UTILITY SAFETY & DESIGN, INC.

City of Falls City, NE

2024 Natural Gas Improvement Project

Construction Specifications – For Bidding

Prepared by: Utility Safety & Design, Inc.

3-6-2025

I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly authorized Licensed Professional Engineer under the laws of the State of Nebraska.

By:_____

Anthony W Everette, P.E. (Date)

License #___E-14376____

My license renewal date is December 31, 2025

Pages or sheets covered by this seal: All Bound Sheets

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2024 NATURAL GAS IMPROVEMENT PROJECT
FALLS CITY, NEBRASKA

NOTICE TO BIDDERS

NOTICE OF TAKING OF BIDS FOR THE CONSTRUCTION OF THE 2024 NATURAL GAS IMPROVEMENT PROJECT FOR THE CITY OF FALLS CITY, NEBRASKA

Sealed proposals must be filed with the City Administrator of the City of Falls City, Nebraska, at the Falls City Utility Department, 2307 Barada Street, Falls City, Nebraska, before 12:00 P.M. on the 1st day of April, 2025, for the construction of the 2024 Natural Gas Improvement Project, and work incidental thereto, as described in the plans and specifications therefor, now on file in the office of the Utility Superintendent at the Falls City Utility Department. Proposals will be opened and the amount of the bids announced in the Council Chambers by the Utility Superintendent at the time and date specified above.

A mandatory pre-bid meeting will be held at the Council Chambers on the 20th day of March 2025 at 1:30 P.M.

During said hearing, any interested person may participate and/or file objections thereto or to the cost of the improvements.

The work to be done is as follows:

Natural Gas Improvement Project, 2024 Natural Gas Improvement Project Addition 1, 2024 Natural Gas Improvement Project Addition 2 and 2024 Natural Gas Improvement Project Addition 3

> Construct gas mains and services including all labor, materials, and equipment necessary for excavation, backfill and sitework, poly pipe installation, valve installation, tie-ins, purging, and abandonment; surface restoration and miscellaneous associated work including cleanup. These tasks shall be completed for all the project along with Addition 1, Addition 2 and Addition 3.

Falls City reserves the right to reduce the project scope based on bid pricing. Falls city may remove either Addition 1, Addition 2, Addition 3 or any combinations of additions from the project.

All work and materials are to be in accordance with the proposed plans, specifications, form of contract and estimate of cost now on file in the office of the Utility Superintendent of Falls City, Nebraska, and by this reference made a part thereof as though fully set out and incorporated herein.

All proposals and bids in connection therewith shall be submitted to the Utility Superintendent of said City on or before the time herein set for said receipt of bids. All proposals shall be made on official bidding blanks furnished by the City, and any alterations in the official form of proposal will entitle the Council, at its option, to reject the proposal involved from consideration. Each proposal shall be sealed and plainly identified.

Each proposal shall be made out on a blank form furnished by the municipality and must be accompanied by bid security, as follows: a certified or cashier's check, drawn on a solvent Nebraska bank or a bank chartered under the laws of the United States or a certified share draft drawn on a credit union in Nebraska or chartered under the laws of the United States, in an amount equal to ten percent (10%) of the bid, or a bid bond executed by a corporation authorized to contract as a surety in the State of Nebraska in a penal sum of ten percent (10%) of the bid.

The bid security should be made payable to the CITY OF FALLS CITY, NEBRASKA. The bid security must not contain any conditions either in the body or as an endorsement thereon. The bid security shall be forfeited to the City as liquidated damages in the event the successful bidder fails or refuses to enter into a contract within 10 days after the award of contract and post bond satisfactory to the City insuring the faithful fulfillment of the contract and the maintenance of said work, if required, pursuant to the provisions of this notice and the other contract documents. Bidders will use the bid bond form included in the specifications.

Bidders will be required to comply with the President's Executive Order No. 11246. The requirements for bidders and contractors under this order are explained in the Federal grant documents.

Bidders will be required to take affirmative steps to involve Disadvantaged Business Enterprise (DBE) in the work under the contract. Bidders shall complete the applicable certification attached to the proposal. The certification shall include a listing of DBEs, the work and estimated dollar amount to be performed by each such enterprise, and the percentage of the total bid to be used for disadvantaged business enterprise(s). The bidder commits itself to the goals for DBE participation contained herein and all other requirements, terms and conditions of these bid conditions when it submits a properly signed bid.

Any bidder or equipment supplier whose firm or affiliate is listed in the GSA publication "List of Parties Excluded from Federal Procurement and Nonprocurement Programs" will be prohibited from the bidding process. Anyone submitting a bid who is listed in this publication will be determined to be a nonresponsive bidder in accordance with 40 CFR Part 31.

A Contractor's Suspension/Debarment Certification will be contained in the specifications; however, this certification should not preclude any interested party from ascertaining whether the certifying person is actually on the "List of Parties Excluded from Federal Procurement and Nonprocurement Programs".

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

Failure to submit a fully completed Bidder Status Form with the bid may result in the bid being deemed nonresponsive and rejected.

The City Council reserves the right to reject any or all bids, to waive informalities or technicalities in any bid and to accept the bid which it deems to be to the best interest of the City.

The City reserves the right to defer acceptance of any proposal for a period not to exceed thirty (30) calendar days from the Deadline for submission of proposals.

The successful bidder will be required to furnish bonds in an amount equal to one hundred percent (100%) of the contract price, said bonds to be issued by responsible surety approved by the City Council

and listed in the U.S. Treasury Department's most current list (Circular 570, as amended) and authorized to transact business in the State of Nebraska and shall guarantee (1) the faithful performance of the contract and the terms and conditions therein contained, (2) the prompt payment to all persons, firms, subcontractors and corporations furnishing materials, service, or transportation for or performing labor in the prosecution of the work, and (3) the maintenance of improvements in good repair for not less than four (4) years from the time of acceptance of the improvements by the City.

There is flexibility regarding the work commencement date to help accommodate Bidders' schedules. Bidders shall include a preferred Work Commencement Date with their bids, ranging from May 1st, 2025 to August 17th, 2025. These dates will be considered when establishing a Work Commencement Date. The work will commence within ten (10) calendar days of the Work Commencement Date set forth in written Notice to Proceed. The date of Substantial Completion will be ninety (90) calendar days after the Work Commencement Date set forth in written Notice to Proceed. The work will be completed and ready for final payment, in accordance with Paragraph 15.06 of the General Conditions, seventy-five (75) calendar days after the Work Commencement Date set forth in written Notice to Proceed, and subject to any extensions of time which may be granted by the City.

The duration of the work is critical to the project so as to minimize the disruption associated with the project to the public. Damages in the amount of Five Hundred Dollars ($500.00) per calendar day will be assessed for each day that the main is not in operation after the date of Substantial Completion at the sole discretion of the City with due allowance for extensions of the contract period due to conditions beyond the control of the Contractor. At the option of the City, damages may be deducted from any retainage prior to release, the final payment to contractor, or through the commencement of a cause of action by the City, in the City's sole discretion. The selection by the City of any particular course of action hereunder is not exclusive and shall not preclude the pursuit of additional remedies by the City. In the event the City institutes legal proceedings, the Contractor shall be responsible for any and all attorney's fees and expenses.

Sales Tax Exemption. Contractors and subcontractors shall not include sales tax for material purchases. At the time of the contract acceptance by the City Council, the prime contractor and all subcontractors will be issued a certificate of exemption.

Payment of the cost of said project will be made from any one or a combination of the following sources at the sole discretion of the City Council: (1) cash to be derived from the proceeds of the issuance and sale of Sewer Revenue Bonds, which will be payable solely and only out of the future net revenues of the Municipal Sewage Utility, and/or from such other cash funds on hand of said Utility as may be lawfully used for said purpose; (2) cash derived from the proceeds of the issuance and sale of General Obligation Bonds of said City; (3) cash from such general funds of said City as may be legally used for such purpose; and (4) cash from proceeds of a State Revolving Loan fund.

Payment to the Contractor for said construction will be made from one or any combination of the following resources: (1) cash on hand as may be legally used for such purposes, (2) cash derived from the proceeds of the sale and issuance of General Obligation Bonds of the City, or any combination thereof.

Payment to the Contractor will be on the basis of monthly estimates equivalent to ninety-five percent (95%) of the contract value of the work completed and payments made to material suppliers for materials ordered specifically for the project or delivered to the site during the preceding calendar month. Estimates will be prepared each month by the Contractor, subject to the approval of the Architect/Engineer, who will certify to the City for payment each approved estimate at least five days prior to City Council meeting. Such monthly payments shall in no way be construed as an act of acceptance for any part of the work partially or totally completed. Upon completion of the work and its acceptance by the City Council, the Contractor will be paid an amount which, together with previous payments, will equal ninety-five percent (95%) of the contract price of the contract. The balance due the Contractor will be paid, subject to the conditions and in accordance with the provisions of Chapters 45 and 77 of the Code of Nebraska, as amended. No such partial or final payments will be due until the Contractor has certified to the City that the materials, labor and services involved in each estimate have been paid for in accordance with the requirements stated in the specifications.

Plans and specifications governing the construction of the proposed improvements, and also the prior proceedings of the City Council referring to and defining said proposed improvements are hereby made a part of this notice and the proposed contract by reference and the proposed contract shall be executed in compliance therewith.

Copies of said plans and specifications and form of contract are now on file in the office of the City Clerk. Copies may be obtained from Utility Safety & Design, Inc., 210 N Elson St. Suite C, Kirksville, MO 63501.

This notice is given by order of the Council of the City of Falls City, Nebraska.

Mark Harkendorff, Mayor

ATTEST:

Trevor Campbell, Public Works Director

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Bidding Documents are to be issued

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within 5 days of Owner's request, Bidder shall submit written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

3.02 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

3.03 To demonstrate Bidder's qualifications, if requested, Contractor is to provide a list of gas system projects from the last 3 years timeframe with proposed date of completion and actual date of completion.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

1. No additional reports of subsurface conditions exist for this project.

4.03 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data

furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.04 Hazardous Environmental Conditions

A. No reports or drawings depicting hazardous on-site conditions exist for this project.

4.05 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.06 *Work at the Site*

A. Reference is made in the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

B. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

E. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the

Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

F. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

G. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports, and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

5.02 The submission of a Bid will constitute an incontrovertible representation by Bidder that the Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent of Bidder's maximum Bid and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which the Work is to be substantially completed and ready for final payment, are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall, within five business days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other

evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Engineer.

13.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein. In the case of optional alternatives the words "No Bid," "No Change," or "Not Applicable" may be entered.

13.03 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership's address for receiving notices shall be shown.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm's address for receiving notices shall be shown.

13.06 A Bid by an individual shall show the Bidder's name and address for receiving notices.

13.07 A Bid by a joint venture shall be executed by an authorized representative of each joint venture in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.

13.08 All names shall be printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

ARTICLE 15 – SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed as described in the "Invitation for Bids."

15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

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

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened privately

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

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

19.05 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, individuals, or entities must be submitted as provided in the Supplementary Conditions.

19.06 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – SALES AND USE TAXES

22.01 Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work. Any applicable taxes shall be included in the Bid. Refer to the Supplemental Conditions for additional information.

ARTICLE 23 – RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

ARTICLE 24 – HOLD HARMLESS AGREEMENT

24.01 The work on this contract shall be completed in the time as specified on the proposal. If the work is not complete by that date, the Contractor shall indemnify and save harmless the Owner from all units, actions, or claims or such character, name and description brought for or on account of said failure to complete the work as stated.

ARTICLE 25 – HISTORICAL AND ARCHAEOLOGICAL

25.01 If during the course of construction, evidence of deposits of historical or archaeological interest is found, the Contractor shall cease operations affecting the find and shall notify the Owner who shall notify the State, c/o Nebraska Historical Society, State Preservation Officer, P. O. Box 82554, Lincoln, Nebraska 68508, Toll Free (800) 833-6747. No further disturbance of the deposits shall ensue until the Contractor has been notified by the Owner that he may proceed. The Owner will issue a Notice to Proceed only after the State Official has surveyed the find and make a determination to the Department of Environmental Quality and Owner. Compensation to the Contractor, if any, for lost time or changes in construction to avoid the find, shall be determined in accordance with changed conditions or change order provisions of the specifications.

ARTICLE 26 – MISCELLANEOUS

26.01 Contractor shall abide by all requirements and guidelines set forth in the "Gas System Operating & Maintenance Plan" (Appendix D). In particular, Contractor shall comply with welding certification requirements as spelled out in Division 8 of the O&M, comply with all testing and inspection requirements, including but not limited to, performing pressure tests as required by Section 6.4 of the O&M, and implement an Anti-Drug Plan, per Section 2.4 of the O&M.

26.02 Contractor shall include in his Bid Price all labor and materials associated with completion of the work shown on the Plans, but shall exclude the material cost of the items listed in the table attached to the Bid Form, which will be purchased by the Owner and provided to the Contractor for installation. Contractors shall also be responsible for re-seeding areas imported which, prior to construction, contained grass.

BID FORM

2024 NATURAL GAS IMPROVEMENT PROJECT

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Falls City Utility Department
2307 Barada Street
Falls City, NE 68355

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

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	**Addendum, Date**
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

ARTICLE 5 – BASIS OF BID

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

Item	Description	Unit	Estimated Qty	Bid Unit Price	Bid Price
1.	Mobilization	LS	1	$	$
2.	Demobilization	LS	1	$	$
3.	2-inch HDPE Main, Complete	LF	3,090	$	$
4.	2-inch HDPE Ball Valve, Complete	EA	4	$	$
5.	1 1/4-inch HDPE Main, Complete	LF	3,180	$	$
6.	HDPE Service Line Tie-In, Complete	EA	99	$	$
7.	1-inch HDPE Service Line, Complete	LF	5,170	$	$
8.	1-1/4-inch HDPE Service Line, Complete	LF	360	$	$
9.	New 2" to Exist. 2" HDPE Main Tie-In, Complete	EA	2	$	$
10.	New 2" to Exist. 2" HDPE Main Tie-ins w/ High Volume Tap Tee, Complete	EA	3	$	$
11.	New 1-1/4" to Exist. 2" HDPE Main with a high-volume tapping tee	EA	1	$	$
12.	New 1-1/4" to Exist. 1-1/4" HDPE Main Tie-In, Complete	EA	2	$	$
13.	Stop, Purge, Cap, and Abandon Existing Mains, Complete	LS	4	$	$
14.	Locating Test Stations, Complete	EA	10	$	$
15.	Anode Installation, Complete	EA	9	$	$

Total Bid Price $_____

Addition 1

Item	Description	Unit	Estimated Qty	Bid Unit Price	Bid Price
1.	1 1/4-inch HDPE Main, Complete	LF	670	$	$
2.	HDPE Service Line Tie-In, Complete	EA	8	$	$
3.	1-inch HDPE Service Line, Complete	LF	280	$	$
4.	New 1-1/4" to Exist. 2" HDPE Main Tie-In, Complete	EA	1	$	$
5.	Stop, Purge, Cap, and Abandon Existing Mains, Complete	LS	1	$	$
6.	Locating Test Stations, Complete	EA	1	$	$
7.	Anode Installation, Complete	EA	1	$	$

Addition 1 Total Bid Price $_____

Addition 2

Item	Description	Unit	Estimated Qty	Bid Unit Price	Bid Price
1.	1 1/4-inch HDPE Main, Complete	LF	1,400	$	$
2.	HDPE Service Line Tie-In, Complete	EA	29	$	$
3.	1-inch HDPE Service Line, Complete	LF	780	$	$
4.	New 1-1/4" to Exist. 2" HDPE Main Tie-In, Complete	EA	1	$	$
5.	Stop, Purge, Cap, and Abandon Existing Mains, Complete	LS	1	$	$
6.	Locating Test Stations, Complete	EA	1	$	$
7.	Anode Installation, Complete	EA	1	$	$

Addition 2 Total Bid Price $_____

Addition 3

Item	Description	Unit	Estimated Qty	Bid Unit Price	Bid Price
1.	2-inch HDPE Ball Valve, Complete	EA	1	$	$
2.	1 1/4-inch HDPE Main, Complete	LF	1,070	$	$
3.	HDPE Service Line Tie-In, Complete	EA	25	$	$
4.	1-inch HDPE Service Line, Complete	LF	1,670	$	$
5.	New 1-1/4" to Exist. 2" HDPE Main with a high-volume tapping tee	EA	1	$	$
6.	Stop, Purge, Cap, and Abandon Existing Mains, Complete	LS	1	$	$
7.	Locating Test Stations, Complete	EA	1	$	$
8.	Anode Installation, Complete	EA	1	$	$

Addition 3 Total Bid Price $_____

Total of Lump Sum and Unit Price Bids = Total Bid Price $ _____

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder has the flexibility to provide preferred Work Commencement Dates ranging from May 1st, 2025 to August 17th, 2025. Bidder agrees that the Work will be substantially complete within ninety (90) calendar days after the Work Commencement Date set forth in written Notice to Proceed. The work will be completed and ready for final payment, in accordance with paragraph 15.06 of the General Conditions, seventy-five (75) calendar days after the Work Commencement Date set forth in written Notice to Proceed, subject to any extensions of time which may be granted by the City.

Preferred Work Commencement Date: _____
(May 1st, 2025 – August 17th, 2025)

Substantial Completion Date: _____
(Ninety (90) calendar days past Preferred Work Commencement Date)

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security in the form of a 5% Bid Bond and/or Cashier's Check;

B. List of Proposed Subcontractors;

C. List of Project References;

D. Required Bidder Qualification Statement with supporting data

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

Bidder's License No.: _____
(where applicable)

BID BOND

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

BIDDER *(Name and Address)*:

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

OWNER *(Name and Address)*:
Falls City Utility Department
2307 Barada Street
Falls City, NE

BID
Bid Due Date:
Description *(Project Name— Include Location)*: **2024 Natural Gas Improvement Project**

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

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

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

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

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

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

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

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

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

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

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

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

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

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

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE OF AWARD

Date of Issuance:

Owner:	Falls City Utility Department	Owner's Contract No.:	N/A
Engineer:	Utility Safety & Design, Inc.	Engineer's Project No.:	N/A
Project:	2024 Natural Gas Improvement Project	Contract Name:	

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

_____ .

[describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is: $_____ *[note if subject to unit prices, or cost-plus]*

Two unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner two counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner**:**

Authorized Signature

By:

Title:

Copy: Owner, Contractor & Engineer

AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between Falls City Utility Department ("Owner") and _____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: 2024 NATURAL GAS IMPROVEMENT PROJECT

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work has been designed by UTILITY SAFETY & DESIGN, INC.

3.02 The Owner has retained Utility Safety & Design, Inc. ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. There is flexibility regarding the work commencement date to help accommodate Bidders' schedules. Bidders shall include a preferred Work Commencement Date with their bids, ranging from May 1st, 2025 to August 17th, 2025. These dates will be considered when establishing a Work Commencement Date. The work will commence within ten (10) calendar days of the Work Commencement Date set forth in written Notice to Proceed. The date of Substantial Completion shall be ninety (90) calendar days after the Work Commencement date set forth in written Notice to Proceed. The work will be completed and ready for final payment, in accordance with Paragraph 15.06 of the General Conditions, seventy-five (75) calendar days after the Work Commencement Date set forth in written Notice to Proceed, subject to any extensions of time which may be granted by the City.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner $350.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.

2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $500.00 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

4.04 *Special Damages*

A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on a monthly basis during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract

a. 90 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. 90 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 125 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the maximum legal rate.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. There are no reports of explorations and tests of subsurface conditions at or adjacent to the Site and drawings of physical conditions relating to existing surface or subsurface structures at the Site for this project.

E. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

F. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

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

H. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

I. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 7, inclusive).
2. Performance bond (pages 1 to 3, inclusive).
3. Payment bond (pages 1 to 3, inclusive).
4. General Conditions (pages 1 to 64, inclusive).
5. Supplementary Conditions (pages 1 to 4, inclusive).
6. Specifications as listed in the table of contents of the Project Manual.
7. Drawings (not attached but incorporated by reference) consisting of 39 sheets with the Drawings listed on the attached sheet index.
8. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid (pages B-1 to B-7, inclusive).
    b. Documentation submitted by Contractor prior to Notice of Award,
        1) Bid Bond
        2) OQ Plan & Anti-Drug and Alcohol Plan
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.

d. Field Orders.

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

OWNER:	CONTRACTOR:
_____	_____
By: _____	By: _____
Title: _____	Title: _____
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
	License No.: _____ *(where applicable)*
	NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

NOTICE TO PROCEED

Owner:	Falls City Utility Department	Owner's Contract No.:	N/A
Contractor:		Contractor's Project No.:	
Engineer:	Utility Safety & Design, Inc.	Engineer's Project No.:	N/A
Project:	2024 Natural Gas Improvement Project	Contract Name:	
		Effective Date of Contract:	

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 20__]. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is _____, and the date of readiness for final payment is_____] ***or*** [the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Owner**:**

Authorized Signature

By:

Title:

Date Issued:

Copy: Owner, Contractor & Engineer

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:
Falls City Utility Department
2307 Barada Street
Falls City, NE 68355

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

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

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

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

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

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

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

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

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

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

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

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

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

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

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

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

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

14. Definitions

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

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:
Falls City Utility Department
2307 Barada Street
Falls City, NE 68355

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

    5.1 Claimants who do not have a direct contract with the Contractor,

        5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2 Pay or arrange for payment of any undisputed amounts.

    7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

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

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

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

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or

(2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

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

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

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

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

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

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

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision

regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

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

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

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

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

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

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

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

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

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

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

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

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

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

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

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

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

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

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

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

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

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

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

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

D. *Defective*:

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

a. does not conform to the Contract Documents; or

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

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

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

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

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

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words

"furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

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

B. *Evidence of Contractor's Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner's Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

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

2. a preliminary Schedule of Submittals; and

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

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

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

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

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

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

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

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

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

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

B. *Resolving Discrepancies*:

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

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

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

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

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

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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

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

5.02 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste

materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

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

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

5.03 *Subsurface and Physical Conditions*

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

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

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

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

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

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

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

5.04 *Differing Subsurface or Physical Conditions*

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

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

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

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

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

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

    b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site

and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

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

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

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

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

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

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and

recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer,

or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

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

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

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

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond

signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

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

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor

to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

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

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

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

2. claims for damages insured by reasonably available personal injury liability coverage.

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

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial

Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

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

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. extend to cover damage or loss to insured property while in transit.

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this

Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

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

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by,

arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

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

7.02 *Labor; Working Hours*

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

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

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

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

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

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

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

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

4) it is not objectionable to Owner.

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

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

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

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

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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

    a. shall certify that the proposed substitute item will:

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

        2) be similar in substance to that specified, and

        3) be suited to the same use as that specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

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

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the

Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

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

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

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

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

7.07 *Patent Fees and Royalties*

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

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the

performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

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

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

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

7.10 *Laws and Regulations*

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

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if

any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

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

7.12 *Safety and Protection*

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

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

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

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

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

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

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

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly

or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

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

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

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

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

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

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

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

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

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

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

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

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and

Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

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

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

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

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

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

2. normal wear and tear under normal usage.

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

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

D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

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

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

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

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

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

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or

alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual

rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

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

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

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

the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

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

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in

contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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

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

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents

governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

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

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

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

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

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

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

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

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

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal

and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

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

Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

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

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

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

5. Supplemental costs including the following:

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

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

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

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

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

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or

indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

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

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

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

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

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

B. *Cash Allowances*: Contractor agrees that:

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

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

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

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

13.03 *Unit Price Work*

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

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

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

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

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

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

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

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

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

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

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

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

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

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

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

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

14.07 *Owner May Correct Defective Work*

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

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

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

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

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

C. *Review of Applications*:

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

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

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon

Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

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

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

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

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

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

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

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

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

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

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

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

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

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

    b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

    c. Contractor has failed to provide and maintain required bonds or insurance;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

    e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

    f. the Work is defective, requiring correction or replacement;

    g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

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

    i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

    j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

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

    l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

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

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

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

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

15.04 *Partial Use or Occupancy*

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

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

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

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

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

    a. all documentation called for in the Contract Documents;

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

    c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

    d. a list of all disputes that Contractor believes are unsettled; and

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

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

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

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

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

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

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

E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

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

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When

exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

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

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

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

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

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

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

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

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

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

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

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

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

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

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Headings*

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

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 Copies of Documents

SC-2.02.A. Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor 2 copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 Subsurface and Physical Conditions

SC 5.03 Delete Paragraphs 5.03.A and 5.03.B in their entirety and insert the following:

A. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

SC-5.06 Hazardous Environmental Conditions

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

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

B. Not Used.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.02 Insurance—General Provisions

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

SC-6.03 Contractor's Insurance

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	**Statutory**

Federal, if applicable (e.g., Longshoreman's):	**Statutory**

Employer's Liability:

Bodily injury, each accident	**$ 1,000,000**
Bodily injury by disease, each employee	**$ 1,000,000**
Bodily injury/disease aggregate	**$ 1,000,000**

Foreign voluntary worker compensation	**Statutory**

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	**$ 2,000,000**
Products - Completed Operations Aggregate	**$ 2,000,000**
Personal and Advertising Injury	**$ 1,000,000**
Each Occurrence (Bodily Injury and Property Damage)	**$ 1,000,000**

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Combined Single Limit of	**$ 1,000,000**

4. Excess or Umbrella Liability:

Per Occurrence	**$ 10,000,000**
General Aggregate	**$ 10,000,000**

[See Paragraph 6.03.E of the General Conditions.]

5. Contractor's Pollution Liability:

Each Occurrence	**$**
General Aggregate	**$**

☒ **If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract**

[See Paragraph 6.03.F of the General Conditions.]

6. **Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following: Fremont Department of Utilities and Utility Safety & Design, Inc.**

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.02 Labor; Working Hours

SC-7.02.B. Add the following new subparagraphs immediately after Paragraph 7.02.B:

1. **Regular working hours will be** *Monday through Friday 6:30 a.m. to 6:30 p.m.*
2. **Owner's legal holidays are** New Year's Day, President's Day, Good Friday (2) hours, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving Day, Christmas Eve Last (4) hours, Christmas Day, New Year's Eve Last (4) hours

SC-7.12 Safety and Protection

SC-7.12 Insert the following after the second sentence of Paragraph 7.12.C:

The following Owner safety programs are applicable to the Work: *City of Falls City Injury Prevention Program dated October 11, 2012*

ARTICLE 9 – OWNER'S RESPONSIBILITIES

SC-9.13 Owner's Site Representative

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

SC-9.13 Owner will furnish an "Owner's Site Representative" to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site Representative will be *Marc Ramsey.*

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

SC-10.03

B. On this Project, by agreement with the Owner, Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.03 Unit Price Work

SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. if the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 10 percent from the estimated quantity of such item indicated in the Agreement; and

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

3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.03 Substantial Completion

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

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Work Change Directive No.

Date of Issuance:		Effective Date:	
Owner:	Falls City Utility Department	Owner's Contract No.:	N/A
Contractor:		Contractor's Project No.:	
Engineer:	Utility Safety & Design, Inc.	Engineer's Project No.:	N/A
Project:	2024 Natural Gas Improvement Project	Contract Name:	

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments: *[List documents supporting change]*

Purpose for Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

☐ Non-agreement on pricing of proposed change.

☐ Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price $ [increase] [decrease].

Contract Time days [increase] [decrease].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price

☐ Cost of the Work ☐ Other

RECOMMENDED:	AUTHORIZED BY:	RECEIVED:
By:	By:	By:
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title:	Title:	Title:
Date:	Date:	Date:

Approved by Funding Agency (if applicable)

By: Date:

Title:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Change Order No. _____

Date of Issuance:		Effective Date:	
Owner:	Fall City Utility Department	Owner's Contract No.:	N/A
Contractor:		Contractor's Project No.:	
Engineer:	Utility Safety & Design, Inc.	Engineer's Project No.:	N/A
Project:	2024 Natural Gas Improvement Project	Contract Name:	

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	**CHANGE IN CONTRACT TIMES** *[note changes in Milestones if applicable]*
Original Contract Price: $_____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: $_____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: $_____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: $_____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: $_____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title _____
Date: _____	Date _____	Date _____

Approved by Funding Agency (if applicable)

By: _____ Date:

Title: _____

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Field Order No. _____

Date of Issuance:		Effective Date:	
Owner:	Falls City Utility Department	Owner's Contract No.:	N/A
Contractor:		Contractor's Project No.:	
Engineer:	Utility Safety & Design, Inc.	Engineer's Project No.:	N/A
Project:	2024 Natural Gas Improvement Project	Contract Name:	

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with General Conditions Paragraph 11.01, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference: _____ (Specification(s)) _____ (Drawing(s) / Detail(s))

Description:

Attachments:

ISSUED:	RECEIVED:
By: _____	By: _____
Engineer (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____
Date: _____	Date: _____

Copy to: Owner

UNIT PRICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit, excluding materials explicitly named as provided by Owner

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to the Contractor.

D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 LIST OF UNIT PRICES

1. Mobilization
    a. Description: Cost of moving all equipment, vehicles, and personnel to and from the job site as well as lodging and meals for the duration of the project.
    b. Unit of Measurement: Lump Sum
2. Demobilization
    a. Description: Cost of removing all equipment, vehicles, and personnel from the job site as well as refurbishing all work areas to pre-work condition.
    b. Unit of Measurement: Lump Sum

3. 2” HDPE Main, Complete
    a. Description: Installation and commissioning of 2” HDPE via HDD or trench according to Contract Drawings. Includes installing tracer wire, joining, fusion, and all other materials necessary for a complete installation. Also includes pigging, purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot

4. 2” HDPE Ball Valve, Complete
    a. Description: Installation of valve including valve box, lid, concrete encasement around lid, and restoration per Contract Drawings.
    b. Unit of Measure: Each

5. 1-1/4” HDPE Main, Complete
    a. Description: Installation of 1-1/4” HDPE via HDD or trench according to Contract Drawings. Includes installing tracer wire, joining, fusion, and all other materials necessary for a complete installation. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot.

6. HDPE Service Line Tie-In, Complete
    a. Description: Tie-in of existing service lines to new HDPE main per Contract Drawings. Includes installing, joining, fusion, excess flow valve or ball valve, and all other materials necessary for a complete installation. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each

7. Unit 1” HDPE Service Line, Complete
    a. Description: Installation of 1” HDPE service lines according to Contract Documents. Includes installing tracer wire, joining, fusion, excess flow valve, anodeless risers, and all other materials necessary for a complete installation. City will build and install the meter set and connect to customer. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot

8. 1-1/4” HDPE Service Line, Complete
    a. Description: Installation of 1” HDPE service lines according to Contract Documents. Includes installing tracer wire, joining, fusion, excess flow valve, anodeless risers, and all other materials necessary for a complete installation. City will build and install the meter set and connect to customer. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot

9. New 2” HDPE to Exist. 2” HDPE Main Tie-in, Complete
    a. Description: Installation and tie-in of new 2” HDPE to existing 2” HDPE main as per the Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each

10. New 2” HDPE to Exist. 2” HDPE Main Tie-ins w/ High Volume Tap Tee, Complete
    a. Description: Installation and tie-in of new 2” HDPE to existing 2” HDPE main (connected to 4” PE main) with a high-volume tapping tee per Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
11. New 1-1/4” HDPE to Exist. 2” HDPE Main Tie-ins w/ High Volume Tap Tee, Complete
    a. Description: Installation and tie-in of new 1-1/4” HDPE to existing 2” HDPE main (connected to 4” PE main) with a high-volume tapping tee per Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
12. New 1-1/4” HDPE to Exist. 1-1/4” HDPE Main Tie-in, Complete
    a. Description: Installation and tie-in of new 1-1/4” HDPE to existing 1-1/4” HDPE main per Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
13. Stop, Purge, Cap, and Abandon Existing Mains and Services, Complete
    a. Description: Stop, purge, cap, and abandon of all existing mains and existing service lines as per Contract Drawings. Contractor shall provide all fittings and equipment required to properly stop all steel pipelines. Includes restoration.
    b. Unit of Measure: Lump Sum
14. Locating Test Stations, Complete
    a. Description: Installation of locating test stations at tracer wire termination points.
    b. Unit of Measure: Each
15. Anode Installation, Complete
    a. Description: Installation of anodes, including wiring into test stations, at tracer wire termination points.
    b. Unit of Measure: Each

Addition 1

1. 1-1/4” HDPE Main, Complete
    a. Description: Installation of 1-1/4” HDPE via HDD or trench according to Contract Drawings. Includes installing tracer wire, joining, fusion, and all other materials necessary for a complete installation. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot.
2. HDPE Service Line Tie-In, Complete
    a. Description: Tie-in of existing service lines to new HDPE main per Contract Drawings. Includes installing, joining, fusion, excess flow valve or ball valve, and all other materials necessary for a complete installation. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
3. Unit 1” HDPE Service Line, Complete
    a. Description: Installation of 1” HDPE service lines according to Contract Documents. Includes installing tracer wire, joining, fusion, excess flow valve,

anodeless risers, and all other materials necessary for a complete installation. City will build and install the meter set and connect to customer. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.

b. Unit of Measure: Linear Foot

4. New 1-1/4" HDPE to Exist. 2" HDPE Main Tie-in, Complete
   a. Description: Installation and tie-in of new 1-1/4" HDPE to existing 2" HDPE main per Contract Drawings. Also includes purging, pressure testing, and restoration.
   b. Unit of Measure: Each
5. Stop, Purge, Cap, and Abandon Existing Mains and Services, Complete
   a. Description: Stop, purge, cap, and abandon of all existing mains and existing service lines as per Contract Drawings. Contractor shall provide all fittings and equipment required to properly stop all steel pipelines. Includes restoration.
   b. Unit of Measure: Lump Sum
6. Locating Test Stations, Complete
   a. Description: Installation of locating test stations at tracer wire termination points.
   b. Unit of Measure: Each
7. Anode Installation, Complete
   a. Description: Installation of anodes, including wiring into test stations, at tracer wire termination points.
   b. Unit of Measure: Each

Addition 2

1. 1-1/4" HDPE Main, Complete
   a. Description: Installation of 1-1/4" HDPE via HDD or trench according to Contract Drawings. Includes installing tracer wire, joining, fusion, and all other materials necessary for a complete installation. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
   b. Unit of Measure: Linear Foot.
2. HDPE Service Line Tie-In, Complete
   a. Description: Tie-in of existing service lines to new HDPE main per Contract Drawings. Includes installing, joining, fusion, excess flow valve or ball valve, and all other materials necessary for a complete installation. Also includes purging, pressure testing, and restoration.
   b. Unit of Measure: Each
3. Unit 1" HDPE Service Line, Complete
   a. Description: Installation of 1" HDPE service lines according to Contract Documents. Includes installing tracer wire, joining, fusion, excess flow valve, anodeless risers, and all other materials necessary for a complete installation. City will build and install the meter set and connect to customer. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
   b. Unit of Measure: Linear Foot

4. New 1-1/4" HDPE to Exist. 2" HDPE Main Tie-in, Complete
    a. Description: Installation and tie-in of new 1-1/4" HDPE to existing 2" HDPE main per Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
5. Stop, Purge, Cap, and Abandon Existing Mains and Services, Complete
    a. Description: Stop, purge, cap, and abandon of all existing mains and existing service lines as per Contract Drawings. Contractor shall provide all fittings and equipment required to properly stop all steel pipelines. Includes restoration.
    b. Unit of Measure: Lump Sum
6. Locating Test Stations, Complete
    a. Description: Installation of locating test stations at tracer wire termination points.
    b. Unit of Measure: Each
7. Anode Installation, Complete
    a. Description: Installation of anodes, including wiring into test stations, at tracer wire termination points.
    b. Unit of Measure: Each

Addition 3

1. 2" HDPE Ball Valve, Complete
    a. Description: Installation of valve including valve box, lid, concrete encasement around lid, and restoration per Contract Drawings.
    b. Unit of Measure: Each
2. 1-1/4" HDPE Main, Complete
    a. Description: Installation of 1-1/4" HDPE via HDD or trench according to Contract Drawings. Includes installing tracer wire, joining, fusion, and all other materials necessary for a complete installation. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot.
3. HDPE Service Line Tie-In, Complete
    a. Description: Tie-in of existing service lines to new HDPE main per Contract Drawings. Includes installing, joining, fusion, excess flow valve or ball valve, and all other materials necessary for a complete installation. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
4. Unit 1" HDPE Service Line, Complete
    a. Description: Installation of 1" HDPE service lines according to Contract Documents. Includes installing tracer wire, joining, fusion, excess flow valve, anodeless risers, and all other materials necessary for a complete installation. City will build and install the meter set and connect to customer. Also includes purging, pressure testing, restoration, and videoing of sewer laterals where cross-bores may have occurred.
    b. Unit of Measure: Linear Foot

5. New 1-1/4” HDPE to Exist. 2” HDPE Main Tie-in, Complete
    a. Description: Installation and tie-in of new 1-1/4” HDPE to existing 2” HDPE main per Contract Drawings. Also includes purging, pressure testing, and restoration.
    b. Unit of Measure: Each
6. Stop, Purge, Cap, and Abandon Existing Mains and Services, Complete
    a. Description: Stop, purge, cap, and abandon of all existing mains and existing service lines as per Contract Drawings. Contractor shall provide all fittings and equipment required to properly stop all steel pipelines. Includes restoration.
    b. Unit of Measure: Lump Sum
7. Locating Test Stations, Complete
    a. Description: Installation of locating test stations at tracer wire termination points.
    b. Unit of Measure: Each
8. Anode Installation, Complete
    a. Description: Installation of anodes, including wiring into test stations, at tracer wire termination points.
    b. Unit of Measure: Each

TABLE OF CONTENTS

1 GENERAL

1.1 ENUMERATION OF DRAWINGS, SPECIFICATIONS AND ADDENDA

The following Drawings and Specifications for the **2024 Natural Gas Improvement Project** form a part of the Contract.

A-1	Cover
A-2	Notes-BOM-Legend
A-3	Service List
B-1	Overview
B-2 – B-12	Replacement Plan
C-1 – C-4	Installation Details
C-5	SWPPP Details

Addition 1

A-1	Cover
A-2	Notes-BOM-Legend
A-3	Service List
B-1	Project Layout
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Addition 2

A-1	Cover
A-2	Notes-BOM-Legend
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B-2 – B-3	Replacement Plan
C-1 – C-3	Installation Details
C-4	SWPPP Details

Addition 3

A-1	Cover
A-2	Notes-BOM-Legend
A-3	Service List
B-1	Overview
B-2	Replacement Plan
C-1 – C-3	Installation Details
C-4	SWPPP Details

1.2 QUANTITIES OF ESTIMATE

Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the Documents, they are given for use as estimates and the right is especially reserved, except as herein otherwise specifically limited, to increase or diminish them as may be deemed

reasonably necessary or desirable by the Owner to complete the work contemplated by their Contract.

1.3 SEQUENCE OF CONSTRUCTION AND CONSTRUCTION SCHEDULE

The sequence of construction and construction schedule shall be filed with the Owner for their approval prior to construction. They shall show order of construction and starting/completion dates and shall be adhered to with reasonable accuracy.

1.4 APPLICABLE CODES

All of the Work shall be governed by and shall be performed in accordance with the following codes and standards, except where the Contract Documents specifically require a greater degree or quality of work: 49 Code of Federal Regulations, Part 192; Nebraska Public Service Commission; and the latest Edition of GPTC Guide. Contractor shall provide Operator Qualification plan and employee records to the Owner for review and approval. Contractor shall submit PHMSA DOT approved Anti-Drug & Alcohol Plan and MIS report to the Owner for review. If there is any conflict or discrepancy among these codes and standards, Contractor shall perform in accordance with the code or standard requiring the greater degree or higher quality of work.

Remainder of page intentionally blank

2 SCOPE OF WORK

2.1 GENERAL

The proposed work consists of furnishing all labor, new materials, tools, equipment and services necessary for the construction of the **2024 Natural Gas Improvement Project**, including all other incidental work as shown on the Drawings and as herein specified.

The City of Falls City is planning to replace a section of steel distribution pipe with high-density polyethylene pipe. The project includes retiring approximately 6,300 feet of steel pipe. The retired steel pipe will be replaced with new HDPE pipe, which includes approximately 3,090 feet of 2-inch HDPE pipe, and 3,100 feet of 1 1/4-inch HDPE pipe, and 8 tie-ins. The project also includes replacing 55 services and tying-in 44 services. The exact course and layout of the pipelines is indicated on the associated Drawings.

Addition 1

The City of Falls City is planning to replace a section of steel distribution pipe with high-density polyethylene pipe. The project includes retiring approximately 670 feet of steel pipe. The retired steel pipe will be replaced with new HDPE pipe, which includes approximately 670 feet of 1 1/4-inch HDPE pipe, and 1 tie-in. The project also includes replacing 6 services and tying-in 2 services. The exact course and layout of the pipelines is indicated on the associated Drawings.

Addition 2

The City of Falls City is planning to replace a section of steel distribution pipe with high-density polyethylene pipe. The project includes retiring approximately 1,400 feet of steel pipe. The retired steel pipe will be replaced with new HDPE pipe, which includes approximately 1,400 feet of 1 1/4-inch HDPE pipe, and 1 tie-in. The project also includes replacing 13 services and tying-in 16 services. The exact course and layout of the pipelines is indicated on the associated Drawings.

Addition 3

The City of Falls City is planning to replace a section of steel distribution pipe with high-density polyethylene pipe. The project includes retiring approximately 1,000 feet of steel pipe. The retired steel pipe will be replaced with new HDPE pipe, which includes approximately 1,000 feet of 1 1/4-inch HDPE pipe, and 1 tie-in. The project also includes replacing 19 services and tying-in 6 services. The exact course and layout of the pipelines is indicated on the associated Drawings.

Contractor shall be charged with full responsibility for agreement of the work with the staked route. Preservation of the stakes shall be the responsibility of the Contractor. Any carelessness or negligence on the part of the Contractor, sub-contractor, or employees that results in loss or misalignment of the stakes will require that the cost of replacement be borne by Contractor.

As construction requires movement of the station stakes, Contractor will relocate the stakes to the edge of the right-of-way approximately perpendicular to the centerline of the pipeline location and across the backfill.

Owner retains the right to make changes or alterations in the routing.

2.2 RESPONSIBILITY

It shall be the responsibility of the Contractor to furnish and install a complete and working system to perform the intended purposes as required by the Drawings and these Specifications. The Contractor shall be responsible for all details which may be necessary to properly install, adjust, pig, test and place into operation the complete installation. The work shall not be considered complete until all required records (see Section 5.13) have been turned in to the Owner. Costs of all such details shall be included in the proposal. The Contractor shall Guarantee that the materials furnished shall be properly installed and, when properly operated, shall perform the duty for which it is intended. The Contractor shall guarantee all materials, workmanship, and completed installation to be first class in every particular and shall, at their own expense, furnish and replace any part or parts that may prove defective in workmanship within one (1) year from the date of substantial completion

3 MATERIALS

3.1 GENERAL

Materials and material handling associated with the pipeline, fittings, and appurtenances to be constructed shall be in compliance with this specification and the following specifications for materials.

All materials to be utilized in this project are to be new and are to be thoroughly examined by the Contractor prior to installation. Any cracked, chipped, bent, scarred, or otherwise damaged material shall be returned to the supplier for replacement by the Contractor.

3.2 OWNER FURNISHED MATERIALS

The Owner has requested the Contractor provide all of the materials necessary for the complete construction of the **2024 Natural Gas Improvement Project** with the exception of those materials listed below.

The following items shall be installed by the Contractor. The Specifications on the material involved is as follows:

3.2.1 OWNER PROVIDED MATERIALS

- All items listed on sheet A-2 of each of the Plans.

3.3 CONTRACTOR FURNISHED MATERIALS

All other materials necessary for the complete construction of the **2024 Natural Gas Improvement Project** shall be furnished by the Contractor. Refer to the plans to see the detailed layout of the components. It shall include, but not limited to, the following items:

- All fittings and equipment required to properly stop all steel pipelines.
- All tools and consumables required to properly clean, prepare, join, and install all piping and components including proper installation of anodes and test stations.
- All test equipment necessary to complete pressure testing of all piping/fittings.
- Coating
- Paint
- All equipment required to video all sewer laterals where cross-bores may have occurred.

3.3.1 Miscellaneous Materials

The Contractor will furnish the tie-ins (prefabricated), fittings, and other appurtenances as shown and specified on the Drawings.

Contractor shall furnish all necessary supervision labor, equipment, and supplies to promptly move and string on right-of-way all furnished pipe required for the Project. All handling of pipe shall be in such a manner that will avoid damage to the pipe.

The Contractor shall be accountable for all materials on the jobsite. Waste shall be kept to a minimum. Any other items, materials, tools, equipment or facilities required to complete the Work shall be furnished by the Contractor at their expense.

3.4 CARE AND HANDLING

Care shall be exercised to avoid rough handling. Pipe shall not be dragged, dropped or have other objects dropped on it. Caution shall be exercised to prevent kinking, buckling, flattening, or other damage. Any damage which occurs shall be removed by cutting out as a cylinder. Pipe ends shall remain capped until pipe is being aligned for welding.

Coated pipe shall be carefully inspected prior to use for cuts, scratches, gouges, and other imperfections. Defective pipe shall not be used. Coated pipe shall also be protected from fire, excessive heat, or harmful chemicals.

Special padded forks, padded calipers or nylon slings shall be used in handling, and storage shall be on padded skids spaced to give adequate support.

3.5 RECORDS

Contractor shall provide all of the following material records for all materials used in the project:

a. Records
    i. Test Records
    ii. As-Built Documentation

Remainder of page intentionally blank

4 EXCAVATING, BORING, TRENCHING AND BACKFILLING

4.1 SCOPE

Furnish all materials, equipment, labor, and related items required to complete work indicated on the Drawings and/or Specifications. The work under this Section includes, but is not limited to, the following items:
Excavation, Backfill of gas pipeline, bores and related items

4.2 GENERAL

Excavating and backfill shall include all excavation, backfilling, compacting, and disposal of surplus material, restoration of all disturbed surfaces and all other work incidental to the construction of trenches, including any additional excavation which may be required for the installation of the pipeline.

Risk - The Contractor must assume the risk of encountering quicksand, hardpan, high water tables, and other soil types which might hinder or slow their progress. No claim for additional compensation shall be entertained on account of the character of the ground in which the excavation is being made.

4.3 SURFACE AND SUBSURFACE STRUCTURES AND OBSTRUCTIONS

Various underground and surface structures may, or may not, be shown on the Drawings. The location and dimensions of such structures, where given, do not purport to be absolutely correct. The structures are plotted on the Drawings for the information of the Contractor, but information so given is not to be construed as a representation that such structures will be found or encountered as plotted. Other structures may also be encountered which are not shown on the Drawings

4.3.1 Utilities

The Contractor shall be aware that utility companies may have buried facilities in some areas of the gas line construction. Before the Contractor begins operations, he shall notify all utility companies affected by construction and request their assistance. Contractor shall also comply with Nebraska law and the One-Call System requirements.
Private Utilities are not registered in the One-Call system, and therefore are not located by any utility company. Therefore, it will be required for the Contractor, at their expense, to locate and expose by whatever means necessary each residence and businesses sewer that the new pipeline will be crossing or be near prior to boring and/or trenching.

4.3.2 Maintaining Utilities

The Contractor shall maintain, in operating condition, all utilities encountered in their work. When, and if, the Contractor intends to interrupt utility service, the owner of the utility, the Owner's Representative and the Contractor shall mutually agree upon a date and time for interruptions which are convenient for the utility and to the utility customer. The Contractor shall indicate to the Owner's Representative at the Pre-Construction Meeting where, and how long, the service interruption will occur. No additional compensation shall be allowed if it is determined necessary to interrupt the existing utility at a time which is beyond regular working hours.

4.3.3 Utility Damage

Any damage to existing utilities as a result of their construction shall be repaired to the satisfaction of the owner of the utility at the Contractor's expense, whether or not said utilities are shown on the Drawings. If such repairs are not made promptly or satisfactorily, the Owner's Representative may have the repairs made, or may deduct the cost thereof from any moneys due, or become due, the Contractor.

4.3.4 Clearance with Underground Utility Structures

Hidden structures shall be located in advance of ditching and the owner consulted to co-ordinate activities. Presence of the utility Owner's representative shall be requested to observe work and protect the owner's property. A minimum clearance of twenty-four inches (24") shall be provided from foreign structures, unless otherwise approved by the Owner's Representative.

4.3.5 Property Damage

The Contractor shall be entirely responsible for all damages to streets, pavements, sidewalks, curbs, fences, culverts, buildings, or other structures of any kind met with during the completion of the work; and shall be liable for damages to public or private property resulting therein, which amount may be deducted from any moneys due him for work done.

4.3.6 Restoration of Property

All existing streets, sidewalks, alleys, driveways, entrances, road shallers, parking areas, lawns, signs, fences, sheds, and other miscellaneous property and drainage features which are removed to allow for the construction, or damaged by it, whether or not the Contractor has paid for the damage under a specific measurement and payment section, shall be restored to a condition at least equivalent to that which existed at the commencement of the work; unless additional written arrangements are made satisfactory to the owner of said property. The Contractor shall be solely liable for damages to items described herein and moneys due him may be withheld to cover such damages. Suitable crossings shall be provided and maintained over the open ditch, where necessary, to permit property owners and the general public to move equipment, or vehicular traffic, over the excavation.

4.3.7 Trees and Shrubs

Existing trees and shrubs within easements and right-of-way's shall be protected from damage and when such trees and shrubs are in the way of construction, the Owner's Representative may instruct the Contractor to prune branches interfering with the work, or remove and dispose of trees and shrubs, or transplant trees and shrubs out of the way of the construction, and the Contract Price shall not be increased for the performance of such work. The Contractor shall be liable for damages to trees and shrubs which were to have been protected as directed by the Owner's Representative, unless such damages are determined by the Owner's Representative to have been unavoidable, and moneys due to

Contractor may be withheld to cover such damages.

4.3.8 Equipment

Tool boxes, equipment, and materials shall not be placed in roadways, driveways, walkways, or any place where they will interfere with pedestrian or vehicular traffic. If it is necessary to obstruct a driveway or walkway, prior permission must be obtained from the owner involved.

4.4 SURFACE REMOVAL

The Contractor shall remove the surface materials along the proposed pipeline if indicated on the Drawings only to such widths as will permit a trench to be excavated, which will afford sufficient room for proper safety and construction. Where driveways, pavements, drainage, and utilities are encountered, care shall be taken to protect such against fracture or disturbance beyond reasonable working limits.

4.4.1 Trenches in Lawns

Care shall be taken in making excavations in lawns, or other grassed areas, to preserve the sod and topsoil so that it may be replaced in proper sequence when backfilling. A tarpaulin shall be used to separate the sod from other backfill material.

When trenching equipment is to be used for excavation in grassed areas, the sod shall be removed along the trench line prior to the start of actual excavation. Wood planks shall be used as a platform for the trenching equipment, when necessary, to avoid damage to grassed areas.

4.4.2 Piling Earth

The soil shall be piled in such a manner that it will not prevent access to fire hydrants, mailboxes, or valve boxes of other utilities. The soil shall not be placed in the gutter, unless other drainage is provided, such as placing boards to span the gutter so that water can drain through the gutter beneath the boards. If at all possible, the soil shall be kept between the trench and road traffic. The soil shall clear the trench excavation by at least twelve inches (12").

4.5 WIDTH OF EXCAVATION

Refer to drawings. Trench Sheeting and bracing, or a trench shield, shall be used as required by the Rules and Regulations of OSHA.

4.6 EXPLORATORY EXCAVATION

Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the best line for the construction of the proposed pipeline, the Contractor shall make explorations and excavations for such purposes.

4.7 ROCK EXCAVATION

Wherever “rock” is used as the name of excavated material, it shall mean boulders or pieces of natural rock measuring one (1) cubic yard, or more, hard shale or solid ledge rock which, in the opinion of the Engineer, requires for its removal and

continuous use of pneumatic tools, or drilling and blasting.

4.7.1 Extra Payment for rock excavation may be allowed. Before extra payment is allowed, however, the Contractor shall be required to demonstrate the material cannot be removed by hand pick, or by power operated excavator or shovel.

4.7.2 No payment shall be made for rock excavations, unless air tools or explosives are used by the Contractor. Any blasting done to facilitate rock excavation shall be done according to Federal Regulations. No rock excavation is anticipated

4.8 BRACED AND SHEETED TRENCHES

Open cut Trenches shall be sheeted and braced, or otherwise protected as required by any governing Federal or State Laws and Municipal Ordinances, and as may be necessary to protect life, property, or the Work. In any event, the minimum protection shall conform to the recommendations in OSHA Safety and Health Standards of Construction.

A Sand Box, or trench shield, may be used in lieu of sheeting as permitted by OSHA.

When Close Sheeting is used, it shall be so driven as to prevent adjacent soil from entering the trench either below, or through, such sheeting.

4.9 TRENCHES WITH SLOPING SIDES, LIMITED

The Contractor may, at their option, where working conditions, easements, and right-of-way's permit (as determined by the Owner's Representative), excavate pipeline trenches with sloping sides, but with the following limitations:

4.9.1 Limited

In general, only braced and vertical trenches will be permitted where trenches endanger structures and buildings.

4.9.2 Sloping Sides

Where trenches with sloping sides are permitted, the slopes shall not extend below the top of the pipeline and trench excavations below this point shall be made with vertical sides, with widths not exceeding those specified in Paragraph 1.3.05 for the various sizes of pipes. Sloping sides above the pipe shall be as OSHA Regulations required.

4.10 PILING EXCAVATED MATERIAL

All excavated material shall be piled in a manner that will not endanger the WORK and that will avoid obstructing road and driveways

4.11 REMOVAL OF WATER

The Contractor shall, at all times during construction, be responsible for all erosion control, provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavations, or other parts of the Work, until all work to be performed therein has been completed.

4.12 EXCAVATION PROTECTION

Excavations shall be protected by barricades. The entire excavation shall be roped off or fenced and flagged when the work area is unattended. All barricades, signs, fencing, etc. shall be supplied by the Contractor. No excavations may be left open over weekends or holidays.

Safety Signs and Flags - Safety signs and flags shall be used when a trench is opened and when men are working. Special care shall be taken in placing safety signs, or flags, so that traffic will be adequately warned of the danger. Material and equipment shall be kept out of the way of pedestrians and traffic and shall be stored in a safe manner.

The Rules and Regulations by OSHA, and appropriate authorities (such as the Nebraska Department of Transportation) respecting safety provisions shall be observed. All permitting requiring traffic control for street and highways shall be followed as listed in the permit

4.13 CONSTRUCTION IN EASEMENTS

In easements across private property, the Contractor shall confine all operations in the easement area and shall be responsible and liable for all damage outside of the easement area, including crop damage.

Trees, fences, shrubbery, or other types of surface improvements located in easements shall require protection during construction

4.14 BACKFILL

Remove all timber, chunks of wood, or other organic material from the backfill. No trash or debris will be allowed in the backfill at any time. Special precautions must be taken with frozen backfill material to prevent clods from falling directly on the pipe.

In rocky soil, a minimum of six inches (6") of rock-free soil padding shall be provided beneath, around, and above the pipe. Rock shield may be used in lieu of dirt padding to protect the pipe.

Sufficient backfill shall be used so that no depressions remain after settling to interfere with traffic or drainage. Excessive mounds shall be avoided. The backfill shall be compacted by use of tamping machines, rolling or wetting down.

Avoid delays in backfilling to prevent the open ditch from interfering with traffic or normal activities. Special attention must be given to adjacent structures to prevent damage during backfilling. Any tile runs interrupted by the ditch shall be carefully restored and protected.

Ditch checks shall be installed, where required, by use of sandbags or other methods.

Granular backfill shall be used at all road and driveway crossings above sand fill around pipe.

Special care shall be taken to fill voids due to settling or cave-ins caused by boring equipment

4.15 ROAD CROSSINGS

Owner has obtained all necessary permits. Contractor shall be responsible for strictly following permit requirements including the following:

All highway and road crossings shall be continuously maintained to insure safe passage of traffic. At all crossings, adequate and proper traffic aids such as warning signs, flares, guards and other safeguards shall be utilized to insure the safety of the public.

All open cut crossings, driveways or roads shall be backfilled with sand to six inches (6") above top of pipe and shall contain no stones, and shall be spread in uniform layers as to completely fill the trench with a uniform dense backfill on the pipe. The remainder of the trench shall be filled with Aggregate Surface Course, Type B, CA-6 or CA-10. In instances where the bore for the crossing leaves voids around the pipe due to cave-ins, washouts, or shifting of the soil, these shall be backfilled with granular backfills above and compacted by hand tamping or machine tamping.

4.16 DIRECTIONAL BORING

The procedures outlined in this section shall be followed whenever directional boring is being used.

4.16.1 DAMAGE PREVENTION WHEN BORING

4.16.1.1 Use the one-call notification system to have facilities within the immediate area located and marked. Directly contact known, non-participating utility owners for facility location.

4.16.1.2 Ensure that known facilities are located and marked prior to commencing work

4.16.1.3 Expose facilities within the immediate work area by hand excavation before starting a bore if the depths of the facilities are not established by other means

4.16.1.4 Consider sewer systems within the area. Sewer systems are especially vulnerable to damage from boring operations for the following reasons:

4.16.1.4.1 Lines are often non-metallic, making them difficult to locate.

4.16.1.4.2 Clean-outs or other indications of laterals may be hidden or non-existent.

4.16.1.4.3 Damage may not be readily apparent when a sewer, particularly a gravity flow system, is pierced by a boring machine.

4.16.1.5 Notify residential and business neighbors in the area of impending work.

4.16.1.6 Ensure adequate clearance of overhead electric, telephone, or cable lines.

4.16.2 Protecting Existing Facilities

4.16.2.1 When it is anticipated that the bore will cross or come near the edge of an underground facility, expose that facility to determine its precise location to ensure adequate separation between the existing and proposed facilities. ***It is a requirement that private sewers be located and exposed, at the Contractors expense, prior to boring.***

4.16.2.2 When the bore will run parallel to an existing facility, expose that facility (pothole) or use locating technology to verify that adequate clearance is maintained between the bore and the existing facilities during the boring operation (for both the drilling of the pilot hole and the back-reaming operation). Calculation of the separation distance shall account for the largest diameter back reamer that will be used in the boring process.

4.16.2.3 Where potholes are used for visual inspection, they shall be placed at intervals that will ensure that clearance is maintained during boring operations. Factors to consider for pothole intervals include the following:

- Proximity of proposed bore path to the pipeline facilities.
- Type of facility (existing and proposed).
- Type of soil.
- Size and controllability of the bore.

4.16.2.4 Locate the existing facility and the newly installed facility to ensure that the installation is in the intended location.

4.16.2.5 Conduct a leakage survey over pipelines that could have been affected by the trenchless installation.

4.16.3 Limits and Obstructions

Obstructions that shall be considered include the following:

- Magnetic influences within 75 feet of the proposed bore path.
- Buried or abandoned structures.
- Utility infrastructure.
- Underground or elevated pipelines.
- Overhead obstructions at the drill site or exit areas.
- Geotechnical characteristics.

4.16.4 INSTRUMENTATION

A surface monitoring system may be used to track the location of the down-hole probe during the pilot hole drilling. The installer shall ensure that such monitoring controls the drilling path accuracy and allows for necessary corrections. The space between monitor readings is determined by the need for accuracy in placement of the pipeline. Some form of gauging shall be used to monitor the pulling force.

4.16.5 CONSTRUCTION INSPECTION

- The installers shall ensure that the pipe pull section is adequately supported during pullback.

- The proper containment and disposal of drilling mud or fluids shall be verified to ensure compliance with applicable requirements.
- Other considerations are as follows:
  - Pipe handling during stringing, welding, and pullback operations.
  - Pipeline testing process.

4.16.6 DAMAGE CAUSED BY DIRECTIONAL DRILLING

If damage is done to existing utilities, the following shall be done:

- The situation shall be stabilized to prevent additional safety hazards and to prevent more damage to utilities. (Note: Safety hazards can include electrocution, explosion, and contamination depending on the type and size of pipeline damaged.)
- The affected utility shall be notified of the damage created, including preliminary observations by the boring machine operator of the location and nature of the damage.
- One call enforcement shall be notified of the damage. Information needed by one call includes dig number for the area, type of facility, the affected utility, and the location of the damage at the dig site.
- Boring in the affected area shall be delayed until the hazard is removed and additional locating is done to prevent future damage. This additional locating can include hand digging and additional line locates. Once an area is determined to be safe and the true location of the damaged utility is located boring can resume.

4.17 CLEAN-UP

Following the installation and backfilling of the pipe line, the right-of-way and the surrounding area traversed shall be restored to its former condition. All holes and ruts shall be repaired and smoothed over and the area restored to a stable and usable condition consistent with the use intended prior to building of the pipeline.

The good will of the property owner, private or public, is essential. All temporary roads, bridges and culverts shall be removed, unless required for permanent access and meet with the land Owner's approval.

Fences shall be restored in kind to their former strength and condition, or better. Other types of enclosures, such as hedges, require special attention.

All surplus materials and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, rubbish, and excess earth from the excavation shall be hauled to a dump provided by the Contractor and the construction site left clean and acceptable to the Owner Representative's discretion at the earliest possible date. No open burning will be allowed.

Clean-up shall be performed as nearly as practicable behind the rest of the construction to prevent inconvenience to the property owner. Complete co-

operation with the owner is essential to ensure that all requirements of right-of-way agreements are satisfied.

4.18 SEEDING

Where existing grassed areas have been disturbed by construction operation, or where designated by the Engineer, the Contractor shall prepare seed beds, furnish and spread fertilizers and lime and furnish and plant seeding as specified below.

4.18.1 MATERIAL

Fertilizer shall be standard commercial 10-8-6 grade, uniform in composition, free flowing and suitable for application with approved equipment.

Lime shall be ground limestone containing all of the finer particles obtained in the grinding process and ground sufficiently fine so that not less than eighty percent (80%) will pass through a No. 8 sieve.

4.18.2 PREPARATION OF SEED BED

After the areas to be seeded have been brought to the proper grades and cleared of all stones, boulders and debris, the areas shall be thoroughly tilled to a depth of at least three inches (3") by disking, harrowing, or other approved methods.

Fertilizer shall be distributed uniformly at the rate of four hundred (400) pounds per acre, over the area indicated to be fertilized, and shall be incorporated into the soil to a depth of at least three (3) inches by disking, harrowing or other approved methods acceptable to the Engineer. The incorporation of fertilizer may be a part of the tillage operation specified above.

Lime shall be distributed uniformly on all areas to be fertilized at the rate of one (1) ton to one (1) acre and shall be incorporated in the soil to a depth of at least three (3) inches by disking, harrowing, or by other methods acceptable to the Engineer, immediately following or simultaneously with the incorporation of the fertilizing.

4.18.3 SEEDING METHODS

No seed shall be sown during high winds or when the ground is not in a proper condition for seeding. Equipment shall be operated in a manner to insure complete coverage of the entire area to be seeded.

Within 12 hours all seed areas shall be rolled at right angles to the runoff with an approved type roller or culti-packer to compact the seed bed and place the seed in contact with the soil. The optimum depth for seeding shall be one quarter inch. Following installation of the fertilizer and seed, straw shall be placed over the area seeded as needed.

4.18.4 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

Surplus excavated material not seeded for backfill shall be promptly removed from the site by the Contractor.

The cost of removal and disposal of surplus excavated materials will be included in the price proposal and no additional payment shall be allowed therefore.

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5 INSTALLATION

5.1 GENERAL

The Work to be performed under this Specification includes the installation of all steel fittings, HDPE pipeline, bores, cathodic protection, and associated appurtenances. The Contractor shall be responsible for the safe storage of all materials to be used in their Work until it has been incorporated into the Work. Attention is directed to the General Conditions and also other sections of the Specifications which offset the Work under this section.

5.2 SUPERVISION AND EMPLOYEES

The Contractor shall have an experienced Construction Inspector on the job at all times. He shall have read and be familiar with these Specifications and the Drawings, and be prepared to direct the work in such a manner as to obtain compliance with these Specifications and Contract Documents. Lack of experience with gas piping construction will constitute a valid reason for complete removal of any Construction Inspector. All employees engaged in the execution of this Contract shall be experienced and qualified in the work they perform so as to produce a first-class installation.

5.3 LAYING OF PIPE

Under normal circumstances, in public right-of-way a minimum of thirty inches (30") of cover below future finished grade of the surrounding area is required. In private property a minimum of eighteen inches (18”) of cover below future finished grade of the surrounding area is required. Additional cover may be required at highway bores and road crossings as indicated on the Drawings.

5.3.1 SKIDS

Skids used to support pipe alongside ditch prior to lowering shall be of sufficient cross-section and strength to support pipe without danger of breaking. They shall be of sufficient length and bearing to provide necessary support at each side of the ditch when used to support pipe over the ditch. Padding shall be used where skids are in contact with coated pipe.

5.3.2 BENDS

The number of bends shall be kept to a minimum by proper grading of the ditch in approaches to road crossings, streams, shallow water course, across rises in the ground, and other obstructions. Changes in vertical or horizontal directions shall be accomplished by use of fittings, if possible, as indicated on the Drawings.

5.3.3 NIGHT CAPPING

The open ends of the pipe shall be securely closed (water tight under 10 ft. head of water) at the end of each day’s work, or when work is discontinued on a section, and shall not be reopened until work on the section is resumed.

5.4 CLEARING

Clearing is defined as the removal of boulders, rocks, trees, shrubs, grass, weeds, crops, or other obstacles on the construction area or right-of-way which of necessity must be removed to accomplish the work.

Contractor shall preserve without injury all roads, poles, lawns, stone walls, ditches, canals, and similar property, as well as trees (in farm yards, groves, orchards, windbreak areas and casual shade trees), shrubs and similar desirable growths, to the full extent consistent with the performance of the work.

The method of clearing rights-of-way shall consider matters of soil stability, protection of natural vegetation, and the protection of adjacent resources.

Contractor shall clear the right-of-way only to a width sufficient for their needs in constructing the line, and within the limits of the rights-of-way furnished by Owner.

Contractor shall protect Owner's survey stakes while clearing and thereafter as long as useful.

5.5 STRINGING PIPE

- All pipe, valves, fittings, pipe coating, casing and material of any description to be used in or about the construction of the facilities hereunder shall be strung on the right-of-way provided by Owner.
- Contractor shall take all necessary precautions to prevent injury or damage to pipe and casing during stringing and shall lift all pipe and casing from trucks with slings equipped with padded hooks or padded calipers.
- Contractor shall string the pipe so as to leave gaps across the right-of-way where requested by the landowner, tenants, or Owners Representative to facilitate the movement of vehicles, or equipment.
- It will be the responsibility of the Contractor to see that the pipe is strung for proper placement of the pipe by size, weight and Specifications as called for herein. Any moving of pipe resulting from failure to comply with these requirements shall be at Contractor's expense.
- In muddy and other areas designated by the Owner's Representative, pipe shall be strung on skids high enough to keep foreign matter from entering the pipe.

5.6 CROSSING OTHER UNDERGROUND FACILITIES

- Protect all underground facilities encountered in the progress of the work.
- Underground facilities located at points where excavation is required shall be uncovered by hand before machine excavation will be permitted.
- The exact location of all underground facilities (except tile lines) shall be marked with appropriate signs by Contractor prior to the commencement of machine excavation.

5.7 JOINTS

5.7.1 QUALIFICATION OF WELDERS

Contractor shall comply with the test requirements of API 1104 Multiple Qualification. The test (at least 6" butt and branch) must be completed by using a qualified procedure and passed by each individual welder under inspection of the Engineer prior to work being done. Testing completed by the welder(s) in the 6 months prior to the commencement of the job may be considered by the Engineer in lieu of an on-site test. Contractor shall provide the Engineer a copy of Contractor's Welding Qualification and Operator Qualification prior to construction.

5.7.2 INSPECTION OF WELDS

Inspection and test of welds shall be performed in accordance with 49 CFR Part 192.241. 100% of all welds shall be visually inspected by a qualified welding inspector according to the standards set forth in American Petroleum Institute's Standard 1104.

5.7.3 REPAIR AND REMOVAL OF DEFECTS

Each weld that is unacceptable under 49 CFR Part 192.241 must be removed or repaired. Repairs shall be performed in accordance with 49 CFR Part 192.245. The Contractor shall be responsible for the cost to repair all welds

5.7.4 WELDING PROCEDURE

Contractor shall use an approved welding procedure for the joining of the new pipeline that will meet or exceed the specified minimum yield strength of 35,000 psi. See Appendix A for approved welding procedure.

- All steel pipe joints shall be thoroughly cleaned and all pipe shall be free from obstructions before pipe connections are made. All main line pipe and fittings will be welded by a SMAW process.
- All pipe joints are to be properly beveled according to API 1104 prior to performing the alignment and welding process.
- All open ends must be thoroughly protected.
- All pipe joints shall be cool to the touch before applying any protective coatings.
- All buried steel pipe joints and fittings shall be coated per Section 6.0 Cathodic Protection Plan.
- Aboveground piping or fittings shall be painted as follows:
  Surface Prep: SSPC – SP6 or NACE 3
  Paint: Sherwin Williams
  Primer coat: Macropoxy 646 2-part epoxy, 6 Mils minimum.
  Top coat: Acrolon 218 – 2-part epoxy, 2 Mils minimum.
  Color: Mill White or White

5.8 LOWERING PIPE

- All pipe shall be placed on skids at the side of the trench.
- The pipe shall be lowered into the trench gradually and uniformly so that

each point of suspension bears its proportional part of its total weight.

- Pipe shall not be lowered into the trench unless Owner's Representative is present.
- Contractor shall, before installation of pipe, remove water from the trench to the extent necessary to prevent floating of pipe, and pipe must be kept dry until coating is repaired.
- Mechanical means or devices shall not be used to force pipe into the trench.
- Pipe shall not be hauled or handled by any means or process which allows risks of injury to the pipeline or prevents inspection of the pipeline in place in the trench before same is covered, except as and to the extent that the Owner's Representative does not prohibit another method of handling.
- If rock is encountered, padding material free from rock or gravel, (subject to approval of the Engineer) shall be placed around the pipe to protect the pipe coating from injury.
- Distribution of slack in the line shall conform to the following:
    - Contractor shall construct pipelines hereunder so as to
    - provide adequate slack and properly distribute such slack throughout the pipeline.
    - All overbends shall be installed to allow six inches (6") clearance or more between pipe and trench bottom.
    - Sag bends will conform to the bottom of the ditch

5.9 CLEANING AND PIGGING

The entire length of newly installed 4-inch HDPE pipeline shall be cleaned by the Contractor with suitable smooth "pigs" before testing is done and tie-ins are made. Cleaning shall be done to the satisfaction of the Engineer and multiple passes of cleaning pigs could be required. Cleaning shall be considered complete when debris penetration into the pig is one half inch or less. When drying, the dewpoint must be -40°F or more negative.

5.10 MISCELLANEOUS

- Any gouges, grooves, dents or damage in the pipeline resulting from Contractor's operations, as further defined below, shall be removed by Contractor, at no expense to Owner.
- Welding operations shall not be performed during periods of rain or excessive wind, unless such operations can be properly protected by the use of shields or other shelter.
- Pipe Damage - No dents, gouges, or grooves shall be permitted in the pipeline.

5.11 PIPELINE MARKERS

Pipeline Markers shall be installed as indicated on Drawings and/or where the owner requests them.

5.12 TESTING & PURGING – 59 PSIG PIPELINE SEGMENTS

The HDPE pipeline and associated 59 PSIG operating pressure segments shall be pressure tested prior to being placed in service. All HDPE and associated steel piping shall be tested to establish a Maximum Allowable Operating Pressure (MAOP) of 66.6 PSIG. New distribution mains shall be tested to 100 PSIG minimum and 240 PSIG maximum for a minimum of one (1) hour. New service lines shall be tested to 100 PSIG minimum and 240 PSIG maximum for a minimum of fifteen (15) minutes. Pressure tests must ensure discovery of all potentially hazardous leaks in the segment being tested. Test shall be documented with calibrated chart recorder or calibrated pressure recording gauge with data collecting log. Air or inert gas (nitrogen) shall be used.

Prior to being placed in service, (test required), all piping shall be purged with gas until completely air free.

5.13 RECORDKEEPING

All test records of pipelines shall be turned in to the Construction Inspector *daily*.

The Construction Inspector shall complete a "Construction Inspection Record" daily which tracks personnel hours, equipment used, weather conditions, a summary of work completed, and documents important events completed for the day. A sample of this form is included in these specifications.

The following additional records are required of the contractor:

- Welder Certifications
- As-builts
    - Map with GPS coordinates
    - Pipe depth/profile
    - Joint locations
        - Coating type
        - Welder
    - Bore profile
- Pressure test records as required per Section 7.0
- Digital photographs

5.14 CLEAN-UP

5.14.1 GENERAL

Contractor shall keep all working areas clear and free from any accumulation of defective material junk, brush, trees, rock and boulders and similar movable objects during the entire process of the work.

All such movable objects shall be accumulated, segregated and disposed of by Contractor in areas approved by the Owner and at Contractor's expense.

Each of Contractor's crews shall keep all working areas completely clear

and free from junk and debris resulting from their particular operation, including immediate disposal of discarded welding rod, pipe trimmings, paint containers, broken skids or any other similar material that might become hazardous if worked into the surface of the ground by traffic.

In all phases of cleanup, there shall be no open burning. Contractor shall, as a contingency of the work, haul and dispose of any material, debris, trees, stumps or vegetation from the right-of-way.

Contractor shall restore drainage ditches as required for the continuation of gravity flow.

5.14.2 FINAL CLEAN-UP

As soon as the work is completed, Contractor shall clean the entire area utilized by their organization.

All new or used construction materials not incorporated in the work shall be neatly piled or stacked on the site of the work, as designated by the Owner's Representative.

In respect to pipeline construction, final cleanup work along the right-of-way shall be done continuously as the work progresses and shall follow the lowering operation.

The work shall not be deemed completed for the purpose of payment until all provisions have been complied with to the satisfaction of the Owner.

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6 CATHODIC PROTECTION PLAN

The following will establish the written procedures used to design, install, operate, & maintain the cathodic protection system to be implemented for the 2024 Natural Gas Improvement Project. The following cathodic protection system has been designed by Tyler Enloe, PE. The system shall be installed, operated, & maintained as designed under the direction of the City of Falls City, NE.

6.1 DESIGN AND INSTALLATION

All underground piping must comply with PHMSA part 192.451. Per PHMSA 192.455, all buried pipe must be protected from external corrosion. This will be achieved by utilizing distributed anodes. The system must be installed within one (1) year of completion of construction of the pipeline.

This Cathodic Protection Plan has been designed so as to meet or exceed the requirements detailed in Appendix D of PHMSA DOT Part 192. Namely, a negative polarized voltage of at least 0.85 vdc with reference to a saturated copper-copper sulfate half-cell, while compensating for IR drop.

6.1.1 PIPE

- All buried steel pipe shall be coated with a minimum of 12 mil fusion bonded epoxy.
- All underground welds shall be cleaned to NACE No. 8 SSPC-14 (near-white metal) before re-coating.
- All underground fittings shall be cleaned to NACE No. 8 SSPC-14 (near-white metal) before re-coating.
- Field applied coating to be one of the following:
  - Tapecoat® H35 applied with a 50% overlap.
  - Denso Protal 7200 Two-Part Epoxy (or equivalent)
  - Densotherm Hot-Applied Tape (or equivalent)
- All bore string welds are to be coated using Denso Protal 7200 Two-Part Epoxy (or equivalent)
- All pipe, fittings, & welds to be inspected via Jeep holiday detector before being lowered into the trench.

6.1.2 ISOLATION

- All underground piping shall be fully isolated electrically from all other structures.
- Flange insulator kits shall be utilized to separate all above ground piping from the cathodically protected underground piping.

6.1.3 TYPICAL TEST STATIONS

- Test stations shall be Tri-View Test Stations with Internal Terminals.
- Two (2) #12 AWG Solid copper THN coated wires shall be attached to the pipe via exothermic welds. These wires shall be connected to the pipe with a minimum of 6” of separation.
- All exothermic welds shall be cleaned to NACE No. 8 SSPC-14 & coated using Tapecoat® H35 applied with a 50% overlap.

6.2 OPERATION

- After installation, an initial pipe-soil survey shall be conducted to establish the baseline of the newly installed steel pipe.
- A pipe-soil survey shall be conducted once per calendar year, not to exceed 15 months.
- All readings shall be maintained at or more negative than -0.85 vdc. If pipe-soil readings are obtained with a reading more *positive* than -0.85, Tyler Enloe, P.E. shall be notified immediately.
- All pipe-soil readings shall be obtained using a copper-copper sulfate half-cell & multimeter with traceable calibration records.

6.3 MAINTENANCE

Whenever pipe is removed from the pipeline for any reason, the internal surface shall be inspected for evidence of corrosion.

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7 CONSTRUCTION PROCEDURES

7.1 Cathodic Protection: System Installation

7.1.1 Anode Installation Procedures

7.1.1.1 Preparation of Anode and Wire

1. Place the anode into the hole as far away from the pipe as is practical. DO NOT use the wire to lift or to lower the anode into the hole. For service line anodes place anode in hole near riser or if drive in anode, drive anode into ground to top of plastic or metal cap.
2. Make sure the anode wire is bright, clean, and dry. Bent or out of round cable will hold the mold open and cause leaks. The wire shall be straightened before clamping the mold in place.
3. If necessary, use a wrap sleeve provided in the kit.

7.1.1.2 Preparation of The Pipe

1. Surface to be welded must be bright, clean, and dry. Remove all rust, oil grease etc.
2. If the pipe has a tendency to sweat, heat it up first with a torch. This will eliminate any moisture problems long enough to make the weld.

7.1.2 Welding Procedure

7.1.2.1 Exothermic Welding (CADWELD, THERMOWELD, Etc.)

1. Ensure the excavation area is gas free by using a CGI prior to cleaning of pipe.
2. The pipe surface must be thoroughly cleaned to a bright shinny appearance and free of moisture, oil, and grease prior to exothermic welding.
3. CAUTION - Never exothermically weld to a corroded pipe surface.
4. ANSI/ASME B31.4 and B31.8 list the following minimum pipe wall thickness data for exothermic welding:

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Table 1: Minimum Pipe Wall Thickness for Exothermic Welding

Nominal Pipe Diameter, in.	Pipe Schedule	Wall Thickness, in.
½	40	0.109
¾	40	0.113
1 to 2	10	0.109
2 ½ to 4	10	0.112
5 to 8	5	> 0.109
≥ 10	5	> 0.109

5. Strip the insulation from the solid core copper #12 AWG anode or test lead wire, about 1 ½ inches from the end.
6. Crimp a copper sleeve on the bare portion of the wire leaving about 1/8 inch of the wire protruding from the end of the copper sleeve.
7. Tie or wrap the wire to the piping so that any mechanical strain will not damage the weld after completion.
8. Open the cover of the oven (crucible) to expose the weld cavity.
9. Clean the cavity using the exothermic furnace-cleaning tool, as necessary.
10. Insert an exothermic metallic disk into the weld cavity with the concave side facing downward to fit the shape of the weld cavity. (For automatic cad welds see manufacturer's instructions and proceed to step 12.)
11. Remove the cap from an exothermic ignition charge container and pour the contents into the weld cavity.
12. Ensure that all of the fine ignition powder from the bottom of the ignition charge container is also poured lastly into the weld cavity. (For furnaces with ignitor hole, place ignition powder on top of furnace.)
13. Close the lid of the exothermic ignition oven (crucible), place it over the wire with the copper sleeve, and hold firmly against the pipe surface to be welded.
14. Wear protective gloves to prevent burns. Use the exothermic charge igniter to light the charge. DO NOT USE MATCHES OR A TORCH.
15. Hold the exothermic ignition oven (crucible) firmly for a moment allowing the weld to cool.

16. Remove the exothermic ignition oven (crucible) from the pipe and test the completed weld with a hammer. Avoid striking the wire directly.
17. After the weld has cooled completely, repair the pipe coating according to company procedures.
18. Shall the anode be a clamp style for service lines, clean coating from riser, file spot for setscrew, install band around riser, tighten band and use Allen wrench to tighten screw. Coat riser in accordance with company procedures.

7.2 Install Cathodic Protection Electrical Isolation Devices

7.2.1 Electrical Isolation Devices

- Flange Isolation Kits
- Insulated Unions

Isolation devices shall be installed according to manufacturer's instructions.

For the threaded and flanged isolation devices, care shall be taken to align the components so undue stress is not placed on the fitting. The insulated flange kits are installed with a non-metallic gasket between the two flanges and insulted sleeves and washers on the bolts. At minimum, one end of the bolt will have an insulated washer and a steel washer. The non-metallic sleeve is placed over the bolt the entire length of the flange. See 8.9 for procedures on Joining of Pipe - Threaded and Flanged Connections.

Shall an isolation device fail at a service terminal location a distinct shift in the cathodic protection potentials will be observed. This shift indicated that a possible foreign contact or "short" has occurred.

7.3 Tubing and Fitting Installation

7.3.1 Tubing and Fitting Installation

7.3.1.1 General

The preparation, bending, joining, and installation of instrument, control and sampling line tubing and fittings shall be performed in accordance with the manufacturer's instructions.

7.3.1.2 General Tubing Bending Steps

1. Inspect the tubing for defects, remove any defects found (i.e. kinks/wrinkles, deep scratches, splits, etc.).
2. All tube bends shall be made using tools designed for that purpose.
3. The bend shall be made using a smooth, even bend with minimal flattening, wrinkles, or damage of the tubing.

a. Tubing benders vary by type/manufacturer - use tool in accordance with manufacturer's instructions.

4. Remove the bent tube from the tubing bender and inspect to ensure that the tubing bend is even with no flattening or other damage to the tubing.

7.3.1.3 General Tubing Installation Steps

1. Inspect the tubing for defects, remove any defects found (i.e. kinks/wrinkles, deep scratches, splits, etc.).
2. Where practical, blow out or flush the inside tubing and visually inspect the visible inside surface of the tubing are clean and free of debris.
3. Install the appropriate fittings prior to any flaring of the tubing ends.
4. Ensure that all tubing will be supported and protected as appropriate.

7.3.2 General Compression-Type Tubing Fittings

1. Inspect the tubing/fitting for defects, remove any defects found (i.e. kinks/wrinkles, deep scratches, splits, etc.).
2. Verify that all components of the fitting are present and not intermingled with parts from another fitting (i.e. fitting nuts, ferrules, etc.) - verify that any ferrules, etc. are oriented per the manufacturer's instructions.
3. Align and insert the tubing into the fitting:
    a. For those fittings designed with a shaller/stop, the tubing shall be inserted until it bottoms out against the shaller/stop.
    b. For those fitting without a shaller/stop, measure and mark the tubing to ensure proper installation.

4. Tighten nut finger tight - if resistance is felt during this process, remove the tubing from the fitting and inspect the fitting - replace if necessary.
5. Using two wrenches tighten the fitting nut(s) according to the manufacturer's instructions.
6. Inspect for proper installation.

7.4 HDPE Pressure Testing

7.4.1 General

All mains (including pipeline components that have not been certified by the manufacturer) designed with an MAOP of 125 psig or less shall be tested with natural gas, air, or inert gas at a minimum pressure of 100 PSIG in accordance with this procedure. Do not test plastic pipe at pressures above 2.5 times the design pressure, which can be found at the end of this procedure.

The test procedure used must ensure discovery of all potentially hazardous leaks in the segment being tested. During this test, the line shall be walked to discover any leaks. Any drop in the initial test pressure more than 2 PSIG and not explained by a temperature change shall result in a failed test. Leak(s) in permanent piping shall be found and repaired and the test shall be conducted over again. Leak(s) in temporary testing apparatus shall be analyzed and repaired if practical. Before test begins, leak rate of temporary testing apparatus shall be monitored to determine if it will result in an unacceptable test. If the leak rate on the temporary test apparatus is large enough to deem the test unacceptable, the leak(s) on the temporary test apparatus shall be fixed. For testing duration of new mains, refer to pressure testing chart below.

7.4.2 Main Line Pressure Test Duration

To determine our pressure test durations for mains, we will assume a leak rate of 5 scfh and a pressure drop of 2 psi as our minimum acceptable loss. The minimum pressure test duration is 1 hour and all test must meet or exceed GPTC test duration guidance.

Table 2: Main Pressure Test Durations

		Pipe Length (ft.)			
		≤100	100 ≤ 500	500 ≤ 3000	>3000
Pipe Size (in)	2	1	4	8	24
	3	1	4	8	24
	4	1	4	8	24
	6	2	4	24	24
	8	2	8	24	24

7.4.3 Pressure Test Duration Formula

The formula used to calculate pressure test durations is as follows:

Test Duration (hours) = $[(3.71 \times 10^{-4}) \times d \times L \times P_d] / L_R$

where:

d = Internal Diameter, inches

L = Length of Test Section, feet

P_d = Pressure Drop, psi

L_R = Leak Rate, scf/hr.

7.4.4 Service Line Pressure Test Duration

Pressure test durations for service lines are listed in Division 6 of Falls City Gas System Operating and Maintenance Plan (Appendix D) as a minimum of fifteen (15) minutes.

7.4.5 Plastic Pipe Design Pressure

Polyethylene piping such as medium-density polyethylene (MDPE) and high-density polyethylene (HDPE) produced after January 22, 2019 can use a design factor (DF) of 0.40 in the design formula instead of 0.32 as long as the piping meets the following requirements:

1. The design pressure does not exceed 125 psig;
2. The material designation code is PE2708 and PE4710;
3. The pipe has a nominal size of 12 inches or less;
4. The wall thickness for a given outside diameter is not less than that listed in the following table:

Table 3: Wall Thickness to SDR for PE Pipe

Pipe Size (inches)	Minimum Wall Thickness (inches)	Corresponding SDR (values)
1/2" CTS	0.09	7
3/4" CTS	0.09	9.7
1/2" IPS	0.09	9.3
3/4" IPS	0.095	11
1" CTS	0.101	11
1" IPS	0.119	11
1 1/4" IPS	0.151	11
1 1/2" IPS	0.173	11
2"	0.216	11
3"	0.259	13.5
4"	0.265	17
6"	0.315	21
8"	0.411	21
10"	0.512	21
12"	0.607	21

Design pressure ratings for HDPE at different SDR values and operating temperatures are below

Table 4: HDPE Design Pressures

Based on Performance Pipe Driscopipe 8100 Pipe (HDPE)			
SDR	**DESIGN PRESSURE @73F**	**DESIGN PRESSURE @100F**	**DESIGN PRESSURE @120F/140F**
7	125	125	125
7.3	125	125	125
9	125	125	100
9.3	125	120	96
10	125	111	89
11	125	100	80
11.5	122	95	76
12.5	111	87	70
13.5	102	80	64
NOTE: DESIGN PRESSURE CANNOT EXCEED 125 PSIG FOR HDPE PIPING			

7.4.6 Additional Pressure Testing Requirements

During pipeline startup and shutdown, care will be given to assure that MAOP is not exceeded. Pressure gauges will be used to monitor pressure changes. If MAOP is exceeded, the pressure change will be stopped until it can be controlled in a way that prevents the MAOP from being exceeded.

7.4.7 Pressure Testing Steps

1. Verify the following information prior to beginning the pressure test:
   a. Maximum Allowable Operating Pressure (MAOP) of the segment to be pressure tested.
   b. The minimum and maximum test pressure for the segment to be pressure tested
   c. The test duration of the segment to be pressure tested.
   d. The test medium to be used for the pressure test.
2. Ensure that pressure gauges/recording instruments have been calibrated in accordance with manufacturers' specifications.
3. Ensure that segment to be pressure tested is:

a. Isolated from any customer piping to prevent the pressure test from being introduced into customer piping.

b. Isolated from the source of gas (to prevent the pressure test from being introduced into the gas stream).

4. Pressure testing records, including duration of test and other specified data on the pipeline test report located in the forms section of this specification.

5. Install test gauge and temperature probe(s) (if using any compressed air) on the isolated segment to be pressure tested.

6. Using the test medium, pressurize the isolated segment according to pressure test duration chart above.

7. If using any compressed air, temperature probe of recording device shall be attached to permanent pipe near test medium introduction point to monitor pipe temperature. During the test, the temperature of the plastic pipe may not be more than 100˚F. If the temperature of the pipe exceeds 100˚F, stop introducing test medium until temperature drops below 100˚F. Additional probe of recording device shall be used to record ambient temperature.

8. Record the initial time of the pressure test.

9. Soap-test the test-gauge and related fittings.

10. If required, walk the pipeline to observe any possible leak.

11. Maintain and observe the test pressure for the required test duration.

a. Investigate and repair all leaks discovered on permanent piping during the pressure test. Investigate and determine if repair is necessary on all leaks discovered on temporary testing apparatus.

b. Apply a new pressure test once leaks have been repaired.

12. If the pressure test reveals that the isolated segment being pressure tested is free of unacceptable leakage, slowly relieve the pressure from the isolated segment.

13. Remove testing device, gauges, and other related fittings.

14. Connect the isolated section to the source of gas.

15. Test the final connection(s) for leaks using a soap-test or other leak detection equipment.

16. Purge the air from the previously isolated segment.

17. Document the work performed as outlined below.

7.4.8 Pressure Test Records

Records shall be kept of all pressure tests done on the system. The

records shall be kept for the life of the system. The records shall contain:

1. Operators name and the name of the employee(s) who perform the test and the test company used.
2. Test medium
3. Test pressure
4. Pressure testing records, including duration of test, pressure recording charts, and other specified data on the ***1601 - Main/Service Installation or Replacement Form*** or the ***Pressure Test Report*** located in the forms section of this specification
5. Any leaks or failures noted and corresponding repairs made

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7.5 Butt Heat Fusion - Manual

7.5.1 Butt, Socket & Saddle Wall Fusion Procedures

Pipe and fitting manufacturers have subjected specimen joints, produced by utilizing the following qualified procedures, to the testing procedures outlined in CFR 192.283. See Appendix B

Remainder of page intentionally blank.

7.6 Butt Heat Fusion - Hydraulic Machine

7.6.1 Butt, Socket & Saddle Wall Fusion Procedures

Pipe and fitting manufacturers have subjected specimen joints, produced by utilizing the following qualified procedures, to the testing procedures outlined in CFR 192.283. See Appendix B

The procedure in Section 8.6 shall be followed for Butt Heat Fusions using a Hydraulic Machine, with the additional considerations being given to the operation of the Hydraulic Machine. Follow manufacturer's operations manual for the use of the Hydraulic Machine.

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7.7 Electrofusion

7.7.1 Electrofusion Procedures

All electrofusion joints must be completed with an electrofusion machine that has been calibrated according to manufacturer's recommendations. Contractor shall provide owner with calibration records.

Pipe and fitting manufacturers have subjected specimen joints, produced by utilizing the following qualified procedures, to the testing procedures outlined in CFR 192.283. See Appendix C

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7.8 Joining of Pipe - Threaded & Flanged Connections

7.8.1 Joining of Pipe - Threaded Joints

When joining pipe using threaded fittings, the following procedure shall be followed:

1. Inspect pipe, fitting, and associated threads for damage, deformities, defects, and/or any condition that may impair a gas tight connection, and remove or replace any fitting or pipe section fitting this criterion.
2. Clean the threaded surfaces to remove any surface rust, dirt, etc.
3. Apply pipe thread sealant in accordance with the pipe thread sealant manufacturer's instructions.
4. Assemble the joint and tighten using the appropriate wrenches. Unless the pipe and/or fitting is being installed with the use of a pipe vise, it is recommended that two wrenches be used to tighten the fitting to the pipe, with one wrench being used to hold the pipe to prevent other fittings from being loosened while the other wrench is used to tighten the fitting to the pipe.
5. Inspect the completed joint for damage, deformities, defects, and/or any other condition that may impair a gas tight condition.

7.8.2 Installation of Steel Flanges

When joining pipe using bolted flanges, the following procedures shall be followed:

7.8.2.1 Flange Assembly

1. Clean the sealing surfaces of the flanges and verify that they are clean and smooth.
2. Ensure that the sealing faces of the flanges are parallel to each other, and that all bolt holes are aligned so that all flange bolts will fit through the flange bolt holes.
3. Using the appropriate gasket, if required, install the gasket between the two flanges. Note: It may be necessary to install a couple of the flange bolts in the bottom bolt holes of the flanges to keep the gasket from dropping out of the bottom of the flange.
4. Verify that the gasket is installed against the sealing surfaces of the flanges.

7.8.2.2 Bolting Methods/Torque Values

1. Flange bolts shall be lubricated prior to installation by using pre-coated bolts or by field application of thread lubricant.
2. Bolt torque shall be applied evenly across the flange. Follow the gasket manufacturer's recommendations for tightening of flanges with nut and bolt.

3. Using a “star” or “crisscross” pattern, install and hand tighten all bolts and nuts, including any insulating kits as needed.
4. Using a torque wrench, tighten all bolts and nuts to approximately 30 percent of final torque.
5. Using a torque wrench, tighten all bolts and nuts to approximately 60 percent of final torque.
6. Using a torque wrench, tighten all bolts and nuts to 100 percent of final torque.
7. Inspect the completed joint for damage, deformities, defects, and/or any other condition that may impair a gas tight condition.

Below are bolt torque rating guidelines for installing steel flanges. The torque rating used is to be checked with a torque wrench. These tables are based on ASME guidelines. For any questions refer to specific manufacturer’s recommendations.

ANSI 150# Flange

Size (Inches)	Quantity Bolts	Bolt Diameter	Suggested Torque (Ft. Lbs.)
1	4	0.50	40
1 1/4	4	0.50	40
1 1/2	4	0.50	40
2	4	0.625	80
2 1/2	4	0.625	80
3	4	0.625	110
4	8	0.625	100
6	8	0.75	130
8	8	0.75	130
10	12	0.875	215
12	12	0.875	220

ANSI 300# Flange

Size (Inches)	Quantity Bolts	Bolt Diameter	Suggested Torque (Ft. Lbs.)
1	4	0.625	80
1 1/4	4	0.625	80
1 1/2	4	0.75	110
2	8	0.625	110
2 1/2	8	0.75	150
3	8	0.75	150
4	8	0.75	180
6	12	0.75	170
8	12	0.875	265
10	16	1.00	320
12	16	1.125	450

ANSI 600# Flange

Size (Inches)	Quantity Bolts	Bolt Diameter	Suggested Torque (Ft. Lbs.)
1	4	0.625	80
1 1/4	4	0.625	110
1 1/2	4	0.75	110
2	8	0.625	110
2 1/2	8	0.75	150
3	8	0.75	150
4	8	0.875	225
6	12	1	320
8	12	1.125	450
10	16	1.25	650
12	20	1.25	675

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7.9 Coating Application

7.9.1 Coating Application

Whenever it is necessary to repair damaged sections of coating on a coated steel line or to coat areas where a tie-in, tapping tee, etc. were placed, or on new or previously uncoated sections of pipe, the following procedure shall be followed:

General procedures for applying wrapped coatings are listed below. All coatings shall be applied in accordance with the manufacturer's instructions.

1. Store, handle, and transport coating material(s) in such a manner as to prevent damage or contamination.
2. Prepare the pipe surface by ensuring that all surface rust, dirt, oil, grease, loose coatings, or other foreign material is cleaned from the pipe surface.
3. Welded joints may need to be wire brushed with a power wire brush or other method that will remove slag or other loose particles.
4. Ensure that the pipe surface is free of moisture and remains free of moisture during the coating process.
5. Apply coating evenly to pipe, fittings, and components ensuring adhesion and complete coverage.
6. The finished coat shall not be disturbed until the coating has thoroughly dried - refer to manufacturer's specifications for drying time.
7. For pipelines extending from underground to aboveground, the coating shall extend a reasonable distance above ground level.
8. Inspect the final coating for verification that coating has been applied correctly

7.9.1.1 Paint Application

1. All pipe and associated fittings must be thoroughly cleaned prior to being coated.
2. All rust must be removed using hand or power brushing. Sandblasting, power sanding, and power grinding shall be avoided, whenever possible.
3. Care must be taken not to remove metal.
4. All existing coating that is damaged and or dis-bonded must be repaired or replaced, especially at pipe-to-soil interfaces, and at pipe supports.

5. Apply primer coat, if required, evenly to the cleaned piping surface according to paint manufacturer directions. Allow primer coat to dry thoroughly.
6. Apply outer paint coat evenly to the primed piping surface according to paint manufacturer directions. Allow outer paint coat to dry thoroughly. A second outer paint coat may be applied as deemed necessary.

7.9.1.2 Pipe Wrap Application

1. Store, handle, and transport coating material(s) in such a manner as to prevent damage or contamination.
2. Prepare the pipe surface by ensuring that all surface rust, dirt, oil, grease, loose coatings, or other foreign material is cleaned from the pipe surface.
   a. Welded joints may need to be wire brushed with a power wire brush or other method that will remove slag or other loose particles.
3. Remove excess water or moisture from the pipe surface.
4. Apply a coat of primer, if application calls for it, using accepted methods such as by brush or roller:
   a. Ensure that the primer is applied evenly across the area to be wrapped
   b. The primer shall be thoroughly mixed prior to application.
5. Allow the primer to dry the recommended drying time (in most cases, dry to the touch).
6. Apply the wrap using a slight tension in a spiral configuration with sufficient overlapping of the wrap to ensure proper coverage taking care to minimize wrinkling of the wrap.
7. If wrapping a pipeline that is to be pulled through a borehole, ensure that the wrap is applied so that the exposed edge of the wrap faces opposite to the borehole.
8. If wrapping a vertical pipe begin below ground on good coating and proceed up the pipe to prevent moisture infiltrating the wrap.

7.9.1.3 Denso Protal 7200 Brush Application

1. Prepare surfaces by grit blasting to a clean near-white finish, SSPC-SP 10 / NACE No. 2.

2. Appropriate angular grit shall be used to achieve a 2.5 to 5 mil (63 to 127 microns) anchor profile.
3. Initially stir the base and hardener. Add the hardener to base and mix at a slow speed until a constant color is achieved making sure all sides of container are scraped.
4. Apply mixed material onto surface and brush, trowel or roll to required mil thickness. A wet-film thickness gauge shall be used to measure mil thickness.
5. If surface temperature falls below 50°F (10°C), surface shall be preheated to achieve faster cure. Preheat may be achieved with a propane torch or induction coil.
6. Resin and hardener component shall be kept warm, at a minimum of 60°F (15°C), to mix easily.
7. For complete application, instructions refer to the Protal 7200 Application Specifications.

The type of coating applied on the transmission line shall be documented.

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7.10 Electrical Inspection Of Pipe Coating (Jeeping)

7.10.1 Procedure

Follow manufacturer's procedures when performing electrical inspection of the pipeline coating. Below is a basic procedure for operating a pipe jeep.

1. Ensure all components are in working order.
2. Ensure spring is clean and free of debris.
3. Connect voltage wand to instrument.
4. Connect ground cable to instrument.
5. Set specific voltage for coating being inspected. See chart below for voltage settings.

a. NACE Specification Equations

Coating	Thickness	Voltage
FBE	10 - 30 Mills	1600 - 3000
Tapecoat		10000
Xtrucoat		8000 - 14000
Coal Tar	3/32"	12500
	5/32"	15000
	3/16"	17000
	1/4"	20000
	1/2"	25000
	5/8"	30000
	3/4"	35000

i. Thin Film Epoxies $V=525 * \sqrt{t}$

where;
V = Voltage Setting
t = Coating Thickness Minimum

ii. Coal Tar 1Mil = 0.001 inches

6. Attach electrode to the voltage wand and apply to structure to be inspected. The electrode shall always make intimate contact with the surface under inspection.
7. Ensure the pipe to be inspected is grounded.
8. Move electrode down the pipeline to inspect for holidays. The speed of the electrode's travel along the pipe shall never be excessive, as faulty inspection may result.
9. Mark all coating defects along the pipe and make repairs as necessary.

7.11 Visually Inspect Pipe & Components Prior To Installation

7.11.1 Construction Inspection

1. The installers shall ensure that the pipe is adequately supported and protected prior to installation. Pipeline coatings and PE pipe shall be protected during pullback and when lowered into a ditch.
2. If steel pipe is being used the pipe coating shall be inspected prior to entering the reamed hole or the ditch. The pipe and coating shall be inspected after pullback at the tie-in. If the pipe and/or pipe coating is found to be damaged, then consideration shall be made based on field conditions to pulling additional pipe into the bore until damage is no longer observed or to pulling the pipe out of the hole and reaming a larger sized hole, using additional drilling fluids or other method of protecting the pipe and pipe coating during pullback. If PE pipe is used, then the pipe shall be inspected for scratches/gouges, which may have occurred during pullback. Scratches and gouges deeper than 10% of the pipe wall must be removed and if necessary additional pipe shall be inspected.
3. Other considerations are as follows.
   a. Pipe handling during stringing, welding, lowering, and pullback operations. Care shall be taken to prevent stretching and/or deformation of PE pipe. A “weak-link” or mechanical breakaway device shall be used for any HDD or Plow installation. The use of two pipe sizes smaller than the pipe to be pulled will suffice for use as a “weak-link”.
   b. Proper joint coating application. Coating application may be inspected using a pipe jeep. Manufacturer’s procedures will be followed for the use of a pipe jeep.
4. Pipe coating repairs.

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7.12 Installing Steel Pipe - Trenching

7.12.1 Steel Pipe Installation Procedures

7.12.1.1 Installation Of Steel Main In A Trench

1. Pipes shall be adequately supported while being lowered into the ditch.
2. The trench bottom shall be relatively smooth, free of rocks, sticks, and other debris that could damage the pipe and coating.
3. When lifting, moving, and lowering pipe into the ditch, be careful to protect the pipe and pipe coating from dents, gouges, nicks, scratches, and other damage.
   a. When using mechanized equipment, lift the pipe using nylon sling, padded calipers, or other appropriate devices.
   b. Pipe shall not be dragged or rolled across the ground or other surfaces where rocks and other sharp objects could cause damage to the pipe coating.
   c. Avoid impact damage to pipe, such as, dropping heavy objects on the pipe.
4. A sufficient clearance between steel piping and other underground structures not associated with the piping must be maintained. If clearance cannot be attained, the piping must be protected from damage that might result from the proximity of other structures.

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7.13 Installing Steel Pipe - Boring

7.13.1 Directional Boring

The methods and procedures outlined in this procedure shall be used as a guide whenever gas facilities are being installed by directional boring or when other underground utilities are being installed with directional boring and the work is near gas pipelines.

7.13.1.1 Methods

When directional boring, all literature and manuals for the machine used shall be followed and will take precedence over any part of this procedure.

A general directional boring procedure is as follows. Boring uses a small diameter non-rotating drill stem to thrust-bore or jet-out a pilot hole that conforms to a crossing geometry. If necessary, a pullback reaming is performed through the pilot hole (several passes possibly required) to establish a diameter sufficient for the carrier pipe installation. The reamed hole shall be somewhat in excess of the carrier pipe diameter. Drilling fluids are used to carry out spoil tailings, cool the drilling head, and help maintain the hole during drilling operations. The assembled and pre-tested pipe string is then pulled in to complete the operation.

7.13.1.2 Damage Prevention When Boring

When installing gas facilities by directional boring, precautions to take may include the following.

1. Using the one-call notification system to have facilities within the immediate area located and marked; and, directly contacting known, non-participating utility owners for facility location.
2. Ensuring that known facilities are located and marked prior to commencing work.
3. Exposing facilities within the immediate work area by hand excavation before starting a bore if the depths of the facilities are not established by other means.
4. Considering sewer systems within the area. Sewer systems are especially vulnerable to damage from boring operations for the following reasons:
    a. Lines are often non-metallic, making them difficult to locate.
    b. Clean-outs or other indications of laterals may be hidden or non-existent.
    c. Damage may not be readily apparent when a sewer, particularly a gravity flow system, is pierced by a boring machine.
5. Notifying residential and business neighbors in the area of impending work.

6. Checking local regulations for the minimum separation distances between the new gas line and the other facilities.
7. Making arrangements with local authorities for traffic control, as necessary.
8. Ensuring adequate clearance of overhead electric, telephone, or cable lines.

7.13.1.3 Protecting Existing Gas Facilities

When excavations near gas facilities will be conducted with directional boring (either by the operator or by a third party), the operator shall consider the following:

1. When it is anticipated that the bore will cross or come near the edge of an underground facility, expose that facility to determine its precise location to ensure adequate separation between the existing and proposed facilities.
2. When the bore will run parallel to an existing facility, expose that facility (pothole) or use locating technology to verify that adequate clearance is maintained between the bore and the existing facilities during the boring operation (for both the drilling of the pilot hole and the back-reaming operation). Calculation of the separation distance shall account for the largest diameter back reamer that will be used in the boring process.
3. Where potholes are used for visual inspection, they shall be placed at intervals that will ensure that clearance is maintained during boring operations. Factors to consider for pothole intervals include the following.
    a. Proximity of proposed bore path to the pipeline facilities.
    b. Type of facility (existing and proposed).
    c. Type of soil.
    d. Size and controllability of the bore.
4. Locating the existing facility and the newly installed facility to ensure that the installation is in the intended location.
5. Conducting a leakage survey over pipelines that could have been affected by the trenchless installation.

7.13.1.4 Essential Planning Considerations

1. Develop an accurate cross-sectional profile of the proposed site to determine the lowest elevation for the pipeline to be installed. The profile shall extend at least 300 feet beyond the proposed entry and exit points.

2. Determine the type of sub-soil to be encountered in the installation. If there is insufficient soil information available for the site, soil borings or seismic studies are recommended. Numerous soil borings may be necessary if gravel, boulders, or rocks are encountered.

7.13.1.5 Limits And Obstructions

Obstructions that shall be considered include the following.

1. Magnetic influences within 75 feet of the proposed bore path.
2. Buried or abandoned structures.
3. Utility infrastructure.
4. Underground or elevated pipelines.
5. Overhead obstructions at the drill site or exit areas.
6. Geotechnical characteristics.

7.13.1.6 Corrosion Considerations

The following are recommended coating systems for directional bored steel pipeline crossings.

1. Abrasion barrier - Epoxy-based polymer concrete, which is used in rocky or highly abrasive soils.
2. Pipe coating - Mill-applied fusion bond epoxy at 14-22 mils.
3. Joint coating - A minimum dry film thickness of 20-22 mils of fusion bond epoxy.

7.13.1.7 Instrumentation

1. A surface monitoring system shall be used to track the location of the down-hole probe during the pilot-hole drilling. The installer shall ensure that such monitoring controls the drilling path accuracy and allows for necessary corrections. The space between monitor readings is determined by the need for accuracy in placement of the pipeline.
2. Some form of gauging shall be used to monitor the pulling force.

7.13.2 Construction Inspection

1. The installers shall ensure that the pipe pull section is adequately supported during pullback. Pipeline coatings shall be protected during pullback.
2. If steel pipe is being used the pipe coating shall be inspected prior to entering the reamed hole. The pipe and coating shall be inspected after pullback at the tie-in. If the pipe and/or pipe coating is found to be damaged, then consideration shall be made based on field conditions to pulling additional pipe into the bore until damage is no longer observed or to pulling the pipe out of the hole and reaming a larger

sized hole, using additional drilling fluids or other method of protecting the pipe and pipe coating during pullback.

3. The proper containment and disposal of drilling mud or fluids shall be verified to ensure compliance with applicable requirements.
4. Other considerations are as follows.
   a. Pipe handling during stringing, welding, and pullback operations. Care shall be taken to prevent damage to the pipe.
   b. Pipeline testing process.
   c. Proper joint coating application.
5. Pipe coating repairs.
6. As built profile for comparison with preliminary profile.
7. Construction site security.

7.13.3 Damage Caused By Directional Drilling

If damage is done to existing utilities, the following shall be done.

1. The situation shall be stabilized to prevent additional safety hazards and to prevent more damage to utilities. (Note: Safety hazards can include electrocution, explosion, and contamination depending on the type and size of pipeline damaged.)
2. The affected utility shall be notified of the damage created, including preliminary observations by the boring machine operator of the location and nature of the damage.
3. One call enforcement shall be notified of the damage. Information needed by one call includes dig number for the area, type of facility, the affected utility, and the location of the damage at the dig site.
4. Boring in the affected area shall be delayed until the hazard is removed and additional locating is done to prevent future damage. This additional locating can include hand digging and additional line locates. Once an area is determined to be safe and the true location of the damaged utility is located boring can resume.

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7.14 Installing Steel Pipe Above Ground - Anchors & Supports

7.14.1 Steel Pipe Installation Procedures

7.14.1.1 Installation Of Steel Pipe Aboveground

1. All joints shall be (as appropriate):
   a. Welded
   b. Threaded
   c. Flanged
   d. Otherwise joined using methods to resist pullout
2. The pipe coating shall extend a reasonable distance above ground level.
3. Ensure that all aboveground piping is protected from atmospheric corrosion by the use of paint or other acceptable coating.
4. Pipe hangers, supports and anchors shall be installed:
   a. To provide adequate support and anchorage for the pipeline; and
5. To allow the normal expansion and contraction of the pipeline.

7.14.1.2 Inspecting Supports And Anchors

1. Visually inspect anchors and supports for signs of corrosion or poor coating condition.
2. Check for indications that the pipe and/or the anchors and supports have moved or are unstable.
3. Check for indications of movement or instability of the ground or structure to which the anchors and supports are attached.

7.14.1.3 Maintaining Supports And Anchors

1. Repair coating as necessary.
2. If the anchors or supports are attached to ground or structures that are unstable, corrective options include:
   a. shoring up the ground or structure,
   b. attaching the anchors or supports to nearby ground or structures that are stable, or
   c. Relocating the pipe, anchors, and supports.

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7.15 Installing Polyethylene Pipe – Trenching

7.15.1 Plastic Pipe Installation Procedures

All rocks, bricks, frozen chunks of dirt, tree limbs, or roots and other objects that might scratch, gouge or kink the plastic pipe shall it be removed from the bottom of the trench. Where embedded rocks protrude from the trench bottom, a layer of sand or clean soil shall be used to cover the embedded rock a minimum of three (3) inches. The trench bottom shall maintain a contour compatible to the flexibility of the pipe being installed.

On projects where it is determined the pipe shall be pigged, for either cleaning or water removal, a pigging procedure will be developed and followed.

7.15.1.1 Installation of Plastic Main In A Trench

1. Pipes shall be adequately supported while being lowered into the ditch.
2. The trench bottom shall be relatively smooth, free of rocks, sticks, and other debris that could damage the pipe and coating.
3. When lifting, moving, and lowering pipe into the ditch, be careful to protect the pipe from dents, gouges, nicks, scratches and other damage.

   a. When using mechanized equipment, lift the pipe using nylon sling, padded calipers, or other appropriate devices.

   b. Pipe shall not be dragged or rolled across the ground or other surfaces where rocks and other sharp objects could cause damage to the pipe.

   c. Avoid impact damage to pipe, such as, dropping heavy objects on the pipe.

4. A sufficient clearance between plastic piping and other underground structures not associated with the piping must be maintained. If clearance cannot be attained, the piping must be protected from damage that might result from the proximity of other structures.

7.15.1.2 Installation Of Locating Wire (Tracer Wire)

For future locating of plastic mains by electromagnetic sensors, insulated located wire will be installed in close proximity to mains and services. Since steel mains and services are conductors, there usually is no need for locating wire with such mains and services. To avoid causing a drain on the cathodic protection system, it is important to avoid electrical bonding between existing steel mains and casing. If a plastic pipe is inserted in a steel casing, locating wire shall be inserted along with the plastic if there is room. If not, then locating wire shall be welded to the carrier pipe.

When attaching locating wire from plastic service to steel main, the locating wire will be bonded to steel main. The bonding and bare wire shall be coated

to prevent corrosion.

Before backfilling, continuity shall be checked to assure the conductivity of all wire connections. Tracer wires on mains shall have an anode attached for Cathodic Protection of the wire.

NOTE: When direct burial of locating wire along with plastic mains and services, there is a potential problem that may exist when electrically conductive wire is wrapped around plastic pipe. There have been reports of lightning being conducted through tracer wire and thereby damaging and causing the plastic pipe to leak. In most cases, lightning had struck a tree and the electrical current traveled from the tree to the plastic pipe, which was buried directly under or very close to the tree.

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7.16 Installing Plastic Pipe - Boring

7.16.1 Directional Boring

The methods and procedures outlined in this procedure shall be used as a guide whenever gas facilities are being installed by directional boring or when other underground utilities are being installed with directional boring and the work is near gas pipelines.

7.16.1.1 Methods

When directional boring, all literature and manuals for the machine used shall be followed and will take precedence over any part of this procedure.

A general directional boring procedure is as follows. Boring uses a small diameter non-rotating drill stem to thrust-bore or jet-out a pilot hole that conforms to a crossing geometry. If necessary, a pullback reaming is performed through the pilot hole (several passes possibly required) to establish a diameter sufficient for the carrier pipe installation. The reamed hole shall be somewhat in excess of the carrier pipe diameter. Drilling fluids are used to carry out spoil tailings, cool the drilling head, and help maintain the hole during drilling operations. The assembled and pre-tested pipe string is then pulled in to complete the operation.

7.16.2 Damage Prevention When Boring

When installing gas facilities by directional boring, precautions to take may include the following.

1. Using the one-call notification system to have facilities within the immediate area located and marked; and, directly contacting known, non-participating utility owners for facility location.
2. Ensuring that known facilities are located and marked prior to commencing work.
3. Exposing facilities within the immediate work area by hand excavation before starting a bore if the depths of the facilities are not established by other means.
4. Considering sewer systems within the area. Sewer systems are especially vulnerable to damage from boring operations for the following reasons:
   a. Lines are often non-metallic, making them difficult to locate.
   b. Clean-outs or other indications of laterals may be hidden or non-existent.
   c. Damage may not be readily apparent when a sewer, particularly a gravity flow system, is pierced by a boring machine.
5. Notifying residential and business neighbors in the area of impending work.
6. Checking local regulations for the minimum separation distances between the new gas line and the other facilities.
7. Making arrangements with local authorities for traffic control, as necessary.

8. Ensuring adequate clearance of overhead electric, telephone, or cable lines.

7.16.3 Protecting Existing Gas Facilities

When excavations near gas facilities will be conducted with directional boring (either by the operator or by a third party), the operator shall consider the following:

1. When it is anticipated that the bore will cross or come near the edge of an underground facility, expose that facility to determine its precise location to ensure adequate separation between the existing and proposed facilities.
2. When the bore will run parallel to an existing facility, expose that facility (pothole) or use locating technology to verify that adequate clearance is maintained between the bore and the existing facilities during the boring operation (for both the drilling of the pilot hole and the back reaming operation). Calculation of the separation distance shall account for the largest diameter back reamer that will be used in the boring process.
3. Where potholes are used for visual inspection, they shall be placed at intervals that will ensure that clearance is maintained during boring operations. Factors to consider for pothole intervals include the following.
   a. Proximity of proposed bore path to the pipeline facilities.
   b. Type of facility (existing and proposed).
   c. Type of soil.
   d. Size and controllability of the bore.
4. Locating the existing facility and the newly installed facility to ensure that the installation is in the intended location.
5. Conducting a leakage survey over pipelines that could have been affected by the trenchless installation.

7.16.4 Essential Planning Considerations

1. Develop an accurate cross-sectional profile of the proposed site to determine the lowest elevation for the pipeline to be installed. The profile shall extend at least 300 feet beyond the proposed entry and exit points.
2. Determine the type of sub-soil to be encountered in the installation. If there is insufficient soil information available for the site, soil borings or seismic studies are recommended. Numerous soil borings may be necessary if gravel, boulders, or rocks are encountered.

7.16.4.1 Alignment Considerations

An important step in planning the directional drilling operation is to use the

information from the previous steps, including the cross-sectional profile and the geo-technical information, to determine the optimum pipeline alignment and placement. An optimum location provides the minimum required pipeline cover in an ideal soil installation medium. A straight-line (horizontal) and smooth curvature (vertical) placement is important.

7.16.4.2 Limits And Obstructions

Obstructions that shall be considered include the following.

1. Magnetic influences within 75 feet of the proposed bore path.
2. Buried or abandoned structures.
3. Utility infrastructure.
4. Underground or elevated pipelines.
5. Overhead obstructions at the drill site or exit areas.
6. Geotechnical characteristics.

7.16.4.3 Instrumentation

1. A surface monitoring system may be used to track the location of the down-hole probe during the pilot-hole drilling. The installer shall ensure that such monitoring controls the drilling path accuracy and allows for necessary corrections. The space between monitor readings is determined by the need for accuracy in placement of the pipeline.
2. Some form of gauging shall be used to monitor the pulling force.

7.16.5 Construction Inspection

1. The installers shall ensure that the pipe pull section is adequately supported during pullback. PE pipe shall be protected during pullback.
2. The pipe shall be inspected after pullback at the tie-in. If the pipe is found to be damaged, then consideration shall be made based on field conditions to pulling additional pipe into the bore until damage is no longer observed or to pulling the pipe out of the hole and reaming a larger sized hole, using additional drilling fluids or other method of protecting the pipe and pipe coating during pullback. The pipe shall be inspected for scratches/gouges, which may have occurred during pullback. Scratches and gouges deeper than 10% of the pipe wall must be removed and if necessary additional pipe shall be inspected.
3. The proper containment and disposal of drilling mud or fluids shall be verified to ensure compliance with applicable requirements.
4. Other considerations are as follows.
   a. Pipe handling during stringing, welding, and pullback operations. Care shall be taken to prevent stretching and/or deformation of PE pipe. A “weak-link” or mechanical breakaway device shall be used.

The use of two pipe sizes smaller than the pipe to be pulled will suffice for use as a “weak-link”.

b. Pipeline testing process.

c. Proper joint coating application.

5. Pipe coating repairs.
6. As built profile for comparison with preliminary profile.
7. Construction site security.

7.16.6 Damage Caused By Directional Drilling

If damage is done to existing utilities, the following shall be done.

1. The situation shall be stabilized to prevent additional safety hazards and to prevent more damage to utilities. (Note: Safety hazards can include electrocution, explosion, and contamination depending on the type and size of pipeline damaged.)
2. The affected utility shall be notified of the damage created, including preliminary observations by the boring machine operator of the location and nature of the damage.
3. One call enforcement shall be notified of the damage. Information needed by one call includes dig number for the area, type of facility, the affected utility, and the location of the damage at the dig site.
4. Boring in the affected area shall be delayed until the hazard is removed and additional locating is done to prevent future damage. This additional locating can include hand digging and additional line locates. Once an area is determined to be safe and the true location of the damaged utility is located boring can resume.

7.17 Backfilling/Excavation

7.17.1 Pipeline Cover And Clearance

All buried mains must be installed with at least 54-inches of cover. Where an underground structure prevents this minimum clearance, the main shall be provided with additional protection to prevent damage from anticipated external loads. Mains shall be installed with enough clearance to allow for maintenance and emergency operations and to prevent damage that might result from proximity to other structures. Typically, 12 inches of clearance shall be sufficient; however, each location shall consider things such as squeeze-off equipment and connections of service laterals. An additional consideration for plastic mains is to ensure that the pipe has enough clearance to protect it from any source of heat such as steam lines or buried electrical lines. See Section 9 for Trenching, Shoring, and Excavation Safety.

7.17.2 Backfilling and Restoration

Backfilling shall follow, as soon as possible, the completion of the main or service line that has been installed. Care shall be taken to assure no damages have occurred during backfilling (gouges or kinks). The first foot of backfill shall consist of clean spoil free of rocks, bricks, and frozen chunks of dirt, or objects that could damage the pipe or its coating.

If clean spoil is not available, a layer of sand may be used as the first foot of backfill.

In non-maintained or rough areas such as vacant lots, appropriate compaction shall be performed so as to avoid either excess mounding or ditch depressions caused by settlement. In maintained or established areas such as streets, alleys, or parking lots, adequate compaction of backfill is to be done prior to surface restoration.

Compaction following excavation in a roadway or trench may be with the same material as that excavated and compacted to its original condition. If the excavated spoil is a material that cannot be properly compacted, sand backfill with appropriate compaction may be used to avoid washouts and settlement.

Cleanup, such as raking, removal of material, equipment, and debris, shall be completed promptly following backfill. When a pavement excavation is required for the pipe installation, a temporary cold patch may be laid following compaction of backfill if permanent repairs cannot be made immediately. All areas shall be inspected frequently after restoration to insure the ground has not eroded (settlements, washouts).

7.17.3 Compaction of Soil Backfills and Fills A

Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

Place backfill and fill soil materials evenly on all sides of structures to

required elevations, and uniformly along the full length of each structure.

7.18 Steel Welding Inspection

7.18.1 Inspection of Welds

All welds must be visually inspected an individual qualified by appropriate training and experience to ensure that:

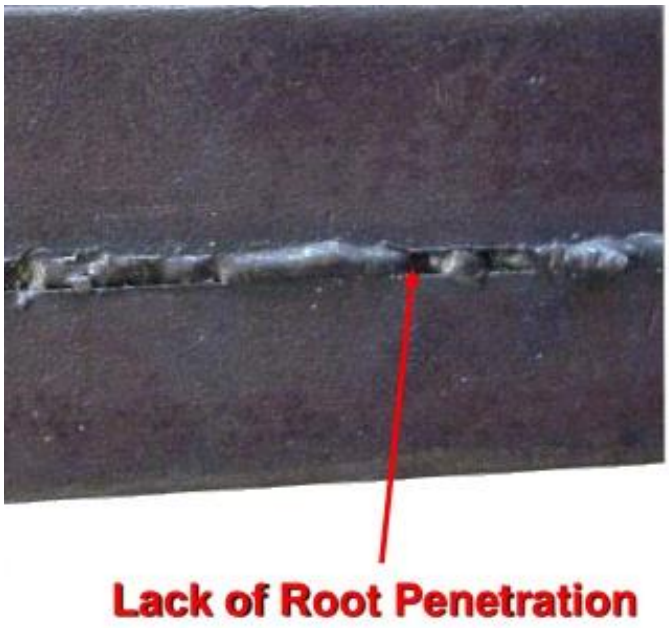
1. The weld is performed in accordance with the qualified procedure
2. The weld is acceptable according to standards found in Section 9 of API 1104. (The acceptance standards listed in Section 9 of API 1104 may be applied to visual inspection as well as non-destructive testing.)

7.18.2 Procedure

Each weld will be visually examined for the following.

1. Cracks

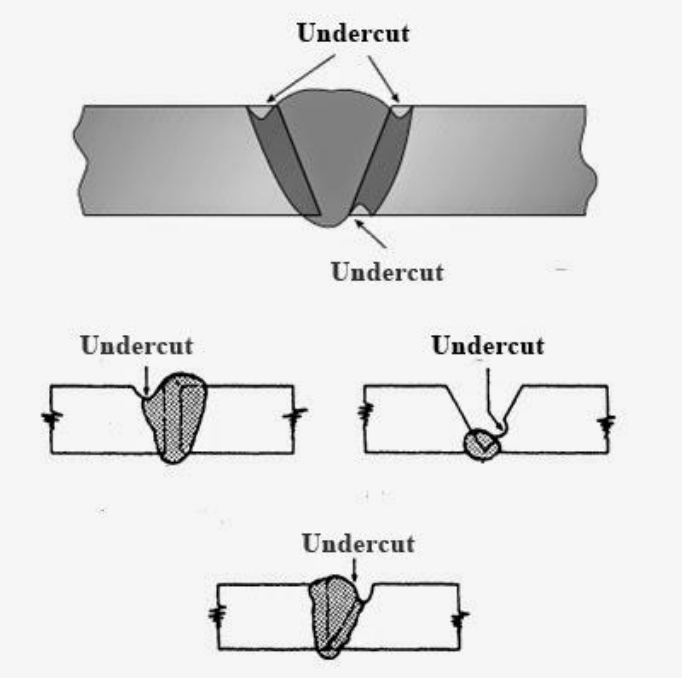
2. Inadequate penetration



3. Burn through

4. A neat workman-like appearance

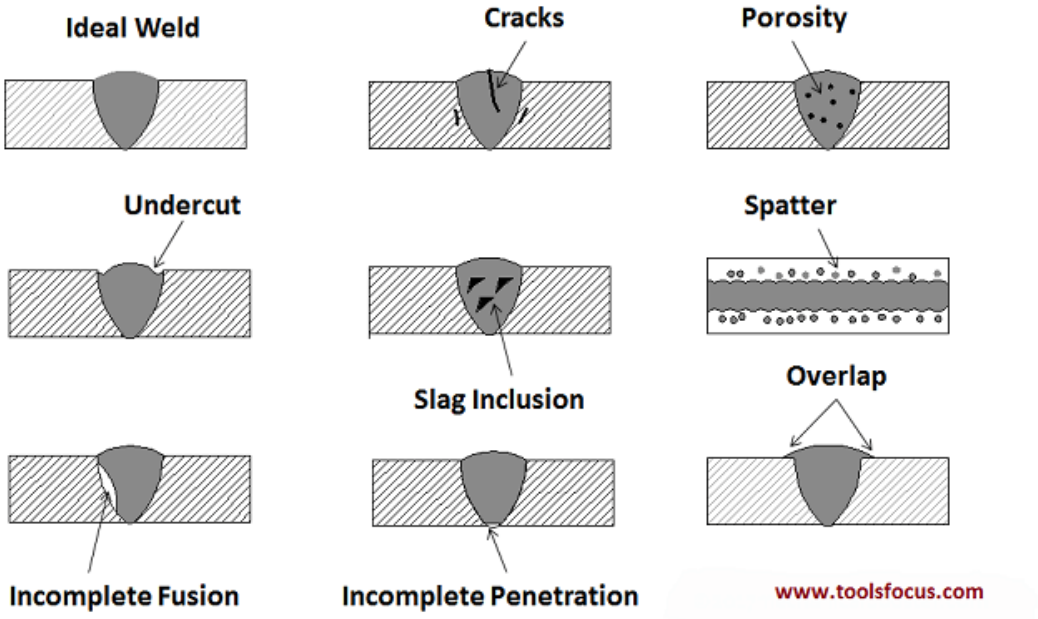
5. Undercutting



a. The final bead on the outside of the pipe shall not be more than 1/32” or 12.5% of the pipe wall thickness, whichever is smaller, and there shall be no more than 2” of undercutting in any continuous 12” length of weld.

7.18.3 Response To Defects

Types of Defects



Any defects found in a weld shall be repaired when possible or the entire weld shall be removed.

7.19 Meter Set Installation - Large Commercial & Industrial

7.19.1 Meter and Regulator Installation

The meters and regulators must be installed to minimize stresses on connecting piping.

7.19.2 Installation

Using associated pipe and fittings as shown on Drawings to install the meter:

a. Verify that the insides of any piping used in the installation are clean and free of obstructions.

b. Use pipe joint material only on the male threads of the pipe being connected.

c. Tighten each fitting sufficiently to provide a gas-tight seal. See 8.9 for procedure on properly tightening fittings and flanges.

d. The meter set shall be installed in a manner that presents a neat appearance, is adequately supported, and level.

e. Upon turning the meter valve to the on position, the following tests shall be completed to ensure the meter set and associated equipment are fit for service.

f. Pressure delivery check - The delivery pressure to the customer shall be verified using a manometer. It is best to install the gauge at the inlet or outlet of the meter. Delivery pressure to residential customers is normally 7 inches of water column or 4 ounces. Adjustments can be made on the adjustment screw on the regulator, if necessary.

g. Soap Test - All fittings on the meter set shall be soap tested at normal operating pressure to ensure no leaks are present. If leaks are found, they must be repaired prior to leaving the meter set in service.

h. ½’ Hand Leak Test - After the meter set is put into service and the inside piping is up to pressure, a ½’ hand leak test shall be completed to ensure no leaks are present on the inside piping. The ½’ hand shall be on the upward spin, a mark shall be made at the current location of the hand. The meter shall then be clocked for a minimum of 5 minutes. Any movement in the ½’ hand will indicate a leak on the inside piping. A pressure test of the inside piping past the meter may be performed in place of the ½’ hand test.

7.20 Purging

7.20.1 Safety Precautions

7.20.1.1 Notifications Prior To Purge

Prior to the beginning of a purging operation, appropriate notifications shall be given to local public officials and the public near the purging operation if:

1. It is anticipated the release of gas/air may disturb normal traffic flow; and/or
2. It is anticipated that there may be calls from the public regarding the purging operation; and/or
3. It is anticipated that the public may be affected by the purging process by things such as:
   a. High Noise Level
   b. Strong Odor
   c. Possibility of Accidental Ignition

7.20.1.2 Prevention Of Accidental Ignition

When conducting purging operations, all potential sources of accidental ignition must be eliminated. There are two specific areas of potential ignition hazard that must be considered:

1. Ignition of the purge discharge - At some point in the purging process, a combustible gas-air mixture is released from the discharge riser and may exist for an extended period of time. If there is an accidental ignition when purging, it is most likely to occur at the discharge riser. Preventing accidental ignition at the riser is the most important safety consideration when purging.
2. Ignition within the piping - Take every precaution to prevent ignition within the piping itself. Ignition within the piping can occur if the purge discharge is accidentally ignited.

Before any work is done to a gas facility that involves welding or other tools that may constitute a potential ignition source, the atmosphere shall be checked with a combustible gas indicator (CGI) to verify a combustible mixture of gas and air is not in the work area.

Uncontrolled fire and explosion, both indoors and outdoors, can result when natural gas comes in contact with ignition sources. If there is any possibility that employees may be working in a gaseous atmosphere, either in a building or outside, it is vitally important to recognize potential ignition sources and know how to prevent accidental combustion.

It is important that employees recognize potential ignition sources and keep these sources from coming in contact with a gaseous atmosphere. All ignition

sources are related to heat.
The following is a list of potential ignition sources. They are divided into 3 categories:

OPEN FLAME	ELECTRICAL SPARK	WORK HAZARD
Smoking materials	Arcing	PE Static Electricity
Lanterns	Doorbells	Actions by pedestrian
Candles	Lights	Vehicular traffic
Pilot lights	Telephones	Isolation devices
Matches	Smoke Detectors	Bond Wires
	Appliances	Welding
	Garage Door openers	Underground Facilities
	Thermostats	Tools
	Beepers and Radios	
	Elevators	
	Wiring and Lighting, Portable	
	Hand Tools	
	Motorized Equipment	
	Rectifiers	
	Static Electricity	

7.20.1.3 Venting

To purge safely, always install proper discharge venting before purging. Vent piping must end in a vertical section, discharge riser, or stack, attached to the main. The method of attachment depends upon pipe material and available equipment.

In a large pipe, carefully control the purge flow rate. Too rapid or too slow a purge produces turbulence inside the pipe, which can create a combustible gas-air mixture. Following are rules regarding the purge riser:

1. The purge riser that is used to purge the gas/air must be metal (steel, copper, stainless steel, etc.) and an electrical ground applied so that the potential for static electricity is minimized - static electricity can be created by the friction of the gas/air molecules on the pipe walls. Plastic pipe is susceptible to static electricity buildup, especially at the ends of pipe.
2. When purging larger diameter pipe, such as 2-inch diameter and larger where a large volume of gas/air is to be purged, the purge riser shall be smaller in diameter than the pipeline being purged.
3. As a general rule, the purge riser shall not be larger than one-half the diameter of the pipeline being purged. This smaller diameter shall help increase velocity of the gas passing through the discharge apparatus and may prevent flashback shall the venting gas ignite.
4. The purge riser shall extend high enough to expel the vented gas/air away from employees (above any workers head) and potential ignition sources.

7.20.1.4 Additional Safety Precautions

In addition to guarding against ignition hazards, the following safety precautions shall be followed:

1. If in an area where public access is likely, place barricades, traffic cones, or the controlling devices with suitable warning signs to limit ingress by the public.
2. Never purge a line in any way that might let gas enter a building or confined space.
3. Set up an approved fire extinguisher at the purging site, placing it upwind. Keep the extinguisher manned throughout the purging procedure.
4. Suitable personal protective equipment shall be used by personnel commensurate with the purging operation. Example(s):
    a) Flame Retardant Clothing
    b) Eye Protection
    c) Hearing Protection
    d) Hand Protection
    e) Other as Needed
5. Ensure that a means of adequate communication is available and established for purging operations where the purge riser location and the means for controlling the release of the air, gas, or inert gas is not in the same vicinity so that the flow may be halted in the event of an emergency.
6. Do not perform any welding on piping containing a natural gas and air mixture.

7.20.2 Purging With Natural Gas

A main or service line cannot be put into service if it contains air. The line must be purged with natural gas before putting it into service, whenever either:

1. New or replacement facilities are installed, or
2. A facility is purged with air to make repairs.

Air can be displaced with gas provided, moderately rapid and continuous flow of gas is introduced at one end of the line, and the air vented out of the other end. If gas cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of nitrogen must be released into the line before the air.

The gas flow shall be continued without interruption until the vented gas is free from air as determined by using a CGI on the 100% scale. The CGI must read 90% or greater gas before the purge is stopped. Following is a detailed procedure:

1. Determine the location for the purging operation.

2. Ensure that all safety precautions are followed.
3. Determine if a purge riser will need to be installed or if service risers or other already installed piping may be used as a purge riser for the purging operation.
4. Install purge riser, if needed (see “3”).
5. Ensure that all purge risers are grounded by attaching a grounding cable to the riser on one end and attaching the other end to a ground rod driven into the ground.
6. Verify that the purge riser is of sufficient height to expel the vented gas/air away from personnel and potential ignition sources.
7. Open the valve or other mechanism that will release the gas into the pipeline and force the air in the pipeline out through the purge riser in a moderately rapid continuous flow - if the gas cannot be introduced in a moderately rapid continuous flow, a slug of inert gas shall be introduced into the pipeline before the gas.
8. Periodically obtain CGI readings at the end of the purge riser - continue purging until 100% gas reading is obtain on the CGI.
9. Note: when purging large sections of newly installed pipelines, the odorant in the gas may be absorbed in the pipe walls - this may result in the gas being purged to exhibit an un-odorized or a lack of odorant condition - *DO NOT RELY ON YOUR SENSE OF SMELL TO DETERMINE IF ALL OF THE AIR IS PURGED FROM THE PIPELINE.*
10. Note: for small sections of service line or main that would not introduce a significant amount of air into the gas stream and therefore would not pose a hazard, purging may not be necessary - if in doubt, purge the air out of the pipeline.
11. Once a 100% gas reading is obtained, close the valve or other mechanism at the purge riser.
12. At the conclusion of the purging operation, remove the purge riser and related equipment, if any (see “3”).

7.21 Pigging of Pipelines Not in Service

7.21.1 Procedure

When using pigs to clean a pipeline not yet in service, the following procedure will be followed.

7.21.1.1 If Launcher and Receiver Are Installed

7.21.1.1.1 Launching of a pipeline pig:

1. Verify that the kicker valve and isolation valves are closed.
2. Open the vent to allow it to reach atmospheric pressure.
3. Leaving the valves open, allow it to drain completely (0 psi), and then open the closure door.
4. Now, install the pipeline pig, allowing firm contact between the reducer, which is situated between the nominal bore section of the launcher and the barrel.
5. Clean all sealing surfaces and the closure seal. Apply lubricant if necessary, and secure the door.
6. Close the drain valve and slowly fill the trap by gradually opening the kicker valve, allowing venting through the vent valve.
7. Once it is filled, close the vent valve, and allow pressure to equalize across the isolation valve.
8. Once you open the isolation valve, your pig is ready to be launched.
9. Partially close the main line valve to increase flow behind the pig and through the kicker valve. Continue closing the main line valve until the pig signal indicator shows that the pig has left the trap and made its way into the main line.
10. Once the pig has left the trap and entered into the main line, it is time to open the main line valve, and to close the kicker valve and isolation valve.

7.21.1.1.2 Receiving a pipeline pig:

Verify whether there is any pressure inside the receiving trap before starting receiving procedures.

1. Ensure that the receiver is pressurized.
2. Fully open the bypass valve.
3. Fully open the isolation valve while partially closing the main valve.
4. Monitor the pig signaler to determine its arrival.
5. Close the bypass and isolation valves.
6. Open the vent valve and the drain valve.

7. Check whether the trap is being de-pressured.
8. Open the trap closure and remove the pipeline pig.
9. Clean and seal the pig closer and closure box, and remove it from your receiver
10. Clean the sealing surfaces as well as any other sealing surfaces. Lubricate as needed and secure the closure door.
11. Return the pig receiver to its original condition.
    a. Ensure all launchers are primed.
    b. Ensure all launchers are hydrostatically tested.
    c. Ensure valves on launchers and receivers are round.
    d. Ensure the full port has a 100% pipe size opening.

7.21.1.2 If Launcher and Receiver Are Not Installed

7.21.1.2.1 Launching of a pipeline pig:

1. Insert pig into the depressurized pipeline.
2. Seal end properly to allow for pressurization behind the pig.
3. Ensure receiving end is open to allow for pressure to be vented on the front side of the pig.
4. Apply appropriate pressure behind the pig using air or nitrogen.
5. Continuous pressure shall be applied to ensure the pig continues to move through the pipeline.

7.21.1.2.2 Receiving a pipeline pig:

1. Ensure that the end of the line is orientated in a safe direction if water or debris were discharged due to the pigging process.
2. If needed, traffic and pedestrian barriers shall be installed.
3. All construction personnel shall remain behind the pig outlet until the pig has been discharged.

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8 TRENCHING, SHORING, AND EXCAVATION SAFETY

8.1 Introduction

Excavating is recognized as one of the most hazardous construction operations. OSHA recently revised Subpart P, *Excavations*, of 29 CFR 1926.650, 29 CFR 1926.651, and 29 CFR 1926.652 to make the standard easier to understand, permit the use of performance criteria where possible, and provide construction employers with options when classifying soil and selecting employee protection methods.

8.2 Definitions

Competent Person is an individual who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to employees, and who *has authorization to take prompt corrective measures to eliminate or control these hazards and conditions*.

Confined Space is a space that, by design and/or configuration, has limited openings for entry and exit, unfavorable natural ventilation, may contain or produce hazardous substances, and is not intended for continuous employee occupancy.

Excavation. An **Excavation** is any man-made cut, cavity, trench, or depression in an earth surface that is formed by earth removal. A **Trench** is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth of a trench is greater than its width, and the width (measured at the bottom) is not greater than 15 ft. (4.6 m). If one form or another, structures installed or constructed in an excavation reduces the distance between the form and the side of the excavation to 15 ft. (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Hazardous Atmosphere is an atmosphere that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful may cause death, illness, or injury to persons exposed to it.

Ingress and Egress mean "entry" and "exit," respectively. In trenching and excavation operations, they refer to the provision of safe means for employees to enter or exit an excavation or trench.

Protective System refers to a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, and from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Support System refers to structures such as underpinning, bracing, and shoring that provide support to an adjacent structure or underground installation or to the sides of an excavation or trench.

Subsurface Encumbrances include underground utilities, foundations, streams, water tables, transformer vaults, and geological anomalies.

Surcharge means an excessive vertical load or weight caused by spoil,

overburden, vehicles, equipment, or activities that may affect trench stability.
Tabulated Data are tables and charts approved by a registered professional engineer and used to design and construct a protective system.
Underground Installations include, but are not limited to, utilities (sewer, telephone, fuel, electric, water, and other product lines), tunnels, shafts, vaults, foundations, and other underground fixtures or equipment that may be encountered during excavation or trenching work.
Unconfined Compressive Strength is the load per unit area at which soil will fail in compression. This measure can be determined by laboratory testing, or it can be estimated in the field using a pocket penetrometer, by thumb penetration tests, or by other methods.
Definitions That Are No Longer Applicable. For a variety of reasons, several terms commonly used in the past are no longer used in revised Subpart P. These include the following:

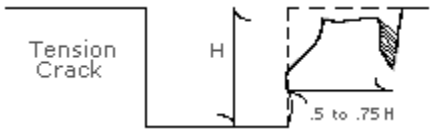
1. **Angle of Repose.** Conflicting and inconsistent definitions have led to confusion as to the meaning of this phrase. This term has been replaced by **Maximum Allowable Slope.**
2. **Bank, Sheet Pile, and Walls.** Previous definitions were unclear or were used inconsistently in the former standard.
3. **Hard Compact Soil** and **Unstable Soil.** The new soil classification system in revised Subpart P uses different terms for these soil types.

8.3 Overview: Soil Mechanics

A number of stresses and deformations can occur in an open cut or trench. For example, increases or decreases in moisture content can adversely affect the stability of a trench or excavation. The following diagrams show some of the more frequently identified causes of trench failure.

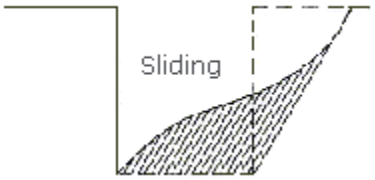
A. **Tension Cracks.** Tension cracks usually form at a horizontal distance of 0.5 to 0.75 times the depth of the trench, measured from the top of the vertical face of the trench. See the accompanying drawing for additional details.

Figure V:2-1. Tension Crack



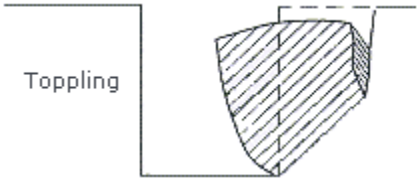
B. **Sliding** or sluffing may occur as a result of tension cracks, as illustrated below.

Figure V:2-2. Sliding



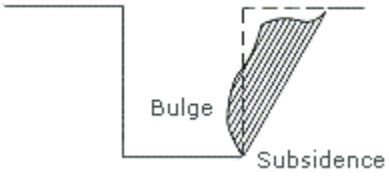
C. **Toppling.** In addition to sliding, tension cracks can cause toppling. Toppling occurs when the trench's vertical face shears along the tension crack line and topples into the excavation.

Figure V:2-3. Toppling



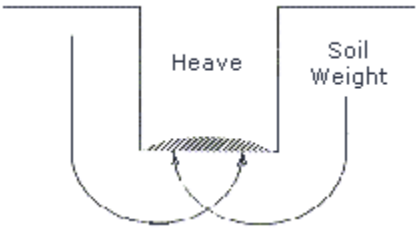
D. **Subsidence and Bulging.** An unsupported excavation can create an unbalanced stress in the soil, which, in turn, causes subsidence at the surface and bulging of the vertical face of the trench. If uncorrected, this condition can cause face failure and entrapment of workers in the trench.

Figure V:2-4. Subsidence and Bulging



E. **Heaving or Squeezing.** Bottom heaving or squeezing is caused by the downward pressure created by the weight of adjoining soil. This pressure causes a bulge in the bottom of the cut, as illustrated in the drawing above. Heaving and squeezing can occur even when shoring or shielding has been properly installed.

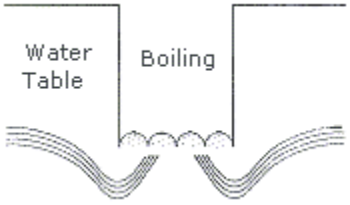
Figure V:2-5. Heaving or Squeezing



F. **Boiling** is evidenced by an upward water flow into the bottom of the cut. A high-water table is one of the causes of boiling. Boiling produces a "quick"

condition in the bottom of the cut, and can occur even when shoring or trench boxes are used.

Figure V:2-6. Boiling



G. **Unit Weight of Soils** refers to the weight of one unit of a particular soil. The weight of soil varies with type and moisture content. One cubic foot of soil can weigh from 110 pounds to 140 pounds or more, and one cubic meter (35.3 cubic feet) of soil can weigh more than 3,000 pounds.

8.4 Determination Of Soil Type

OSHA categorizes soil and rock deposits into four types, A through D, as follows:

A. **Stable Rock** is natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed. It is usually identified by a rock name such as granite or sandstone. Determining whether a deposit is of this type may be difficult unless it is known whether cracks exist and whether or not the cracks run into or away from the excavation.

B. **Type A Soils** are cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) (144 kPa) or greater. Examples of Type A cohesive soils are often: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. (No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, is part of a sloped, layered system where the layers dip into the excavation on a slope of 4 horizontal to 1 vertical (4H:1V) or greater, or has seeping water.

C. **Type B Soils** are cohesive soils with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa). Examples of other Type B soils are: angular gravel; silt; silt loam; previously disturbed soils unless otherwise classified as Type C; soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured or subject to vibration; dry unstable rock; and layered systems sloping into the trench at a slope less than 4H:1V (only if the material would be classified as a Type B soil).

D. **Type C Soils** are cohesive soils with an unconfined compressive strength of 0.5 tsf (48 kPa) or less. Other Type C soils include granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable. Also included in this classification is material in a sloped, layered system where the layers dip into

the excavation or have a slope of four horizontal to one vertical (4H:1V) or greater.

E. **Layered Geological Strata.** Where soils are configured in layers, i.e., where a layered geologic structure exists, the soil must be classified based on the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e., where a Type C soil rests on top of stable rock.

8.5 Test Equipment And Methods For Evaluating Soil Type

Many kinds of equipment and methods are used to determine the type of soil prevailing in an area, as described below.

A. **Pocket Penetrometer.** Penetrometers are direct-reading, spring-operated instruments used to determine the unconfined compressive strength of saturated cohesive soils. Once pushed into the soil, an indicator sleeve displays the reading. The instrument is calibrated in either tons per square foot (tsf) or kilograms per square centimeter (kPa). However, Penetrometers have error rates in the range of ± 20-40%.

B. **Shearvane (Torvane).** To determine the unconfined compressive strength of the soil with a shearvane, the blades of the vane are pressed into a level section of undisturbed soil, and the torsional knob is slowly turned until soil failure occurs. The direct instrument reading must be multiplied by 2 to provide results in tons per square foot (tsf) or kilograms per square centimeter (kPa).

C. **Thumb Penetration Test.** The thumb penetration procedure involves an attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably Type A. If the thumb penetrates no further than the length of the thumbnail, it is probably Type B soil, and if the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and is therefore the least accurate of the three methods.

D. **Dry Strength Test.** Dry soil that crumbles freely or with moderate pressure into individual grains is granular. Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can be broken only with difficulty) is probably clay in combination with gravel, sand, or silt. If the soil breaks into clumps that do not break into smaller clumps (and the soil can be broken only with difficulty), the soil is considered unfissured unless there is visual indication of fissuring.

E. **Plasticity or Wet Thread Test.** This test is conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread approximately 1/8 inch (3 mm) in diameter (thick) by 2 inches (50 mm) in length. The soil sample is held by one end. If the sample does not break or tear, the soil is considered cohesive.

F. **Visual Test.** A visual test is a qualitative evaluation of conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. If the soil remains in clumps, it is cohesive; if it appears to be coarse-grained sand or gravel, it is considered granular. The evaluator also checks for any signs of vibration.

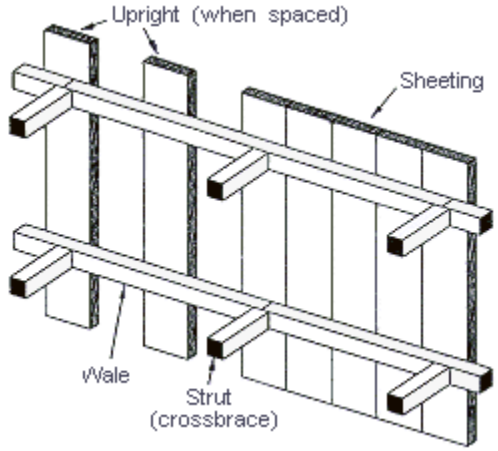
a. During a visual test, the evaluator shall check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has previously been disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

b. The evaluator shall also look for signs of bulging, boiling, or sluffing, as well as for signs of surface water seeping from the sides of the excavation or from the water table. If there is standing water in the cut, the evaluator shall check for "quick" conditions. In addition, the area adjacent to the excavation shall be checked for signs of foundations or other intrusions into the failure zone, and the evaluator shall check for surcharging and the spoil distance from the edge of the excavation.

8.6 Shoring Types

Shoring is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. Shoring systems consist of posts, wales, struts, and sheeting. There are two basic types of shoring, timber, and aluminum hydraulic.

Figure V:2-7. Timber Shoring



A. Hydraulic Shoring

The trend today is toward the use of hydraulic shoring, a prefabricated strut and/or wale system manufactured of aluminum or steel. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove hydraulic shoring. Other

advantages of most hydraulic systems are that they:

a. Are light enough to be installed by one worker;

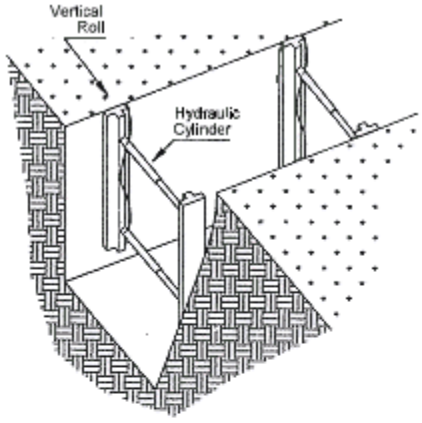
b. Are gauge-regulated to ensure even distribution of pressure along the trench line;

c. Can have their trench faces "preloaded" to use the soil's natural cohesion to prevent movement; and

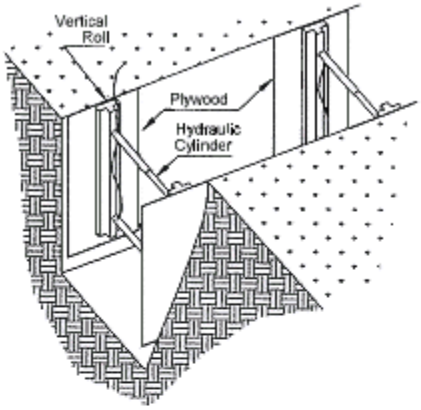
d. Can be adapted easily to various trench depths and widths.

All shoring shall be installed from the top down and removed from the bottom up. Hydraulic shoring shall be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

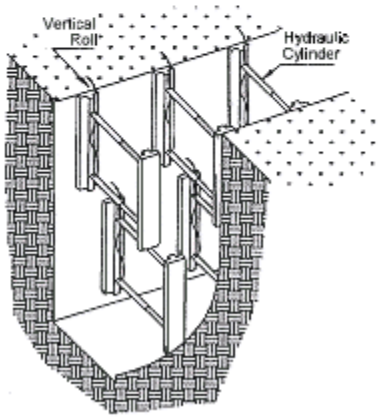
Figure V:2-8. Shoring Variations: Typical Aluminum Hydraulic Shoring Installations



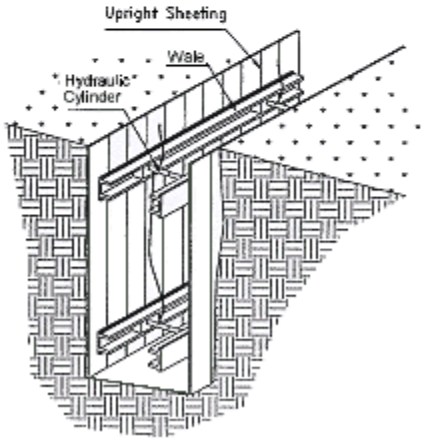
Vertical Aluminum Hydraulic Shoring
(Spot Bracing)



Vertical Aluminum Hydraulic Shoring
(With Plywood)



Vertical Aluminum Hydraulic Shoring
(Stacked)



Aluminum Hydraulic Shoring Waler System
(Typical)

B. **Pneumatic Shoring**

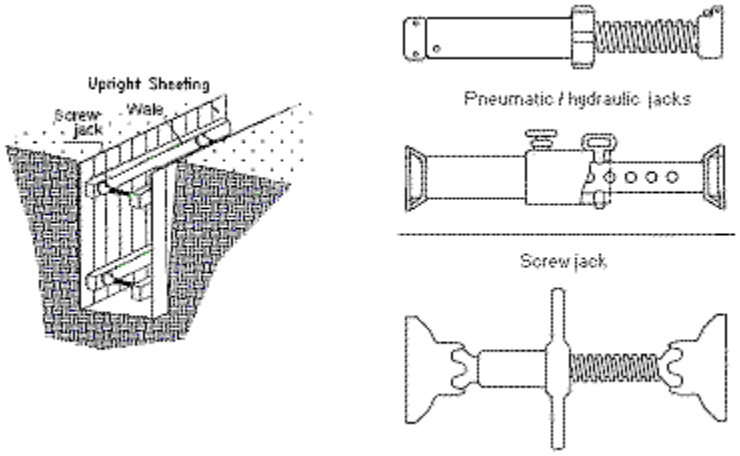
Pneumatic works in a manner similar to hydraulic shoring. The primary difference is that pneumatic shoring uses air pressure in place of hydraulic pressure. A disadvantage to the use of pneumatic shoring is that an air compressor must be on site.

a **Screw Jacks.** Screw jack systems differ from hydraulic and pneumatic systems in that the struts of a screw jack system must be adjusted manually. This creates a hazard because the worker is required to be in the trench in order to adjust the strut. In addition, uniform "preloading" cannot be achieved with screw jacks, and their weight creates handling difficulties.

b **Single-Cylinder Hydraulic Shores.** Shores of this type are generally used in a water system, as an assist to timber shoring systems, and in shallow trenches where face stability is required.

c **Underpinning.** This process involves stabilizing adjacent structures, foundations, and other intrusions that may have an impact on the excavation. As the term indicates, underpinning is a procedure in which the foundation is physically reinforced. Underpinning shall be conducted only under the direction and with the approval of a registered professional engineer.

Figure V:2-9. Shoring Variations



8.7 Shielding Types

A. Trench Boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents. The excavated area between the outside of the trench box and the face of the trench shall be as small as possible. The space between the trench boxes and the excavation side are backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those that the system was designed to withstand.

Figure V:2-10. Trench Shield

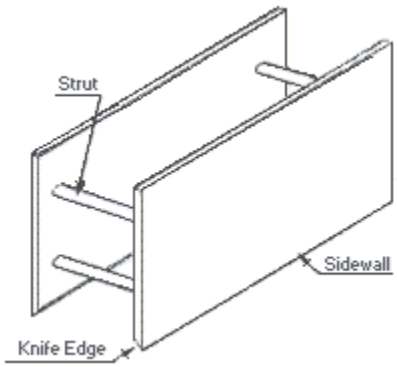
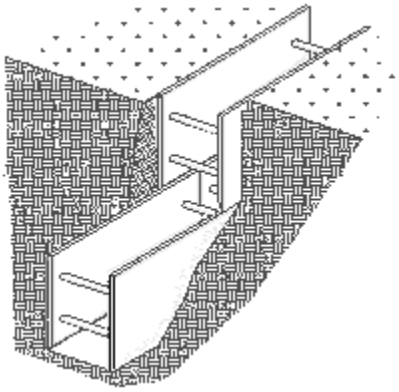


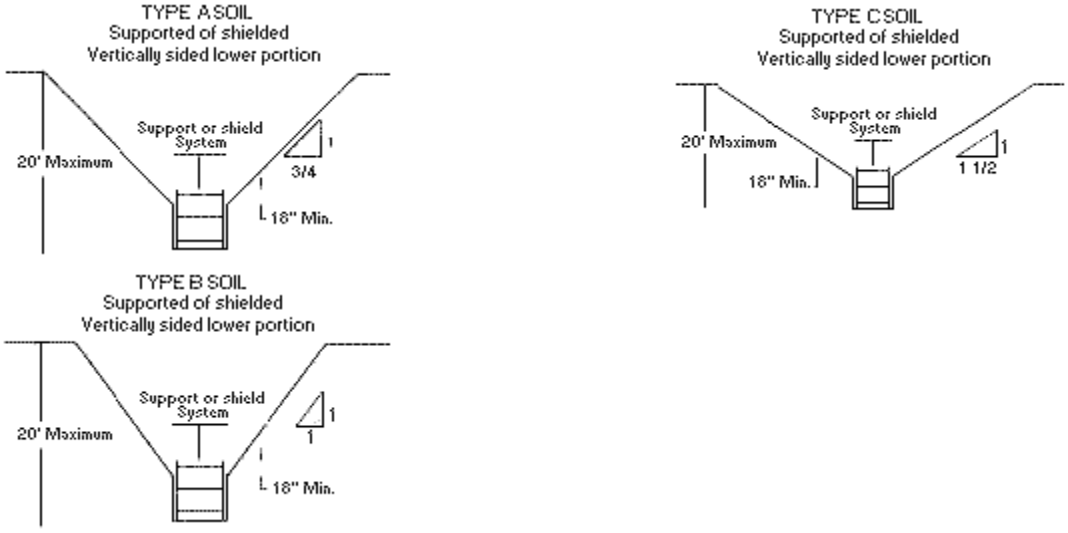
Figure V:2-11. Trench Shield, Stacked



B. Combined Use. Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching. The box shall extend at least 18 in (0.45 m) above the surrounding area if there is sloping toward excavation. This can be accomplished by providing a benched area adjacent to the box.

Earth excavation to a depth of 2 ft. (0.61 m) below the shield is permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of possible loss of soil from behind or below the bottom of the support system. Conditions of this type require observation on the effects of bulging, heaving, and boiling as well as surcharging, vibration, adjacent structures, etc., on excavating below the bottom of a shield. Careful visual inspection of the conditions mentioned above is the primary and most prudent approach to hazard identification and control.

Figure V:2-12. Slope and Shield Configurations



8.8 Sloping And Benching

A. Sloping

Maximum allowable slopes for excavations less than 20 ft. (6.09 m) based on soil type and angle to the horizontal are as follows:

Table V:2-1. Allowable Slopes

Soil type	Height: Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A(short-term)	½:1	63°
(For a maximum excavation depth of 12 ft.)		

Figure V:2-13. Slope Configurations: Excavations in Layered Soils

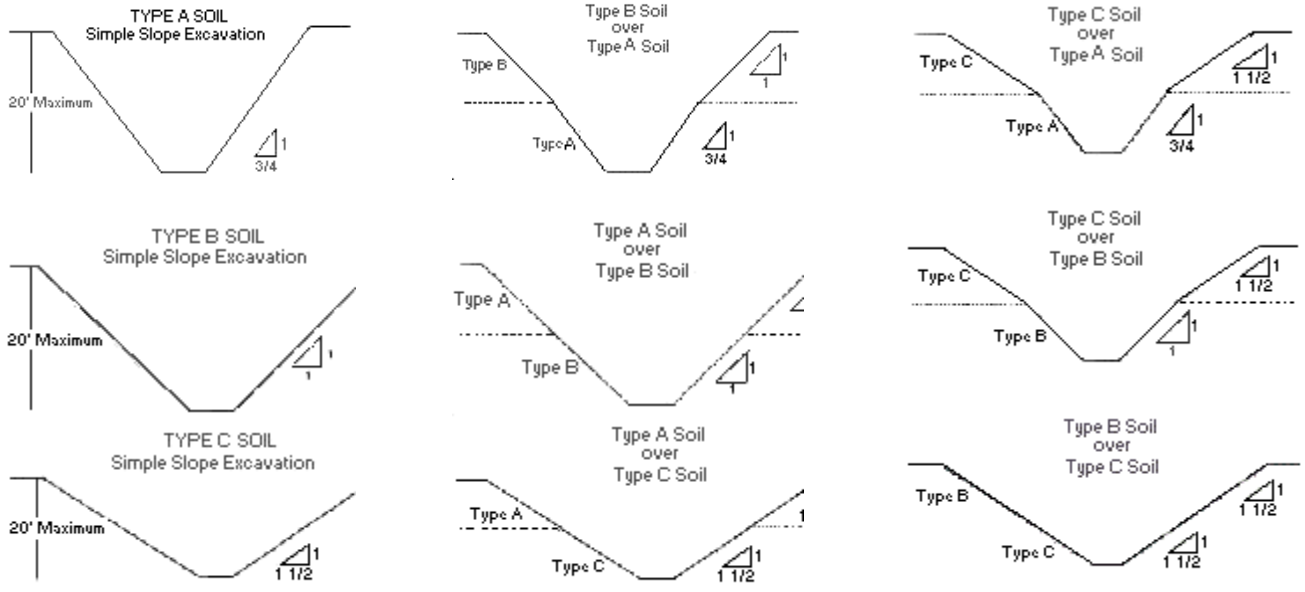
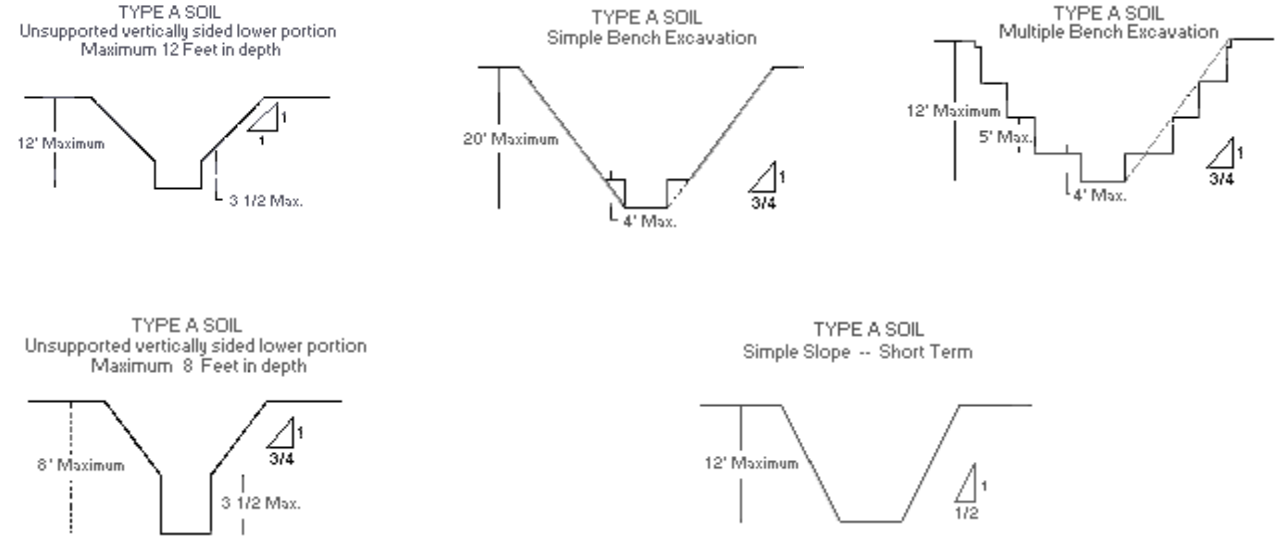


Figure V:2-14. Excavations Made in Type A Soil

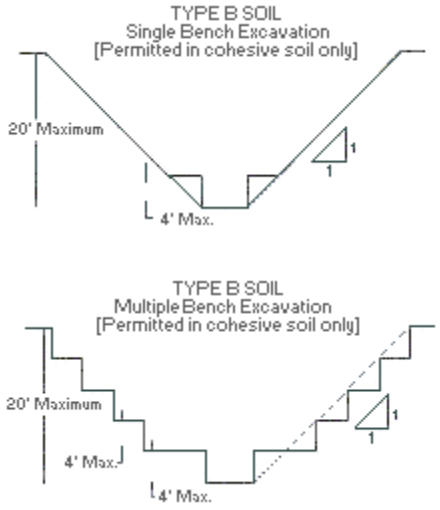


B. Benching

There are two basic types of benching, simple and multiple. The type of soil determines the horizontal to vertical ratio of the benched side.

As a general rule, the bottom vertical height of the trench must not exceed 4 ft. (1.2 m) for the first bench. Subsequent benches may be up to a maximum of 5 ft. (1.5 m) vertical in Type A soil and 4 ft. (1.2 m) in Type B soil to a total trench depth of 20 ft. (6.0 m). All subsequent benches must be below the maximum allowable slope for that soil type. For Type B soil, the trench excavation is permitted in cohesive soil only.

Figure V:2-15. Excavations Made in Type B Soil



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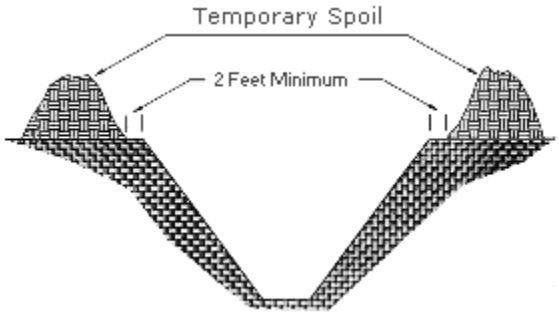
8.9 Spoil

Figure V:2-16. Temporary Spoil



A. Temporary Spoil

Temporary spoil must be placed no closer than 2 ft. (0.61 m) from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance shall not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.

Spoil shall be placed so that it channels rainwater and other run-off water away from the excavation. Spoil shall be placed so that it cannot accidentally run, slide, or fall back into the excavation.

B. Permanent Spoil

Permanent spoil shall be placed at some distance from the excavation. Permanent spoil is often created where underpasses are built or utilities are buried. The improper placement of permanent spoil, i.e. insufficient distance from the working excavation, can cause an excavation to be out of compliance with the horizontal-to-vertical ratio requirement for a particular excavation. This can usually be determined through visual observation. Permanent spoil can change undisturbed soil to disturbed soil and dramatically alter slope requirements.

8.10 Special Health And Safety Considerations

A. Competent Person

The designated competent person shall have and be able to demonstrate the following:

a. Training, experience, and knowledge of:

i. Soil analysis;

ii. Use of protective systems; and

iii. Requirements of 29 CFR Part 1926 Subpart P

b. Ability to detect:

i. Conditions that could result in cave-ins;

ii. Failures in protective systems;

iii. Hazardous atmospheres; and

iv. Other hazards including those associated with confined spaces.

c. Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

B. Surface Crossing of Trenches

Surface crossing of trenches shall be discouraged; however, if trenches must be crossed, such crossings are permitted only under the following conditions:

a. Vehicle crossings must be designed by and installed under the supervision of a registered professional engineer.

b. Walkways or bridges must be provided for foot traffic. These structures shall:

i. Have a safety factor of 4;

ii. Have a minimum clear width of 20 in (0.51 m);

iii. Be fitted with standard rails; and

iv. Extend a minimum of 24 in (.61 m) past the surface edge of the trench.

C. Ingress and Egress

Access to and exit from the trench require the following conditions:

a. Trenches 4 ft. or more in depth shall be provided with a fixed means of egress.

b. Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 ft. laterally to the nearest means of egress.

c. Ladders must be secured and extend a minimum of 36 in (0.9 m) above the landing.

d. Metal ladders shall be used with caution, particularly when electric utilities are present.

D. Exposure to Vehicles

Procedures to protect employees from being injured or killed by vehicle traffic include:

a. Providing employees with and requiring them to wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility materials.

b. Requiring a designated, trained flag person along with signs, signals, and barricades when necessary.

E. Exposure to Falling Loads

Employees must be protected from loads or objects falling from lifting or digging equipment. Procedures designed to ensure their protection include:

a. Employees are not permitted to work under raised loads.

b. Employees are required to stand away from equipment that is being loaded or unloaded.

c. Equipment operators or truck drivers may stay in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

F. Warning Systems for Mobile Equipment

The following steps shall be taken to prevent vehicles from accidentally falling into the trench:

a. Barricades must be installed where necessary.

b. Hand or mechanical signals must be used as required.

c. Stop logs must be installed if there is a danger of vehicles falling into the trench.

d. Soil shall be graded away from the excavation; this will assist in vehicle control and channeling of run-off water.

G. Hazardous Atmospheres and Confined Spaces

Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with:

a. Less than 19.5% or more than 23.5% oxygen;

b. A combustible gas concentration greater than 20% of the lower flammable limit; and

c. Concentrations of hazardous substances that exceed those specified in the *Threshold Limit Values for Airborne Contaminants* established by the ACGIH (American Conference of Governmental Industrial Hygienists).

All operations involving such atmospheres must be conducted in accordance with OSHA requirements for occupational health and environmental controls (see 29 CFR Part 1926 Subpart D) for personal protective equipment and for lifesaving equipment (see 29 CFR Part 1926 Subpart E). Engineering controls (e.g., ventilation) and respiratory protection may be required.

When testing for atmospheric contaminants, the following shall be considered:

a. Testing shall be conducted before employees enter the trench and shall be done regularly to ensure that the trench remains safe.

b. The frequency of testing shall be increased if equipment is operating in the trench.

c. Testing frequency shall also be increased if welding, cutting, or burning is done in the trench.

Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program. Some trenches qualify as confined spaces. When this occurs, compliance with the Confined Space Standard is also required.

H. Emergency Rescue Equipment

Emergency rescue equipment is required when a hazardous atmosphere exists or can reasonably be expected to exist. Requirements are as follows:

a. Respirators must be of the type suitable for the exposure. Employees must be trained in their use and a respirator program must be instituted.

b. Attended (at all times) lifelines must be provided when employees enter bell-bottom pier holes, deep confined spaces, or other similar hazards.

c. Employees who enter confined spaces must be trained.

I. Standing Water and Water Accumulation

Methods for controlling standing water and water accumulation must be provided and shall consist of the following if employees are permitted to work in the excavation:

a. Use of special support or shield systems approved by a registered professional engineer.

b. Water removal equipment, i.e. well pointing, used, and monitored by a competent person.

c. Safety harnesses and lifelines used in conformance with 29 CFR 1926.104.

d. Surface water diverted away from the trench.

e. Employees removed from the trench during rainstorms.

f. Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.

J. Inspections

Inspections shall be made by a competent person and shall be documented. The following guide specifies the frequency and conditions requiring inspections:

a. Daily and before the start of each shift;

b. As dictated by the work being done in the trench;

c. After every rainstorm;

d. After other events that could increase hazards, e.g. snowstorm, windstorm, thaw, earthquake, etc.;

e. When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur;

f. When there is a change in the size, location, or placement of the spoil pile; and

g. When there is any indication of change or movement in adjacent structures.

K. Site Assessment Checklist

1. Is the cut, cavity, or depression a trench or an excavation?
2. Is the cut, cavity, or depression more than 4 ft. (1.2 m) in depth?
3. Is there water in the cut, cavity, or depression?
4. Are there adequate means of access and egress?
5. Are there any surface encumbrances?
6. Is there exposure to vehicular traffic?
7. Are adjacent structures stabilized?
8. Does mobile equipment have a warning system?
9. Is a competent person in charge of the operation?
10. Is equipment operating in or around the cut, cavity, or depression?
11. Are procedures required to monitor, test, and control hazardous atmospheres?
12. Does a competent person determine soil type?
13. Was a soil-testing device used to determine soil type?
14. Is the spoil placed 2 ft. (0.6 m) or more from the edge of the cut, cavity, or depression?
15. Is the depth 20 ft. (6.1 m) or more for the cut, cavity, or depression?
16. Has a registered professional engineer approved the procedure if the depth is more than 20 ft. (6.1 m)?
17. Does the procedure require benching or multiple benching? Shoring? Shielding?
18. If provided, do shields extend at least 18 in (0.5 m) above the surrounding area if it is sloped toward the excavation?
19. If shields are used, is the depth of the cut more than 2 ft (0.6 m) below the bottom of the shield?

20. Are any required surface crossings of the cut, cavity, or depression the proper width and fitted with handrails?
21. Are means of egress from the cut, cavity, or depression no more than 25 ft. (7.6m) from the work?
22. Is emergency rescue equipment required?
23. Is there documentation of the minimum daily excavation inspection?

9 FORMS

NOTE: Any of the following forms containing vital information regarding the integrity of the pipeline system must be retained for a minimum of 10 years to fulfill Integrity Management Program requirements.

Valve Inspection and Maintenance Form:
This form is used to record the inspection and maintenance of each critical valve in the system.

Pipeline Pressure Test Report:
This report is used to document each pressure test performed on a section of pipeline to establish a maximum allowable operating pressure (MAOP) as required by these Technical & Construction Specifications.

Main/Service Installation Form:
Record all materials that were used during installations and repairs capturing the critical information required per State and Federal pipeline safety regulations.

Construction Inspection Record:
This document tracks personnel hours, equipment used, weather conditions, a summary of work completed, and documents important events completed for the day. This is used as a tracking mechanism for the Contractor to clearly communicate the progress and status of the project to the Owner.

Daily Weld Inspection Form:
This form documents the welder, the welds completed, procedure used, and if any repairs were made.

Version - 17.1
Rev. Date - 9/1/2017

Valve Inspection & Maintenance Form-601

City/Company:

Company Valve # or ID #:		**Valve Material:**	
Manufacturer:		**Valve Purpose:**	
Valve Size:		**Pressure Rating:**	
Manufacturer ID or Serial #:		**Location:**	
Valve Type:			
Critical Valve?		**Year Installed:**	

☐ **Above Ground** ☐ **Below Ground**

Date Inspected	Inspector Initials	Notes	Date Inspected	Inspector Initials	Notes

Valve Location (Sketch w/ Landmarks & Dimensions)

Version - 18.1
Rev. Date - 5/3/2018

Pressure Test Report-701

City/Company:	
Testing Company:	
Location of Installation:	

Pressure Test Information

Pipe Specifications:	
Pipe Size/Material:	
Length of Pipe:	
Pipeline MAOP:	
Class Location:	
Test Medium:	
Pressure Recorder:	
Pressure Recorder SN:	

Min. Proposed Test Pressure:	
Max Proposed Test Pressure:	
Min. Proposed Test Duration:	
Test Start - Date:	
Test Start - Time:	
Pressure at Start:	
Temp. at Start:	
Test End - Date:	
Test End - Time:	
Pressure at End:	
Temp. at End:	

Line Loss Information

Line Loss:	
Amount of Loss(MCF):	
Reason for Line Loss:	
Corrective Measures Taken:	
Remarks:	

Company Representative: Date:

Version - 19.1
Rev. Date - 1/2/2019

USDI

Main/Service Installation or Replacement Form-1601

City/Company: | **Service ID #:**

Date of Installation: | **Job #:**

Location of Installation:

☐ Main ☐ Service Line
☐ New ☐ Replacement

Pipe Information

Pipe Type:	
Pipe Size:	
Length of Pipe:	
Type of Fusion:	
Wall Thickness/SDR:	
Factory Coating:	
Yield Strength:	
Lot Number:	
Manufacturer:	
Manufacture Date:	
Design MAOP:	

Pressure Test Information

Test Medium:	
Start - Time/Date:	
End - Time/Date:	
Pressure at Start:	
Pressure at End:	
Line Loss:	
Amount of Loss(MCF):	
Reason for Line Loss:	

Pressure Recorder Used: ☐ Chart ☐ Gauge

Pressure Recorder SN:

*See Pressure Recorder Calibration Record

Installation Checklist:

Depth of Cover:

Pipe to Soil Reading: ☐ Yes ☐ No Reading: VDC

Anode Installed?: ☐ Yes ☐ No Size(#): Quantity:

Joints/Bare Pipe Coated?: ☐ Yes ☐ No

Coating Type:

Welds Tested: ☐ Yes ☐ No

Tracer Wire: ☐ Yes ☐ No

Material List: ☐ Yes ☐ No

EFV Installed: ☐ Yes ☐ No Capacity of EFV: cfh

EFV Size:

EFV Model:

Manual Shut Off Valve Installed: ☐ Yes ☐ No

Any Foreign Structures? ☐ Yes ☐ No

If yes, Specify utility, structure, clearance, etc.:

Directional Bore: ☐ Yes ☐ No

Estimated Footage:

Purge Checklist:

Was the line purged: ☐ Yes ☐ No

What was purged from the line: ☐ Gas ☐ Air ☐ Nitrogen

Was a CGI used: ☐ Yes ☐ No

Was the gas/air purged completely: ☐ Yes ☐ No

How long did the purge last :

Installation Completed By:

Signature:

Version – 17.1
Rev. Date – 9/8/2017

USDI

Construction Inspection Record - 1604

Daily Inspection Form

Owner:	
Project Na	
Date:	
Ins. Signat	

Site Information

Locates Completed:	
Locate Ticket on Site:	
Muddy:	
Snow on Ground:	

Personnel	Occupation	Hrs. Worked

Weather

Start Time ° F	
Noon ° F	
Quit Time °F	
Sunny/Cloudy	
Snowing	
Raining	
Ice	

Equipment On Site	Used Today?

Daily Work Summary	

Version - 17.1
Rev. Date - 9/1/2017

Daily Weld Inspection Report-1701

USDI

City/Company: **Contractor:**

Date: **Job:**

Location of Work On This Date:

Pipe Diameter: Wall Thickness: Material Type: Grade:

Code Numbers: ☐ 1104 ☐ B31.8 ☐ B31.3

Welding Procedure:

Welder	Weld #	Stringer	Filler & Cap	Speed	Defects	Repairs	Accept/Reject	Inspector

Remarks:

Signed:

10 EROSION AND SEDIMENT CONTROL

10.1 Description of Work

A. Furnish all materials; install, construct, maintain, and remove specified erosion control devices; at locations specified in the contract documents, or where specified by the Engineer.

B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified, from initial construction stages to final completion of the project.

10.2 Submittals

Upon request, provide copies of all records and documentation related to compliance with the all applicable Nebraska permits & the Nebraska Drainage Design and Erosion Control Manual (Link).

10.3 Scheduling and Conflicts

A. Implement erosion and sediment control measures at the appropriate time(s).

B. Coordinate construction to minimize damage to erosion and sediment control devices.

10.4 Special Requirements

A. **Permit:**

1. When applicable, comply with the requirements of the all applicable Nebraska permits and plans & the Nebraska Drainage Design and Erosion Control Manual (Link).
2. For projects covered under all applicable Nebraska permits and plans, sign on as a co-permittee with the owner and any other contractors or subcontractors.
3. When applicable, comply with the local jurisdiction's permitting requirements.

B. **Protection of Property:** Prevent accumulation of soil, sediment, or debris from project site onto adjoining public or private property. Remove any accumulation of soil or debris immediately, and take remedial actions for prevention.

C. **Permit Compliance:** When applicable, conduct all operations in compliance with all applicable Nebraska permits and plans. Labor, equipment, or materials not included as a bid item, but necessary to prevent stormwater contamination from construction related sources, are considered incidental. Incidental work related to compliance with the permit may include, but is not limited to: hazardous materials protection, fuel containment, waste disposal, and providing employee sanitary facilities.

D. **Project Staging:** Replacing erosion and sediment control practices that are damaged or removed by the contractor in a manner that is inconsistent with the current project staging or SWPPP is the Contractor's responsibility and will be at the Contractor's expense

10.5 **Measurement and Payment**

All payment shall be included in the project bid price.

10.6 **Products & Installation**

10.6.1 Refer to Nebraska Drainage Design and Erosion Control Manual (Link)

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11 APPENDICES

USDI WELDING PROCEDURE MANUAL

Last Revision Date: **NOVEMBER 15, 2022**

USDI - WELDING PROCEDURE MANUAL

CONTENTS

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STEEL WELDING GENERAL

SECTION A. WELDING OVERVIEW (192.231, 192.233, 192.235)

All welding on the natural gas pipeline system must be performed by a qualified welder using qualified welding procedures. The welding procedures are qualified by destructively testing a test weld made using the procedure. All welding procedures shall be recorded in detail and these procedures shall be followed whenever welding on the pipeline or pipeline facilities.

Each transmission line or main must be constructed in accordance with comprehensive written specifications or standards that are consistent with 40 CFR Subpart G - General Construction Requirements for Transmission Lines and Mains. § 192.303

See Section E for more information on qualifying welding procedures.

The welding operation must be protected from weather conditions that would impair the quality of the completed weld § 192.231.

For Transmission Lines; no miter joints will be allowed that create a deflection of more than 3 degrees, miters on Distribution Line will be approved by management and in accordance with § 192.233 Miter joints.

The welding surfaces must be clean and free of foreign materials and good alignment must be obtained and preserved while the root bead is being deposited.

Piping shall be welded by qualified welders using qualified procedures.

The surfaces to be welded shall be smooth, uniform, and free from laminations, tears, scale, slag, grease, paint, and other deleterious material that might adversely affect the welding.

The joint design and spacing between abutting ends shall be in accordance with the procedure specification used.

The alignment of abutting ends shall minimize the offset between surfaces. For pipe ends of the same nominal thickness, the offset should not exceed 1/8 in. (3 mm). Larger variations are permissible provided the variation is caused by variations of the pipe end dimensions within the pipe purchase specification tolerances, and such variations have been distributed essentially uniformly around the circumference of the pipe. Hammering of the pipe to obtain proper lineup should be kept to a minimum.

All mill bevels on pipe ends shall conform to the joint design used in the procedure specification.

Pipe ends should be field beveled by machine tool, machine oxygen cutting; or (only when deemed necessary), manual oxygen cutting. The beveled ends shall be reasonably smooth and uniform, and dimensions shall be in accordance with the procedure specification.

At the company's option, roll welding shall be permitted, provided alignment is maintained by the use of skids or a structural framework with an adequate number of roller dollies to prevent sag in the supported lengths of pipe.

For roll welding, the number of filler and finish beads shall be such that the completed weld has a substantially uniform cross section around the entire circumference of the pipe.

At no point shall the crown surface fall below the outside surface of the pipe, nor should it be raised above the parent metal by more than 1/16 in. (1.6 mm). The face of the completed weld should be approximately 1/8 in. (3 mm) wider than the width of the original groove. As the welding progresses, the pipe shall be rolled to maintain welding at or near the top of the pipe. The completed weld shall be thoroughly brushed and cleaned.

When the pipe is welded above ground, the working clearance around the pipe at the weld should not be less than 16 in.

When the pipe is welded in a trench, the bell hole shall be large enough to provide the welder or welders with ready access to the joint.

Scale and slag shall be removed from each bead and groove. Cleaning may be performed with either hand or power tools. When semiautomatic or mechanized welding is used, surface porosity clusters, bead starts, and high points shall be removed by grinding before weld metal is deposited over them. When requested by the company, heavy glass deposits shall be removed before weld metal is deposited over them.

The company shall have the right to inspect all welds by nondestructive means or by removing welds and subjecting them to mechanical tests. The inspection may be made during the welding or after the weld has been completed. The frequency of inspection shall be as specified by the company.

A record shall be maintained of the tests given to each welder and of the detailed results of each test.

A list of qualified welders and the procedures for which they are qualified shall be maintained.

REQUALIFICATION OF WELDERS

A welder or welding operator qualified under an earlier edition of API 1104 than that listed in § 192.7 may weld but may not requalify under that earlier edition.

A welder may be required to requalify if a question arises about their competence.

For steel transmission pipe installed after July 1, 2021, records demonstrating each individual welder qualification at the time of construction in accordance with this section must be retained for a minimum of 5 years following construction.

SECTION B. WELDER QUALIFICATION METHODS (192.227)

Welders who weld on natural gas pipelines must be qualified using the qualified procedures found in this section of the manual or procedures provided by others and accepted by the utility in accordance with API 1104 Incorporated By Reference IBR (see 192.7)

All weld tests will be documented on a form than contains the information required by API 1104 IBR Figure 2 (see appendix B of this manual)

a. Except as provided in paragraph (b) of this section, each welder or welding operator must be qualified in accordance with section 6, section 12, Appendix A or Appendix B of API Std 1104 (incorporated by reference, see § 192.7), or section IX of the ASME Boiler and Pressure Vessel Code (ASME BPVC) (incorporated by reference, see § 192.7).

b. A welder may qualify to perform welding on pipe to be operated at a pressure that produces a hoop stress of less than 20 percent of SMYS by performing an acceptable test weld, for the process to be used, under the test set forth in section I of Appendix C of CFR part 192. Each welder who is to make a welded service line connection to a main must first perform an acceptable test weld under section II of Appendix C of CFR part 192 as a requirement of the qualifying test.

c. For steel transmission pipe installed after July 1, 2021, records demonstrating each individual welder qualification at the time of construction in accordance with this section must be retained for a minimum of 5 years following construction. Welder Qualification Records will be kept using Appendix A or B of this manual as appropriate.

LIMITATIONS ON WELDERS AND WELDING OPERATORS § 192.229.

(a) No welder or welding operator whose qualification is based on nondestructive testing may weld compressor station pipe and components.

(b) A welder or welding operator may not weld with a particular welding process unless, within the preceding 6 calendar months, the welder or welding operator was engaged in welding with that process. Alternatively, welders or welding operators may demonstrate they have engaged in a specific welding process if they have performed a weld with that process that was tested and found acceptable under section 6, 9, 12, or Appendix A of API Std 1104 (incorporated by reference, see § 192.7) within the preceding 71/2 months.

(c) A welder or welding operator qualified under § 192.227(a) –

a. May not weld on pipe to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS unless within the preceding 6 calendar months the welder or welding operator has had one weld tested and found acceptable under either section 6, section 9, section 12 or Appendix A of API Std 1104 (incorporated by reference, see § 192.7). Alternatively, welders or welding operators may maintain an ongoing qualification status by performing welds tested and found acceptable under the above acceptance criteria at least twice each calendar year, but at intervals not exceeding 71/2 months. A welder or welding operator qualified under an earlier edition of a standard listed in § 192.7 of this part may weld, but may not re-qualify under that earlier edition; and,

b. May not weld on pipe to be operated at a pressure that produces a hoop stress of less than 20 percent of SMYS unless the welder or welding operator is tested in accordance with

paragraph (c)(1) of this section or re-qualifies under paragraph (d)(1) or (d)(2) of this section.

(d) A welder or welding operator qualified under § 192.227(b) (Appendix C of Part 192) may not weld unless –

a. Within the preceding 15 calendar months, but at least once each calendar year, the welder or welding operator has re-qualified under § 192.227(b); or

b. Within the preceding 7 1/2 calendar months, but at least twice each calendar year, the welder or welding operator has had –

i. A production weld cut out, tested, and found acceptable in accordance with the qualifying test; or

ii. For a welder who works only on service lines 2 inches (51 millimeters) or smaller in diameter, the welder has had two sample welds tested and found acceptable in accordance with the test in section III of 192 Appendix C.

SECTION C. QUALIFICATION OF WELDERS (192.227)

Welds that are submitted for destructive testing will be tested in accordance with either:

A. Appendix C to Part 192- Qualification of Welders for Low Stress Level Pipe I, II, and for welders of small service lines III or;
B. API 1104 Section 6, section 12, Appendix A or Appendix B of API Std 1104 (incorporated by reference, see § 192.7)

The welds shall be produced using the qualified procedures as seen in Section F or other company approved Qualified API 1104 IBR welding procedures.

APPENDIX C TO PART 192 QUALIFICATION OF WELDERS FOR LOW STRESS LEVEL PIPE

A. For basic qualification under of CFR 192 Appendix C a test weld must be made on a pipe 12 inches or less in diameter. This weld must be made on pipe that is in a fixed horizontal position so that overhead welding is included. The pipe shall then cut into four coupons approximately 1 " wide and 9" long (see Fig. 1for locations); each coupon shall be root bend tested. Root bend testing shall be accomplished by bending each section in a jig shown in Fig. 2. The section shall be placed root side centered toward the gap and the plunger shall be forced into the gap until the test section forms a U-shape. If two or more of the test sections develop cracks in the weld material or between the weld material and base metal more than 1/8" long in any direction, the weld is unacceptable. During the testing cracks that develop on the corner of the section shall not be considered.

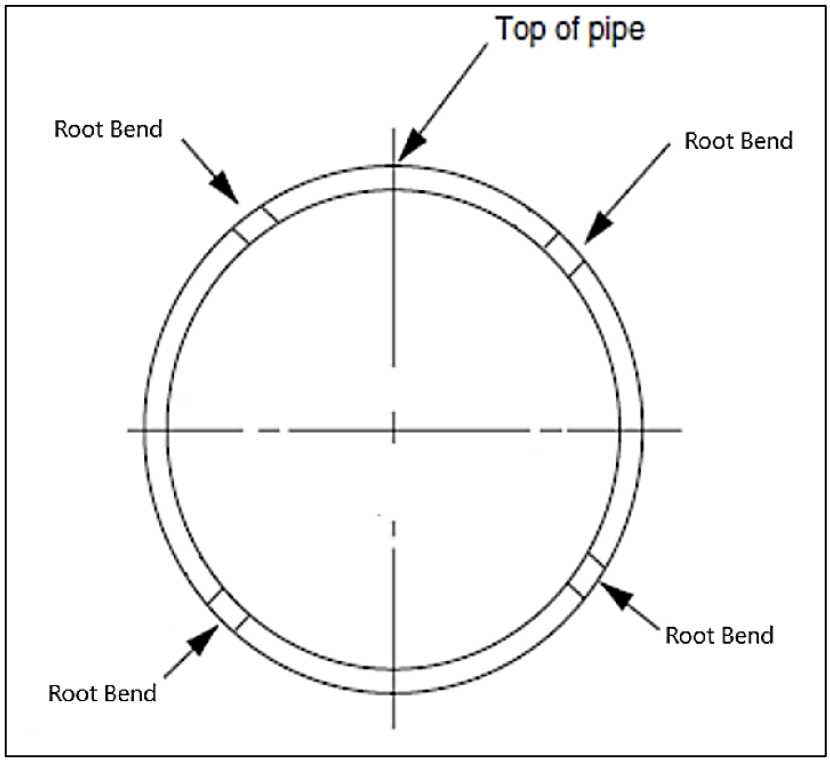


Figure 1

B. For welders working on service line connections, a test weld using or simulating a service line connection shall be made using the same welding position as in the field. Typically, a 1" nipple on a 2" main. The test sample shall be examined for undercutting or rolled edges. Either of these shall render the sample unacceptable. Additionally, the weld shall be tested by trying to break the fitting off of the main. Welds shall be considered unacceptable if it breaks, shows incomplete fusion, overlap, or poor penetration at the junction of the fitting and pipe.

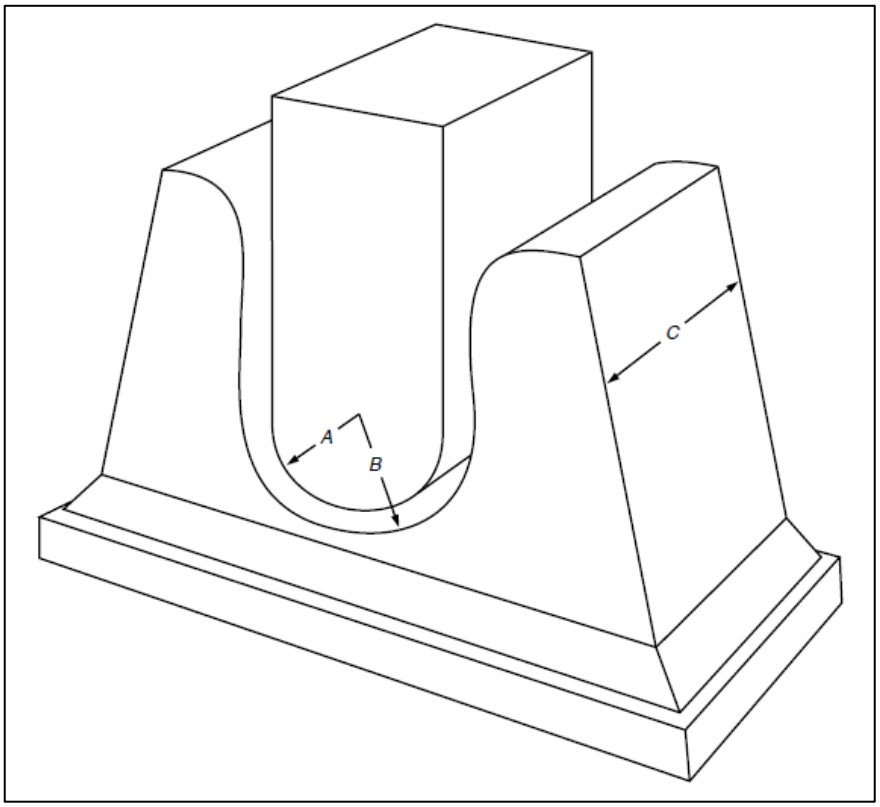


Figure 2

Note: This figure is not drawn to scale. Radius of plunger, A = 1 3/4 in.; radius of die, B = 2 5/16 in.; width of die, C = 2 in.

C. Welders of small service lines shall either produce two samples of welded service lines or have two field welds cut out and tested. Typically, ¾" IPS or 1" IPS
   a. One sample shall be bent on the root bend test machine for a distance of 2" on each side of the weld. The weld is considered unacceptable if any cracks or breaks form.
   b. The other sample shall be subjected to a tensile test and shall fail if the failure occurs in or near the weld metal. If no tensile test machine is available, the second sample will be subjected to a bend test like the first sample.

A welder who successfully passes a butt-weld qualification test under A above shall be qualified to weld on all pipe diameters less than or equal to 12 inches.

CONTINUATION OF QUALIFICATION UNDER APPENDIX C PART 192

A welder qualified under Appendix C Part 192 may continue to weld if

1. Within the preceding 15 calendar months, but at least once each calendar year, the welder or welding operator has re-qualified under § 192.227(b); or

2. Within the preceding 7 1/2 calendar months, but at least twice each calendar year, the welder or welding operator has had
    a. A production weld cut out, tested, and found acceptable in accordance with the qualifying test; or
    b. For a welder who works only on service lines 2 inches (51 millimeters) or smaller in diameter, the welder has had two sample welds tested and found acceptable in accordance with the test in section III of Appendix C of this part.

API 1104 WELDER QUALIFICATION

SINGLE QUALIFICATION

For qualification on a single welding procedure, a welder shall make a weld using a qualified procedure joining two pipe segments. This weld will be made in the fixed position and the pipe axis shall be either horizontal (5G) or raised vertically to a 45° angle (6G). For a welder to be qualified, both a visual inspection and destructive test must be satisfactory.

A welder making a single-qualification test for branch connections, fillet welds, or other similar configurations shall follow the specific procedure specification.

For a qualification test weld to meet the requirements for visual examination, the weld shall be free from cracks, inadequate penetration, and burn-through, and must present a neat workman-like appearance.

The depth of undercutting adjacent to the final bead on the outside of the pipe shall not be more than 1/32 in. (0.8 mm) or 12.5% of the pipe wall thickness, whichever is smaller, and there shall not be more than 2 in. (50 mm) of undercutting in any continuous 12 in. (300 mm) length of weld.

When semi-automatic or mechanized welding is used, filler wire protruding into the inside of the pipe shall be kept to a minimum.

Failure to meet the requirements of this subsection shall be adequate cause to eliminate additional testing.

A welder who has successfully completed the qualification test described above shall be qualified within the limits of the essential variables described below.

A welder who successfully passes a butt-weld qualification test in the fixed position with the axis inclined 45° from the horizontal plane shall be qualified to do butt welds and lap fillet welds in all positions.

ESSENTIAL VARIABLES

If any of the following essential variables are changed, the welder using the new procedure shall be requalified:

1. A change from one welding process to another welding process or combination of processes, as follows:
    a. A change from one welding process to a different welding process; or
    b. A change in the combination of welding processes, unless the welder has qualified on separate qualification tests, using each of the welding processes that are to be used for the combination of welding processes.
2. A change in the direction of welding from vertical uphill to vertical downhill or vice versa.
3. A change of filler-metal classification from Group 1 or 2 to Group 3, or from Group 3 to Group 1 or 2 (see Table 1of API 1104 IBR).
4. A change from one outside diameter group to another. These groups are defined as follows:
    a. Outside diameter less than 2.375 in. (60.3 mm).
    b. Outside diameter from 2.375 in. (60.3 mm) through 12.750 in. (323.9 mm).
    c. Outside diameter greater than 12.750 in. (323.9 mm).

5. A change from one wall thickness group to another. These groups are defined as follows:
    a. Nominal pipe wall thickness less than 0.188 in. (4.8 mm).
    b. Nominal pipe wall thickness from 0.188 in. (4.8 mm) through 0.750 in. (19.1 mm).
    c. Nominal pipe wall thickness greater than 0.750 in. (19.1 mm).
6. A change in position from that for which the welder has already qualified (for example, a change from rolled to fixed or a change from vertical to horizontal or vice versa).
7. A change in the joint design (for example, the elimination of a backing strip or a change from V bevel to U bevel).

Note: The utility has no pipe greater than 12.750" in outside diameter and has no pipe with a wall thickness greater than 0.500".

For information on actual test procedures including: tensile tests, nick-break tests, and root bend tests, please see section D.

The type and number of samples for destructive testing of butt welds shall be as follows:

Table 1

Table 3—Type and Number of Butt-weld Test Specimens per Welder for Welder Qualification Test and Destructive Testing of Production Welds

Outside Diameter of Pipe		Number of Specimens					
Inches	Millimeters	Tensile Strength	Nick-Break	Root Bend	Face Bend	Side Bend	Total
Wall Thickness ≤ 0.500 in. (12.7 mm)							
< 2.375	< 60.3	0	2	2	0	0	4[a]
2.375 – 4.500	60.3 – 323.9	0	2	2	0	0	4
> 4.500 – 12.750	> 114.3 – 323.9	2	2	2	0	0	6
> 12.750	> 323.9	4	4	2	2	0	12
Wall Thickness > 0.500 in. (12.7 mm)							
≤ 4.500	≤ 114.3	0	2	0	0	2	4
> 4.500 – 12.750	> 114.3 – 323.9	2	2	0	0	2	6
> 12.750	> 323.9	4	4	0	0	4	12

[a]For pipe less than or equal to 1.315 in. (33.4 mm) in outside diameter, specimens from two welds or one full-section tensile-strength specimen shall be taken.

Multiple Qualification

Butt Welds

For qualification on multiple pipe welding procedures, the welder shall successfully complete the following two tests.

Test one shall be a butt weld made in the position from the horizontal plane or inclined plane up to 45°. The type of pipe used shall have an outside diameter of at least 6.625" and a wall thickness of at least 0.219". However, the welder shall only be qualified for diameters up to and including the diameter submitted for testing up to a maximum of 12.75". The samples shall be considered acceptable if they pass visual inspection and destructive testing.

For a weld to be considered acceptable under a visual examination, the weld shall not contain any of the following: cracks, inadequate penetration, and burn through. Also, the undercutting depth of the weld adjacent to the final bead shall not be more than 1/32" or 12.5% of the pipe wall thickness and there shall not be more than 2" of undercutting in any continuous 12" length of weld.

See Table 1 for the type and number of test specimens of butt welds.

See section D of this manual for information on the test procedures including: location of coupons, acceptability requirements for tensile tests, nick-break tests, root, face or side bend tests.

Branch Welds

The second test shall include the welder laying out, cutting, fitting, and welding a full-sized fillet connection. The pipe used shall have at least an outside diameter of 6.625" and a nominal wall thickness of 0.250". A full-size hole shall be cut in the main and a weld being made with the main in a horizontal position and the branch-pipe extending down vertically from the run as seen in figure 3.

The finished weld shall be neat and uniform. The weld shall exhibit complete penetration around the entire circumference. The root beads shall not contain burn through of more than a ¼". Additionally, the total amount of burn throughs in any 12" continuous weld shall not exceed ½".

Four nick break samples shall be removed from the weld as shown in "FILLET WELD TEST LOCATIONS Fig. 9."

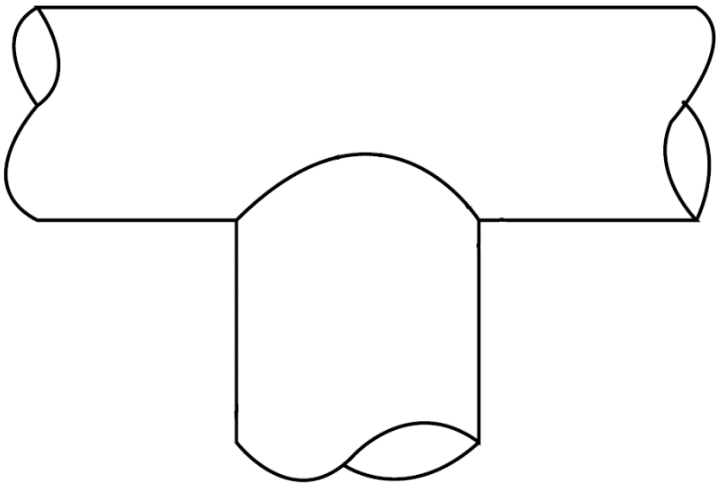


Figure 3. Down Tee

LIMITATIONS OF MULTIPLE QUALIFICATION

A welder who has successfully completed the butt-weld qualification test described above on pipe with an outside diameter *greater than or equal to 12.750 in*. and a full-size branch-connection weld on pipe with an outside diameter greater than or equal to 12.750 in. shall be qualified to weld in all positions (including rolled); on all wall thicknesses, joint designs, and fittings; and on all pipe diameters.

A welder who has successfully completed the butt-weld and branch connection requirements above on pipe with an outside diameter *less than 12.750 in.* shall be qualified to weld in all positions(including rolled); on all wall thicknesses, joint designs, and fittings; and on all pipe outside diameters less than or equal to the outside diameter used by the welder in the qualification tests.

CONTINUATION OF QUALIFICATION UNDER API 1104 IBR

Welders who have been qualified in accordance with API Std. 1104 (incorporated by reference, see § 192.7) may keep qualifications current by submitting for testing one butt weld on pipe with an outside diameter of at least 4.5" O.D. with a wall thickness of at least 0.237". This test must be completed twice each calendar year in periods not to exceed 7 ½ months. Testing shall be radiographic in accordance with

section 9 of API Std. 1104 (incorporated by reference, see § 192.7) or destructive in accordance with section D of this manual.

Alternatively, welders may continue qualifications by having a production weld tested in accordance with section 9 of API Std 1104 (incorporated by reference, see § 192.7) within the preceding 7 1/2 months but at least twice a year.

SECTION D. API 1104 IBR QUALIFICATION TESTING FOR WELDERS

GENERAL

The purpose of the welder qualification test is to determine the ability of welders to make sound butt or fillet welds using previously qualified procedures. Before any production welding is performed, welders shall be qualified according to the applicable requirements of Section C of this manual (either Single or Multiple Qualification method).

It is the intent of this Section that a welder who satisfactorily completes the procedure qualification test described below is a qualified welder within the limits of the essential variables listed in Section C of this manual, provided the number of test specimens required by Section C of this manual have been removed, tested, and meet the acceptance criteria of this section for each welder.

Prior to starting the qualification tests, the welder shall be allowed reasonable time to adjust the welding equipment to be used. The welder shall use the same welding technique and proceed with the same speed they will use if they pass the test and are permitted to do production welding. The qualification of welders shall be conducted in the presence of a representative acceptable to the company.

Details on where each test sample should be taken from can be found in Figs. 8 & 9. Sample welds shall be air-cooled. For pipes smaller than 1.315" in diameter the entire pipe section can be used for root bend and nick break samples.

A welder who qualifies without backing is qualified to weld with backing but not vice versa.

IN-SERVICE WELDER TESTING

For the purpose of this manual IN-SERVICE WELDING is defined as any pipe that fails the CHECK FOR HIGH FLOW as described in Section F. If the HIGH FLOW conditions cannot be mitigated by either:

1. Lowering the pressure or,
2. Lowering the flow rate

Then a welder qualified in accordance with API 1104 IBR "APPENDIX B—IN-SERVICE WELDING" will make the welding using IN-SERVICE WELDING procedures found in Section F of this manual or other IN-SERVICE WELDING procedures qualified in accordance with API 1104 IBR "APPENDIX B—IN-SERVICE WELDING"

The following tests details are taken from API 1104 IBR Sections 5 and 6.

TENSILE TEST

Test samples for use in a tensile strength test shall be approximately 9" long by 1" wide and may be made by either machine cut or oxygen cut. The sides may not be notched and shall be parallel. If necessary, the specimens shall be machined so that the sides are smooth and parallel. Do not remove the cap or root.

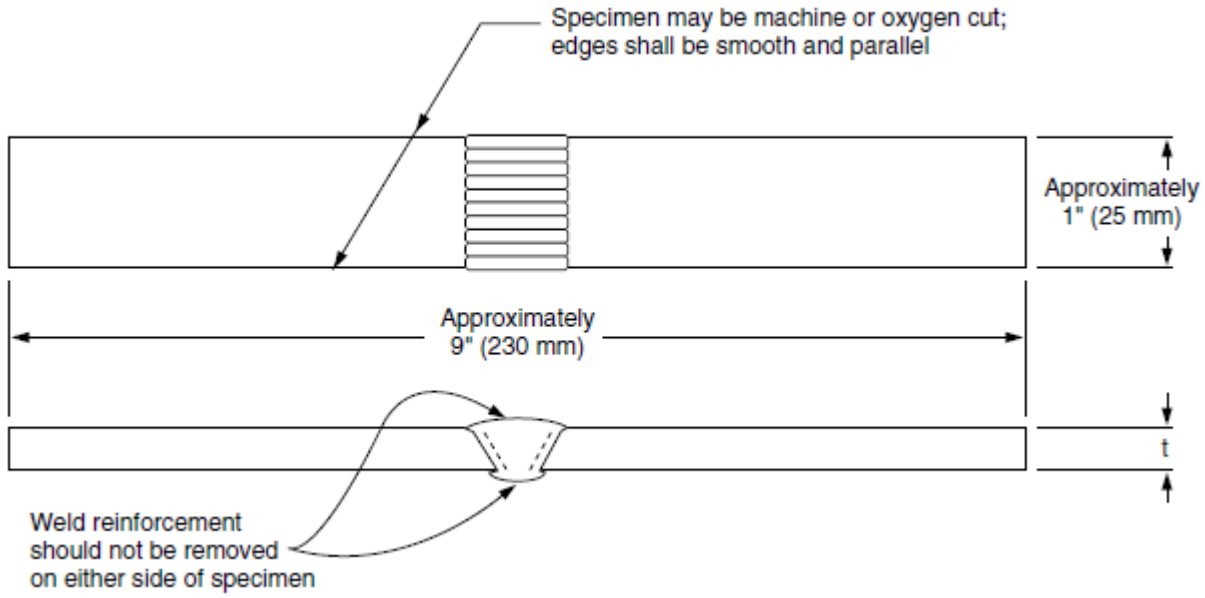


Figure 4—Tensile Test Specimen

The tensile-strength test specimens shall be broken under tensile load using equipment capable of measuring the load at which failure occurs. The tensile strength shall be computed by dividing the maximum load at failure by the smallest cross-sectional area of the specimen, as measured before the load is applied. However, for the purpose of welder qualification, it is not necessary to calculate the tensile strength of the coupons. The tensile strength test may even be omitted, in which case the specimens designated for the test shall be subjected to the Nick-break test.

NICK-BREAK TEST

Test samples for use in a nick-break strength test shall be approximately 9" long by 1" wide and may be made by either machine cut or oxygen cut. Each sample shall be notched on each side at the center of the weld to a depth of 1/8".

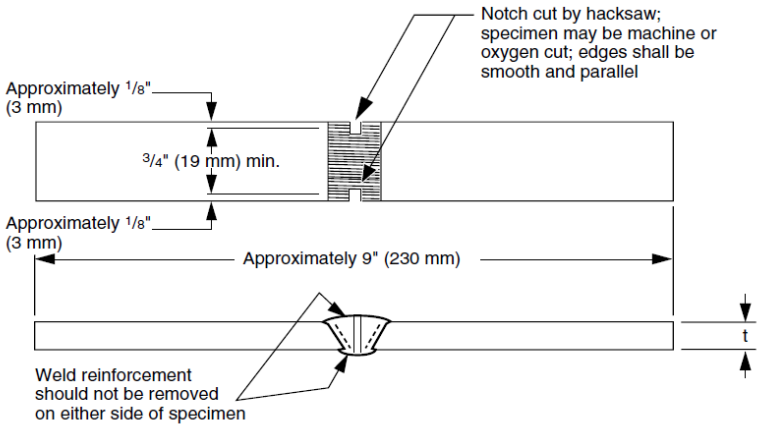


Figure 5—Nick-break Test Specimen

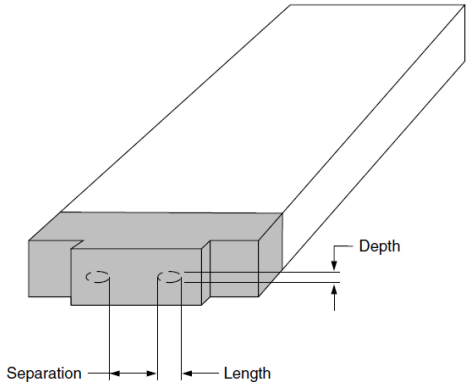
The samples shall be broken by either a tensile machine, or supporting the ends and hitting the center with a hammer, or supporting one end and hitting the other with a hammer to create a crack at least ¾" wide.

The sample may also be broken by securing one end in a vice with the root even with the jaws; an axial force can then be applied to break the sample at the notches.

A sample passes the nick-bend test if the specimen shows complete penetration and fusion.

No gas pocket shall exceed 1/16" and the total amount of gas pockets shall not exceed 2% of the total area.

Slag inclusions shall be no more than 1/32" deep or 1/8" in length or one-half the nominal wall thickness in length, whichever is smaller. At least ½" should separate the slag inclusions.

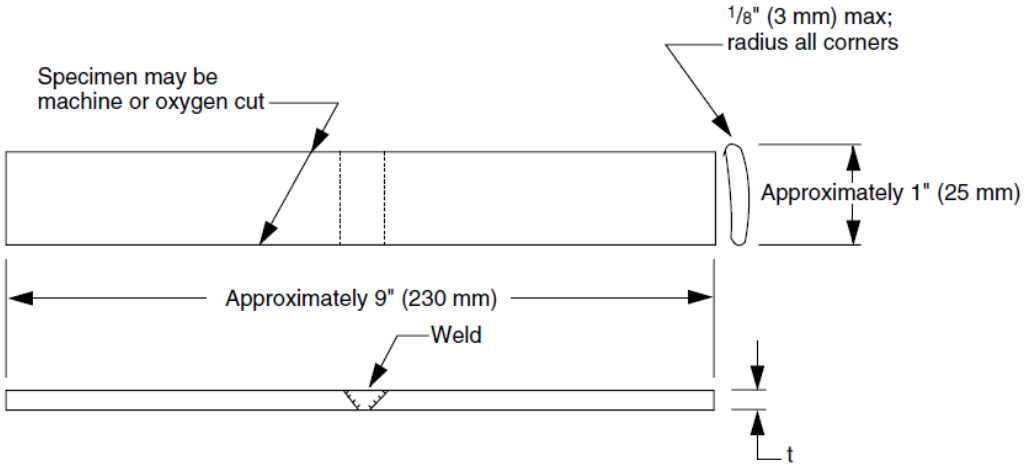


Note: A broken nick-break test specimen is shown; however, this method of dimensioning applies also to broken tensile and fillet weld test specimens.

Fig. 6 Dimensions of Imperfections of Exposed Weld Surface

ROOT AND FACE-BEND TEST

Test samples for use in a Root or Face Bend Test shall be approximately 9" long by 1" wide with rounded corners and may be made by either machine cut or oxygen cut.



Note: The weld reinforcement shall be removed from both faces with the surface of the specimen. The specimen shall not be flattened prior to testing.

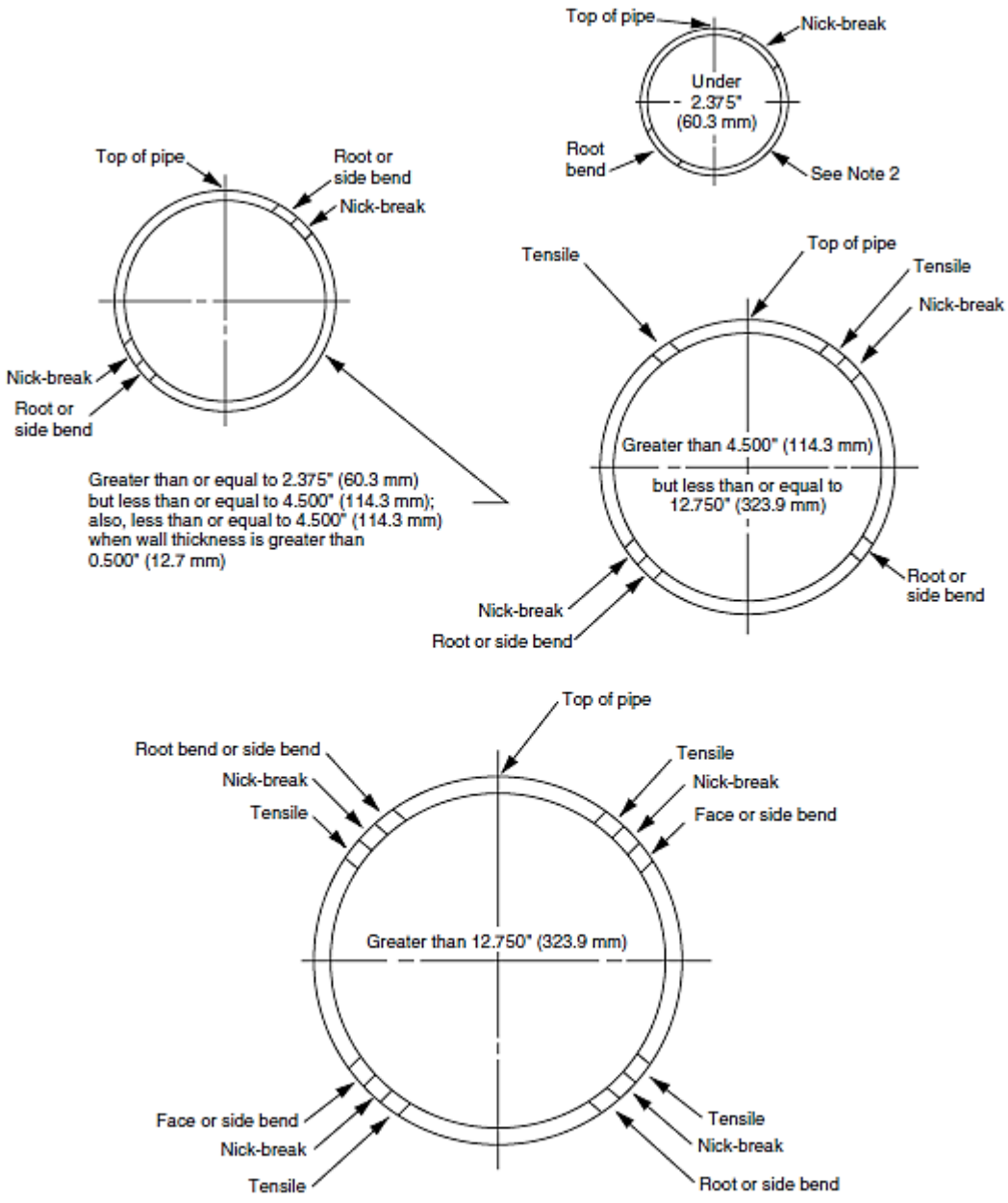
Fig. 7 Root and Face Bend Test Sample: Wall Thickness ≤ .500 in.

For wall thicknesses greater than .500 in. the sample shall be subject to a side bend (consult API 1104 Incorporated by Reference §192.7)

The root- and face-bend specimens shall be bent in a guided-bend test jig as shown I n Section C Fig. 2. Each specimen shall be placed on the die with the weld at mid span. Face-bend specimens shall be placed with the face of the weld toward the gap, and root-bend specimens shall be placed with the root of the weld toward the gap. The plunger shall be forced into the gap until the curvature of the specimen is approximately U-shaped.

The weld is acceptable if no crack or imperfection greater than 1/8" or ½ the wall thickness is present. Cracks starting at the outside of the sample that are less than ¼" shall not be considered unless an imperfection exists.

BUTT WELD TEST LOCATIONS



Notes:
1. At the company's option, the locations my be rotated, provided they are equally spaced around the pipe; however, specimens shall not include the longitudinal weld.
2. One full-section tensile-strength specimen may be used for pipe with an outside diameter less than or equal to 1.315 in. (33.4 mm).

Fig. 8 Test Sample Locations

FILLET WELD TEST LOCATIONS

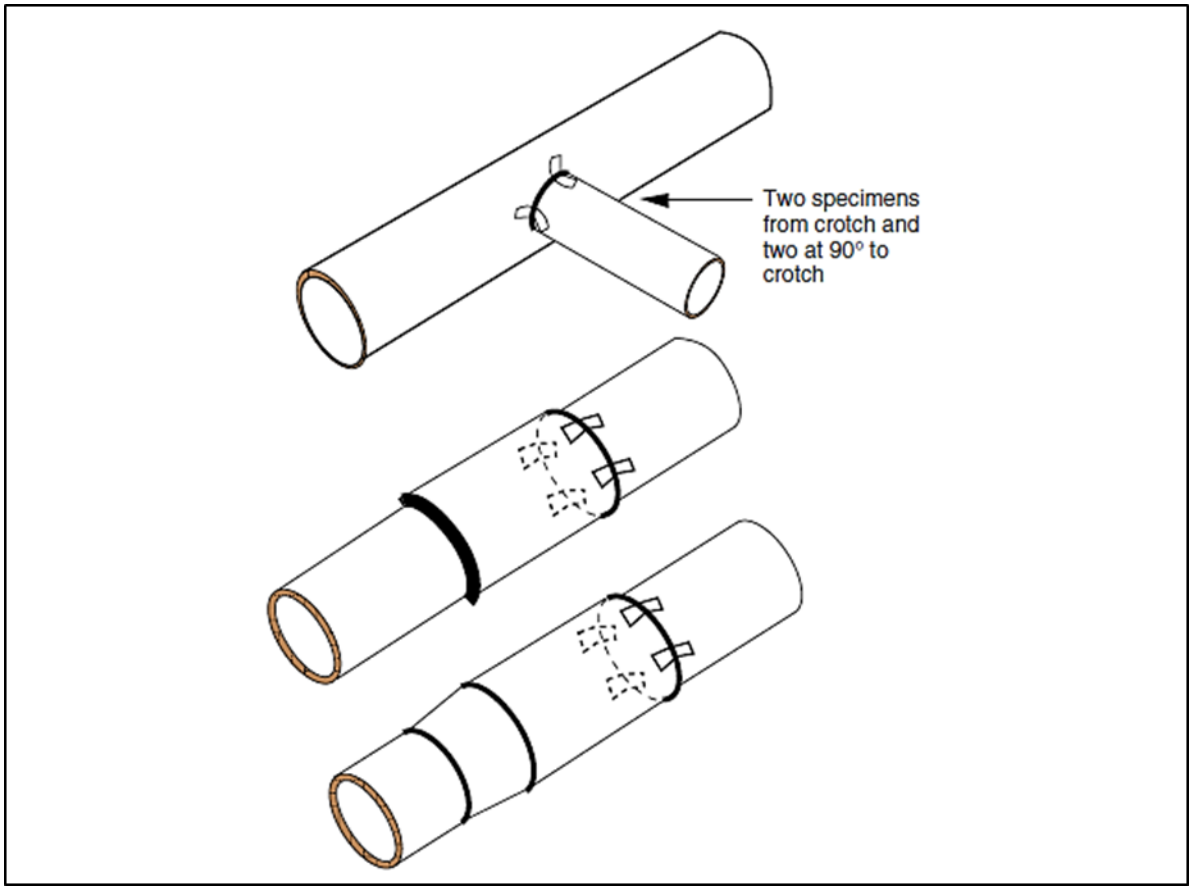


Figure 9

Note: This figure shows the location of test specimens for joints with an outside diameter greater than or equal to 2.375 in. For joints with an outside diameter less than 2.375 in. specimens shall be cut from the same general location, but two specimens shall be removed from each of two test welds.

SECTION E. WELDING PROCEDURE QUALIFICATION (192.225)

Any welding procedure used on the utility's piping not described in the standard procedure specifications in the following section (F) or not qualified by others must become qualified.

(a) Welding must be performed by a qualified welder or welding operator in accordance with welding procedures qualified under section 5, section 12, Appendix A or Appendix B of API Std 1104 (incorporated by reference (IBR), see § 192.7), or section IX of the ASME Boiler and Pressure Vessel Code (ASME BPVC) (incorporated by reference, see § 192.7) to produce welds meeting the requirements of this subpart. The quality of the test welds used to qualify welding procedures must be determined by destructive testing in accordance with the applicable welding standard(s).

(b) Each welding procedure must be recorded in detail, including the results of the qualifying tests. The record must contain the information found in Figure 2 from API 1104 IBR (See Appendix B of this Manual) This record must be retained by the company and followed whenever the procedure is used.

Changes in essential welding variables represent a change in welding procedure. This requires that the new welding procedure be established and qualified as outlined in API 1104 IBR Section 5.

The following is a list of essential variables that require a change in welding procedure:

1. Weld Process
2. Base Material
3. Joint Design
4. Weld Position
5. Wall Thickness
6. Filler Metal
7. Electrical Characteristics
8. Time Between Passes
9. Direction of Welding
10. Shielding Gas and Flow Rate
11. Shielding Flux
12. Speed of Travel
13. Preheat
14. Post heat treatment

SECTION F. WELDING PROCEDURES (192.225)

REQUIREMENTS

All welds shall be made under the procedure for the process, pipe size, and wall thickness of the pipe being installed. For each change in variable, a different procedure shall be used. The following pages list different types of welds and the detailed processes used in each that have been adopted by the gas utility.

The following procedures have been qualified and tested in accordance with API 1104 IBR and shall be used by anyone welding on the gas system. Other procedures may be used as long as they have been examined and approved by the gas utility and a copy of the qualification tests have been provided as well for file.

The following procedures have been adopted by the utility from either the Iowa Association of Municipal Utilities-Model Gas Distribution Pipeline Welding Procedures Manual or Qualified by Utility Safety and Design Inc.

Copies of the procedure qualifying tests are available upon request.

SECTION F. PRODUCTION WELDING PROCEDURES

STANDARD PROCEDURE SPECIFICATION NO. A-1

For Arc Welding of Steel Pipe and Fittings

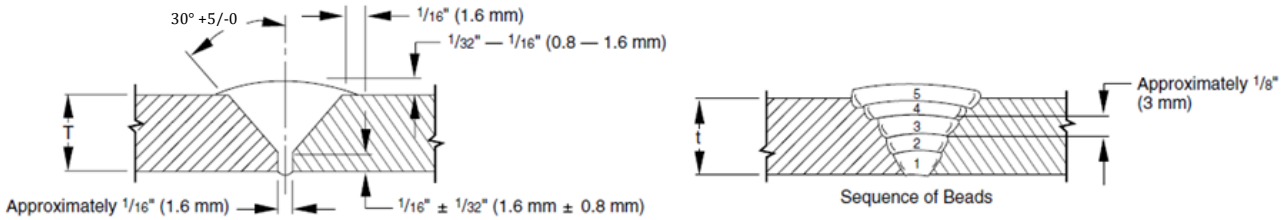
Less than 2-3/8" 0.D. and Less than 3/16" Wall Thickness

A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: group P-1 carbon steel -- API 1104 grade B through X42

C. Diameter and Wall Thickness: less than 2-3/8" O.D. and less than 3/16" wall thickness

D. Joint Design: single "V" groove, 60° included angle (30° bevel + 5° - 0°) alternate designs are shown in Section F. "STANDARD END PREPARATIONS"



E. Filler Metal and Number of Beads: electrodes E6010, E7010, or other group 1 filler metals per API-1104, table 1, AWS specification A5.1 or 5.5.

WALL THICKNESS	ROD SIZE	MIN. NO. OF BEADS
.125 -.187	3/32" or 1/8" (ANY PASS)	3

F. Electrical Characteristics: welding current D.C. reverse polarity, electrode positive.

ROD SIZE	***AMPERES/ELECTRODE***		***VOLTAGE/ELECTRODE***	
	E 6010	**E 7010**	**E 6010**	**E 7010**
3/32"	40-75	50-90	22-26	22-26
1/8"	90-120	90-120	24-28	24-28

STANDARD PROCEDURE SPECIFICATION NO. A-1

Page2

G. Position: Fixed

H. Direction of welding: downhill

I. Number of Welders: one

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: external

L. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must be completed before removal of the clamp. (See API 1104, 2

M. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

N. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required.

O. Shielding Gas and Flow Rate: (N/A)

P. Shielding Flux: (N/A)

Q. Speed of travel: 5 to 15 inches per minute

STANDARD PROCEDURE SPECIFICATION NO. A-2

For Arc Welding of Steel Pipe and Fittings

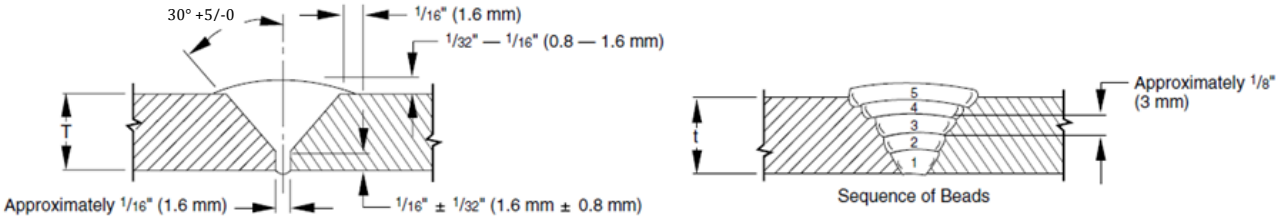
2-3/8" through 12-3/4" O.D. and 3/16" to 3/4" Wall Thickness (Nominal Pipe Sizes 2" - 12")

A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: group P-1 carbon steel - API 1104 grade B through X42

C. Diameter and Wall Thickness: 2-3/8" through 12-3/4" 0.D. and 3/16" to 3/4" wall thickness

D. Joint Design: single “V” groove, 60o included angle (30o bevel + 5o- 0o) alternate designs are shown in Section F. “STANDARD END PREPARATIONS”



E. Miller Metal and Number of Beads: electrodes E6010, E7010, or other group 1 filler metals per API 1104, table I , AWS specification A5.1 or 5.5

	ROD SIZE				
WALL THICKNESS	***3/32"***	***1/8"***	***5/32"***	***3/16"***	***MIN. NO. OF BEADS***
.188 - .249	ANY PASS		FILL OR CAP ONLY		3
.250 - .343	ANY PASS		FILL OR CAP ONLY		4
.344 - .436	ANY PASS		FILL OR CAP ONLY		5
.437 - .561	ANY PASS		FILL OR CAP ONLY		6
. 562 - .687	ANY PASS		FILL OR CAP ONLY		7
.688 - .750	ANY PASS		FILL OR CAP ONLY		8

STANDARD PROCEDURE SPECIFICATION NO. A-2

Page 2

F. Electrical Characteristics: welding current D.C. reverse polarity. Electrode positive

	AMPERES/ ELECTRODE		***VOLTAGE/ ELECTRODE***	
ROD SIZE	**E 6010**	**E 7010**	**E 6010**	**E 7010**
3/32"	40-75	50-90	22-26	22-26
l/8"	90-120	90-120	22-28	22-28
5/32"	110-160	110-160	24-30	24-30
3/16"	140-190	140-190	28-32	28-32

G. Position: Fixed

H. Direction of Welding: downhill

I. Number of Welders: One

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: external

L. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must be completed before removal of the clamp. (API 1104 IBR 7.3 use of lineup clamp for butt welds.)

M. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

STANDARD PROCEDURE SPECIFICATION A-2
Page 3

N. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required.

O. Shielding Gas and Flow Rate: (N/A)

P. Shielding Flux: (N/A)

Q. Speed of travel: 5 to 15 inches per minute

STANDARD PROCEDURE SPECIFICATION NO. A-3

For Arc Fillet Welding of Steel Pipe and Fittings Less than 3/16" Wall Thickness

A. Process: manual shield metal arc weld (SMAW)

B. Material Specification: group P-1 carbon steel - API I 104 grade B through X42

C. Wall Thickness Group: all branch diameters with less than 3/16" wall thickness

D. Joint Design: Fillet

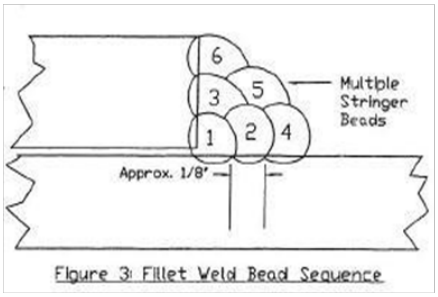


Figure 3: Fillet Weld Bead Sequence

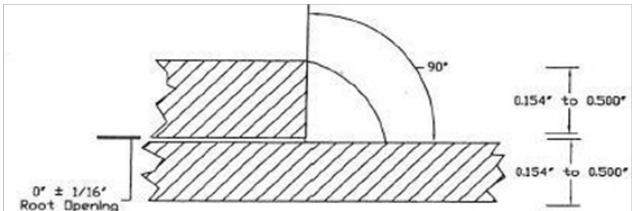


Figure 4: Fillet Weld Demension

E. Filler Metal and Number of Beads: electrodes E6010, E7010, or other group 1 filler metals per API 1l04, table I, AWS specification A5.1 or 5.5. The first two beads (stringer & hot pass) shall be made with 3/32" electrodes. Additional beads shall be made with l/8" electrodes. At least three passes shall be made.

F. Electrical Characteristics: welding current D.C. reverse polarity, electrode positive

	AMPERES/ELECTRODE	***VOLTAGE/ELECTRODE***
ROD SIZE	E 6010	E 6010
3/32”	40-75	22-26
1/8”	75-120	24-28

G. Position: Fixed

H. Direction of welding: downhill

I. Number of Welders: one

STANDARD PROCEDURE SPECIFTCATION NO. A-3

Page2

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: external

R. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must he completed before removal of the clamp. (API 1104 IBR 7.3 use of lineup clamp for butt welds.)

L. Cleaning: All rust dirt, and foreign matter shall be removed from bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

M. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required

N. Shielding Gas and Flow Rate: (N/A)

O. Shielding Flux: (N/A)

P. Speed of naval: 5 to 15 inches per minute

STANDARD PROCEDURE SPECIFICATION NO. A-4

For Arc Fillet Welding of Steel Pipe and Fittings 3/16" to 3/4" Wall Thickness

A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: group P-1 carbon steel -- API 1104 grade B through X42

C. Wall Thickness Group: all branch diameters with 3/16" to 3/4" wall thickness

D. Joint Design: fillet

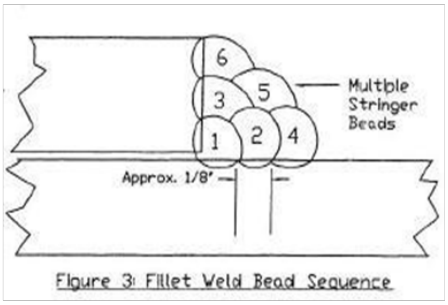


Figure 3: Fillet Weld Bead Sequence

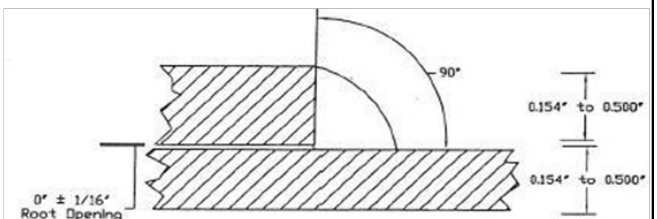


Figure 4: Fillet Weld Demension

E. Filler Metal and Number of Beads: electrodes E6010, E7010, or other group 1 filler metals per API1104, table I, AWS specification A5.1 or 5.5

	ROD SIZE				
WALL THICKNESS	**3/32"**	**1/8"**	**5/32"**	**3/16"**	**MIN. NO. OF BEADS**
.188 - .249	ANY PASS		FILL OR CAP ONLY		3
.250 - .343	ANY PASS		FILL OR CAP ONLY		4
.344 - .436	ANY PASS		FILL OR CAP ONLY		5
.437 - .561	ANY PASS		FILL OR CAP ONLY		6
.562 - .687	ANY PASS		FILL OR CAP ONLY		7
.688 - .750	ANY PASS		FILL OR CAP ONLY		8

STANDARD PROCEDURE SPECIFICATION NO. A-4

Page2

F. Electrical Characteristics: welding current D.C. reverse polarity, electrode positive

	AMPERES/ ELECTRODE		***VOLTAGE/ ELECTRODE***	
ROD SIZE	**E 6010**	**E 7010**	**E 6010**	**E 7010**
3/32"	40-75	50-90	22-26	22-26
l/8"	90-120	90-120	22-28	22-28
5/32"	110-160	110-160	24-30	24-30
3/16"	140-190	140-190	28-32	28-32

G. Position: Fixed

H. Direction of Welding: downhill

I. Number of Welders: one

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: external

S. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must be completed before removal of the clamp. (API 1104 IBR 7.3 use of lineup clamp for butt welds.)

L. Cleaning: All must, di rt. and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity or the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding hall be done in the rain unless suitable protection is provided.

M. Preheat. Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the

STANDARD PROCEDURE SPECIFICATION NO. A-4

Page 3

weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re- form. Post-heat, Stress relief is not required.

N. Shielding Gas and Flow Rare: (N/A)

O. Shielding Flux: (N/A)

P. Speed of travel: 5 to 15 inches per minute

STANDARD PROCEDURE SPECIFICATION NO. A-5

For Arc Welding of Steel Pipe and Fittings

2-3/8" O.D. and .154" Wall Thickness

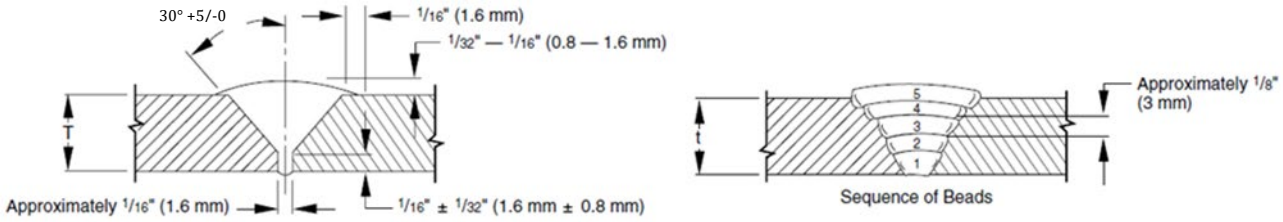
(Nominal Pipe Sizes 2" - Schedule 40)

A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: group P-1 carbon steel - ASTM A53 grade B: API5L; API5LX; or materials of similar physical chemical properties

C. Diameter and Wall Thickness: 2-3/8" diameter and 0.154" wall thickness (2" – Schedule 40 Pipe)

D. Joint Design: single "V" groove, 60° included angle (30° bevel + 5° - 0°) alternate designs are shown in Section F. "STANDARD END PREPARATIONS"



E. Filler Metal and Number of Beads: electrodes E 6010 or other group 1filler metals per API 1104, table 1, AWS specification A5.1 or 5.5

WALL THICKNESS	ROD SIZE	MIN. NO. OF BEADS
.154	3/32" or 1/8" (ANY PASS)	3

F. Electrical Characteristics: welding current D.C. reverse polarity, electrode positive

	AMPERES/ELECTRODE	***VOLTAGE/ELECTRODE***
ROD SIZE	**E 6010**	**E 6010**
3/32"	40-75	22-26

1/8"	75-120	24-28

STANDARD PROCEDURE SPECIFICATION NO. A-5

Page2

G. Position: Fixed

H. Direction of Welding: downhill

I. Number of Welders: one

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: external Removal of Line-up Clamp: Uniformly spaced root bead segments co the circumference must be completed before removal of the clamp. Section 5.3.2.11)

L. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started: the bevel surface includes that area on the inside of the pipe in immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux smoke, and weld splatter.

M. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re- form. Post-heat, Stress relief is not required.

N. Shielding Gas and Flow Rate: (N/A)

O. Shielding Flux: (N/A)

P. Speed of travel: 5 to 15 inches per minute

Tested: Jeff Mitchell – CWT Welder: Mike Dummctt

Kirkwood Community College

Adopted: _____ Location: Kirkwood Comm. College

NOTE: (A-6 Welding Procedure Not Adopted by {ENTER UTILITY NAME})

STANDARD PROCEDURE SPECIFICATION NO. A-7

For Arc Welding of Steel Pipe and Fittings

2-3/8" Pipe Diameters and Larger and 0.188" thru 0.750" Wall Thickness

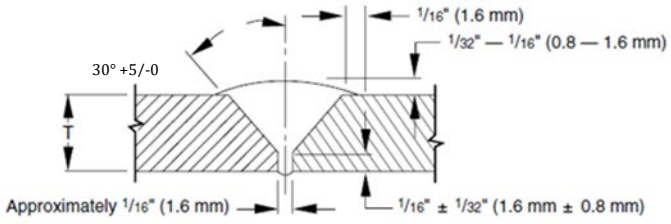
(Nominal Pipe Sizes 2" and Larger)

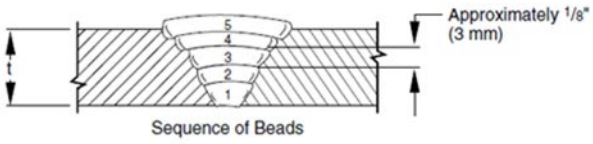
A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: API Specification 5L grades greater than X42 thru X60 or specifications having similar mechanical and chemical properties. Fitting material shall conform to greater than ASTM Grade Y-42/F-42 thru Y-60/F-60.

C. Diameter and Wall Thickness: All pipes with outside diameters of 2-3/8 inches and larger. Applies to pipes with wall thicknesses of 0.188-inch to and including 0.750-inch.

D. Joint Design: Single "V" groove, 60o included angle (30o bevel + 5o- 0o), alternate designs are shown in Section F. "STANDARD END PREPARATIONS"





E. Filler Metal and Number of Beads: Electrodes E6010, E7010, or other Group 1 filler metals per API 1104, Table I, AWS Specification A5.1 or 5.5. All root passes shall conform to AWS classification E6010. The remaining passes shall conform to AWS classification E7010.

WALL THICKNESS	***ROD SIZE***				
	3/32"	**1/8"**	**5/32"**	**3/16"**	**MIN. NO. OF BEADS**
.188 - .249	ANY PASS		FILL OR CAP ONLY		3
.250 - .343	ANY PASS		FILL OR CAP ONLY		4
.344 - .436	ANY PASS		FILL OR CAP ONLY		5

.437 - .561	ANY PASS	FILL OR CAP ONLY	6
.562 - .687	ANY PASS	FILL OR CAP ONLY	7
.688 - .750	ANY PASS	FILL OR CAP ONLY	8

STANDARD PROCEDURE SPECIFICATION NO. A-7

Page 2

F. Electrical Characteristics: welding current D.C. reverse polarity. Electrode positive

	AMPERES/ ELECTRODE		***VOLTAGE/ ELECTRODE***	
ROD SIZE	**E 6010**	**E 7010**	**E 6010**	**E 7010**
3/32"	40-75	50-90	22-26	22-26
l/8"	90-120	90-120	22-28	22-28
5/32"	110-160	110-160	24-30	24-30
3/16"	140-190	140-190	28-32	28-32

G. Position: Fixed

H. Direction of Welding: Downhill

I. Number of Welders: Two welders should be used on 16 inches and larger outside diameter pipe.

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: External

T. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must be completed before removal of the clamp. (API 1104 IBR 7.3 use of lineup clamp for butt welds.)

L. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

STANDARD PROCEDURE SPECIFICATION NO. A-7

Page 3

M. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required

N. Shielding Gas and Flow Rate: (N/A)

O. Shielding Flux: (N/A)

P. Speed of Travel: 4 to 15 inches per minute

STANDARD PROCEDURE SPECIFICATION NO. A-8

For Arc Fillet Welding of Steel Pipe and Fittings

0.188" thru 0.750" Wall Thickness

A. Process: manual shielded metal arc weld (SMAW)

B. Material Specification: API Specification 5L grades greater than X42 thru X60 or specifications having similar mechanical and chemical properties. Fitting material shall conform to greater than ASTM Grade Y-42/F-42 thru Y-60/F-60.

C. Wall Thickness Group: All branch and sleeve diameters with 0.188-inch wall thickness up to and including 0.750-inch.

D. Joint Design: Fillet, See Figure Below

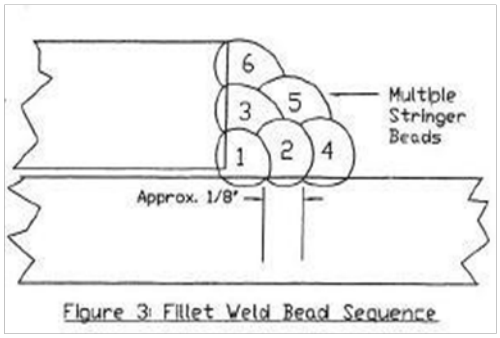


Figure 3: Fillet Weld Bead Sequence

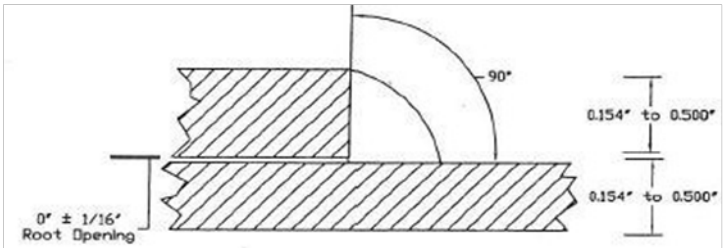


Figure 4: Fillet Weld Demension

E. Filler Metal and Number of Beads: Electrodes E6010, E7010, or other Group 1 filler metals per API 1104, Table I , AWS Specification A5.1 or 5.5. All root passes shall conform to AWS classification E6010. The remaining passes shall conform to AWS classification E7010.

STANDARD PROCEDURE SPECIFICATION NO. A-8

Page 2

	ROD SIZE				
WALL THICKNESS	**3/32"**	**1/8"**	**5/32"**	**3/16"**	**MIN. NO. OF BEADS**
.188 - .249	ANY PASS		FILL OR CAP ONLY		3
.250 - .343	ANY PASS		FILL OR CAP ONLY		4
.344 - .436	ANY PASS		FILL OR CAP ONLY		5
.437 - .561	ANY PASS		FILL OR CAP ONLY		6
. 562 - .687	ANY PASS		FILL OR CAP ONLY		7
.688 - .750	ANY PASS		FILL OR CAP ONLY		8

F. Electrical Characteristics: Welding current D.C. reverse polarity. Electrode positive

	AMPERES/ ELECTRODE		***VOLTAGE/ ELECTRODE***	
ROD SIZE	**E 6010**	**E 7010**	**E 6010**	**E 7010**
3/32"	40-75	50-90	22-26	22-26
l/8"	90-120	90-120	22-28	22-28
5/32"	110-160	110-160	24-30	24-30
3/16"	140-190	140-190	28-32	28-32

G. Position: Fixed

H. Direction of Welding: Downhill

I. Number of Welders: Two welders should be used on 16 inches and larger outside diameter pipe.

STANDARD PROCEDURE SPECIFICATION NO. A-8

Page 3

J. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

K. Type of Line-up Clamp: External

U. Removal of Line-up Clamp: Uniformly spaced root bead segments covering at least 50 percent of the circumference must be completed before removal of the clamp. (API 1104 IBR 7.3 use of lineup clamp for butt welds.)

L. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

M. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required

N. Shielding Gas and Flow Rate: (N/A)

O. Shielding Flux: (N/A)

P. Speed of Travel: 4 to 15 inches per minute.

STANDARD PROCEDURE SPECIFICATION NO. GMA-P1

For Gas Metallic Arc Welding of Steel Pipe and Fittings

Less than 2-3/8" O.D. and Less than 3/16" (0.188) Wall Thickness Grade B – X42

Through

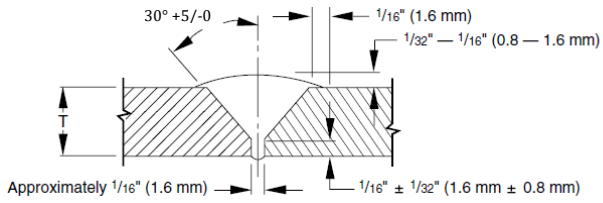
Equal to and greater Than 2-3/8" O.D. and ≤ ¾" (0.750) Wall Thickness Grade B – X60

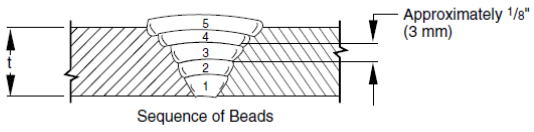
A. Process: Gas Metallic Arc Welding (GMAW)

B. Material Specification: group P-1 carbon steel – API 5L for O.D.s < 2.375" with a SMYS of ≤ X42; and for O.D.s ≥ 2.375" – 12.750" with a SMYS of X42 - X60.

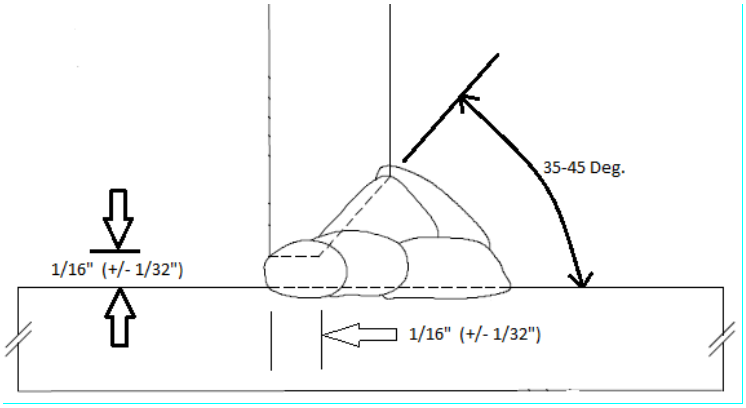
C. Diameter and Wall Thickness: < 2-3/8" O.D. and less than .188" Wall Thicknesses; and ≥2.375" - 12.750" O.D. and wall thickness .189" - .750".

D. Joint Design: single "V" groove, 60° included angle (30° bevel + 5° - 0°) with or without backing; alternate designs are shown in Section F. "STANDARD END PREPARATIONS".





E. Joint Design: Full Penetration Fillet Weld (Branch)



SPECIFICATION NO. GMA-P1
Page 2

WALL THICKNESS	***ELECTRODE SIZE***	***MIN. NO. OF BEADS***
.109 -.187	0.035" (ALL PASSES)	2
.188 - .321	0.035" (ALL PASSES)	3
.322 - .406	0.035" (ALL PASSES)	4
.406 - .438	0.035" (ALL PASSES)	5
.439 - .594	0.035" (ALL PASSES)	6
.595 - .688	0.035" (ALL PASSES)	7
.689 - .750	0.035" (ALL PASSES)	8

F. Filler Metal and Number of Beads: single electrodes ER70S-6; ER80S-D2, or other group 5 filler metals per API-1104 IBR, Table 1—Filler Metal Groups, AWS specification A5.18 or A5.28

G. Electrical Characteristics:

a. Welding Current: D.C.

b. Reverse Polarity, (Electrode Positive)

c. Electrode Wire Feed Speed Range: 160 – 210 in/min

d. Mode of Transfer: Short Circuit

SIZE	AMPERES/ELECTRODE		VOLTAGE/ELECTRODE	
0.035"	ER 70S-6	ER80S-D2	ER 70S-6	ER80S-D2
	90 - 140	90 - 140	17 - 22	17 - 22

H. Position: Fixed or Rolled

I. Direction of welding: Downhill

J. Number of Welders: One Welder for O.D.s ≤ 10.750"

SPECIFICATION NO. GMA-P1
Page 3

K. Time Lapse between Passes: The second pass shall follow the root bead within 5 minutes except when UNAVOIDABLE circumstances prevail which make this requirement impractical; in this case the weld will be preheated to 250° F prior to starting the hot pass. Additional weld passes shall be started within 5 minutes of the previous weld. The complete weld shall be finished within 8 hours or before the end of the work day.

L. Type of Line-up Clamp: None Required; when used either External or Internal

M. Removal of Line-up Clamp: Root bead equally spaced around the circumference of the pipe segment; remove EXTERNAL-AFTER 10% (fabrication) & 50%(line pipe) of the root pass is completed and INTERNAL-AFTER 100% of the root pass if conditions make it difficult to prevent movement

N. Cleaning: All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started; the bevel surface includes that area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. Holes must be cleaned with ice picks or chisels. The finished weld and immediately adjacent pipe surface must be cleaned of all flux, smoke, and weld splatter. No welding shall be done in the rain unless suitable protection is provided.

O. Preheat, Stress Relief: Preheat shall be required when the ambient temperature or metal temperature is below 50°F. The minimum preheat temperature is 250°F for 3" on both sides of the weld. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form. Post-heat, Stress relief is not required.

P. Shielding Gas and Flow Rate: 100% CO2; 25-45 CFH

Q. Shielding Flux: (N/A)

R. Speed of travel: 2 to 14 inches per minute

S. Technique: Both Stringer or Weave

T. Orifice or Gas Cup: 1/4", 3/8" or 1/2" diameter gas nozzle

U. Contact Tube to Work Distance: 3/8" – 5/8"

V. Initial and Interpass Cleaning: Grinding and power wire brushing

IN-SERVICE WELDING PROCEDURES

In-service welding, also known as Low Hydrogen welding, can be any welding performed on a pipeline or pressure piping system that contain gas under static or flowing conditions, see section D. IN-SERVICE WELDER TESTING of this manual for the definition of IN-SERVICE WELDING.

Burn- through and hydrogen induced cracking are major concerns when performing in-service welding.

In-service welding requires the use of Low Hydrogen welding electrodes and an additional welder qualification test specific to the welding procedure, see section D. IN-SERVICE WELDER TESTING.

Any electrodes which have been exposed to moisture shall not be used for in-service welding applications.

CHECK FOR HIGH-FLOW

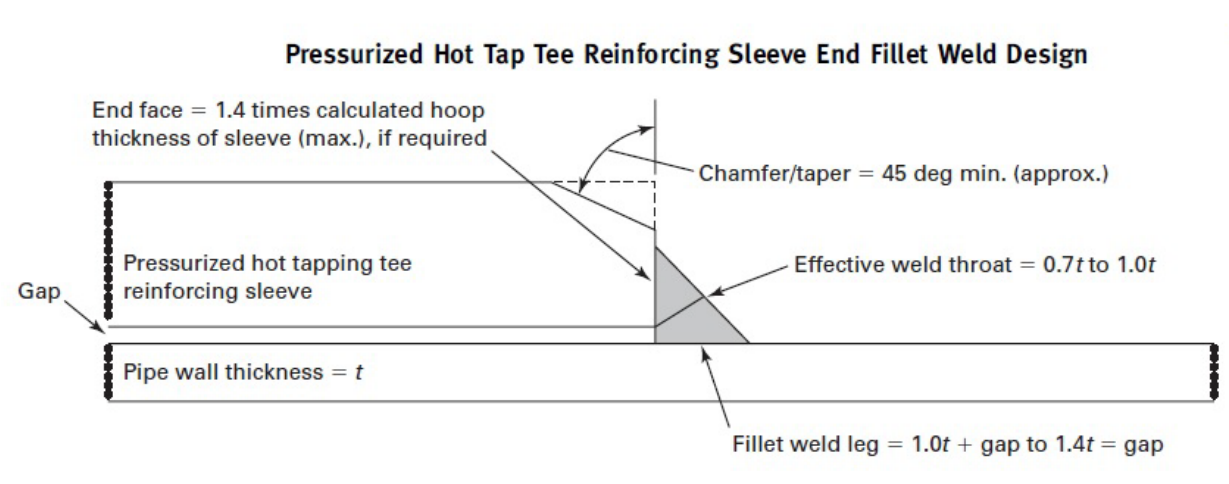
In order to determine if an In-Service Welding Procedure should be used, the welder should first measure the surface temperature of the pipe using a contact thermometer or infrared temp. gun. Then the welder should preheat the entire circumference of the pipe in the area where welding is to be performed to a minimum of 200 degrees F and a maximum of 500 degrees F. Using the same tool determine if the surface temperature of the pipe returns to its initial temperature or "cools out" within 4 minutes, this would indicate HIGH FLOW and if the conditions cannot be mitigated the weld must be made with an approved In- Service Welding Procedure.

If the surface temperature of the pipe stays above its initial temperature after 4 minutes, then the welder may use cellulose coated electrodes as allowed in an alternative welding procedure.

TAPPING AND REINFORCING SLEEVE WELD DESIGN

When encountering thin wall pipe applying a larger than necessary fillet weld applied to the sleeve ends can place undue stress on the toe of the weld leading to a crack, in these instances fillet welds applied to the sleeve end and carrier pipe should have leg lengths a minimum of 1.0 x the thickness of the carrier pipe

plus the gap and a maximum of 1.4 times the thickness of the carrier pipe plus the gap. The un-welded portion of the sleeve end should chamfered/tapered to conform with the figure below.



In-Service Welding Procedure Specification

IN-SERVICE BRANCH PROCEDURE (LOW HYDROGEN)

Weld Process

Shielded Metal Arc Welding (SMAW) process – API Standard 1104, 20th edition, October 2005, including errata/addendum (July 2007) and errata 2 (2008), Appendix B

Base Material

- The pipe and branch material shall conform to API-5L, less than Grade X65.
- This procedure shall apply for pipe, branch, or fittings with a maximum allowable carbon equivalency (CEIIW) less than or equal to 0.50% as calculated per API 1104 Appendix B.

Pipeline Operating Conditions

For in-service welds, the weld cooling rate, due to the flow rate of the natural gas contained in the pipeline, constitutes an essential variable. This procedure applies to all flow rates.

Wall Thickness

This procedure applies to pipe and branches of all pipe diameters and wall thicknesses.

Joint Design

- The branch ends shall be beveled to the standard 30° to 37 ½° bevel with 1/16" root face, specified in Figure 1.

- The branch weld is a full penetration fillet weld.

Heat Input Range

The heat input range is specified for each electrode in Table 1. For the branch weld, the minimum heat input is 28 kJ/inch and the maximum is 63 kJ/inch. Heat Input (kJ/in) = (Amps X Volts X 60)/ (Travel Speed(in/min) X 1000)

Filler Metal

- Filler metal for branch welds shall conform to AWS classification E7018 for all passes (IS- Branch).

Electrode Size and Number of Beads

The electrode size and minimum number of beads is specified in Table 1 for branch welds.

Electrical Characteristics

Electrodes and electrical characteristics are specified in Table 1. The welding current used shall be direct current. The pipe and branch shall be negative and the electrode positive (reverse polarity).

Weld Position

The pipe is to be in a fixed position during welding. The procedure is for all welding positions.

Line-up Equipment

Line-up equipment such as a chain load binder is not required to hold the branch in place.

Direction of Welding

- Branch welds shall proceed upward from bottom center or any side of the pipe to the top of the pipe, as well as across the top of the pipe, when using normal low-hydrogen electrodes.
- For outside diameter pipe sizes 16-inches or larger, two welders working simultaneously and on opposite sides of the pipe shall be used to complete branch welds. Minimum of three (3) beads are required for these welds.
- When two welders are not used, the branch weld must be completed on one side of the pipe before starting the welding on the opposite side of the pipe.

Travel Speed

Weld travel speeds are specified in Table 1 and are not to be exceeded.

Time Between Weld Passes

The time between completion of the root bead pass and the start of the second bead shall not exceed five minutes. All welds should be welded continuously without interruption until they are completed.

Cleaning of Pipe and Weld

All rust, dirt, oil, moisture, and foreign material shall be removed from the bevel or branch weld surfaces before welding is started. Stringer bead stops shall be feathered by grinding. Scale and slag shall be removed from each bead and groove before starting the next bead. Power tools shall be used when called for. The finished weld must be cleaned and all splatter removed from adjacent pipe surface.

Preheat/Post heat

Preheating/Post heating shall be used when applicable to reduce the likelihood of hydrogen cracking.

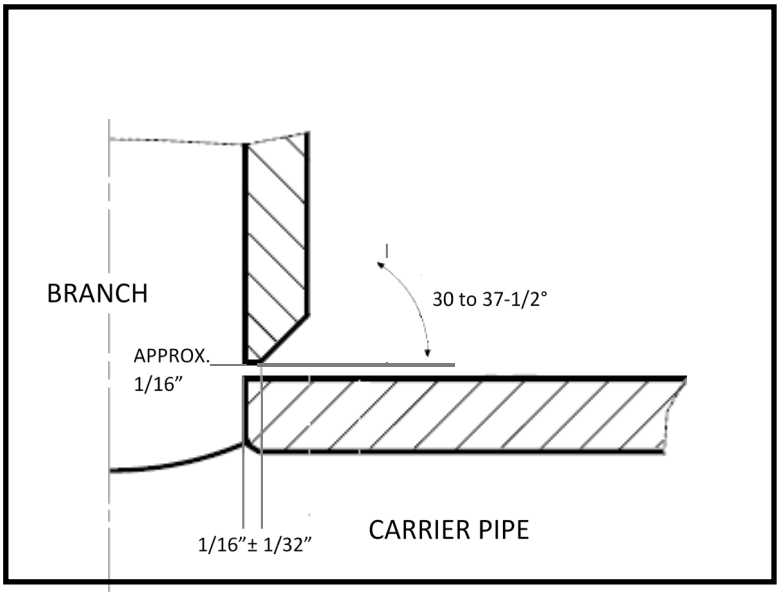


Figure 1 – Standard Branch Weld Joint

Table 1- Electrode and Electrical Characteristics						
Bead	**Electrode Size (in)**	**Electrode Type**	**Voltage Range**	**Amperage Range**	**Min. Heat Input (kJ/in)**	**Travel Speed (in/min)**
Root	3/32	E7018	20-30	70-110	15	2-6
Hot	3/32	E7018	20-30	70-110	20	2-6
Cover	3/32	E7018	20-30	70-110	20	2-6
	1/8	E7018	20-30	90-140	20	3-8

*A minimum of 3 beads are required for this weld.

In-Service Welding Procedure Specification

IN-SERVICE FILLET PROCEDURE (LOW HYDROGEN PROCEDURE)

WELD PROCESS

Shielded Metal Arc Welding (SMAW) process – API Standard 1104, Appendix B

BASE MATERIAL

- The pipe material shall conform to API-5L, less than Grade X65.
- The sleeve or fitting material shall conform to API-5L, less than Grade X65 or to ASTM specifications having similar mechanical and chemical properties.
- This procedure shall apply for pipe, sleeve, or fittings with a maximum allowable carbon equivalency (CEIIW) less than or equal to 0.50% as calculated per API 1104 Appendix B.

PIPELINE OPERATING CONDITIONS

For in-service welds, the weld cooling rate, due to the flow rate of the natural gas contained in the pipeline, constitutes an essential variable. This procedure applies to all flow rates.

WALL THICKNESS

This procedure applies to pipe and sleeves of all pipe diameters and wall thicknesses. For in- service fillet welds, pipe wall thickness is not an essential variable.

JOINT DESIGN

- Sleeve girth ends shall be cut (0° bevel) for fillet welding, specified in Figure 1 of this procedure.

HEAT INPUT RANGE

The heat input range is specified for each electrode in Table 1. For the sleeve end fillet weld, the minimum heat input is 28 kJ/inch and the maximum is 63 kJ/inch. Heat Input (kJ/in) = (Amps X Volts X 60)/ (Travel Speed(in/min) X 1000)

FILLER METAL

- Filler metal for fillet welds shall conform to AWS classification E7018 for all passes (IS- Fillet).

ELECTRODE SIZE AND NUMBER OF BEADS

The electrode size and minimum number of beads is specified in Table 1 of this procedure for fillet welds.

ELECTRICAL CHARACTERISTICS

Electrodes and electrical characteristics are specified in Table 1 of this procedure. The welding current used shall be direct current. The pipe and sleeve shall be negative and the electrode positive (reverse polarity).

WELD POSITION

The pipe is to be in a fixed position during welding. The procedure is for all welding positions.

LINE-UP EQUIPMENT

Line-up equipment such as a chain load binder is required to align and hold the sleeve halves in place during side seam welding. Sleeve halves shall fit tight to the pipe. Line-up equipment can be removed prior to the start of the end fillet welds.

DIRECTION OF WELDING

- Side seam welds shall be completed before the first end fillet weld is started.
- Fillet welds shall proceed upward from bottom center or any side of the pipe to the top of the pipe, as well as across the top of the pipe, when using normal low-hydrogen electrodes.
- The second end fillet weld shall only be started after the first end fillet weld has been completed.
- For outside diameter pipe sizes 16-inches or larger, two welders working simultaneously and on opposite sides of the pipe shall be used to complete end fillet welds. Minimum of three (3) beads are required for these welds.

TRAVEL SPEED

Weld travel speeds are specified in Table 1 below and are not to be exceeded.

TIME BETWEEN WELD PASSES

The time between completion of the root bead pass and the start of the second bead shall not exceed five minutes. All welds should be welded continuously without interruption until they are completed.

CLEANING OF PIPE AND WELD

All rust, dirt, oil, moisture, and foreign material shall be removed from the bevel or fillet weld surfaces before welding is started. Stringer bead stops shall be feathered by grinding. Scale and slag shall be removed from each bead and groove before starting the next bead. Power tools shall be used when called for. The finished weld must be cleaned and all splatter removed from adjacent pipe surface.

PREHEAT/POST HEAT

Preheating/Post heating shall be used when applicable to reduce the likelihood of hydrogen cracking.

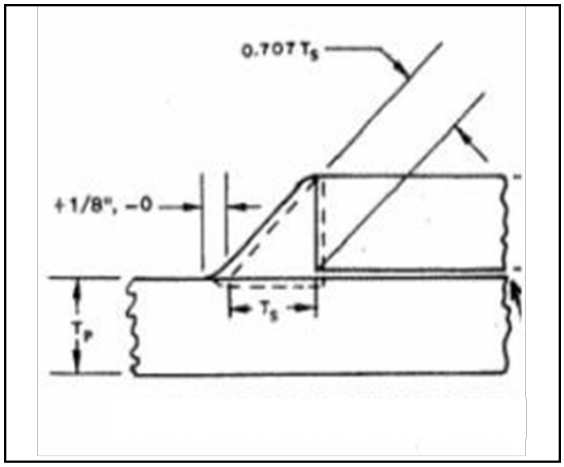


Figure 1 – Standard Fillet Weld Joint

Table 1- Electrode and Electrical Characteristics

Bead	Electrode Size (in)	Electrode	Voltage Range	Amperage	Min. Heat Input (kJ/in)	Travel Speed (in/min)
Root	3/32	E7018	20-30	70-110	15	2-6
Cover	3/32	E7018	20-30	70-110	20	2-6
	1/8	E7018	20-30	90-140	20	3-8

*A minimum of 3 beads are required for this weld.

In-Service Welding Procedure Specification

IN-SERVICE LONG SEAM 1 (LOW HYDROGEN)

WELD PROCESS

Shielded Metal Arc Welding (SMAW) process – API Standard 1104, Appendix B

BASE MATERIAL

- The pipe material shall conform to API-5L, less than Grade X65.
- The sleeve and fitting material shall conform to API-5L, less than Grade X65 or to ASTM specifications having similar mechanical and chemical properties.
- This procedure shall apply for pipe, sleeve, or fittings with a maximum allowable carbon equivalency (CEIIW) less than or equal to 0.50% as calculated per API 1104 Appendix B.

PIPELINE OPERATING CONDITIONS

For in-service welds, the weld cooling rate, due to the flow rate of the natural gas contained in the pipeline, constitutes an essential variable. This procedure applies to all flow rates.

WALL THICKNESS

This procedure applies to pipe and sleeves of all pipe diameters and wall thicknesses.

JOINT DESIGN

- Side Seam ends shall be beveled to the standard 30° to 37 ½° bevel with 1/16” root face, specified in Figure 1.
- Backing strips fit to the sleeve internal diameter are not required for this procedure if side seam welds do not contact the line pipe.

HEAT INPUT RANGE

The heat input range is specified for each electrode in Table 1. For the sleeve long seam weld, the minimum heat input is 28 kJ/inch and the maximum is 63 kJ/inch. Heat Input (kJ/in) = (Amps X Volts X 60)/ (Travel Speed(in/min) X 1000)

FILLER METAL

- Filler metal for side seam welds shall conform to AWS classification E6010 (penetration to carrier pipe prohibited) for root pass only.
- All remaining weld passes for side seams welds shall be completed with filler metal that conforms to AWS classification E7018.

ELECTRODE SIZE AND NUMBER OF BEADS

The electrode size and minimum number of beads is specified in Table 1 for long seam welds.

ELECTRICAL CHARACTERISTICS

Electrodes and electrical characteristics are specified in Table 1. The welding current used shall be direct current. The pipe and sleeve shall be negative and the electrode positive (reverse polarity).

WELD POSITION

The pipe is to be in a fixed position during welding. The procedure is for all welding positions.

LINE-UP EQUIPMENT

Line-up equipment such as a chain load binder is required to align and hold the sleeve halves in place during side seam welding. Sleeve halves shall fit tight to the pipe. In most situations, line-up equipment shall not be removed until the root bead is at least 25-50% complete with only the length under the chain not welded.

DIRECTION OF WELDING

- Side seam welds shall be welded first. For outside diameter pipe sizes 16-inches and larger, two welders, one on each side, shall weld the side seams simultaneously.
- Side seam welds shall proceed end to end or from any point to the other end horizontally.
- Side seam welds shall be completed before the first end fillet weld is started.
- Minimum of three (3) beads are required for these welds.

TRAVEL SPEED

Weld travel speeds are specified in Table 1 and are not to be exceeded.

TIME BETWEEN WELD PASSES

The time between completion of the root bead pass and the start of the second bead shall not exceed five minutes. All welds should be welded continuously without interruption until they are completed.

CLEANING OF PIPE AND WELD

All rust, dirt, oil, moisture, and foreign material shall be removed from the bevel or fillet weld surfaces before welding is started. Stringer bead stops shall be feathered by grinding. Scale and slag shall be removed from each bead and groove before starting the next bead. Power tools shall be used when called for. The finished weld must be cleaned and all splatter removed from adjacent pipe surface.

PREHEAT/POST HEAT

Preheating/Post heating shall be used when applicable to reduce the likelihood of hydrogen cracking.

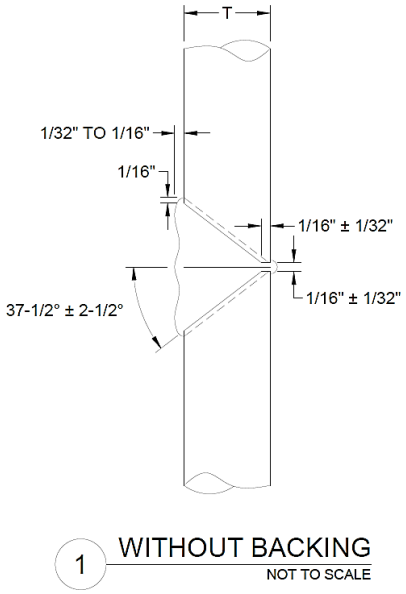


Figure 1 – Standard Side Seam Weld Joint without Backing

Table 1- Electrode and Electrical Characteristics

Bead	Electrode Size (in)	Electrode	Voltage Range	Amperage	Min. Heat Input (kJ/in)	Travel Speed (in/min)
Root	3/32	E6010	20 – 30	50 – 80	10	8 – 12
	1/8	E6010	20 – 30	75 – 125	10	
Hot Pass	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	
Fill/Stripper	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	
Cover	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	

*A minimum of 3 beads are required for this weld.

IN-SERVICE WELDING PROCEDURE SPECIFICATION

IN-SERVICE LONG SEAM 2 (LOW HYDROGEN PROCEDURE)

WELD PROCESS

Shielded Metal Arc Welding (SMAW) process – API Standard 1104, Appendix B

BASE MATERIAL

- The pipe material shall conform to API-5L, less than Grade X65.
- The sleeve and fitting material shall conform to API-5L, less than Grade X65 or to ASTM specifications having similar mechanical and chemical properties.
- This procedure shall apply for pipe, sleeve, or fittings with a maximum allowable carbon equivalency (CEIIW) less than or equal to 0.50% as calculated per API 1104 Appendix B.

PIPELINE OPERATING CONDITIONS

For in-service welds, the weld cooling rate, due to the flow rate of the natural gas contained in the pipeline, constitutes an essential variable. This procedure applies to all flow rates.

WALL THICKNESS

This procedure applies to pipe and sleeves of all pipe diameters and wall thicknesses.

JOINT DESIGN

- Side Seam ends shall be beveled to the standard 30° to 37 ½° bevel with 1/16" ± 1/32" root face, specified in Figure 2 Below.
- Backing strips fit to the sleeve internal diameter shall be used at side seam welds in contact with the line pipe. Backing strips shall be mild steel and sized according to sleeve manufacturer's specifications (Typically ¾" wide x 1/16" thick). Steel banding strap material is NOT allowed.

HEAT INPUT RANGE

The heat input range is specified for each electrode in Table 1. For the sleeve side seam weld, the minimum heat input is 28 kJ/inch and the maximum is 63 kJ/inch. Heat Input (kJ/in) = (Amps X Volts X 60)/ (Travel Speed(in/min) X 1000)

FILLER METAL

Filler metal for side seam welds shall conform to AWS classification E7018 (backing strips required).

ELECTRODE SIZE AND NUMBER OF BEADS

The electrode size and minimum number of beads is specified in Table 1 for low hydrogen side seam welds.

ELECTRICAL CHARACTERISTICS

Electrodes and electrical characteristics are specified in Table 1. The welding current used shall be direct current. The pipe and sleeve shall be negative and the electrode positive (reverse polarity).

WELD POSITION

The pipe is to be in a fixed position during welding. The procedure is for all welding positions.

LINE-UP EQUIPMENT

Line-up equipment such as a chain load binder is required to align and hold the sleeve halves in place during side seam welding. Sleeve halves shall fit tight to the pipe. In most situations, line-up equipment shall not be removed until the root bead is at least 25-50% complete with only the length under the chain not welded.

DIRECTION OF WELDING

- Side seam welds shall be welded first. For outside diameter pipe sizes 16-inches and larger, two welders, one on each side, shall weld the side seams simultaneously.
- Side seam welds shall proceed end to end or from any point to the other end horizontally.
- Side seam welds shall be completed before the first end fillet weld is started.
- Minimum of three (3) beads are required for these welds.

TRAVEL SPEED

Weld travel speeds are specified in Table 1 and are not to be exceeded.

TIME BETWEEN WELD PASSES

The time between completion of the root bead pass and the start of the second bead shall not exceed five minutes. All welds should be welded continuously without interruption until they are completed.

CLEANING OF PIPE AND WELD

All rust, dirt, oil, moisture, and foreign material shall be removed from the bevel or fillet weld surfaces before welding is started. Stringer bead stops shall be feathered by grinding. Scale and slag shall be removed from each bead and groove before starting the next bead. Power tools shall be used when called for. The finished weld must be cleaned and all splatter removed from adjacent pipe surface.

PREHEAT/POST HEAT

Preheating/Post heating shall be used when applicable to reduce the likelihood of hydrogen cracking.

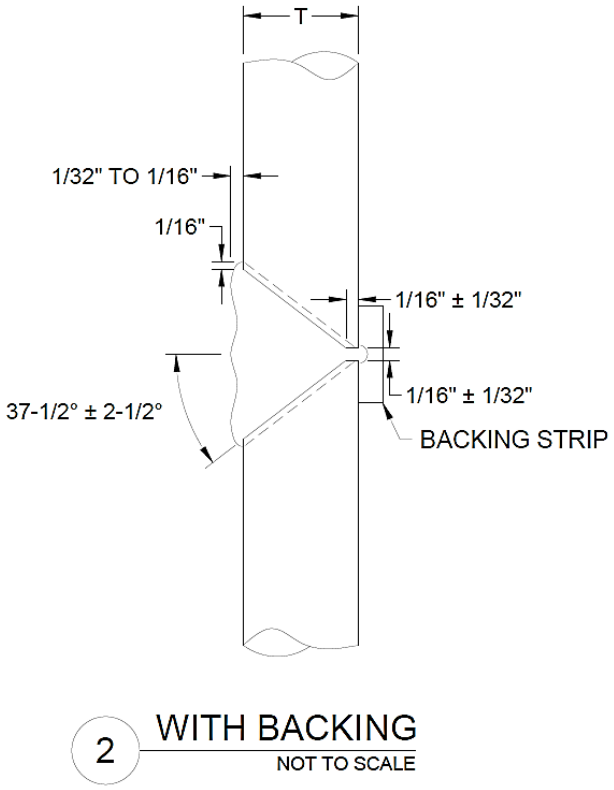


Figure 2 – Standard Side Seam Weld Joint with Backing

Table 1- Electrode and Electrical Characteristics

Bead	*Electrode Size (in)*	*Electrode Type*	*Voltage Range*	*Amperage Range*	*Min. Heat Input (kJ/in)*	*Travel Speed (in/min)*
Root	3/32	E7018	20 – 30	70 – 110	15	2 – 6
	1/8	E7018	20 – 30	90 – 140	15	
Hot Pass	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	
Fill/Stripper	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	
Cover	3/32	E7018	20 – 30	70 – 110	20	3 – 8
	1/8	E7018	20 – 30	90 – 140	20	

*A minimum of 3 beads are required for this weld.

ALIGNMENT OF ABUTTING ENDS

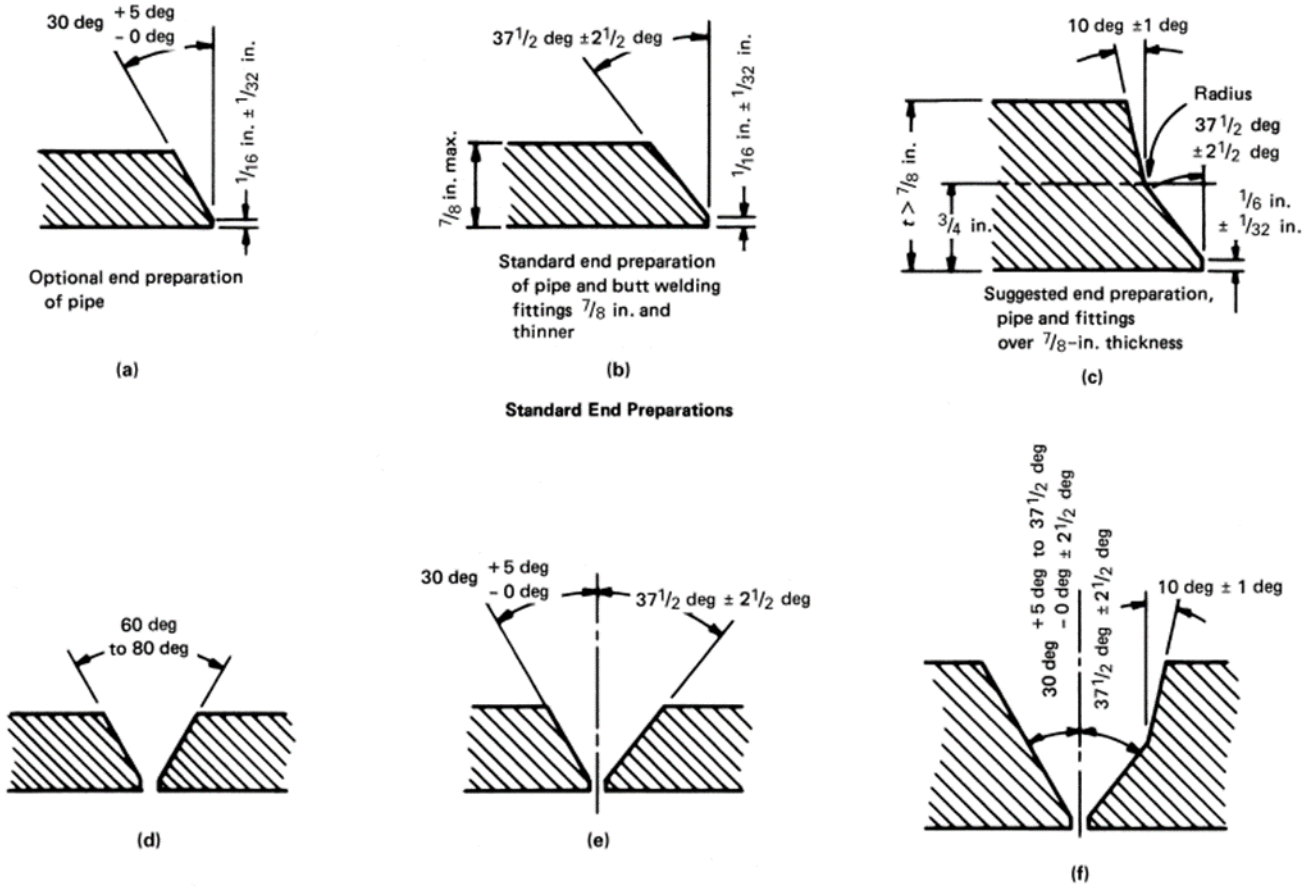
The alignment of the abutting ends shall be such as to minimize the offset between surfaces. For pipe of the same nominal wall thickness, the offset shall not exceed 1/16". Hammering of the pipe to obtain proper lineup shall be held to a minimum. Prior to welding, all rust and scale shall be removed from the bevel ends, and the bevel ends shall be cleaned to bright metal. Welds shall not be cooled with water. All pipe ends, whether prepared in the mill or field, shall be beveled to specifications as shown below.

When pipe is welded above ground, adequate working clearance shall be provided. Sixteen inches (16") is the recommended height. When the pipe is welded in the trench, the bell hole shall be of sufficient size to provide the welder(s) ready access to the joint.

WHEN WELDING, ALL SAFETY RULES SHALL BE STRICTLY FOLLOWED AND PROPER PROTECTIVE EQUIPMENT SHALL BE USED AT ALL TIMES.

STANDARD END PREPARATIONS

End preparations shall conform to the Welding Procedure Specification (WPS)



END PREPARATION FOR BUTT WELDING SECTIONS HAVING UNEQUAL THICKNESS

GENERAL

The sketches on the following page illustrate acceptable preparations for joining pipe ends by butt-welding for materials having unequal wall thickness or with unequal specified minimum yield strengths (SMYS).

Sharp notches or grooves at the edge of the weld where it joins a slanted surface are prohibited. The maximum thickness tD for design purposes shall not be greater than 1.5t.

INTERNAL DIAMETERS UNEQUAL

If the nominal wall thickness of the adjoining ends do not vary more than 3/32" no special treatment is necessary, provided full penetration and bond is accomplished in welding. See sketch (2) the following page.

Where the nominal internal offset is more than 3/32" the transition must be made by a taper cut on the inside of the thicker section. See sketch (3) on the following page. The taper shall not be less than 14° nor more than 30°.

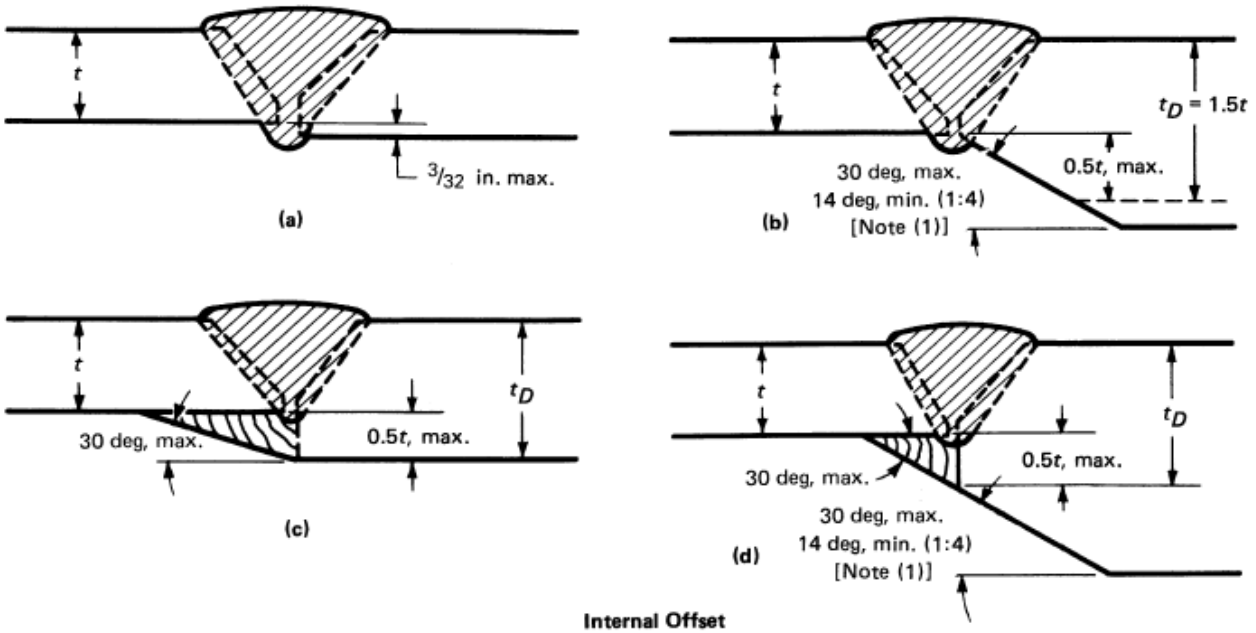
EXTERNAL DIAMETERS UNEQUAL

Where the external offset does not exceed one-half (1/2) the thinner section, the transition may be made by welding provided the angle of rise of the weld surface does not exceed 30° and both bevel edges are properly fused. See sketch (6) on the following page.

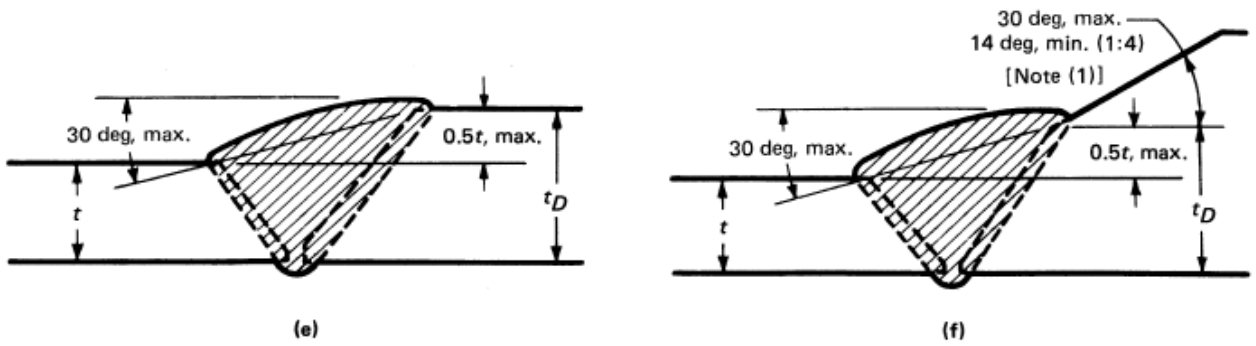
Where there is an external offset exceeding one-half (1/2) the thinner section, that portion of the offset over ½ shall be tapered. See sketch (7) on the following page.

INTERNAL AND EXTERNAL DIAMETERS UNEQUAL

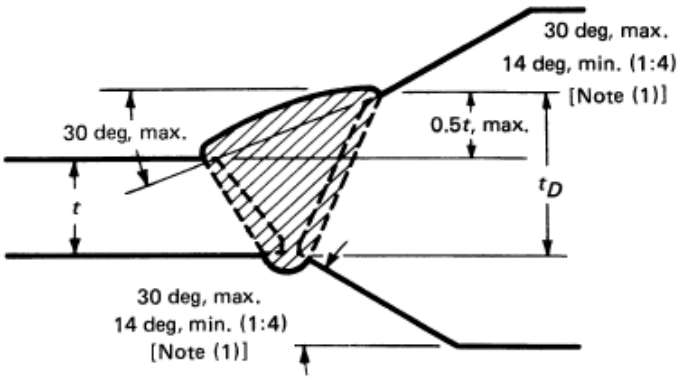
Where there is both an internal and an external offset, the joint design shall be a combination of the procedures (a) – (f), see sketch (8) on the following page. Particular attention must be paid to proper alignment under these conditions.



Internal Offset



External Offset



(g) Combination Offset

NOTE:
(1) No minimum when materials joined have equal specified minimum yield strengths.

Sketch (8)

MINIMUM WALL THICKNESS FOR USE WITH STANDARD PIPE FITTINGS

If the wall thickness of the pipe (not due to metal loss) is less than that shown below, the ends of the standard weight fittings shall be machined to the dimensions shown or special thin wall fittings shall be used.

End preparation shall be in accordance with Sketch (8) above.

2.375" O.D. = 0.064" W.T.

3.500" O.D. = 0.125" W.T.

4.500" O.D. = 0.156" W.T.

6.625" O.D. = 0.219" W.T.

8.625" O.D. = 0.250" W.T.

10.750" O.D. = 0.279" W.T.

12.750" O.D. = 0.312" W.T.

14.000" O.D. = 0.312" W.T.

16.000" O.D. = 0.312" W.T.

ARC WELDING REQUIREMENTS

Welds shall be made with the American Welding Society classification and diameter of welding rod listed in the procedure for the outside diameter and wall thickness of the pipe being installed.

Each bead shall be completed, and the scale and slag removed before starting the next bead. No two arc weld passes shall be started in the same location. The hot or filler passes shall immediately follow the stringer bead or first pass. The remaining passes should be completed as soon as possible. No weld shall remain uncompleted overnight.

SECTION G. WELDING CHECKLISTS AND FILLER MATERIALS

WELDING CHECKLIST

The following is a welding checklist. It shall be followed to produce quality welds. Additionally, all welding surfaces must be clean and free of any material detrimental to the weld. No welding shall be done in severe weather conditions unless care is taken to shield the process from the elements.

1. Welding Equipment
   a) What is the apparent mechanical condition of the equipment?
   b) Do meters and gauges hold calibrations?
   c) Are cables/hoses in good condition and not frayed, etc?
   d) Are ground clamps clean and capable of holding tight contact?
   e) Is the equipment the proper type for the process to be used?
   f) Has the equipment been well maintained?

2. Pipe and Fitting Material
   a) What is the general condition of the pipe and coating?
   b) Are the pipe ends round?
   c) Are there any apparent dents, grooves, etc. in the lengths?
   d) What is the condition of the weld bevel-clean, straight, etc.?
   e) Is there any coating material on or near the weld bevel?
   f) Is the welder lightly filing or grinding the weld bevel prior to beginning welding?

3. Diameter-Wall Thickness Group
   a) Is the pipe the proper size, grade, and wall thickness?

4. Joint Design
   a) Is the weld bevel in accordance with the appropriate design sketch for the process and type of weld?
   b) Is there an unacceptable mismatch of pipe fittings?
   c) Are the fittings counter bored, if required?
   d) Will back welding be required?

5. Filler Metal and Number of Beads
   a) Are the correct electrodes or rod being used?
   b) Are the electrodes new, or if previously opened are they in good usable condition and properly stored?
   c) Is the correct electrode or rod size being used for the proper bead?
   d) If low hydrogen electrodes are being used, are they being stored and used under the proper conditions?
   e) Is the weld cap or crown about the surface of the pipe weld, but not over 1/16” higher?
   f) Is the completed cap approximately 1/8” greater than the original weld groove width?

g) What is the general overall surface condition of the weld-any porosity, pinholes, cracks or aged appearance?

6. Electrical Characteristics
   a) Is the polarity of the electrode holder proper as required by the procedure?
   b) Are the ground claps of the approved type; are they clean and tightly fastened to prevent arc burns underneath?
   c) Are the proper amperages and voltages being used for the proper size and type of electrodes?

7. Pipe Position for Welding
   a) Is the pipe being welded in the proper position?
   b) Is the pipe being adequately supported?
   c) Does the method of support allow proper alignment?

8. Direction of Welding
   a) Are the welders welding in the proper direction per the procedure requirements?
   b) Are succeeding beads being started in new locations other than where the last bead was started?
   c) Are starts, stops and tacks being ground?
   d) Are the top and bottom buttons of a reasonable size or are they excessively mounded or wide?

9. Number of Welders for Stringer Bead
   a) Are the correct number of welders being used for the procedure?
   b) Are two or more welders starting their beads in the proper quadrants and at the same time, to avoid concentrated thermal stresses in regions opposite?

10. Time Lapse Between Passes
    a) Is the hot pass being installed immediately following the running of the stringer pass and its subsequent power grinding?
    b) The most important point to keep in mind in all pipe welding and particularly in the high yield pipe grades is that the weld area must be kept as hot as possible between installing the tacks, running the beads, removing the clamps and grinding and cleaning of the beads. It's a difficult point to control at times but the net result is high quality welds in all cases.

11. Type of Line-up Clamp
    a) Line-up clamps should be carefully inspected. They are one of the most important tools in welding, yet they are also the most abused.
    b) Do they fit tightly to maintain good joint fit-up?
    c) Do not allow excessive hammering of the pipe and clamps to achieve good lineup?
    d) The welder should obtain the proper type clamps or use wedges to achieve lineup. Otherwise, the pipe should be rejected if out of tolerance.

12. Removal of Line-up Clamp
    a) The line-up clamp must not be moved, even to readjust, once the stringer bead has been started.

13. Cleaning the Weld Beads or Passes
    a) Has the weld bevel been filed or ground to bright metal before beginning the weld?
    b) Always see that slag is removed from the weld pass before beginning the next bead.
    c) Always see that the stringer bead is cleaned using a power grinder, except only in those specific special procedures that advise not grinding in order to maintain the interpose temperatures.
    d) Always see that the completed weld has been power brushed to clean bright metal.

14. Preheat and Stress Relief
    a) The procedure always should be checked carefully to determine whether preheating of the weld area will be required.
    b) If preheat is required, the required temperature to be established must be determined by use of proper melting point "Tempilstik" temperature indicating crayons, or a direct reading pyrometer. Preheating may be accomplished by utilization of propane, natural gas or oxyacetylene fired torches or ring burners.
    c) When preheating car must be always taken to ensure that localized areas of overheating be prevented and conversely that other areas not be heated enough. The intent is to preheat the weld area to the required preheat temperature uniformly over the entire weld area.
15. Weather Conditions When Welding

    Depending on the welding process being utilized, weather conditions are extremely important factor influencing the quality of weld.

    a) Wind can cause may problems, such as porosity. If winds are excessive, then a wind- block of some type should be constructed to minimize any negative influence on the weld.
    b) No welds should be made in rain or snow without suitable protection.
    c) Preheating of the weld surface may be necessary if temperatures are below 50 degrees F.

HANDLING AND STORAGE OF FILLER MATERIALS

1. In order to ensure the quality level of completed welds it is most essential that all covered steel welding electrodes be properly handled and stored during use on the job.
2. Hydrogen can have an adverse effect on welds and is a prime factor in causing underbead cracking. A potential source of hydrogen is the moisture contained in electrode coverings. Therefore, it is essential that the absolute moisture in the covering be maintained at or near the same level as existed when the electrodes were packed in their original hermetically sealed container.
3. Electrodes in opened containers shall be protected. From the deterioration by the elements by storing them in suitable containers.
4. Particular caution must be exercised when using low hydrogen type electrodes (E-XX16 and E- XX18). Use only those electrodes that have been stored in their original, hermetically sealed packaging or immediately transferred to a proper container or rod oven.

After the seal on the original packaging has been broken, the electrodes must immediately be placed in special air tight containers or in heated dry rod ovens to prevent moisture absorption prior to use.

SECTION H. INSPECTION OF WELDS (192.241, 192.243)

§ 192.241 Inspection and test of welds.

All welds must be visually inspected an individual qualified by appropriate training and experience to ensure that:

1. The weld is performed in accordance with the qualified procedure
2. The acceptability of a weld that is nondestructively tested or visually inspected is determined according to the standards in section 9 or Appendix A of API Std 1104 (incorporated by reference, see § 192.7). Appendix A of API Std 1104 may not be used to accept cracks.

If the weld is made on a pipeline that operates at or above 20 percent of SMYS, then the weld will be required to be non-destructively tested in accordance with 192.241 & 192.243. Except when welds are visually inspected and approved by a qualified welding inspector and either:

1. The pipe has a nominal diameter of less than 6 inches or;
2. The pipeline is to be operated at a pressure that produces a hoop stress of less than 40 percent of SMYS and the welds are so limited in number that nondestructive testing is impractical..

If there is no one at the utility qualified to visually inspect a weld, then the welder making the weld must demonstrate the knowledge and ability necessary to perform inspection on each weld.

Additionally, construction standards should be specifically produced for any pipeline project being considered; these construction plans should be adopted by the utility and the requirements of 192.241 must be met in any construction plan.

§ 192.243 Nondestructive testing.

(a) Nondestructive testing of welds must be performed by any process, other than trepanning, that will clearly indicate defects that may affect the integrity of the weld.

(b) Nondestructive testing of welds must be performed:

(1) In accordance with written procedures; and

(2) By persons who have been trained and qualified in the established procedures and with the equipment employed in testing.

(c) Procedures must be established for the proper interpretation of each nondestructive test of a weld to ensure the acceptability of the weld under § 192.241(c).

(d) When nondestructive testing is required under § 192.241(b), the following percentages of each day's field butt welds, selected at random by the operator, must be nondestructively tested over their entire circumference:

(1) In Class 1 locations, except offshore, at least 10 percent.

(2) In Class 2 locations, at least 15 percent.

(3) In Class 3 and Class 4 locations, at crossings of major or navigable rivers, offshore, and within railroad or public highway rights-of-way, including tunnels, bridges, and overhead

road crossings, 100 percent unless impracticable, in which case at least 90 percent. Nondestructive testing must be impracticable for each girth weld not tested.

(4) At pipeline tie-ins, including tie-ins of replacement sections, 100 percent.

(e) Except for a welder or welding operator whose work is isolated from the principal welding activity, a sample of each welder or welding operator's work for each day must be nondestructively tested, when nondestructive testing is required under § 192.241(b).

(f) When nondestructive testing is required under § 192.241(b), each operator must retain, for the life of the pipeline, a record showing by milepost, engineering station, or by geographic feature, the number of girth welds made, the number nondestructively tested, the number rejected, and the disposition of the rejects.

Beginning November 15, 2022, the individual requesting nondestructive testing shall also request the following:

1. *The most current Nondestructive Testing Procedure(s) from the company providing the service and,*
2. *The qualifications of Nondestructive personnel performing evaluations and/or reporting results.*

The documents along with the results of any Nondestructive test required by 192.241(b) will be kept in accordance with (f) above.

The preferred vendor(s) for Nondestructive Examination are (but not limited to),

In this order:

1. *Prime NDT Services Inc. &*
2. *JanX.*

An archive of previous Nondestructive Examination procedures can be found in the USDI ShareFile: *S:\Shared Folders\USDI\USDI-Welding Procedures\Client Non-Shared\MPT and Radiographic Procedures/ and are available upon request.*

I. REPAIR OF WELDS (192.245)

Each weld that is unacceptable under § 192.241(c) must be removed or repaired; a weld must be removed if it has a crack that is more than 8 percent of the weld length.

Each weld that is repaired must have the defect removed down to sound metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability.

Repair of a crack, or of any defect in a previously repaired area must be in accordance with written weld repair procedures that have been qualified under § 192.225.

The Utility does not have repair procedures therefore you cannot repair a previous repair/crack.

Welds may also be repaired if Operations Management approves the repair.

If a weld contains a crack penetrating the root bead or second bead, it shall be removed from the pipeline.

The repair must meet the minimum mechanical characteristics of the original weld.

The following shall be used when defective welds are found.

1. When visual, radiographic or other inspection methods indicate a weld contains defects beyond the minimum standards of acceptability per Section 6 or 9 of API 1104, the weld shall be cut from the pipeline as a cylinder containing the defect or the defective area shall be removed and the weld repaired to meet the minimum standards of acceptability.
2. The judgment and discretion of Operations Management or USDI Engineer will determine whether the defective weld shall be removed or repaired. Discretion is necessary to account for the imprecise nature of the code and the compound effects of multiple defects.
3. The judgment of an inspector or other responsible person may take into account the level of skill of the welder. For example, the removal of a defect area and a preparation of the surface for a proper weld sometimes necessitates gouging or grinding completely through the weld metal. This can result in either an excessively wide gap to bridge with new weld metal or a narrow, feather-edged gap that can foster burn-through and entrapment of slag. Successful repair of such welds demands extraordinary welder skill.
4. The following are a number of important and essential operations which must be performed in order to produce a sound and acceptable weld repair:
   a) Determine accurately the location and extent of the defect area.
   b) Using a disc type grinder, remove all defects from the defective area by grinding to sound clean metal. All scale, rust, paint, coating, dirt or other foreign substances shall be removed from all surfaces immediately and account to the repair area by wire brushing.
   c) The cavity that results from grinding shall be not less than 2" in length and its transverse contour shall be such that it will permit the introduction and manipulation for the welding electrode to deposit sound weld metal without the danger of slag entrapment or poor fusion.
   d) Preheat the pipe and/or fitting and the area 4" beyond the repair area to a minimum temperature of 250 degrees Fahrenheit. Maintain that temperature during repair welding. Determine and check appropriate temperature using indicating crayons.
   e) Repair weld the area using the original procedure fill metal classification type.
   f) Deposit weld beads using 3/32" electrode at the voltages and amperages specified in the original procedure for that electrode. (Larger electrodes may be used depending on cavity size)
   g) Where defect removal has penetrated through the entire weld, the gap can be reduced by carefully depositing a small amount of weld metal on either side of the bottom of the cavity. This will provide a land for the deposition of succeeding passes and successful repair.
   h) Avoid superimposing the stop and start of a succeeding weld pass over the start or stop of the preceding weld pass or bead. Overlap preceding passes by at least ¼".
   i) Remove all beads or pass starts and stops, indications of surface porosity, slag deposits, and high spots by grinding before depositing succeeding weld passes.
   j) Remove any notches, including those occurring along the edges of a bead, by grinding.
   k) Remove excess weld metal from all completed repair welds by grinding to conform to the surface of the original weld passes or beads.
   l) Clean the completed repair area as well as the entire original weld area with a wire brushing to facilitate visual inspection.

m) Visually inspect the repair weld to ensure compliance with the prescribed minimum standard of acceptability.

APPENDIX A

Version - 21.1
Rev. Date - 3/23/2021

Part 192 Appendix C Weld Test Report-1702

Welder: **Welding Time:** **Hours**

Date Welded: **Location of Test:**

Company/Utility:

Welding Process: Shielding: Composition:

Mean Temperature: Degrees Weather Conditions:

Time Started: A.M. P.M. Wind Break Used?

Make of Welding Machine: Voltage:

Brand of Electrode: Amperage:

Pipe Manufacturer: Fixed Position Weld Roll Weld

Pipe Type and Grade:

Wall Thickness (For Bend Test): Outside Diameter (For Bend Test):

Wall Thickness (For Butt Weld Test): Outside Diameter (For Butt Weld Test):

Wall Thickness (For Service Tee Test): Outside Diameter (For Service Tee Test):

Bead Number	**1**	**2**	**3**	**4**	**5**	**Date Tested**
Basic Weld Coupons						
Welding Procedure						
Size of Electrode						
Service Lines - Bend Test						
Welding Procedure						
Size of Electrode						
Service Tee						
Welding Procedure						
Size of Electrode						

Remarks on Strap Bend Tests:

Remarks on Butt Welds:

Remarks on Service Tee:

Qualified **Disqualified**

Tested By: Supervised By:

Signed: Signed:

APPENDIX B

USDI Page 1 of 1 **Coupon Test Report Procedure Qualification** Utility Safety Design Inc. Olney IL.

Welder Name: _____ Welder ID: _____ Weld Procedure NO: _____
State: _____ Date Welded: _____ Test Method: _____
Company: _____ Time of Day: _____ Qualification Method: _____

COUPON TEST DATA

Process: _____ Joint Design: _____
Position: _____ Direction: _____
Pipe Size (O.D.) : _____ Wall Thickness: _____
Material Spec: _____ Electrode Size & Type: _____
Number of Beads: _____ Machine Type: _____
Voltage: _____ Amperage: _____
Shielding Gas: _____ Composition: _____
Flow Rate: _____ Ambient Temperature: _____

Weather Conditions: ☐ Raining ☐ Overcast ☐ Sunshine ☐ N/A Preheat Used: ☐ Yes ☐ No

Location: ☐ Inside ☐ Outside ☐ Windbreak Used

TENSILE TEST RESULTS

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load	Tensile (psi.)	Failure Type/Location

GUIDED/FULL SPECIMAN TEST RESULTS

ROOT BEND TEST	FACE/FULL BEND TEST	SIDE BEND TEST
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.

NICK BREAK/KNOCK OFF TEST RESULTS

☐ NICK BREAK OR ☐ KNOCK OFF

1. _____
2. _____
3. _____
4. _____

Visual Examination

☐ SAT	☐ UNSAT	CRACKS	☐ SAT	☐ UNSAT	REINFORCEMENT
☐ SAT	☐ UNSAT	PENETRATION	☐ SAT	☐ UNSAT	FUSION
☐ SAT	☐ UNSAT	BURN THRU	☐ SAT	☐ UNSAT	GAS POCKETS
☐ SAT	☐ UNSAT	INTERNAL UNDERCUT	☐ SAT	☐ UNSAT	SLAG INCLUSIONS
☐ SAT	☐ UNSAT	EXTERNAL UNDERCUT	☐ SAT	☐ UNSAT	POROSITY

Code/Standard

☐ API 1104 20th edition, incorporated by reference. ☐ CFR 192 APPENDIX C ☐ ASME SECTION IX 2007 edition, incorporated by reference

☐ Procedure ☐ Welder ☐ Qualifying Test ☐ Continuation Test ☐ Qualified ☐ Disqualified

I _____ certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance within the requirements of the above code/standard.

Organization: _____ Signature: _____ Date Tested: _____

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Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

TR-33

2012

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Contents

FOREWORD

GENERIC BUTT FUSION JOINING PROCEDURE FOR FIELD JOINING OF POLYETHYLENE PIPE

This report was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute, Inc.). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The purpose of this technical report is to provide important information available to PPI on a particular aspect of polyethylene pipe butt fusion to engineers, users, contractors, code officials, and other interested parties. More detailed information on its purpose and use is provided in the document itself.

This report has been prepared by PPI as a service of the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered without any warranty, expressed or implied, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Consult the manufacturer for more detailed information about the particular joining procedures to be used with its piping products. Any reference to or testing of a particular proprietary product should not be construed as an endorsement by PPI, which does not endorse the proprietary products or processes of any manufacturer. The information in this report is offered for consideration by industry members in fulfilling their own compliance responsibilities. PPI assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this report from time to time, in response to comments and suggestions from users of the report. Please send suggestions of improvements to the address below. Information on other publications can be obtained by contacting PPI directly or visiting the web site.

The Plastics Pipe Institute, Inc.

www.plasticpipe.org

This Technical Report, TR-33, was first issued in October 1999, and was revised in 2006, and in June 2012.

SECTION I – GENERIC BUTT FUSION PROCEDURE TESTING FOR FIELD JOINING OF ASTM D2513 GAS PIPING MATERIALS[1]

1.0 INTRODUCTION

In 1994, representatives of the U.S. DOT (Department of Transportation), Office of Pipeline Safety requested that the Plastics Pipe Institute (PPI) assist in promoting greater uniformity in the joining procedures utilized by gas utilities in the butt fusion of polyethylene (PE) gas piping products. DOT reported that it had encountered a proliferation of similar but slightly varying joining procedures from individual PE pipe producers. The slight differences in the various procedures made it more difficult for pipeline operators to qualify persons with appropriate training and experience in the use of these procedures. It was even more difficult for DOT to enforce the joining requirements in § 192.283 (Plastic pipe, qualifying joining procedures) of the C.F.R. (Code of Federal Regulations) Title 49.

In response to DOT's request, PPI established a task group to examine the differences among the varying joining procedures, to identify similarities in those procedures, and to determine whether there were a sufficient number of common elements to provide a basis for a more uniform, or "generic" joining procedure that could be qualified by pipeline operators for most applications. A more uniform joining procedure would bring greater consistency to this aspect of gas pipeline installation, facilitate the pipeline operator's efforts to qualify the procedure, reduce costs, and simplify DOT's enforcement duties.

2.0 SCOPE

The program undertaken by the PPI Task Group for the testing of representative materials under a generic set of conditions was designed to reflect the fusion conditions and parameters specified in most joining procedures recommended by pipe producers and qualified by pipeline operators. It was intended to provide a technical basis for the development of a generic butt fusion procedure (see Appendix A) that can be offered to the industry for use with selected PE (polyethylene) piping products. The procedure would be available for use by pipeline operators who would determine whether the procedure is appropriate for use with the PE piping products it employs. Pipeline operators could consider the recommendations and testing performed by others in their effort to comply with the fusion procedure qualification requirements of 49 C.F.R. § 192.283 (Plastic pipe, qualifying joining procedures).

It is important to emphasize that the testing performed by the PPI Task Group was intended only to establish a technical basis for developing and proposing a more generic fusion joining procedure that would offer the maximum opportunity to be qualified and used by pipeline operators with a broad range of polyethylene piping products. The testing was not intended to qualify the

[1] Dupont Aldyl A MDPE, Uponor Aldyl A MDPE and Phillips Driscopipe 7000 and 8000 HDPE are not included in this procedure.

procedure for use with any particular pipe product, and PPI offers no opinion on whether the procedure is properly qualified for use with any particular PE pipe product. PE pipe producers remain solely responsible for any representations that they may make about the use of this generic procedure or any other joining procedure with their proprietary PE piping products, and pipeline operators remain solely responsible for compliance with the requirements of 49 C.F.R. § 192.283 (Plastic pipe, qualifying joining procedures) when qualifying any procedure for use with the products it selects for its pipelines. PPI member pipe manufacturers have endorsed this generic procedure for joining their product to itself and to other commercially available pipe materials. Pipe producer compliance letters are in Appendix B for gas pipe applications and Appendix D for all other applications. A typical illustration of a properly made butt fusion joint is in Appendix D.

PPI hopes that the inherent value of greater uniformity will provide all the incentive necessary for companies to evaluate the generic procedure in Appendix A as a first option for butt fusion joining of its PE piping products. Use of this procedure is obviously not mandatory, and every PE pipe producer and pipeline operator retains the option of developing different procedures for its particular products and pipelines. However, PPI believes that its work in developing this generic procedure as a candidate for widespread acceptance throughout the industry will lead to greater efficiency, simplicity, and understanding in this area and promote the use of effective, qualified procedures for butt fusion joining of PE pipe.

3.0 TESTING PROGRAM TO EVALUATE USE OF GENERIC JOINING PROCEDURE WITH POLYETHYLENE GAS PIPING PRODUCTS

The Task Group collected and examined a large number of diverse procedures now in use by gas pipeline operators or recommended by pipe producers for specific PE piping products. It then identified those conditions and fusion parameters that were common to the majority of those procedures. The Task Group proposed the following fusion parameters as representative of the conditions in the individual procedures that they reviewed:

Heater Surface temperature	**400 - 450° F (204-232°C)**
Interfacial Pressure	**60-90 psi (4.14-6.21 bar)**

From its review of the different procedures collected from PE gas pipe producers, the Task Group further developed the generic joining procedure set out in Appendix A, based on its assessment of the common elements in the individual procedures. It was agreed that proprietary products such as Uponor Aldyl A MDPE products and Phillips Driscopipe® 8000 HDPE piping products were sufficiently different from the remainder of the materials being discussed that they were not included in the test program.[2] The manufacturers should be contacted for more information on particular joining procedures for those

[2] Uponor Aldyl-A and Phillips Driscopipe 8000 are no longer manufactured.

products. Only current commercially available products from PPI member companies were included in this test program. For information on older or other products, please contact the manufacturer of those products.
Using these parameter ranges and procedures, the Task Group initiated a 3-part test program to evaluate whether a representative cross-section of marketed PE gas piping products would qualify under the qualification requirements of Part 192 when joined in accordance with this generic joining procedure. The evaluation was conducted using pipe from MDPE and HDPE materials deemed suitable for fuel gas applications per ASTM D2513. These materials have a grade designation, in accordance with ASTM D3350, of PE24 and PE34, respectively.

Grade	Density (Grams/cc)	Melt Index (Grams/10min.)	Pipe Marking
PE 24	.926 - .940	.15 to .40	PE 2406
PE 34	.941 - .955	.05 to .15	PE 3408

After fusion of the samples, tensile and quick-burst tests were conducted in accordance with the requirements of 49 C.F.R. § 192.283 (Plastic pipe, qualifying joining procedures). Non-destructive ultrasonic inspections and high speed tensile impact testing were also conducted on each fusion combination. Additional testing conducted only on 8” pipe samples, included 176° F (80°C), 1,000-hour long-term hydrostatic testing at 580 psi (40 bar) hoop stress. The results of the test program are described in the following sections. PPI’s Conclusions and Recommendations, based on the Task Group’s work, are found at the end of this section. Test data are maintained at PPI headquarters.

Part 1 - Pipe Fusion and Testing - 2" IPS DR 11 (Like Materials)

Part 1 of this project was to evaluate the generic procedure for use in fusing a PE pipe producer’s product to itself (e.g., Phillips MDPE to Phillips MDPE). The Task Group members supplied 2" SDR 11 pipe samples for fusion joining.

A total of 24 sample fusions, like material to like material, were made for each MDPE and HDPE pipe product. The total number of sample pieces was 72 and the total number of fusion joints made was 290. To evaluate the fusion parameters initially selected by the Task Group, all combinations of min/max heater surface temperatures 400 - 450°F (204 -232°C) and min/max interfacial pressures 60—90 psi (4.14-6.21 bar) were used in this testing. In addition, sample fusions at heater face temperatures (375°F and 475°F) (191°C and 246°C) and interfacial pressures (50 and 100 psi) (3.45 and 6.90 bar) were made and tested to examine conditions for fusion outside the initially generic parameters. The Task Group agreed to use these same fusion parameters for both the MDPE and HDPE.

The results of testing these fusion samples were 100% positive. All of the fusion joints (including those made under the extended parameters) passed every test

conducted. As noted above, these tests included tensile testing, quick burst testing, high speed tensile impact testing and 100% ultrasonic inspection.

Part 2 - Pipe Fusion and Testing -2" IPS DR11 (Unlike Materials)

Part 2 of this project was to evaluate the generic procedure, the fusion temperature range, and the interfacial pressure range for cross fusions of unlike materials (e.g., Phillips MDPE to PLEXCO MDPE or Uponor MDPE to KWH Pipe HDPE).

Again 2" IPS SDR11 PE pipe was chosen. The Task Group members reviewed the information presented in *Table* 1. Overview of Polyethylene Plastic Gas Pipe Materials and decided that the cross fusion program could be simplified by selecting representative materials only. For MDPE materials it was decided that two materials could be selected to represent the two main families of MDPE materials (chromium oxide/slurry loop produced MDPE and Unipol Gas Phase MDPE). The two specific materials selected were Phillips Marlex TR-418 and Union Carbide DGDA 2400. The testing of these two materials would help to assess the appropriateness of the generic conditions for cross fusion of all MDPE plastic pipe gas compounds commonly being used today. The Task Group decided to use the same joining parameters as in Part 1 in these tests, based on the view that successful fusions under these conditions would cover all the other materials under the generic ranges. The chosen combinations of joining parameters were (1) 475°F/100 psi (246°C/6.90 bar) and (2) 375°F/50 psi (191°C/3.45 bar). The remainder of the fusion procedures remained the same as Part 1. Fusion joints between Phillips TR-418 and Union Carbide DGDA 2400 were prepared. There were nine (9) joints made at each joining parameter, for total of (18) joints.

For HDPE materials, the Task Group selected three (3) HDPE materials for evaluation: Chevron 9308, Novacor HD2007-H and Fina 3344. There were nine (9) joints made at each of the selected combinations of fusion parameters and combinations of materials, for total of (54) joints.

For MDPE to HDPE joints, the Task Group elected to fuse Union Carbide 2400 to Fina 3344 to establish the cross fusion procedure for the fusion of MDPE to HDPE. Nine (9) joints were made at each of the two extended parameter combinations, for total of (18) joints.

The results of testing these fusion samples were 100% positive. All of the fusion joints passed every test conducted. As noted above, these tests included tensile testing, quick burst testing, high speed tensile impact testing and 100% ultrasonic inspection.

Part 3 - Pipe Fusion and Testing - 8" IPS DR11 (Unlike Materials)

Part 3 of this project was to test 8" IPS SDR 11 PE pipe to establish a range of pipe sizes where the generic procedure could be used. For MDPE materials, the Task Group identified five different medium density polyethylene materials which can be classed into two main types based on catalyst family, production process and melt index:

A. Phillips Marlex TR-418, Chevron 9301, 9302, Solvay Fortiflex K38-20-160
B. Novacor Chemical HD-2100, Union Carbide 2400

The Task Group agreed to make (10) joints of each of the following combinations:

UCC2400 to Phillips Marlex TR-418
UCC2400 to Chevron 9301
UCC2400 to Solvay Fortiflex K38-20-160

The joints were made at the same parameters as before with five (5) made at 475°F/100 psi (246°C/6.90 bar) interface and five (5) made at 375°F/50 psi (191°C/3.45 bar) interface. In effect, this would provide representative results for all medium density polyethylene except Uponor Aldyl A MDPE. Thus, this portion of the testing program would require 30 joints in total. It was also decided that if there were any failures with joints made under these parameters, then the fusions should be duplicated under the generic parameters 400 - 450°F/60-90 psi (204-232°C/4.14
6.21 bar).

For HDPE materials, the Task Group identified seven different high density polyethylene materials which could be classed into three main categories based on catalyst family, production process and melt index:

A. Chevron 9308, Phillips TR 480 and Solvay Fortiflex K44-15-123.
B. Novacor Chemical HD-2007-H, Chevron 9346 and UCC2480
C. Fina 3344

The HDPE cross fusion testing covered 10 joints for each of the following combinations: A to A, B to B, C to C, A to B, B to C, and A to C, for a total of 60 fusion joints. The representative materials selected from each category were the Fina 3344, UCC2480 and Phillips TR480.

For MDPE to HDPE cross fusions, the Task Group decided to use the same materials as were used for the cross fusion of 2" pipe; i.e., Fina 3344 and Union Carbide 2400. This portion of the testing program would involve A to B fusions of the two materials, for a total of 10 joints.

In addition to the tensile testing, high speed tensile impact testing, quick burst testing and 100% ultrasonic inspection, each fusion combination described in

Part 3 was subjected to a long- term 176°F (80°C), 1000 hour test using 580 psi (40 bar) hoop stress. As with the 2" IPS testing, all joints passed every test conducted.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that there is a single fusion procedure with defined ranges of acceptable heater surface temperature, 400-450°F (204-232°C), and interfacial pressure, 60-90 psi (4.14-6.21 bar), for fusing most of the PE gas pipes on the market today. The PE pipes used in these tests were selected PE2406 and PE3408 materials, which were deemed suitable for fuel gas applications (per ASTM D2513) and which have a grade designation, in accordance with ASTM D3350, of PE24 and PE34, respectively, excluding Uponor Aldyl A MDPE and Phillips Driscopipe 8000 HDPE. The results further indicate that there is a strong likelihood that the generic fusion procedure used in this testing (see Appendix A) could be qualified by gas pipeline operators under DOT's regulations in Part 192 for use with most of these PE gas piping products. To the extent that this PPI generic procedure in Appendix A can be qualified for use with more and more of the PE pipe products in the marketplace, the closer the industry can move to meeting DOT's objective of greater uniformity, efficiency, and simplicity in the area of fusion procedures.

5.0 ACKNOWLEDGEMENTS

This document has been produced by an industry Task Group from equipment, fitting, pipe, and resin manufacturers from the following companies.

Performance Pipe (formerly Phillips Driscopipe and PLEXCO)
PolyPipe Central Plastics US Poly (formerly Uponor)
Charter Plastics
BP Solvay
Total Petrochemicals (formerly Fina)
KWH Pipe
McElroy Manufacturing
Connectra Fusion Technologies, LLC

Table 1. Overview of Polyethylene Plastic Gas Pipe Materials

Company	Resin	Melt Index (MI) Grams/10 min.	High Load MI Grams/10 min.
Phillips	TR480	.11	13
Solvay	K44-15-123	.12	13
Solvay	K44-08-123	.08	8.5
Chevron	9346	.08	10
Chevron	9308	.10	10
Novacor Chem.	HD-2007-H	.07	8.5
Union Carbide	2480	.10	12
Fina	3344	.10	8
Phillips	TR418	.12	
Chevron	9301	.20	
Solvay	K38-20-160	.20	
Novacor Chem.	2100	.15	
Union Carbide	2400	.20	

Note: Some resins may no longer be produced, or company names may have changes. This information is for historical purposes for the types of resin utilized in this report.

SECTION II – GENERIC BUTT FUSION PROCEDURE TESTING FOR FIELD JOINING OF ASTM F714, ASTM D3035, AWWA C-901, AWWA C-906 AND PE PIPING FOR OTHER APPLICATIONS.

1.0 SCOPE

This program, undertaken by a different PPI Task Group, than the Task Group that established the Generic Butt Fusion Procedures for Polyethylene Gas Pipe (TR33/2001) for the testing of representative materials under a generic set of conditions, was designed to reflect the fusion conditions and parameters currently specified in TR-33/2001, Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe. While it is recognized that these fusion conditions do not include some parameters currently specified by some pipe producers for their Municipal and Industrial products, it was selected in an attempt to bring uniformity of fusion parameters to the industry. Additionally, as part of the overall goal of the Task Force, it was intended to provide a technical basis for the development of a generic butt fusion procedure (see Appendix A) that can be offered to the industry for use with selected PE (polyethylene) piping products. The procedure would be available for use by pipeline operators who would determine whether the procedure is appropriate for use with the PE piping products it employs.

It is important to emphasize that the testing performed by the PPI Task Group was intended only to establish a technical basis for developing and proposing a more generic fusion joining procedure that would offer the maximum opportunity to be qualified and used by pipeline operators with a broad range of polyethylene piping products. The testing was not intended to qualify the procedure for use with any particular pipe product, and PPI offers no opinion on whether the procedure is properly qualified for use with any particular PE pipe product. PE pipe producers remain solely responsible for any representations that they may make about the use of this generic procedure or any other joining procedure with their proprietary PE piping products. PPI member pipe manufacturers have endorsed this generic procedure for joining their products to themselves and to other commercially available pipe materials. A generic endorsement for the range of resins that have been proven to be successfully joined by this method is detailed in Appendix C along with a list of many product standards that utilizes these resins. An illustration of a properly made butt fusion joint is in Appendix D.

PPI hopes that the inherent value of greater uniformity will provide all the incentive necessary for companies to evaluate the generic procedure in Appendix A as a first option for butt fusion joining of its PE piping products. Use of this procedure obviously is not mandatory, and every PE pipe producer and pipeline operator retains the option of developing different procedures for its particular products and pipelines. However, PPI believes that its work in developing this generic procedure as a candidate for widespread acceptance throughout the industry will lead to greater efficiency, simplicity and understanding in this area and promote the use of effective, qualified procedures for butt fusion joining of PE pipe.

2.0 TESTING PROGRAM TO EVALUATE USE OF GENERIC BUTT JOINING PROCEDURE FOR FIELD JOINING OF POLYETHYLENE PIPING PRODUCTS

The Task Group looked at the Generic Butt Fusion Procedure previously released in TR-33 (2001) and other procedures approved by pipe manufacturers for butt fusing PE pipe products that satisfy the ASTM F714, ASTM D3035, AWWA C-901, and AWWA C-906 Pipe Specifications. Since there was overlap in the main fusion parameter areas, the Task Group proposed the same butt fusion parameters previously released in TR-33 (2001) for PE gas piping products be utilized, recognizing that the selected interfacial pressure range does not include all of the interfacial pressures that are promoted on a global basis. Interfacial fusion pressure recommendations typically range from a low of 21.7 psi (1.5 bar) to a maximum of 150 psi (10.34 bar). In spite of this broad range, the fact still remains that properly conducted fusions, across this range of interfacial pressures result in quality fusions that cannot always be differentiated by the various available testing techniques.

Heater Surface temperature	**400-450ºF (204-232ºC)**
Interfacial Pressure	**60-90 psi (4.14-6.21 bar)**

From its review of the different procedures collected from the PE pipe producers, the Task Group further developed the Generic Butt Joining Procedure set out in Appendix A., based on its assessment of the common elements in the individual procedures. The only exception to this was that fusion pressure was used to seat the pipe against the heater plate and this pressure remained until an indication of melt around the circumference of the pipe was observed. Then the pressure was reduced to drag pressure and the carriage control valve shifted to the middle position to keep the carriage from moving. It was agreed that proprietary products such as Phillips Driscopipe 8000/8600 series HDPE piping products were sufficiently different from the remainder of the materials being discussed that they were not included in the test program[3]. The manufacturer should be contacted for more information on particular joining procedures for those products. Only current commercially available products from PPI member companies were included in this test program. For information on older or other products, please contact the manufacturer of those products.

Using these parameters and procedures, the Task Group initiated a 2-part test program to evaluate butt fused samples joined at the extremes of the parameters. After the samples were fused, they were cut into tensile test specimens where high speed tensile testing was conducted on each specimen. PPI's Conclusions and Recommendations, based on the task group's work, are found at the end of this section. Test data are maintained at PPI headquarters.

[3] Phillips Driscopipe 8000 and 8600 are no longer manufactured.

Part 1 – Pipe Fusion and Testing – (5) different pipe manufacturers pipe samples with various wall thickness.

The pipe samples we tested were:

KWH Pipe –12" IPS DR11
KWH Pipe – 12" IPS DR6
Phillips – 14"IPS DR 9
Plexco – 12"IPS DR 9
Plexco – 12" IPS DR 9 Yellowpipe

Like pipe to like pipe was fused in this evaluation. There were (4) joints made at the following parameters for each pipe size to be tested:

400º F and 60 psi interface
400º F and 90 psi interface
450º F and 60 psi interface
450º F and 90 psi interface

We recorded the following times and bead sizes in the fusion process:

- Time to get indication of melt
- Soak time to heater removal
- Bead size per side at the time of heater removal
- Total bead size after fusion
- Cooling time under pressure
- Bead temperature at the time of pipe removal

The fused samples were joined and allowed to cool under pressure until cool to the touch using 30-90 seconds per inch of diameter as a cool time guideline. The samples were allowed to cool for an additional 24 hours before cutting into the tensile test sample configuration.

A tensile test sample was cut from each fused pipe interface at 12:00, 3:00, 6:00 and 9:00 positions. The test samples were machined to the attached configuration and a high speed tensile impact test was conducted on all samples.

The results of testing these fusion samples were 100% positive. All of the fusion joints failed in a ductile mode outside the joint area.

Part 2 – Pipe Fusion and Testing – Compare tensile test results using different interfacial pressures.

The heavy wall pipe samples we tested were:

PolyPipe 16” IPS DR 7
KWH Pipe 22” IPS DR11

We fused like pipe to like pipe in this evaluation. There was (1) joint made at the following parameters for each pipe size to be tested:

425º F and 25 psi interface
425º F and 40 psi interface
425º F and 75 psi interface

We recorded the following times and bead sizes in the fusion process:

- Time to get indication of melt
- Soak time to heater removal
- Bead size per side at the time of heater removal
- Total bead size after fusion
- Cooling time under pressure
- Bead temperature at the time of pipe removal

The fused samples were joined and allowed to cool under pressure until cool to the touch using 30-90 seconds per inch of diameter as a cool time guideline. The samples were allowed to cool for an additional 24 hours before cutting into the tensile test sample configuration.

A tensile test sample was cut from each fused pipe interface at 12:00, 3:00, 6:00, and 9:00 positions. The test samples were machined to a dog-bone configuration that is recommended by the British WIS 4-32-08 standard. This test is designed to cause failure in the joint area. We pulled the samples in a high-speed tensile impact machine at a rate of 4” per second. The energy in ft-lbs at yield and failure, the samples pull area and the amount of energy per square inch of area was recorded for all three interfacial area samples. The beads were removed on all samples. In order to mask actual values derived in the test that might allow one to compare strengths between materials, the results are shown as percentages of increased or decreased average strength as compared to that material’s joint strength at 25 psi interfacial.

The results of these tests were:

Pipe 1	25 psi	Average	100%
Pipe 1	40 psi	Average	104%
Pipe 1	75 psi	Average	105%

Pipe 2	25 psi	Average	100%
Pipe 2	40 psi	Average	97%
Pipe 2	75 psi	Average	101%

For both pipe sizes tested, the nominal 75 psi interface pressure joints proved to have a higher tensile strength before failure than 40 or 25 psi interface.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that it is possible to standardize on a single set of butt fusion parameters that can be used for fusing most of the polyethylene gas pipe and municipal and industrial pipe available on the market today. We recognize that the recommended parameters utilized are a small subset of the various fusion parameters utilized today, but believe in the benefit of moving towards a common standardized fusion procedure. The more the industry can move to greater uniformity, efficiency and simplicity in the area of fusion procedures, the more acceptance it will receive in the different industries.

PPI hopes that the inherent value of greater uniformity will provide all the incentive necessary for companies to evaluate the generic procedure in Appendix A as the preferred option for butt fusion joining of PE piping products. Use of this procedure obviously is not mandatory, and every PE pipe producer and pipeline operator retains the option of developing different procedures for its particular products and pipelines.

Other Acceptable Fusion Procedures

It must be recognized that there are many other different procedures and fusion parameters used throughout the world that have been proven to make effective, reliable joints. The pipeline operator and ever pipe producer retains the option of developing different fusion procedures for its particular products and pipelines. In certain cases, due to operating conditions, weather, or the characteristics of the joining equipment, it may be necessary or even advisable to use another procedure.

PPI believes that its work in developing this generic procedure as a candidate for widespread acceptance throughout the industry will lead to greater efficiency, simplicity and understanding in this area and promote the use of effective, qualified procedures for butt fusion joining of PE pipe.

SECTION III – BUTT FUSION PROCEDURE TESTING FOR FIELD BUTT FUSION OF PE 4710 PIPE FOR ALL APPLICATIONS.

1.0 SCOPE

A PPI Task Group was developed to make butt fusion joints on PE4710 piping products to the procedures and parameters outlined in ASTM F2620 and do the testing of those joints to qualify the procedure for that piping material. The procedure would be available for use by pipeline operators who would determine whether the procedure is appropriate for use with the PE piping products it employs.

It is important to emphasize that the testing, performed by the PPI Task Group, was intended only to show that the procedures and parameters in ASTM F2620 could be used to butt fuse PE 4710 piping material. This procedure would offer the maximum opportunity to be qualified and used by pipeline operators with a broad range of polyethylene piping products. PE pipe producers remain solely responsible for any representations that they may make about the use of this procedure or any other joining procedure with their proprietary PE piping products.

PPI hopes that the inherent value of greater uniformity will provide all the incentive necessary for companies to evaluate the procedure in ASTM F2620 as a first option for butt fusion joining of its PE piping products. Use of this procedure obviously is not mandatory, and every PE pipe producer and pipeline operator retains the option of developing different procedures for its particular products and pipelines. However PPI believes that its work in developing this procedure as a candidate for widespread acceptance throughout the industry will lead to greater efficiency, simplicity and understanding in this area and promote the use of effective, qualified procedures for butt fusion joining of PE pipe.

2.0 TESTING PROGRAM TO EVALUATE THE USE OF ASTM F2620-11 BUTT JOINING PROCEDURES FOR FIELD JOINING OF PE 4710 POLYETHYLENE PIPING PRODUCTS

The Task Group looked at the ASTM Standard Butt Fusion Procedure F2620 and decided to use similar parameters and procedures for the Three Phase Test Program for different pipe sizes of PE 4710 pipe. Parts of the procedure were further clarified so it is easier to monitor the procedure used and inspect the joints. A minimum heat soak time was added to pipe sizes 14” and larger to insure that the thicker wall pipes receive enough heat before joining. This minimum heat soak time is 4.5 minutes per inch of wall thickness. A maximum open/close (dwell) time was established by wall thickness to make sure the fusion machine is opened, the heater removed and the pipe ends brought together at the fusion pressure in a prompt time. The cool time under fusion pressure was changed from 30-90 seconds per inch of pipe diameter to 11 minutes per inch of wall thickness. This better clarifies the cool time required for

pipes of all wall thicknesses and is easier to monitor. All of these changes are outlined in ASTM F2620-11e1.

The three phase program was focused on pipes in different size ranges:

Phase I --- 2” IPS DR11 PE 4710 pipe from different manufacturers and resins for cross fusion compatibility testing

Phase II --- 8” IPS PE 4710 pipe fused to other PE 4710 pipes and also to PE 3608 pipe and PE 2708 pipe for compatibility testing.

Phase III --- 6”IPS DR11, 12” IPS DR11, 20” DIPS DR 11, 28” IPS, DR11 and 36” IPS DR9 PE 4710 pipe sizes were fused to validate the parameters and procedures for a variety of pipe sizes and wall thicknesses.

Phase I --- Pipe Fusion and Testing – 2” IPS pipe size

Five (5) different PE 4710 pipe resins were used to make (10) different cross-fusion combinations for tensile testing and quick burst testing.

All pipe sizes were 2” IPS DR11. The combinations fused and tested were:

CP Chem 9346P8 to Dow DGDA 2490
CP Chem 9346P8 to Total XT 10N
CP Chem 9346P8 to Ineos TUB 121
CP Chem 9346P8 to Equistar Alathon L4904
Dow DGDA 2490 to Total XT 10N
Dow DGDA 2490 to Ineos TUB 121
Dow DGDA 2490 to Equistar Alathon L4904
Total XT 10N to Ineos TUB 121
Total XT 10N to Equistar Alathon L4904
Ineos TUB 121 to Equistar Alathon L4904

The Task Group decided to use parameters that were outside the ASTM F2620 procedure to make sure we had a safety zone around the actual parameters recommended. The parameters used for these fusions were:

375 degree F Heater Surface Temperature and 50 psi interfacial pressure
375 degree F Heater Surface Temperature and 100 psi interfacial pressure
500 degree F Heater Surface Temperature and 50 psi interfacial pressure
500 degree F Heater Surface Temperature and 100 psi interfacial pressure

We recorded the following parameters during the fusion process of each joint:

- Time to get an indication of melt
- Soak time to heater removal
- Pressure during the heat soak cycle
- Total open/close (dwell) time for heater removal
- Fusion pressure
- Cooling time at fusion pressure

The samples were allowed to cool for at least an additional 24 hours before cutting test specimens and conducting the tensile and quick burst tests.

Three separate task group companies made the fusion joints and three task group companies did the tensile tests on these samples. Twelve fusion joints at each parameter condition were made with (24) tensile test specimens made for each condition. The tensile tests were conducted per ASTM F2634 and D638. A total of 250 + tensile tests were conducted in Phase 1. All joints passed the tensile tests in a ductile manner outside the fusion zone.

Twelve fusion joints at each parameter condition were made and quick burst tested per D1599. A total of 40 quick burst tests were conducted in Phase 1 with three fusion joints in each test pipe. All joints passed the quick burst tests with failures in the pipe and not the fusion joint.

Phase II --- Pipe Fusion and Testing – 8” IPS pipe size

The Task Group continued testing of PE 4710 piping material with a larger diameter and heavier wall pipe size. The fusion joints were made between different resins of PE 4710 and between PE 4710 and standard PE 3608 and PE 2708 piping materials. These joints were tested using tensile tests and sustained pressure tests at elevated temperatures. The combinations fused and tested were:

8” IPS DR 11 Equistar L4904 PE 4710 to 8” IPS DR 9 PE 3608 pipe
8” IPS DR 13.5 Dow DGDA 2490 PE 4710 to 8” IPS DR 13.5 Ineos TUB 121 PE 4710
8” IPS DR 11 Total XT10N PE 4710 to 8” IPS DR 11 PE 2708 pipe

The Task Group decided to use parameters that were outside the ASTM F2620 procedure to make sure we had a safety zone around the actual parameters recommended. The parameters used for these fusions were the same as in Phase 1:

375 degree F Heater Surface Temperature and 50 psi interfacial pressure
375 degree F Heater Surface Temperature and 100 psi interfacial pressure
500 degree F Heater Surface Temperature and 50 psi interfacial pressure
500 degree F Heater Surface Temperature and 100 psi interfacial pressure

We recorded the following parameters during the fusion process of each joint:

- Time to get an indication of melt
- Soak time to heater removal
- Pressure during the heat soak cycle
- Total open/close (dwell) time for heater removal
- Fusion pressure
- Cooling time at fusion pressure

The samples were allowed to cool for at least an additional 24 hours before cutting test specimens and conducting the tensile and 80° C sustained pressure tests.

Three separate task group companies made the fusion joints and three task group companies did the tensile tests on these samples. Six fusion joints at each parameter condition were made with (24) tensile test joints made for each condition. Three fusion joints at each parameter condition were made for each pipe combination. The tensile tests were conducted per ASTM F2634 and D638. A total of 312 tensile tests were conducted in Phase II. All joints passed the tensile tests in a ductile manner outside the fusion zone. We then conducted elevated temperature (80º C) sustained pressure testing per ASTM D3035 or F714. We tested a total of 36 joints with all passing the requirements in the D3035 or F714 standards.

<u>Phase III</u> --- Pipe Fusion and Testing – Variety of pipe sizes from 6” to 36” and up to 4” wall thickness

The Task Group continued testing of PE 4710 piping material with a larger diameter and heavier wall pipe size. The fusion joints were made on pipe made from PE 4710 resins and were made using the following pipe sizes and at the following parameters. These joints were fused by two different member companies and tested by performing tensile impact testing per ASTM F2634 on the samples from these joints. We also tested the parent pipe to compare the tensile strength between the joint and the pipe.

The Task Group decided to use parameters that were outside the ASTM F2620 procedure to make sure we had a safety zone around the actual parameters recommended:

375 degree F Heater Surface Temperature and 50 psi interfacial pressure
375 degree F Heater Surface Temperature and 100 psi interfacial pressure
475 degree F Heater Surface Temperature and 50 psi interfacial pressure
475 degree F Heater Surface Temperature and 100 psi interfacial pressure

We recorded the following parameters during the fusion process of each joint:

- Time to get an indication of melt
- Soak time to heater removal
- Pressure during the heat soak cycle
- Total open/close (dwell) time for heater removal
- Fusion pressure
- Cooling time at fusion pressure

The pipes tested are listed below:

6” IPS DR11	Total XT10N PE 4710 Resin
12” IPS DR11	CP Chem H516HP PE 4710 Resin
20” DIPS DR11	Total XT10N PE 4710 Resin
28” IPS DR11	Equistar L4904 PE 4710 Resin
36” IPS DR9	Dow DGDA 2492 PE 4710 Resin

Pipe Size	**No. of Joints**	**Heater Surface Temp ° F**	**Interfacial Pressure PSI**	**Total No. of Tensile Tests**
6” IPS DR11	2	425	75	8
12” IPS DR11	1	375	50	4
12” IPS DR11	1	375	100	4
12” IPS DR11	1	475	50	4
12” IPS DR11	1	475	100	4
12” IPS DR11	2	425	75	8
20” DIPS DR11	1	375	50	4
20” DIPS DR11	1	375	100	4
20” DIPS DR11	1	475	50	4
20” DIPS DR11	1	475	100	4
20” DIPS DR11	2	425	75	8
28” IPS DR11	2	425	75	8
36” IPS DR9	1	375	50	8
36” IPS DR9	1	375	100	8
36” IPS DR9	1	475	50	8
36” IPS DR9	1	475	100	8
36” IPS DR9	2	425	75	16

The fused joints in the 36” pipe were over 4” in wall thickness and were machined to approximately 2” in wall in order to test in the tensile machine. There were (22) joints made with 112 tensile tests on the joints and 32 tensile tests on the pipe. The results showed all the joints failed in a ductile manner.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that when the butt fusion procedure, outlined in ASTM F2620-11e1 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings, is used to join PE 4710 piping material, the pipeline owner can expect leak free butt fusion joints that are as strong as, if not stronger than, the pipe when subjected to pressurization, tension and/or bending. As the polyethylene industry moves to broader uniformity, efficiency and simplicity in the area of fusion procedures, the more acceptance PE will receive in the different piping markets.

APPENDIX A

Generic Butt Fusion Joining Procedure for Field Joining PE (Polyethylene) Pipe

Note: The procedure, outlined in Appendix A, was used to make the joints in Section I and Section II of this document. The procedure shown in ASTM F2620 -11e1 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings was used in making the joints in Section III with the parameter exceptions shown in that Section. ASTM F2620 is a refined and expanded copy of this Appendix and should be used as the guide for further qualification.

This Appendix is intended to be used only in conjunction with PPI's Technical Report TR-33 that more fully explains the background, scope and purposes of the PPI generic procedure. This procedure has not been qualified for use with any particular piping product or combination of piping products and must be qualified for use in accordance with 49 CFR Part 192 prior to its use to join PE pipe in a gas pipeline. Any copying or reproduction of this procedure without this footnote and the accompanying TR-33 is a violation of the copyright.

This procedure is intended for butt fusion joining of PE fuel gas pipe produced in accordance with (ASTM D2513), excluding Dupont Aldyl A MDPE, Uponor Aldyl A MDPE and Phillips Driscopipe 7000 and 8000 HDPE[4]. It also is intended for butt fusion joining of PE potable water, sewer and industrial pipe manufactured in accordance with ASTM F714, ASTM D3035, AWWA C-901 and AWWA C-906, as well as other PE pipe and fitting standards listed in Appendix C.

Butt Fusion Procedure Parameters:

Generic Fusion Interface Pressure Range[5]	60-90 psi (4.14-6.21 bar)
Generic Heater Surface Temperature Range	400 - 450°F (204-232ºC)

Butt Fusion Procedures:

The principle of heat fusion is to heat two surfaces to a designated temperature, then fuse them together by application of a sufficient force. This force causes the melted materials to flow and mix, thereby resulting in fusion. When fused according to the proper procedures, the joint area becomes as strong as or stronger than the pipe itself in both tensile and pressure properties.

[4] Dupont Aldyl A MDPE, Uponor Aldyl-A and Phillips Driscopipe 7000 and 8000 were not included in the study.

[5] Interfacial pressure is used to determine fusion joining pressure settings for hydraulic butt fusion machines when joining specific pipe diameters and DR's. Interfacial pressure in NOT the gauge pressure.

Field-site butt fusions may be made readily by trained operators using butt fusion machines that secure and precisely align the pipe ends for the fusion process. The six steps involved in making a butt fusion joint are:

1. Securely fasten the components to be joined
2. Face the pipe ends
3. Align the pipe profile
4. Melt the pipe interfaces
5. Join the two profiles together
6. Hold under pressure

1.0 SECURE

Clean the inside and outside of the pipe to be joined by wiping with a clean lint-free cloth. Remove all foreign matter.

Clamp the components in the machine. Check alignment of the ends and adjust as needed.

2.0 FACE

The pipe ends must be faced to establish clean, parallel mating surfaces. Most, if not all, equipment manufacturers have incorporated the rotating planer block design in their facers to accomplish this goal. Facing is continued until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaw bushings. Open the jaws and remove the facer. Remove any pipe chips from the facing operation and any foreign matter with a clean, lint-free cotton cloth. Bring the pipe ends together with minimal force and inspect the face off. A visual inspection of this operation should verify that faces are square, perpendicular to the pipe centerline on each pipe end and with no detectable gap.

3.0 ALIGN

The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by tightening clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion. Re-face the pipe ends and remove any chips from re-facing operation with a clean, lint-free cotton cloth.

4.0 MELT

Heating tools that simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, the thermometer can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature-measuring device should be used before the first joint of the day is made and periodically throughout the day to insure proper temperature of the heating tool face that contacts the pipe or fitting ends. Additionally, heating tools are usually

equipped with suspension and alignment guides that center them on the pipe ends. The heater faces that come into contact with the pipe should be clean, oil-free and coated with a nonstick coating as recommended by the manufacturer to prevent molten plastic from sticking to the heater surfaces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions. Never use chemical cleaners or solvents to clean heating tool surfaces.

The surface temperatures must be in the temperature range 400-450°F (204-232°C). Install the heater in the butt fusion machine and bring the pipe ends into full contact with the heater. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure very briefly, it should be released without breaking contact. On larger pipe sizes, initial pressure may be maintained until a slight melt is observed around the circumference of the pipe before releasing pressure. Continue to hold the components in contact with each other, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surfaces all around the pipe or fitting ends, remove the heater. Melt bead size is dependent on pipe size. See table below for approximate melt bead sizes.

Table 2. Approximate Melt Bead Size

Pipe Size	Approximate Melt Bead Size
1 ¼" and smaller (40mm and smaller)	1/32" – 1/16" (1-2mm)
Above 1 ¼" through 3" (above 40mm-90mm)	About 1/16" (2mm)
Above 3" through 8" (above 90mm-225mm)	1/8"-3/16" (3-5mm)
Above 8" through 12" (above 225mm-315mm)	3/16"-1/4" (5-6mm)
Above 12" through 24" (above 315mm-630mm)	1/4"-7/16" (6-11mm)
Above 24" through 36" (above 630mm-915mm)	About 7/16" (11mm)
Above 36" through 63" (above 915mm-1600mm)	About 9/16" (14mm)

5.0 JOINING

After the heater tool is removed, quickly inspect the pipe ends (NOTE: If a concave melt surface is observed, unacceptable pressure during heating has occurred and the joint will be low quality. Do not continue. Allow the component ends to cool completely, and restart at the beginning. Except for a very brief time to seat the components fully against the heater tool, do not apply pressure during heating.), then immediately bring the molten pipe ends together with sufficient fusion force to form a double rollback bead against the pipe wall.

For larger manual and hydraulic butt fusion machines, fusion force is determined by multiplying the interfacial pressure, 60-90 psi, by the pipe area. For manually operated fusion machines, a torque wrench may be used to apply the proper force. For hydraulically operated fusion machines, the fusion force

can be divided by the total effective piston area of the carriage cylinders to give a hydraulic gauge reading in psi. The gauge reading is theoretical; internal and external drags are added to this figure to obtain the actual fusion pressure required by the machine. The hydraulic gauge reading is dependent upon pipe diameter, DR and machine design. Interfacial pressure and gauge reading are not the same value.

6.0 HOLD

Hold the joint immobile under fusion force until the joint has cooled adequately to develop strength. Allowing proper cooling times under fusion force prior to removal from the clamps of the machine is important in achieving joint integrity. The fusion force should be held between the pipe ends for approximately 30-90 seconds per inch of pipe diameter or until the surface of the melt bead is cool to the touch.

Avoid pulling, installation or rough handling for an additional 30 minutes. Additional time may be required for pipes with a wall thickness greater than 2".

7.0 VISUAL INSPECTION

Visually inspect and compare the joint against the manufacturer's recommended appearance guidelines. Visually, the width of butt fusion beads should be approximately 2-2 ½ times the bead height above the pipe and the beads should be rounded and uniformly sized all around the pipe circumference. The v-groove between the beads should not be deeper than half the bead height above the pipe surface. When butt fusing to molded fittings, the fitting-side bead may display shape irregularities such as minor indentations, deflections and non-uniform bead rollover from molded part cooling and knit lines. In such cases, visual evaluation is based mainly on the size and shape of the pipe-side bead. (See Appendix D for bead configuration). Visually unacceptable joints should be cut out and re-fused using the correct procedure. (See manufacturer's visual inspection guidelines)

Figure A-1. Visually unacceptable mitered joint

Visually mitered (angled, off-set) joints should be cut out and re-fused (straight or coiled pipe).

Coiled pipe is available in sizes through 6” IPS. Coiling may leave a bend in some pipe sizes that must be addressed in the preparation of the butt fusion process. There are several ways to address this situation:

1. Straighten and re-round coiled pipe before the butt fusion process. (ASTM D2513 requires field re-rounding coiled pipe before joining pipe sizes larger than 3” IPS.)

2. If there is still curvature present, install the pipe ends in the machine in an “S” configuration with print lines approximately 180° apart in order to help gain proper alignment and help produce a straight joint. See Figure A-2.

3. If there is still a curvature present, another option would be to install a straight piece of pipe between the two coiled pipes.

Every effort should be made to make the joint perpendicular to the axis of the pipe.

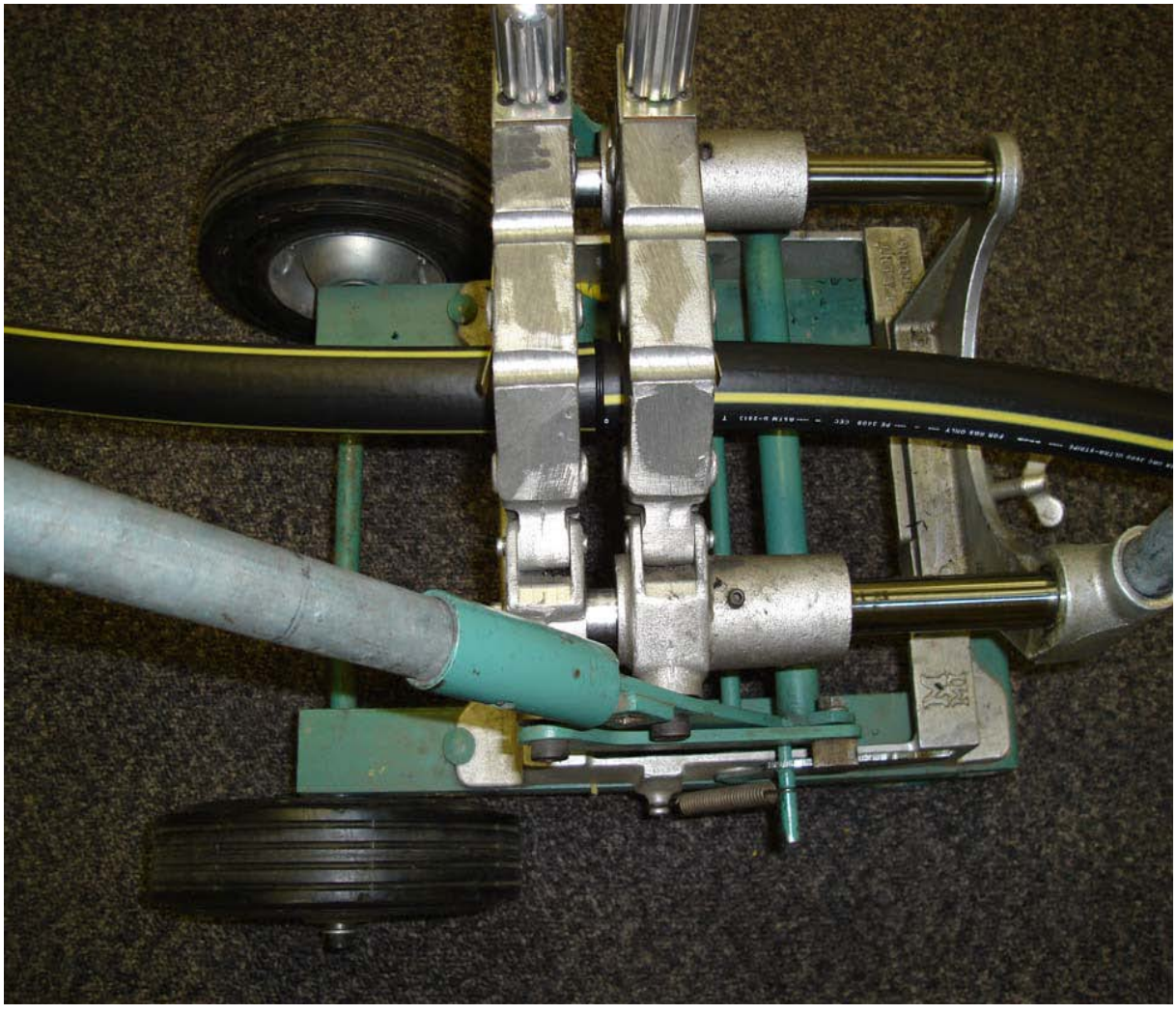


Figure A-2. Alignment of Coiled Pipe Ends Through a Butt Fusion Machine

APPENDIX B

LETTERS OF COMPLIANCE FROM PPI MEMBER COMPANIES FOR 49 CFR §192.283 FOR PIPE INTENDED FOR GAS DISTRIBUTION APPLICATIONS

Please contact the pipe or fittings manufacturer for letters of compliance.

APPENDIX C

Municipal and Industrial Applications

Materials that have been pre-qualified to be joined by this generic fusion procedure are within the nominal melt index range of 0.05 to 0.25 gm/10 minutes (190°C/ 2.16 Kg), or a high load melt flow of 6 to 17 gm/10 minutes (190°C/21.6 Kg), and a nominal density range of 0.936 to 0.955 gm/cc.

Materials within this melt index and density range were included in the study and can be joined by this methodology. However, PE materials outside of this range may also be able to be joined by this generic method, but they have not been included in this study. Contact the manufacturer to verify that their products can be joined by this generic method.

Qualified materials are typically used in the production of pipe and/or fittings that are manufactured according to the following standards:

ASTM
D2104 Polyethylene (PE) Plastic Pipe, Schedule 40

D2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

D2447 Polyethylene (PE) Plastic Pipe, Schedules 40 to 80, Based on Outside Diameter

F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2634 Standard Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

D3035 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

D3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

F714 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Outside Diameter

F771 Polyethylene (PE) thermoplastic high-pressure Irrigation Pipeline Systems F 810 Smooth wall Polyethylene (PE Pipe for Use in Drainage and Waste Disposal Absorption Fields

AWWA

C-901 Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2“through 3” for Water Service

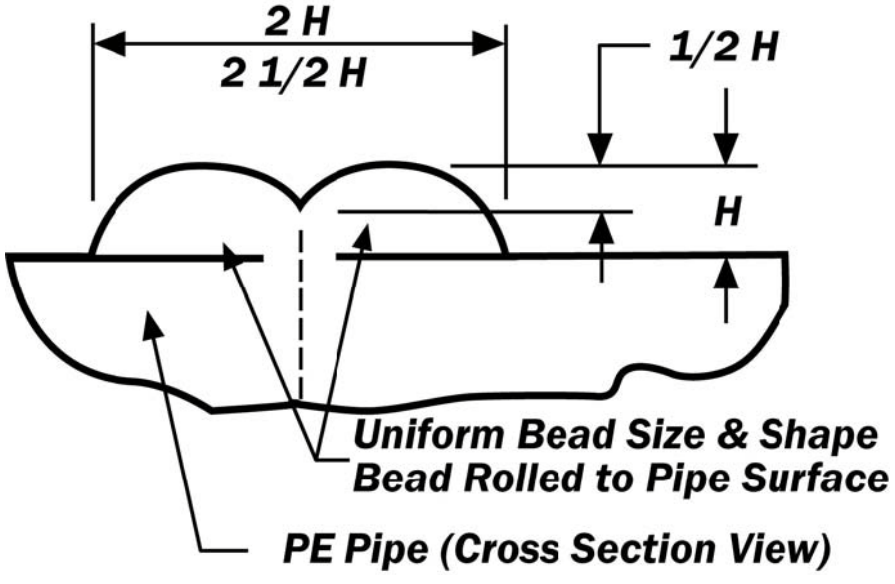
C-906 Polyethylene (PE) Pressure Pipe and Fittings, 4” through 63” for Water Distribution

CSA

B 137.1 Polyethylene Pipe, tubing and Fittings for Cold Water Pressure Services

APPENDIX D

ILLUSTRATION OF A PROPERLY MADE BUTT FUSION JOINT



Note: When butt fusing to molded fittings, the fitting side bead may have an irregular appearance. This is acceptable provided the pipe side bead is correct.

This bead configuration DOES NOT apply to joints made with Dupont Aldyl A MDPE, Uponor Aldyl A MDPE or Phillips Driscopipe 7000 and 8000 HDPE.

Generic Electrofusion User Guide for Field Joining of Polyethylene Gas Piping

TR-49

2020

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FOREWORD

This user guide was developed and published with the technical help of the members of the PPI (Plastics Pipe Institute, Inc.). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The purpose of this user guide is to provide important information available to PPI on a particular aspect of polyethylene pipe electrofusion to engineers, users, contractors, code officials, and other interested parties. More detailed information on its purpose and use is provided in the document itself.

This guide has been prepared by PPI as a service of the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered “as is” without any express or implied warranty, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Consult the manufacturer for more detailed information about the particular joining procedures to be used with its piping products. Any reference to or testing of a particular proprietary product should not be construed as an endorsement by PPI, which does not endorse the proprietary products or processes of any manufacturer. The information in this report is offered for consideration by industry members in fulfilling their own compliance responsibilities. PPI assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this guide from time to time, in response to comments and suggestions from users of the report. Please send suggestions of improvements to the address below. Information on other publications can be obtained by contacting PPI directly or visiting the web site.

The Plastics Pipe Institute, Inc.

www.plasticpipe.org

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ACKNOWLEDGMENTS

Critical input and review was requested of and provided by gas utility operators, Gas Technology Institute (GTI), Operations Technology Development (OTD) members, and electrofusion fitting and equipment manufacturers.

The following is a list of contributors that provided technical assistance, user input, editorial review, and endorsement of this guide:

Atmos Energy
CenterPoint Energy
CenterPoint Vectren
ConEdison
Dominion Energy
Gas Technology Institute
Infrasource
National Grid
Northeast Gas Association
Northwest Natural
One Gas
Peoples Gas
Quanta Services
SoCal Gas
Palermo Plastics Pipe (P3)
Plastics Pipe Institute (PPI)
Friatec (IPEX)
Georg Fischer Central Plastics LLC
Plasson USA

Generic Electrofusion User Guide for

Field Joining of Polyethylene Gas Piping

1.0 HISTORY

Electrofusion joining of PE pressure pipe has been commonly used in North America for over 30 years. ASTM standard specifications for materials (ASTM D3350), performance (ASTM F1055), and installation practice (ASTM F1290) have been in publication for many years. Since each fitting manufacturer may have slightly varying geometrical designs, and each manufacturer is responsible for establishing safe installation temperature limits, it is also common that installation instructions can vary from one manufacturer to another. Although instructions can vary, all fitting designs share some common requirements for installation and all manufacturer's instructions include these same requirements.

A PPI task group was formed in 2017 to examine the differences among the varying joining procedures, to identify similarities in those procedures, and to determine whether there were a sufficient number of common elements to provide a basis for a more uniform, or "generic" joining procedure that could be implemented by pipeline operators for regulated gas applications as required in §192.283 (Plastic pipe, qualifying joining procedures) of C.F.R (Code of Federal Regulations) Title 49.

The result of the task group work, along with input from utility users and industry expertise, is the following technical report, *TR-49 - Generic Electrofusion User Guide for Field Joining of Polyethylene Gas Piping*.

2.0 SCOPE

The purpose of this document is to provide background and supporting information related to the common installation practices for electrofusion fittings. This information is intended to be used in support of the development of generic joining procedures and practices. The procedures contained herein are in alignment with the manufacturers procedures that have been qualified by subjecting specimen joints made using this procedure to the tests described in C.F.R Title 49, Part 192, §192.283 (1)(iii) and (2).

This document is applicable for electrofusion joining to modern commercially available PE pipe grades of PE2406, PE2708, PE3408, and PE4710. Legacy materials such as PE2306, PE3406, PE3306, Dupont® Aldyl A, Uponor® Aldyl A, and Driscopipe® 7000 or 8000 pipe materials were not included in the development of this document.

PPI hopes that the inherent value of greater uniformity will provide all the incentive necessary for companies to evaluate this procedure as a first option for electrofusion joining of its PE piping products. Use of this procedure is obviously not mandatory, and every electrofusion fitting producer, pipe producer, and pipeline operator retains the option of developing different procedures for its particular products and pipelines. However, PPI believes that its work in developing this procedure as a candidate for

widespread acceptance throughout the industry will lead to greater efficiency, simplicity, and understanding in this area and promote the use of effective, qualified procedures for electrofusion joining of PE gas pipe.

3.0 INTRODUCTION

Electrofusion is widely used in the installation of polyethylene (PE) piping for gas pressure applications. Electrofusion fitting designs vary between manufacturers and historically each manufacturer had developed and qualified its own installation procedure. Slight differences in procedures between manufacturers made it difficult for pipeline operators to qualify persons through appropriate training and experience. Creating a more uniform electrofusion joining guideline for natural gas distribution systems would bring greater consistency to this aspect of the gas pipeline installation, facilitate the pipeline owner's efforts to qualify the procedure, increase efficiencies, and simplify DOT enforcement duties.

Pipe preparation is perhaps the most important and least understood aspect of making a sound electrofusion joint. Improper pipe preparation is overwhelmingly the leading cause of unsuccessful electrofusion joint attempts because the installer may not completely understand the goal of pipe scraping, which is to remove a thin layer of the outer pipe surface (see trouble-shooting section for more details) to expose clean virgin material beneath. Additionally, contamination is the second leading cause of failures. Installers must appreciate the vital need to keep all surfaces of the pipe and the electrofusion absolutely clean and free of contamination or other foreign matter.

Proper installation techniques, installer understanding of and training to these techniques, and effective examination before installation are key to a successful installation. This document provides detailed instructions for each key step to a successful installation, why each step is important, and how to tell if the requirements of each step have been accomplished.

3.1. **Other Acceptable Fusion Procedures**

It must be recognized that there are many different procedures used both currently and historically throughout the world that have been proven to make effective, reliable electrofusion joints. The pipeline operator and every fitting producer retain the option of developing different fusion procedures for its particular products and pipelines. In certain cases, due to operating conditions, weather, or the characteristics of the joining equipment, it may be necessary or even advisable to use another procedure.

4.0 SAFETY NOTES AND WARNING SYMBOLS

Safety notes are included in this manual where appropriate, however this manual does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this manual to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

Symbols are used throughout this manual to indicate the potential for danger, injury, and/or material damage, and to alert the user of important information related to the fusion process. Symbols indicate that particular attention should be given and that an action is necessary.

Symbol	Meaning
	Attention! – Important Information! Possible danger, damage, risk of unsuccessful fusion or poor fusion quality.
	Best Practice – This symbol is used to indicate an instruction that is considered to be a “best practice”. This practice is recommended and potentially vital to success.
	Prohibited! – This symbol is used to indicate a practice, material, tool, or action that is specifically prohibited in conjunction with instructions in this manual.

- ⚠ **Follow company guidelines and safety procedures for grounding/static discharge.**
- ⚠ **Electrofusion fittings and equipment are not to be considered “explosion proof”.**
- ⚠ **Caution should be exercised when working with generators and other electrical power sources.**
- ⚠ **Scraping/peeling tools can have sharp edges. Use with care to avoid injury.**
- ⚠ **Tools should be in good working order and inspected before use for wear and/or damage. Damaged or worn tools should not be used until repaired.**
- ⚠ **The electrofusion processor and generator should be located out of the excavation, when in a gaseous atmosphere, during the electrofusion operation.**

5.0 JOBSITE PREPARATION

All heat fusion joining methods require that there is no water or any other foreign liquids flowing or standing in the pipe that can reach the fusion surfaces. De-watering of the site or excavation may be required to prevent ground water or other liquids from reaching the fusion and contaminating the surfaces to be joined. Dewatering can be accomplished using portable pumps (Fig.1) in moderate conditions.

Figure 1: Submersible pump

Electrofusion fittings can be installed in ambient temperatures as recommended by the manufacturer. A typical qualified temperature range for installation is 14°F minimum to 113°F maximum. Some manufacturers have lower and/or higher temperature limits and will state their qualified range in their technical specifications, contact the fitting manufacturer to verify.

6.0 FITTING STORAGE AND HANDLING

Electrofusion fittings are packaged in sealed plastic bags as protection against accumulation of dust, dirt, and contamination. The bag should remain in place during normal handling and should only be removed immediately prior to installation. Fittings are typically boxed to protect against sources of degradation, such as oxidation due to UV exposure over long periods of storage. Surface oxidation can still occur, therefore electrofusion fittings should not be exposed for long periods to direct sunlight. Fittings should always be stored indoors in their original packaging until installation. For transportation until installation, enclosed utility truck storage bins are suitable.

⚠ **Fittings with an unknown storage history or that have been exposed to questionable storage conditions should be evaluated through destructive testing of sample fusions. If fusion quality is shown to be affected, the fittings in question should not be installed.**

Fittings should be inspected for damage before installing to ensure that connection points such as terminal pins have not been damaged from handling, that there is no visible damage to fusion surfaces or heating wires, and that no foreign materials are present on or near the fusion surfaces.

Fittings can be cleaned if incidental contact is made with the fusion surface. A suitable cleaning agent that contains no additives to hinder the fusion process must be used. A 90% or greater concentration of Isopropyl alcohol, with no additional additives except water, is universally accepted as a good cleaning agent. Ensure that wipes are clean before use and do not use wipes on multiple surfaces to avoid picking up and spreading contaminants.

Other cleaning agents, such as acetone, have been evaluated[1] and may be acceptable alternates to Isopropyl alcohol. The fitting manufacturer or local regulations should be consulted in case of questions.

⚠ **DO NOT USE DENATURED ALCOHOL – Denatured alcohols may contain additives that can prevent fusion and should not be used.**

7.0 REQUIRED TOOLS

Proper tools are essential to a successful electrofusion installation. Tools include devices for measuring, marking, cutting, scraping, peeling, cleaning, clamping (which includes aligning and securing), re-rounding, and power delivery. At minimum, the following items should be accessible during installation

- **Measuring:** A tape measure, rule, or fitting can be used for measurement of insertion (stab) depth of pipe ends inside a coupling. A circumferential wrap Pi tape for measurement of pipe diameter is also recommended to determine that the pipe diameter is within specified tolerance.

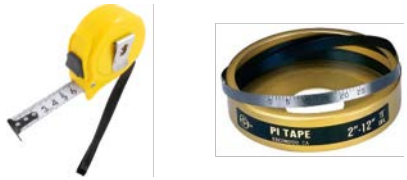

Figure 2: Tape Measure and Pi Tape

[1] GTI-OTD FINAL REPORT 5.16.a-Project Number 21948 *Solvent Cleaning and PE Joining Procedures.*

- **Marking:** A fast-drying permanent visible marker of contrasting color to the pipe is used to mark the pipe surface. The marker must not contain oils or other ingredients that could accidentally contaminate a prepared pipe surface. Marks are needed to locate insertion depths and to use as a guide for pipe scraping effectiveness.

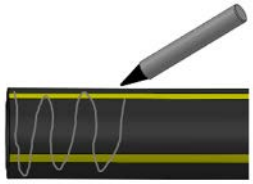

Figure 3: Pipe Marking

⚠ **Markers that are slow-drying or contain oils that could be spread onto fusion surfaces should not be used.**

- **Cutting:** Devices that deliver a relatively clean and square cut (±3 degrees) on the pipe ends are recommended. Square cut pipe ends are important when inserting into electrofusion couplings because a pipe end that is cut with a severe enough angle may not completely extend into the center cold zone or may not cover the heating wires.

  Many suitable types of pipe cutters are commercially available that can be used for diameters of 12 inch and smaller (see Figure 4).

⚠ **Use only those devices that are allowed/approved by the pipeline operator in a manner that complies with all safety requirements.**

⚠ **Use caution when cutting pipe that has carried natural gas. Follow company safety guidance for proper tools, grounding, or anti-static discharge measures.**

Figure 4: Pipe cutters (rotational, ratcheting, and guillotine style)

✓ For larger diameter pipe, a suitable saw (without lubricants that can be detrimental to the joint) and a guide or guide marks can be used; reciprocating saws, circular saws with a coarse-tooth blade, hot saws, chop saws, and chain saws are commonly used for larger pipes with appropriate safety precautions and personal protective equipment. Cutting marks can be made around the pipe using a 2 inch or wider strap or

encirclement clamp as a guide so that the pipe can then be cut along the line as shown in Figure 5.

Figure 5: Marking and cutting larger diameter pipes

8.0 MEASURING PIPE

8.1. **Diameter**

Electrofusion fittings are designed for use on pipe made to standard diameters in dimensions for Iron Pipe Size (IPS) and Copper Tube Size (CTS). Pipe that is outside of the diameter tolerance band of the appropriate pipe standard should not be used. The following tables include diameters and tolerances from ASTM D2513 and ASTM D2737 and can be used for reference when measuring gas distribution pipe diameter to ensure that is within tolerance.

Table 1: Standard Pipe Dimensions - Iron Pipe Size (IPS) ASTM D2513

IRON PIPE SIZE (IPS) ASTM D2513		
Nominal Pipe Size	Nominal Diameter (inches)	Tolerance (+/-)
1/2 IPS	0.840	0.004
3/4 IPS	1.050	0.004
1 IPS	1.315	0.005
1 1/4 IPS	1.660	0.005
1 1/2 IPS	1.900	0.006
2 IPS	2.375	0.006
3 IPS	3.500	0.008
4 IPS	4.500	0.009
6 IPS	6.625	0.011
8 IPS	8.625	0.013
10 IPS	10.750	0.015
12 IPS	12.750	0.017

Table 2: Standard Pipe Dimensions - Copper Tube Size (CTS) ASTM D2737

COPPER TUBE SIZE (CTS) ASTM D2737		
Nominal Tubing Size	Nominal Daimeter (inches)	Tolerance (+/-)
1/2 CTS	0.625	0.004
3/4 CTS	0.875	0.004
1 CTS	1.125	0.005
1 1/4 CTS	1.375	0.005
1 1/2 CTS	1.625	0.006
2 CTS	2.125	0.006

8.2. Pipe Toe-in

A slight reduction in pipe diameter at the end of the pipe is referred to as toe-in. Pipes that are freshly cut and molded fittings generally do not have toe-in. If severe toe-in is present, trimming up to 2 inches off the pipe end will usually remove it.

8.3. Roundness

Polyethylene is a flexible material. Although pipe may be round at the time of manufacture, pipe roundness can be affected by a number of conditions to include coiling, storage/stacking, bending, and soil load if buried. The following information can be used to determine if a pipe is suitable for electrofusion joining without the use of re-rounding devices.

The condition of pipe roundness can be expressed in two ways; “out-of-roundness” and “ovality”. While both are referencing the same basic condition, it can sometimes be confusing.

8.3.1. Out-of-roundness is the difference in the maximum measured diameter minus the minimum measured diameter. The pipe can be measured with a tape measure or calipers to find the maximum (d1) and minimum (d2) diameter points. The out-of-roundness is calculated as d1- d2 as measured in the field.

8.3.2. Ovality is the difference between the maximum and minimum measured outside diameters expressed as a percentage. Ovality is calculated as (d1 – d2) / $D_{average}$ x 100.

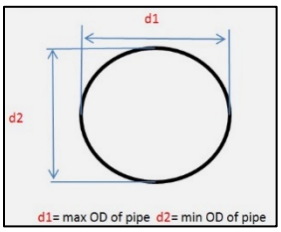

Figure 6: Roundness Measurement

Pipe out-of-roundness can have a negative effect on electrofusion joint quality. If the pipe is out-of-round and is not corrected, the amount of gap between the pipe and fitting can be too large for the melt expansion to close and for proper heat transfer to occur between the fitting and the pipe. An out-of-round pipe can also increase the difficulty of sliding (coupling) or clamping (saddle) the fitting onto the pipe.

Most often, 2 IPS and smaller diameter tubing is flexible enough that the coupling and alignment clamps will provide the necessary rounding forces and no other re-rounding device is needed.

For sizes equal to or larger than 3" IPS, re-rounding clamps may be needed on either side of an electrofusion fitting to ensure that the gap between the pipe and fitting is not too large. The table below can be used for guidance when re-rounding clamps are used.

Table 3: Maximum Out-of-Roundness (IPS/DIPS)

PIPE SIZE	d1 - d2
3"	.0625 or 1/16"
4"	.0625 or 1/16"
6"	.125 or 1/8"
8"	.125 or 1/8"
10"	.125 or 1/8"
12"	.125 or 1/8"

8.3.3. **Pipe scratches, gouges, and damage:** Installation of pipe can cause surface scratches or gouges. Smaller scratches from dragging or normal handling are not problematic and will normally be removed during the pipe preparation process by scraping.

⚠ **Gouges that are deeper than the scrape depth may also require extra attention when scraping the pipe to ensure that any debris or contaminants embedded in the gouges are removed. If the gouge exceeds 10% of the pipe wall thickness**

(refer to Coupling Installation, Sec. 4, p. 17), that pipe section should be cut out and replaced to maintain the maximum pressure rating of the pipe.

⚠ **Hydrocarbon contamination of PE pipe can result in reduced heat fusion joint strength. Do not attempt to electrofuse to pipe that has been permeated by heavy hydrocarbons at the external surface of the pipe area being fused. Refer to ASTM D2513 Appendix X.1 for guidance on joining PE pipe that is known to have hydrocarbon permeation.**

9.0 PIPE PREPARATION

9.1. Cleaning

1. Clean the pipe beyond the area to be scraped with clean water[2] without soap to remove dirt, mud, or other debris. Soaps should not be used because it may contain surfactants or wetting agents that could be detrimental the fusion process.
2. Clean the pipe for a length far enough beyond the area to be fused to ensure that remaining debris on the pipe surface will not be transferred to the area to be prepared during handling.
3. Inspect the cleaned pipe surface for gouges or embedded debris such as rocks that might damage scraping and peeling blades.
4. Next, clean an area approximately twice as long as the area to be scraped with 90% or greater isopropyl alcohol.

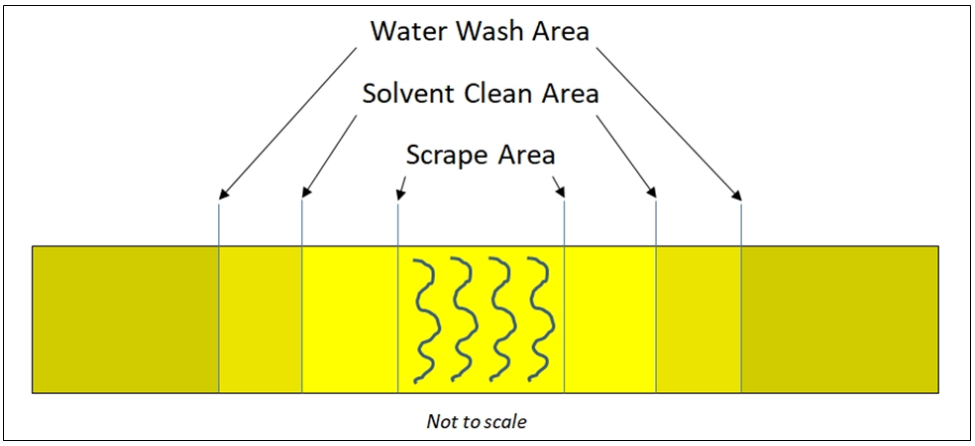

Figure 7: Schematic of Cleaned Pipe Areas

NOTE 1: Other cleaning agents (such as acetone) may be suitable. Refer to local regulations for environmental and health effects.

[2] At installation temperatures at or below freezing, a solvent may be used in place of water for the initial cleaning.

9.2. **Scraping/Peeling**

Pipe preparation is perhaps the most important and least understood aspect of making a sound electrofusion joint. Improper pipe preparation is overwhelmingly the leading cause of unsuccessful electrofusion joint attempts because the installer may not completely understand the goal of pipe scraping, which is to remove a thin layer of the outer pipe surface (see trouble-shooting section for more details) to expose clean virgin material beneath.

Pipe surfaces exhibit surface oxidation from the extrusion process, transportation, and outdoor exposure. Surface oxidation is a normal chemical reaction that results in a physical change to the molecular structure of the polymer chains on the pipe surface. Oxidation acts as a physical barrier and therefore those surfaces cannot be heat fused. Simply roughing the pipe surface is not sufficient. In order to achieve fusion, this layer must be removed. Even new pipe must be properly scraped and prepared before a fusion will be successful.

NOTE 2: The pipe preparation method discussed in this guide and references to “peeling” or “peelers” refers to methods of removing the outer surface of the PE pipes. It should not be confused with commercial products designated as “peelable pipes” which contain a removable outer layer. While peelable pipe is suitable for use with electrofusion, the pipe preparation methods discussed in this guide and references to “peeling” or “peelers” are not related to the use of peelable pipe.

The outer oxidation layer on a pipe surface is very thin. It does not increase in depth of more than a few thousandths of an inch even over long periods of outdoor exposure, so regardless of the amount of time the pipe has been stored before scraping, the scraping depth requirement is the same. An adequate minimum amount of material that must be removed is just seven thousandths of an inch (.007” or 7 mils). That thickness is approximately the same as two sheets of ordinary paper.

Pipe preparation tools should be inspected at each use to ensure that they are performing as intended. Cutting blades can dull quickly as they peel pipe. Measurement of material thickness of peeled ribbon can be helpful to determine if tools are working properly. The figure below shows a caliper being used to measure a plastic peel ribbon. The 0.008 inch thickness indicates that the tool is working properly. Preparation tools should be cleaned before each use to remove any dirt, oils, or other residues from parts that will contact the pipe surface.

Figure 8: Scraping/Peeling measurement using a caliper

⚠ **Sand paper, emery cloth, or other abrasives should never be used to prepare a pipe surface for electrofusion. Abrasives have been proven to be ineffective for electrofusion because they don't adequately remove material, they can redistribute contaminants on the surfaces, and because they can leave behind a grit residue that forms another barrier that will also prevent fusion.**

There are many tools that can be used for pipe preparation, however there are differences in operation that should be considered, differences in appearance of the pipe surface after use, and care must be used depending on the type of tool selected. The only tools suitable for use for pipe surface preparation are those that are specifically designed and qualified for electrofusion scraping and peeling.

9.2.1. **Peelers**

Examples of acceptable tools that “peel” the pipe surface to a controlled depth are most commonly referred to as “peelers” and are shown below.

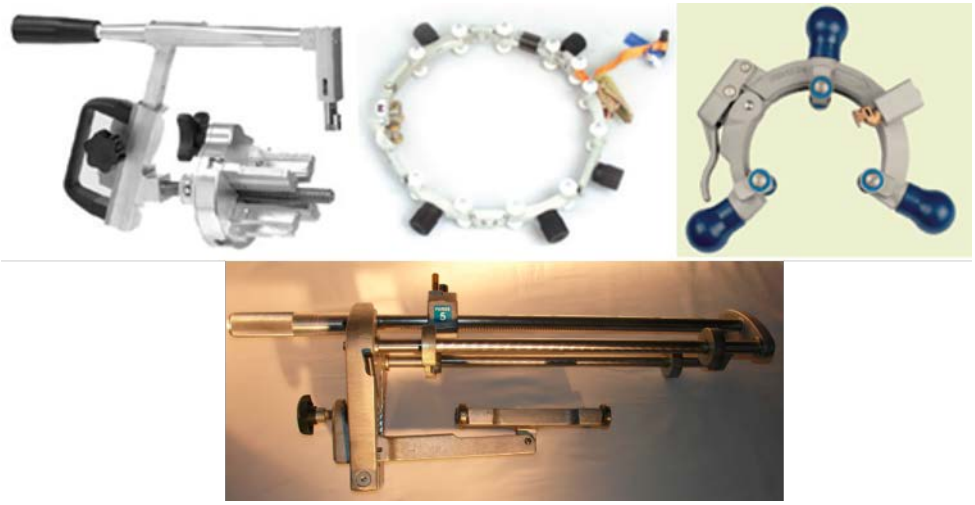

Figure 9: Pipe Peelers

Figure 10: Tubing Peelers (≥ 2 IPS)

9.2.2. **Scrapers**

Tools with serrated blades are also available; these tools physically scrape the pipe surface by pulling the serrated blade across the pipe in a perpendicular position to the pipe. Although these tools can be used satisfactorily for pipe preparation, it is important to know that serrated blades sometimes mask the pipe surface by leaving behind score marks that make it difficult to visually tell if all of the original surface material has been removed. Additionally, if a pipe surface with serrations becomes dirty or contaminated, it may not be reliably cleaned with a solvent and wipe due to the serrations trapping and retaining material.

Figure 11: Examples of serrated type blade scrapers

9.2.3. A third type of tool is referred to as a "hand scraper". **These scrapers are generally not recommended** when peelers and scrapers are commercially available due to inconsistent surface preparation and difficulty in mastering skills required for uniform surface preparation, however they can be used effectively. As a best practice, they should only be used in situations where confined working space or pipe scratches or gouges require a hand tool.

Figure 12: Hand Scrapers

⚠ **<u>Wood rasps and metal files are not acceptable scraping tools.</u>**

It is strongly recommended that, no matter what type of tool is used, witness marks should be made on the pipe surface with a permanent marker prior to scraping. Some reviews have shown that markers can penetrate the pipe surface so any marking that remains after scraping is clear evidence to the user that areas were missed or that more scraping is required.

10.0 FITTING CLAMPING

Electrofusion fittings generate significant pressures from thermal expansion during the melt phase of the fusion process. This melt pressure is an integral part of the fusion process and a designed function of the fitting and fusion parameter. Polyethylene is also a thermoplastic that softens when heated. As a result, it is recommended that all electrofusion fittings should be installed with the use of alignment and restraining clamps or devices.

Couplings use clamps that restrain the pipe ends from moving and keep the pipes in alignment. Some coupling clamp designs when placed on either side of the fitting also serve to round the pipe. The pipe and coupling must be properly aligned and supported in a stress-free condition for fusion and cooling.

Figure 13: Pipe Alignment and Restraining Clamps

Saddle type fittings require clamps to secure the fitting to the main to prevent movement, restrain against generated melt pressure, and in some cases to form the fitting to the contour of the main. Saddles are designed to be used with a particular clamping device. Clamping devices are typically not interchangeable from one fitting design or main size to another. In some cases clamping devices may be a part of the fitting in the form of nylon straps or plastic clamps that bolt to the fitting (commonly referred to as under-parts). Straps and underparts are typically intended to remain in place after fusion.

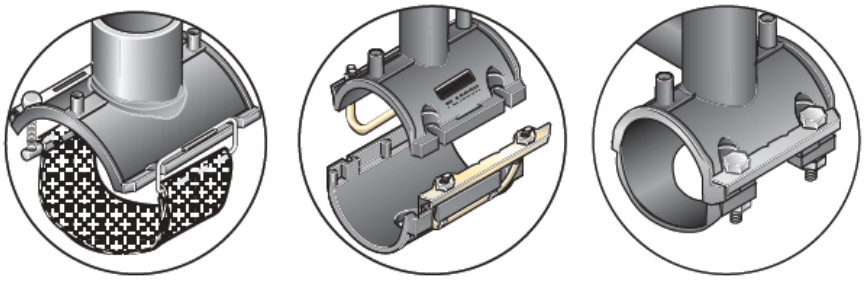

Figure 14: Integral saddle clamps that remain in place after fusion

Some other designs include a clamp that is re-usable and is removed after the fitting has cooled.

⚠ **Alignment and restraining clamps need to be inspected for excessive wear or defects.**

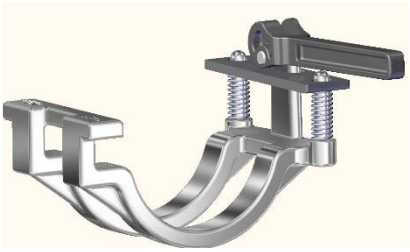

Figure 15: Reusable saddle clamps

11.0 CONTROL BOX

Electrofusion control boxes, sometimes referred to as processors, perform vital functions during the fusion process. The control box provides carefully regulated voltage for the required fusion time to input the designed energy necessary for fusion. The control box performs basic checks prior to the beginning the fusion to verify that the fitting coil has continuity, that the coil resistance matches the barcode information, and that the voltage being supplied is sufficient. During the fusion process, the control box also monitors the power being supplied to the fitting and can detect certain assembly or fitting errors such as shorted heating coils or short-stabbed pipe ends.

When using the fitting barcode, the control box checks the ambient air temperature and automatically adjusts the fusion time for ambient temperature effects if the fitting barcode requires.

The control box will terminate a fusion process when any defined protocol is out of range and will display an error message. Most control boxes have a list of error message meanings affixed to the unit that can be referred to if an error occurs. A record of each fusion, as well as the result of the fusion cycle, is stored in a downloadable memory.

The control box manufacturer recommends regular calibration intervals, typically every 2 years, to ensure that all monitored parameters are measured accurately and the control box is functioning normally. Units that are past their calibration interval will normally alert the operator at power-up, but will continue to function when acknowledged.

⚠ **It is not recommended that units continue to be used beyond their calibration period.**

12.0 POWER REQUIREMENTS

Control boxes are typically available in 110v or 220v versions. The control box monitors the energy input from the power source to ensure that fluctuations from the generator are within designed tolerances and alerts the installer when parameters fall out of range. Control boxes are typically tolerant to small fluctuations in input voltage or frequency, however not all generators or inverters are equal. Generators frequently are the cause of intermittent errors, when the assembly is known to have been completed correctly. It is important to ensure that the power supply is in good working order and capable of supplying the required energy for the fitting being fused.

Each electrofusion fitting has an integral heating coil that requires a defined amount of energy input to achieve the designed results. Heating coils are engineered specifically for a fitting size or configuration and power requirements will vary from one manufacturer to another for the same size fitting. The fitting manufacturer can provide specific requirements for its particular products, but the table below can be used as a guide for most fittings that are commonly available.

Table 4: Input Power Requirements

INPUT POWER REQUIREMENTS					
FITTING TYPE	**FITTING SIZE**	**GENERATOR MINIMUM**	**BREAKER MINIMUM 110v / 220v**	**EXTENSION CORD GAGE (25 ft.)**	**EXTENSION CORD GAGE (50 ft.)**
SOCKET	1/2" to 2"	2.5 kVA	15 / 15 AMP	#10/3	#8/3
SOCKET	3" to 12"	5 kVA	30 / 20 AMP	#10/3	#8/3
SADDLE	ALL	2.5 kVa	15 / 15 AMP	#10/3	#8/3

Extension cords can be used, however the wire gage should not be less than that shown in the table above for the applicable maximum length.

Consult the control box manufacturer for further details on recommended extension cords, pigtails, generators or inverter needs.

Load tests can be performed on power supply equipment to verify output and duty cycle.

13.0 FUSION PARAMETERS

Fusion parameters such as fusion time, voltage, and cooling time, can be entered into the control box by various means.

- All electrofusion fittings have a fusion barcode attached that contains all of the information needed by the control box to perform the fusion process. Barcodes contain additional information about the fitting manufacturer, fitting resistance, and temperature correction values if required by the fitting manufacturer.
    - Codes are displayed on the fitting label in an interleaved barcode format that can be read by a barcode wand or hand-held scanner.
    - The 24-digit numerical value is also printed on the label, either directly above or below the barcode that can be entered into the control box in in the event that the code cannot be scanned.

Figure 16: 24-Digit Barcode

- Identification resistors are supplied in some fitting designs that can be read by a compatible control box to automatically set the fusion time, voltage, and cooling time. The resistor pin is usually identified by a colored insert in the center of the pin that can be matched to a colored end of the control box cable.

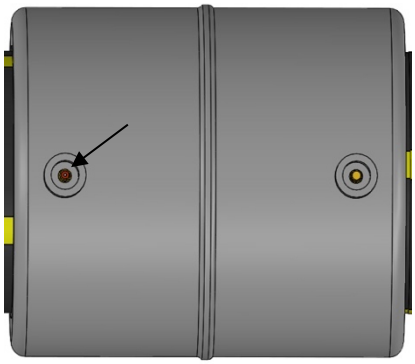

Figure 17: Identification Resistor Pins

- Manual entry of fusion time and voltage entry may be possible if printed on the fitting label. The fusion time is typically preceded by the word “WELD” or “FUSE” and displayed in seconds. The voltage is displayed and followed by “V”.

Figure 18: Fusion Time & Voltage Label

14.0 ELECTROFUSION INSTALLATION TRAINING PROCEDURES

Preamble: It is important to note that the cleaning, scraping, assembly and fusion steps should be performed promptly in succession, for any type of fitting being installed. Prompt execution of these steps will minimize the chances of contamination on the fusion surfaces of the pipe and fitting.

14.1. **COUPLING INSTALLATION**

1. Cut the pipe ends (after cleaning first if necessary) squarely and evenly to remove any toe-in.

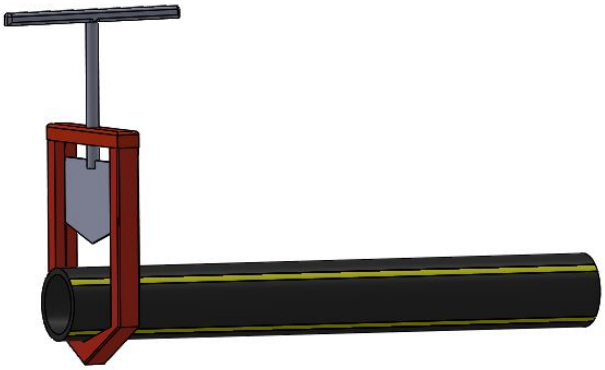

Figure 19: Cut Pipe Ends

2. Clean the pipe ends inside and out to remove dirt, mud, and other debris prior to scraping.

    a. Clean water (no soap) can be used for initial cleaning of pipe surfaces prior to scraping. Clean the pipe for a length far enough beyond the area to be fused to ensure that remaining debris on the pipe surface will not be transferred to the area to be prepared during handling. Dry with a single-use clean cotton towel or disposable paper towel.

    b. Solvent-clean the pipe with 90% or greater isopropyl alcohol using a one-time use pre-saturated wipe or single use clean cotton towel or disposable paper towel (exceeding area to be scraped, but within the water-washed area). See Figure below and the Pipe Preparation section for more details.

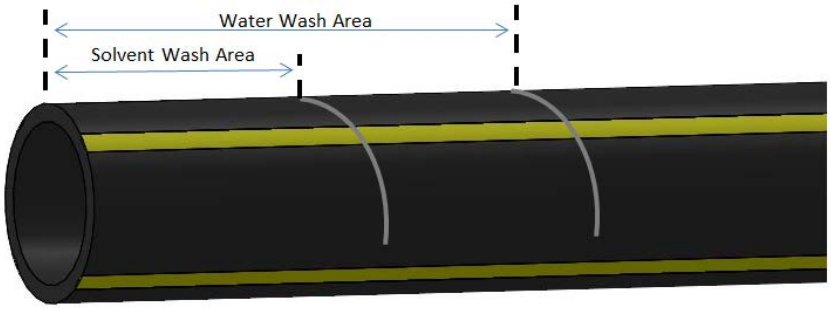

Figure 20: Pipe Cleaning – Steps 2a and 2b

3. Measure and mark the stab depth on the pipe ends. If stab depth marks are not indicated on the outside of the coupling, measure the total length of the coupling to be installed and make a mark on both pipe ends equal to ½ the length of the coupling. This mark is used as visual indication by the installer of the minimum length that needs to be scraped and that the pipe ends are correctly inserted to the center of the coupler. Check the pipe surface for any embedded debris that may cause damage to scraping tools, and once more make sure that the outer pipe surface is clean and free of any dirt or mud that could re-contaminate the scraped pipe surfaces. Mark the entire pipe surface to be scraped with longitudinal and/or circumferential lines.

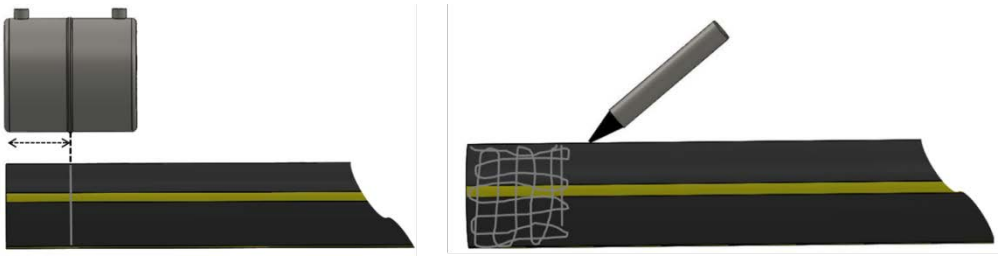

Figure 21: Stab Depth Markings

4. Scrape the outside of the pipe surface to remove oxidation and other contaminants. Scrape for a distance slightly longer than the stab depth so that the scraped area is visible beyond the coupling after assembly. Use an appropriate scraping/peeling tool as described in the PIPE PREPARATION section of this guide. Scrape the pipe surface until the outer layer or “skin”, at least .007” thick, of the pipe has been removed to expose a clean, virgin pipe material. If using a peeling tool, periodically break the ribbon to prevent it from wrapping around the pipe. Continue scraping/peeling to remove longitudinal or circumferential markings made in step 3. Inspect the entire scraped area to ensure total scraping coverage.

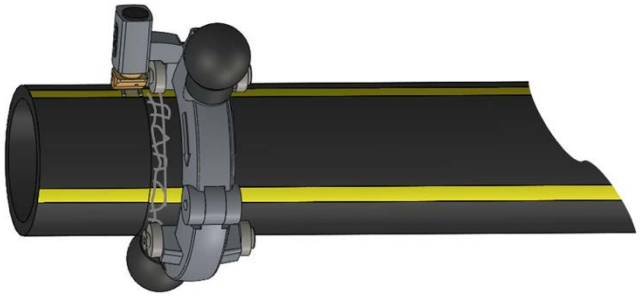

Figure 22: Scrape pipe surface to remove oxidation

5. Remark the stab depth. Avoid touching the scraped pipe surface or the inside of the coupling as body oils and other contaminants can affect fusion joint performance. Optionally, clean thoroughly with 90% or greater isopropyl alcohol using a one-time use pre-saturated wipe or single use clean cotton towel or disposable paper towel. Allow to dry before assembling. Do not use alcohol with any additives other than water.

⚠ **CAUTION: Avoid all possible recontamination of the prepared surface.**

⚠ **Do not use Denatured Alcohol.**

Figure 23: Remark Stab Depth

6. Remove coupling from plastic bag and immediately slide the coupling over the scraped pipe ends to the stab depth markings. Fitting fusion surfaces can be cleaned with 90% or greater isopropyl alcohol using a single-use pre-saturated wipe or single-use low lint clean towel. Allow to dry before assembling.

Figure 24: Install fitting to stab depth

7. Clamp the pipe ends to align and secure the assembly. Verify alignment and that no stress is exerted on the assembly. Make adjustments if necessary and re-secure.

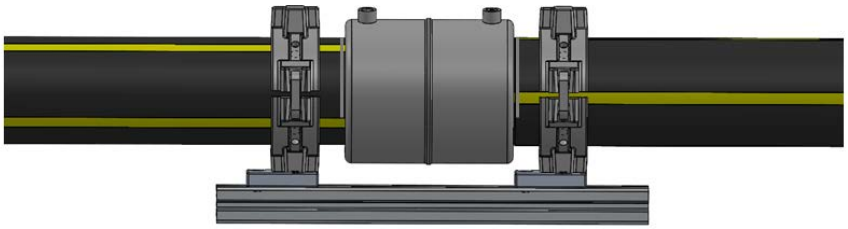

Figure 25: Secure the pipe

8. Connect the fitting to the control box, enter the fusion parameters, and fuse the joint. See “Fusion Parameter” section for details.

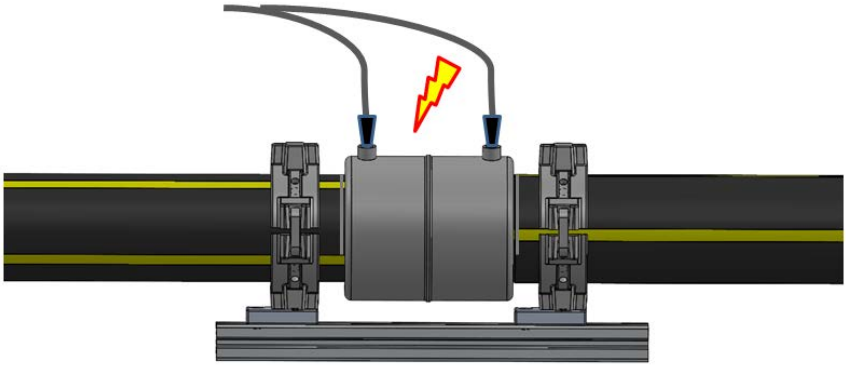

Figure 26: Connect to Control Box

9. Allow the fused fitting and pipe assembly to remain undisturbed for the minimum recommended cooling time.

⚠ **Cooling is a vital part of the fusion process. Proper cooling and rough handling times must be observed. See “clamping” section of this guide for further details.**

15.0 SADDLE INSTALLATION

15.1. **Clean the pipe**

1. Clean the pipe to remove dirt, mud, and other debris.
   a. Clean water (no soap) can be used for initial cleaning of pipe surfaces prior to scraping. Clean the pipe for a length far enough beyond the area to be fused to ensure that remaining debris on the pipe surface will not be transferred to the area to be prepared during handling. Dry with a single-use clean cotton towel or disposable paper towel.

b. Next, solvent clean a smaller area of the pipe with 90% or greater isopropyl alcohol using a single-use pre-saturated wipe or single-use clean cotton towel or disposable paper towel (exceeding the area to be scraped, but within the water-washed area). See Figure below and the Pipe Preparation section for more details.

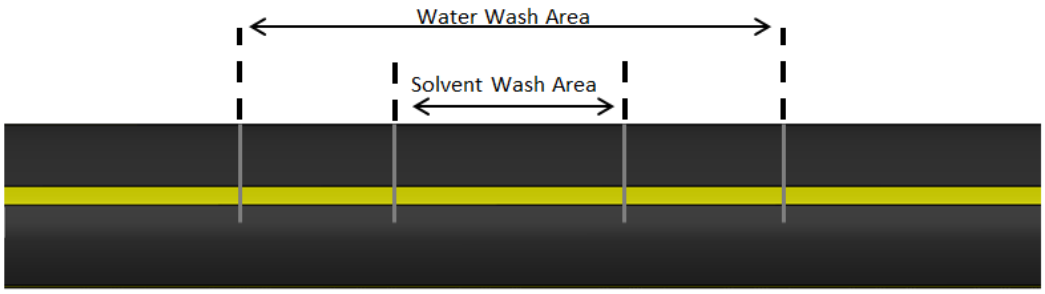

Figure 27: Pipe Wash Areas

2. Mark the area on the pipe where the saddle is to be installed. This mark is used by the installer to indicate the approximate size of the area to be prepared. Check the pipe surface for any embedded debris that may cause damage to scraping tools, and once more make sure that the outer pipe surface is clean and free of any dirt or mud that could contaminate the scraped pipe surface. Mark the entire pipe surface to be scraped with longitudinal and/or circumferential lines.

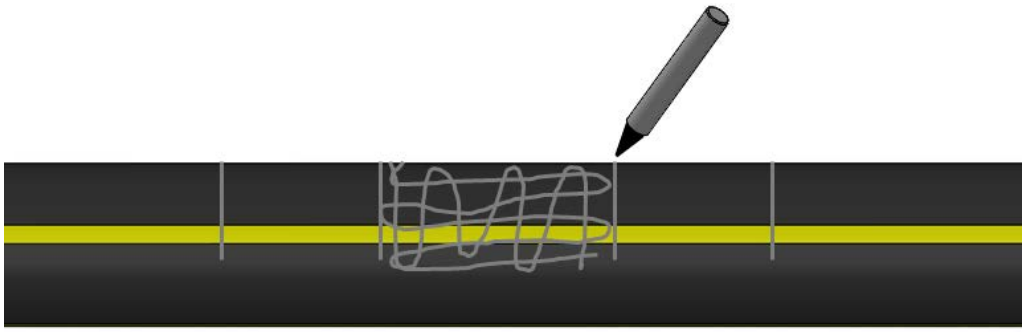

Figure 28: Marked Scraping Area

3. Scrape the outside of the pipe surface to remove oxidation and other contaminants. Use an appropriate scraping tool as described in the PIPE PREPARATION section of this guide. Scrape the pipe surface until the outer layer or “skin”, at least .007” thick, of the pipe has been removed to expose a clean, virgin pipe material. . If using a peeling tool, periodically break the ribbon to prevent it from wrapping around the pipe. Remove longitudinal or circumferential markings made in step 3. Inspect the entire scraped area to ensure total scraping coverage.

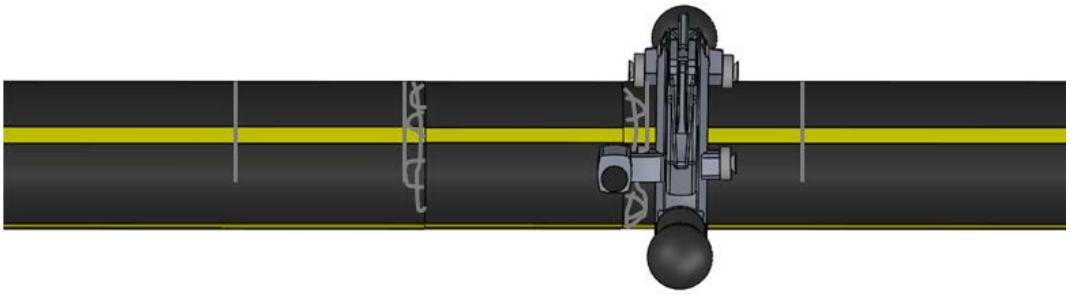

Figure 29: Pipe Scraped Area

4. Avoid touching the scraped pipe surface or the fusion surface of the saddle as body oils and other contaminants can affect fusion joint performance. Optionally, clean thoroughly with 90% or greater isopropyl alcohol using a one-time use pre-saturated wipe or single use clean cotton towel or disposable paper towel. Allow to dry before assembling. Do not use alcohol with any additives other than water.

⚠ **CAUTION: Avoid all possible recontamination of the prepared surface.**

⚠ **Do not use Denatured Alcohol.**

5. Remove saddle from bag and immediately place the saddle over the scraped pipe surface. Ensure that the fitting fusion surface is only in contact with the scraped pipe surface. Fitting fusion surfaces can be cleaned with 90% or greater isopropyl alcohol using a single-use pre-saturated wipe or single-use low lint clean towel. Allow to dry before assembling.

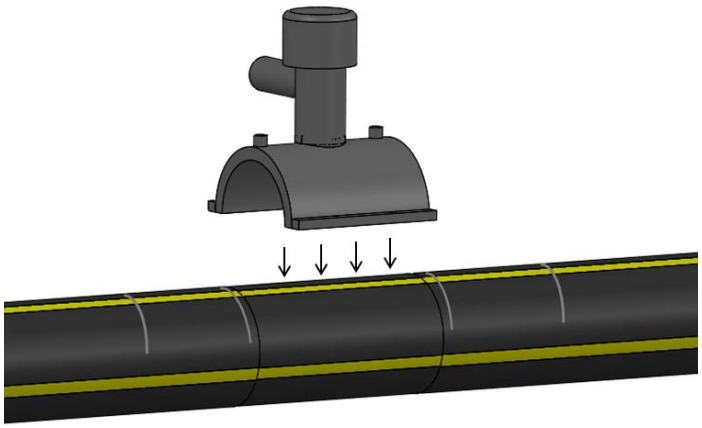

Figure 30: Saddle Placement

6. Secure the saddle-to-pipe assembly with the appropriate clamping mechanism required by the fitting manufacturer. If bolts are used in the clamping device, make sure they are tightened in the proper sequence and the required amount. See “clamping” section of this guide for further details.

Figure 31: Secure Saddle

⚠ **Use only the clamps provided or required by the fitting manufacturer. Clamps from one manufacturer's fitting are not interchangeable with another's.**

7. Connect the fitting to the control box, enter the fusion parameters, and fuse the joint. See "Fusion Parameter" section for details.

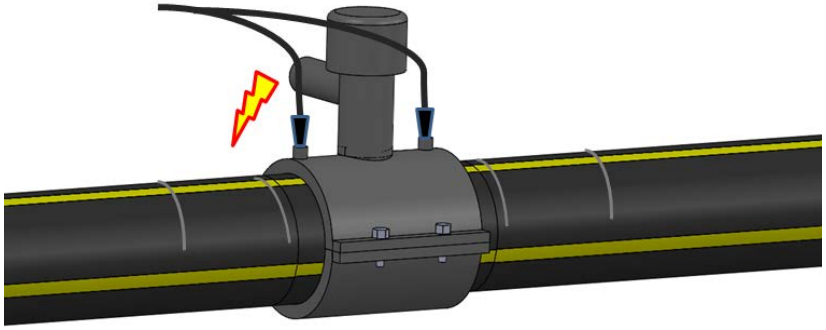

Figure 32: Control Box Connection

8. Allow the fused fitting and pipe assembly to remain undisturbed for the minimum recommended cooling time.

⚠ **Cooling is a vital part of the fusion process. Proper cooling and rough handling times must be observed.**

16.0 INSTALLATION INSPECTION CHECKLIST

- SQUARE CUT (±3 Degrees)

  The square-ness of the cut can be checked if needed by placing a square at the end of the pipe at its longest point and measuring the resulting gap between the square and shortest point of the cut. The table below indicates the resulting maximum measured gap when the cut angle is approximately 3 degrees from square.

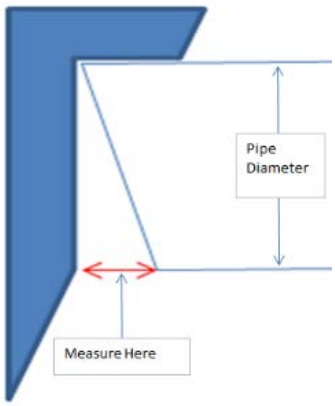

Figure 33: Pipe Square-ness Measurement

Table 5: Maximum Pipe Square-ness Gap

Pipe or tubing size	Maximum gap between square and pipe end to result in approximately 3 degree angled cut
1 1/2 & 2 IPS	1/8"
4 IPS	1/4"
8 IPS	1/2"
12 IPS	5/8"

- SCRAPING

  A properly scraped pipe has a thin outer layer of the pipe surface removed to expose clean virgin PE material for fusion. Visual indicators can be very helpful to ensure that all of the surface has been scraped, and that an adequate amount has been removed.

  Marking the pipe surface with a permanent marker is a simple and effective step. Using the pipe print line as a depth indicator is also useful.

Figure 34: Correct

Figure 35: Incorrect

- ASSEMBLY/ALIGNMENT/RESTRAINT

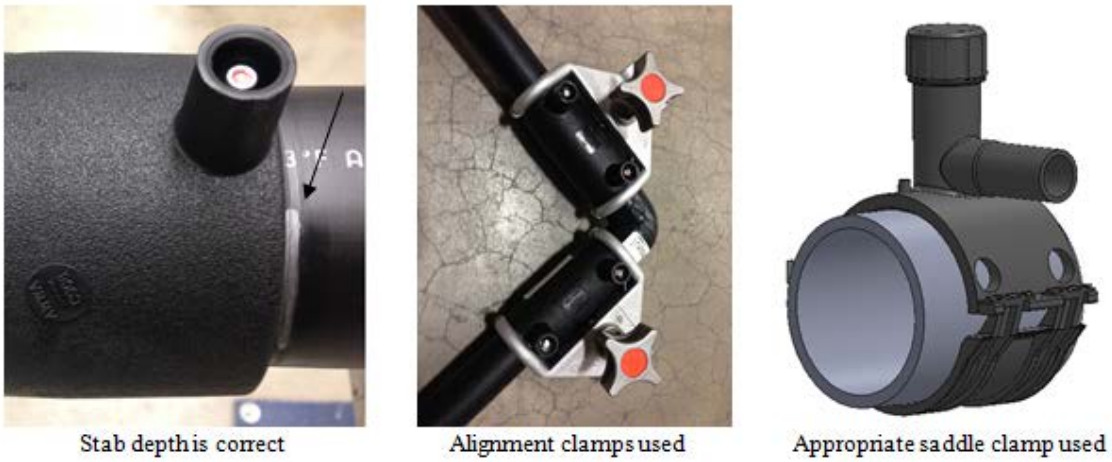

Figure 36: Correct

- FUSION
    - Ensure that the generator or power source is adequately sized for the fitting being fused.
    - Ensure that the power source has an adequate supply of fuel to complete the fusion cycle.
    - Ensure that any extension cords are appropriately sized for the fitting being fused.

- COOLING
    - At minimum, mark the time on or near the fitting to indicate when the minimum cooling time has elapsed. This will prevent inadvertent movement or removal of the assembly and/or clamps.
    - Additional information to be marked may include operator identification, control box and fusion record number, or other installer or inspector information.

17.0 JOINT INSPECTION/ACCEPTANCE CRITERIA

Inspection of electrofusion joints can only determine what is visible externally after the fusion has taken place. Quality assurance of the fusion joint before placing into service is accomplished during installation by several methods.

17.1. **During installation:**

- A trained and qualified installer performed the installation.
- Adherence to installation instructions ensured proper pipe preparation was accomplished.
- Avoidance of the introduction of contamination on the prepared pipe and fitting surfaces was ensured by pre-washing and solvent cleaning.
- Scraping/peeling tools were inspected, cleaned, and in good working order.
- Peeling ribbons were measured and inspected for adequate peeling depth.
- Witness marks on the pipe surface were completely removed by scraping/peeling.
- Cleaning, scraping/peeling, fitting assembly, and fusion steps were performed in a sequence without interruption.
- The fitting was properly clamped and aligned during the fusion and cooling cycle.
- The correct energy was supplied to the fitting and recorded by the calibrated control box.
- Extension cords are correct gage and length, if applicable.

17.2. **After installation:**

- The fitting remained clamped and free of external stresses until the entire cooling time elapsed.
- No error messages were displayed/stored by the control box.
- No abnormal events were observed during the fusion or cooling cycles.
- Pressure test at 1.5 times the operating pressure was completed and passed.

18.0 ASSEMBLY ERROR EXAMPLES

- **Short Stab** – Incorrect Assembly: Assembly errors that can occur include "short-stab" conditions where the one or both of the pipe ends are not centered in the coupling. This condition is avoidable by measuring and marking the stab depth on the pipe ends before inserting them into the coupling. If the pipe ends are not properly inserted, the melt generated during the fusion cycle will expand and flow over the end of the exposed pipe inside the fusion zone. Heating coil wires are carried by the uncontained melt flow, causing shorting and rapid overheating of the fusion zones.

Figure 37: Short Stab - Incorrect Assembly

- **Mis-Stab** – Incorrect Assembly: A mis-stab is another avoidable assembly error where the pipes are not located in the center cold zone of the coupling. In this case, one pipe end is over-inserted into the coupling, while the other is under-inserted. Melt again is allowed to escape between the pipe ends and the potential for heating coil shorting is likely.

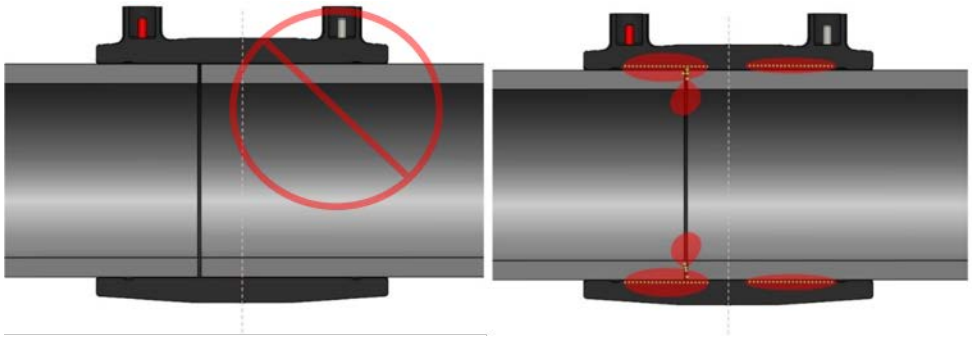

Figure 38: Mis-Stab - Incorrect Assembly

- **Mis-cut** - Another potential error that can cause loss of melt containment is the lack of a square cut on the pipe ends. While it is not necessary, nor practical, that the pipe ends must be cut to exactly 90 degrees, care should be taken to keep the cut as square as possible. Cold zone lengths are designed to accommodate some degree of mis-cut on the pipe ends and still ensure full coverage of the heating wires and sufficient cold zone contact to contain melt flow. A condition where the pipe end is cut at too great an angle to allow the pipe end to cover the heating coil and cold zone is referred to as a “mis-cut” assembly.

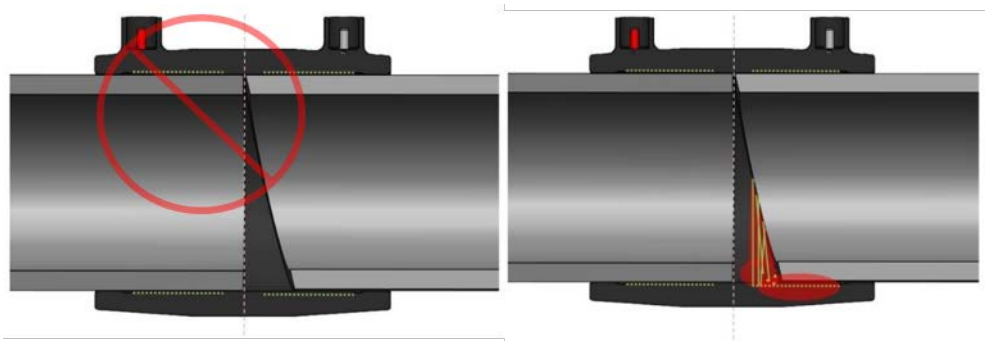

Figure 39: Mis-Cut - Incorrect Assembly

FREQUENTLY ASKED QUESTIONS

1. What pipes can be fused with electrofusion fittings?

    - Electrofusion fittings are compatible with pipe dimensions conforming to ASTM D2513, F714 and D3035.
    - Fittings are typically compatible with pipes with an SDR or DR range of 9 to 17. Other wall thickness ranges and pressure ratings may also apply. Consult the specific fitting manufacturer for details.
    - Electrofusion fittings are fusible to PE 2406/2708 and PE3408/3608/3708/3710/4710 pipes.

2. What are the power requirements?

    A reliable source of AC power is necessary for a successful fusion.

    - Generator – well maintained generator meeting the capacity requirements shown in the Table under “POWER REQUIREMENTS”.
        - Generator should have enough fuel to complete the electrofusion cycle.
        - The governor/economy switch should be off so that the throttle is opened all the way in anticipation of the power draw at the start of the fusion cycle.
        - Provide output voltage in the range that meets the specifications of the applicable processor model.
        - Operate within a frequency range of 50 to 60 Hertz.
        - A matching outlet is needed to mate with the plug equipped on the electrofusion processor.

3. Can I use an extension cord with my processor?

    The use of extension cords should be avoided; in the event an extension cord must be used a 25-foot cord should have a wire gage of #10/3 and a 50-foot cord should have a wire gage of #8/3.

4. Can I use a pigtail with my electrofusion processor?

    No for field installations

5. What are the most common electrofusion failures?

   Electrofusion has proven to be an extremely reliable joining system. The most common reasons for failure account for more than 95% of all fusion failures:

   - Contamination – poor pipe preparation
     - Poor, over, or under scraping

   - Dirt, mud, dust
     - Grease, oils
     - Moisture
     - Hands (body oil, sunscreen, etc.)
     - Solvents, unsuitable wiping fluids
     - Unclean or unsuitable wiping rags

   - Geometry – pipe out of round or not cut square
     - Alignment Errors
       - Pipe Mis-Stab – pipe not cut square and pipe ends not being centered in the cold zone of the fitting.
       - Short Stab – can result from improper insertion of the pipe or movement during weld due to incorrect restraint
       - Excessive Gap – excessive gap between pipe and fitting due to pipe out of roundness, undersized pipe or over scraping of pipe surface.
       - Pipe Movement during Fusion Cycle – due to external forces or forces induced by the welding process, when the pipes are not clamped properly.

   - Movement – pipe not properly restrained during fusion process
     - Removal of clamping equipment before observance of minimum cooling times.

   - Unusual conditions - Contact EF manufacturers if smoke or melt flow outside the fitting are observed.

6. Can I use sandpaper, dragon skin or emery cloth to clean the PE pipe?

   No, it is very important to note that abrasive materials such as sand paper, dragon skin or emery cloth should never be used in place of an approved scraping tool. Abrasive materials have been proven to be ineffective in the removal of sufficient amounts to surface material needed to achieve an electrofusion bond and in fact have been shown to impede the electrofusion process.

   See “SCRAPER” section of this document.

- Note the use of wood rasps, metal files or paint scrapers are not considered acceptable.

7. Why does the fitting need to observe the entire cooling time prior to pressure test or backfill?

    - One of the most misunderstood and often ignored components of the entire electrofusion process is the cooling phase. It is often assumed that if the fitting is cool enough to touch it must be cool enough to remove the restraint device or even pressure test the connections. The cooling phase is critical to the success of the electrofusion process and careful attention should be given to ensure that the stated cooling times are properly adhered to (refer to fitting manufacturer for specific fitting cooling times).

    - When current is applied to the fitting the plastic in the fitting and on the pipe surface begins to melt and form a melt pool. With continued application of current the melt pool deepens at the pipe and fitting interface which in turn forces internal pressure to build up. After the heating phase, the melt pool re-solidifies. This process is known as co-crystallization between the melted pipe and fitting material. The cooling phase provides a controlled environment between the pipe and fitting where solidification can effectively take place. This cooling phase begins immediately following the termination of current being supplied to the fitting and continues for a period of time beyond the point where the PE polymer re-solidifies (also known as clamping time). This allows ample time for the fusion area to regain the strength and flexibility it exhibited prior to fusion. Any movement or external stresses applied to the fused are during this cooling phase may result in a compromised fusion joint.

8. Do I need to use clamps?

    - Electrofusion couplings:

      Electrofusion couplings (regardless of manufacturer) require the pipe to be restrained or sufficiently supported on each side of the pipe to restrict movement during the fusion and cooling process and alleviate or eliminate sources of stress and/or strain until both the fusion cycle and the cooling cycle are completed.

      To achieve this we recommend the use of some form of pipe restraint and/or support for the primary purpose of controlling and eliminating any movement of the fitting due to fusion pressures generated during the fusion process and/or any external forces exerted on the pipe or fitting. The basis for using pipe restraint and/or support when joining two pieces of PE pipe with an electrofusion coupling is to:

      - Minimize potential short stab, mis-stab or binding situations
      - Ensure proper cold zone contact with the prepared fusion area so that sufficient interfacial pressure is achieved.
      - Eliminate unwanted loss of molten material from the fusion zone

- Electrofusion saddles

  Electrofusion saddles fittings include tapping tees, branch saddles, corp saddles and others. Installation of an electrofusion saddle requires the use of recommended restraint systems for the purpose of:

  - Holding the fitting in place during the fusion process
  - Eliminating fitting movement due to material expansion
  - Ensuring proper cold zone contact with the prepared fusion area so that sufficient interfacial pressure is built up.

✅ A properly prepared and assembled joint that is kept stationary and free from stresses and strains during the fusion process and recommended cooling time should have good joint integrity that will last for the lifetime of the pipeline.

9. Can electrofusion fittings be re-fused if I have a power related failure?

   - Electrofusion fittings can be re-fused only in the event of an input power interruption.

     - Fusion leads were detached during fusion
     - Generator runs out of gas
     - Processor malfunction
     - Other circumstances that results in processor input power interruption

   - Recommended procedure for re-fusing fittings:

     1. Fitting should remain in restrained position
     2. Fittings should be allowed to cool to ambient temperature
     3. Fitting should be reconnected to the processor
     4. Fitting should be completely refused for the entire fitting fusion time

⚠ **<u>This re-fusion procedure should be used for fusions that terminated due to input power reasons only. Fittings that fault for any other reason should be removed or abandoned</u>**

OPERATOR TRAINING AND QUALIFICATION GUIDELINES

This guide provides a general introduction to the tools and steps required for making a sound electrofusion joint. It does not take the place of operator training, experience, and qualification through destructive testing. Installers shall complete these requirements prior to installation of electrofusion fittings in a gas distribution system.

The instructions contained in this manual have been qualified to the requirements of Title 49 Code of Federal Regulations, Part 192.283.

Electrofusion fittings shall be installed only by persons that have received training from an authorized instructor, that have a strong working knowledge of polyethylene and heat fusion, and that have demonstrated their understanding of these requirements by making electrofusion joints that have been qualified by destructive testing. Persons responsible for the joining of polyethylene pipe for regulated gas applications must qualify according to the requirements of Title 49 Code of Federal Regulations, Part 192.285. Other regulations may also apply depending on the application, local codes, and/or jurisdictional oversight of state and local regulating agencies.

49 CFR §192.285 Plastic pipe: Qualifying persons to make joints.

(a) No person may make a plastic pipe joint unless that person has been qualified under the applicable joining procedure by:

(1) Appropriate training or experience in the use of the procedure; and

(2) Making a specimen joint from pipe sections joined according to the procedure that passes the inspection and test set forth in paragraph (b) of this section.

(b) The specimen joint must be:

(1) Visually examined during and after assembly or joining and found to have the same appearance as a joint or photographs of a joint that is acceptable under the procedure; and

(2) In the case of a heat fusion, solvent cement, or adhesive joint:

(i) Tested under any one of the test methods listed under §192.283(a), or for PE heat fusion joints (except for electrofusion joints) visually inspected and tested in accordance with ASTM F2620-12 (incorporated by reference, *see* §192.7) applicable to the type of joint and material being tested;

(ii) Examined by ultrasonic inspection and found not to contain flaws that would cause failure; or

(iii) Cut into at least 3 longitudinal straps, each of which is:

(A) Visually examined and found not to contain voids or discontinuities on the cut surfaces of the joint area; and

(B) Deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area.

(c) A person must be re-qualified under an applicable procedure once each calendar year at intervals not exceeding 15 months, or after any production joint is found unacceptable by testing under §192.513.

(d) Each operator shall establish a method to determine that each person making joints in plastic pipelines in the operator's system is qualified in accordance with this section.

(e) For transmission pipe installed after July 1, 2021, records demonstrating each person's plastic pipe joining qualifications at the time of construction in accordance with this section must be retained for a minimum of 5 years following construction.

SAMPLE WRITTEN REVIEW

The following is a sample written qualification test. Users should modify this test to address their unique operating environment.
Generic Electrofusion Operator Training & Qualification Section

Operator Name: _____ Date: _____

Location: _____

All Questions should be answered with either T for True or F for False.

1. The purpose of scraping is to remove the oxidized layer of PE pipe from the pipe surface prior to electrofusion.
   a. True
   b. False

2. For out of round pipe it is acceptable to scrape the high points until the pipe fits into the electrofusion coupling.
   a. True
   b. False

3. Sand paper, dragon skin, emery cloth, and other abrasives are acceptable for scraping.
   a. True
   b. False

4. If the pipe becomes re-contaminated after scraping it is acceptable to use a suitable solvent for cleaning purposes.
   a. True
   b. False

5. It is acceptable to perform an electrofusion with a slight trickle of water running across the fusion area.
   a. True
   b. False

6. In case of an input power interruption only, an electrofusion fitting can be refused for the entire fusion time after it has been allowed to cool completely.
   a. True
   b. False

7. Pressurizing, testing, and backfill can be performed immediately after the electrofusion has been completed.
   a. True
   b. False

8. Pipe ends can be cut to within 10° of being completely square.
   a. True
   b. False

9. A 2500 watt generator is recommended for fusing electrofusion couplings (12" and smaller).
   a. True
   b. False

10. Slow drying markers that contain oils should not be used when marking the pipe for scraping.
    a. True
    b. False

11. If the electrofusion coupling is to be pushed completely over one pipe, it is necessary to scrape the entire length of the coupling onto one of the pipes.

    a. True
    b. False

12. A standard metal file is acceptable for scraping the pipe surface.
    a. True
    b. False

13. There is no need to support hanging pipe ends during fusion.
    a. True
    b. False

14. Operators must re-qualify annually or if they make any bad joint
    a. True
    b. False

15. Observance of pipe print line under saddle fitting fusion area after scraping is acceptable.
    a. True
    b. False

16. A gouge or scratch in the pipe of more than 15% of the wall thickness is acceptable.
    a. True
    b. False

17. An electrofusion joint should not be started if the processor incorrectly identifies the fitting fusion parameters.
    a. True
    b. False

18. Alignment clamps should be used only if the pipes do not line up.
    a. True
    b. False

19. The generator should be checked prior to electrofusion to make sure it is sufficiently fueled .
    a. True
    b. False

20. Electrofusion fittings should be kept in original packaging until installed
    a. True
    b. False

Number Correct: _____

Authorized Trainer: _____ Date: _____

FALLS CITY UTILITIES

GAS SYSTEM
OPERATING AND MAINTENANCE
PLAN

Adopted Date: February 3, 2011
Revised
February 13, 2025

FALLS CITY UTILITIES
GAS DEPARTMENT

STANDARD PRACTICE MANUAL
(2025 REVISION)

This manual covers the Falls City Gas System and its applicable requirements relative to the Department of Transportation, Office of Pipelines Safety's Part 191, 192 and 199.

The Gas System receives gas from one tap on the Southern Star Transmission Main.

In general, the gas is transported to the TBS (Town Border Stations) at 150 p.s.i.g. T.B.S., pressures are then reduced to 100 p.s.i.g and 59 p.s.i.g. and delivered to the multiple individual D.R.S.'s (District Regulator Stations) where the pressure is further reduced to 35 p.s.i.g – 31 oz. Standard delivery pressure to the customer is 7 Inches Water Column.

F.C.U. operates approximately 37 miles of distribution main. Distribution mains and service lines are constructed of steel or polyethylene.

GAS OPERATING AND MAINTENANCE PLAN

TABLE OF CONTENTS

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DIVISION FIVE – PIPELINE INSPECTION AND MAINTENANCE

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DIVISION NINE – ODORIZATION

DIVISION TEN — REPORTING REQUIREMENTS

DIVISION ELEVEN — PIPELINE DESIGN and COMPONENTS

DIVISION ONE
PURPOSE AND CONSTRUCTION

1.1 POLICY

It is the policy of the utility to take all practical steps to safeguard employees from injuries, to provide a safe and healthful working environment, to ensure public safety, and to maintain its operational practices so as to comply with applicable governmental regulations.

1.2 SCOPE

This Operating and Maintenance Plan (O&M Plan) prescribes minimum requirements for inspection, operation and maintenance of all gas pipeline facilities operated by the utility. It is adopted pursuant to requirements of the Code of Federal Regulations, Title 49, section 192.603, 192.13(c), 192.601, 192.605 and is subject to modification from time to time to conform to changes in regulations and utility policy. All work performed on gas pipeline facilities will be in accordance with the O&M Plan. It shall be the utility's responsibility to ensure that all contractors and consultants complete work in accordance with the O&M Plan and to maintain records of work performed under the plan.

All reference material incorporated into this plan shall be maintained by the utility in a separately bound volume.

1.3 PURPOSE

The purpose of the plan is to ensure safe and efficient gas service by:

- Establish written procedures for inspection, operation and maintenance;
- Operating the utility in conformance with the plan; and
- Maintaining necessary records to administer the plan.

1.4 CONSTRUCTION (Interpretation)

The plan conforms to and implements applicable provisions of the U.S. Department of Transportation's "Pipeline Safety Regulations" and should be construed in such a manner as to avoid conflict with those provisions.

Reference: 49 CFR Part 191 (including amendments 1 thru 8) and Part 192 (including amendments 1 thru 65). Content of the plan is based on 49 CFR 192.605, including amendment 59 and on the "Guidance Manual for Operators of Small Gas Systems"

1.5 DEFINITIONS

Unless another meaning is specifically indicated, when used in the O&M Plan:

a. ***Cathodic Protection*** means the procedure by which underground metallic pipe is protected against corrosion. It is a method for controlling the corrosion or deterioration of steel pipe and connected metallic equipment.

b. ***Corrosion*** means the rusting of a metal caused by an electro-chemical reaction between the metal and its surroundings.

c. ***Customer Meter*** means a device used to measure the volume of gas transferred from the utility to a customer.

d. ***Gas*** means manufactured gas, natural gas, other hydrocarbon gases, or any mixture of gases produced, transmitted, distributed or furnished by the utility.

e. ***Gas Operator*** means the utility and its employees and representatives.

f. ***High Pressure Distribution System*** means a distribution system in which the gas pressure in the main is higher than the pressure at which gas is provided to the customer.

g. ***Low pressure Distribution System*** means a distribution system in which the gas pressure in the main is substantially the same as the pressure at which gas is provided to the customer.

h. ***Main*** means a gas distribution line that serves as a common source of supply for more than one service line.

i. ***Maximum Allowable Operating Pressure (MAOP)*** means the maximum allowable pressure at which a pipeline or segment of a pipeline may be operated under 49 CFR 192. MAOP is established by past operating history, pressure testing and pressure ratings.

j. ***Meter*** without other qualification, means any device or instrument, which is used by the utility in measuring a quantity of gas.

k. ***F.C.U.*** means Falls City Utilities.

l. ***Overpressure Protection*** means equipment installed to prevent pressure in a system from exceeding the maximum pressure limit for safe operation of the system.

m. ***Pipeline*** means all parts of those physical facilities through which gas moves in transportation, including pipe, valves, compressor units, metering stations, regulator stations, delivery stations, holders, fabricated assemblies and other attachments.

n. ***Pressure*** is an expression of pounds per square inch above atmospheric pressure, i.e., gauge pressure (abbreviated “psig”).

o. ***Pressure Regulating/Relief Station*** means an installation designed to automatically reduce and control gas pressure downstream from a high-pressure source of gas into a system operating at a lower pressure. It includes any enclosures, relief devices and ventilating equipment, and any piping and auxiliary equipment, such as valves, regulators, control instruments or control lines.

p. ***Operating Pressure*** means the pressure maintained on the gas system. The operating pressure may be less than, but cannot exceed, the MAOP.

q. ***Riser*** means the section of a service line, which extends out of the ground and is often near the wall of a building. This usually includes a shut-off valve, regulator and unit meter.

r. ***Service Line*** means a distribution line that transports gas from a common source of supply to a customer meter or the connection to a customer’s piping, whichever is farther downstream, or the connection to a customer’s piping if there is not a meter.

s. ***Service Regulator*** means a device that reduces and limits gas pressure to the customer.

t. ***Shut-Off Valve*** means a valve used to shut off the gas supply to a customer. The valve may be located ahead of the service regulator, below ground at the property line or where the service line connects to the main.

u. ***SMYS*** means specified minimum yield strength.

v. ***Transmission Line*** means a pipeline, other than a gathering line, that;
   1) Transports gas from a gathering line or storage facility to a distribution center or storage facility;
   2) Operates a hoop stress of 20% or more of SMYS; or
   3) Transports gas within a storage field.

w. ***Utility*** means the municipal gas utility adopting this plan, the Falls City Utilities.

DIVISION TWO
EMPLOYEE RESPOSIBILITIES

2.1 PLAN ADMINISTRATOR

The following person has primary responsibility for the administration of this plan (see also Division 3, Subsection 3.2):

Marc Ramsey, Falls City Utilities Gas Superintendent

Plan administration includes: maintenance of the complete O&M Plan, including materials incorporated by reference; distribution of the plan or appropriate parts of the plan to personnel or locations where operation and maintenance activities are conducted; periodic review and update at intervals not exceeding 15 months, but at least once each calendar year; record keeping necessary to administer the plan; personnel training and work review intended to determine the effectiveness and adequacy of procedures and modifications of procedures when deficiencies are found; and evaluate training effectiveness and review employee activities to determine whether the procedures were effectively followed in each emergency situation.

ANNUAL REVIEW OF O&M PLAN		
Date of Review	**Sections Reviewed**	**Reviewed By**
	All sections reviewed	All F.C.U. gas personnel

ANNUAL REVIEW OF O&M PLAN		
Date of Review	**Sections Reviewed**	**Reviewed By**

2.2 GENERAL EMPLOYEE RESPONSIBILITIES AND INSTRUCTIONS

The instructions contained in this O&M Plan cover operating and maintenance procedures, which shall be followed during normal operations and while making repairs.

Gas department employees and office personnel who may take gas leak calls or requests for pipeline locating are expected to be knowledgeable about those portions of the O&M Plan covering operating and maintenance procedures during normal operation and repairs. Information from any call concerning any abnormal operating condition shall be provided immediately to the operator in charge. All utility employees "regardless of specific responsibility" shall be expected to know general procedures to prevent accidental ignition of gas when strong gas odor is detected, as well as utility procedures regarding statements to representatives of the news media or general public.

Reference: 49 CFR 192.605(a)

2.3a ANNUAL REVIEW OF FACILITIES

F.C.U. will, at least annually, survey and review facilities for changes in class location, failures, leakage history, corrosion, substantial changes in cathodic protection requirements and other unusual operating and maintenance conditions.

If a segment of pipeline is determined to be unsatisfactory condition, but no immediate hazard exists, F.C.U. will initiate a plan to recondition, phase out or replace the pipeline.

Reference: F.C.U. O&M, Division 7, Section 7.10, Paragraph 2; for assessing criteria for "unsatisfactory condition"

2.3b EMERGENCY PROCEDURES REVIEW

Following each emergency, employee activities should be reviewed, by examining the log of events and actions taken, to determine whether the procedures were effectively followed. Consideration should be given especially to whether responses to the emergency were timely. In addition, consideration should be given to the need for changes in the written procedures as may be indicated by the experience gained during the emergency.

2.4 ANTI-DRUG PLAN

In accordance with 49 CFR 199 (Drug Testing) and 49 CFR 40 (Procedures for Transportation Workplace Drug Testing Programs), an anti-drug plan has been established by the utility under separate cover. All provisions for complying with 49 CFR Parts 199 and 40 are included in the Anti-Drug Plan, which shall be considered part of these operating procedures. All employees and/or contractors who are engaged in operation, maintenance or emergency response functions covered by pipeline safety standards in 49 CFR Parts 191 or 192 shall be included in an Anti-Drug program.

Reference: Anthony Nussbaum, City of Falls City Administrator

2.5 ADDITIONAL RESPONSIBILITIES AND INSTRUCTIONS

Reference: Separate Mutual Aid Manual

2.6 OPERATOR QUALIFICATION PLAN

In accordance with 49 CFR Part 192 Subpart O, Falls City Utilities has established and utilizes an Operator Qualification Plan under a separate cover. All provisions for complying with Part 192 Subpart O are included in the plan, which should be considered part of these operating procedures. All employees and/or contractors who are engaged in operation, maintenance or emergency response functions covered by pipeline safety standards in 49 CFR Parts 191 or 192 shall be included in OQ Plan.

2.7 PUBLIC AWARENESS PLAN

In accordance with 49 CFR Part 192 .616 Public Awareness, Falls City Utilities has developed and implemented a written continuing public education program that follows the guidance provided in the American Petroleum Institute's (API) Recommended Practice (RP) 1162. All provisions for complying with continuing public education are included in the plan, which should be considered part of these operating procedures.

2.8 WELDING AND JOINING PROCEDURES MANUAL

In addition to the Operations and Maintenance Plan a manual prescribing procedures and certification of welding and joining of pipeline materials will be maintained under a separate cover.

2.9 REPORTING REQUIREMENTS

Required reporting of specific information can be found in Division Ten

DIVISION THREE
EMERGENCY PLAN

3.1 POLICY

An emergency is a condition that requires prompt action to minimize the effect of an existing or potential hazard to the lives and/or property of the public or this utility. In all cases, our first concern shall be for human safety. All emergencies shall have priority over normal operations.

3.2 EMERGENCY PROCEDURES (General)

Division three of the F.C.U. O&M Plan contains procedures for preventing accidents and responding quickly and effectively should accidents occur or should emergency conditions exist. An emergency condition exists when the gas operator determines that extraordinary procedures, equipment, manpower, and/or supplies must be used to protect the public from existing or potential hazards. These hazards include, but are not limited to:

a. Under pressure in the system
b. Overpressure in the system
c. Large amounts of escaping gas
d. Fire or explosion near or directly involving a pipeline facility
e. Any leak considered hazardous
f. Danger to major segment(s) of the system
g. Natural disasters (floods, tornados, hurricanes, earthquakes, etc.)
h. Civil disturbance (riots, etc.)
i. Load reduction conditions (result in voluntary or mandatory reduction of gas usage)

3.3 EMERGENCY RESPONSE COORDINATOR

The following person shall be responsible for coordinating emergency response under these procedures (see Division 2, Subsection 2.1):

Marc Ramsey, Falls City Utilities Gas Superintendent

3.4 REVIEW AND DISTRIBUTION

The Emergency Response Coordinator shall be responsible for reviewing and updating information contained in the Emergency Plan not less than once each year.

Copies of the Operations and Maintenance Manual or separately bound copies of the Emergency Plan shall be maintained at the following locations:

Utility Superintendent	2307 Barada St.
City Clerk/Treasurer	2307 Barada St.
Gas Superintendent (Emergency Plan Only)	1004 Crook St.
Fire Department	1820 Towle St.

Police Department	2307 Barada St.
Power Plant	South Crook St.
Line Repair Shop	South Crook St.

ANNUAL REVIEW OF EMERGENCY PLAN		
Date of Review	**Sections Reviewed and Updated at All Locations**	**Reviewed By**
	All sections reviewed and plans updated	All F.C.U. gas personnel

3.5 INDENTIFICATION AND CLASSIFICATION OF EMERGENCIES

Each call or report of a condition that presents the potential for an emergency situation will be treated as an emergency until it is determined otherwise. Prompt and effective response to the following conditions shall be made in accordance with procedures found in this division: gas leaks; interruptions of service; line hits; detection or suspicion of carbon monoxide in a building; and interruption in gas supply.

Major Emergency conditions require a call to 911, alerting them of the situation when there is any indication of a pipeline rupture or other emergency condition which may have an adverse impact on public safety or the environment.

Response to other emergency conditions or abnormal operating conditions shall be made in a manner consistent with procedures that are included in this division and that are intended to protect people first, then property. Examples of these other conditions include: the unintended closure of a valve or a shutdown, and increase or decrease in pressure or flow rate outside normal operating parameters; loss of communications; failure of safety devices; or any other malfunction of a component, deviation from normal operation, personnel error, fire or explosion near gas facilities, natural disaster, or civil disturbance that poses a potential hazard to the people, property, or the integrity of the system. At a minimum, procedures for response to such conditions shall include:

a. Prompt reporting to appropriate operating personnel;
b. Continuous action to correct any condition that may pose a hazard to persons or property;
c. Where appropriate, coordination of the response with appropriate outside agencies and the public;
d. Where appropriate, checking variations from normal operation after abnormal operation has ended at sufficient critical locations in the system to determine continued integrity and safe operation; and
e. Investigation of the circumstances surrounding the incident, including the date and time it occurred or was first observed and reported, as well as a summary of actions taken to correct the condition, determine the cause, and prevent recurrence.

3.6 EMERGENCY NOTIFICATION LIST

a. CITY SUPERVISORY/MANAGEMENT PERSONNEL

Anthony Nussbaum	City Clerk/Treasurer	64888 709 Rd. Verdon,NE	801-1566
Trevor Campbell	Public Works Director	Reserve, KS	402-801-0780
Marc Ramsey	Gas Superintendent	2303 Lane St.	801-1171
Mark Harkendorff	Mayor	2626 Clifton Ave.	245-5379

b. UTILITY OPERATING PERSONNEL

Power Plant Operator <u>24 HRS</u>. Phone: 245-3521

Marc Ramsey	Home Address:	2303 Lane St, Falls City, NE	
(Office) 245-2691	(Residence)	801-1171	(Cell) 801-1171
Joel Thompson	Home Address:	65269 703 LOOP, Falls City, NE	
(Office) 245-2691	(Residence)	883-7770	(Cell) 883-7770
Shawn Thompson	Home Address:	1220 Chase St, Falls City, NE	
(Office) 245-2691	(Residence)	245-3971	(Cell) 801-1034
Steve Deckinger	Home Address:	1605 Dewey Ave, Falls City, NE	
(Office) 245-2691	(Residence)	883-7638	(Cell) 883-7638
Larry Strecker	Home Address:	1603 Fair Ave, Falls City, NE	
(Office) 245-2691	(Residence)	245-3239	(Cell) 245-0125
Jonathan McAndrew	Home Address:	408 E. 4th St, Verdon, NE	
(Office) 245-2691	(Residence)	883-0464	(Cell) 883-0464

c. LAW ENFORCEMENT AGENCIES

City Police	245-4422
County Sheriff @ Richardson County Law Enforcement	245-2479
State Patrol @ Lincoln (Emergency)	(402) 417-4545

d. FIRE & OTHER DEPARTMENTS

Fire Department	Office 245-4422
Matt Beer (Fire Chief)	Cell 245-0090
	Home 245-2212
Electric Department	Office 245-3824
Eric Kreifels	Home 801-8104
Water Department	Office 245-4850
David Aitken	Home 245-5359
Sewer Department	Office 245-3195
Doug Wheeler	Home 245-2004
Street Department	Office 245-3519
Gary Richey	Home 245-5883

e. GAS SUPPLIER

Southern Star Gas Co. Emergency	**#800-324-9696**	
James Crowley – Region Manager	Office (913)422-6303	Cell (785)813-5923
Dalyn Buchanan – Field Operations Leader	Office (913)369-1301	Cell (913)416-0653
Tad Rankin - Meter Technician	Office (913)804-4148	Cell (913)426-5175

f. EMERGENCY MEDICAL FACILITIES

Falls City Ambulance	18th & Barada St.	Office 245-4422	
Community Medical Center	3307 N. Barada St.	Office 245-2428	
Sandy Catlin, APRN	3307 N. Barada St.	Office 245-4475	Home 883-2508
Gayle Keller, APRN	3307 N. Barada St.	Office 245-4475	Home 245-3974
Celeste Jones, PA-C	3307 N. Barada St.	Office 245-3232	Home 245-4449
Dr. A. W. Tramp	1423 Stone St.	Office 245-3232	Home 245-2999

g. GAS CONTRACTORS

Jones Air Conditioning Inc.	Gary Jones	245-3526
Jones & Jones	Jerry Jones	245-3133
Chuck Bennett, Verdon, NE	Chuck Bennett	883-2728
Meyer Home Center	Allen Meyer	245-4661
A+ Heating & Cooling	Donnie Stice	245-3830

h. MUTUAL AID

Nebr. City Utilities Nebr. City, NE	Jeff Kohrs	(402)873-3353

i. LOCAL MEDIA

KTNC - 1602 Stone St. -	Heather Gill	245-2453
KNZA - Hiawatha, KS	Justin Fluke, Oper. Manager	(620)886-0581
KLZA - 1602 Stone St.	John Nixon	245-6010
Falls City Journal – 1709 Stone St.	Nikki McKim , Editor	245-2431

j. CIVIL DEFENSE

Director – Brian Kirkendall	Office 245-2446	Cell 801-0522

3.7 KEY BUSINESSES

The following Falls City businesses have agreed to open and provide services for emergency personnel and/or evacuees:

City Auditorium	Anthony Nussbaum, City Clerk	Office 245-2533	Cell 801-9658
Grand Weaver Hotel	Mitch Glaeser, Owner	Office 245-2448	
Family Fare	Christie Saulsberry, Manager	Office 245-3440	Cell 402-274-8122
Check-In Motel	Natwarbhai Panchal, Owner	Office 245-2433	Home 245-3870
Vision Inn Motel		Office 245-2459	

Shelter and food for evacuees are coordinated through the local civil defense director.

3.8 PUBLIC AND PRESS RELATIONS

The Mayor is responsible for all news releases to the media during an emergency. In their absence, the Utility Superintendent is responsible for news releases.
The general public has the right to know what happened and what progress is being made.
News media have the right to facts and photographs for public information, and cooperation shall be extended on an equal basis.
No statements shall be made regarding responsibility for an accident which could be construed as admission of liability for personal injury or property damage.
Damage estimates shall not be made which might complicate insurance settlements.
Names of employee casualties shall not be released to news media until after the next of kin has been notified. Casualty information is considered privileged.

3.9 EMERGENCY TRAINING

The utility shall conduct a documented training meeting each year in which employees shall receive training in those emergency training procedures within their individual responsibilities. Training shall include:

a. Procedures for updating the Emergency Plan.
b. A review of each employee's responsibility in an emergency, including the responsibility of all - employees to adhere to utility guidelines for statements to the press and general public.
c. A review of the location, use and periodic inspection of emergency equipment.
d. A review of the location and use of system maps, main records, service records, valve records, regulator schematics, and properties of natural and LP-gas.
e. Bypass procedures.
f. A step-by-step review of procedures using a hypothetical emergency situation, including procedures for contact with public officials, fire, police and other agencies.
g. Record keeping.
h. Emergency reports (telephonic and written).

Documentation: Training Record

3.10 POLICE AND FIRE LIAISON

The utility shall conduct documented meetings at least annually with representatives of the police and fire departments concerning applicable procedures during an emergency, including:

a. The department's contact of the utility in the event of gas related fires, physical damage to pipeline facilities, line hits, suspected leaks, etc.
b. Respective responsibilities during gas related accidents.
c. Rules when fighting gas-fed fires.
d. Instruction on valves – where, who shuts off what, and when.

Training or instructional materials describing the basic properties of natural gas shall also be provided.

Reference: Separate Public Awareness Manual
Documentation: Fire Department Training Record

3.11 PUBLIC EDUCATION

The utility shall conduct a documented program of continuing education that enables customers, the public, appropriate governmental organizations, and persons engaged in excavation-related activities, to recognize and report gas emergencies.

In accordance with 49 CFR Part 192 .616 Public Awareness, the Utility has developed and implemented a written continuing public education program under a separate cover. The PAP follows the guidance provided in the American Petroleum Institute's (API) Recommended Practice (RP) 1162. All provisions for complying with continuing public education are included in the plan, which should be considered part of these operating procedures.

The program shall contain information about how to report emergencies to the utility or to the appropriate public officials (fire dept., police dept., etc.) and

1) Information about gas.
2) How to recognize gas odors.
3) The do's and don'ts when gas odor is strong.
4) 24-hour emergency and office telephone numbers.
5) Prior to any excavation, an excavator must contact NE811.

The system operators shall review their public education program for the appropriateness of information provided and for the effectiveness of the program. If deficiencies are observed the program shall be modified to assure the adequacy of the program.

Examples of Falls City Utilities Program:

a. Letters sent to contractors about One Call.
b. Public information on utility bills (If You Smell Gas).
c. Scratch and sniff insert.

Reference: Separate Public Awareness Manual

3.12 KEY VALVES

The gas distribution system is a network of interconnected mains. For purposes of sectionalizing, valves have been installed throughout the system. All main valves are clearly marked on system maps.

a. Improper operation of a valve may create a hazardous condition or make a hazardous condition worse. ONLY authorized utility personnel should operate valves. Fire, police, and other officials are not authorized to operate valves (except meter shut-off valves).

b. The utility has designated valves as key valves. Valves located at the town border station can isolate the entire system from the utility's gas supplier. Other key valves are shown on system map(s).

COMPLETE SYSTEM MAPS ARE LOCATED:

Location	Phone
Falls City Utilities (Gas Superintendent office – all records)	245-2691

3.13 SYSTEM HISTORY AND CONSTRUCTION RECORDS

In addition to maintaining maps at these locations, pertinent data concerning construction and historical records shall be kept and made available to appropriate operating personnel.

Reference: 49 CFR 192.605(b)(3)

3.14 EMERGENCY EQUIPMENT

The Utility Superintendent and Gas Superintendent shall be responsible for the adequacy, availability and condition of emergency equipment.

a. LOCATION – Emergency Procedures Manual, valve keys and wrenches, leak detection and repair equipment, fire extinguisher and other hand tools likely to be needed in an emergency shall be maintained at the utility operations center or in utility service trucks.

b. ADDITIONAL VEHICLES AND EQUIPMENT – Additional vehicles and equipment shall be assigned by the Emergency Response Coordinator or his/her designee. Additional equipment may also be obtained through the Mutual Aid program.

Reference: Separate Mutual Aid Manual

c. EMERGENCY COMMUNICATION- Communication with operating personnel is via on-call cell phone, portable and mobile radio. Portable and mobile radio unit numbers and persons to which they are assigned are as follows:

On-Call Phone #	402-801-1457
Portable #137	Marc Ramsey
Portable #157	Larry Strecker
Portable #147	Joel Thompson
Portable #117	Shawn Thompson
Portable #127	Steve Deckinger
Portable #167	Jonathan McAndrew
Mobile #52	Chevy ½ ton 4x4 Pickup
Mobile #23	Ford 1 ton 4x4 Pickup
Mobile #16	Chevy Const./Welding Truck
Mobile #41	Chevy Service Van
Mobile #158	Chevy Service Van
Mobile #17	Ford 550 4x4 Truck

d. The crew and service trucks are equipped with the tools and materials necessary to handle emergencies. Additional tools and material are stored in the warehouse in areas well known to all gas personnel. All trucks have valve books with information for all valves in the system. All employees have a complete list of all other gas employees and phone numbers for after hour's assistance.

3.15 INCIDENT COMMAND SYSTEM (ICS).

a. In the context of applying the ICS, the Federal Emergency Management Agency (FEMA) has defined the term incident as "an occurrence, either caused by humans or natural phenomena that requires response actions to prevent or minimize loss of life or damage to property and/or the environment." Certain gas emergencies could fall within the FEMA definition of an incident. Examples of FEMA incidents include the following.

1) Fire, both structural and wild land.
2) Natural disasters, such as tornadoes, floods, ice storms, or earthquakes.
3) Human and animal disease outbreaks.
4) Search and rescue missions.
5) Hazardous materials incidents.
6) Criminal acts and crime scene investigations.
7) Terrorist incidents, including the use of weapons of mass destruction.
8) National Special Security Events, which are designated by the U.S. Department of Homeland Security (e.g., Presidential inaugurations, national political conventions, Super Bowls).
9) Other planned events, such as parades or demonstrations.

b. The ICS is a management system for dealing with emergencies. It has been developed from reviewing past emergencies and formalized into a structured system by FEMA and other emergency response agencies. It is a consistently applied system for controlling on-site personnel, facilities, equipment, and communications in an emergency. It is a designated system used from the time a FEMA incident occurs until the requirements for implementing the ICS no longer exist.

c. When an operator and other emergency responders implement an ICS, respective plans may differ but should be based on similar principles so the plans are compatible. The ICS may be used for small or large incidents, remaining adequately flexible to adjust to the changing needs of an incident.

d. The ICS functions typically include the following.

1) Safety – public and employees**.**
2) Security – utilize public safety personnel.
3) Commander responsibilities – establish command center, transfer of command.
4) Operational – incident stabilization plan, repair plan.
5) Logistics – material, equipment, other resources.
6) Public relations – communications, notifications, information liaison.
7) Personnel management.

e. The ICS supports responders and decision makers by providing the data they need through effective information and intelligence management. The data provided may include information on the following.

1) Maps and records for critical infrastructure and other facilities.
2) Load studies.
3) Affected customers, including residential, commercial, and industrial customers.

f. Additional information on the ICS can be found at www.training.fema.gov/EMIWeb/IS/ICSResource/index.htm

3.16 RESPONDING TO LEAK REPORTS AND INTERRUPTIONS OF GAS SERVICE

All leaks shall be classified, investigated and reported.

Documentation: Gas Leak Service Order

a. LEAK REPORT PRIORITY – Leak reports, including line hits (whether a leak is evident or not), shall:

1) Take priority over any other type of work.
2) Be answered expeditiously.
3) Be investigated, even if force entry with police assistance is required.
4) Be classified according to the criteria in this subsection.

b. LEAK CLASSIFICATION CRITERIA – Leaks shall be classified and responded to in accordance with the following criteria:

GRADE 1 – A leak that represents an existing or probable hazard to persons or property and requires immediate repair or continuous action until the conditions are no longer hazardous.

Grade 1 leaks require prompt action to protect life and property, which must continue until conditions are no longer hazardous.

Examples of Grade 1 leaks include:

1) Any leak which, in the judgment of operating personnel at the scene, is regarded as an immediate hazard.
2) Escaping gas that has ignited.
3) Any indication of gas which has migrated into or under a building, or into a tunnel.
4) Any reading at the outside wall of a building, or where gas would likely migrate to an outside wall of a building.
5) Any reading of 80% LEL, or greater, in a confined space.
6) Any reading of 80% LEL, or greater in small substructures (other than gas associated substructures) from which gas would likely migrate to the outside wall of a building.
7) Any leak that can be seen, heard, or felt, and which is in a location that may endanger the general public or property.

GRADE 2 – A leak that, while recognized as being non-hazardous at the time of detection, poses a probability of future hazard sufficient to warrant scheduled repair.

Grade 2 leaks should be repaired within one calendar year, but no later than 15 months from the date it was reported. In determining repair priority, consideration should be given such factors as: amount and migration of gas; proximity of gas to buildings and subsurface structures; extent of pavement; and soil type (considered with such conditions as frost cap, moisture, and natural venting). Reevaluation of grade 2 leaks should be made not less than once every 3 months.

Examples of Grade 2 leaks include:

1) Any reading of 40% LEL, or greater, under a sidewalk in a wall-to-wall paved area that does not qualify as a Grade 1 leak.
2) Any reading of 100% LEL, or greater, under a street in a wall-to-wall paved area that has significant gas migration and does not qualify as a Grade 1 leak.
3) Any reading less than 80% LEL in small substructures (other than gas associated substructures) from which gas would likely migrate creating a probable future hazard.
4) Any reading between 20% LEL and 80% LEL in a confined space.

5) Any reading on a pipeline operating at 30 percent SMYS, or greater, in a class 3 or 4 location, which does not qualify as a Grade 1 leak.
6) Any reading of 80% LEL, or greater, in gas associated substructures.
7) Any leak which, in the judgment of operating personnel at the scene, is of sufficient magnitude to justify scheduled repair.

GRADE 3 – A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous.

Grade 3 leaks should be rechecked within 3 months and, if not regraded, at each succeeding survey (not exceeding 15 months) until the leak is repaired, regraded or no longer results in a reading.

Examples of grade 3 leaks include:

1) Any reading of less than 80% LEL in small gas associated substructures.
2) Any reading under a street in areas without wall-to-wall paving where it is unlikely the gas could migrate to the outside wall of a building.
3) Any reading of less than 20% LEL in a confined space.

c. LEAK CALL INFORMATION – Utility personnel likely to receive telephonic reports of gas leaks shall be trained in gathering information and providing essential customer advice, including the following:

Any Employee receiving notice of an emergency shall attempt to obtain the following information and record it on the appropriate form:

1) Who is calling.
2) Where the emergency is.
3) What the situation is.
4) When the problem was first noticed.
5) Where will the caller be.

The employee shall then provide the caller with the following essential directions:

1) No one is to turn electrical switches ON or OFF.
2) No one is to ring doorbells or use the phone.
3) Leave telephone in position found.
4) Extinguish all open flames. No smoking.
5) Ventilate building.
6) Turn off gas supply, if feasible.
7) Evacuate building and remain a safe distance away.
8) Go on foot – no engines or sparks.

The employee shall then immediately notify the gas serviceman or the gas utility employee on call, if after business hours, of the emergency. Depending upon the extent of the emergency, responding gas utility employee shall determine if the gas superintendent should be notified.

d. INSIDE LEAK INVESTIGATIONS – The steps outlined in this subsection are to be followed in investigating reported gas leaks inside a building. The steps should generally be followed in the order listed until the leak is identified. The investigation may stop at that point ONLY if the investigator is satisfied that there are no more leaks.

Leak Investigation Steps:

1) Upon arrival at customer's premises, prepare gas detection equipment for use.
2) KNOCK. Do not use the doorbell.
3) Upon admittance to customer premises, test free air immediately. (First test near ceiling).
4) Ask customer probable location of leak. Instruct customer to use no light switch, etc., until determination has been made that there is no explosive condition.
5) Test air at top of basement stairwell (if any), as natural gas is lighter than air and this is an area for potential collection. This check is essential to do as soon as possible after gaining admittance.
6) If customer specifically locates the leak, proceed directly to that area. If not, proceed with step 7.
7) Using gas detection equipment, take samples in crawl spaces, sewer openings and basement wall area around the gas fuel line entrance.
8) Check all above ground utility facilities.
9) Bar hole test every 10 feet or survey with F.I. unit in following locations:
   a) Customer riser and completely around foundation.
   b) Customer service line from building to service tap.
   c) Adjacent buildings service lines and side of foundation adjoining the leak investigation address.
   d) All gas mains adjoining the leak investigation address and adjacent addresses.
10) If leak is still not evident, perform a lock up gas meter test on house piping and appliances.
11) Start vented gas appliances or advise customer to contact appliance dealer or contractor to determine if flue conditions are good. CAUTION: this step should be done after gas free condition has been confirmed.
12) If this is not possible to identify gas as the source of odor at this point and all possible checks have been made, attempt to identify source of any related odors.
13) When leaving customer's premises, assure customer that their complaint has not been a nuisance and that any future incidence of gas odor should be reported.

e. INSIDE EMERGENCY PROCEDURE – The following procedures are to be taken when an inside emergency – evidenced by strong odor, large gas concentrations, fire or explosion – has been found to exist:

1) Evacuate building.
2) Close valve at meter and call qualified personnel for disconnection of electricity, telephone and other utilities that, if left in service, could provide a source of ignition.
3) Ventilate building. Exercise EXTREME caution when gas concentration greater than the upper explosive limit is present, so that the ventilation process doesn't bring the concentration level back through the explosive envelope with ignition source present.
4) Radio for emergency personnel (fire, police, extra help).
5) Check surrounding buildings at utility service entries, basement wall cracks, sewer drains, etc., to determine limits of emergency area – evacuate if necessary.
6) If emergency area is widespread, evacuate all buildings, close appropriate valves to sectionalize emergency area (including key valves if city wide emergency is believed to exist).
7) Identify leak source(s).
8) Repair leak(s).
9) Follow service restoration procedures.
10) Complete documentation and telephonic report, as required.

f. OUTSIDE LEAK INVESTIGATIONS – The steps outlined in this subsection are to be followed in investigating reported outside gas leaks. The steps should generally be followed in the order listed until the leak is identified. The investigation may stop at that point ONLY if the investigator is satisfied that there are no more leaks.

Leak Investigation Steps:

1) Upon arrival at customer's premises, prepare gas detection equipment for use.
2) KNOCK. Do not use the doorbell.
3) Upon admittance to customer premises, test free air immediately. (First test near ceiling).
4) Ask customer probable location of leak. Instruct customer to use no light switch, etc., until determination has been made that there is no explosive condition.
5) Test air at top of basement stairwell (if any), as natural gas is lighter than air and this is an area for potential collection. This check is essential to do as soon as possible after gaining admittance.
6) If customer specifically locates the leak, proceed directly to that area. If not, proceed with step 7.
7) Bar hole test every 10 feet or survey with F.I. unit in following locations:
  a) Customer riser and completely around foundation.
  b) Customer service line from building to service tap.
  c) Adjacent buildings service lines and foundation.
  d) All gas mains adjoining the leak investigation address and adjacent addresses.
8) Check all manholes, catch basins, sewers, etc., in the area.
9) If odor is prominent, attempt to locate source by smell.
10) Check all above ground utility facilities inside or out.
11) If it is not possible to identify gas as the source of odor at this point and all possible checks have been made, attempt to identify source of any related odors.
12) When leaving the customer's premises, assure customer that their complaint has not been a nuisance and that any future incidence of gas odor should be reported.

g. OUTSIDE EMERGECNY PROCEDURE FOR LARGE LEAKS – The following procedures are to be taken when an outside emergency – evidenced by strong odor, large gas concentrations or obvious physical damage to pipeline – has been found to exist:

1) Assess danger to people first, then property.
2) Contact appropriate emergency personnel (fire, police).
3) Eliminate sources of ignition and blockade area.
4) Evacuate buildings and immediate area, (if appropriate).
5) Determine whether gas flow to the area should be shut off. If large leak is blowing gas, shut off gas as part of 4.
6) Check surrounding buildings at utility service entries, basement wall cracks, sewer drains, etc., to determine limits of emergency area – probe as needed, evacuate the area if necessary.
7) If emergency area is widespread, evacuate all buildings, close appropriate valves to sectionalize emergency area (including key valves if citywide emergency is believed to exist).
8) Identify leak source(s).
9) Repair leak(s).
10) Follow service restoration procedures.
11) Complete documentation and telephonic report, as required.

h. **OUTSIDE EMERGENCY PROCEDURE FOR FIRE, EXPLOSIONS OR NATURAL DISASTERS** – The following procedures are to be used when an outside emergency, evidenced by fire or explosion, has been found to exist:

1) Contact appropriate emergency personnel (fire or police).
2) Evacuate area.
3) Blockade area.
4) In the event of a fire or explosion, shutting off gas flow to area should be top priority.
5) Fires should not be extinguished until gas flow is stopped.
6) Check surrounding buildings at utility service entries, basement wall cracks, sewer drains, etc., to determine limits of emergency area - evacuate if necessary.
7) If emergency area is widespread, evacuate all buildings, close appropriate main valves to sectionalize emergency area (including key valves if citywide emergency is believed to exist).
8) Identify leak source(s).
9) Repair leak(s).
10) Follow service restoration procedures.
11) Complete documentation and telephonic report, as required.

3.17 PINPOINTING GAS LEAKAGE

Pinpointing is the process of tracing a detected gas leak to its source. It should follow an orderly systematic process that uses one or more of the following procedures to minimize excavation. The objective is to prevent unnecessary excavation which is more time consuming and costly than time spent pinpointing a leak.

Procedure:

a. The migration of gas should be determined by establishing the outer boundaries of the indications. This will define the area in which the leak will normally be located. These tests should be made with a CGI without expending excessive effort providing sample points.

b. All gas lines should be located to narrow the area of search. Particular attention should be paid to the location of valves, fittings, tees, stubs, and connections, the latter having a relatively high probability of leakage. Caution should be exercised to prevent damage to other underground structures during barring or excavating.

c. Foreign facilities in the area of search should be identified. The operator should look for evidence of recent construction activities that could have contributed to the leakage. Gas may also migrate and vent along a trench or bore hole provided for other facilities. Leaks could occur at the intersection of the foreign facility and the gas pipeline. Particular attention should be given to these intersections.

d. Evenly spaced bar or test holes should be used over the gas line suspected to be leaking. All barholes should be of equal depth and diameter (and down to the pipe depth where necessary) and all CGI readings should be taken at an equal depth in order to obtain consistent and worthwhile readings. Using only the highest sustained readings, the gas can be traced to its source by identifying the test holes with the highest readings.

e. Frequently, high readings are found in more than one barhole and additional techniques are necessary to determine which reading is closest to the probable source. Many of the barhole readings will normally decline over a period of time but it may be desirable to dissipate excess gas from the underground locations to hasten this process. Evaluation methods should be used with caution to avoid distorting the venting patterns.

f. Once underground leakage has been identified, additional holes and deeper holes should be probed to more closely bracket the area. For example, test holes may be spaced six feet apart initially and then the six foot spacing between the two highest test holes might be probed with additional test holes, with spacing as close as twelve inches.

g. Additional tests include taking CGI readings at the top of a barhole or using manometer or bubble forming solution to determine which barhole has the greatest positive flow. Other indications are dust particles blowing from the barholes, the sound of gas coming from the barhole or the feel of gas flow on a sensitive skin surface. On occasion, sunlight diffraction can be observed as the gas vents to the atmosphere.

h. When gas is found in an underground conduit, testing at available openings may be used to isolate the source in addition to the techniques previously mentioned. Many times the leak is found at the intersection of the foreign conduit and a gas line. Particular attention should be given to these locations.

i. When the pattern of the CGI readings has stabilized, the barhole with the highest reading will usually pinpoint the gas leak.

j. The operator should test with bubble forming solution where piping has been exposed, particularly to locate smaller leaks.

Precautions:

a. When placing barholes for testing, consideration should be given to barhole placement and depth to minimize the potential for damage to other underground facilities and possible injury to personnel conducting the investigation.

b. Unusual situations may complicate these techniques on some occasions. They are unlikely, but possible. For example, multiple leakage can be occurring which gives confusing data. The area should be rechecked after repairs are completed to eliminate this potential. Gas may occasionally pocket and give a strong indication until the cavity has been vented. Foreign gases, such as gas from decomposed material, can occasionally be encountered. This is characterized by fairly constant CGI readings between 15 percent and 30 percent gas throughout the area. Indications of gas detected in sewer systems should be considered migrating gas leakage until proven otherwise by test or analysis.

c. When pinpointing leakage where the gas is heavier than air (LP gas), the gas will normally stay low near the pipe level, but may flow downhill. LP gases usually do not diffuse or migrate widely so the leak is generally close to the indication. If the gas is venting into a duct or sewer system, it can travel considerable distance.

3.18 MAKING SAFE ANY ACTUAL OR POTENTIAL HAZARD

Provisions should be described for identifying, locating, and making safe any actual or potential hazard.

These may include the following.

a. Controlling pedestrian and vehicular traffic in the area.
b. Eliminating potential sources of ignition.
c. Controlling the flow of leaking gas and its migration.
d. Ventilating affected premises.
e. Venting the area of the leak by removing manhole covers, barholing, installing vent holes, or other means.
f. Determining the full extent of the hazardous area, including the discovery of gas migration and secondary damage such as the following.
    1) Deformation of a gas service line indicating that the service line might be separated underground near a foundation wall or at an inside meter set assembly.
    2) Multiple underground leaks that may have occurred, allowing gas to migrate into adjacent .... buildings.
    3) Potential pipe separation and gas release at unseen underground locations that may result in gas entering adjacent buildings, or following or entering other underground structures connected to buildings.
g. Monitoring for a change in the extent of the hazardous area.
h. Determining whether there are utilities whose proximity to the pipeline may affect the response.
    1) Visually identify the presence of electric and other utilities surrounding the pipeline facility.
    2) Evaluate the potential risk associated with the continued operation of the surrounding utilities.
i. Coordinating with fire, police, and other public officials the actions to be taken.
j. Maintaining ongoing communication with fire, police, and other public officials as events unfold to ensure that information pertinent to emergency response is shared in a timely manner.

3.19 LINE HITS

All reported line hits, whether a leak is evident or not, shall be considered as leak reports and documented as such.

a. Line Hit Investigation Steps:
    1) Upon arrival, assess damage to line at and near point of impact.
    2) Immediately check surrounding area, including building foundations, with gas detection ..... equipment.
    3) Check for gas nearby manholes, catch basins, sewers, etc.
    4) Locate and bar hole survey mains and service line at ten-foot intervals from point of impact. Also survey any known compression fittings.
    5) Make repairs as required.
    6) Recheck within 24 hours of initial investigation.
    7) Complete documentation.

b. LINE HIT EMERGENCY PROCEDURES – If a line hit has resulted in a leak; fire or explosion, initiate appropriate outside and inside emergency actions.

3.20 CARBON MONOXIDE INVESTIGATION PROCEDURES

    1) Calibrate test equipment before entering residence/commercial building.

2) Check the residence/commercial building with the sampling instrument measuring C.O. in air, in parts per million (PPM).
3) If C.O. levels of 10 to 35 PPM are found, recommend that the residents leave the building until the problem has been corrected and the atmosphere has been re-checked and found clear. Explain the effects of C.O. to the customer.
4) If C.O. levels of over 35 PPM are found, the customer will be required to leave the building until the problem has been corrected and the area is re-tested and found clear. Failure to leave the building would require that the gas be turned off at the meter and sealed. Red tag offending appliance if known.
5) If no C.O. is detected start gas appliances and retest.
6) Check appliance flues for proper venting

3.21 CARBON MONOXIDE EMERGENCY PROCEDURES

The steps outlined in this subsection should be followed in the event that carbon monoxide is detected or suspected in a building:

1) Move occupants to fresh air outdoors.
2) Contact appropriate emergency help.
3) Ventilate building.
4) Shut off offending appliance.
5) Remedy problem, red tag appliance, or advise customer that appliance must not be used until a qualified gas appliance dealer or contractor repairs the faulty condition.

3.22 GAS OUTAGE PROCEDURES

These procedures would be used following a partial or complete shutdown of the system, which resulted from a mechanical failure or an emergency.

Reference: 191.9(b) and 191.15(b)
Reference: Separate Mutual Aid Manual

The following is an outline of procedures to follow in the event of an unscheduled outage involving a sizeable section of the system. The size and location of the outage will determine what parts of these procedures are used and their priority. A small outage may not require all or any of the guidelines that would be used for a larger outage.

Utility Superintendent:

1) General supervision over all activities.
2) Arrange for publicity (radio announcements, etc.).
3) Arrange for mutual aid.
4) Visit with the industries about curtailment of their gas loads.

IF NECESSARY:

5) Arrange for extra phone lines.
6) Arrange for legal and police assistance to gain access to buildings.
7) Arrange for meals, housing, gasoline and tools for crews.

Note: A list of appropriate phone numbers is kept in the outage kit and will be updated yearly.

Gas Superintendent:

1) Assign personnel in accordance with organization chart.
2) Direct supervision over all service and distribution crews.
3) Instruct crews on light-up procedures (all appliances to be relit or shut off).
4) Assign crew leaders taking into account familiarity with outage area.
5) Issue route assignments.
6) Receive all dispatching orders from the dispatcher.
7) Keep records of all assignments listing locations and what crews.
8) Arrange for mutual aid (coordinate with manager).
9) Determine crew schedules.
10) Maintain contact with repair crew on progress of repairs.

IF NECESSARY:

11) Notify local authorities and State Fire Marshals office.
12) Record times of events and other specifics.

Crew Leader: (this could be a non gas department employee, such as an employee from another department who is familiar with the outage area and has a vehicle equipped with a radio)

1) Direct the crew members to streets and customers to be relit.
2) Record all "Can't Get Ins".
3) Record and report all problems such as gas leaks and appliance problems.
4) Maintain a checklist to be certain all customers on route are contacted.
5) Report to the Gas Superintendent.

Special Service Crew: (this could be the gas serviceman)

1) Check emergency calls such as gas leaks (Priority).
2) Handle forced entries with police.
3) Handle "Can't Get Ins" as they come in.

Distribution Crew: (Normal Distribution Crew)

1) Repair the problem responsible for the outage.
2) Check operation of regulator stations and monitor pressure after repairs are made and system is turned back on.
3) Assist with the re-light of system.

Subsection 3.24 of the Emergency Plan (RESTORATION OF SERVICE DUE TO OUTAGE) SHALL be followed when outage occurs.

3.23 INTERRUPTION OF GAS SUPPLY

An interruption in gas supply could be due to: freezing of the regulators, a break in the line, sabotage, or supplier cut off. In event of an interruption in supply, the following steps should be taken:

a) Call supplier to determine if interruption cause is known. If system is not already depressurized, initiate procedures to prevent under pressurizing of system.
b) Locate leak or other source of interruption. Initiate appropriate emergency procedures.
c) Correct or repair.
d) Follow service restoration procedures, if necessary.

e) Complete documentation and telephonic report, as required.

3.24 RESTORATION OF SERVICE DUE TO OUTAGE

When the supply of gas has been cut off to an area, no gas should be turned on to the affected area until the individual service to each customer has been turned off.

a) A house-house operation will be conducted, in which each customer's service will be turned off at the meter.
b) When re-pressurizing affected area, MAOP limits must not be exceeded. All gas piping and meters will be purged and appliances relit. Gas must not be turned on at the meter without access to ALL appliances on the customer piping. If a customer is not at home, a card will be left in a conspicuous location, requesting customer to call the utility to arrange for restoration of service. Extreme care will be taken in coordinating service restoration to ensure strict compliance with restoration procedures.
c) A complete record of the incident will be maintained.

Execution of the repair and restoration of service functions will necessitate prior planning, such as the following.

1) Sectionalizing to reduce extent of outages and to expedite turn-on following a major outage.
2) Lists and maps for valve locations, regulator locations, and blowoff or purge locations.
3) Provisions for positive identification of valves and regulator facilities.
4) Equipment checklist for repair crews.
5) List of contractors, other utilities, and municipalities that have agreed to provide equipment and workmen to assist with repair and service restoration. Procedures for securing and utilizing this manpower and equipment should be described.
6) Prearranged use of facilities, owned by others, for temporary operating headquarters for repair and restoration activities. Arrangements should also be made for all necessary support functions for such temporary operating headquarters.
7) Cooperation with appropriate civil organizations in providing housing and feeding facilities for persons requiring shelter during an outage in severe weather.
8) Arrangements to maintain service to critical customers, such as hospitals, to the degree possible during a general service curtailment or outage. In addition, a similar priority should be assigned for turn-off activities.

3.25 METER LOCK-UP TEST

Whenever there is an interruption of service or a service is put back into operation a lock-up test of the piping system must be done to test for leaks. Prior to the test it should be determined that the meter is working properly, has not been bypassed and all appliances and pilots are shut off.

The test dial should be observed while on the upstroke to determine if there is gas passing thru the meter. A piece of wet paper or tape on the dial can be used to help in watching the test hand. There should be no movement of the hand.

Test duration:

¼ Cubic Foot Hand	5 minutes
½ Cubic Foot Hand	5 minutes

2 Cubic Foot Hand	10 minutes
5 Cubic Foot Hand	20 minutes
10 Cubic Foot Hand	30 minutes

The test procedure must be documented on the work ticket.

These procedures are in accordance with NFPA 54 Appendix D

3.26 EMERGENCY SHUTDOWN AND PRESSURE REDUCTION

a) Provisions for shutdown or pressure reduction in the pipeline system, as may be necessary to minimize hazards, should be described. The plans should include the following.

1) Circumstances under which available shutdown, pressure reduction, or system isolation methods are applicable. Considerations should include access to, and operability of, valves located in areas prone to high water or flooding conditions.

2) Circumstances under which natural gas might be allowed to safely escape to the atmosphere (i.e., vent) until shutdown or repair.

(i) Some possible reasons for using this alternative are as follows.

(A) Curtailment will affect critical customers (e.g., hospitals).
(B) Curtailment will affect large numbers of customers during adverse weather conditions.
(C) Line break or leak is remotely located and does not cause a hazard to the public or property.

(ii) Some factors to consider are as follows.

(A) Sources of ignition.
(B) Leak or damage location (rural vs. urban).
(C) Proximity to buildings and other structures.
(D) Ability to make and keep the area safe while gas vents.
(E) Ability to coordinate with other emergency responders and public officials.

3) Lists or maps of valve locations, regulator locations and blowdown locations.

4) Maps or other records to identify sections of the system that will be affected by the operation of each valve or other permanent shutdown device.

5) Provision for positive identification of critical valves and other permanent facilities required for shutdown.

6) Provisions for notifying affected customers.

7) Provisions for confirming that the shutdown or pressure reduction was effective.

b) Distribution system plans should include consideration of the potential hazards associated with an outage and the need to minimize the extent of an outage, and to expedite service restoration. In addition to the use of any existing emergency valves within a distribution system, consideration should also be given to other methods of stopping gas flow, such as:

1) Injecting viscous materials or polyurethane foam through drip risers or any other available connections to the main.

2) Use of squeeze-off or bagging-off techniques.

3.27 TOWN BORDER STATION EMERGENCY

In the event of damage to facilities or failure of equipment at the gas supplier's town border station (TBS), it may be necessary to bypass TBS pressure regulating and metering equipment.

When starting up or shutting down segments of the system, care must be taken to follow proper procedures and sequences. Pressures must be monitored during these times to assure that M.A.O.P. limits are met.

3.28 VARIATION FROM NORMAL OPERATIONS

After an abnormal operation has ended, the operator shall make checks at a sufficient number of locations in the system to determine the integrity of the system and guarantee continued safe operation.

Reference: 192.605(c)(2)

3.29 INVESTIGATIONS OF ACCIDENTS AND FAILURES

The utility shall fully investigate each accident, any unintended release of gas, or failure for the purpose of determining causes and minimizing the possibility of recurrence. Physical evidence, including samples of the failed facility or equipment, shall be gathered for possible laboratory examination and shall be retained for a reasonable period of time. A written record of the investigation shall be made.

DIVISION FOUR
DAMAGE PREVENTION

4.1 DAMAGE PREVENTION (General)

The program outlined in this part is intended to protect lives and property by reducing the chance of damage to utility pipelines during excavation activities.

F.C.U. does belong to the State One-Call program. Employees monitor the system on a daily basis for any activity where excavating is taking place and there are no signs of locating being done.

All excavators and contractors known to do business in our area are notified in writing each year of the areas we serve and a reminder of the requirements of the One-Call program. Customers receive One-Call information in their billing along with gas leak notification information.

Reference: Separate Public Awareness Manual

4.1.1 DEFINITIONS

Excavation: For the purpose of this section, excavation means any activity in which earth, rock, or other material in or on the ground is moved or otherwise displaced by means of tools, equipment, or explosives and shall include grading, trenching, digging, ditching, drilling, auguring, tunneling, scraping, and cable or pipe plowing or driving. There are exceptions explained within the One Call Act.

Excavation Damage: Any impact that results in the need to repair or replace an underground facility due to a weakening, or the partial or complete destruction, of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection, or the housing for the line device or facility.

Emergency condition means any condition which constitutes a clear and present danger to life, health, or property or which demands immediate action to prevent or repair a major service outage.

Hand Digging shall mean any excavation involving non-mechanized tools or equipment. It shall include but not be limited to, digging with shovels, picks, and manual post-hole diggers, vacuum excavation or soft digging.

Mandatory Electronic Positive Response shall mean an electronic response transmitted to the center indicating the facility's response status to a ticket.

4.2 ONE-CALL NOTICE REQUIRED

Any person planning excavation activities is required to contact the “Statewide One-Call” toll free number 811, at least two business days prior to commencement of the planned excavation, excluding Saturdays, Sundays and legal holidays. Prior to commencement of excavation, the excavator must obtain verification of the absence or the presence of underground facilities, which shall be marked to identify those facilities. The only exception shall be when an emergency exists. Under such conditions, operations can begin immediately, provided reasonable precautions are taken to protect the underground facilities. The excavator shall notify the notification center as soon as practical. Otherwise excavation shall not commence until locate verification has been received from the utility. When the excavation work will exceed 17 days, a refresh excavation request should be made on the 14th day of activities.

a. The following information is required for locate requests:

1) The name of the person providing the notice;
2) The name and telephone number of the excavator;
3) The precise location of the proposed area of excavation, including the range, township, section and quarter section, if known;
4) The date and time excavation is scheduled to commence;
5) The depth of excavation;
6) The type and extent of the proposed excavation;
7) Whether the discharge of explosives, boring or tunneling is anticipated; and

For purposes of statutory requirements, an excavation commences the first time excavation occurs in an area that was not previously identified by the excavator in an excavation notice.

TICKET START TIME - will not include the day the request is made to provide for a full two working day notice. For example, a request made Monday at noon would require a start date of sometime on Thursday (Monday does not count, Tuesday and Wednesday would be the two full working days).

TICKET LIFE - will be calculated by adding 17 calendar days to the start date and time requested on the ticket. For example, a ticket with a start time of 9/1/19 at noon would have an expiration date of 9/18/19 at noon. Refresh tickets should be requested anytime marks are destroyed or become unusable, but a refresh will be required if work will continue beyond the expiration date. To avoid delays, refresh tickets should be completed at least two working days before the ticket expires.

b. RESPONSIBILITIES OF THE UTILITY AND EXCAVATORS – When the utility receives notice from the One-Call center, it will mark the horizontal location of its underground facilities in accordance with Nebraska's One-Call guidelines. The excavator shall use due care in excavating in the marked area to avoid damaging the underground facility.

The utility will utilize only trained and operator qualified individuals for locating their underground utilities.

The utility shall complete such locating and marking within 2 business days after receiving the notice, excluding Saturday's, Sunday's and legal holidays, unless otherwise agreed by the utility and the excavator. The locating and marking of the underground facilities shall be completed at no cost to the excavator.

If, in the opinion of the utility, the planned excavation requires that the precise location of the underground facilities be determined, which includes all directional boring, the excavator shall hand dig test holes to determine the location of the facilities unless the utility specifies an alternate method.

The marking required under this subsection shall be done in a manner that will last for a minimum of five working days on any nonpermanent surface, or a minimum of ten days on any permanent surface.

If the markings become unclear or unusable, the excavator will submit a refresh locate to the One Call center.

The utility will mark lines using the American Public Works Association (APWA) color codes.

Yellow = Gas
Red = Electric
Blue = Water
Orange = Communications
Green = Sewer

Pink = Temporary Survey Markings
White = Proposed Excavation

Markings shall include the use of paint, flags, stakes, whiskers, signs, posts or any combination of these.

Paint stripe is the preferred method of communicating the location of underground utility however painted spots or dots can be used to identify utilities; the direction of the facility must be identifiable.

Location offsets can be used when there is a strong likelihood that marks may be destroyed. Offsets are placed parallel to the running line of the facility. The offset shall indicate the distance and direction from the offset to the facility.

When known, the markings for the underground utility shall include: the size of the facility, if over 2 inches in width; the material make-up of the facility, and the facility name. This information can be communicated to the excavator by placing the information upon the utility marking flag or by paint marking upon the surface of the ground.

Upon completion of physically marking underground utilities, or determining that there are no underground utilities in the area, the utility will use the "Mandatory Electronic Positive Response" mechanism to notify the excavator that utilities have completed their portion of the locate request.

Hand digging shall be required within eighteen inches plus half the width of the marked underground facility, an excavator shall expose the underground facility to its outermost surfaces by hand or other nondestructive techniques.

If the excavation will continue for more than 17 days, a re-fresh request should made on the 14th day. The utility shall remark the location of the underground facility upon the request of the excavator. The re-fresh request shall be made through the One Call center.

Excavators should never use line markers as absolute guides for close proximity digging with power equipment.

4.3 RECEIVING AND RECORDING LOCATE REQUEST

The utility shall maintain a log of requests for pipeline location, which will be retained for a minimum of five years following the request.

4.4 DAMAGE REPORTING

If the damage is to a gas pipe and there is a release of natural gas, immediately contact the local emergency response center 911 and inform them of the event, and location.

An excavator shall, as soon as practical, notify the utility when any damage occurs to an underground facility as a result of excavation. The notice shall include the type of facility damaged and the extent of the damage.

The excavator will report damage to the One Call Center. The notice shall include the type of facility damaged and the extent of the damage.

When damage occurs, an excavator shall refrain from back filling in the immediate area of the underground facilities until the damage has been investigated by the utility, unless the utility authorizes otherwise.

If the damage results in an emergency, the excavator shall take all reasonable actions to alleviate the emergency, including, but not limited to, the evacuation of the affected area. The excavator shall leave all equipment situated where the equipment was at the time the emergency was created and immediately contact the utility and appropriate authorities and necessary emergency response agencies.

4.5 LINE MARKERS

Line markers are placed over buried pipelines and along above ground pipelines in accordance with the requirements of applicable federal regulations. Some provisions of the program are carried out in lieu of the installation of line markers on mains in Class 3 locations, although the utility may install line markers at locations where additional safeguards are deemed prudent.

a. BURIED TRANSMISSION LINES – A line marker must be placed and maintained as close as practical over each buried transmission line at each crossing of a highway or road, railroad crossing, creek crossing and in fenclines. A line marker must also be placed wherever necessary to identify the location of the line to reduce the possibility of damage or interference.

b. BURIED DISTRIBUTION MAINS – A line marker must be placed and maintained as close as practical over each buried distribution main at each crossing of a highway or railroad. A line marker must also be placed wherever necessary to identify the location of the main to reduce the possibility of damage or interference. Because the utility participates in a "Statewide One-Call" system, line markers are not required and may not be used for buried mains in Class 3 or 4 locations where it can be shown to be impractical.

   Reference: Class locations are defined in 49 CFR 192.5

c. PIPELINES ABOVE GROUND – Line markers must be placed and maintained along each section of a main that is located above ground in an area accessible to the public. This includes above ground valves and regulator stations.

d. MARKERS – The following must be written legibly on a background of sharply contrasting color on each line marker:

   1) The words "Warning", "Caution", or "Danger" followed by the words "Gas (or name of gas transported) Pipeline". Letters must be at least 1 inch high with one-quarter inch stroke.
   2) The name of the utility and the telephone number (including area code) where the utility can be reached at all times.
   3) The One-Call number for locate requests will also be listed and identified.

      Reference: 49 CFR 192.707

4.6 UTILITY INSPECTION OF EXCAVATION ACTIVITIES

The utility shall make-on-site inspections whenever there is reason to believe the activities could damage gas pipe. In determining the frequency and extent of inspection, the utility shall consider the following:

a. Type and duration of activities.
b. Proximity of pipelines to excavation.
c. Type of excavation equipment being used.
d. Consequences of pipeline hit at work site.
e. Past experience with excavator.
f. Pipeline material.

In any case where excavation has included blasting, a subsequent leak survey shall be made using gas detection equipment.

4.7 PERSONNEL PRECAUTIONS IN EXCAVATED TRENCHES

Adequate precaution shall be taken to protect personnel from the hazards of unsafe accumulations of vapor or gas. When required, emergency rescue equipment, including but not limited to, breathing apparatus, fire protection suit, fire extinguisher placed upwind, rescue harness and lines shall be provided at the excavation site. The utilities confined space program and excavation procedures shall be followed as required.

Reference: Separate Operator Qualification Manual

4.8 PUBLIC & EXCAVATOR AWARENESS

For maximum effectiveness of the damage prevention program, the program information shall be disseminated to persons known to engage in excavation activities, as well as to the general public. The entire Public Awareness Program can be found under separate cover and is included here as a reference only. The PAP follows the guidance provided in the American Petroleum Institute's (API) Recommended Practice (RP) 1162.

Because even relatively minor excavation activities (for example: installing mail boxes, privacy fences and poles, performing landscaping, building constructing storage buildings, etc.) can cause damage to a pipeline or its protective coating or to other buried utility lines,
There is need for excavators to report any suspected signs of damage.
The use of an excavation One-Call Notification system is required by State Law.
Call 811 prior to any excavation.
Information on the prevalence of third party damage should be provided as appropriate.
The state has established penalties for failure to use established damage prevention procedures.

As a baseline practice, excavation and one-call Information should include:
* Request that everyone contact the local One-Call System before digging
* Explain what happens when the One-Call Center is notified.
* Provide the local or toll-free One-Call Center telephone number (811)
* Explain that the one-call locate service is typically free.
* Remind, if applicable, that to call is required by law.

The baseline information to excavators contains:
- Pipeline purpose and reliability
- Awareness of hazards and prevention measures undertaken
- Leak recognition and response
- One-call requirements
- How to get additional information about pipelines

Information provided to the general public shall be:
1) Information about gas.
2) How to recognize gas odors.
3) The do's and don'ts when gas odor is strong.
4) 24-hour emergency and office telephone numbers.
5) Prior to any excavation, an excavator must contact NE811.

Reference: Separate Public Awareness Manual

4.9 SUBSTRUCTURE DAMAGE PREVENTION GUIDELINES FOR DIRECTIONAL DRILLING AND OTHER TRENCHLESS TECHNOLOGIES

SCOPE: Damage to existing underground facilities can result from directional drilling or the use of other trenchless technologies. These general guidelines apply to directional drilling and trenchless technologies performed by the operator or a third party in proximity to gas facilities. In part, they provide the following.

(a) Criteria for planning and precautions.
(b) Recommended procedures.

DAMAGE PREVENTION WHEN INSTALLING FACILITIES

Precautions should be taken when installing gas facilities by directional drilling or other trenchless technologies, which may include the following.

(a) Using available one-call notification system(s) to have facilities within the immediate area located and marked; and directly contacting known, non-participating utility owners for locations of their facilities.

(b) Ensuring that known facilities are located and marked prior to commencing work.

(c) Exposing facilities within the immediate work area by hand excavation before starting a bore if the depths of the facilities are not established by other means.

(d) Considering sewer systems within the area, which are especially vulnerable to damage from boring operations for the following reasons:

(1) Sewer lines are often non-metallic, which make them difficult to locate.
(2) Clean-outs or other indications of sewer laterals may be hidden or non-existent.
(3) Damage may not be readily apparent when a sewer, particularly a gravity flow system, is pierced by a boring machine.

(e) Notifying residences and businesses in the area of impending work.

(f) Checking local regulations for the minimum separation distances between the new gas piping and the other facilities.

(g) Making arrangements with local authorities for traffic control, as necessary.

(h) Ensuring adequate clearance of overhead electric, telephone, or cable lines from construction equipment.

(i) Reviewing precautions recommended by manufacturers of trenchless technology equipment prior to construction.

(j) Following applicable state and local requirements for damage prevention.

PROTECTING EXISTING GAS FACILITIES

When either an operator or a third party shall excavate near an existing gas facility by directional drilling or using other trenchless technologies, the operator should consider the following.

(a) Where it is anticipated that the bore will cross an existing facility, or come within a safety zone (as established by the operator or a jurisdictional regulatory agency), expose that facility to determine its precise location to ensure adequate separation between the existing and proposed facilities.
(b) Where the bore will run parallel to an existing facility, expose that facility (pothole) or use locating technology to verify that adequate clearance is maintained between the bore and the existing facility during the boring operation, which includes the drilling of the pilot hole and back reaming. Calculation of the separation distance should account for the largest diameter back reamer that will be used in the boring process.
(c) Potholes used for visual inspection should be excavated at intervals ensuring clearance is maintained during boring operations. Factors to consider for pothole intervals include the following.

(1) Proximity of proposed bore path to the existing gas facilities.
(2) Type of existing and proposed facilities.
(3) Type of soil.
(4) Size and controllability of the bore.

(d) Locating existing facilities and the newly installed facility to ensure that the installation is in the intended location.
(e) Conducting a leakage survey over gas facilities that could have been affected by the new installation.

4.10 INVESTIGATIONS OF EXCAVATION DAMAGE

The utility shall investigate each excavation damage for the purpose of determining apparent root cause and minimizing the possibility of recurrence. A written record of the investigation shall be made. *(Excavation Damage Investigation Form)*

4.11 EXCAVATION DATA and EXCAVATION DAMAGE DATA

Excavation data and excavation damage data will be acquired in order to report that data to the Pipeline and Hazardous Materials Service Administration (PHMSA) for the Annual Distribution Report. This same data will be needed for the Distribution Integrity Management Plan when addressing threats and risks. This data may also be utilized for the Public Awareness Program Effectiveness Evaluation.
This data will include:
Number of locate request received by the utility.
Number of excavation(s) that caused damage to gas pipeline.
Number of damages causing a release of natural gas from mains.
Number of damages causing a release of natural gas from services.
The apparent root cause of the excavation damage, as provided for in the detail columns.

In addition the following data may be applicable

Number of locate request generated by the gas utility.
Number of excavation(s) by utility excavators that caused damage to underground utilities.
Number of excavation(s) by utility excavators that caused damage to gas pipeline.

DIVISION FIVE
PIPELINE INSPECTION AND MAINTENANCE

5.1 PIPELINE INSPECTION AND MAINTENANCE PROCEDURES (General)

The inspection and maintenance procedures contained in this part shall constitute a minimum plan and procedures for inspecting and maintaining the utility's pipeline. Patrolling, leakage surveys, and the inspection and servicing of key valves and regulator station components shall be in accordance with these procedures. In addition to scheduled inspections, all utility personnel are expected to watch for and report any operating conditions and activities, which may present a hazard to the continued safe operation of the system.

5.1.1 SEISMIC ACTIVITY/EARTHQUAKES

In the event of an earthquake within the area served by the utility the Gas Superintendent will determine what steps need to be taken to investigate the potential damage. These steps include but are not limited to; immediate investigation at the TBS (Town Border Station), pressure checks at all above ground loops that have a pressure monitoring gauges installed.

The Gas Superintendent or his designee/designees may also conduct Patrols and Surveys throughout the natural gas system to insure no hazards exist. If an emergency exists the procedures outlined in Division 3 (Emergency Plan) will be followed.

5.2 SCHEDULED PATROLLING

The utility shall inspect the surface of the ROW and leak survey area of mains which require patrolling under 49 CFR 192.705 and 192.721 including: mains located in business districts and outside business districts in places or on structures where anticipated physical movement or external loading (weight, traffic) could cause failure or leakage. These places or structures include bridges, highway crossings, railway crossings, waterways, land slide areas, areas susceptible to earth subsidence (cave ins), or areas of construction activity. Patrolling of these mains will be at quarterly intervals (not exceeding 4-1/2 months) and include leak survey conducted with gas detection equipment.

Reference: 49 CFR 192.705 and 192.721

5.2.1 PATROL PROCEDURE

Patrols are conducted to observe surface conditions on and adjacent to the pipeline line right-of way for indications of leaks, construction activity, and other factors affecting safety and operation.
Distribution mains shall be patrolled, as necessary, to observe factors affecting safe operation and to enable correction of potentially hazardous conditions. Patrol of system may be accomplished in conjunction with leakage surveys, scheduled inspections and other routine activities. Mains on structures where anticipated physical movement or external loading could cause failure or leakage must be patrolled at the following intervals not exceeding 4-1/2 months, but at least four (4) times each year.
The Gas Superintendent will determine the frequency of additional patrols if severe conditions exist which could cause failure or leakage and consequent hazards to public safety. Deficiencies found during the patrols shall be corrected promptly. Patrolling may be conducted by foot patrol or driving patrol.
What to Look for When Patrolling

In addition to evidence of leakage, patrol considerations should include observation and reporting of potential hazards such as the following:

- Excavation, grading, demolition or other construction activity.
- Coating damage and atmospheric corrosion of exposed piping, deterioration of pipeline spans and structural pipeline supports (such as bridges, piling, headwalls, casings and foundations).
- Land subsidence, earth slippage, soil erosion, flooding, and other natural causes which can result in impressed secondary loads.
- Need for additional distribution pipeline identification and marking in private right-of-way and in rural areas.
- After local flooding or sustained heavy rains when determined necessary.

Examples of locations where anticipated physical movement or external loading could cause failure or leakage are:

- Exposed main piping
- Bridge crossings
- Structural pipeline supports
- Lines installed where land subsidence, earth slippage, soil erosion, flooding and other natural causes could overstress the gas pipeline.
- Shorelines of river and stream crossings
- Casings under active railroads
- Casings under roads with heavy truck traffic.

During all patrols of river and stream crossings, look for the following:

- Exposed segments of the gas pipeline.

Examine the approach slope to the river/stream bank and closely examine the river/stream bank and the water's edge for segments of exposed gas pipelines.
Look for scouring of the river banks and stream bed which may cause exposure of the gas pipeline or loss of earthen cover.

- Land subsidence, earth slippage, and soil erosion over and adjacent to the gas pipelines.
- Earth movements such as these can induce substantial stresses and strains on gas pipelines.
- Water boils, frothing, or bubbles which may indicate gas leakage beneath the water.
- Damaged coating on exposed pipelines.
- Damaged, missing, or 'outdated' pipeline markers and river crossing signs.

If the person conducting the patrol discovers pipe that is normally buried and has been exposed by a washout, etc., complete a "Pipe Inspection Report".
Include the following information on the Visual Inspection Report

- location,
- name of inspector,
- date,
- hazardous condition and / or atmospheric corrosion, if observed (otherwise OK),
- the nature and extent of any deficiencies.
- corrective action taken or recommended

5.3 LEAKAGE SURVEYS

Leak surveys shall be conducted at scheduled intervals and at other times when conditions warrant. Reports of suspected leaks shall be treated as leaks and inspected in the manner prescribed in the

Emergency Procedures Manual of this O&M Plan (Division 3). In the event a leak is found, procedures (including documentation) outlined in that division shall be followed.

a. SURVEY OF BUSINESS DISTRICT – A survey of the business district using gas detection equipment shall be conducted at intervals not exceeding 7 1/2 months, but at least twice each calendar year. The survey shall include tests of the atmosphere of all utility manholes, ground surface over mains and services, storm sewer inlets, cracks in pavement and sidewalks and at other locations providing an opportunity for finding gas leaks.

b. SURVEY OF OUTSIDE BUSINESS AREA – Areas outside of the principal business district shall be surveyed at least once every 3 calendar years at intervals not exceeding 39 months. The survey shall be conducted with gas detection equipment. The survey shall include tests of the atmosphere of all utility manholes, ground surface over mains and services, storm sewer inlets, cracks in pavement and sidewalks and at other locations providing an opportunity for finding gas leaks.

c. SURVEY OF SCATTERED BUSINESSES AND PUBLIC BUILDINGS – A survey of businesses scattered outside the normal business district and public buildings such schools, churches and City, County, State or Federal office buildings shall be conducted at intervals not exceeding 15 months, but at least each calendar year. The survey shall be conducted with gas detection equipment. The survey shall include tests of the atmosphere of all utility manholes, ground surface over mains and services, storm sewer inlets, cracks in pavement and sidewalks and at other locations providing an opportunity for finding gas leaks.

d. INDOOR COMMERCIAL AND PUBLIC BUILDING SURVEY – An indoor survey of commercial and public buildings using gas detection equipment shall be conducted at intervals not exceeding 15 months, but at least each calendar year. Buildings required to be surveyed include: Hospitals, nursing homes, theaters, schools, churches, auditoriums and City, County, State or Federal office buildings. The survey shall include tests of the atmosphere in the following locations:

    1) Top of stairway entering basement.
    2) Along accessible gas piping within the building and around gas fired equipment at ceiling where leaking gas may accumulate.
    3) Where other utilities enter the building below grade.
    4) Around floor drains and other sanitary sewer facilities.

e. Mains with odorized gas that are classified, as transmission lines, will be surveyed each calendar year at intervals not to exceed 15 months.

Reference: 49 CFR 192.706

5.4 KEY VALVES (EMERGENCY VALVES)

Valves necessary for the safe operation of the distribution system shall be inspected and maintained to ensure that they can be found, accessed, and operated for the purpose for which they are intended. Key valves are necessary to shut down the system or a portion of the system in case of emergency. The criteria for determining the necessity of "key" designation include consideration of the time required to restore service by available personnel. Key valves shall be clearly marked on a system map, readily available to operating personnel.

Reference: 49 CFR 192.747, 192.749
Documentation: Valve inspection card and valve book

a. MAINTENANCE SCHEDULE – Key valves shall be checked at intervals not exceeding 15 months, but at least once each calendar year. In the event that a valve is redesignated, i.e., given designation other than key valve, maintenance would be done at intervals not exceeding three years.

b. MAINTENANCE REQUIREMENTS – All valves shall be fully operated at the time of inspection. If full operation is not feasible, the valves shall be operated a minimum of 1/8th turn. Valves directly upstream of a regulator that are fully operated shall be gradually reopened to avoid potential regulator damage.

   Valves requiring lubrication shall be lubricated in accordance with the manufacturer's recommended procedures. Care shall be exercised to avoid over lubrication, particularly on valves directly upstream of regulators.

c. Below grade installations with valve boxes shall be cleared of debris so that the valve stem is accessible for proper operation. Vault floors shall also be cleared so that they are reasonably free from debris. Valves, except valve box installations, shall be checked for adequate paint to prevent atmospheric corrosion.

5.5 REGULATOR STATIONS

Regulator stations shall be inspected and relief devices tested at intervals not exceeding 15 months, but at least once each calendar year.

If there are indications of abnormally high- or low-pressure, the regulator and the auxiliary equipment must be inspected and the necessary measures employed to correct any unsatisfactory operating conditions.

Starting up and shutting down pipelines:

When starting up or shutting down segments of the system, care must be taken to follow proper procedures and sequences. Pressures must be monitored during these times to assure that M.A.O.P. limits are met.

References: 49 CFR 192.739, 192.741, 192.743 and 192.769. For general information on regulators and relief devices see Appendix "H" of the "Guidance Manual for Operators of Small Gas Systems"

Documentation: Regulator Station Inspection: Form

a. LOCATION – Regulator stations are marked on the system map(s).

b. INSPECTION – Inspection of regulator stations shall be made to ensure that equipment and facilities are:

   1) In good mechanical condition.
   2) Adequate for capacity and reliability.
   3) Set to function at correct pressures.
   4) Properly installed and protected in accordance with manufacturer's specifications retained for reference by the utility.

c. START UP AND SHUTDOWN PROCEDURES – As part of the regular inspection and at any time shutdown is required, the procedures listed below shall be followed:

   1) Removing district regulator station from service:
      a) Turn off downstream flow valve.
      b) Turn off upstream valve and pilot valves.
      c) Turn off downstream pilot valves.

District regulator station is now out of service.

2) Returning district regulator station to service:
   a) Turn on upstream valve and pilot valves.
   b) Turn on downstream pilot valves.
   c) Visually check gauges for regulator lock out pressure.
   d) Slowly turn on downstream flow valve, monitoring the pressure gauge until fully open.

District regulator station is now back in service.

A simple lock up test will be performed annually in accordance with the manufacturer's specifications. In the event district-type regulators are not designed to lock up, they will be tested in accordance with manufacturer's specifications. Permanent records of inspections will be kept, including a record of as-found and as-left set points.

d. Testing of relief devices shall be in accordance with the following:

1) If feasible, pressure relief devices (except rupture discs) must be tested in place, at intervals not exceeding 15 months, but at least once each calendar year, to determine that they have enough capacity to limit the pressure on the facilities to which they are connected to the desired maximum pressure.

2) If a test is not feasible, review and calculation of the required capacity of the relieving device at each station must be made at intervals not exceeding 15 months, but at least once each calendar year, and these required capacities compared with the rated or experimentally determined relieving capacity of the device for the operating conditions under which it works. After the initial calculations, subsequent calculations are not required if the review documents that parameters have not changed in a manner which would cause the capacity to be less than required.

   Reference: 49 CFR 192.743

3) If the relieving device is of insufficient capacity, a new or additional device must be installed to provide the additional capacity required.

4) Records of inspections must be retained in a permanent file to show that the relief capacity or the validity of the relief calculations was checked each year. Station inspections should include a check for anything, which might affect the validity of the calculations.

5.6 TELEMETERING

All F.C.U. telemetering and pressure recording gauges will be checked at 4 month intervals for accuracy. If there are indications of abnormally high- or low-pressure, the regulator and the auxiliary equipment must be inspected and the necessary measures employed to correct any unsatisfactory operating conditions.
Each distribution system supplied by more than one district pressure regulating station must be equipped with telemetering or recording pressure gages to indicate the gas pressure in the district.

On distribution systems supplied by a single pressure regulating station, the Utility shall determine the necessity of installing telemetering or recording gages in the district, taking into consideration the number of customers supplied, the operating pressures, the capacity of the installation, and other operating conditions.

Reference: 40 CFR 192.741

DIVISION SIX
OPERATING PROCEDURES

6.1 OPERATING PROCEDURES (GENERAL)

Procedures in this part shall be followed in the general operation of the system. Procedure review criteria and safety related conditions while performing the procedures are included in the separate Operator Qualification Manual.

Reference: The procedures and other information in this division are largely derived from the "Guidance Manual for Operators of Small Gas Utilities" (Rev. 2-91). Separate Operator Qualification Manual

6.2 MAOP DETERMINATION AND REVIEW

The utility will establish maximum allowable operating pressure (MAOP) for steel or plastic pipelines as prescribed in 49 CFR 192.619 and 192.621. Design pressure shall be limited by the weakest component in the segment consistent with 49 CFR 192, Subparts C and D.

6.3 UPRATING MAOP

Prior to any uprate in pressure, a Plan and procedure must be established.
The process begins with review and documentation of the design, operating and maintenance history of the segment of pipeline. When determined by study or design that a section of pipeline requires a higher MAOP than currently exists, a step by step procedure will be formulated. This process must be documented by:

a) Justification of uprate.

b) Designation of area to be affected

c) Designation of the required pressure to achieve.

d) Verification of system design to sustain new MAOP.

e) Designation of incremental pressure increases to be performed
(The increase in maximum allowable operating pressure must be in increments that are equal to 10 p.s.i.g. or 25% of the pressure increase, whichever produces the fewer number of increments. There must be at least two approximately equal incremental increases.)

f) Establish procedure to be followed during uprate of pressure, which includes

1) Listing of service regulators operating from existing system.
2) Listing of relief devices affected by this uprate in pressure.
3) Leakage survey prior to date of uprate.
4) Repairs of (ALL) leaks prior to first incremental increase in pressure.
5) Make repairs, replacements or alterations in the segment of pipeline that are necessary for safe operation at the increased pressure.
6) Isolate the segment of pipeline in which the pressure is to be increased from any adjacent segment that will continue to be operated at a lower pressure.
7) At the end of each incremental increase, the pressure must be held constant while the entire segment of pipeline that is affected is checked for leaks.
8) Each leak detected must be repaired before a further pressure increase is made. The exception being when a leak is determined not to be potentially hazardous.

Retain for the life of the segment, a record of each investigation, of all work performed and of each pressure test conducted with the uprating.

REFERENCE: 49 CFR 192, Subpart K. The written plan for uprating shall be as described in Appendix G of "Guidance Manual for Operators of Small Gas Systems" current edition.

6.4 TESTING FOR NEW OR REINSTATMENT OF DISTRIBUTION MAINS AND SERVICE LINES

The following testing procedures must ensure discovery of all potentially hazardous leaks in the segment being tested.

New distribution mains will be tested at 100 p.s.i. for a minimum of 1 hour.
New service lines will be tested at 100 p.s.i. for a minimum of 15 minutes.

For pipeline to be operated at over 66 psig, the test pressure will be 1 ½ times MAOP, for a minimum of 1 hour.
Tie-In or repair fittings will be leak tested with soap or bubble solution, while under normal pressure.
The test medium may be, air, natural gas, or inert gas that is non flammable.
During the test, the temperature of thermoplastic (PE) material may not be more than 100(F (38(C).

Disconnected lines shall be tested in the same manner as new lines. If the line is temporarily disconnected from the main, it should be tested from the point of disconnection to the service line valve or new point of connection. However, if provisions are made to maintain continuous service, such as by installation of a bypass, any part of the original line used to maintain continuous service need not be tested.

Documentation: Pipeline Test Report, The pressure test shall be documented and include the following items:
(1) The method and equipment used. (pressure test)
(2) The test medium and maximum test pressure.
(3) The duration of the test, and time started, time stopped.
(4) Description of the piping and its location. (point to point)
(5) Date of test.
(6) Leaks and failures noted and their disposition.

References: 49 CFR 192.725. Procedures for testing service lines can be found in “Chapter III” and “Appendix L” of the “Guidance Manual for Operations of Small Gas Utilities” (Rev. 2-91)

Documentation: Pipeline Test Report

6.5 ABANDOMENT OR INACTIVATION OF FACILITIES

Inactive pipelines, other than service lines, and all abandoned pipeline shall be disconnected, purged, and sealed at both ends. However, pipeline smaller than four inches in diameter need not be purged if the line is depressurized and if the volume of gas is so small there would be no potential hazard. Records must be kept on all facilities abandoned. This includes location, date and method of discontinuing service (abandoning the facility).

Reference: 49 CFR 192.727

a. ABANDONING MAINS – Mains that are abandoned in place shall be physically disconnected from active pipeline. The open end of the abandoned main shall be bled down and purged with air and closed with a welded cap or other suitable mechanical fitting.

b. ABANDONING SERVICE LINES – Service lines abandoned in place shall be cut and capped at both ends. However, where both the main and service line are being abandoned, the service line need not be cut at the main.

c. DISCONNECTION OF SERVICE LINES FOR ADMINISTRATIVE REASONS, INCLUDING NON-PAYMENT OF A BILL – When the service to a customer is temporarily disconnected for administrative reasons, one of the following must be done:

   1) The valve must be closed to prevent the flow of gas to the customer and secured with a lock or other device to prevent opening of the valve by unauthorized people;
   2) A mechanical device or fitting that will prevent the flow of gas must be installed in the service line or meter assembly; or
   3) The customer's piping must be physically disconnected from the gas supply and the open end sealed.

6.6 PIPELINE MATERIALS (General)

Whenever possible, manufacturer's data specific to the vintage and/or type shall be maintained for use in planning leakage surveys, replacement and repairs. Minimum requirements for the selection and qualification of pipe and components for use in pipelines shall be as stated in the following subsections.

Reference: 49 CFR Parts 192-143 thru 157

Materials for pipe and components must be:

a. Able to maintain the structural integrity of the pipeline under temperature and other environmental conditions that may be anticipated;
b. Chemically compatible with any gas that they transport and with any other material in the pipeline with which they are in contact; and
c. Qualified in accordance with the applicable requirements in 49 CFR Part 192.51.

6.7 STEEL PIPE

Criteria for use of steel pipe are determined by both its use (operating pressure) and its age, according to provisions of this subsection and applicable regulations.

a. New steel pipe is qualified for use if:

   1) It was manufactured in accordance with a listed specification;
   2) It meets the requirements of 49 CFR 192, Appendix B, Paragraph II **or,** if it was manufactured before November 12, 1970, if it meets the requirements of 49 CFR 192, Appendix B, Paragraphs II **or** III;
   3) It is used in accordance with subparagraphs "c" or "d" of this subsection.

b. Used steel pipe is qualified for use if:

   1) It was manufactured in accordance with a listed specification and it meets the requirements of 49 CFR 192, Appendix B, and Paragraph II (C);

2) It meets the requirements of 49 CFR 192, Appendix B, and Paragraph II **or,** if it was manufactured before November 12, 1970, it meets the requirements of 49 CFR 192, Appendix B, Paragraphs II **or** III;
3) It has been used in an existing line of the same or higher pressure and meets the requirements of 49 CFR 192, Appendix B, Paragraph II (C); or
4) It is used in accordance with subparagraph "c" of this subsection.

c. New or used steel pipe may be used at a pressure resulting in a hoop stress of less than 6,000 p.s.i.g., where no close coiling or close bending is to be done, if visual examination indicates that the pipe is in good condition and that it is free of split seams and other defects that would cause leakage. If it is to be welded, steel pipe that has not be manufactured to a listed specification must also pass the weld ability tests prescribed in 49 CFR 192, Appendix B, Paragraph II (B).

d. Welding material must be chosen in accordance with the compatibility requirements of material to be joined and location to be welded.

Reference: To the utility's qualified welding standards and supporting documents, such as *IAMU Welding Procedures Workshop Manual,* pages 9 and 10

e. Steel pipe that has not been previously used may be used as replacement pipe in a segment of pipeline if it has been manufactured prior to November 12, 1970, in accordance with the same specification as the pipe used in constructing that segment of pipeline.

f. New steel pipe that has been cold expanded must comply with the mandatory provisions of API Specification 5L.

6.8 PLASTIC PIPE

Criteria for use of plastic pipe are determined by both its use (operating pressure) and its age, according to provisions of this subsection and applicable regulations.

a. New plastic pipe is qualified for use under this part if:

1) It is manufactured in accordance with a listed specification ASTM D 2513; and
2) It is resistant to chemicals with which contact may be anticipated.

b. Used plastic pipe is qualified for use under this part if:

1) It was manufactured in accordance with a listed specification;
2) It is resistant to chemicals with which contact may be anticipated;
3) It has been used only in natural gas service;
4) Its dimensions are still within the tolerance of the specification to which it was manufactured; and
5) It is free of visible defects.

c. For the purpose of subparagraphs "a (1)" and "b (1)" of this subsection, where pipe of a diameter included in a listed specification is impractical to use, pipe of a diameter between the sizes included in a listed specification may be used if:

1) Meets the strength and design criteria required of pipe included in that listed specification; and
2) Is manufactured from plastic compounds which meet the criteria for material required of pipe included in that listed qualification.

6.9 MARKING OF MATERIALS

Materials shall be marked in accordance with the provisions of this subsection and applicable regulations.

a. Except as provided in subparagraph “d” of this subsection, each valve, fitting, length of pipe, and other components must be marked as prescribed in the specification or standard to which it was manufactured **or** must be marked to indicate size, material, manufacturer, pressure rating, and temperature rating, and as appropriate, type, grade, and model.

b. Surfaces of pipe and components that are subject to stress from internal pressure may not be field die stamped.
c. If any item is marked by die stamping, the die must have blunt or rounded edges that will minimize stress concentrations.

d. Subparagraph “a” of this subsection does not apply to items manufactured before November 12, 1970, that meet all of the following:

    1) The item is identifiable as to type, manufacturer, and model; and
    2) Specifications or standards giving pressure, temperature, and other appropriate criteria for the use of items are readily available.

6.10 QUALIFYING COMPONENTS

Notwithstanding any standard incorporated by reference in 49 CFR 192, Appendix A, a metallic component manufactured in accordance with other editions of those standards is qualified for use under that part if:

a. It can be shown through visual inspection of the cleaned component that no defect exists which might impair the strength or tightness of the component; and

b. The edition of the standard under which the component was manufactured has equal or more stringent requirements for pressure testing, materials, and pressure and temperature ratings than the edition of that standard currently listed in Appendix A.

6.11 VALVES

The following criteria shall apply to valves:

a. Except for cast iron and plastic valves, each valve must meet the minimum requirements, or equivalent, of API 6D. A valve may not be used under operating conditions that exceed the required pressure temperature ratings.

b. Each cast iron and plastic valve must comply with the following:

    1) The valve must have a maximum service pressure rating for temperatures that equal or exceed the maximum service temperature.
    2) The valve must be tested as part of the manufacturing as follows:

        a) With the valve in the fully open position, the shell must be tested with no leakage to a pressure at least 1.5 times the maximum service pressure rating.

b) After the shell test, the seat must be tested to a pressure no less than 1.5 times the maximum service pressure rating. Except for swing check valves, test pressure during the seat test must be applied successively on each side of the closed valve with the opposite side open. No visible leakage is permitted.

c) After the last pressure test is completed, the valve must be operated through its full travel to demonstrate freedom from interference.

c. Each valve must be able to meet the anticipated operating conditions.

d. No valve having shell components made of ductile iron may be used at pressures exceeding 80% of the pressure ratings for comparable steel valves at their listed temperature. However, a valve having shell components made of ductile iron may be used at pressures up to 80% of the pressure ratings for comparable steel valves at listed temperature, if:

1) The temperature adjusted service pressure does not exceed 1,000 p.s.i.g.; and
2) Welding is not used on any ductile iron component in the fabrication of the valve shells or their assembly.

6.12 VALVE INSTALLATION IN PLASTIC PIPE

a. LOADING IMPOSED BY VALVE OPERATION

Common methods to prevent excessive strains in plastic pipe at valve installations include the following:

1) Using a valve having a low operating torque.
2) Anchoring the valve body to resist twisting.
3) Making the transition from plastic-to-metal some distance from the valve. Transition pieces approximately 2 feet long will usually provide sufficient stabilization. However, each installation should be designed to prevent excessive strain on the plastic pipe.
4) Installing protective sleeves, designed to mitigate the stresses imposed on the plastic pipe in the transition area between the valve and the plastic piping, should be considered if undue stresses at this joint are anticipated, or if recommended by the manufacturer. The installation of protective sleeves, in addition to providing adequate backfill and compaction around the transition area, reduces excessive bending and shear stresses. For protective sleeves, see guide material under §192.367.

b. SECONDARY STRESSES

1) Transitions:

The transition from plastic pipe to metal or to a more rigid section of plastic pipe should be supported by undisturbed or well-compacted soil, by bridging, or by sleeve encasement. In addition to providing adequate backfill and compaction around the transition area, the installation of protective sleeves or bridging should be considered to reduce excessive bending and shear stresses. These stresses have been known to cause premature brittle-like failures in some pre-1982 PE piping materials. For protective sleeves, see guide material under §192.367.

2) Valve enclosures:

Where curb boxes or other enclosures are used, they should not be supported by the plastic pipe and should not in any way impose secondary stresses on the plastic pipe.

3) Coiled pipe.

Valves installed in thermoplastic piping that has been coiled should be suitably restrained to prevent the rotation that may occur.

6.12.1 MANUAL SERVICE LINE SHUT-OFF VALVE

Manual service line shut-off valve means a curb valve or other manually operated valve located near the service line that is safely accessible to operator personnel or other personnel authorized by the operator to manually shut off gas flow to the service line, if needed.

a. *Installation requirement.* The operator must install either a manual service line shut-off valve or, if possible, based on sound engineering analysis and availability, an EFV for any new or replaced service line with installed meter capacity exceeding 1,000 SCFH.

b. *Accessibility and maintenance.* Manual service line shut-off valves for any new or replaced service line must be installed in such a way as to allow accessibility during emergencies.

c. Manual service shut-off valves installed under this section are subject to regular scheduled inspection and maintenance.

1) Inspection shall include:
   - Inspecting for debris in valve box and report if cleaning is required.
   - Verifying that the valve is readily accessible to be operated and report if work is required to make it accessible.

2) Perform maintenance when there is indication a problem.
   - Valves that are found to be inoperable or inaccessible must be: repaired within one year.
   - Record the inspection/maintenance performed
     Include date, who performed task, any comments relative to inspection/maintenance

6.13 FLANGES AND FLANGE ACCESSORIES

The following criteria apply to flanges and flange accessories:

a. Each flange or flange accessory (other than cast iron) must meet the minimum requirements of ANSI B16.5 MSS SP-44, or the equivalent.

b. Each flange assembly must be able to withstand the maximum pressure at which the pipeline is to be operated and to maintain its physical and chemical properties at any temperature to which it is anticipated that it might be subjected in service.

6.14 STANDARD FITTINGS

The following criteria apply to standard fittings:

a. The minimum metal thickness of threaded fittings may not be less than specified for the pressures and temperatures in the applicable standards referenced in this part, or their equivalent.

b. Each steel butt-welding fitting must have pressure and temperature ratings based on stresses for pipe of the same or equivalent material. The actual bursting strength of the fitting must at least equal the computed bursting strength of pipe of the designated material and wall thickness, as determined by a prototype that was tested to at least the pressure required for the pipeline to which it is being added.

6.15 TAPPING

The following criteria apply to tapping:

a. Each mechanical fitting used to make a hot tap must be designed for at least the operating pressure of the pipeline. All hot taps to be made by qualified personnel only.

b. Personnel performing hot taps should be:

1) Familiar with the pressure limitations of the hot tapping equipment to be used; and
2) Thoroughly trained in the mechanical procedures and safety precautions associated with the use of such equipment.

Reference: Separate Operator Qualification Manual

6.16 IDENTIFICATION OF PIPE

Accurately identify the line to be tapped. Special caution should be exercised when other underground facilities are known or suspected to be in the area. Special caution should also be exercised when personnel locating the line to be tapped are unfamiliar with the area. The operator's personnel should be familiar with the piping materials used by other utilities in the area, such as steel, plastic, and cast iron.

Reference: Separate Operator Qualification Manual

6.17 PURGING

The following criteria apply to purging:

a. When a pipeline is being purged of air by use of gas, the gas must be released into one end of the line in a moderately rapid and continuous flow. If gas cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the gas. Confirm that all air is purged from the line. An indication of 100% gas is the proper indication.

b. When a pipeline is being purged of gas by use of air, the air must be released into one end of the line in a moderately rapid and continuous flow. If air cannot be supplied in sufficient quaintly to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the air. Confirm that all gas is purged from the line. An indication of 0% gas or 0 LEL is the proper indication.

NOTIFICATIONS PRIOR TO PURGE OR BLOWDOWN

Public officials.
The appropriate public officials should be notified prior to a purge or blow down in those situations where the normal traffic flow through the area might be disturbed, or where it is anticipated that there will be calls from the public regarding the purge or blow down.
Public in vicinity of gas discharge.

The public in the vicinity of the gas discharge should be notified prior to a purge or blow down, if it is anticipated that the public might be affected by the process. The primary considerations for determining the need for notification are noise, odor, and the possibility of accidental ignition.

6.18 PREVENTION OF ACCIDENTAL IGNITION

The utility will take every precaution to prevent accidental ignition of gas. Gas alone is not explosive but when it is mixed with air in the proper ratio, it can ignite or explode with tremendous force. When it is necessary to vent gas into air, whether by accidental rupture or because of operational necessity, a fire extinguisher must be available. Every possible effort, including warning signs, shall be made to protect property and the public.

a. GENERAL

1) *Smoking and open flames*, should be prohibited in the following locations:
   a. In structures or areas containing gas facilities where possible leakage or presence of gas constitutes a hazard of fire or explosion.
   b. In the open when accidental ignition of gas-air mixture might cause personal injury or property damage.

2) *Accidental electric arcing.* To prevent accidental ignition by electric arcing, the following should be considered:
   a. Flashlights, portable floodlights, extension cords, and any other electrically powered tool or equipment should be of a type approved for use in hazardous atmospheres.
   b. Internal combustion engines that power trucks, cars, compressors, pumps, generators and other equipment should not be operated in suspected or known hazardous atmospheres.
   c. Bonding to provide electrical continuity should be considered around all cuts separating metallic pipes that may have natural gas present. This bond should be installed prior to cutting and maintained until all reconnections are completed or a gas free environment exists. Bond cables should be installed in such a manner to ensure that they do not become detached during construction and that they provide minimal electrical resistance between pipe sections.

Note: Cell phones, pagers and other personal electronic devices (PEDs), both company and employee owned, that have not been positively identified as being explosion-proof may not be turned on or used until the environment has been determined to be nonhazardous.

3) *Static electricity on plastic pipe.* A static electric charge can build up on both the inside and outside of plastic pipe due to the dielectric properties of plastic. Discharging of the static electricity going to ground can cause an arc that will cause ignition if a flammable gas-air mixture is present. In plastic pipe operations, it is essential to avoid the accumulation of a flammable gas-air mixture and the arcing of a static electrical discharge. When conditions exist that a flammable gas-air mixture may be encountered and static charges may be present, such as when repairing a leak, squeezing-off an open pipe, purging, making a connection, etc., arc preventing safety precautions are necessary. The following should be considered:
   a. Leaking or escaping gas should be eliminated by closing valves or excavation and squeezing-off in a separate excavation at a safe distance from the escaping gas.
   b. If escaping gas cannot be effectively controlled or eliminated and it is necessary to work in an area of escaping gas, safety provisions should be considered such as dissipating or

preventing the accumulation of a static electrical charge, venting the gas from the trench, and grounding those tools used in the area. Additionally, flame-resistant clothing treated to prevent static buildup and respiratory equipment should be used. Acceptable methods of dissipation or preventing the accumulation of static electricity include wetting the exposed area with an electrically conductive liquid (e.g., soapy water with glycol added when ambient temperatures are below freezing) and using an anti-static polyethylene (PE) film or wet non-synthetic cloth wound around or laid in contact with the entire section of exposed pipe and grounded with a brass pin driven into the ground. Commercially available electrostatic discharge systems may be considered as a means of eliminating static electricity from both the inside and outside of PE pipe.

c. A plastic pipe vent or blow down stack should not be used due to the possibility that venting gas with a high scale or dust content could generate an internal static electrical charge that could ignite the escaping gas. Metal vent stacks should be grounded before placement in the escaping gas stream.

d. To reduce potential sources of ignition, all tools, including squeeze-off tools, used in gaseous atmospheres should be grounded or the non-sparking type.

4) *Other sources of ignition*. Care should be taken in selecting the proper hand tools for use in hazardous atmospheres and in handling tools to reduce the potential for a spark.

b. WELDING, CUTTING AND OTHER HOT WORK

GENERAL

Prior to welding, cutting, or other hot work in or around a structure or area containing gas facilities, a thorough check should be made with a gas detector for the presence of a combustible gas mixture. Prior to entering pipe, tanks, or similar confined spaces, appropriate instruments should be used to ensure a safe, breathable atmosphere. Work should begin only when safe conditions are indicated. The atmosphere should be tested periodically for oxygen deficiency and combustible mixtures.

1) Pipeline filled with gas. When a pipeline or main is to be kept full of gas during welding or cutting operations, the following are recommended:

a. A slight flow of gas should be kept moving towards the cutting or welding operation.

b. The gas pressure at the site of the work should be controlled by suitable means.

c. All slots or open ends should be closed with tape, tightly fitted canvas, or other suitable material immediately after a cut is made.

d. Two openings should not be uncovered at the same time.

2) Pipelines containing air.

a. Before the work is started, and at intervals as the work progresses, the atmosphere in the vicinity of the zone to be heated should be tested with a combustible gas indicator or by other suitable means.

b. Unless a suitable means (such as an air blower) is used to prevent a combustible mixture in the work area, welding, cutting or other operations that could be a source of ignition should not be performed on a pipeline, main or auxiliary apparatus that contains air and is connected to a source of gas..

c. When the means noted in subsection 2 (above) are not used, one or more of the following precautions are suggested, depending upon the job site circumstances.

1) The pipe or other equipment upon which the welding or cutting is to be done should be purged with an inert gas.
2) The pipe or other equipment upon which the welding or cutting is to be done should be continuously purged with air in such a manner that combustible mixture does not form in the facility at the work area.

6.19 COMPONENTS FABRICATED BY WELDING

The following criteria apply to components fabricated by welding:

References: 49 CFR 192, Subparts B, C, and D. General information on material standards can be found in Chapter II of the "Guidance Manual for Operators of Small Gas Systems" entitled "Materials Qualified for Use in Gas Systems"

a. Except for branch connections and assemblies of standard pipe and fittings joined by welds make around the circumference of the pipe of fitting, the design pressure of each component fabricated by welding, whose strength can't be determined, must be established in accordance with paragraph UG-101 of section VIII of the ASME Boiler and Pressure Vessel Code.

b. Each prefabricated unit that uses plate and longitudinal seams must be designated, constructed, and tested in accordance with the ASME Boiler and Pressure Vessel Code, except for the following:
   1) Regularly manufactured butt-welding fittings.
   2) Pipe that has been produced and tested under specification listed in Appendix B to this part of 49 CFR Part 192.
   3) Partial assemblies such as split rings or collars.
   4) Prefabricated units that the manufacturer certifies have been tested to at least twice the maximum pressure to which they will be subjected under the anticipated operating conditions.

c. Orange-peel bull plugs and orange-peel swages may not be used on pipelines that are to operate at a hoop stress of 20% or more the SMYS of the pipe.

d. Except for flat closures designed in accordance with section VIII of the ASME Boiler and Pressure Code, flat closures and fish tails may not be used on pipe that either operates at 100 p.s.i.g., or more, or is more than 3 inches nominal diameter.

e. Each welded branch connection made to pipe in the form of a single connection, or manifold as a series of connections, must be designed to ensure that the strength of the pipeline system is not reduced, taking into account the stresses in the remaining pipe wall due to the opening in the pipe or header, the shear stresses produced by the pressure acting of the area of the branch opening, and any external loading due to thermal movement, weight and vibration.

6.20 PIPELINE CONSTRUCTION AND LEAK REPAIR

Pipeline shall be installed in accordance with accepted standards and shall be tested before being placed in service.

a. Distribution mains will be constructed and installed in compliance with Part 192 and will be inspected to insure that it does comply.

b. All components shall be inspected prior to their installation to insure their condition.

c. Scratched and dented sections of pipe will be removed and replaced with a new section of pipe of equal or greater design strength.

d. Arc burns may be repaired by grinding as long as the wall thickness remains to be in tolerances with the original specifications or have remaining wall thickness required for the design of the pipeline.

e. Polyethylene pipelines that are damaged or found to be defective shall be removed.

f. Bends and elbows shall comply with 49 CFR 192-313.

g. Each pipeline shall be protected from damage by vehicles by barricades and/or by being placed a safe distance from the traffic (49 CFR 192-317).

h. INSTALLATION OF PIPE IN DITCH:

1) Pipe shall be inspected for any defects that might impair it serviceability.
2) Steel pipe shall fit in the ditch so as to minimize stress to the pipe. Backfilling shall be done in a manor that will not be harmful to the pipe or its coating.

INSTALLATION OF PLASTIC PIPE:

1) An electrical conductor must be installed with direct burial plastic pipe (preferably 2" to 6" from the pipe) to facilitate locating with an electronic detector unless other means are available for locating the pipe underground. This conductor will be coated metal wire and should be corrosion-resistant. Leads into curb boxes, valve boxes and on service risers can be used for direct connection of locating equipment. (Prudent option- anodes on the tracer wire to prevent its corrosion).
2) Plastic pipe shall terminate below ground.
3) The pipe shall be snaked in the ditch to allow for contraction and expansion and other movement.

Note: 49 CFR 192.321 requires that plastic pipe that is not encased must have an electrically conductive wire or other means of locating the pipe while it is underground. The Office of Pipeline Safety (OPS) has alerted all operators of gas pipeline facilities that wrapping an electrically conductive tracer wire around plastic pipe has resulted in conducting lighting through the tracer wire, thereby damaging and causing the plastic pipe to leak. Accordingly, each gas pipeline operator using a tracer wire as a means to comply with Section 192.321 should lay the tracer wire along the plastic pipe with 2" to 6" separation, rather than wrap the tracer wire around the plastic pipe.

i. UNDERGROUND CLEARANCE:

1) Distribution mains should have at least 12 inches of clearance from other unassociated structures. If clearance cannot be obtained other means must be used to protect the line from being damaged by the other structure.
2) Steel distribution mains should have enough clearance for proper maintenance between other underground structures. Protect the main if it is not possible to keep two feet of separation.
3) Polyethylene mains and service lines must be installed with sufficient clearance, or must be insulated, from any source of heat that might damage the pipe.

j. COVER:

	Normal Soil:	Consolidated rock:
Distribution mains: (all)	30"	24"

Service Lines	Private property – 18”	Public Property – 24”

6.21 MAIN CONNECTION AND PE PIPING

General requirements for connections to main piping:

a. **Location:**
Each service line connection to a main must be located at the top of the main or, if that is not practical, at the side of the main, unless a suitable protective device is installed to minimize the possibility of dust and moisture being carried from the main into the service lines.

The connection between a PE service line and the service tee at the main is particularly susceptible to excessive bending and shear stresses due to the design of the joint.

b. **Backfill and compaction:**
It is important that adequate backfill and compaction be provided in the transition area to reduce the stresses at the joint between the service tee and the plastic piping. Protective sleeves or bridging should also be considered if undue stresses are anticipated at these joints.

c. **Protective sleeves:**

1) Purpose:

Protective sleeves mitigate excessive bending and shear stresses imposed on the plastic pipe at transition areas. Protective sleeve installations are in addition to providing adequate backfill and compaction around transition areas.

2) Design:

(a) The protective sleeve should be designed to fully support the PE pipe in the joint area at the service tee.

(b) The protective sleeve should be of adequate length and inside diameter to ensure that the manufacturer’s minimum bend radius is not exceeded.

(c) The annulus between both the protective sleeve and the service tee, and the PE service line, should be of such fit to avoid overstressing the joint due to anticipated earth settlement after installation.

(d) Protective sleeves, supplied by several manufacturers, are typically lengths of either PE or PVC pipe.

d. **Bending at joints in PE piping:**

Due to the nature of installation, the service tee connection can experience excessive bending forces that are transmitted to the piping at the service tee joint.

1) Bending of PE piping can overstress the joints, which can lead to premature failures. These concerns are heightened when making mechanical joints from steel service tees to PE pipe as the transition is from a rigid steel coupling to a flexible pipe, concentrating stresses at the transition area.

2) The minimum bend radii recommendations received from various PE piping manufacturer's range from 90 to 125 pipe diameters depending on the PE used.

6.22 EXTRUDED OUTLETS

Each extruded outlet must be suitable for anticipated service conditions and must be at least equal to the design strength of the pipe and other fittings in the pipeline to which it is attached.

6.23 FLEXIBILITY

Each pipeline must be designed with enough flexibility to prevent thermal expansion or contraction from causing excessive stresses in the pipe or components, excessive bending or unusual loads at joints, or undesirable forces or moments at points of connection to equipment, or at anchorage or guide points.

6.24 SUPPORTS AND ANCHORS

The following criteria apply to the use of supports and anchors:

a. Each pipeline and its associated equipment must have enough anchors or supports to:
    1) Prevent undue strain on connected equipment;
    2) Resist longitudinal forces caused by a bend or off set in the pipe; and
    3) Prevent or damp out excessive vibration.

b. Each exposed pipeline must have enough supports or anchors to protect the exposed pipe joints from the maximum end force caused by internal pressure and any additional forces cause by temperature expansion or contraction or by the weight of the pipe and its contents.

c. Each support or anchor on an exposed pipeline must be made of durable, non-combustible material and must be designed and installed as follows:
    1) Free expansion and contraction of the pipeline between supports or anchors may not be restricted.
    2) Provision must be made for the service conditions involved.
    3) Movement of the pipeline may not cause disengagement of the support equipment.

d. Each support on an exposed pipeline operated at a stress level of 50% or more SMYS must comply with the following:
    1) A structural support may not be welded directly to the pipe.
    2) The support must be provided by a member that completely encircles the pipe.
    3) If an encircling member is welded to a pipe, the weld must be continuous and cover the entire circumference.

e. Each underground pipeline that is connected to a relatively unyielding line or other fixed object must have enough flexibility to provide for possible movement, or it must have an anchor that will limit the movement of the pipeline.

f. Except for offshore pipelines, each underground pipeline that is being connected to new branches must have a firm foundation for both the header and the branch to prevent detrimental lateral and vertical movement.

6.25 CUSTOMER METERS/REGULATORS

a. Normal customer meter location is to be outside of the customer's building at a location either facing the main or no more than 2 feet back on either side of the building edge. On existing buildings only, the Gas Superintendent may approve an exception to the normal meter location where structural conditions make it impractical to locate the meter set as noted above. In these cases, the meter set may be placed back a maximum of 20 feet on either side of the building edge with the service line being run 5 feet from the exterior building wall and then perpendicular (90˚) to the meter set location. The meter will not be in an area that is restricted from being read or maintained, such as under a deck, or behind an air conditioner.

b. The regulator will be adjusted to the correct pressure before the meter set is put into service.

c. The meter set shall not support the customer piping or be stressed by the customer piping.

d. Customer meters and regulators shall be installed in accordance with applicable provisions of 49 CFR 192, Subpart H, which prescribes minimum requirements for installing customer meters, service regulators, service lines, service line valves, and service line connections to mains.

References: 49 CFR, Subpart H. Additional information can be found in Chapter IV of the "Guidance Manual for Operators of Small Gas Systems" entitled "Proper Locations and Design of Customer Meter and Regulator Sets"

6.26 SERVICE LINES

The following are installation practices for installing service lines:

a. Service lines shall have a 5 ft. easement on each side. No above ground structures shall be permitted within this easement so that emergency excavation is possible. Service lines will not be installed under buildings. The Gas Superintendent may approve an exception and the service line would be required to be cased and vented in accordance to regulations.

b. Riser brackets will be used on new construction where settlement is anticipated.

c. Care will be taken when backfilling around the service T and riser to eliminate settlement as much as possible.

d. The service valve at the meter set will be locked off until customer piping has been inspected and pressure tested.

e. Service lines shall be installed in accordance with 49 CFR 192.361 thru 192.379.

6.27 EXCESS FLOW VALVES

Falls City Utilities will install an excess flow valve (EFV) on new and replacement service lines that operate continuously throughout the year at a pressure of 10 p.s.i. or more and have rated capacity of less than 1000 SCFH. For service lines that have more than 1000 SCFH capacity, Falls City Utilities will install either a manual service line shut-off valve (see 6.12.1) or, if possible, based on sound engineering analysis and availability, an EFV for any new or replaced service line with installed meter capacity exceeding 1,000 SCFH.

Falls City Utilities will utilize EFV's that are manufactured and tested by the manufacturer according to an industry specification, or the manufacturer's written specification to ensure that each valve will:

a. Function properly up to the maximum operating pressure at which the valve is rated;

b. Function properly at all temperatures reasonably expected in the operating environment of the service line;

c. At 10 p.s.i.

1) Close at, or not more than 50 percent above, the rated closure flow rate specified by the manufacturer; and

2) Upon closure, reduce gas flow-
   a) For an excess flow valve designed to allow pressure to equalize across the valve, to no more than 5 percent of the manufacturer's specified closure flow rate, up to a maximum of 20 cubic feet per hour (0.57 cubic meters per hour); or
   b) For an excess flow valve designed to prevent equalization of pressure across the valve, to no more than 0.4 cubic feet per hour (.01 cubic meters per hour); and

d. Not close when the pressure is less than the manufacturer's minimum specified operating pressure and the flow rate is below the manufacturer's minimum specified closure flow rate.

Falls City Utilities will:

a. Use an excess flow valve that meets the applicable requirements of Part 192, Subparts B and D.

b. Mark or otherwise identify the presence of an excess flow valve on the service line.

c. Locate an excess flow valve as near as practical to the fitting connecting the service line to its source of gas supply.

d. Not install an excess flow valve on a service line where we have experience with contaminants in the gas stream, where these contaminants could be expected to cause the excess flow valve to malfunction or where the excess flow valve would interfere with necessary operation and maintenance activities on the service, such as blowing liquids from the line.

Reference: 49 CFR 192.381

6.27.1 CUSTOMER'S RIGHT TO REQUEST AN EFV

Existing service line customers who desire an EFV on service lines not exceeding 1,000 SCFH and who do not qualify for one of the exceptions in the following section 6.27.2, may request an EFV to be installed on their service lines. If an eligible service line customer requests an EFV installation, Falls City Utilities will install the EFV at a mutually agreeable date and at a rate to be determined prior to the installation. Falls City Utilities has provided written or electronic notification to customers of their right to request the installation of an EFV.

6.27.2 EXCEPTIONS TO EXCESS FLOW VALVE INSTALLATION REQUIREMENT

Falls City Utilities will not install an excess flow valve if one or more of the following conditions are present:

a. The service line does not operate at a pressure of 10 psig or greater throughout the year;

b. The operator has prior experience with contaminants in the gas stream that could interfere with the EFV's operation or cause loss of service to a customer;

c. An EFV could interfere with necessary operation or maintenance activities, such as blowing liquids from the line; or

d. An EFV meeting the performance standards in § 192.381 is not commercially available to the operator.

6.28 CASING INSTALLATION

Each casing utilized on will meet requirements of 49 CFR 192.323. Cathodic protection monitoring will be as required under 49 CFR 192.467.

6.29 INSTALLATION OF ELECTRONIC AND ELECTRICAL EQUIPMENT

Only a person who has sufficient knowledge and the capabilities to complete the work in accordance with National Codes shall do the installation of electronic equipment and the wiring or repair of such equipment.

6.30 CUSTOMER SERVICE: PAST METER

We will relight pilots on customer's appliances if needed if they are off due to work performed by F.C.U. A contractor shall do any further repairs needed

6.31 CUSTOMER PIPING

Black pipe and corrugated stainless tubing similar to Gastite are permitted in our system. Copper is not permitted. Any mechanical fittings and threaded joints shall be accessible for inspection.

When copper in established piping is found leaking or when appliance is replaced, it will be replaced with black pipe or corrugated stainless steel tubing and it will be pressure tested.

6.32 CUSTOMER UNDERGROUND PIPING

Falls City Utilities does maintain customer owned piping up to a point where it enters the first building downstream of the meter or principal gas utilization equipment. If an unsafe condition is found on customer owned piping, FCU will shut off the flow of gas, advice the customer of the need to repair the unsafe condition, or repair the unsafe condition.

6.33 WARNING AND TAGS

WARNING TAG: This is a notice of "Hazardous Condition". When this tag is used the appliance will be shut off. If there is no working valve to isolate the faulty appliance the service valve will be shut off.

The customer will be advised to hire a qualified contractor.

6.34 STARTING UP A PIPELINE DURING NORMAL OPERATION : Reference: [192.605(b)(5)]

a. When a pipeline is put into service, it shall have pressure-limiting, and/or control devices, and gauges connected to the pipeline, so that the MAOP plus allowable build-up will not be exceeded.
b. Verify MOAP of pipeline section.
c. Verify that gauges are in place for pressurizing the pipeline section.
d. Verify that the pipeline is ready to have natural gas introduced into the specific section of pipeline. Gas or air within the pipeline may need to be purged. Follow purging procedures. Reference: Section 6.17
e. When purging is completed, closed vent valves, allow inlet valve to feed natural gas.
f. Monitor pressure within the pipeline, so that the MAOP plus allowable build-up will not be exceeded. "Be ready to close inlet valve if pressures near MOAP"

6.35 SHUTTING DOWN A PIPELINE DURING NORMAL OPERATION

a. During shut-down of a pipeline, the pressure-limiting and/or control devices shall already be in place.
b. Gauges shall be connected to the pipeline to verify pressure.
c. Verify that valve(s) or squeeze-off devices are in correct location to shut off gas flow to the specific pipeline.
d. Terminate gas flow to specific section of pipeline. Shut gas flow off.
e. Gas within the pipeline may need to be purged to permit repair or replacement. Follow purging procedures. Reference: Section 6.17
f. Verify gas displacement with a combustible gas indicator.

6.36 ISOLATING PIPELINE SEGMENTS ON PLANNED WORK TO MINIMIZE THE POTENTIAL OF IGNITION

a. GENERAL: Planned work on gas facilities should incorporate procedures to shut off or minimize the escape of gas. No portion of a pipeline, large-diameter service line, or main should be cut out under pressure, unless the flow of gas is shut off or minimized by the use of line valves, line plugging equipment, bags, stoppers, or pipe squeezers. Where 100 percent shutoff is not feasible, the following precautions are recommended.

    1) Plan the job to minimize the escape of gas and sequence steps to limit the time and amount of gas to which personnel are exposed.
    2) Ensure that the size and position of the cut allows the gas to vent properly even with an employee in the excavation.
    3) Protect personnel working in a gaseous atmosphere under an overhang, in a tunnel, or in a manhole.

b. Isolating pipeline segments.

1) Preliminary action. The operator should conduct a pre-work meeting(s) to review the following with the personnel involved.
   a) The method of isolation.
   b) The purpose of each activity.
   c) Drawings, procedures, and schematics, as applicable.
   d) Responsibilities of each individual, including the designation of an individual to be in charge of the operation.

c. Isolation precautions.

1) The operator should ensure that the isolation equipment is appropriate and sized correctly for the job.
2) Isolation equipment left unattended should have a positive means of preventing unauthorized operation.
3) Positive means should be provided at the work site to alert and protect personnel from unintentional pressuring. Consideration should be given to the use or installation of items such as:
   a) Relief valves.
   b) Rupture discs.
   c) Pressure gauges.
   d) Pressure recorders.
   e) Vents.
   f) Pressure alerting devices.
   g) Other pressure detecting devices.
4) Isolation equipment should be inspected and maintained prior to use.
5) Temporary closures capable of withstanding full line pressure should have a means to determine pressure buildup, such as gauges and vents.

d. Monitoring isolated segments.

1) Monitoring procedures should be established based on the pressure, volumes, closures, and other pertinent factors.
2) Personnel assigned to operate isolation equipment should have a means to determine pressure build-ups, such as gauges and vents.
3) Personnel monitoring at remote locations should have communication with the work site and the individual in charge of the operation.

6.37 MONITOR AND CONTROL OF DOWNSTREAM PRESSURE WHILE BY-PASSING REGULATOR EQUIPMENT

If it is necessary to bypass pressure controlling or regulating equipment during maintenance or in an emergency, the person that controls the bypass valve with full authority to shut the gas off, will also monitor the downstream pressure gauge and will keep the downstream pressure at or below the system MAOP.
If the person that is controlling the bypass valve cannot see the downstream pressure gauge, then a second person will monitor the downstream pressure and shall be in constant communication with the person that is controlling the bypass valves to assure the system pressure never exceeds the MAOP.
The bypass valves will be manned continually and the downstream pressure monitored until the pressure control equipment is back in service and the downstream pressure has been properly regulated. Be sure to verify the SYSTEM MAOP before shutting down regulating equipment.

DIVISION SEVEN
CORROSION CONTROL

7.1 CORROSION CONTROL PROGRAM

The utility shall carry out a corrosion control program, (as per new 192.605 (B) (2)), under the direction of a person qualified in pipeline corrosion control, for the protection of metallic pipelines from external, internal and atmospheric corrosion. The program shall be based on procedures that include design, installation, operation and maintenance of a cathodic protection system.

References: 49 CFR 192, Subpart I. For general information see Appendix E of the "Guidance Manual for Operators of Small Gas Utilities" entitled "Federal Requirements for Corrosion Control" and Appendix F entitled "Some Principles and Practices of Cathodic Protection"

7.2 CATHODIC PROTECTION

All buried metallic pipeline shall be cathodically protected.
Aluminum may not be installed in a buried or submerged pipeline.

Reference: 49 CFR 192.453. Specific corrosion control requirements can be found 49 CFR 192, Subpart I

7.3 DESIGN CRITERIA

A minimum criteria of –0.85 volts will be maintained for coated steel, if the pipe-to-soil reading is below the minimum of –0.85, remedial action will be taken. F.C.U. will clear or remove problem area within 1 year, when deemed necessary by qualified personnel. Consideration will be given to the voltage (IR) drop (which is the difference between the voltage at the top of the pipe and the voltage at the surface of the earth).

Reference: 49 CFR 192.455

7.4 PROTECTIVE COATING

All metallic pipelines installed below ground as a new piping system or a replacement system shall be entirely coated.

(a) Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must-

(1) Be applied on a properly prepared surface;
(2) Have sufficient adhesion to the metal surface to effectively resist under film migration of moisture;
(3) Be sufficiently ductile to resist cracking;
(4) Have sufficient strength to resist damage due to handling and soil stress; and,
(5) Have properties compatible with any supplemental cathodic protection.

(b) Each external protective coating which is an electrically insulating type must also have low moisture absorption and high electrical resistance.

(c) Each external protective coating must be inspected just prior to lowering the pipe into the ditch and backfilling, and any damage detrimental to effective corrosion control must be repaired.

(d) Each external protective coating must be protected from damage resulting from adverse ditch conditions or damage from supporting blocks.

(e) If coated pipe is installed by boring, driving, or other similar method, precautions must be taken to minimize damage to the coating during installation.

References: 49 CFR 192.455 and 192.461. A discussion of different types of coatings and handling practices is included in Appendix F of the "Guidance Manual for Operators of Small Gas Systems"

7.5 CORROSION CONTROL MONITORING

Cathodic protection levels will be tested at least once per calendar year at intervals not exceeding 15 months to determine adequate protection levels as required under 49 CFR 192, Subpart I. Prompt remedial action will be taken to correct any deficiencies indicated by the monitoring.

Pipe-to-Soil potentials will be completed utilizing a reference electrode connected to a multi-meter design for pipeline inspection.

1) Place reference electrode in contact with soil, near pipeline.
2) Contact pipeline with lead from multi-meter.
3) Read and document test result.

Reference: NACE RP-0-169 for testing procedures.

F.C.U. will provide sufficient test stations or other contact points for electrical measurement to determine the adequacy of cathodic protection. Any contact point location (such as valves, meters, service lines, regulators and regulator vents which are electrically continuous with the structure under test) may be chosen for testing as long as the level of cathodic protection is effectively determined.

7.6 RECTIFIER MONITORING

Each cathodic protection rectifier or other impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2 1/2 months, to insure that it is operating. Results of this inspection will be documented.

7.7 ELECTRICAL ISOLATION

Each buried or submerged pipeline must be electrically isolated from other underground metallic structures, unless the pipeline and the other structures are electrically interconnected and cathodically protected as a single unit.
F.C.U. will install one or more insulating devices, where electrical isolation of a portion of a pipeline is necessary to facilitate the application of corrosion control. Insulating devices may consist of insulating flange assemblies, unions or couplings, or fabricated insulating joints. These devices should be properly rated for temperature, pressure, and dielectric strength.
Typical locations where electrical insulating devices should be considered include the following:

(a) At supporting pipe stanchions, bridge structures, and reinforced concrete foundations where electrical contact would preclude effective cathodic protection (CP). It may be necessary to electrically isolate the piping from such a structure, or the piping and structure from adjacent underground piping.

(b) Where a pipe enters a building through a metallic wall sleeve and where it is intended to maintain electrical isolation between the sleeve and the pipe. To accomplish this, insulating spacers should be used.

(c) Points at which facilities change ownership, such as meter stations.
(d) Inlet and outlet piping of inline measuring or pressure regulating stations or both.

(e) In stray current areas.

(f) At the termination of service line connections and entrance piping to prevent electrical continuity with other metallic systems.

(g) Each metallic pipeline must be electrically isolated from metallic casings that are a part of the underground system.

Inspection and electrical tests must be made to assure that electrical isolation is adequate.
An insulating device may not be installed in an area where a combustible atmosphere is anticipated unless precautions are taken to prevent arcing.

Reference §192.467 External corrosion control: Electrical isolation.

7.8 CASINGS

In addition to tests on pipeline facilities and structures, casings will include testing for shorts using one of the following methods:

a. CASING TEST USING LINE LOCATOR – Switch the line locator to the conductive mode and connect the transmitter to the pipeline at a test point remote from the casing. Locate pipe from the test point across the casing, while monitoring signal strength. If no sudden drop in signal strength is detected, the casing is isolated from gas main.

b. CASING TEST USING EXTERNAL POWER SUPPLY – Take potential reading of the casing and pipeline. Induce a negative D.C. current at a test point remote from the casing and then re-check the potential at the casing. If there is no appreciable difference in the potential readings at the casing, no shorts exist.

If a short is found it will be monitored quarterly with leak detection equipment until proper repairs can be completed.

Reference §192.467 External corrosion control: Electrical isolation (c)

7.9 INSPECTING UNCOVERED PIPELINE

Whenever a portion of buried pipeline is uncovered, the exposed portion shall be examined for evidence of external corrosion. If external corrosion if found, investigate circumferentially and longitudinally beyond the exposed portion (by visual examination, indirect method, or both) to determine whether additional corrosion requiring remedial action exists in the vicinity of the exposed portion. Remedial action must be taken to the extent required by 49 CFR 192.483 and the applicable paragraphs of sections 192.485, 192.487 and 192.489.

Reference: §192.461 External corrosion control: Protective coating.

Exposed protective coatings must be inspected for any damage. Detrimental damage to protective coatings that could affect corrosion control must be repaired.

Reference: §192.461 External corrosion control: Protective coating.(c)

7.10 INTERNAL PIPE INSPECTION

If any metallic pipe is removed from a pipeline or a segment of metallic pipeline opened, the internal surface shall be inspected for evidence of corrosion. If internal corrosion is found:

a. The adjacent pipe must be investigated to determine the extent of internal corrosion.

b. Replacement must be made to the extent required by the applicable guidelines.

c. Steps must be taken to minimize the internal corrosion.

Documentation: Steel Main Inspection Card

7.11 GENERAL AND LOCALIZED CORROSION PITTING

a. GENERAL CORROSION: is corrosion pitting so closely grouped as to affect the overall strength of the pipe is considered general corrosion for the purpose of this paragraph.

1) Each segment of distribution line pipe with general corrosion and with a remaining wall thickness less than that required for the MAOP of the pipeline, or a remaining wall thickness less than 30% of the nominal wall thickness will be replaced.

Corroded pipe may be repaired by a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe.

b. LOCALIZED CORROSION PITTING:

1) Each segment of distribution line pipe with localized corrosion pitting to a degree where leakage might result, will be replaced or repaired.

References: 49 CFR Parts 192.485, 192.487

7.12 INTERFERENCE CURRENTS

F.C.U. will annually check for stray current from pipeline crossings and known impressed current systems. Qualified personnel will take readings from other companies test stations. Remedial action will be taken promptly, if problems seem to exist.

Interference surveys and additional investigations will be conducted when any of the following three criteria are present:

a. An impressed current system is in the vicinity of company pipelines.

b. A foreign line crosses or parallels company pipelines.

c. A wide fluctuation or variance is identified in cathodic protection reading:
   1. The P/S potential changes polarity
   2. The P/S potential indicates AC voltages greater than 10 volts.
   3. The P/S potential exceeds -2.0 volts with the current applied and/or an instant off of - 1. 2 volts or greater. (While current is interrupted)
   4. An increase / decrease of 300mV negative potential over previously monitored readings.
   5. A shift in pipeline potential of 50 mV (+ or -) when the suspected interfering rectifier is cycled off and on.

Documentation: Foreign Pipeline Crossings

7.13 PROCEDURES FOR INSTALLING TEST LEADS

All test leads will installed by using the following method:

a. Wrap #10 wire around main and twist together, thermite weld or braze the wire to the main and then coat with approved coating. Refer to Division 8 section 8.5 for thermite weld procedures.

b. Test leads will be brought above ground and installed within a test box.

c. CP boxes will be located on power poles or meter. If needed an underground CP box can be used, with the top of the box to be placed at ground level.

7.14 CATHODICALLY ISOLATED SHORT SEGMENTS:

A list of short segments of metallic pipeline within the distribution system has been compiled. A minimum of 10% of this list is sampled each calendar year with a different 10% checked each subsequent year. All short segments will be checked within a ten-year period. The list is reviewed each year for any changes that have been made in the system. Any deficiencies found during monitoring, will be remediated within 1 year, when deemed necessary.

Reference: 49 CFR 192.465 (a)
Documentation: Isolated section list

7.15 ATMOSPHERIC CORROSION CONTROL AND INSPECTION

Above ground piping subject to corrosive conditions which cannot be controlled by cathodic protection shall be coated or jacketed to prevent atmospheric corrosion.

All above ground piping shall be inspected at intervals not exceeding three years. Re-evaluate pipeline exposed to the atmosphere and take remedial action whenever necessary to maintain protection against atmospheric corrosion.

Monitoring is performed in conjunction with leak surveys and line patrol.

Personnel will give particular attention to pipe at soil-to-air interfaces, under disbonded coatings, paint and at pipe supports. Areas needing attention are recorded in Atmospheric Corrosion Survey Book.

If atmospheric corrosion is found during an inspection, protection will be provided against the corrosion as required by the environment.

All gas department personnel engaged in painting and coating piping are trained on the types of products used and their proper use. Employees are assigned areas to clean and paint meter sets, regulator sets and other facilities.

7.16 CORROSION CONTROL RECORDS

F.C.U. shall maintain the following records for corrosion control for the periods specified:

a. F.C.U. shall maintain records or maps to show the location of cathodically protected piping, cathodic protection facilities, galvanic anodes, and neighboring structures bonded to the cathodic protection system. Records or maps showing a stated number of anodes, installed in a stated manner or spacing, need not show specific distances to each buried anode.

b. A record of each test, survey, or inspection required by subpart I of Part 192, in sufficient detail to demonstrate the adequacy of corrosion control measures or that a corrosive condition does not exist.

c. These records must be retained for at least 5 years, except that records related to Parts 192.465(a) and (e) and 192.475(b) must be retained for as long as the pipeline remains in service.

Reference: 49 CFR 192.491

DIVISION EIGHT
WELDING AND JOINING

8.1 WELDING AND JOINING (GENERAL)

Welding and joining of materials shall be performed in accordance with written standards, consistent with applicable regulations. The welding procedures used have been compiled by Iowa Association of Municipal Utilities, have been accepted by Falls City Utilities and can be found within the Joining Procedures Manual. Joining procedures for other than welding have been developed by "Manufacture" and have been accepted by Falls City Utilities and can be found within the Joining Procedures Manual.

a. STEEL WELDING – All welding done on steel pipelines shall be performed by a welder qualified under F.C.U.'s qualified welding procedures and 49 CFR 192.221 thru 192.245. The utility will consider accepting qualification of a welder, who has been qualified under API 1104 or ASME Boiler and Pressure Vessel, code.

1) Welders shall be qualified by performing an acceptable test weld, for the process to be used, under the test set forth in section I of Appendix C of CFR 49 Part 192.227. Each welder who is to make a welded service line connection to a main must also first perform an acceptable test weld under section II of Appendix C of CFR 49 Part 192.227 as a requirement of the qualifying test.

2) The annual qualification of each welder is performed at our shop or Qualified Training Facility. A weld for each procedure is completed and destructive tested. A six- month qualification is also done in our shop and a destructive test done on coupons of each weld.

3) Documentation of currently qualified welders shall be on file at the FCU office. Documentation of qualified welders in past years will be maintained for at least 5 years.

4) Re-qualification and Limitations:

The following conditions are imposed on FCU qualified welders:

a) A welder who fails a test may be given a second opportunity to qualify if the failure was due to unavoidable conditions or conditions beyond the welder's control. Otherwise no further retests shall be given until the welder has further welder training.
b) A welder shall be required to re-qualify if there is a question about the welder's ability.
c) No welder whose qualifications are based on non-destructive tests may weld on piping.
d) No welder may weld with a particular welding process (metal arc and gas) unless within the preceding six months he has engaged in welding with that process.
e) No welder who is qualified may weld unless within the preceding six months, has had a weld for each process qualification inspected/tested and is found acceptable.

b. INSPECTION PROCEDURES - FCU shall have the right to inspect all welds by non-destructive means or by removing welds and subjecting them to mechanical tests. The inspection may be made during the welding after the weld has been completed. All welds shall be visually inspected to insure that the welding is performed in accordance with the welding procedures.

The acceptability of a weld that is nondestructively tested or visually inspected is determined according to the standards in Section 9 of API Standard 1104. However, if a girth weld is unacceptable under

those standards for a reason other than a crack, and if Appendix A to API 1104 applies to the weld, the acceptability of the weld must be performed by any process, other than trepanning, that will clearly indicate defects that may affect the integrity of the weld. The most prevalent methods for through-the-wall inspection are radiography and ultrasonic. For surface examination, dye penetrate or magnetic particle inspections are useful.

NDT must be performed by a person who has been trained and qualified in the established procedures and with the equipment employed in testing.

c. VISUAL INSPECTION REQUIREMENTS - For steel welds, each weld must be visually inspected to determine acceptability prior to being placed into service.

1) Visual inspection of welding must be conducted by an individual qualified by appropriate training and experience to ensure that:

a) The welding is performed in accordance with the welding procedure; and
b) The weld is acceptable.

2) The measures listed below should be performed at sufficient intervals to ensure good quality workmanship. Consideration should be given to nondestructively testing, repairing, or cutting out any weld with questionable acceptability under Section 9 of API Std 1104.

a) Inspect the fit-up of a joint before the weld is made.
b) Visually inspect the stringer bead before subsequent beads are applied. Each bead inspected should be examined for defects that may make the weld unacceptable, such as:
(1) Incomplete fusion.
(2) Slag inclusion.
(3) Porosity.
(4) Cracks.
c) Inspect the completed weld before coating.

d. INSPECTOR QUALIFICATIONS

1) In determining whether an individual has appropriate training and experience, consideration should be given to the individual's qualification examination results, if any, and welding education.

2) The documentation of inspector qualifications should be retained.

8.2 QUALIFICATION OF WELDING PROCEDURES:

a. PROCEDURE QUALIFICATION – Prior to the start of production welding a detailed welding procedure shall be established and qualified to demonstrate that welds having suitable mechanical properties and soundness can be made by this welding procedure. The quality of the welds shall be determined by destructive testing. These welding procedures shall be adhered to.

b. RECORDS – The details of each welding procedure shall be recorded. This record shall show complete results of the welding procedure qualification test.

c. CHANGES TO WELDING PROCEDURES – When any of the essential variables listed below are changed; a new welding procedure must be established and qualified. Changes other than those

shown below may be made in a welding procedure without the necessity for re-qualification, provided the welding procedure is revised to show these changes.

1) Change in welding process or method of application
2) Change in pipe material group.
3) Change in joint design.
4) Change in position (from roll to fixed or vice versa).
5) Change in wall thickness group.
6) Change in filler metal group.
7) Change in time lapse between root and second bead.
8) Change in direction (from downhill to uphill or vice versa).
9) Change in shielding gas.
10) Major change in shielding gas flow rate.
11) Change in shielding flux.
12) Change in speed of travel.

8.3 GENERAL Consideration for steel welding

a. The welding of piping shall be performed by qualified welders using qualified procedures. The surfaces to be welded shall be smooth, uniform, free of fins, laminations, tears, scale, slag, grease, paint and other foreign material, which might adversely affect the welding. The joint design and spacing between abutting ends shall be in accordance with the welding procedure specification to be used.

b. No miter joints will be allowed.

c. Orange-peel bull plugs and orange-peel swages may not be used on pipelines.

d. Except for flat closures designed in accordance with section VIII of the ASME Boiler and Pressure Code, flat closures and fish tails may not be used on pipelines

e. ARC Welding: The welder will use the best voltage and amperage that is the most practical for the thickness and diameter of the pipe. He shall use the correct size of electrode to match the amperage and make as many passes as the welder deems necessary to produce a sound and quality weld.

GAS Welding: The welder will select the torch tip size of his choice to match the thickness of the pipe. The ends of the pipe shall be pre-cleaned removing any rust, dirt or contaminates that will cause the weld to fail. He shall use an approved filler rod and make as many passes as the welder sees fit to make a sound weld.

f. The welder will visually inspect each weld after completion looking for flaws of any sort. He shall be sure that the pipe ends or area to be welded is clean and free of any contaminates.

g. When the pipe temperature is 40 degrees or less, preheating of the ends to be welded will be done to relieve stress.

h. ALIGNMENT – Alignment of the abutting ends shall be such as to minimize the offset between surfaces. For pipe of the same nominal wall thickness, the offset shall not exceed 1/16" (1.59 mm). Any greater offset, provided it is caused by dimensional variation, shall be equally distributed around the circumference of the pipe. Alignment shall be maintained while welding the root bead. Hammering of the pipe to obtain proper lineup should be held to a minimum.

i. USE OF LINE-UP CLAMPS: BUTT WELDS – Line-up clamps shall be used in accordance with the requirements of the welding procedure. Removal of the line-up clamps shall follow the requirements of the welding procedure used to make the weld.

j. BEVEL –

1) Mill Bevel: Pipe ends shall be provided with mill bevels conforming to the joint design used in the welding procedure.
2) Field Bevel: Pipe ends should be field beveled by machine tool, machine oxygen cutting or manual oxygen cutting. The beveled ends shall be reasonably smooth and uniform. Dimensions shall be in accordance with the welding procedure.

k. WEATHER CONDITIONS – Welding shall not be done when the quality of the completed weld would be impaired by the prevailing weather conditions, such as falling moisture, blowing sand or high winds. Windshields may be used when practical. The supervisor in charge shall decide if weather conditions are suitable for welding.

l. CLEARANCE – Clearance around the pipe at the weld shall be sufficient to provide the welder or welder's access to the joint.

m. CLEANING OF BEADS – Scale and slag shall be removed from each bead and groove. Cleaning may be done with either hand or power tools except that all root beads, when arc welded, shall be ground out with a power tool.
When automatic or semi-automatic welding is used, clusters of surface porosity, bead starts and high points shall be removed by grinding prior to depositing weld metal over them. Silicon slag deposits shall be removed before depositing weld metal over them.

n. FIXED WELDING – All fixed position welds shall be made with the parts to be joined secured against movement.

The number of beads shall conform to the procedure specification and be such that the completed weld shall have a substantially uniform cross section around the entire circumference of the pipe. At no point shall the crown surface be below the outside surface of the pipe, nor should it be raised above the pipe by more than 1/16" (1.59 mm).

After the root bead has been completed, the remaining beads shall be completed within the time required by the welding procedure specification. The completed weld should be finished before the end of the day. No two beads shall be started at the same location.

The face of the completed weld should be approximately 1/8" (3.17 mm) greater than the width of the original groove. The completed weld shall be thoroughly brushed and cleaned.

o. ROLL WELDING – All roll welding shall be done with an approved positioner rotating the pipe. Line-up clamps shall be used to securely hold the parts to be joined. The filler metal shall be deposited at or near the top center while the parts to be joined are rotated past the rod or wire.

p. PRE-HEATING – The welding procedure specification shall specify the pre-heating requirements, which are to be followed when materials or weather conditions make it necessary. The proper preheat temperature shall be determined by using a Thermomelt or equivalent temperature indicator.

q. COOLING – Welds shall be allowed to air cool. Water or similar liquids must not be used to cool the welds. Soap solutions for leak testing must not be applied until the weld has properly cooled.

r. GROUND CABLES – Ground cables shall be securely attached to the pipe by mechanical means. Do not tack or weld ground cables to the pipe. Arcing between the ground lead and the pipe will not be permitted.

s. LONGITUDAL PIPE SEAMS – The pipe shall be installed so the seam or longitudinal welds are in the upper quadrant and within 45° of the vertical centerline. The seams or longitudinal welds shall be staggered at least 20° between abutting pipe joints.

t. ARC BURNS – Arc burns shall not be permitted.

u. TRANSITION FITTINGS – When welding of PE to steel transition fittings, protect the PE part of the transition fitting from being overheated.

v. REPAIR OR REMOVAL OF DEFECTIVE WELDS – Each weld that is unacceptable must be removed or repaired. A weld must be removed if it has a crack that is more than 2" long or that penetrates either the root or second bead.

Each weld that is repaired will be made by cutting out a cylindrical piece of pipe and replacing it with a segment of pipe that is equal to or has greater design strength or must have the defect removed down to clean metal and the segment to be repaired must be preheated
After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability. If the repair is not acceptable, the weld must be removed.

w. UNEQUAL WALL THICKNESS AND SPECIFIED YIELD STRENGTHS –

1) General:

When the specified minimum yield strength (SMYS) of the sections to be joined are unequal, the deposited weld metal shall have mechanical properties at least equal to those of the section having the higher strength.

The transition between ends of unequal thickness may be accomplished by taper or welding. Sharp notches or grooves at the edge of the weld where it joins a slanted surface shall be avoided.

2) Internal Diameters Unequal:

a) For piping to operate at a hoop stress of less than 20% SMYS:

If the nominal wall thickness of the adjoining ends does not vary more than 1/8" (3.17 mm), no special treatment is necessary provided adequate penetration and bond is accomplished in welding. If the offset is greater than 1/8" (3.17 mm) follow the procedures within the Joining Manual.

3) External Diameters Unequal:

Where the external offset does not exceed one half of the thinner section, the transition may be made by welding, provided the angle of rise of the weld surface does not exceed 30° and both bevel edges are properly fused.

8.4 JOINING OF MATERIALS OTHER THAN WELDING - will be in accordance with 49 CFR 192.271 thru 192.287.

Joiners shall be re-qualified annually in area of butt-fusion, Saddle fusion, electro-fusion and mechanical joining.

a. POLY FUSION – All joining of plastic pipe shall be performed in accordance with procedures recommended by the manufacturer. These procedures are on file at the F.C.U. office. The procedures shall incorporate the recommendations contained in 49 CFR 192.273 (C), 192.285 and 192.287.

F.C.U. shall provide annual training to personnel sufficient to meet these requirements or shall engage a contractor trained in the procedure. If possible our pipe and fusion equipment representative will be present during our annual certification to inspect our equipment and view our procedures.

All joints made during qualification will be inspected and destructively tested as per recommended by the manufacturer.

1) Visually examined during and after assembly or joining and found to have the same appearance as a joint or photographs of a joint that is acceptable under the procedure; and

2) Cut into at least three longitudinal straps, each of which is:

   a) Visually examined and found not to contain voids or discontinuities on the cut surfaces of the joint area; and
   b) Deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area.

Reference: FCU Joining Manual / FCU Operator Qualification Plan

3) VISUAL INSPECTION REQUIREMENTS for PE joining

   a) No person may carry out the inspection of joints in plastic pipes unless that person has been qualified by appropriate training or experience in evaluating the acceptability of plastic pipe joints made under the applicable joining procedure.
   b) Each joint must be made in accordance with written procedures that have been proved by test or experience to produce strong gastight joints.

b. POLYETHYLENE JOINING

1) General. A plastic pipe joint or heat fusion may not be disturbed until it has properly set.

2) Plastic pipe may not be joined by a threaded joint or miter joint.

3) Heat-fusion joints. Each heat-fusion joint on plastic pipe must comply with the following:

   a) A butt heat-fusion joint must be joined by a device that holds the heater element square to the ends of the piping, compresses the heated ends together, and holds the pipe in proper alignment while the plastic hardens.
   b) A saddle heat-fusion joint must be joined by a device that heats the mating surfaces of the joint uniformly and simultaneously to essentially the same temperature.
   c) An electro-fusion joint must be joined utilizing the equipment and techniques of the fittings manufacturer or equipment and techniques shown, by testing joints to the

requirements of §192.283(a)(1)(iii), to be at least equivalent to those of the fittings manufacturer.

d) Heat may not be applied with a torch or other open flame.

4) PA and PE cannot be fused to each other.

5) Care should be used in the heating operation. The material should be sufficiently heated to produce a sound joint but not overheated to the extent that the material is damaged.

6) Square cut ends, free of burrs, are required for a proper joint.

7) The mating surfaces should be clean, dry, and free of material which might be detrimental to the joint.

8) PE piping of different compounds or grades can be heat fused to each other. Such joining should not be undertaken indiscriminately, and should be undertaken only when qualified procedures for joining the specific compounds are used. Suggested references are as follows.

a) PPI TN-13, "General Guidelines for Butt, Saddle and Socket Fusion of Unlike Polyethylene Pipes and Fittings."
b) PPI TR-33, “Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe.”
c) PPI TR-41, “Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping.”

9) Rain, cold, and windy weather conditions can influence fusion quality. Modification of the recommended heating time in the procedure should be given consideration during such conditions.

10) The condition of equipment for heat fusing PE must conform to the equipment manufacturer's recommended tolerances for acceptable wear of critical components. The use of damaged or worn equipment may result in fusion joints that are weak or out of alignment.

11) The frequency of inspection should be determined by the operator based on equipment usage, equipment age and condition, and manufacturer's recommendation.

12) Each fusion joint that is made shall be visually inspected for acceptance prior to air testing.

c. MECHANICAL JOINTS. Each compression type mechanical joint on plastic pipe must comply with the following:

1) The gasket material in the coupling must be compatible with the plastic.
2) A rigid internal tubular stiffener, other than a split tubular stiffener, must be used in conjunction with the coupling.

d. Mechanical joints for all plastic piping. (Plastic-to-plastic and plastic-to-metal)

1) When compression type mechanical joints are used, the elastomeric gasket material in the fitting should be compatible with the plastic; that is, neither the plastic nor the elastomer should cause deterioration in chemical or mechanical properties to the other over a long period.

2) A stiffener is required for thermoplastic piping. The tubular stiffener required to reinforce the end of the pipe or tubing should extend at least under that section of the pipe compressed by the gasket or gripping material. The stiffener should be free of rough or sharp edges that could damage the

piping. Stiffeners that fit the pipe or tube too tightly or too loosely may cause defective joining. The operator should check with the manufacturer for recommendations.

3) The pull-out resistance of compression-type fittings varies with the type and size of the fitting and the wall thickness of the pipe being joined. ASTM D2513 describes requirements for three categories of mechanical fittings.

    a) Category 1 – full seal, full restraint. These types of mechanical fittings, when properly installed, are designed to provide a joint that is stronger than the piping being connected.
    b) Category 2 – full seal, no restraint.
    c) Category 3 – full seal, partial restraint.

4) All mechanical joints should be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping and by maximum anticipated external loading. To minimize these forces, practices such as the following should be used.

    a) With direct burial, snaking the pipe in the ditch when the pipe is sufficiently flexible.
    b) With insertion in a casing, pushing the pipe into place so that it is in compression rather than tension.
    c) Allowing for the effect of thermal expansion and contraction of installed pipe due to seasonal changes in the temperature. The importance of this allowance increases with the length of the installation. This allowance may be accomplished by the following:

        (i) Offsets.
        (ii) Anchoring.
        (iii) Strapping the joint.
        (iv) Placing the pipe in slight axial compression.
        (v) Expansion-contraction devices.
        (vi) Fittings designed to prevent pull-out (ASTM D2513, Categories 1 and 3).
        (vii) Combinations of the above.

This allowance is of paramount importance when the plastic pipe is used for insertion inside another pipe because it is not restrained.

8.5 THERMITE WELDING

For steel gas piping systems, operated within the wall thickness and pressure limitation in the table below, the thermite weld process may be used to attach test leads, anode leads and bonding wire lead to pipeline facilities. The thermite weld process is used to make electrical connections of copper to steel or copper-to-copper in which a source of heat or power is required. Powdered metals, aluminum and copper oxide, are placed in a graphite mold with a starting powder and ignited by means of a flint lighter. The exothermic reaction, a reduction of the copper oxide by the aluminum, produces a molten copper and slag. The molten copper flows over the conductors in the mold, melts them and welds them together.

Wall thickness maximum pressure:

<0.109 0
<0.124 500
<0.140 600
<0.155 750

>0.156 MAOP

A thermite weld connection, properly completed, will produce a connection that is superior in performance to any known mechanical or pressure type connection. The weld will not loosen or corrode.

Reference: FCU Joining Manual

DIVISION NINE
ODORIZATION

F.C.U. is responsible for the proper odorization of natural gas supplied to its customers. Odor is monitored monthly and records kept on file. Qualified personnel only following procedures set forth by F.C.U. will add odor to our tanks.

Gas is odorized at the Town Border Station by means of a NJEX-6200GE injection odorizer. The Town Border Station feeds all customers in our system.

9.1 ODORIZATION (General)

Gas shall be odorized so that, at a concentration in air of one-fifth the explosive limit, the gas is readily detectable by a person with a normal sense of smell. Odorant level shall be checked as necessary and at least quarterly and a record of the amount of odorant used shall be made.

a. The lower explosive limit for natural gas is approximately 4% natural gas in air by volume; therefore, odorant must be present at approximately 1% gas in air by volume. The odorant and its product of combustion shall not be toxic to humans, or harmful to components that make up your piping system. The odorant shall not be soluble in water to an extent greater than 2.5 parts to 100 parts by weight. To assure that all gas in distribution mains and service lines is odorized, periodic instrument checks will be made at system extremities.
b. A record of the type of odorant used in the system shall be maintained, along with the manufacturer's recommended rate of odorization.
c. Odorization equipment that introduces the odorant without wide variation in the level of odorant shall be used. The equipment will be maintained as recommended by the manufacturer.

9.2 TESTING OF ODORANT LEVEL

In addition to testing for odorant injection rate, F.C.U. will perform monthly testing with an odorameter, including tests at the outer extremities of the pipeline system, to verify that the odor is distinctive at one-fifth the lower explosive limit. F.C.U. will maintain records of injection rate and odor sampling for a minimum of five years.

References: 49 CFR 192.625. For federal information see the "Guidance Manual for Operators of Small Gas Utilities", Appendix I, "Odorization Equipment"

Documentation: Monthly odor check cards

DIVISION TEN
REPORTING REQUIREMENTS

10.1 INVESTIGATIONS OF ACCIDENTS AND FAILURES

The utility shall fully investigate each accident, any unintended release of gas, or failure for the purpose of determining causes and minimizing the possibility of recurrence. Physical evidence, including samples of the failed facility or equipment, shall be gathered for possible laboratory examination and shall be retained for a reasonable period of time. A written record of the investigation shall be made.

10.2 Incident Reporting Criteria

Under certain conditions - accidents, leaks, deaths, injuries, etc. - must be reported to the National Response Center (NRC) and the Nebraska State Fire Marshal's Pipeline Division. Within 1 hour of confirmed discovery or as soon as practical, following one or more of the following incidents:
A release of gas and;

a death, or a personal injury necessitating in-patient hospitalization,

Estimated property damage of $122,000 or more, including loss to the operator and others, or both,

but excluding cost of gas lost;

Unintentional estimated gas loss of three million cubic feet or more;

Or an event that is significant, in the judgment of the operator,
even though it did not meet the other criteria.

The operator shall notify the NRC, and State Fire Marshal's Pipeline Safety Section.
The report shall contain the following:

The name of the operator and the person making the report,
including telephone numbers.
The location of the incident.
The date and time of the incident.
The number of fatalities and/or personal injuries.
All other significant facts, which are known by the operator, that are relevant to the cause of the incident, including the extent of damages.

Note: The reporting party will be given a NRC report number, document this number for referral in written reports.

10.3 Reporting Contacts

National Response Center (NRC) electronically at **http:// www.nrc.uscg.mil/nrchp.html**
National Response Center, U.S. Department of Transportation 1-800-424-8802
Nebraska State Fire Marshal, Division of Pipeline Safety: **531-333-2710** or 1-402-471-9466

10.4 Report Submission to PHMSA, Nebraska State Fire Marshal.

The report must be submitted to the **National Response Center (NRC)** either by telephone to **800-424-8802** or electronically at ***http:// www.nrc.uscg.mil/nrchp.html*** (note that the toll-free number may be answered "U.S. Coast Guard"). These phone numbers should be posted in a conspicuous place.

WRITTEN reports will be filed with the **Pipeline and Hazardous Materials Safety Administration** at ***http://portal.phmsa.dot.gov/pipeline*** unless an alternative reporting method is authorized. The report must be made to Pipeline and Hazardous Materials Safety Administration as soon as possible but no longer than 30 days of any incident required to be reported under 7100.1 addition guidance is provided within "Gas Distribution Incident Report Instructions F 7100.1"

When there is a report submitted to NRC, a "report number" will be given. This number must be used when submitting any additional information.

Within 48 hours after the confirmed discovery of an incident, to the extent practicable, an operator must revise or confirm its initial telephonic notice required in section 10.2, with an estimate of the amount of product released, an estimate of the number of fatalities and injuries, and all other significant facts that are known to be relevant to the cause of the incident or extent of the damages.
If there are no changes or revisions to the initial report, the operator must confirm the estimates in its initial report.

When additional relevant information is obtained after the initial is submitted, a **supplementary report** shall be submitted, with a clear reference by NRC report #, date, and subject to the original report.

A copy of this report will be sent to;

Nebraska State Fire Marshal
Pipeline Safety Section
246 S 14th Street
Lincoln, NE 68508-1804

10.5 Telephonic Notice to Nebraska State Fire Marshal

Under certain conditions a telephonic notice shall be made to the Nebraska State Fire Marshal's Pipeline Division. Within 1 hour of confirmed discovery or as soon as practical, the following events are to be reported as follows:

a) Reportable incidents as stated within section 10.2 of this Division, that involves a release of gas from a pipeline that results in one or more of the following consequences:
b) Any suspected release on natural gas which results in the explosion or ignition of natural gas

before or after the meter.

c) An occurrence that results in a natural gas release due to over-pressure that exceeds the allowances of 192.201A.

d) An occurrence that results in a natural gas release due to :
   i) excavation damage,
   ii) outside force damage or
   iii) natural force damage. Natural force damage includes but is not limited to: earth movement; earthquakes; lightning; flooding; high winds; tornado; or similar natural causes.

e) An occurrence that has or will interrupt natural gas service to 50 or more customers. This does not include scheduled or planned maintenance.

f) An occurrence related to a natural gas release that results in the evacuation of:
   i) Four or more one or two family dwellings; or
   ii) One or more multifamily dwellings; or
   iii) Any evacuation of a business, public building or public gathering.

g) An occurrence that is significant in the judgment of the operator that could affect the daily operations of the pipeline, safety of the public or operator personnel, even though it does not meet the above criteria.

The utility will communicate a report for the above events, by telephone to 531-333-2710 or contacting one of the Nebraska State Fire Marshal personnel:

If your initial call is answered by voicemail, leave a message indicating who you are and that you are reporting a gas incident. If you do not receive a call back within 15 minutes, continue with the following contacts

Deputy Scott Petersen at 308-390-0460
Deputy Scott Knoles at 308-340-6730
Deputy Kevin Bumgardner 402-705-7100
Deputy Daniel Niles 402-720-1103
Fuels Division Chief Dave Levering 402-416-0071
Assistant Fire Marshal Doug Hohbein 402-326-2765
Fire Marshal Scott Cordes 402-471-2027
Administrative Assistant Rosemary Hatton 402-471-9664

10.6 National Registry of Pipeline and LNG Operators.

The Utility will:

a) Obtain from PHMSA an Operator Identification Number (OPID).

b) Use the OPID issued by PHMSA for all reporting requirements covered under this subchapter and for submissions to the National Pipeline Mapping System.

c) Validate the information associated with each OPID through the National Registry of Pipeline and LNG

Operators at ***http://opsweb.phmsa.dot.gov***, and correct that information as necessary,

d) Notify PHMASA for the following events not later than 60 days before the event occurs:
   i) Construction or any planned rehabilitation, replacement, modification, upgrade, uprate, or update of a facility, other than a section of line pipe that costs $10 million or more.
   ii) Construction of 10 or more miles of a new pipeline; or
   iii) Construction of a new LNG plant or LNG facility.

e) Notify PHMSA of any of the following events not later than 60 days after the event occurs:
   (i) A change in the primary entity responsible (i.e., with an assigned OPID) for managing or administering a safety program required by this part covering pipeline facilities operated under multiple OPIDs.
   (ii) A change in the name of the operator;
   (iii) A change in the entity (e.g., company, municipality) responsible for an existing pipeline, pipeline segment, pipeline facility, or LNG facility;
   (iv) The acquisition or divestiture of 50 or more miles of a pipeline or pipeline system subject to Part 192 of this subchapter; or
   (v) The acquisition or divestiture of an existing LNG plant or LNG facility.

10.7 ANNUAL REPORT

It shall be the duty of the administration of the Utility to submit an annual report for that system on Department of Transportation's Form F 7100.1-1 to the Pipeline and Hazardous Materials Service Administration (PHMSA) and copied to the Nebraska State Fire Marshal, Pipeline Safety Division. This report must be submitted each year, not later than March 5, for the preceding calendar year. The report will be submitted electronically to PHMSA-OPS website at ***https://portal.phmsa.dot.gov/portal***.

A copy of these reports will be filed with the Nebraska State Fire Marshal – Pipeline Safety Section.

10.8 MECHANICAL FITTING FAILURE REPORTING

It shall be the duty of the administration of the Utility to submit data into the PHMSA Portal, and copied to the Nebraska State Fire Marshal, Pipeline Safety Division, for mechanical fitting reporting at least annually. The report will be submitted using the Mechanical Fitting Failure Report Form *PHMSA* F- 7100.1-2.
The report will be submitted electronically to PHMSA-OPS website at ***https://portal.phmsa.dot.gov/portal***.

10.9 DRUG AND ALCOHOL TESTING

The Utility will annually submit data information related to the "Drug and Alcohol Testing" as required by 49 CFR Parts 199 and 40.
Navigate to PHMSA's, Office of Pipeline Safety web site, located at ***https://portal.phmsa.dot.gov/portal***.
Look to left of screen for DAMIS link.

10.10 Reporting Unsafe Conditions

All utility personnel who perform operation and maintenance activities are to be aware of and / or recognize any condition involving gas facilities that constitutes a hazard to life and / or property or any condition that cause or has caused a significant change in the operation of the pipeline facilities.
These conditions may be caused by:

General corrosion that has reduced the wall thickness to less than that required for the maximum allowable operating pressure, and localized corrosion pitting to a degree where leakage might result.

Unintended movement or abnormal loading, such as earthquake, landslide, flood, or storm.

Any malfunction or error that causes the pressure of a pipeline to rise above its M.A.O.P.

Any material defect or physical damage that impairs the serviceability of a pipeline.

A leak in the pipeline or facilities that constitutes an emergency.

Any safety related condition at could lead to an imminent hazard and causes a 20 percent or more reduction in operating pressure or a shutdown of operations of a pipeline.

Reports are not required on conditions that are repaired or replaced in accordance with applicable safety standards before the deadlines for filling safety related conditions reports.

10.11 Filing Safety Related Condition Reports

Each report must be filed in writing within five working days after the condition has been determined to exist. It must contain the following information:

Titled “Safety Related Condition Report”
Name & address of the utility
Date of report
Name, Title, & Phone of person submitting the report
Name, Title, & Phone of person who determined that the condition exist
Date that the condition was found and determined to exist.
Location of condition with references to address, landmarks, milepost, etc.
Description of the condition including circumstances leading to its discovery & significant effects of the condition to safety.
Corrective measures taken prior to the report and planned follow up action, or future corrective action, the schedules for startup and completion.

Submit each report electronically to the Pipeline and Hazardous Materials Safety Administration at ***http://portal.phmsa.dot.gov/pipeline*** unless an alternative reporting method has been authorized.

With copy to:
Nebraska State Fire Marshal
Pipeline Safety Division
246 South 14th Street
Lincoln, Nebraska 68509-4677

DIVISION 11
PIPELINE DESIGN and COMPONENTS

11.1 DESIGN (GENERAL)

The Utility will utilize pipe and components designed with sufficient wall thickness, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation.

Valves will be spaced or installed so as to reduce the time to shut down a section of main in an emergency. The valve spacing is determined by the operating pressure, the size of the mains, and the local physical conditions.
Each regulator station controlling the flow or pressure of gas in a distribution system must have a valve installed on the inlet piping at a distance from the regulator station sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

The Utility will take all practicable steps to protect each main from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads.
Each above ground facility will be protected from accidental damage by vehicular traffic or other similar causes, either by being placed at a safe distance from the traffic or by installing barricades.

Design of District Regulator Stations
Selection of inlet and outlet pressure ratings of control equipment, such as regulators and control valves, should include consideration of the following.
(a) The maximum inlet pressure at which the regulator will perform in accordance with the manufacturer's specifications.
(b) The maximum pressure to which the inlet may be subjected, under abnormal conditions, without causing damage to the regulator.
(c) The maximum outlet pressure at which the regulator will perform in accordance with the manufacturer's specifications.
(d) The maximum pressure to which the outlet may be subjected under abnormal conditions without causing damage to the internal parts of the regulator.
(e) The maximum outlet pressure which can be safely contained by the pressure carrying components, such as diaphragm cases, actuators, pilots and control lines.
(f) Springs, orifices, or other parts should not be changed or modified without reevaluation of the above factors.

Suitable devices to prevent over pressuring of high-pressure distribution systems include the following.
(a) Spring-loaded relief valves meeting the provisions of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
(b) A series regulator set to continuously limit the pressure on the inlet of the primary regulator to not more than the maximum allowable operating pressure of the distribution system.
(c) Pilot-operated back-pressure regulators used as relief valves and designed so that failure of the control lines will cause the regulator to open.
(d) Spring-loaded diaphragm relief valves.

Pressure relief or pressure limiting device must:
(a) Be constructed of materials such that the operation of a device will not be impaired by corrosion;
(b) Have valves and valve seats that are designed not to stick in a position that will make the device inoperative;

(c) Be designed and installed so that it can be readily operated to determine if the valve is free, can be tested to determine the pressure at which it will operate, and can be tested for leakage when in the closed position;
(d) Have support made of noncombustible material;
(e) Have discharge stacks, vents, or outlet ports designed to prevent accumulation of water, ice, or snow, located where gas can be discharged into the atmosphere without undue hazard;
(f) Be designed and installed so that the size of the openings, pipe, and fittings located between the system to be protected and the pressure relieving device, and the size of the vent line, are adequate to prevent hammering of the valve and to prevent impairment of relief capacity;
(g) Where installed at a district regulator station to protect a pipeline system from overpressuring, be designed and installed to prevent any single incident such as an explosion in a vault or damage by a vehicle from affecting the operation of both the overpressure protective device and the district regulator; and,
(h) Except for a valve that will isolate the system under protection from its source of pressure, be designed to prevent unauthorized operation of any stop valve that will make the pressure relief valve or pressure limiting device inoperative.

When bypass piping is included in the station design to facilitate maintenance or inspection of automatic overpressure protection devices, consideration should be given to the following:
(a) Providing a regulator on the bypass piping.
(b) Arranging the bypass piping for series regulators so that only one regulator at a time is bypassed.
(c) When only a manually operated bypass valve is installed:
    1) Providing upstream and downstream pressure gauges within sight of a person operating the manual valve, and
    2) Specifying a manual valve that is marked with the flow direction and the operating direction to close it.

11.2 DESIGN OF INSTRUMENT, CONTROL, AND SAMPLING PIPE AND COMPONENTS.

All materials employed for pipe and components must be designed to meet the particular conditions of service and the following:
(a) Each takeoff connection and attaching boss, fitting, or adapter must be made of suitable material, be able to withstand the maximum service pressure and temperature of the pipe or equipment to which it is attached, and be designed to satisfactorily withstand all stresses without failure by fatigue.
(b) Except for takeoff lines that can be isolated from sources of pressure by other valving, a shutoff valve must be installed in each takeoff line as near as practicable to the point of takeoff. Blowdown valves must be installed where necessary.
(c) Brass or copper material may not be used for metal temperatures greater than 400(F (204ºC).
(d) Pipe or components that may contain liquids must be protected by heating or other means from damage due to freezing.
(e) Pipe or components in which liquids may accumulate must have drains or drips.
(f) Pipe or components subject to clogging from solids or deposits must have suitable connections for cleaning.
(g) The arrangement of pipe, components, and supports must provide safety under anticipated operating stresses.
(h) Each joint between sections of pipe, and between pipe and valves or fittings, must be made in a manner suitable for the anticipated pressure and temperature condition. Slip type expansion joints may not be used. Expansion must be allowed for by providing flexibility within the system itself.

(i) Each control line must be protected from anticipated causes of damage and must be designed and installed to prevent damage to any one control line from making both the regulator and the over-pressure protective device inoperative.

11.3 SYSTEM DESIGN FOR STEEL

DESIGN PRESSURE ; For steel pipeline is determined in accordance with the following formula:

$P = (2\ St/D) \times F \times E \times T$

P = Design pressure in pounds per square inch (kPa) gage.
S = yield strength in pounds per square inch (kPa) determined in accordance with §192.107.
D = Nominal outside diameter of the pipe in inches (millimeters).
t = Nominal wall thickness of the pipe in inches (millimeters). If this is unknown, it is determined in accordance with §192.109
F = Design factor determined in accordance with §192.111.
E = Longitudinal joint factor determined in accordance with §192.113.
T = temperature derating factor determined in accordance with §192.115.

Additional wall thickness is required for concurrent external loads, may not be included in computing design pressure. Consideration should also be given to welding or mechanical joining requirements.

YEILD STRENGTH for Steel Pipe:
For pipe that is manufactured in accordance with a specification listed in section I of Appendix B of CFR Part 192, the yield strength to be used in the design formula is the SMYS stated in the listed specification.

DESIGN FACTOR
(a) Except as otherwise provided in paragraphs (b), (c), and (d) of this section, the design factor to be used in the design formula is determined in accordance with the following table

Installation Condition	Class Location	1	2	3	4
Crossings <u>without casings</u> of: Private roads (See Note 1)		.72	.60	.50	.40
The rights-of-way of unimproved public roads		.60	.60	.50	.40
The rights-of-way of hard surfaced roads, highways, public streets, railroads		.60	.50	.50	.40
-Crossings with **casings** of: Private roads (See Note 1)		.72	.60	.50	.40
The rights-of-way of unimproved public roads		.72	.60	.50	.40
The rights-of-way of hard surfaced roads, highways, public streets, railroads		.72	.60	.50	.40
Parallel encroachments on: Private roads (See Note 1)		.72	.60	.50	.40
The rights-of-way of unimproved public roads		.72	.60	.50	.40
The rights-of-way of hard surfaced roads, highways, public streets, railroads		.60	.60	.50	.40
Pipelines on bridges		.60	.60	.50	.40
Fabricated assemblies		.60	.60	.50	.40
Regulating, or measuring station piping		.50	.50	.50	.40
Pipe risers,		.50	.50	.50	.40

Notes:1. Private roads" are roads that are not intended for use by the general public and over which travel and transportation are restricted.

LONGITUDIAL JOINT FACTOR
The longitudinal joint factor to be used in the design formula is determined in accordance with the table associated with 192.113.

TEMPERATURE DERATION FACTOR
The temperature derating factor to be used in the design formula is 1.000.

11.4 DESIGN LIMITATIONS FOR PLASTIC PIPE.

The wall thickness for thermoplastic pipe may not be less than 0.062 inches (1.57 millimeters).
PVC is not an acceptable gas piping material.

The operating pressure for PE mains and services, may not exceed a gauge pressure of 100 psig (689 kPa), except for PE material produced after July 14, 2004, providing that:
(1) The design pressure does not exceed 125 psig (862 kPa);
(2) The material is a PE2406 or a PE3408; ASTM D2513
(3) The pipe size is nominal pipe size (IPS) 12 or less; and
(4) The design pressure is determined in accordance with the following design formula.

11.5 DESIGN FORMULA FOR PE Pipe

$$P = 2S \left(\frac{t}{(D-t)} \right) (D-F)$$

P = Design pressure, gauge, psig (kPa).
S = For thermoplastic pipe, the HDB is determined in accordance with the listed specification at a temperature equal to 73 °F (23°C), 100°F (38°C), 120°F (49°C), or 140°F (60°C). In the absence of an HDB established at the specified temperature, the HDB of a higher temperature may be used in determining a design pressure rating at the specified temperature by arithmetic interpolation using the procedure in Part D.2 of PPI TR-3/2004, HDB/PDB/SDB/MRS Policies (incorporated by reference, see §192.7). For reinforced thermosetting plastic pipe, 11,000 psig (75,842 kPa). [Note: Arithmetic interpolation is not allowed for PA-11 pipe.]
t = Specified wall thickness, inches (mm).
D = Specified outside diameter, inches (mm)
SDR = Standard dimension ratio, the ratio of the average specified outside diameter to the minimum specified wall thickness, corresponding to a value from a common numbering system that was derived from the American National Standards Institute preferred number series 10.
D F = 0.32 or
= 0.40 for nominal pipe size (IPS or CTS) 4-inch or less, SDR-11 or greater (i.e. thicker pipe wall),

Note: Hydrostatic Design Basis (HDB) values are awarded by the Hydrostatic Stress Board (HSB) of the Plastics Pipe Institute (PPI) and are listed in PPI TR-4, which can be accessed at www.plasticpipe.org, and are list here for pipe material:

PE 2406 HDB @ 73 F is 1250 psi
PE 3408 HDB @ 73 F is 1650 psi

CITY OF FALLS CITY

Injury Prevention Program

October 11, 2012

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SECTION 001 OBJECTIVE

The City of Falls City is committed to employee safety. Therefore, the safety and protection of employees, equipment, and facilities are a vital consideration to the operations in all activities of the City. Safety must be considered equally with other aspects when supervisors are planning their daily operations.

Accident prevention is a policy which must be adopted and pursued by all employees, supervisors and management. The policy of the City of Falls City is to provide a safe working environment, adequate tools, and necessary protective equipment. It is our goal to promote safe work practices and the firm belief that it is in the mutual self interest of employees, supervisors and management to eliminate accidents from our working environment.

It is a policy of the City of Falls City that all regulations contained in this handbook shall be complied with, *by* every employee of the City, under every circumstance where they are applicable. Additionally, the supervisor shall make certain that all employees under their jurisdiction are instructed and advised of the proper application of these regulations.

In case of an emergency which may result in a serious personal injury, a supervisor, or employee in charge, may modify or suspend any of these rules as may be considered temporarily necessary to permit proper handling of the specific emergency. In any such case, the person so acting shall be fully accountable for the reasonableness of these actions and for any accident or service interruption resulting there from.

SECTION 002 EMPLOYEE RESPONSIBILITY

Each employee has a responsibility for their own safety. They must observe safety practice regulations and instructions relating to efficient performance of their work. Safe and efficient operations are reached only

when all employees are safety conscious and keenly alert both mentally and physically. All employees shall:

1. Comply with all safety policies of this handbook.
2. Comply with their supervisor's instruction.
3. Report all accidents and injuries immediately to their Supervisor.
4. Submit recommendations for improving safety and efficiency.
5. Attend safety meetings and training when required.
6. Promptly report any hazardous condition that they may observe or have reported to them no matter what department is responsible, and if necessary guard it until repair personnel arrives.
7. Report all accidents and injuries involving medical treatment, lost time, or any property damage, to their supervisor on the report of Accident/Injury Form.

It is every employee's responsibility to prevent damage to City or private property and equipment. Equipment shall be treated as if it were individually owned. Equipment shall not be used if its condition poses a hazard. Abuse or misuse of equipment will be subject to disciplinary action.

When any employee believes a particular assignment will expose workers to unusual hazards, they shall immediately report the condition to their supervisor. If a question arises, the final interpretation rests with the supervisor on the assignment.

SECTION 003 SUPERVISORS RESPONSIBILITY

Supervisors shall:

1. Insure that both they and their employees have a thorough knowledge of the contents of this handbook.
2. Analyze work in advance to determine the safe, economical procedure and physical protection necessary to perform each project and to see that this protection is provided, maintained and used throughout the project.

3. Insure employees assigned to unfamiliar work receive specific instruction of cautions to be observed and advise employees of location of safety and first aid equipment.
4. Insure safety regulations of the City, as outlined in this handbook, are complied with at all times, except when compliance may constitute more of a hazard. Responsibility for such exceptions rest directly with the supervisor.
5. Insure that they and their employees attend safety meetings and Safety training meetings.
6. Hold tailgate sessions as detailed in this handbook before starting each project.
7. Report all accidents and injuries involving medical treatment, lost time, or any property damage, to their manager on the report of Accident/Injury Form.
8. Annually review, at a minimum, all applicable procedures with employees.

SECTION 004 SAFETY VIOLATIONS

Noncompliance by any employee or supervisor of the safety practices as outlined in this handbook, including the reporting of all accidents and injuries, is subject to disciplinary action. Disregard of safety practices shall result in reprimands, temporary suspension or termination.

SECTION 005 PERSONAL PROTECTIVE EQUIPMENT

GENERAL Employees shall at all times wear suitable clothing to minimize work hazards. Clothing made of synthetic material is not recommended for work clothing when working where electric flash or excessive heat is possible. Appropriate hand covering should be worn by all employees engaging in construction, maintenance, mechanical or hazardous work.

SAFETY VEST All employees working on any right of way who are exposed to vehicular traffic at any time day or night shall wear approved construction safety vest of the reflective type. The vest shall be securely fastened and worn on the outside of all other garments.

HARD HATS Head protection meeting ANSI Z89.2 for Electrical industrial workers ANSI C89.1 Class B specifications shall be worn in accordance with the following policy:

1. A11 construction work being performed with overhead lifting equipment and in instances where personnel and/or equipment are working or suspended above the employee.
2. During forestry operations.
3. In all hard hat designated areas.
4. When working on poles or structures or from buckets.
5. When working in proximity to exposed energized lines or equipment.
6. When working on other activities where directed by the supervisor on the project.
7. Hard hat liners should be worn during periods of cold weather.
8. Hard hats shall not be painted or otherwise decorated in any manner other than with approved decals.
9. FOOT WEAR Firm leather steal toed foot wear shall be worn by all employees where there is a danger of injury to feet due to falling or moving objects, burning, scalding, cutting, penetration or like hazards.

SAFETY GLASSES Safety glasses should fit properly, be kept clean at all times, and shall be worn when an employee is engaged in, or in the vicinity of work involving the following:

1. Handling of exposed energized parts, equipment or systems.
2. Jackhamnering, grinding, buffing, welding, cutting, burning or wire

brushing.

3. When using hot or dangerous substances or chemicals.
4. When there is a danger of dust or other flying particles.
5. Any other job where there is a recognized danger of eye injury.

FACE SHIELDS Full face shields shall be worn when:

1. Setting or removing energized meters.
2. When removing energized elbows from within a vault or other enclosure.
3. At any other time when there is a recognized danger of eye and face injury.

RUBBER GLOVES Approved rubber gloves shall be worn at all times when unprotected energized conductors (greater than 300 volts) are within reach of an employee. Exceptions may be permitted of the above as follows:

1. Working with hot line tools provided all energized conductors within reach, other than the one being worked on, are covered.
2. Operating a GOAB switch with a grounded switch platform.
3. Setting or removing - hour meters.
4. Performing work in electric stations within reach of low voltage conductors and equipment (less than 300 volts) provided that adequate measures or insulated tools and devices are used to protect the employee from electrical shock.
5. Performing work inside de-energized and grounded power breakers, relays, and similar equipment.
6. Routine checking or watt hour meters for accuracy when working on equipment under 300 volts and provided that adequate measures or insulated tools and devices are used to protect the employee from electrical shock.

LEATHER GLOVES Leather gloves that are designed to serve as rubber glove protectors and which are purchased by the City for that purpose shall not be used for any purpose other than a rubber glove protector.

EAR PROTECTION Ear protection devices shall be worn at work location where there is a possibility of hearing damage or when directed by the supervisor.

DUST MASK Shall be worn when working in an area where construction is causing airborne particles or when directed by the supervisor.

PERSONAL PROTECTIVE EQUIPMENT FURNISHED BY THE CITY The City of Falls City will furnish the following personal protective equipment for the employees as needed: Safety vests, hard hats and liners, safety glasses, face shields, electrically insulated rubber gloves and protector, and ear protection. Employees shall be responsible for the care of all their equipment, to insure that it is available when needed, and that it is only used when on duty. Additional job specific equipment will be considered on a case by case basis.

SECTION 006 TAILBOARD BRIEFINGS

Tailboard briefings shall consist of talking a job over before starting work so that the members of each crew involved in the project thoroughly understand the job to be done and the method of accomplishing it. Before starting each job every supervisor shall call their crew together and outline the proper work procedure to be followed in such a manner that the following will be accomplished:

1. Each employee will understand the purpose of the job.
2. Each employee will understand what they are to do.
3. Each employee will understand what the other members of the crew are

to do.

4. Each employee will understand the supervisors' manner of carrying on the job.
5. Each employee will be apprised of the hazards or potential trouble spots involved and will know how the supervisor *is* proposing to overcome such problems.
6. Supervisors shall notify each crew member of any change of conditions or status of electric lines or equipment as a project progresses.

Tailboard briefings may be waived at the discretion of the supervisor for routine, daily activities where all crew members are experienced in the execution of the same.

SECTION 007 VEHICLES AND VEHICLE EQUIPMENT OPERATIONS

Only those employees specifically authorized and who possess a valid State of Nebraska license shall operate City owned vehicles on City business. Supervisors shall be responsible for insuring that their employees demonstrate a level of proficiency relating to the safe, legal, and proper operation of any vehicle or piece of equipment before authorizing said employee to operate the vehicle or piece of equipment. Operators shall know and obey all state and local motor vehicle laws.

Operators shall keep all vehicles and equipment clean and in good operating condition. Unsafe or defective equipment shall be reported to the supervisor who shall schedule its repair with the city mechanic as soon as possible. Daily, before starting the engine, the operator shall check the engine oil level, visually check tires for proper inflation, and windshields, headlights, taillights, and clearance lights for breakage. After starting the engine, the operator shall check gauges, brakes, lights, and windshield wipers to insure that they are working

properly. Diesel engines shall be allowed to warn up before moving. Operators and passengers shall wear seat belts where they are provided. Operators shall follow all state rules and regulations with regard to operation of said vehicle. Passengers shall not ride on any part of the vehicle except on seats or inside the body walls.

Operators shall not permit vehicles to be loaded beyond the safe and legal capacity of the unit. Dump beds shall be properly blocked when being worked on in the raised position.

Extreme caution shall be exercised when backing to avoid injury to persons and to prevent property damage. If another employee is present, they shall assist the driver in backing the vehicle safely, especially if the view to the rear is obstructed. When possible, position the vehicle to avoid excessive backing.

SECTION 008 STREET AND HIGHWAY OPERATIONS

When working within the traveled way of streets and highways, traffic must be warned. The nature of warning and the distance for advanced warning will depend upon the traffic speed and road conditions.

When working within the traveled way of a highway, the following precautions for vehicle traffic shall be observed as a minimum:

1. A temporary advance warning sign shall be placed to face the oncoming traffic lane at an adequate distance from the work site to allow motorists sufficient time to react. (minumuxn distances for posted speed limit; 0-25 mph - 200 ft., 26-35 mph - 300 ft., 36-50 mph - 500 ft., rural highway - 1500 ft.)
2. High visibility traffic cones shall be placed in such a way as to divert traffic around the work site.
3. Reflective barricades shall be used at the work site for surface replacement or excavation projects.

4. If possible, vehicles with four way flashers and beacon shall be parked between oncoming traffic and the work to serve as a barrier.
5. Additional warning may be needed when-working at night or under adverse weather conditions.
6. The above conditions may be waived for projects of short duration such as changing street light bulbs, putting up welcome flags, performing leak survey, etc. If a vehicle is being used it shall have four way flashers and beacon in operation.

When working in the traveled way of city streets or county roads, the following precautions will be taken as a minimum:

1. A vehicle with four way flashers and beacon in operation shall be used to warn oncoming traffic.
2. High visibility traffic cones will be used as needed to divert traffic around the work site.
3. Advance warning signs may be required, depending upon traffic speed and road conditions (i.e. on county road over a crest of a hill).

When any portion of the traveled way of a street or highway must remain closed for any reason, the following minimum precautions shall be followed:

1. Reflective barricades and/or flashing barricades shall be placed to warn oncoming traffic. Periodic checks will be made to insure the barricades are in place and functioning.
2. If the project involves open excavation it shall be temporarily fenced whenever employees are not in the immediate area and it presents a hazard to the public, exceptions shall be approved by the supervisor.
3. Advance signing to warn or detour traffic may be needed depending upon traffic volume, traffic speed, and road conditions. (Highway Projects

would always require advance warning and channeling devices to direct traffic movement).

SECTION 009 CONFINED SPACE ENTRY

A confined space is any enclosed or semi-enclosed space that has limited openings for entry and exit and is not intended for continuous employee occupancy. In addition, this space does not have sufficient ventilation to prevent the buildup of hazardous atmosphere. Typical confined spaces are man-holes, pits, vaults, or holding tanks in which any substance other than fresh water is or has been stored or transported within. Storm sewers are generally not included in this category as they usually do not present any great degree of potential dangers.

All employees who enter or act as stand by for confined space entry shall be properly trained by the responsible supervisor. Employees shall have a written procedure to be followed when making confined space entries. Minimum crew size shall consist of two employees, one to enter the confined space and one to stand by.

The following sequence shall be followed when entering a potentially hazardous atmosphere of a confined space:

1. Install advanced warning devices for vehicular traffic. Barricade immediate area if needed for safety of City employees or the public.
2. Test the atmosphere of the confined space for oxygen level, Percent of LEL, and toxic materials. If the atmosphere is determined to be safe at the point of entry, remove the lid and lower the atmospheric tester into the confined space. If the atmospheric readings at this level are determined to be safe, proceed with step number three, if not, notify the immediate supervisor for directions.

3. Set up blower with end of hose being within three feet of the bottom of the confined space.
4. Monitor the atmosphere of confined space frequently.
5. Insure means of entering and exiting the confined space.
6. Put on proper protective equipment (full) coverage clothing, rubber gloves, safety glasses, hard hat and safety harness.
7. Insure that stand by employees have a direct means of communications at all times, either visually or by radio.
8. Enter the confined space.

Infections are a serious consideration when entering sanitary sewer man holes. Employees working in these types of environments on a regular basis are encouraged to be immunized and receive renewal immunizations at the recommended intervals for tetanus, diphtheria, oral polio and typhoid.

Any crew engaged in confined space entry shall have a type ABC fire extinguisher with current test inspection tag and basic first aid kit available.

SECTION 010 EXCAVATIONS

Prior to any excavation, the Underground Hotline (Diggers Hotline of Nebraska) shall be notified a minimum of two working days in advance in order to give utilities the opportunity to locate affected facilities. When an excavator approaches the estimated location of such utility, the exact location shall be determined by hand digging or hydro-vac if necessary and every effort shall be made to protect and support the utility until back fill operations have been completed.

Any excavations left unattended for any period of time shall be adequately covered or fenced and barricaded to prevent injury to any member of the public.

In excavations where employees may be required to enter, excavated or

other materials shall be stored and retained at least two feet back from the edge of the excavation. The sides of all trenches or excavations five feet or more in depth shall be supported by one of the following methods:

1. Aluminum hydraulic shoring system (continuous sheeting shall additionally be used when working in soft, sandy or filled materials, or when trenching is to a depth below the existing ground water level).

2. Steel trench boxes.
3. Sides for the trench in hard or compact soil, as determined by the supervisor, may be sloped above the four foot level to preclude collapse. The material shall be sloped at not to exceed its angle of repose but in no case steeper than one foot vertical to each one foot horizontal.
4. Trenches less than five foot in depth shall be protected when examination of the ground indicates hazardous ground movement may be expected.

SECTION 011 CHEMICAL HANDLING

DRY CHEMICALS Employees handling or exposed to dry chemicals shall wear protective equipment appropriate for the exposure. Long sleeved clothing and rubber gloves shall be worn with chemicals which are irritating to the skin. Dust masks shall be worn where dust is irritating to the mucous membrane.

GASEOUS CHEMICALS (CHLORINE) If located in an enclosed space, exhaust ventilation shall be turned on before entering. Each site shall have a functional canister type gas mask available for use if there is a chlorine leak. The canister shall be kept current as to expiration date. If there is a question as to the concentration of chlorine exceeding the allowable capacity of the mask, supplied-air breathing apparatus shall

be obtained (available at City Fire Department) before entering the area.

Cylinders shall be stored in an upright position with protective caps in place. Cylinders shall be secured against tipping.

All sites shall have first aid procedures for chlorine exposure posted and familiar to the employee.

LIQUID CHEMICALS Employee handling or exposed to liquid chemicals shall wear protective equipment, appropriate for the exposure. Rubber gloves and eye protection as a minimum shall be worn when pouring or mixing herbicides or pesticides. Depending upon the toxicity of the chemical being used, liquid proof coveralls, foot protection and/or respirator may be needed.

Chemicals shall not be mixed or sprayed when conditions are such that it is a hazard to the employee or spray could drift to adjacent property. Chemicals shall be used in accordance with the manufacturers recommendations and at the suggested rates of application. Restricted herbicides or pesticides shall only be applied by certified applicators.

SECTION 012 ELECTRICAL DISTRIBUTION

1. **CONDITION** When called out after hours, employees shall notify the dispatcher at the power plant when going out on a call, when arriving at the location, when finishing the call, and when arriving back at the shop. If any assistance is needed, they should notify the dispatcher at the power plant so that one or more additional crew members can be called. During severe weather, it is especially advisable to call out a second employee for other than routine repairs. Repair of de-energized circuits shall be closely coordinated with other crew members and the dispatcher at the power plant to avoid accidental energizing. Authorized employees may enter substations only after obtaining clearance from their supervisor or

by notifying the dispatcher at the Power Plant before entering and after leaving the enclosure.

2. GROUNDING Only approved grounding, test, and jumper equipment shall be used. An approved testing device shall be used to prove that a line is in fact de-energized at the point where work is being performed. De-energized lines shall be appropriately grounded before being worked on. When splicing overhead conductors at ground level that are exposed to induced voltages, a ground shall be installed on each side and within ten feet of the work. Ungrounded conductors may be worked on with approved hot line tools.

3. LOADING AND TRANSPORTING POLES The end of poles extending more than forty-eight inches beyond the end of the vehicle in which they are being transported, shall be marked with a red flag. When unloading poles, employees shall not stand beneath suspended loads, nor shall they place their feet where poles might roll and cause injury.

4. BACKFEED Before contacting the high voltage side of a de-energized transformer or conductors connected thereto, all possible sources of backfeed shall be eliminated by disconnecting, grounding, or short circuiting the low voltage side.

5. OVERHEAD ENERGIZED CONDUCTORS Energized conductors shall be defined as those having above three hundred volts phase to phase. Only qualified linemen or linemen 1 linemen 2 employees under continuous supervision shall be assigned to work on energized lines. Except in emergencies involving hazards to life or property, no employee shall be assigned to work alone on energized lines. The exception would be the replacement of line fuses with hot line tools from an aerial device which can be performed by one person.

Electrical equipment lines shall be always considered as energized unless they are positively known to be de-energized. Because

wires designed to operate at ground potential may sometimes become energized by reason of faulty or inadequate connections, care shall always be exercised to handle ground wires with the same caution as is used with energized wires.

All cutouts shall be operated with hot line tools.

When working on energized lines, all energized conductors, ground conductors, or guy wires, within reach of any part of the body shall be covered with protective equipment except the conductor or apparatus on which the employee is working.

When working on de-energized lines or equipment, all energized lines and normally energized equipment within reach of any part of the body shall be covered. Employees shall always protect the nearest and lowest wires first and shall remove the protective equipment in the reverse order. Before climbing Poles, employees shall familiarize themselves with the circuits, voltages, and apparatus thereon. Not more than one employee shall ascend or descend a pole at the same time.

Before climbing poles, employees shall assure that said pole is strong enough to safely sustain their weight. If the structural stability of the pole is in doubt, it shall be adequately supported before work is started. Climbers shall not be used after the gaffs are worn or filed to less than one and one quarter inches long measured on the underside of the gaff.

When setting or removing poles, all persons not engaged in the operation shall be kept out of the work area- Care shall be taken not to allow the pole to make contact with energized conductors. Employees handling the butt of the pole shall wear rubber gloves. No one shall step on or off the derrick truck or touch any part of the truck from the ground while the pole is being set if it could possibly come in contact with an energized conductor. When stringing or taking down

wire the number of persons actually handling the wire at any time shall be held to a minimum. When working over streets or highways cautionary measures such as flagging, cradles, and barriers shall be used as required. In stringing or taking down wires in proximity to energized lines, precautions shall be taken to adequately insulate employees from the stringing equipment so that they do not become a parallel path to ground. When stringing or taking down wires crossing over energized lines, suitable protection or guard shall be installed at the point of crossing as necessary.

Before work is done on capacitors at any voltage, the capacitors shall be de-energized. After waiting five minutes, the capacitor terminals shall be shorted by means of temporary jumpers and adequately bonded to the case. Hot line tools shall be used to apply the shorts and bond. Care shall be taken not to make contact with any pole top apparatus or other metal hardware in the area of an energized capacitor installation.

No work shall be done on a de-energized transformer, until the fuses have been pulled and removed and required backfeed precautions have been taken. Where secondaries of transformers are banked or there is a possibility of a backfeed, the transformers secondary leads shall be disconnected in addition to pulling the primary fuses before any work is done on a transformer.

When working with hot line tools, employees shall not place their hands closer than specified under working distances. Metal parts of hot line tools or energized conductors shall not be brought into contact with cross arms, poles or associated hardware apparatus. No other work shall be done on a pole or structure upon which hot line work is in progress. Employees working with hot line tools shall use adequate protective equip-ment on Primary conductors, low voltage conductors, cable TV circuits, and other wires which are within reaching distance. Hold out ropes or hot line tools being used to spread or raise conductors shall be securely

fastened and shall not be held by employees except as necessary to secure or release them. Hold out ropes or hot line tools shall be secured to a link stick and shall not be supported from a phase or neutral conductor.

No employee shall approach or take any conductive object, except with approved devices, closer to unprotected energized Parts than a 24 inch minimum for 2.1 to 15 KV. If the voltage to be approached or climbed is 2.1 to 17 KV and no part of a workers body except forearms will be closer to the energized conductors than the distance that is stated above, the worker may approach or climb through while wearing rubber gloves.

6. UNDERGROUND RULES When entering an underground vault, employees shall observe the precautions as outlined in the confined space entry section.

Cable or equipment to be worked on shall be positively identified by tags, duct location, charts, or proof testing means before work is started. Cable and equipment shall be considered energized and worked with adequate protective devices until it has been proven de-energized. All switches through which it is possible to energize the cable to be worked upon shall be open. Energized cables shall be moved only with insulated protective equipment.

When installing underground cable in proximity to exposed conductors, precautions shall be taken to prevent accidental contact between the cable or Pulling devices and the exposed energized conductors. Pull ropes, fish tapes, and cable shall not be pulled into a duct already occupied by an energized conductor.

When working on pad mounted transformers, cables and terminations shall be considered energized unless tested as de-energized with approved testing devices immediately prior to operations.

7. METERS AND METERING Proper hand protection and face shield shall be worn when setting or removing meters, leather gloves for de-

energized service equipment and rubber gloves for energized service equipment. If practical, two employees shall be present to set or pull an electric meter energized at 300 volts or more. When installing instrument transformers, employees shall exercise due caution to avoid backfeed. All wires shall be positively identified. While working with meters and/or meter circuits, only one phase or wire shall be worked upon at any one time. All line and load conductors to the metering equipment shall be kept in the clear when the equipment is being connected to the line. The cabinet shall be treated as an energized conductor. Name plate on each instrument transformer, on all meters, and on all instruments shall be carefully checked to see that it is both the correct type and rating for the specific job.

When changing out voltage (potential) transformers only one transformer shall be changed at a time. A live part shall be protected with tested and approved protective line hose and/or rubber goods. Secondary leads shall be disconnected before inspecting all installations which are equipped with current and/or voltage (potential) transformer for evidence of either open ground leads and/or evidence of arcing around the ground connections, around any wiring connections or around the meter prior to contacting any part of the connective equipment and/or conduit.

An approved hot line tool shall be used when clamp on amperage meters are used on lines over 600 volts.

SECTION 013 STORAGE BATTERIES

Employees shall wear protective gloves and face shields when working with storage batteries to protect themselves from accidental spills and splashes. Eye wash solution and first aid kits shall be available at all storage battery installations. Only distilled water shall be added to a wet cell. Battery connections shall be clean and free of corrosion. A carbon

dioxide type extinguisher shall be maintained in the general area. Batteries shall be kept properly filled to the water line mark and all battery cable connections shall be tight to avoid sparking.

SECTION 014 STORAGE OF FLAMMABLE AND COMBUSTIBLE MATERIALS

Flammable liquids for use in small engines shall be stored and dispensed utilizing safety cans. Cans shall be stored away from any source of ignition. Defective or leaking cans shall be promptly replaced.

The storage of combustible liquid shall be as per the fire prevention code currently adopted by the City of Falls City.

Greasy or oily substances which are subject to spontaneous ignition shall be placed in metal or noncombustible receptacles. Receptacles shall be placed on noncombustible floors or on the ground outside of buildings, and all locations shall be not less than two feet away from any wall or partitions constructed of combustible materials and away from windows.

SECTION 015 INTOXICATING BEVERAGES AND DRUGS

Use of drugs or alcohol or being under the influence of drugs or alcohol while on assignment is prohibited and shall be sufficient cause for disciplinary action. Any employee taking drugs prescribed by a physician or over-the-counter drugs which could impair his or her assigned work shall report this fact to their supervisor before beginning work.

SECTION 016 HOUSEKEEPING

a. Work locations, vehicles and buildings (inside and outside), shall be kept clean and orderly at all times.
b. Permanent floors, platforms and sidewalks shall be kept free of dangerous projections or obstructions and shall be maintained reasonably free from oil, grease or water. Where the type of operations produces slippery conditions; mats, grates, cleats, or other methods shall be

used to reduce the hazard of slipping.

c. Stairways, aisles, permanent roadways, walkways, and material storage areas in yards shall be kept reasonably clear and free from obstructions, depressions, and debris.

d. Materials and supplies shall be stored in an orderly manner so as to prevent their falling or spreading and to eliminate tripping and stumbling hazards.

SECTION 017 SMOKING

Smoking or open flames shall not be permitted in areas where dangerous gases or combustible material might be present. Absence of "No Smoking" signs shall not excuse smoking in dangerous places. Areas include gas pumps, and confined spaces.

SECTION 018 GENERAL

Fire extinguishers shall be available in all City vehicles and properly located in buildings and work areas as needed.

All tools shall be in good condition and used properly for the job performed. Defective tools shall be repaired or replaced.

All employees shall be trained as necessary before using tools. All protective guards shall be in place and properly maintained.

Welding shall only be performed by experienced and properly trained employees. Fire extinguishing apparatus shall be available. The operator shall wear approved helmet, gloves and clothing.

SECTION 019 OFFICE SAFETY

a. Employees shall report all injuries, regardless of severity, to their Supervisor.

b. Drawers of desks and file cabinets shall be kept closed when not in use.

c. Caution shall be exercised when walking around blind corners.

d. Only one drawer of a file cabinet shall be pulled out at a time in order to avoid over-balancing, unless the cabinet is securely fastened to the wall or to other cabinets.

e. Do not sit on the edge of a chair. Do not tilt back when sitting in a straight chair.

f. Boxes, chairs, etc., shall not be used in place of ladders.

g. The floor shall be kept free of tripping hazards such as telephone cords, electric extension cords, paper cartons, pencils, etc.

h. Materials shall be stored on shelves in a manner to prevent falling; heavy objects shall be placed on lower shelves.

i. Employees shall not attempt to clean, oil, or adjust any machine that is running. If the machine is not equipped with a starting switch that can be locked in the "off" position, it shall be disconnected from its power source.

j. Unsafe electrical cords, faulty electrical or other equipment, or any other hazardous condition shall be reported to their Supervisor.

k. Safety shall be considered in what you wear on the job. Loose-fitting clothing, dangling bracelets, rings and ties may cause serious injury to employees operating or working around power driven machines and shall not be worn.

1. Broken glass and other sharp objects shall not be placed in waste paper containers.

SECTION 020 FIRST AID

The municipality requires CPR training to those municipal employees who have no physical limitations. Costs of the training, recertification and hours required will be financed through departmental training budgets.

Electric Department personnel shall know the essential elements of pole top rescue.

SECTION 021 CORRECTIVE MEASURES

The below corrective measures are meant to establish good safety habits on the job:

a. Reminders.

b. Verbal warning (should be reported to and noted by the Department Head).

c. Written warning (to be placed in employee's personnel file).

d. Suspension (ranging from 1 to 3 days).

e. Demotion.

f. Termination.

Depending on the seriousness of the infraction, corrective measures will be followed as listed with the exception of the two following areas:

a. An employee coming to work under the influence of intoxicating beverages and/or drugs will be suspended until the next working day.

b. Corrective measures will be up to the discretion of the Supervisor if an employee is insubordinate in reference to safety practices.

SECTION 022 RESPONSIBLITIES

It is the responsibility of the supervisor to keep an accurate record of any corrective measures concerning their employees and to place a written documentation in the employee's yearly evaluation. Records of reprimand, suspension and demotion will also be kept on file at the office of the City Clerk.