on plastic pipelines, install one test lead to first fitting from the test station and second test lead to farthest fitting from the test station. This will allow the continuity between the metallic fittings to be confirmed.

I. Flush mounted test stations or 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 flush mounted test stations or tracer wire access boxes for support. Install supports and concrete collar around test station to prevent settlement.
2. Install a minimum 6-inch thick concrete collar either in a minimum 2-foot square pad or 3-foot diameter circular pad around flush mounted test stations or tracer wire access boxes as shown on Drawings. Shape selected by Owner.

   a) See Detail 13942FH for co-located test stations and tracer wire access boxes.

3. When installed in roadway, 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 wire lid shall be set level and ½- to 1-inch higher than finished grade in open dirt and lawn areas. Test stations and 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 box or tracer wire access box.

6. Do not connect test or tracer wire terminal board to flush mounted test stations or tracer wire access box lids that may short wires together.

J. Test wires shall be attached to the pipe as specified under WIRE CONNECTIONS.

K. 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.

L. All cathodic protection and test wires shall be buried a minimum of 36-inches below finished grade.

M. Test stations shall be located and identified by test station location tags. Contractor shall supply the type and number of location tags sufficient for the number of test stations listed in the Test Station Schedule for the project. One UNSTAMPED tag shall be left in each test station. City personnel or Engineer will stamp the tags with appropriate identification at the time of final acceptance testing.

N. 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.
O. 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 in this section, shall be maintained throughout project.

P. 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 then close test station.

3.08 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 coated with an approved electrical seal coat in accordance with the tape manufacturer's installation instructions, or with a specially fabricated splicing kit, or made with an approved epoxy insulated splice kit.

C. Insulation damage or splices to large cathodic protection cables (No. 4 AWG or larger) shall only be made with an approved epoxy insulated splice kits.

D. Install splice kits in accordance with the product manufacturer's written directions. Allow splice kits to cool and set before moving.

E. All wire splices and wire insulation repair locations shall be observed by the Engineer. Contractor shall record the location in the as-constructed plans using station-offset or coordinates relative to the project horizontal datum. Recorded location shall be within 0.5 feet of true location of splice or insulation repair.

3.09 WARNING TAPE

A. Bury warning tape, if specified, above all underground cathodic protection cable and conduit. Warning tape shall be placed approximately 12-inches above pipe and structures being identified or at specified depths as required in other sections of this contract document or shown on the details. Align parallel to and within two (2) inches of the centerline of conduit or cable run.
3.10 PLASTIC PIPE TRACING WIRE

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

B. Tracer wire shall be electrically continuous between tracer wire access boxes with no accidental electrical contacts (shorts) to metallic fittings, anodes or other structures.

C. Tracer wire shall be centered on top of plastic or non-metallic pipeline and securely held in place with tape meeting requirements provided under TRACER WIRE. Tracer wire shall be taped with two full circumferential wraps, or as approved by the Engineer, at a maximum distance of every five feet (5') along the pipe and within one foot either side of each fitting. Standard-duty Duct Tape is not an acceptable product.

1. The first wrap of tape shall be started under the tracer wire, adhesive side down, inverted after six inches so adhesive side is up and wrap continued around pipe circumference. With tracer wire on top of first wrap, flip tape over so adhesive side is down and wrap around pipe circumference ending past the start of the initial tape wrap.

2. The intent is to have the tape adhere to itself with the tracer wire in between the two adhesive sides to minimize tracer wire falling from top of pipe.

D. For short sections of plastic pipe (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. These No. 12 AWG bond wires are not the same as test station wires. If listed on the test station schedule install separate wires for the test leads.

E. For plastic pipe installed by directional drilling in bores, install tracer wire in heavy duty plastic conduit bored in at the same time as the waterline. Terminate tracer wires at each bore pit in flush type tracer wire access boxes.

F. Do not attach tracing wire directly to metallic fittings or appurtenances.

G. Install tracer wire access boxes and terminate tracer wires at all fire hydrant assemblies, each end of all casings, bores, building or tank walls, and each end of a pipe run.

H. Install tracer wire access boxes at the end of all plastic pipe runs whether shown or not on the test station and tracer wire access boxes schedule and/or drawings.

I. Maximum tracer wire span distance shall be:
1. The maximum span distance shall be five hundred feet (500') or less.

J. On private plastic water service lines, tracer wire shall extend from the curb stop to the residence. The tracer wire from the plastic service line shall be clamped to the copper service line using a brass ground clamp. A single tracer wire shall be extended up the curb stop box and terminate above ground in order to trace both to the main and to the residence.

K. Field terminate tracer wires in accordance with the Drawings by:

1. Bring end of tracing wire leg from each pipe direction to abovegrade surface elevation by installing a flush tracer wire access box. One tracer wire end shall come from each pipe direction.

2. Terminate tracing wire abovegrade at tracer wire access boxes located next to pipe appurtenances (vaults, vent pipes, blow-offs, or at fire hydrant bases).

3. Tracer wire shall be electrically continuous between tracer wire access boxes locations. Tracer wires shall not be terminated in valve boxes or below grade.

4. Color code and connect the tracer wire for each tracer wire span to the same terminal location on the terminal board depending on wire direction (i.e., top terminal board location for north or west tracer wire directions and bottom terminal location for south or east tracer wire directions).

5. Make inline splices and insulation repair as specified under section WIRE INSULATION REPAIR only when observed by Engineer.

6. Terminate tracer wire in a flush tracer wire access box per test station schedule in accordance with Engineer direction.

7. If tracer wires terminate 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 penetrations 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.

8. Install tracer wire access boxes and terminate each tracer wire span in box with ring tongue terminals connected to the tracer wire access box terminal board.

9. Provide jumper bond wires with ring tongue terminal connected across the two tracer wire span terminals on the test station terminal board for transmission-type projects. The jumper bond wire shall be installed under
another nut on the front side of the terminal board to bond consecutive spans together while allowing easy temporary removal for testing.

L. Test tracer wire for continuity with an approved method in accordance with the specified functional testing per this specification section, prior to final acceptance of the pipeline installation. Functional testing to be completed by Contractor as a minimum shall consist of the following:

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. At end of project after all excavations have been completed.

4. Use of pipeline locator equipment for functional testing is not recommended.

5. For transmission-type projects, bond all of the tracer wire spans together with jumper bond wires or shorting straps and conduct final round of Contractor tracer wire functional testing for the entire length of transmission main project.

3.11 INSULATED JOINTS

A. Insulated joints shall be installed to electrically isolate the pipeline from other structures.

1. Insulated joints shall be located at connections to existing metallic pipe, where loose bonded coated (polyethylene encased) pipe is connected to tight bonded coated pipe, where concrete encased pipe is connected to dielectric coated pipe, where cathodically protected pipe connects to pipe not intended to have cathodic protection, and where shown. Install a flush test station at each buried insulated joint.

2. Insulated joints shall be utilized to isolate electric motors and magnetic water meters from cathodically protected pipeline sections.

3. Provide electrical shields at locations where other metallic structures (pipe supports, conduit, bare ground wires, etc.) either may be in contact with piping or are in close proximity to the pipe. Install on both sides of the insulated joint to maintain electrical isolation.

4. Install electrical shield between pipelines at crossings or close parallels as shown on drawings or specified.
5. Install copper insulating joints where copper services are connected to metallic water mains and at service meters or curb stops where ownership of copper service lines changes.

B. Install insulated joints at locations listed on test station schedule or as shown on the Drawings. Coordinate and carefully follow both insulating joint and manufacturer’s recommendations for large diameter insulating joint installations.

C. Allowable insulating joint type for maximum pipe diameter size for buried locations shall be 36-inches for insulating flanges.

D. Install insulated joints abovegrade in buildings, vaults, and manways whenever possible. Insulated joints shall be installed a minimum of 12-inches clearance above floor or from wall to allow access for testing and maintenance. Maintain clearance from other structures or provide electrical shields as required to maintain electrical isolation.

E. Insulated joints shall be provided over-voltage protection with ground cells, flange protectors, or polarization cell replacement (PCR) devices at locations as shown on the Drawings and/or listed on the test station schedule.

F. General:
   1. Carefully align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials.
   2. Support, backfill, and compact pipe and fitting in accordance with the insulator and pipe manufacturer’s recommendations that will not cause leaks or damage to the insulating joint.
   3. Test each insulating joint as specified under FUNCTIONAL AND PERFORMANCE TESTING this specification section. Test buried insulating joints before and after backfilling.

G. Insulated Flanges: Install insulated flanges, sleeves, and washers according to manufacturer’s recommendations.
   1. Bolts for insulated flanges and restrained couplings should be undersized or holes slightly oversized to allow installation of insulating sleeves. Bolts shall be threaded for full length. Coordinate with fitting manufacturer and insulating flange manufacturer.
   2. Clean flange surface and holes of all dirt, grease, oil, and contamination. Examine flange and bolt holes for burrs, sharp edges, or spurs. Remove any irregularities.
   3. Confirm that both flange faces are free of all pits, dents, gouges, grooves, corrosion, burrs, or other type of irregularities. Both flange faces surfaces
shall be smooth with a finish no rougher than 250 RMS. Refinish flange faces if surface too rough in accordance with flange insulator manufacturer’s recommendations.

4. Align flanges so that they are concentric and parallel and carefully install flange gasket to not damage sealing element. Do not use grease, lubricant or adhesives on either the flange faces or the flange gasket.

5. Check bolts and nuts and clean as required. Apply non-conductive lubricant to all threads and flange side of nuts.

6. Carefully align bolt holes to minimize damage to insulating sleeves during assembly. Line up bolt holes with non-tapering drift pins at a minimum three locations with 120° between locations.

7. Carefully measure and adjust sleeve length as required to provide an air gap (space) between end of sleeve and nut after flange is tightened down, length as recommended by the insulator manufacturer.

8. Carefully insert sleeves over bolts and place insulating washer and metal washer over end, line up holes in fitting, install bolt with sleeve into place. Do not force bolt insulating sleeves into the flange hole. If force is required to insert the insulating sleeve, check alignment and readjust as required. Replace any damaged insulating bolt sleeves as required. Place insulating washer and metal washer on opposite end with nut.

9. Two insulated washers, one on either side of insulator are required for all abovegrade applications. Insulating washers are only required on the unprotected pipe side for buried or immersed insulated flange locations.

10. Tighten bolts a few turns at a time in sequence and procedure as recommended by insulator manufacturer until all bolts are uniformly tightened. Repeat torque sequence; repeat tightening in sequence to final torque. Do not exceed manufacturer’s recommended pounds per square inch of pressure during initial torque-up. Go completely around flange rechecking all bolts for correct torque. All bolt tightening shall be done in accordance with insulating flange manufacturer’s recommended sequence with torque wrenches (mechanical or hydraulic) or with a stud tension measuring device.

   a) For all above grade flange locations recheck bolt tightness after system has been pressurized.

11. Visually inspect for physical damage to insulating sleeves or washers, replace if cracked or damage observed. Check flanges (visually with a flashlight, calibers, or feeler gauge, etc.) for a section that may not be
aligned correctly and which may show a gap or separation. Correct in accordance with the insulating flange manufacturer.

12. Test for electrical isolation before top-coating.

a) In abovegrade locations where high humidity or high contamination present, seal with rubber caulk type sealer or provide and install above grade flange protectors at insulating flange locations in corrosive or wet environments in accordance with specific product manufacturer’s instructions.

b) In buried locations, coat after assembly and testing as specified.

H. Insulated Couplings: Install insulating boots and insulated flexible couplings in accordance with the manufacturer’s recommendations and AWWA Standard C219.

1. Clean and install insulated boot (sleeve, band, etc.) over end of each pipe, two boots required for each location. Push insulating boot into place over pipe until small insulating boot lip contacts pipe end. Clean, lubricate, and install other sealing gaskets, middle ring and follower rings according to manufacturer’s recommendations.

2. Line up and install bolts as required. Tighten bolts a few turns at a time in sequence and procedure as recommended by insulator manufacturer until all bolts are uniformly tightened. Do not exceed manufacturer’s recommended pounds per square inch of pressure during initial torque-up. For all above grade locations recheck bolt tightness after system has operated.

3. Insulating boot should be visible on either side of coupling when completed.

4. Bond buried coupling body into protected pipe side with pigtail wires.

5. Test for electrical isolation both before top-coating insulated couplings and after burial.

I. Restrained Insulated Joints:

1. If insulated flexible coupling is utilized electrically isolate restraining rod assembly with insulating G-10 sleeves and washers on both ends of restraining rods. Oversize restraining device bolt holes or undersize restraining rod as required to not damage insulating materials and still meet specified restraining strength and pressure requirements. For buried or submerged insulator locations, only install insulating sleeve and insulating washer on unprotected end of restraining rod assembly.
2. Test restrained rod installation for electrical isolation prior to top-coating or backfill. Coat per specification if not stainless steel or fusion-bonded coated rod, with heat shrink, liquid 100-percent moisture cured epoxy repair coating, or petrolatum tape coated.

3. Test buried insulator both prior to and after backfill.

J. Buried Flange Insulator Coating: At buried insulated flange locations, Contractor shall coat exterior portion of insulating joint after assembly and testing. At Contractor’s option, coating shall consist of either:

1. Four-layer petrolatum wax-tape system intended for burial conditions per AWWA C217.

2. A 100-percent solids epoxy mastic coating, filler tape top-coated with two layers of specified pipeline joint/repair tape coating, or heat shrink sleeve.

K. Copper Service Line Insulators: Install insulated corporation ball valves, insulated curb ball valves, and insulated service fittings at locations as shown on the Drawings in accordance with the service liner manufacturer’s instructions.

3.12 INSULATING WALL AND FLOOR SLEEVES

A. Coordinate and install pipe and wall sleeve sto provide a smooth uniformly round shaped opening per pipe and modular seal manufacturer’s recommendations.

B. Coordinate pipe fabrications, wall sleeves and modular seal types and sizes for wall or floor penetrations to allow for the watertight sealing system used at wall or penetrations. Install pipe and wall sleeve or core wall to provide uniformly round shape, grind as required to control weld seam height per pipe and modular seal manufacturer’s recommendations. Factory grind all welds at wall sleeve location and a minimum of 12-inches on either side of wall or floor opening, do not remove parent material during grinding operations. Repair coating as required.

C. Insulating wall or floor sleeves or seals shall be installed according to manufacturer’s recommendations. Wall sleeves shall be positioned so that the water stop (collar) is centered in the width of the opening and the water stop (collar) contacts the opening evenly for the minimum 1-inch distance or more as recommended by the modular seal manufacturer. Center the pipe in the opening and adequately support on both sides. Make sure that the pipe, opening, and wall sleeve are clean, smooth, and round. Install the exact number of links per the manufacturer’s recommendations for the size and type of opening and pipe diameter.
D. Install the links in the same direction so that the bolts can be tightened from the inside of the building or vault location. Assemble, insert, align, and evenly tighten insulating modular seal in accordance with the manufacturer’s installation instructions in a manner that will not damage pipe coating or insulating modular seal. Position centering blocks for casing end seal type installations on bottom one-half of the pipeline as recommended by the modular seal manufacturer. Position the modular seal so that it is centered in the wall sleeve and that when tightened down it provides an even, uniform spacing in the wall sleeve. Take up free slack in bolts and then tighten each bolt clockwise in opposing succession at torque and sequence as recommended by seal manufacturer. Evenly tighten the individual bolts the maximum number of turns as recommended by the manufacturer until the sealing elements bulges around all of the pressure plates. Do not use power tools to tighten stainless steel bolts. Completed installation shall provide long term insulated and sealed (liquid tight) connection between pipe and floor or wall opening, sleeve, or casing.

E. Insulating wall or floor sleeve shall be positioned to allow adjustment from interior side of building and vault locations and exterior side of water bearing structure locations.

F. For water bearing structures or for locations if shown on the drawings install a second modular wall seal.

3.13 ELECTRICAL SHIELDS

A. Install electrical shields between sections of cathodically-protected pipe and pipe supports connected to or sitting on unprotected supports or structures in order to maintain electrical isolation as shown on the drawings.

3.14 FACTORY AND FIELD REPAIR COATINGS FOR PIPING, FITTINGS AND ACCESSORIES

A. Miscellaneous Incidental 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 section. 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) A minimum of ten dry film thickness measurements shall be completed on each 40-foot length of pipe.
b) 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 with provided repair kits or repair materials recommended and approved by the original coated material manufacturer.

B. Field testing, surface preparation and coating for field coating or repair of damaged coating on new or existing pipe, piping, appurtenances, and fittings shall be in accordance with this specification section

1. Inspect and repair any coating or lining damage with original manufacturer’s approved repair kit.

2. Follow coating manufacturer’s written directions for surface preparation and repair coating application.

3. Utilize potable water approved materials for coatings and linings in contact with potable water.

4. Complete surface preparation and field repairs of coatings and linings in accordance with coating manufacturer’s written directions.

5. Observe environmental (weather and surface temperature) requirements.

6. Allow to cure in strict accordance with coating manufacturer’s recommendations based on surface and weather conditions prior to handling, burial, or exposure to liquids.

C. External incidental pipe and fitting field or repair coatings shall consist of external coating materials and repair procedures as recommended by the original pipe or fitting coating manufacturer.

1. Fusion-bonded epoxy coated items shall be repaired with epoxy repair coating outlined in these specifications.

2. Epoxy coated items shall be repaired with repair coating from the original coating manufacturer.

3. Spot coating damage at thermite weld connections shall be repaired with a 100-percent solids epoxy repair coating that can cure in either wet or dry conditions.

4. Field epoxy coat, tape coat or heat shrink sleeve, short sections of buried metallic piping such as vent pipes, blow-off assemblies, and pipe stubs to be concrete encased under or next to buildings or tanks if not already coated with an approved specified factory applied coating system.
5. Provide epoxy coatings for pipe and fittings in vaults if not already coated with an approved specified factory applied coating system. Provide epoxy/polyurethane enamel type coating system for abovegrade appurtenances if not already factory coated with an approved specified factory applied coating system.

D. Repair or field coatings shall overlap intact factory coating a minimum of ½-inch in all directions from the damaged area.

E. Install coated valves, fittings, and miscellaneous metallic pieces in a manner that will not damage coating or lining.

F. 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.

G. Fitting and Appurtenance Fasteners (Bolts, Nuts, and Similar Items): Series 300 stainless steel or fusion-bonded epoxy coated depending on specified location.

1. All bolts and nuts shall be installed according to manufacturer's requirements including the use of anti-galling lubricant compound for stainless steel materials.
   a) If galling or seizing of the nut and bolt occurs the bolt shall be cut off, nut and bolt discarded and replaced with a new nut and bolt.
   b) Exercise care to assure tightening of the nut is against the flange or gland and not due to galling or seizing.

2. Conduct testing of Series 300 stainless steel materials with magnet to confirm Series 300 stainless steel provided prior to installation.

H. If approved by Engineer, coat miscellaneous hard to coat items with four-layer petrolatum tape system or heat shrink repair coating.

3.15 FIELD COATING FOR INCIDENTAL STEEL AND DUCTILE IRON PIPE STUB PIECES AND FITTINGS

A. Field tape coat or heat shrink sleeve, short sections of buried metallic piping such as vent pipes, blow-off assemblies, and pipe stubs to be concrete encased under or next to buildings or tanks if not already coated with an approved specified factory applied coating system.

1. Bituminous asphaltic coating does not qualify as an approved factory tight bonded coating.

B. Follow the coating manufacturer's recommendations and the referenced AWWA Standards.
1. Acceptable products are specified under PIPE AND FITTING FIELD COATING REPAIR MATERIALS.

2. Solvent wipe per SSPC SP-1 if required to remove contamination.

3. Hand tool clean small surfaces only. Abrasive blast location areas larger than 12-square inches. Abrasive blast to SSPC SP-10 (Near White) for external surfaces and SSPC SP-5 (White) for internal surfaces.

4. Repair coating should overlap intact factory coating a minimum of 4-inches in all directions from the damaged area.

5. Field Tape Coating:
   a) For hand taping, provide suitable field primer (if required) and 35-mil field applied repair tape with aggressive adhesive and release liner, 4- or 6-inches width. Apply with 50-percent overlap for a minimum 70-mil hand tape coating system.
   b) Pipe shall be clean and dry prior to and during application of both primer and tape coating. Tape shall be applied in a spiral wrap with a 50-percent overlap in accordance with AWWA C209.

6. Heat Shrink Field Coating:
   a) For heat shrink sleeve installation, provide suitable filler material and heat shrink sleeve material for pipe size required or heat shrink repair patch as required for field repair.
   b) Pipe shall be clean and dry prior to and during installation of heat shrink sleeve. Install sleeve in accordance with AWWA C216, the coating manufacturer’s recommendations and these specifications.

7. Moisture Cure 100-Percent Epoxy Repair Coating
   a) Spot coating damage locations and hard-to-coat fittings and appurtenance (edges, flanges, tie-rods, bolts, nuts, etc.) locations shall be coated with a moisture cure 100-percent epoxy repair coating.
   b) Clean and prepare surface in accordance with repair coating manufacturer’s directions. Wire brush and sand as required. Clean per SSPC SP-1 if required.
   c) Mix epoxy repair coatings at ratio and for time per repair coating manufacturer’s directions. Apply to repair area by hand application method (brush, trowel, spatula, etc.) and smooth out onto intact
coating in accordance with repair coating manufacturer’s recommendations.

d) Provide manufacturer recommended 25- to 30-MDFT coating thickness.

8. Petrolatum Tape Coating System

a) Field apply petrolatum tape system for all restraining fittings and rods if not already coated with an approved specified factory applied coating system or stainless steel.

b) Provide petrolatum system coating at insulated location to existing pipe or appurtenances exposed as part of connection installation if not already coated.

c) Provide petrolatum system coating for isolated copper fittings if not already protected by a galvanic anode system.

d) For petrolatum system tape installation per AWWA C217, provide suitable primer, filler material (mastic), petrolatum tape and outer wrap material for burial application.

1) Pipe or fitting shall be clean and dry prior to and during installation of four-layer petrolatum wax tape system.

2) Install petrolatum tape system in accordance with coating manufacturer’s instructions and these specifications.

3) Apply primer in an even uniform manner to entire tie rod, pipe, or fitting surface area to be coated to achieve minimum primer thickness of 3-mil wet film thickness. Increase amount of primer at and work primer into threads, cavities, pits, angles, edges, and other irregular areas. Apply primer with brush or glove.

4) Apply mastic immediately after application of primer, drying of primer is not required. Work and mold mastic into irregular shapes to fill voids and achieve a uniform contour to provide a smooth even support for the tape coating system to avoid bridging.

5) Apply one or more petrolatum tape layer(s) in a spiral wrap fashion around the tie rod or fitting circumference with a 50-percent minimum overlap onto the proceeding layer.

e) Apply the 10-mil PVC outer wrap tape layer in a spiral fashion around the pipe or fitting with a 50-percent minimum overlap.
f) The completed petrolatum coating system shall be a minimum of 40 MDFT and adhere tightly to the coated structure and present a smooth unwrinkled appearance.

### 3.16 FUNCTIONAL AND PERFORMANCE TESTING

A. Functional Testing: Provide the Engineer with a minimum of seven (7) calendar days' advanced 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.

2. Test each wire for continuity with potential measurements to a copper/copper sulfate reference electrode and with an ohm-meter between wires prior to connecting together on the terminal board.

3. Test the buried permanent reference electrode, if present, 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.

4. Testing results shall be recorded on Form 8B.1 and transmitted to the Engineer following completion of functional testing.

5. Do not connect reference electrodes to pipe test lead terminals.

C. Electrical Insulating Joints:

1. Test each insulated joint after assembly for electrical isolation in accordance with the insulation checker manufacturer's written instructions and by potential measurements.

2. Test insulator with radio frequency type insulator checker prior to backfill. Utilize a radio frequency type meter that is self-zeroing such as the Model RF-IT manufactured by Tinker and Rasor or approved equal.

3. Test and provide electrical isolation as specified in accordance with NACE SP0286.
4. Buried electrical insulating joints shall be tested both before and after burial.

5. Test for electrical isolation at electrical shields between pipe and pipe supports and at wall or floor penetrations.

6. All defective electrical shields, pipe supports, wall penetrations, insulating joints, and/or damaged or defective insulation parts shall be corrected or replaced by the Contractor at his sole expense.

D. Tracer Wires:

1. Demonstrate correct installation of tracer wire access boxes and tracer wire termination and continuity by field functional tests.

2. Acceptable tracer wire continuity testing methods shall consist of:
   a) Electrical continuity (four wire) type testing that demonstrates voltage (potential) changes at end of line from temporary connection to a DC current source at far end of the tracer wire,
   b) Verification of a voltage measurement to a test battery with the tracer wire as one side of the two-wire circuit, and/or
   c) Use of commercially-available cable continuity verification testing equipment utilized in accordance with the test equipment manufacturer’s written instructions.
   d) Use of typical pipe locating type equipment IS NOT an acceptable continuity verification test method. This type of equipment may walk through tracer wire breaks.

3. Contractor shall utilize Form 8B.2 for recording continuity testing results and transmit results to Engineer following functional testing. Test data will be reviewed by Engineer prior to acceptance of tracer wires and access boxes.

4. Potential Functional Testing Outcomes:
   a) Similar or equal potential change observed at the far end and start of tracer wire span is an indication of an electrically continuous tracer wire with no accidental shorts.
   b) No change at the far end of the span being tested indicates a possible break in the tracer wire.
   c) A difference between the potential measurement value at the start of the test span and the measured value at the far end of the test span
may be an indication of an accidental electrical contact or short to one or more metallic fittings. The greater the potential difference, the more likelihood of a short or the larger the surface area shorted to.

d) Typically measured potential values at the start and end of a tracer wire span should be approximately 10- to 12-volts or higher at each end, if the source is a full-charged 12-volt battery. Measured potentials lower than 10-volts at either end indicate a possible accidental short to one or more metallic fittings or structures.

e) If potentials below 10-volts are measured conduct additional testing with a cable-type locator and A-frame to locate and correct possible tracer wire insulation damage or accidental shorts to other metallic structures.

1) Operate cable locating equipment in accordance with equipment manufacturer’s instructions at the lowest output settings possible in order to be more sensitive to problem locations and to minimize walk-through (jumping the discontinuity or break) or missing accidental contacts.

2) Carefully observe changes in signal strength and depth measurement values as likely indicators of either possible breaks or accidental contact locations.

3) Once discontinuity is located, test the span from the opposite direction to confirm discontinuity location prior to commencing with repair(s).

f) Repair all insulation damage found. Retest tracer wire span with 12-volt potential test to confirm all possible shorts have been found and corrected.

E. 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.

a) Zinc anodes should read a minimum of -1.0 volt and

b) 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 or fitting leads together with a shunt in test stations until Engineer is present.

3.17 FINAL TESTING

A. General:

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.

2. At Contractor's option, he may be present during this final testing if desired.

B. Galvanic Anodes Cathodic Protection System:

1. The 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. Tracer Wire and Access Boxes:

1. The Engineer shall make sufficient tests to determine proper installation of the tracer wire and access box system. The acceptance method for the final tracer wire continuity testing shall be by the potential shift method.

D. 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.

E. Any defects in the corrosion protection system, (including but not limited to fitting, valve or other metallic appurtenance coating or lining, tracer wire 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.

1. Contractor shall provide the Engineer with a minimum of 7 day advanced notice before beginning warranty repairs.
8B.4 METHOD OF MEASUREMENT

4.01 Galvanic Anodes
   A. Anodes and the attachment of lead wires to fittings, valves or other metallic components shall be incidental to each of the new metallic water system components installed. No separate measurement will be made.

4.02 Cathodic Test Stations
   A. Cathodic test stations shall be counted on a per each basis for “Test Station”. The cathodic test station bid item shall include all items specified and necessary to install and to make operational a complete test station.

4.03 Tracer Wire and Tracer Wire Access boxes
   A. Tracer wire and all accessory items necessary for the installation of an electrically-continuous tracing system shall be incidental to the pipe installed. No separate measurement will be made.

   B. Tracer wire access boxes for 2-wire, 45-mil insulation shall be counted on a per each basis for “Tracer Wire Access Box – 2-wire”.

   C. Tracer wire access boxes for more than two tracer wires with 45-mil insulation or wires greater than 100-mil insulation shall be counted on a per each basis for “Tracer Wire Access Box – Large”.

4.04 Service Line Insulators
   A. Service line insulators shall be incidental to the service line installed. No separate measurement will be made.

4.05 Coating Repairs
   A. Coating repairs to fittings, existing coated pipe or project specified coated pipe are considered incidental to the pipe or fittings installed. No separate measurement will be made.

4.06 Functional Testing
   A. Functional testing of the cathodic protection and tracer wire systems shall be incidental to the water system components installed. No separate measurement will be made.

4.07 Final Acceptance Testing
   A. Final acceptance testing will be performed by the City.
8B.5 BASIS OF PAYMENT

5.01 Galvanic Anodes
   A. No separate payment will be made.

5.02 Cathodic Test Stations
   A. Payment for cathodic test station bid item shall be made for “Test Station” and shall include all items specified and necessary to install and to make operational a complete test station.

5.03 Tracer Wire and Tracer Wire Access boxes
   A. No separate payment will be made for tracer wire and all accessory items necessary for the installation of an electrically-continuous tracing system.
   B. Payment for tracer wire access boxes for 2-wire, 45-mil insulation bid item shall be made for “Tracer Wire Access Box – 2-wire” and shall only include furnishing and installing a complete tracer wire access box.
   C. Payment for tracer wire access boxes for more than two 45-mil insulation tracer wires or tracer wire with 100-mil+ insulation bid item shall be made for “Tracer Wire Access Box – Large” and shall only include furnishing and installing a complete tracer wire access box.

5.04 Service Line Insulators
   A. No separate payment will be made.

5.05 Coating Repairs
   A. No separate payment will be made.

5.06 Functional Testing
   A. No separate payment will be made.

5.07 Final Acceptance Testing
   A. No separate payment will be made.
   B. If final acceptance testing shows inconsistencies in the cathodic protection or tracer wire systems, the Contractor shall be responsible for all labor, equipment and materials necessary to determine the cause and the location of the inconsistencies and the repair of the problem.
      1. The Contractor is also responsible for the costs of subsequent acceptance testing associated with the cost of repairs incurred by the Engineer.
### FORM 8B.1
**STRUCTURE-TO-REFERENCE ELECTRODE POTENTIAL AND GALVANIC ANODE MEASUREMENTS**

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Tested By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>Date</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Station</th>
<th>Test Location Structure and Wire Size, Type &amp; Color Code</th>
<th>Test Station Type</th>
<th>Anode Shunt (mV)</th>
<th>Milli-Amps</th>
<th>Potential (Volts) OFF</th>
<th>Potential (Volts) ON</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Submitted By: ____________________________ Date: __________________

---

CITY OF RAPID CITY
STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION
CORROSION PROTECTION – PLASTIC PIPE SYSTEMS

(Rev 10/16)  Page 8B.91
### TRACER WIRE POTENTIAL AND ELECTRICAL CONTINUITY TEST WORKSHEET

**CLIENT:** ___________________________  **PROJECT#:** ___________________________

**PROJECT:** ___________________________  **LOCATION:** ___________________________

**PURPLE COLOR:** _____ NORTH (1) OR _____ WEST (2) TAPE STRIPS / TOP 2 TERMINAL LOCATIONS

**GRAY COLOR:** _____ SOUTH (1) OR _____ EAST (2) TAPE STRIPS / BOTTOM 2 TERMINAL LOCATIONS

**FROM STATION ______+______ TO STATION ______+_______ TOTAL DISTANCE (FT) = ___________

*PROVIDE A SKETCH BELOW (INCLUDE TEST CONNECTIONS, DISTANCES, STATIONING, ETC.):*

<table>
<thead>
<tr>
<th>START TEST POINT STA</th>
<th>END TEST POINT STA</th>
<th>COLOR, NUMBER &amp; CURRENT (ON Test)</th>
<th>ON/OFF POTENTIAL SHIFT</th>
<th>COLOR, NUMBER &amp; CURRENT (ON Test)</th>
<th>ON/OFF POTENTIAL SHIFT</th>
<th>COLOR, NUMBER &amp; CURRENT (ON Test)</th>
<th>ON/OFF POTENTIAL SHIFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT START, TOP TERMINAL COLOR _____ POTENTIAL BEFORE TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT START, TOP TERMINAL COLOR _____ POTENTIAL AT TEST (RECORD mVolt and mAmp)</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT START, BOTTOM TERMINAL COLOR _____ POTENTIAL BEFORE TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT START, BOTTOM TERMINAL COLOR _____ POTENTIAL AT TEST (RECORD mVolt and mAmp)</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT END, TOP TERMINAL COLOR _____ POTENTIAL BEFORE TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT END, TOP TERMINAL COLOR _____ POTENTIAL AT TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT END, BOTTOM TERMINAL COLOR _____ POTENTIAL BEFORE TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT END, BOTTOM TERMINAL COLOR _____ POTENTIAL AT TEST</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS/NOTES:**

---

CITY OF RAPID CITY  
STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION  
CORROSION PROTECTION – PLASTIC PIPE SYSTEMS  
(Rev 10/16)  
Page 8B.93
# FORM 8B.3
## INDIVIDUAL WIRE JOINT BOND RESISTANCE TEST SUMMARY

**PIPE NAME/SIZE:**

**CONTRACTOR:**

**DATE**

**SHEET**

**OF**

---

**Conduct test at DLRO min. 10 A, current output 6,000 micro-ohm setting**

<table>
<thead>
<tr>
<th>MAXIMUM ALLOWABLE JOINT WIRE RESISTANCE</th>
<th>Calibration Time/By</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2 AWG Joint Bond Wires</td>
<td></td>
</tr>
<tr>
<td>Structure or Bond Type and Length</td>
<td>Micro-Ohms</td>
</tr>
<tr>
<td>Two (2) Joint Bond Wires (18” Long)</td>
<td></td>
</tr>
<tr>
<td>Three (3) Joint Bond Wires (18” Long)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Pipe Joint No.</th>
<th>Approx. Pipe Stationing at Joint Measured</th>
<th>Measured Bond Resistance (Micro-Ohms)</th>
<th>Type of Joint &amp; Pass Yes or No. If No Add Another</th>
<th>Additional Bond Micro-Ohms</th>
<th>Time Measured</th>
<th>Tested By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© RUSTNOT
ATTACHMENT A and B
PVC PIPE and DUCTILE IRON FITTINGS CERTIFICATION

CONTRACT: ___________________________ DATE: ___________________________

CONTRACTOR:_________________________________________________________

PIPE MANUFACTURER: _________________________________________________

DUCTILE IRON FITTINGS MANUFACTURER: _______________________________

This certification applies to PVC pipe and Ductile Iron Fittings, as may be provided by Manufacturers as identified above. Omission of any required project certification herein does not relieve the Pipe or Ductile Iron Fittings Manufacturers or the CONTRACTOR from responsibilities of performance as may be required by the Contract Documents.

For pipe and pipe materials, joints and fittings to be supplied on the above referenced contract, the listed Pipe Manufacturer certifies as follows:

1. The PVC pipe shall be manufactured as specified in Section 8AR – Water Piping Systems – of the Standard Specifications.

2. Ductile Iron Fitting Manufacturer shall provide required coatings and linings in accordance with Section 8B – Corrosion Protection - Plastic Pipe Systems – of the Standard Specifications.

[Remainder of page left blank intentionally]
ATTACHMENT A
PVC PIPE CERTIFICATION

IN CERTIFICATION THEREOF:

Name: ________________________________

Title: ________________________________

Signature: ____________________________

Company: ____________________________

Address: ______________________________

____________________________________

____________________________________

Phone: ____________________________ e-mail: ________________________________

This certification shall be sent by the Pipe Manufacturer to the CONTRACTOR, and then forwarded by CONTRACTOR to ENGINEER. This certification shall be signed by an authorized representative (with power of attorney) of the Pipe Manufacturer.

NOTARY:

The above certification was signed by ___________ of ___________ in my presence on ___________ , 20________

Notary Public: ________________________________

My Commission Expires On: ________________ 20____
ATTACHMENT B
DUCTILE IRON FITTINGS CERTIFICATION

IN CERTIFICATION THEREOF:

Name: ____________________________________________

Title: ____________________________________________

Signature: ____________________________________________

Company: ____________________________________________

Address: ____________________________________________

Phone: ____________________ e-mail: ____________________

This certification shall be sent by the Ductile Iron Fittings Manufacturer to the CONTRACTOR, and then forwarded by CONTRACTOR to ENGINEER. This certification shall be signed by an authorized representative (with power of attorney) of the Ductile Iron Fittings Manufacturer.

NOTARY:

The above certification was signed by __________ of __________

in my presence on __________ , 20________
Notary Public: ______________________________

My Commission Expires On: ____________________ 20____
ATTACHMENT C (Part 1)
MATERIAL HANDLING AND INSTALLATION CERTIFICATION

CONTRACT: ____________________________ DATE: ____________________

CONTRACTOR: ____________________________

PIPE MANUFACTURER: ____________________________

This certification applies to all plastic pipe, fittings, and materials as may be provided by Pipe Manufacturer as identified above. Omission of any required project certification herein does not relieve the Pipe Manufacturer or the CONTRACTOR from responsibilities of performance as may be required by the Contract Documents.

For pipe and pipe materials, joints and fittings to be supplied on the above referenced contract, the listed Pipe Manufacturer certifies as follows:

1. The Pipe Manufacturer has been present and observed the CONTRACTOR’s work for the placement of the first _____ feet of pipe from Station ______ to Station ______ _____ for the dates of _______ to ___________. During their observation of the CONTRACTOR, the CONTRACTOR was following the Pipe Manufacturer’s recommendation for handling, storing, assembling and installing pipe, pipe joints, fittings, and repair procedures for coating and linings.

2. During the site visit, Pipe Manufacturer observed construction from Station ______ to Station ______ between the dates of _______ to ___________. The Pipe Manufacturer has observed the CONTRACTOR’s storage and handling of the pipe, assembly of pipe joints, fittings, and proper repair procedure for coatings and linings, where applicable, and all are in conformance with the Pipe Manufacturer’s recommendations.

A trip report with summary of observations shall be attached to this certification and shall include any additional items that may be need to be addressed by the Contractor or problems resolved during site visits.

The Pipe Manufacturer has reviewed the Contract Documents and has taken into consideration the contract requirements governing pipe manufacture and installation as specified therein.

[Remainder of page left blank intentionally]
ATTACHMENT C (Part 2)
MATERIAL HANDLING AND INSTALLATION CERTIFICATION

IN CERTIFICATION THEREOF:

Name: ____________________________________

Title: ____________________________________

Signature: ________________________________

Company: __________________________________

Address: __________________________________

Phone: ___________________________ e-mail: _________________________________

This certification shall be sent by the Pipe Manufacturer to the CONTRACTOR, and then forwarded by CONTRACTOR to ENGINEER. This certification shall be signed by an authorized representative (with power of attorney) of the Pipe Manufacturer.

NOTE: Attachment C is required to be completed by the Manufacturer for projects of any size diameter pipe when the total length of pipe is greater than 2,600 feet OR when project pipe diameters are larger than 12-inches and the total length of large diameter pipe is greater than 600 feet. Refer to Infrastructure Design Criteria Manual for further information.
## ESTIMATE OF QUANTITIES

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ITEM</th>
<th>UNIT</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MOBILIZATION</td>
<td>LS</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>INCIDENTAL WORK</td>
<td>LS</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>AASHTO T-180 SOL TEST</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>EXCAVATION, EXPLORATORY</td>
<td>HR</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>SODDING</td>
<td>SY</td>
<td>85</td>
</tr>
<tr>
<td>6</td>
<td>8” PVC WATER MAIN C-900, DR 18</td>
<td>LF</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>6” 45 DEGREE BEND</td>
<td>EA</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>8” X 6” REDUCER</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>FIRE HYDRANT/VALVE BOX</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1” COPPER SERVICE (TRENCHLESS)</td>
<td>LF</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>1” TAPPING SADDLE</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>1” CURB STOP AND BOX</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>ABANDON VALVE BOX</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>ABANDON CURB STOP</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>CONNECT TO EXISTING WATERMAIN</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>RECONNECT WATER SERVICE</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>CATHODIC CONTROL TEST STATION</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>TRACER WIRE ACCESS BOX - 2-WIRE</td>
<td>EA</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>SLT FENCE, HIGH FLOW</td>
<td>LF</td>
<td>45</td>
</tr>
<tr>
<td>20</td>
<td>9’ WATTLES</td>
<td>LF</td>
<td>45</td>
</tr>
<tr>
<td>21</td>
<td>EROSION CONTROL, INLET PROTECTION</td>
<td>EA</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>TRAFFIC CONTROL</td>
<td>LS</td>
<td>1</td>
</tr>
</tbody>
</table>

## TABLES

### THRUST BLOCK TABLE

<table>
<thead>
<tr>
<th>FITTING</th>
<th>MIN BEARING AREA (SF)</th>
<th>MIN CONC VOLUME (C³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6” 45 DEGREE BEND</td>
<td>2.8</td>
<td>0.20</td>
</tr>
<tr>
<td>FIRE HYDRANT</td>
<td>5.0</td>
<td>0.34</td>
</tr>
</tbody>
</table>

### FIRE HYDRANT TABLE

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>BURY DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAST SIDE OF SIOUX SAN ON PROPERTY LINE</td>
<td>8.0'</td>
</tr>
</tbody>
</table>

The proposed Bury Depth is a planned depth based on asbuilt drawings showing the existing main 12’ deep and may vary dependent upon several factors, such as: existing water main depth, other utilities, field changes & etc.
GENERAL NOTES

CONSTRUCTION SCHEDULE

SUBCONTRACTOR & SUPPLIER LIST

FITTING

STORM WATER PLAN

PVC WATER MAIN MATERIAL: 6" schedule 40, 8" schedule 80, 10" schedule 10, 12" schedule 80, 14" schedule 80

SOIL DESIGN DEPARTING PIPING

WATER Main Installation

TYPE 1 RECLAIMED MATERIAL

OTHER SUBMITTALS

TRAFFIC CONTROL

THE CONTRACTOR IS REQUIRED TO MAINTAIN TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AS SHOWN ON THE PDF SHEET. ALL TRAFFIC CONTROL SHALL CONFORM TO THE LATEST VERSION OF THE MUTCD.

SIGNAGE, PROPERLY APPLIED AND PRECISELY BY PROPER SIGN MARKS MAY BE REQUIRED WHEN MAINTENANCE WORK IS PERFORMING OR VARIOUS WORKER TRAFFIC ENTRAPED IN A LARGE SCALE INDUSTRIAL AREA OR WHERE REQUIRED TO MAINTAIN TRAFFIC WHEN WORKING NEAR AN INTERSECTION.

THE CONTRACTOR IS REQUIRED TO HAVE A PERSONAL AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK TO MAINTAIN TRAFFIC CONTROL DEVICES. THE NAME AND TELEPHONE NUMBER OF THE PERSON SHALL BE SHOWN TO THE ENGINEER AT THE PRE-CONSTRUCTION MEETING.

Erosion and Water Pollution Control

A STATE permit IS NOT REQUIRED FOR THIS PROJECT. HOWEVER, A CITY PERMIT IS REQUIRED. THE CONTRACTOR SHALL PROVIDE AN EROSION AND WATER POLLUTION PLAN CONTROL THAT COMPLIES WITH THE CURRENT EDITION OF THE CITY OF RAPID CITY WATER MAIN INSTALLATION STANDARD.

THE CONTRACTOR IS ADVISED that several agencies have the authority to "STOP WORK" IF THE POLLUTION PREVENTION CONTROL IS NOT IMPLEMENTED OR IS NOT CONSIDERED when the pollution prevention will be FORFEITING FOR "TIME LOST" DUE TO "STOP WORK" ORDER.

MANTENANCE AND REPAIR OF EROSION CONTROL DEVICES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL DEVICES AT LEAST ONCE A WEEK AND AFTER EACH RAIN.

REMOVAL OF EROSION DEVICES ONCE THEY REACH 30 PERCENT OF THE HEIGHT OF THE DEVICE TO PROVIDE Jorge ON THE STORAGE VOLUME FOR THE NEXT RAIN. MAINTENANCE AND REPAIR OF THE EROSION DEVICES SHALL BE INCIDENTAL TO THE UNIT PRICE.

DURING THE COURSE OF CONSTRUCTION, HEAVY RAINFALL EVENTS MAY OCCUR. THE CONTRACTOR SHALL MAKE SURE THAT THEstorms RAINWATER WILL GO INTO THE GROUND AND NOT INTO THE CURRENT AREA. THE CONTRACTOR HAS THE RESPONSIBILITY TO MAINTAIN TRAFFIC CONTROL AND FOR ALL TRAFFIC ACTIVITIES AND OPERATIONS BY THE CONTRACTOR SHALL BE ADHERED INTO THE ITEM WHICH IT RELATES. NO ADDITIONAL PAYMENT WILL BE MADE.

CONSTRUCTION SCHEDULE

THE LOG OF CONSTRUCTION SUBMITTALS SHALL INCLUDE BUT IS NOT LIMITED TO THE SHEET SUMMARIES, CONSTRUCTION SCHEDULE, SUBCONTRACTOR & SUPPLIER LIST, FITTING, STORM WATER PLAN, PIPING WATER MAIN INSTALLATION, OTHER SUBMITTALS.

CONTRACTION SCHEDULE

SUBCONTRACTOR & SUPPLIER LIST

FITTING

STORM WATER PLAN

PVC WATER MAIN MATERIAL: 6" schedule 40, 8" schedule 80, 10" schedule 10, 12" schedule 80, 14" schedule 80

SOIL DESIGN DEPARTING PIPING

WATER Main Installation

TYPE 1 RECLAIMED MATERIAL

OTHER SUBMITTALS

TRAFFIC CONTROL

THE CONTRACTOR IS REQUIRED TO MAINTAIN TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AS SHOWN ON THE PDF SHEET. ALL TRAFFIC CONTROL SHALL CONFORM TO THE LATEST VERSION OF THE MUTCD.

SIGNAGE, PROPERLY APPLIED AND PRECISELY BY PROPER SIGN MARKS MAY BE REQUIRED WHEN MAINTENANCE WORK IS PERFORMING OR VARIOUS WORKER TRAFFIC ENTRAPED IN A LARGE SCALE INDUSTRIAL AREA OR WHERE REQUIRED TO MAINTAIN TRAFFIC WHEN WORKING NEAR AN INTERSECTION.

THE CONTRACTOR IS REQUIRED TO HAVE A PERSONAL AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK TO MAINTAIN TRAFFIC CONTROL DEVICES. THE NAME AND TELEPHONE NUMBER OF THE PERSON SHALL BE SHOWN TO THE ENGINEER AT THE PRE-CONSTRUCTION MEETING.

Erosion and Water Pollution Control

A STATE permit IS NOT REQUIRED FOR THIS PROJECT. HOWEVER, A CITY PERMIT IS REQUIRED. THE CONTRACTOR SHALL PROVIDE AN EROSION AND WATER POLLUTION PLAN CONTROL THAT COMPLIES WITH THE CURRENT EDITION OF THE CITY OF RAPID CITY WATER MAIN INSTALLATION STANDARD.

THE CONTRACTOR IS ADVISED that several agencies have the authority to "STOP WORK" IF THE POLLUTION PREVENTION CONTROL IS NOT IMPLEMENTED OR IS NOT CONSIDERED when the pollution prevention will be FORFEITING FOR "TIME LOST" DUE TO "STOP WORK" ORDER.

MANTENANCE AND REPAIR OF EROSION CONTROL DEVICES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL DEVICES AT LEAST ONCE A WEEK AND AFTER EACH RAIN.

REMOVAL OF EROSION DEVICES ONCE THEY REACH 30 PERCENT OF THE HEIGHT OF THE DEVICE TO PROVIDE Jorge ON THE STORAGE VOLUME FOR THE NEXT RAIN. MAINTENANCE AND REPAIR OF THE EROSION DEVICES SHALL BE INCIDENTAL TO THE UNIT PRICE.

DURING THE COURSE OF CONSTRUCTION, HEAVY RAINFALL EVENTS MAY OCCUR. THE CONTRACTOR SHALL MAKE SURE THAT THEstorms RAINWATER WILL GO INTO THE GROUND AND NOT INTO THE CURRENT AREA. THE CONTRACTOR HAS THE RESPONSIBILITY TO MAINTENANCE TRAFFIC CONTROL AND FOR ALL TRAFFIC ACTIVITIES AND OPERATIONS BY THE CONTRACTOR SHALL BE ADHERED INTO THE ITEM WHICH IT RELATES. NO ADDITIONAL PAYMENT WILL BE MADE.

CONSTRUCTION SCHEDULE

THE LOG OF CONSTRUCTION SUBMITTALS SHALL INCLUDE BUT IS NOT LIMITED TO THE SHEET SUMMARIES, CONSTRUCTION SCHEDULE, SUBCONTRACTOR & SUPPLIER LIST, FITTING, STORM WATER PLAN, PIPING WATER MAIN INSTALLATION, OTHER SUBMITTALS.

CONTRACTION SCHEDULE

SUBCONTRACTOR & SUPPLIER LIST

FITTING

STORM WATER PLAN

PVC WATER MAIN MATERIAL: 6" schedule 40, 8" schedule 80, 10" schedule 10, 12" schedule 80, 14" schedule 80

SOIL DESIGN DEPARTING PIPING

WATER Main Installation

TYPE 1 RECLAIMED MATERIAL

OTHER SUBMITTALS

TRAFFIC CONTROL

THE CONTRACTOR IS REQUIRED TO MAINTAIN TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AS SHOWN ON THE PDF SHEET. ALL TRAFFIC CONTROL SHALL CONFORM TO THE LATEST VERSION OF THE MUTCD.

SIGNAGE, PROPERLY APPLIED AND PRECISELY BY PROPER SIGN MARKS MAY BE REQUIRED WHEN MAINTENANCE WORK IS PERFORMING OR VARIOUS WORKER TRAFFIC ENTRAPED IN A LARGE SCALE INDUSTRIAL AREA OR WHERE REQUIRED TO MAINTAIN TRAFFIC WHEN WORKING NEAR AN INTERSECTION.

THE CONTRACTOR IS REQUIRED TO HAVE A PERSONAL AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK TO MAINTAIN TRAFFIC CONTROL DEVICES. THE NAME AND TELEPHONE NUMBER OF THE PERSON SHALL BE SHOWN TO THE ENGINEER AT THE PRE-CONSTRUCTION MEETING.

Erosion and Water Pollution Control

A STATE permit IS NOT REQUIRED FOR THIS PROJECT. HOWEVER, A CITY PERMIT IS REQUIRED. THE CONTRACTOR SHALL PROVIDE AN EROSION AND WATER POLLUTION PLAN CONTROL THAT COMPLIES WITH THE CURRENT EDITION OF THE CITY OF RAPID CITY WATER MAIN INSTALLATION STANDARD.

THE CONTRACTOR IS ADVISED that several agencies have the authority to "STOP WORK" IF THE POLLUTION PREVENTION CONTROL IS NOT IMPLEMENTED OR IS NOT CONSIDERED when the pollution prevention will be FORFEITING FOR "TIME LOST" DUE TO "STOP WORK" ORDER.

MANTENANCE AND REPAIR OF EROSION CONTROL DEVICES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL DEVICES AT LEAST ONCE A WEEK AND AFTER EACH RAIN.

REMOVAL OF EROSION DEVICES ONCE THEY REACH 30 PERCENT OF THE HEIGHT OF THE DEVICE TO PROVIDE Jorge ON THE STORAGE VOLUME FOR THE NEXT RAIN. MAINTENANCE AND REPAIR OF THE EROSION DEVICES SHALL BE INCIDENTAL TO THE UNIT PRICE.

DURING THE COURSE OF CONSTRUCTION, HEAVY RAINFALL EVENTS MAY OCCUR. THE CONTRACTOR SHALL MAKE SURE THAT THEstorms RAINWATER WILL GO INTO THE GROUND AND NOT INTO THE CURRENT AREA. THE CONTRACTOR HAS THE RESPONSIBILITY TO MAINTENANCE TRAFFIC CONTROL AND FOR ALL TRAFFIC ACTIVITIES AND OPERATIONS BY THE CONTRACTOR SHALL BE ADHERED INTO THE ITEM WHICH IT RELATES. NO ADDITIONAL PAYMENT WILL BE MADE.

CONSTRUCTION SCHEDULE

THE LOG OF CONSTRUCTION SUBMITTALS SHALL INCLUDE BUT IS NOT LIMITED TO THE SHEET SUMMARIES, CONSTRUCTION SCHEDULE, SUBCONTRACTOR & SUPPLIER LIST, FITTING, STORM WATER PLAN, PIPING WATER MAIN INSTALLATION, OTHER SUBMITTALS.

CONTRACTION SCHEDULE

SUBCONTRACTOR & SUPPLIER LIST

FITTING

STORM WATER PLAN

PVC WATER MAIN MATERIAL: 6" schedule 40, 8" schedule 80, 10" schedule 10, 12" schedule 80, 14" schedule 80

SOIL DESIGN DEPARTING PIPING

WATER Main Installation

TYPE 1 RECLAIMED MATERIAL

OTHER SUBMITTALS

TRAFFIC CONTROL

THE CONTRACTOR IS REQUIRED TO MAINTAIN TRAFFIC CONTROL IN ACCORDANCE WITH THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AS SHOWN ON THE PDF SHEET. ALL TRAFFIC CONTROL SHALL CONFORM TO THE LATEST VERSION OF THE MUTCD.

SIGNAGE, PROPERLY APPLIED AND PRECISELY BY PROPER SIGN MARKS MAY BE REQUIRED WHEN MAINTENANCE WORK IS PERFORMING OR VARIOUS WORKER TRAFFIC ENTRAPED IN A LARGE SCALE INDUSTRIAL AREA OR WHERE REQUIRED TO MAINTAIN TRAFFIC WHEN WORKING NEAR AN INTERSECTION.

THE CONTRACTOR IS REQUIRED TO HAVE A PERSONAL AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK TO MAINTAIN TRAFFIC CONTROL DEVICES. THE NAME AND TELEPHONE NUMBER OF THE PERSON SHALL BE SHOWN TO THE ENGINEER AT THE PRE-CONSTRUCTION MEETING.

Erosion and Water Pollution Control

A STATE permit IS NOT REQUIRED FOR THIS PROJECT. HOWEVER, A CITY PERMIT IS REQUIRED. THE CONTRACTOR SHALL PROVIDE AN EROSION AND WATER POLLUTION PLAN CONTROL THAT COMPLIES WITH THE CURRENT EDITION OF THE CITY OF RAPID CITY WATER MAIN INSTALLATION STANDARD.

THE CONTRACTOR IS ADVISED that several agencies have the authority to "STOP WORK" IF THE POLLUTION PREVENTION CONTROL IS NOT IMPLEMENTED OR IS NOT CONSIDERED when the pollution prevention will be FORFEITING FOR "TIME LOST" DUE TO "STOP WORK" ORDER.

MANTENANCE AND REPAIR OF EROSION CONTROL DEVICES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. ALL EROSION CONTROL DEVICES AT LEAST ONCE A WEEK AND AFTER EACH RAIN.

REMOVAL OF EROSION DEVICES ONCE THEY REACH 30 PERCENT OF THE HEIGHT OF THE DEVICE TO PROVIDE Jorge ON THE STORAGE VOLUME FOR THE NEXT RAIN. MAINTENANCE AND REPAIR OF THE EROSION DEVICES SHALL BE INCIDENTAL TO THE UNIT PRICE.

DURING THE COURSE OF CONSTRUCTION, HEAVY RAINFALL EVENTS MAY OCCUR. THE CONTRACTOR SHALL MAKE SURE THAT THEstorms RAINWATER WILL GO INTO THE GROUND AND NOT INTO THE CURRENT AREA. THE CONTRACTOR HAS THE RESPONSIBILITY TO MAINTENANCE TRAFFIC CONTROL AND FOR ALL TRAFFIC ACTIVITIES AND OPERATIONS BY THE CONTRACTOR SHALL BE ADHERED INTO THE ITEM WHICH IT RELATES. NO ADDITIONAL PAYMENT WILL BE MADE.

CONSTRUCTION SCHEDULE

THE LOG OF CONSTRUCTION SUBMITTALS SHALL INCLUDE BUT IS NOT LIMITED TO THE SHEET SUMMARIES, CONSTRUCTION SCHEDULE, SUBCONTRACTOR & SUPPLIER LIST, FITTING, STORM WATER PLAN, PIPING WATER MAIN INSTALLATION, OTHER SUBMITTALS.
**GENERAL NOTES**

1. **General Work**
   - Incidental work shall include all miscellaneous items not included in the regular items listed in the proposal and shown on the drawings, but which must be performed in order to properly complete the work.
   - The items and work listed below are to be included in the incidental work item, but the list does not limit the scope to only these items.
   - The contractor shall be responsible for providing the necessary equipment and materials for the performance of these tasks.

2. **Construction Staging**
   - The city shall provide construction staging for the project in accordance with section 201 of the standard specifications. A minimum of barrier (SS) working days notice shall be given before starting any construction staging. Additional staging shall be at the contractor's expense and shall be considered incidental work.

3. **As-Built Plans**
   - The contractor shall measure and record any horizontal or vertical deviations from the contract drawings. The changes shall be recorded on an accurate, neat fashion on the drawings and furnished to the engineer upon completion of the project. Specifically, all service taps, connections, anchors, and buried utilities shall be recorded for the record. The as-built drawings shall be on-site and available for review by the engineer upon request.

4. **Fire Hydrant Coating**
   - The city of Rapid City public works director issued a waiver to the 2022 edition standard specifications requiring the internal epoxy coating for fire hydrants. Any fire hydrant that does not have the internal epoxy coating per the specifications shall double the fire protection, and any fire hydrant that does not meet the M1 thickness requirement does not have a fire hydrant. In the case of a fire hydrant that does not meet the M1 thickness and does not meet the M2 thickness, the fire hydrant may be used as a fire hydrant, but not the fire hydrant that does not meet the M1 thickness.

5. **Resident Notification**
   - The contractor shall notify the residents affected by the project of the construction schedule and the extent of work for a minimum of 3 days in advance of beginning construction. Verification of the resident notification shall be provided to the engineer.

6. **Warranty Period**
   - The warranty period for this project shall start when the project is complete and shall not be based on completion of different phases or completion dates of the project.
TRAFFIC CONTROL

F & I
SHOULDER WORK SIGN, 1 EA

F & I
ROAD WORK AHEAD, 2 EA
### WATER FITTING AND FIRE HYDRANT LOCATION TABLE

<table>
<thead>
<tr>
<th>POINT NUMBER</th>
<th>NORTH</th>
<th>EAST</th>
<th>ELEVATION</th>
<th>RAW DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
<td>650784.56</td>
<td>1195144.25</td>
<td>3326.00</td>
<td>6&quot; X 8&quot; INCREASER</td>
</tr>
<tr>
<td>3001</td>
<td>650784.55</td>
<td>1195147.68</td>
<td>3326.20</td>
<td>45° VERTICAL BEND</td>
</tr>
<tr>
<td>3002</td>
<td>650784.54</td>
<td>1195151.28</td>
<td>3329.80</td>
<td>45° VERTICAL BEND</td>
</tr>
<tr>
<td>3003</td>
<td>650784.53</td>
<td>1195157.77</td>
<td>3330.00</td>
<td>FIRE HYDRANT</td>
</tr>
</tbody>
</table>

ELEVATIONS SHOWN IN THE TABLE ARE DESIGNED TOP OF PIPE ELEVATIONS. THE FIRE HYDRANT FINISHED BURY LINE ELEVATION SHALL BE 3338.00.

---

### Diagram Notes

- EXCAVATION FOR SERVICE LINE RECONNECTION SHALL BE NO CLOSER THAN 10' FROM THE RETAINING WALL.
- DO NOT DISTURB RETAINING WALLS.
- DO NOT DISTURB TREES.
- DO NOT DISTURB RETAINING WALLS.
- EXISTING GROUND 3338.00
- TOP OF PIPE 3330.00
- TOP OF PIPE 3329.80
- TOP OF PIPE 3326.20
- TOP OF PIPE 3326.00 FROM ASBUILTS

---

### Connect to Existing 8" PVC Water Main, 1 EA

- F & I 8" X 6" INCREASER, 1 EA
- F & I 6" PVC C900 WATER MAIN, 2 LF
- F & I 6" 45° BEND (VERTICAL), 1 EA
- F & I 6" PVC C900 WATER MAIN, 5 LF
- F & I 6" 45° BEND (VERTICAL), 1 EA
- F & I 6" PVC C900 WATER MAIN, 6 LF
- F & I FIRE HYDRANT W/AUX VALVE & BOX, 1 EA

---

### Test Station and Tracer Wire Access

- F & I TEST STATION AND TRACER WIRE ACCESS BOX-2-WIRE, 1 EA
- ABANDON GATE VALVE, 1 EA
- ABANDON EXISTING 6" WATER MAIN
- F & I 1" TAPPING SADDLE, 1 EA
- F & I CURB STOP AND BOX, 1 EA
- F & I 1" COPPER WATER SERVICE, 90 LF
- INSTALLED BY TRENCHLESS MEANS
- RECONNECT WATER SERVICE, 1 EA
- ABANDON CURB STOP, 1 EA

---

### Tie-In Location

- TIE-IN LOCATION IS APPROXIMATE AND BASED ON UTILITY MAINTENANCE LOCATES. TIE-IN AND FITTING LOCATIONS MAY BE REQUIRED TO BE MOVED DUE TO ACTUAL FIELD CONDITIONS.

---

### Excavation

- EXCAVATION FOR SERVICE LINE RECONNECTION SHALL BE NO CLOSER THAN 10' FROM THE RETAINING WALL.
3.2 LANDSCAPING AND EROSION CONTROL

F & I SILT FENCE, 45 LF

F & I INLET PROTECTION, 2 EA

F & I 9" WATTLE, 45 LF

F & I SOD, 85 SY

DO NOT DISTURB TREES

DO NOT DISTURB RETAINING WALLS

F & I - FURNISH & INSTALL

AS SHOWN

CITY OF RAPID CITY
PUBLIC WORKS DEPARTMENT
ENGINEERING SERVICES

MJK
21-2678
08/21

AS SHOWN

08/21

MJK

2021 HALL STREET WATER MAIN AND FIRE HYDRANT INSTALLATION
PROJECT NO. 21-2678 CIP NO. 50808

F & I - FURNISH & INSTALL

DO NOT DISTURB TREES

DO NOT DISTURB RETAINING WALLS

F & I SILT FENCE, 45 LF

F & I INLET PROTECTION, 2 EA

F & I 9" WATTLE, 45 LF

F & I SOD, 85 SY
NOTES:
1. COPPER ADAPTER SLEEVE REQUIRED FOR THERMITE WELDING OF NO. 2, NO. 4, NO. 10 AND NO. 12 AWG WIRE.
2. WELDER AND CARTRIDGE SIZE VARIES ACCORDING TO SURFACE SHAPE, MATERIAL, AND HORIZONTAL OR VERTICAL SURFACE. CONSULT WELDER MANUFACTURER FOR RECOMMENDED WELDER AND CARTRIDGE.
3. FOR MULTIPLE WIRE CONNECTIONS TO PIPE, SEPARATE THERMITE WELD CONNECTIONS BY ONE PIPE DIAMETER MINIMUM, 2"-2" DIAMETER.
4. WIRE CONNECTIONS TO FOREIGN PIPELINES SHALL BE MADE BY FOREIGN PIPELINE REPRESENTATIVE.
5. COAT COMPLETED THERMITE WELD CONNECTIONS WITH EPOXY REPAIR COATING, THERMITE WELD PROTECTOR PAD, OR AS OWNER SPECIFIED.
6. UTILIZE INSULATED STRANDING COPPER WIRE ONLY, SIZE AS SPECIFIED. COLOR CODE WIRE ACCORDING TO WIRE COLOR CODE, SEE NTS.
7. CONNECT BOND AND TEST WIRE TO METALLIC FITTINGS PRIOR TO ASSEMBLY. AS REQUIRED TO ALLOW CONNECTIONS TO BE MADE TO LEVEL, FLAT (HORIZONTAL TYPE) SURFACES ON TOP OF FITTINGS.
8. ATTACH THERMITE WELD TO STUD OR WELD BASE PLATE IF PROVIDED OR TO DRY SIDE OF JOINT IF APPROVED BY PIPE MANUFACTURER.

CITY OF RAPID CITY
PUBLIC WORKS DEPARTMENT

VERTICAL AND HORIZONTAL WIRE THERMITE WELD CONNECTIONS

DATE: 9-26-16

CITY OF RAPID CITY
PUBLIC WORKS DEPARTMENT

GENERAL EXOTHERMIC WELD AND COATING PROCEDURES

THERMITE WELD WIRE CONNECTIONS

DATE: 9-26-16

CITY OF RAPID CITY
PUBLIC WORKS DEPARTMENT
GALVANIC ANODE INSTALLATION AT BURIED METALLIC FITTINGS

NOTES:
1. MINIMUM OF TWO NO. 12 AWG BOND WIRE EACH FOR 12" AND LARGER PIPE. ONE BOND WIRE FOR SMALLER PIPE.
2. PROVIDE TYPE, NUMBER AND SIZE OF ANODES AS SPECIFIED. MINIMUM SHALL BE ONE ANODE PER FITTING.

CITY OF RAPID CITY
PUBLIC WORKS DEPARTMENT
DATE: 9-23-16

13940

FLUSH TYPE TEST STATIONS AT HYDRANT ASSEMBLIES W/ PLASTIC STUB

NOTES:
1. PLACE TEST STATION IN A PROTECTED LOCATION SO AS TO NOT INTERFERE WITH OPERATION OF VALVES OR FIRE HYDRANT. TERMINAL FITTING TEST WIRES, ANODE LEAD AND TRACER WIRES IN TEST STATION AND TRACER WIRE ACCESS BOX, RESPECTIVELY, WITH MIN. 18" SLACK.
2. INSTALL HYDRANT ANODE MINIMUM 3'-0" FROM AND 1'-0" BELOW PIPELINE, FITTING, OR VALVE INVERT ELEVATION. INSTALL MINIMUM NUMBER, TYPE, AND SIZE OF HYDRANT ANODES SPECIFIED.
TRACER WIRE DETAIL

NOTES:

1. TERMINATE TRACER WIRE AT TRACER WIRE ACCESS BOXES ONLY AT SPECIFIED DISTANCES, STRUCTURES AND ENDS OF EACH PIPE RUN. TEST TRACER WIRE ELECTRICAL CONTINUITY AS SPECIFIED PRIOR TO PLACEMENT OF CURB AND GUTTER OR PAVING. DO NOT CONNECT TRACER WIRE DIRECTLY TO EXISTING OR NEW METALLIC PIPE OR FITTING.

2. LOCATE TRACER WIRE ACCESS BOXES IN PROTECTED LOCATIONS DIRECTLY OVER PIPE UNLESS OFFSET REQUIRED BY PLANS OR FIELD CONDITIONS (IN ROAD, FIELD, ETC.). OFFSET TO BACK OF CURB AND GUTTER OR HYDRANT, IF NO PROTECTED LOCATION AVAILABLE OVER PIPELINE. COORDINATE LOCATIONS WITH ENGINEER.

3. TRACER WIRE ACCESS BOX LOCATIONS SHALL BE DOCUMENTED BY THE CONTRACTOR IN THE RED-LINE, AS-CONSTRUCTED PLANS BY STATION/OFFSET OR SURVEY COORDINATES CONSISTENT WITH PROJECT HORIZONTAL DATUM. LOCATION PROVIDED SHALL BE WITHIN 0.5 FEET OF TRUE LOCATION.

PLASTIC PIPE METALLIC FITTING GLANDS AND MECHANICAL RESTRAINT RINGS BONDING

NOTES:

1. BOND PLASTIC PIPE METALLIC GLANDS TO METALLIC FITTING BODY. COMPLETE PIGTAIL WIRE CONNECTIONS TO GLANDS BEFORE ASSEMBLY.

2. MINIMUM OF 2 NO. 12 AWG PIGTAIL BONDS EACH FOR 12" AND LARGER PIPE. MINIMUM OF ONE BOND FOR PIPE SMALLER THAN 12".

3. NUMBER, SIZE AND TYPE OF GALVANIC ANODES REQUIRED PER SPECIFICATIONS.