CITY OF BLOOMFIELD, IOWA

Operations & Maintenance Plan

Written Procedures

GAS SYSTEM

OPERATING AND MAINTENANCE PLAN

A Model Plan from the

IOWA ASSOCIATION OF MUNICIPAL UTILITIES

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Ankeny, Iowa 50021-9353

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This model plan has been developed by the Iowa Association of Municipal Utilities to promote the safe operation and maintenance of municipal gas systems and compliance with federal regulation of gas pipeline operators.

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General Employee Responsibilities and Instructions

1) The instructions contained in this O&M Plan cover operating and maintenance procedures, which shall be followed during normal operations, maintenance, and while making repairs.
2) 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 & 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.
3) Personnel who work on pressure control equipment, or who would respond to an emergency at a pressure control station, must be given authority to shut off the gas when pressure control is lost.
4) In addition to maintaining maps, all pertinent data concerning construction and historical records shall be kept and made available to appropriate operating personnel.

Plan Administrator

1) The Plan Administrator is responsible for ensuring that the Operations and Maintenance Plan, Requirements & Recommendations and Written Procedures are updated and made available to all operations and maintenance personnel through either electronic or paper means.
2) The following individual(s) has primary responsibility for the overall administration of this Plan.

List name(s) or job title(s)

GAS SUPERINTENDENT

Schedule of O&M Activities

The following table may be used to create a schedule or to provide a guideline for when operations and maintenance activities should be completed to meet the requirements of this Plan and 49 CFR Part 191 & 192.

O&M Activity	Frequency Required	Completion Schedule (list month to be completed)
O&M Plan Review	Annually not to exceed 15 months	
Effectiveness of Written Procedures	Once each calendar year	
Emergency Plan & Procedures Review	Annually not to exceed 15 months	
Employee Emergency Training	Annually	
Effectiveness of Employee Emergency Training	Annually	
First Responders & Public Officials Emergency Training & Liaison	Annually	
Transmission &/or Distribution Patrolling	Determined by facility type	
Transmission &/or Distribution Leakage Survey	Determined by facility type & circumstances	
Emergency Valve Maintenance	Annually not to exceed 15 months	
Curb Valve Maintenance	Every 5 years not to exceed 63 months	
Regulator Station Inspection	Annually not to exceed 15 months	
Farm Tap Regulator & Relief Inspection	Every 3 calendar years not to exceed 39 months	
Corrosion Control Monitoring (pipe to soil readings)	Annually not to exceed 15 months	
Atmospheric Corrosion Control Survey	Determined by facility type, every 3 or 5 years	

Rectifier Inspections & Readings	6 times each calendar year not exceeding 2 1/2 months	
CGI Calibration	Determine by manufacturer	
Odorometer Calibration	Determined by manufacturer	
Heat Fusion Equipment Calibration	Determined by manufacturer	
Odorant Usage	Quarterly	
Odorant Level (Sniff Test)	Quarterly	
PHMSA Distribution Report	Due by March 15 for the previous calendar year	
PHMSA Transmission Report (transmission only)	Due by March 15 for the previous calendar year	
National Pipeline Mapping System Confirmation (transmission only)	Due by March 15 for the previous calendar year	
Customer-Owned Piping Notification	Within 90 days of initial service and periodically as needed	
Excess Flow Valve Notification	At time customer signs up for service with existing service line	
Distribution Integrity Management Plan (DIMP)		
• Update Information	Annually	
• Plan Reevaluation	Every 5 years	
Public Awareness Plan		
• Distribution of Educational Materials	Determined by Stakeholder Group	
• Annual Review	Annually	
• Effectiveness Assessment	Every 4 years	

CITY OF BLOOMFIELD, IOWA

Miscellaneous

Reviews, Evaluations, Reports & Notifications

IAMU Procedure M-1: Operations and Maintenance Plan Review

1) At least once each calendar year with intervals not exceeding 15 months, sections of the Operations and Maintenance Plan, Requirements & Recommendations and Written Procedures that pertain specifically to the Operators' system must be reviewed and if necessary, updated.
2) If changes or modifications are made to procedures, operating and maintenance personnel should be made aware of the changes and a review of the changes conducted at that time.

Annual Review of O&M Plan		
Date of Review	**Sections Reviewed**	**Reviewed By**

IAMU Procedure M-2: Effectiveness of Written Procedures

1) The operator shall at least once each calendar year, select a procedure from the O&M Written Procedures and review that procedure to determine the effectiveness or adequacy of that specific procedure.
   a) The review of procedure effectiveness may be performed during the following:
      i) While completing operations and maintenance tasks.
      ii) While completing performance evaluations for operator qualification.
      iii) Performed as a simulation.
2) If during the review process, it is determined that changes or modifications to the procedure are necessary, the operator should incorporate those changes into the procedure or contact IAMU and suggest to modify the procedure accordingly.

Annual Review of Procedure Effectiveness			
Date of Review	Procedure Reviewed	Reviewed By	Effective? Yes or No

IAMU Procedure M-3: PHMSA Annual Distribution Report

Annual Report for Calendar Year _____ Gas Distribution System

1) On or before March 15 of each calendar year, the operator must submit the annual report DOT Form PHMSA F7100.1-1.
2) The PHMSA F7100.1-1 must be completed and submitted electronically through the PHMSA portal which can be found at https://portal.phmsa.dot.gov/pipeline.
3) All information contained in this report will be for data collected during the previous calendar year.
   a) Example; the 2022 Annual Report will contain all data through December 31, 2021.

NOTE: Once the PHMSA F7100.1-1 report has been completed and submitted to PHMSA through the portal, the operator must submit a copy of that report to the Iowa Utilities Board through the Electronic Filing System (IUB 24-7) in a timely manner.

NOTE #2: When figuring for lost and unaccounted for gas, it must be calculated from July 1 through June 30 of the previous calendar year. If the % gas lost is calculated above 4%, additional investigation must be completed to find the source of the volume of lost gas.

IAMU Procedure M-4: Annual Transmission Report

Annual Report for Calendar Year _____ Natural or Other Gas Transmission & Gathering Systems

1) On or before March 15 of each calendar year, the operator must submit the annual report DOT Form PHMSA F7100.2-1.
2) The PHMSA F7100.2-1 must be completed and submitted electronically through the PHMSA portal which can be found at https://poral.phmsa.dot.gov/pipeline.
3) All information contained in this report will be for data collected during the previous calendar year.
   a) Example; the 2022 Annual Report will contain all data through December 31, 2021.

NOTE: Once the PHMSA F7100.2-1 report has been completed and submitted to PHMSA through the portal, the operator must submit a copy of that report to the Iowa Utilities Board through the Electronic Filing System (IUB 24-7) in a timely manner.

IAMU Procedure M-5: NPMS Annual Reporting (Transmission)

Each operator of a gas transmission pipeline must provide the following geospatial data to PHMSA for that pipeline or facility:

1) Geospatial data, attributes, metadata and transmittal letter appropriate for use in the National Pipeline Mapping System. Acceptable formats and additional information are specified in the NPMS Operator Standards Manual available at www.npms.phmsa.dot.gov or by contacting the PHMSA Geographic Information Systems Manager at 202-366-4595.
2) The name and the address for the operator.
3) The name and contact information of a pipeline company employee, to be displayed on a public website, who will serve as a contact for questions from the general public about the operator's NPMS data.
4) The information required from paragraph (1) above must be submitted each year, on or before March 15, representing assets as of December 31 of the previous calendar year. If no changes have occurred since the previous year submission, follow the procedure below to update NPMS as required or refer to the guidance provided in the NPMS Operator Standards Manual available at www.npms.phmsa.dot.gov or by contacting the PHMSA Geographic Information Systems Manager at 202-366-4595:
    i. Visit the website www.npms.phmsa.dot.gov/OSAVE and log into the system using your PIMMA login information.
    ii. Review the pipeline data currently in the NPMS national layer for your OPID via a web map viewer.
    iii. View the NPMS pipeline submission history for your OPID.
    iv. Update information, if required, for your OPID's pipeline-related primary, technical, and public contacts.
    v. Convey a notification of no changes for pipelines.
5) For additional information regarding Operator Submission and Validation Environment (OSAVE), please refer to the OSAVE Users Guide located at www.npms.phmsa.dot.gov.

NOTE: The annual NPMS submission notification must also be filed with the Iowa Utilities Board through their Electronic Filing System (IUB 24-7) in a timely manner.

IAMU Procedure M-6: Customer Owned Piping Notification

NOTE: For the additional information and specific requirements of a customer owned piping notification, see O&M Requirements & Recommendations Division 2.7.

1) If the operator does NOT maintain customer owned piping (piping downstream of the meter set), the operator must notify each customer, in writing, of their responsibility to maintain their own piping. This notice must be distributed to the customer within 90 days of when the customer first receives service.
2) See example below of Customer Owned Piping Notification which can be downloaded at www.iamu.org and modified for your own use.

Customer Owned Piping Notification

As your natural gas distributor, CITY OF BLOOMFIELD, IOWA Municipal Utilities, in accordance with federal regulations, wishes to make you aware of certain safety recommendations regarding your underground natural gas piping.

CITY OF BLOOMFIELD, IOWA Municipal Utilities operates our gas system with an emphasis on safety. We are required to design, operate and maintain our underground natural gas pipeline in accordance with prescribed federal safety standards. The gas system does not maintain the gas piping that is customer owned. Customer owned piping is any piping that is located after the utility owned gas meter. These lines feeding a structure or a gas burning appliance are the responsibility of the customer who owns that piping. If the buried pipe is not properly maintained, it may be subject to corrosion (if the piping is metallic) and/or leakage. To ensure the continued safe and reliable operation of these lines, the buried piping should be periodically inspected for corrosion and checked for leaks. If any unsafe condition is discovered at any time, repairs should be made as soon as possible.

Before any excavation, One-Call must be notified and all utilities marked. When excavating within 18 inches of a buried gas line, excavation should be done by hand, being careful not to damage the buried pipe. You (or the building owner) are advised to contract a licensed plumber or heating contractor or possibly the gas operator to assist you in locating, inspecting and repairing your buried gas piping.

If we can answer any questions regarding this notice, please give us a call at 641-664-9652.

Sincerely: TODD SCHUMAKER

Title: GAS SUPERINTENDENT

Record Requirements:

1) A record must be kept of those customers who received the notice over the previous 3 years. The Customer Owned Piping & EFV Notification Record or other company approved document may be used as a record retention document.
2) The most current copy of the notice must be available for Federal or State inspections.

IAMU Procedure M-7: Excess Flow Valve (EFV) – Right to Request

NOTE: This does NOT apply to systems that operate below 10 psi throughout the year and the request must come from a customer with an existing service line that does not already contain an excess flow valve. See Division 9.23 of O&M Requirements and Recommendations for specific details.

1) Existing service line customers who desire an EFV on service lines not exceeded 1,000 SCFH and who do not qualify for one of the exceptions listed in Division 9.22 of O&M Requirements & Recommendations, may request an EFV be installed on their service line. If an eligible service line customer requests an EFV installation, an operator must install the EFV at a mutually agreeable date. The operator's rate-setter determines how and to whom the costs of the EFV installation are distributed.
2) A Customer Notification of Excess Flow Valve Installation may be found in Division 9.23 of O&M Requirements and Recommendations and may be modified for use with the operators' system.
   a) This notice must be made available to all new customers who sign up for service at a location where the existing service line does not contain an EFV.
   b) A copy of the current notice in use must be made available for inspection.
   c) It is also recommended that documentation be kept of those individuals who received the notification. Documentation may be kept on the Customer Owned Piping & EFV Notification Record or other company approved document.

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PART ONE

Joining of Material Other Than by Welding

IAMU Procedure #1A – Maintenance and/or Calibration of Heat Fusion Equipment

Requirements:

1) All equipment used to join PE pipe by means of heat fusion must be maintained in accordance with the manufacturer's recommended practices.
2) Electrofusion processors must be sent to the manufacturer or manufacturer approved representative for calibration.

Frequency:

1) The frequency for completing maintenance and/or calibration of heat fusion equipment must be completed as required by the manufacturer's recommended practices for the specific equipment being used.

Record Keeping Requirements:

1) Maintenance and/or calibration records for heat fusion equipment must be kept and maintained for as long as that specific piece of equipment is in use.
2) If the required maintenance is performed "in-house" and the equipment is not sent off to the manufacturer, the Heat Fusion Equipment Maintenance Record or other company approved document may be used as a record.

IAMU Procedure #1.0: Joining of Pipe - Threaded Joints

Before installation, visually inspect the pipe and fittings for any manufacturing defects. Also, visually inspect the pipe threads for burrs or metal shavings that might prevent a gas tight joint.

1) Clean the threads of both the pipe and fitting with a wire brush or wire wheel.
2) Apply an even coating of an approved thread lubricant or Teflon tape to the male ends of the pipe connection. If possible, DO NOT apply thread lubricant or tape to the first two threads of the male pipe end as these ends are tapered and the thread lubricant could possibly enter the gas stream and cause problems downstream of the joint.
3) Assemble and initially hand tighten the joint making sure NOT to cross thread. Cross threading can cause damage to the threads and prevent a gas tight joint. If the pipe and fitting will not assemble without cross threading, replace pipe and fitting.
4) Once the joint is hand tight, use a pipe wrench to complete and final tighten the connection.
5) DO NOT put the piping system into service until all connections have been pressure tested, if required, and checked for leaks.

IAMU Procedure #1.1: Joining of Pipe – Butt Fusion (Manual)

NOTE: The following procedure was obtained from the Plastic Pipe Institutes Generic Butt Fusion Procedure for Field Joining of Polyethylene Pipe TR-33, 2012. All joining must be performed by qualified individuals

Generic Butt Fusion Joining Procedure for Field Joining PE (Polyethylene) Pipe

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.

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)

See the next 3 pages for examples of correct and incorrect butt fusion joints

Butt Fusion Bead Proportions (ASTM F2620)

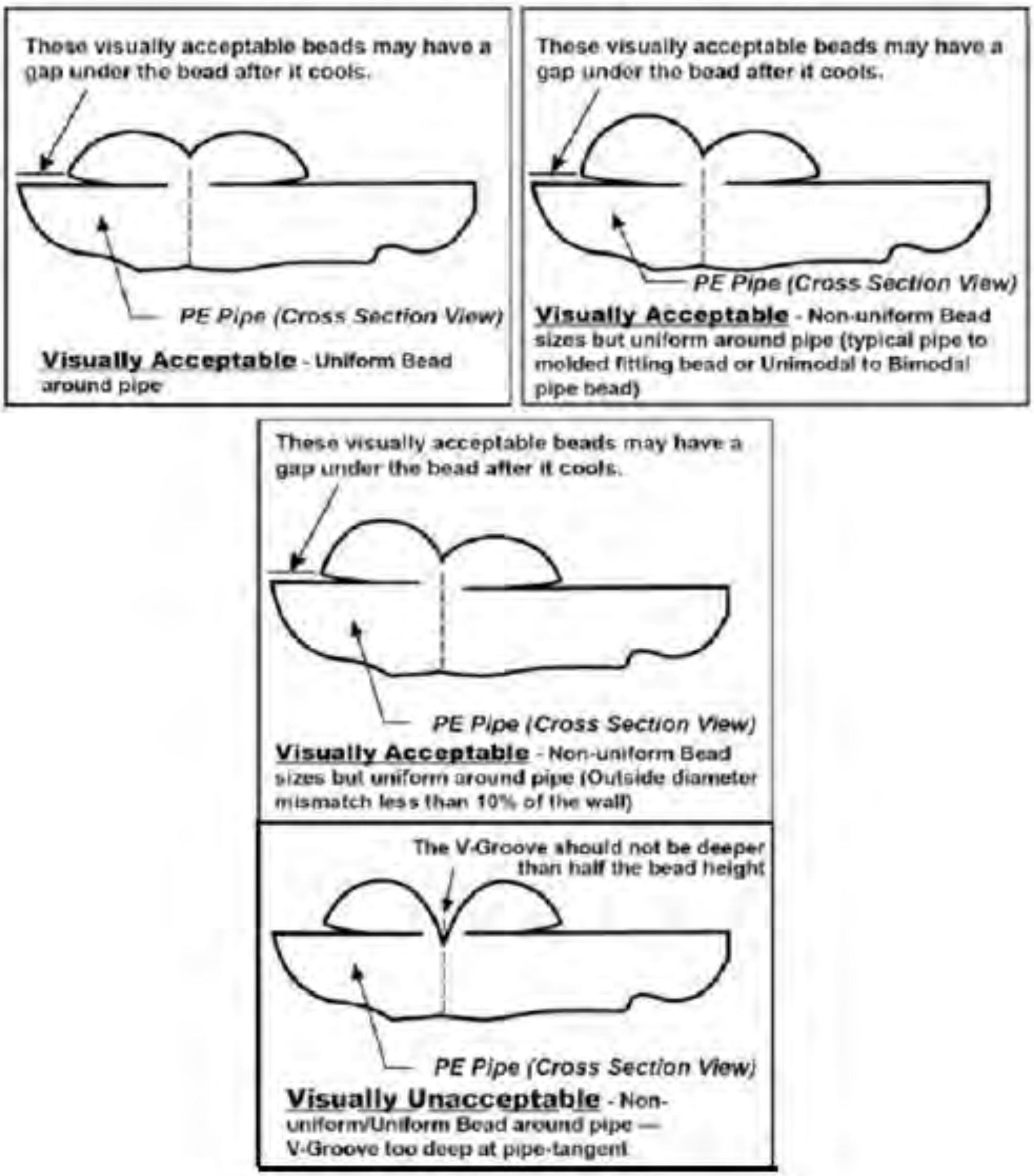
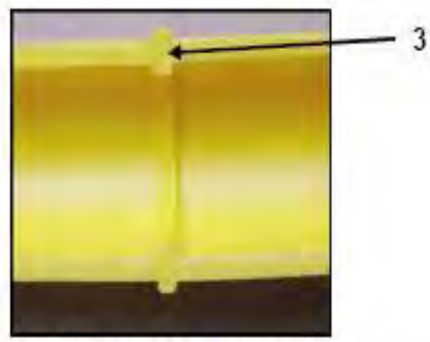


Table 3: Butt Fusion Bead Troubleshooting Guide

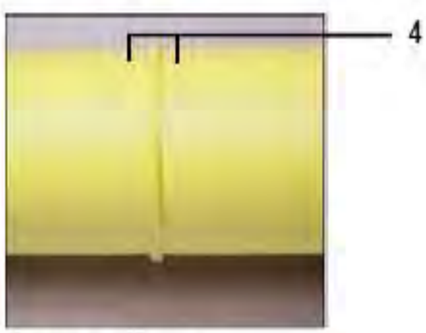
Observed Condition	*Possible Causes*
Double bead v-groove too deep	Pressure applied during the heating cycle.
Non-uniform bead size around pipe	Misalignment; defective heating tool; worn equipment; incomplete facing
One bead larger than the other	Different bead sizes are expected when joining different material types, such as heat fusion joining MDPE to HDPE pipes. If the two materials being joined are the same, then having one bead being larger than the other bead may be a sign that the component slipped in clamp; that the heating tool may be defective or that there may be incomplete facing;
Beads too small	Insufficient heating; insufficient joining force
Beads too large	Excessive heating time
Rough, sandpaper-like, bubbly, or pockmarked melt bead surface	Hydrocarbon contamination

Acceptable Fusions

1. Proper double roll-back bead
2. Proper alignment



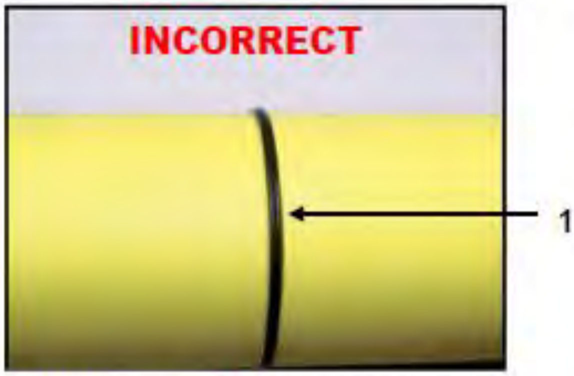
3. Proper double roll-back bead



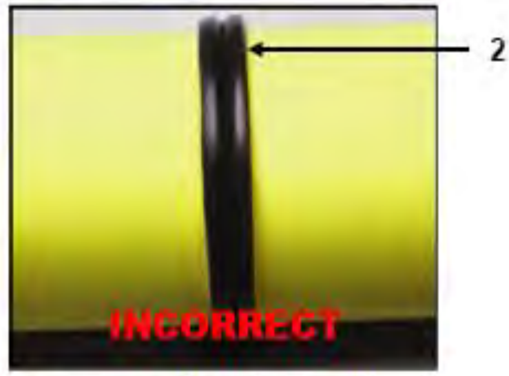
4. Proper alignment

5. No gaps or voids when bent

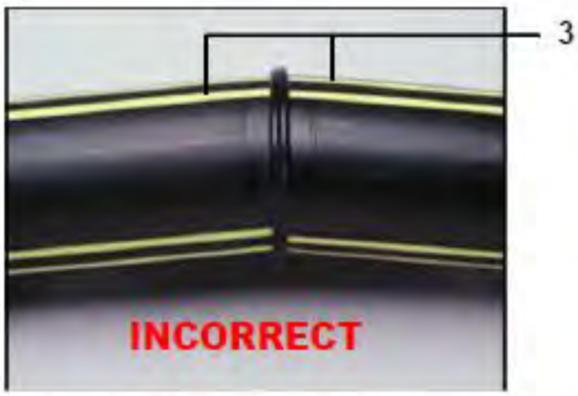
Unacceptable Fusions



1. Insufficient heat time; melt bead too small

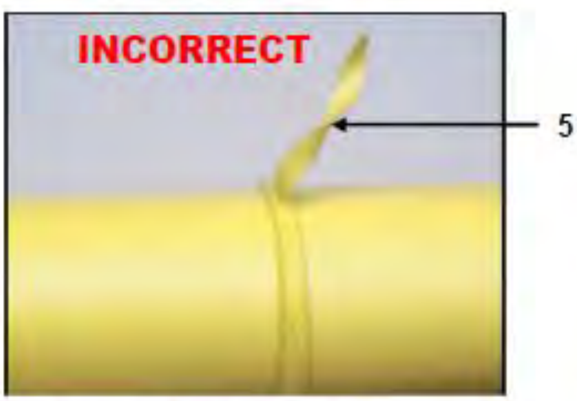


2. Excessive heat time or pressure applies during heating; melt bead too large

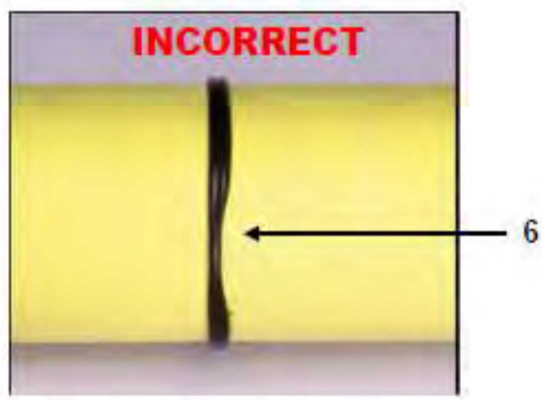


3. Pipe angled into fusion unit

4. Improper "High-Low" alignment



5. Incomplete face off or failure to remove faced off ribbons



6. Incomplete face off

Bend Back Testing of Butt Fused Joints

For Gas Utilities, refer to DOT CFR 192.285 for qualifying persons to make joints.

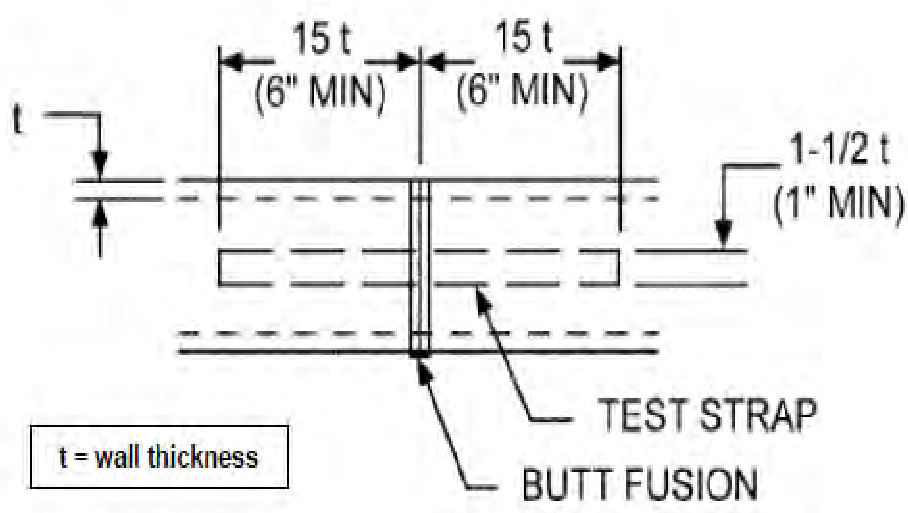
1. Allow sample joints to cool for no less than one hour.
2. Prepare and cut joint samples into test straps. Please refer to **Figure** 3 below. For these qualifying procedures, limit the joint samples to pipe wall thickness of no greater than 1 in. (25 mm).

♦ ***WARNING** – Bend testing of pipes with a wall thickness greater than 1 in. (25 mm) can be dangerous and should be done with an approved bending fixture that supports and contains the pipe during testing.*

3. Visually inspect the cut joint for any indications of voids, gaps, misalignment of surfaces that have not been properly bonded during the fusion process.
4. Bend each test strap at the fusion joint with the inside of the pipe facing out until the ends touch. The test strap must be free of cracks and separations within the fusion joint zone.
5. If flaws are observed in the fusion zone, compare appearance with pictures of unacceptable joints. Prepare a new sample joint using correct joining procedure and repeat the qualifying procedure.

Figure 3

Butt Bent Strap Test Specimen



IAMU Procedure #1.2: Joining of Pipe – Butt Fusion (Hydraulic)

NOTE: The following procedure was obtained from McElroy Fusion Equipment and is specific to the Type 28 and 250 Hydraulic Fusion Machine. All joining must be performed by qualified individuals.

Read Before Operating

Before operating this machine, please read this manual thoroughly, and keep a copy with the machine for future reference.

Return manual to the protective storage box when not in use. This manual is to be considered part of your machine.

TX00401-9-15-94

Check Hydraulic Fluid Level

Check fluid level in sight gauge on filler spout and add fluid if necessary.

Refer to the "Hydraulic Fluids" section of this manual for hydraulic fluid recommendations.

TX00364-05-09-14

Connecting machine to Power

⚠ DANGER All electrical equipment and power sources must be located outside an explosive atmosphere. Failure to do so can result in serious injury or death.

Plug machine's electrical cord into a proper power source.

TX00668-05-09-14

Prepare Heater

⚠ DANGER Heater is not explosion proof. Operation of heater in an explosive atmosphere without necessary safety precautions will result in serious injury or death.

If operating in an explosive atmosphere, heater should be brought up to temperature in a safe environment, then unplugged before entering the explosive atmosphere for fusion.

Install butt fusion heater plates.

NOTICE: The heater should never be used without butt fusion heater plates installed. Refer to the "Maintenance" section of this manual for installation procedure.

Place heater in insulated heater stand.

Plug heater into a proper power source.

Allow heater to warm-up to operating temperature.

Refer to the "Maintenance" section of this manual for instructions on how to adjust heater temperature.

TX02310-03-24-14

Set up Pipe Supports

Set up pipe stands and adjust height so the pipe is in line with the jaws.

TX00367-9-15-94

Install Clamping Inserts

Select and install appropriate clamping inserts for the pipe that is being fused.

Clamping inserts are required for all sizes except 8" DIPS.

TX01310-4-1-97

Pump Motor

DANGER Electric motors are not explosion proof. Operation of these components in an explosive atmosphere without necessary safety precautions will result in serious injury or death.

For operation in an explosive atmosphere consult the instructions in the "Special Operation" section of this manual.

Locate pump motor in a safe environment. Plug the electrical cord into a proper power source.

Turn on hydraulic pump motor and note pressure at the relief valve.

Set the system pressure to 900 psi for most pipe sizes and SDR's. When facing heavy wall pipe, it may necessary to increase the pressure to 1200 psi. Reduce the pressure to 900 psi when facing is completed. Prolonged operation at increased pressure can overheat the oil

IMPORTANT: Unplug heater when starting pump motor. This will reduce the load on the power supply.

TX02135-05-09-14

Loading Pipe Into Machine

Clean the inside and outside of pipe ends that are to be fused.

Open the upper jaws and insert pipe in each pair of jaws with applicable inserts installed. Let the ends of the pipe protrude about 1" past the face of the jaws.

TX00371-9-15-94

Positioning Pipe In Machine

Swing the facer into place. With the carriage control valve lever, move the carriage toward the fixed jaws, while watching the gap at each end of the facer rest buttons. When the pipe is in contact with the facer, this gap indicates the amount of material that will be trimmed from the pipe end. Assure sufficient material will be removed for a complete face off. Tighten the clamp knobs on the outside jaws. Hand tighten the inside clamp knobs.

TX00372-9-15-94

Begin Facing

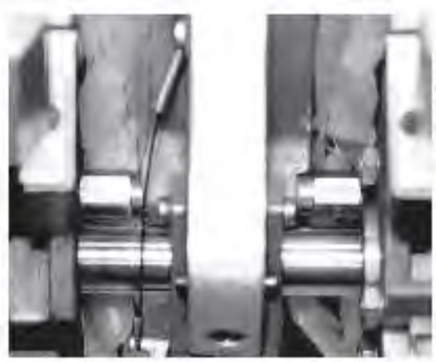
Turn facer on by opening valve on top of the facer.

Move the selector valve on the hydraulic manifold block to the top (facing pressure) position.

The facing pressure should be set as low as possible while still facing pipe. Excessive facing pressure can damage the facer. It may be necessary to adjust the carriage pressure.

⚠WARNING Facer blades are sharp and can cut. Never attempt to remove shavings while the facer is running, or is in the facing position between the jaws. Use care when operating the facer, and when handling the unit.

Activate the carriage control valve and move the carriage to the left to begin facing. Continue to face the pipe until the rest buttons on the jaws bottom out on the facer rest buttons.



TX04261-3-30-11

After Facing

Turn facer motor off. Move carriage all the way to the right. Center the facer in between the pipe ends to avoid dragging facer stops on the pipe ends. Swing facer to the out position. Clean shavings out of pipe ends and from between the jaws. Do not touch faced pipe ends.

TX04262 3-30-11

Determine Drag Pressure

Drag pressure should be determined using the following procedure:

Move the carriage so that the faced pipe ends are approximately 2" apart.

Shift the carriage control valve to the middle (neutral) position.

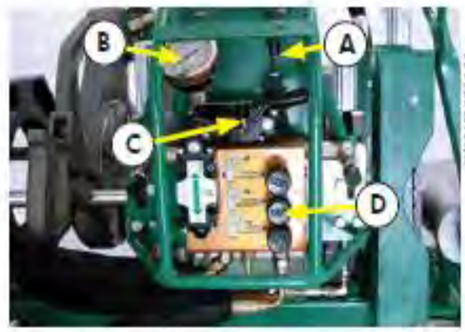
Select the heating mode, and adjust the middle pressure reducing valve to its lowest pressure by turning the valve counterclockwise.

Shift the carriage control valve to the left.

Gradually increase the pressure by turning the valve clockwise. Increase the pressure until the carriage moves.

Quickly reduce the heating pressure valve counterclockwise until the carriage is just barely moving.

Record this actual drag pressure.



A - Carriage Control Valve
B - Pressure Gauge
C - Pressure Selector Valve
D - Pressure Reducing Valves (3)

TX03023-8-19-09

Set Fusion Pressure

With the selector valve in the down position, the fusion pressure can be set.

The theoretical fusion pressure can be calculated using the enclosed fusion pressure calculator. Always add drag pressure to the theoretical fusion pressure.

Gauge (Fusion) Pressure = Theoretical Fusion Pressure + Drag Pressure

TX03024-10-19-10

Check for Slippage

Bring the two sections of pipe together under fusion pressure to make sure they don't slip in the jaws.

If slippage occurs, return to **Loading Pipe into Machine**.

TX00971-12-7-10

Check Alignment

Move carriage to the left at facing pressure, until pipe ends contact. Look across the top surface of pipe ends to check alignment. If there is a noticeable step across the joint, adjustments must be made.

⚠WARNING Hydraulically operated equipment is operated under pressure. Anything caught in the machine will be crushed. Keep fingers, feet, arms, legs, and head out of the machine while operated.

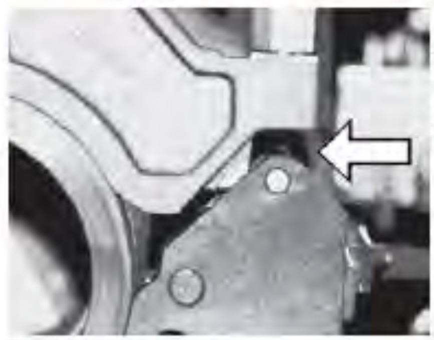
If pipe is not lined up, tighten the high side jaw to bring into alignment.

IMPORTANT: Always tighten the side that is higher, never loosen the low side.

When the pipe is properly aligned, ensure all clamp knobs are tight.

NOTICE: When clamping, do not over-tighten the clamp knobs because machine damage can result. Check to see if there is space between the upper and lower jaws. If the two jaws are touching, do not continue to tighten.

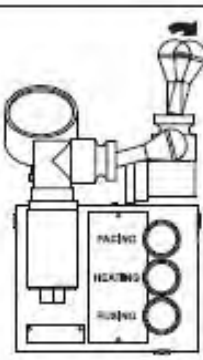
TX04263-3-30-11



Position Carriage for Heater Insertion

Move carriage to the right to open a gap large enough to insert the heater.

TX00374-9-15-94



Check Heater Temperature

NOTICE: Incorrect heating temperature can result in questionable fusion joints. Check heater plates periodically with a pyrometer and make necessary adjustments.

Refer to the "Maintenance" section of this manual for instructions how to adjust heater temperature.

Check heater surface temperature.

Refer to the pipe manufacturer's recommendations for proper heater temperature.

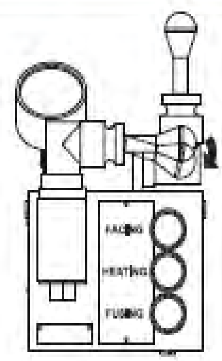
IMPORTANT: The dial thermometer on the heater indicates internal temperature which varies from the actual surface temperature.

The dial thermometer can be used as reference once the surface temperature has been verified.

TX02001-11-1-02

Select the Fusion Position

Move selector valve handle down to the fusing position.



TX00376-9-15-94

Inserting Heater

⚠ DANGER Heater is not explosion proof. Operation of heater in an explosive atmosphere without necessary safety precautions will result in serious injury or death.

If operating in an explosive atmosphere, heater should be brought up to temperature in a safe environment, then unplugged before entering the hazardous atmosphere for fusion.

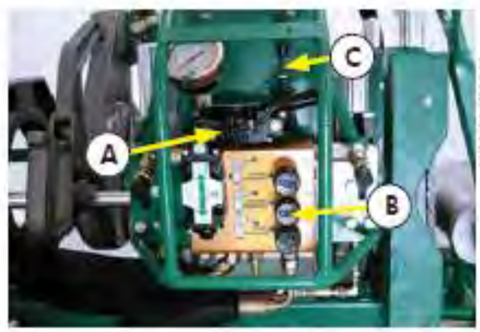
Use a clean non-synthetic cloth to clean the butt fusion heater adapter surfaces.

Verify heater temperature by noting the reading on the dial thermometer.

Insert heater between the pipe ends.

TX00377-04-16-14

Heat Pipe



Shift the selector valve (A) to the center position, and set the heating pressure (if required). If heating pressure is not required, set the pressure reducing valve (B) at its lowest setting, or the drag pressure, whichever is higher.

Shift the selector valve (A) to the fusion position and move the carriage control valve (C) to the left to bring pipe ends in contact with the heater. Move selector valve (A) to middle (heating mode) position. If heater pressure is not required by pipe manufacturer or joining standard, or opposing forces are not great enough to move the carriage away from the heater, shift the carriage control valve to neutral.

IMPORTANT: Always shift into the heating mode **before** returning carriage valve to neutral.

Follow the pipe manufacturer's suggested heating and soaking procedure or joining standard.

TX04264-3-30-11

Fusing the Pipe

NOTICE: Failure to follow the pipe manufacturer's heating time, pressure and cooling time may result in a bad joint.

After following the heating procedure, verify carriage control valve is in neutral and move selector valve down, to fusion position.

Move the carriage to the right just enough to remove the heater.

Quickly remove the heater.

Quickly inspect pipe ends for appropriate melt.

When heater is clear of the jaws, quickly move the carriage to the left and bring the pipe ends together using the pipe manufacturer's recommended pressure.

Allow joint to cool under pressure according to pipe manufacturer's recommendations or appropriate joining standard.

Visually examine the entire circumference of the joint for compliance with standards established by your company, customer, industry, federal, state, or local regulations.

TX04265-1-20-12

PH00363-9-12-94

Opening Movable Jaws

After the joint has cooled for the pipe manufacturer's recommended time or appropriate joining standard, shift the carriage control valve to the neutral position.

Loosen all clamp knobs, and move carriage to the right far enough to open the jaw nearest the facer.

Open the movable jaws.

TX00380-9-15-94

PH02315-4-24-02

Opening Fixed Jaws

Open the fixed jaws.

TX00381-9-16-94

PH02496-07-08-03

Raise Pipe

Raise the joined pipe using both of the pipe lifts.

TX00382-9-16-94

Position Pipe for Next Joint

Move the fusion machine to end of pipe, or pull the pipe through the jaws until the end of the pipe is protruding 1" past the jaw face of the fixed jaw.

TX00383-9-15-94

Install Next Piece of Pipe

Insert a new piece of pipe in movable jaws and repeat all previous procedures.

TX00384-10-12-95

IAMU Procedure #1.3: Joining of Pipe – Socket Fusion

NOTE: The following procedure was obtained from the Performance Pipe Heat Fusion Joining Procedures and Qualification Guide which is aligned with ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings. All joining must be performed by qualified individuals.

SOCKET FUSION

REQUIRED EQUIPMENT

This procedure requires: Chamfering tool, depth gauge (some manufacturers combine chamfering tool and depth gauge), cold ring clamp, heating tool with male and female socket faces, and timing equipment (such as a watch with a second hand). Holding tools are desirable for 2" IPS (90 mm OD) and larger pipe and fittings. Clean work gloves are suggested.

✓ Heating tool male and female socket faces should meet ASTM F1056 *Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings*.

SET-UP PARAMETERS

HEATING TOOL SURFACE TEMPERATURE - MINIMUM 490°F – MAXIMUM 510°F (255–265°C)

- Where heating tool surfaces will contact the main or the fitting, all points on both heating tool surfaces must be within the prescribed minimum and maximum temperatures before you begin.
- Molten PE material may be cleaned from heating tool faces with a wooden implement such as a tongue depressor. To remove burned or charred material from socket faces, heat the faces, insert a short length of pipe or tubing into the female face and a socket fitting onto the male face. Then unplug the heating iron and let it cool completely. When the pipe or tubing and the fitting are removed from the cold heating tool, the burned or charred material will come off with them.

PROCEDURE

1. *Clean and Cut.* Clean the inside and outside of the pipe and fitting with a clean, dry, lint-free, non-synthetic (cotton) cloth, or paper towel. Do not touch cleaned surface with your hands. The pipe or tubing end must be squarely cut. If the end is not squarely cut, use a plastic pipe cutter or hand saw and cut the pipe or tubing end squarely.
    - When using a wheel-type pipe cutter, be sure the cutter wheel does not thread down the pipe – cut off all partial cuts before fusion.
    - On larger pipes, toe-in may need to be removed before fusion
2. *Chamfer.* For all pipe and tubing sizes, chamfer the end to remove the sharp outer edge on the OD. Remove all burrs from inside of pipe ends. Make sure the pipe or tubing end is clean, dry and free of foreign substances. Wipe with a clean, dry, lint-free, non-synthetic (cotton) cloth, or paper towel. Do not touch cleaned surfaces with your hands.
3. *Round.* Place the depth gauge snugly over the chamfered end of the pipe and clamp the cold ring clamp on the pipe OD immediately behind the depth gauge. Remove the depth gauge
    - In socket fusion, there is an interference fit between the pipe or tubing and the socket, that is, the socket is slightly smaller than the pipe. They won't fit together cold.
    - Heating tool faces are tapered which produces a tapered melt. Therefore, the pipe or tubing and the fitting will tend to push away from the heating tool during heating and will tend to push apart

when first joined together. It is necessary to hold the pipe and fitting against the heater faces during heating and to hold them together when fusing.

- When using a socket coupling to join coiled pipe, if possible "S" the pipes on either side of the coupling to compensate for coil curvature and make it easier to join the second pipe to the coupling.

4. ***Heat.*** Verify that the heating tool is between 490°F- 510°F. Push the socket fitting onto the male socket face. DO NOT TWIST. The socket fitting must bottom out completely and be held against the back surface of the male heater face. Then and only then, push the pipe or tubing end into the female socket face. DO NOT TWIST. The cold ring clamp must be completely against the female socket face and held in place. Heating time starts when the cold ring is against the female heater face and when pipe and fitting are fully inserted. Heat the pipe end and the fitting socket for the time required in **Table 6**.

   ➔ *Important*: For socket fusion joining of medium density to high density, pre-heat the high density component. This pre-heat time can be found by subtracting the shorter heating time (medium density) from the longer heating time (high density). If heating times are within 10% of each other, the longer heating time may be used for both components.[3]

5. ***Join.*** At the end of the heating time, quickly remove the pipe and fitting from the Heating Tool simultaneously using a snap action. DO NOT TWIST. Inspect the melt pattern on the pipe and fitting socket. The surfaces should be 100% melted with no cold spots. Within 3 seconds after removing from the heating tool, firmly push the pipe end and the fitting socket straight together, DO NOT TWIST PIPE OR FITTING, until the cold ring clamp makes firm contact with the end of the fitting socket.

   ➔ *Important*: Remove the pipe and the fitting straight out from the heating tool faces. Do not displace the melt. If the pipe or fitting are removed at an angle or twisted, melt can be displaced, and the joint may leak or fail. Grasp the pipe behind the cold ring clamp. Pulling on the cold ring clamp handle can cause slippage or displace the melt.

- If the melt is not complete, do not continue with the joint. Cut off the melted pipe end, use a new fitting and start over from Step 1. **Do not re-use a melted fitting**. If the melt is correct, continue the joining procedure.

- Grasp the pipe behind the cold ring clamp. Pushing on the cold ring clamp handle can cause slippage or a crooked joint.

6. ***Hold.*** Hold the pipe and socket fitting firmly together until the **Table 6** cooling time has been met. **DO NOT TWIST PIPE OR FITTING.** For ambient temperatures 100°F and higher, additional cooling time may be needed. Remove the rounding clamp and inspect the end of the socket fitting at the pipe for a complete impression of the rounding clamp in the melt surface. Allow the joint to cool for an additional 5 minutes before exposing the joint to any type of stress (ex: burial, testing or fusing the other end of the fitting, etc.).

   ➔ *Important:* Push the pipe and fitting straight together. If joined at an angle or misaligned, the joint may leak or fail.

   - Clean heater faces carefully after each fusion with a wooden implement such as a tongue depressor to remove any molten PE from the male and female socket faces.

7. ***Inspect.*** Inspect the end of the socket fitting at the pipe. There should be a clear impression of the cold ring clamp into the melt ring at the end of the fitting with no visible gaps or voids around the pipe at the socket melt ring. The pipe and fitting should be aligned straight with each other. Use **Table 7** for common socket fusion problems. If flaws are observed in the joint, find the cause of the flaw and repeat the procedures to prepare a new joint.

   ➔ *Important:* For installation purposes, the pipe bend radius should be kept to 100 times the outside diameter when a socket fusion fitting is present to avoid over stressing the pipe and/or fitting connection

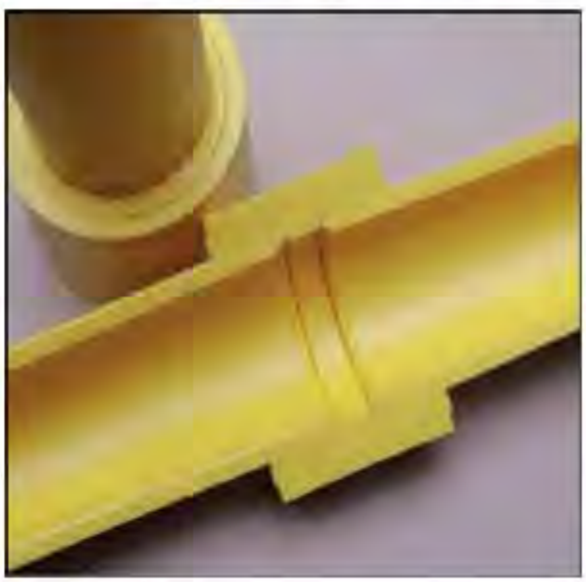
Table 6: Socket Fusion Heating & Cooling Times

Pipe Size	*PE 2406 / PE 2708*		*PE 3408 / PE 3608 / PE 4710*	
	Heating Time, seconds	*Cooling Time, seconds*	*Heating Time, seconds*	*Cooling Time, seconds*
1/2" CTS	6 – 7	30	6 – 10	30
3/4" CTS	6 – 7	30	6 – 10	30
1" CTS	9 – 10	30	9 – 16	30
1-1/4" CTS	10 –12	30	10 – 16	30
1/2" IPS	6 – 7	30	6 – 10	30
3/4" IPS	8 – 10	30	8 – 14	30
1" IPS	10 –12	30	15 – 17	30
1-1/4" IPS	12 –14	45	18 – 21	60
1-1/2" IPS	14 –17	45	20 – 23	60
2" IPS	16 –19	45	24 – 28	60
3" IPS	20 – 24	60	28 – 32	75
4" IPS	24 – 29	60	32 – 37	75

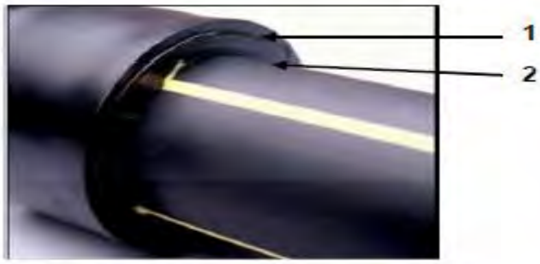
Table 7: Socket Fusion Troubleshooting Guide

Observed Condition	*Possible Cause*
No cold-ring impression in socket fitting melt bead	Depth gauge not used; cold ring not used, or set at incorrect depth; Insufficient heat time
Gaps or voids around pipe at socket fitting edge	Pipe or fitting not removed straight from heater face (twisting or removing from heater face at an angle); pipe or fitting not inserted straight into each other when fusing; Joining together at an angle; twisting while joining pipe and fitting together; cold ring not used or set too deep
Wrinkled or collapsed pipe or tubing end *(when viewed from inside, or when qualifying lengthwise cut joint)*	Incorrect heating sequence – always push the pipe or tubing into the heater *after* the fitting has been pushed on the heater (inserting the tubing first heats the tubing too long); cold ring set too deep; cold ring not used
Voids in fusion bond area *(when qualifying lengthwise cut joint)*	Pipe or fitting not removed straight from heater face (twisting or removing from heater face at an angle); pipe or fitting not inserted straight into each other when fusing; joining together at an angle; twisting while joining pipe and fitting together; cold ring not used or set too deep
Unbonded area on pipe or tubing at end of pipe or tubing *(when qualifying lengthwise cut joint)*	Cold ring not used or set too deep
Socket melt extends past end of pipe or tubing *(when qualifying lengthwise cut joint)*	Cold ring set too shallow
Rough, sandpaper-like, bubbly, or pockmarked melt bead surface	Hydrocarbon contamination

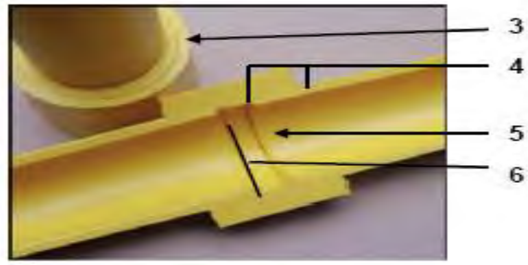
Acceptable Appearance



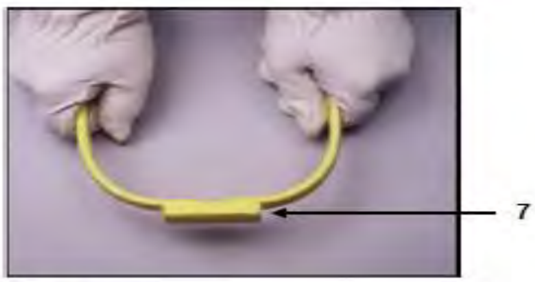
Acceptable Fusions



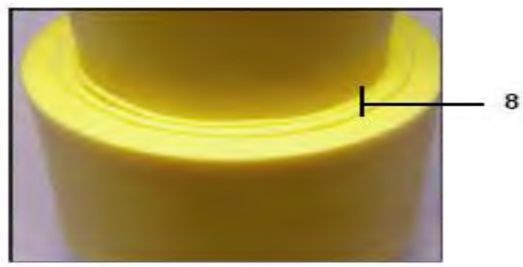
1. Melt bead flattened by cold ring
2. No gaps or voids



3. No gap or voids
4. Proper insertion depth
5. Acceptable internal fusion bead
6. Complete internal melt bead

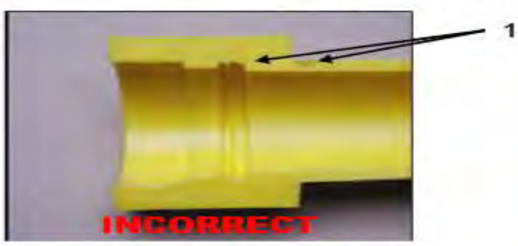


7. No gap or voids

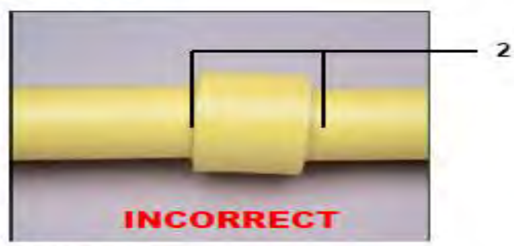


8. Melt bead flattened by cold ring

Unacceptable Fusions

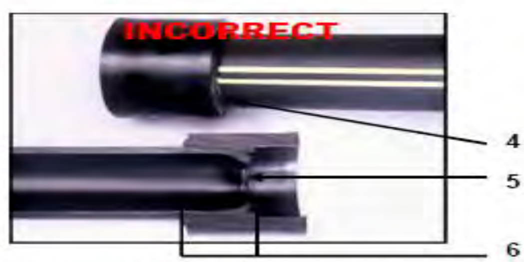


1. Improper insertion depth/short stab depth



2. Misalignment

3. Excessive heating



4. Melt bead not flattened against fitting/no cold ring
5. Improper insertion depth/no cold ring
6. Excessive heating

Bend Back Testing of Socket Fused Joints

For Gas Utilities, refer to DOT CFR 192.285 for qualifying persons to make joints.

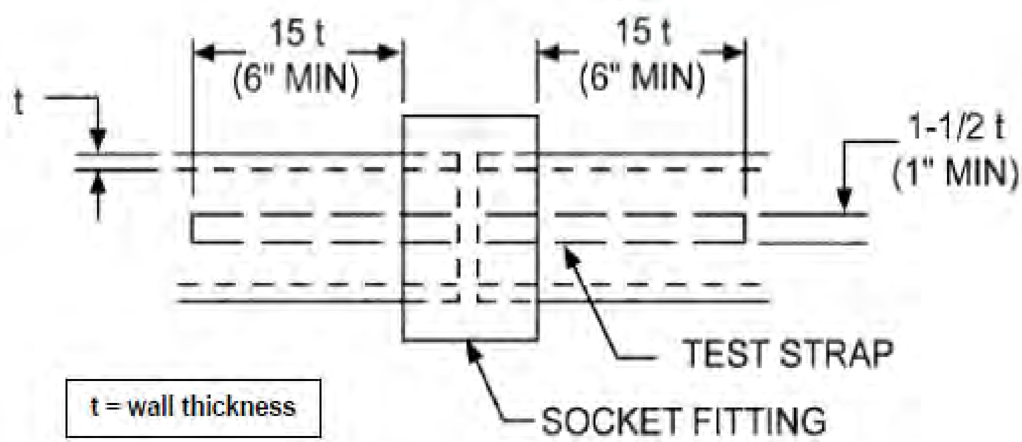
1. Prepare fusion joint samples. Pipe on either side of the fitting should extend at least 6" (150 mm) or 15 times the wall thickness in length. Please refer to **Figure 6** below. For these qualifying procedures, limit the joint samples to pipe wall thickness of no greater than 1 in. (25 mm). Observe the joining process to determine that the correct procedure is being followed.

♦ ***WARNING** – Bend testing of pipes with a wall thickness greater than **1 in. (25 mm)** can be dangerous and should be done with an approved bending fixture that supports and contains the pipe during testing.*

2. Allow the sample joints to cool for no less than one hour.
3. Cut sample joint lengthwise along the main pipe and through the saddle fitting to prepare a test strap. Please refer to **Figure 6**.
4. Visually inspect the cut joint for any indications of voids, gaps, misalignment of surfaces that have not been properly bonded during the fusion process.
5. Bend test straps at the fusion joint as pictured above. The test strap joint must be free of cracks and separations within the fusion zone.
6. If flaws are observed in the fusion zone, compare appearance with pictures of unacceptable joints. Prepare new sample joints using correct joining procedure and repeat the qualifying procedure.

Figure 6

Socket Bent Strap Test Specimen



IAMU Procedure #1.4: Joining of Pipe – Saddle/Sidewall Fusion

NOTE: The following procedure was obtained from the Plastic Pipe Institutes Generic Saddle Fusion Procedure of Polyethylene Pipe Mains 1 ¼" IPS and Larger TR-41, 2018. All joining must be performed by qualified individuals.

GENERIC SADDLE FUSION JOINING PROCEDURE OF PE (POLYETHYLENE) PIPE MAINS 1 1/4" IPS AND LARGER

This procedure can be used for PE fuel gas pipe and fittings that meet ASTM D 2513 and have a grade designation (in accordance with ASTM D3350) of PE24 and PE34, excluding Uponor's Aldyl A MDPE and Phillip's Driscopipe 8000 HDPE (both of which have been discontinued). The pipe and fitting nominal melt index range would be .07-.20 g/10 min. This procedure is intended only as a guide because heating times can vary under different ambient conditions.

Generic Saddle Fusion Parameters

Heater Adapter Surface Temperature	500°±10°F
Initial Interfacial Pressure	60±6 psi
Heat Soak Interfacial Pressure	0 psi
Fusion Interfacial Pressure	30±3 psi
Total Heating Time on Main - 1 ¼" IPS Pressure Main	15 seconds max.
Total Heating Time on Main - 2" IPS Pressure Main	25-35 seconds max.
Total Heating Time on non-pressure 1 ¼" IPS, 2" IPS mains, and on pressure or non-pressure 3" IPS and larger mains.	Look for a 1/16" bead around the fitting base

Note: Look in the lower right hand corner of the fitting label for the forces required for that fitting (Initial Heat Force / Heat Soak Force / Fusion Force) (example 180/0/90)

DEFINITIONS

Initial Heat (Bead-up) – The heating step used to develop an initial melt bead on the main pipe.

Initial Heat Force (Bead-up force)—The force (pounds) applied to establish an initial melt pattern on the main pipe. The Initial Heat Force is determined by multiplying the fitting base area (sq. inches) by the initial interfacial pressure (pounds per square inch)

Heat Soak Force—The force (pounds) applied after an initial melt pattern is established on the main pipe. The Heat Soak Force is the minimum force (essentially zero pounds) that ensures that the fitting, heater and main stay in contact with each other.

Fusion Force—The force (pounds) applied to establish the fusion bond between the fitting and the pipe. The Fusion Force is determined by multiplying the fitting base area (square inches) by the fusion interfacial pressure (pounds per square inch).

Total Heat Time—A time that starts when the heater is placed on the main pipe and initial heat force is applied and ends when the heater is removed.

Cool Time—The time required to cool the joint to approximately 120°F (49°C). The fusion force must be maintained for 5 minutes on 1 ¼" IPS or 10 minutes for all other main sizes, after which the saddle fusion equipment can be removed. The joint must be allowed to cool undisturbed for an additional 30 minutes before tapping the main or joining to the branch outlet.

Interfacial Area for rectangular base fittings-- The major width times the major length of the saddle base, without taking into account the curvature of the base or sides, minus the area of the hole in the center of the base.

Interfacial Area for round base fittings-- The radius of the saddle base squared times π (3.1416), without taking into account the curvature of the base or sides, minus the area of the hole in the center of the base.

Fitting Label—The initial heat force, heat soak force and the fusion force will be listed in the lower right hand corner of the fitting label for all saddle fusion fittings, This will eliminate the need to calculate the fusion forces in the field. (example: 180/0/90)

Preparation

This procedure requires the use of a Saddle Fusion Tool. This tool must be capable of holding and supporting the main, rounding the main for good alignment between the pipe and fitting, holding the fitting, and applying and indicating the proper force during the fusion process.

1. Install the Saddle Fusion Tool on the main according to the manufacturer's instructions. The tool should be centered over a clean, dry location where the fitting will be fused. Secure the tool to the main. A main bolster or support is recommended under the pipe on 6" IPS and smaller main pipe sizes.
2. Abrade the main, where the fitting will be joined, with a 50-60 grit utility cloth until a thin layer of the pipe surface is removed. The abraded area must be larger than the area covered by the fitting base. After abrading, brush residue away with a clean, dry cloth.
3. Abrade the fusion surface of the fitting with 50 to 60 grit utility cloth; remove all dust and residue. Insert the fitting in the Saddle Fusion Tool loosely. Using the Saddle Fusion Tool, move the fitting base against the main pipe and apply about 100 pounds-force to seat the fitting. Secure the fitting in the Saddle Fusion Tool.

Heating

4. The heater must be fitted with the correct heater adapters. The temperature of the heater adapter fusion surfaces must be 490-510°F.
5. Place the heating tool on the main centered beneath the fitting base. Immediately move the fitting against the heater faces, apply the Initial Heat Force (see fitting label), and start the heat time. Apply the Initial Heat Force until melt is first observed on the crown of the pipe main (Initial Heat is the term used to describe the initial heating (bead-up) step to develop a melt bead on the main pipe and usually is 3-5 seconds) and then reduce the force to the Heat Soak Force (Bead-up force) (see fitting label). Maintain the Heat Soak Force until the Total Heat Time is complete.
6. At the end of the Total Heat Time, remove the fitting from the heater and the heater from the main with a quick snapping action. Quickly check for an even melt pattern on the pipe main and fitting heated surfaces (no unheated areas). Total Heat Time ends:
    a. When the Total Heating Time expires for a pressurized 1 ¼" IPS or 2" IPS main, or
    b. When a melt bead of about 1/16" is visible all around the fitting base for a 1 1/4 " IPS or 2" IPS non-pressurized main, or a larger pressurized or non-pressurized main.

Fusion and Cooling

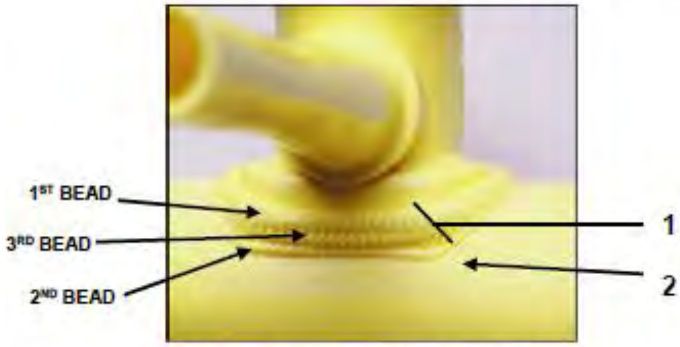
7. Whether or not the melt patterns are satisfactory, press the fitting onto the main pipe very quickly (within 3 seconds) after removing the heater and apply the Fusion Force (see the fitting label). Maintain the Fusion Force on the assembly for 5 minutes on 1 ¼" IPS and for 10 minutes on all larger sizes, after which the saddle fusion equipment may be removed. (Fusion Force adjustment may be required during Cool Time, but never reduce the Fusion Force during cooling.)
8. Cool the assembly for an additional 30 minutes before rough handling or tapping the main. (If step 7 melt patterns were not satisfactory or if the fusion bead is unacceptable, cut off the saddle fitting above the base to prevent use, relocate to a new section of main, and make a new saddle fusion using a new fitting.)

NOTE:

These procedures are based on tests conducted under controlled ambient temperature conditions. Environmental conditions on a job site could affect heating and cooling times. Regardless of job site conditions or ambient temperature, the prescribed heating tool temperature is required. Do not increase or decrease the heating tool temperature.

** See the next 2 pages for examples of correct and incorrect saddle/sidewall fusion joints**

Acceptable Fusions

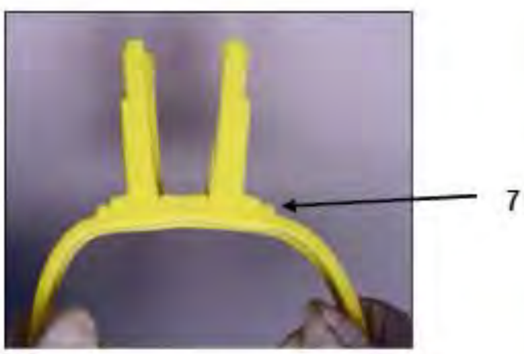


1. Proper alignment, force and melt
2. Proper pipe surface preparation

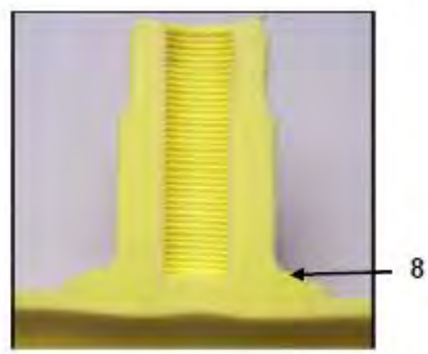
3. Proper alignment, force and melt
4. Proper pipe surface preparation

5. Melt bead below or parallel with top of fitting base

6. Material pulled from pipe when impact tested

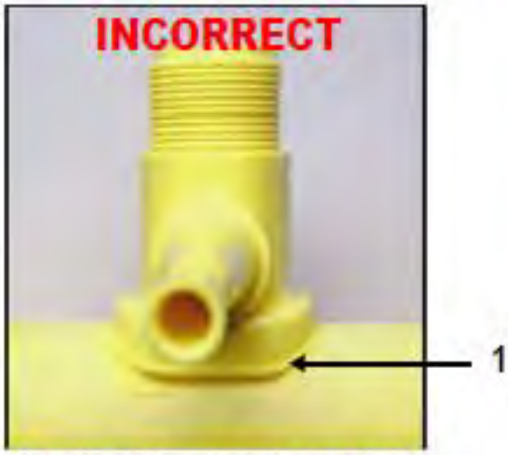


7. No gap or voids when bent

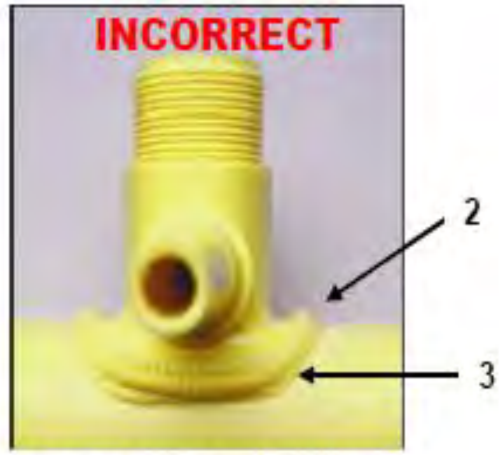


8. No gaps or voids at fusion interface

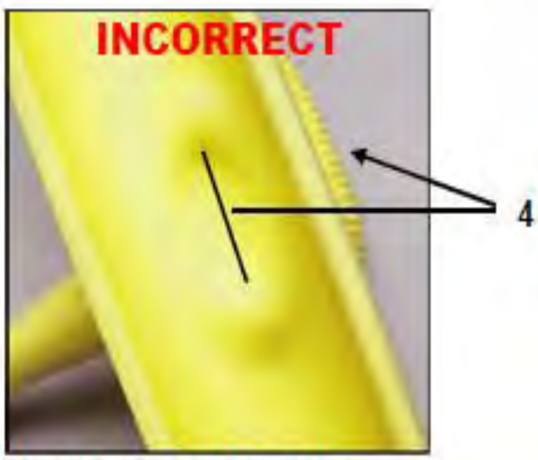
Unacceptable Fusions



1. Insufficient melt and misaligned



2. Bead above base of fitting
3. Excessive melt and force



4. Excessive melt and force

5. Insufficient melt

Bend Back Testing of Saddle Fused Joints

For Gas Utilities, refer to DOT CFR 192.285 for qualifying persons to make joints.

1. Prepare fusion joint samples. Pipe on either side of the fitting should extend at least 6" (150 mm) or 15 times the wall thickness in length. Please refer to **Figure 5** below. For these qualifying procedures, limit the joint samples to pipe wall thickness of no greater than 1 in. (25 mm). Observe the joining process to determine that the correct procedure is being followed.

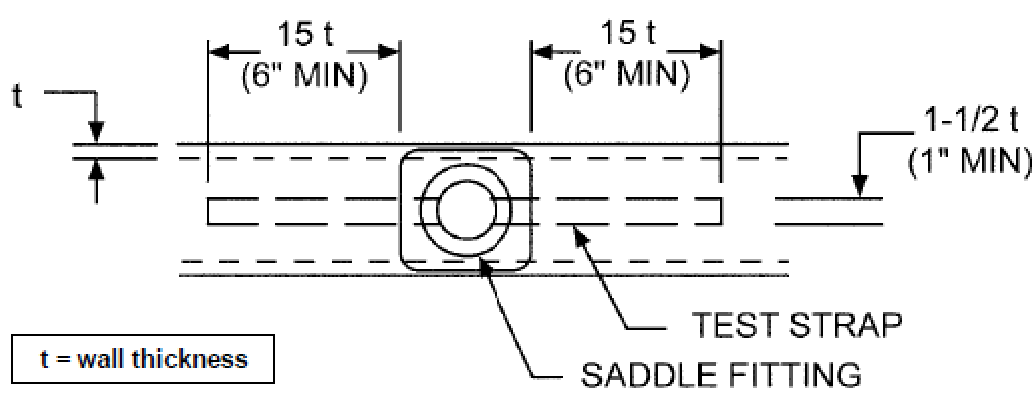
◆ ***WARNING** – Bend testing of pipes with a wall thickness greater than 1 in. (25 mm) can be dangerous and should be done with an approved bending fixture that supports and contains the pipe during testing.*

2. Allow the sample joints to cool for no less than one hour.
3. Cut sample joint lengthwise along the main pipe and through the saddle fitting to prepare a test strap. Please refer to **Figure 5**.
4. Visually inspect the cut joint for any indications of voids, gaps, misalignment of surfaces that have not been properly bonded during the fusion process.
5. Bend test straps at the fusion joint as pictured above. The test strap joint must be free of cracks and separations within the fusion zone.
6. If flaws are observed in the fusion zone, compare appearance with pictures of unacceptable joints. Prepare new sample joints using correct joining procedure and repeat the qualifying procedure.

Alternate Bend Back Testing of Saddle Fused Joints

Test a sample joint by impact against the saddle fitting. Failure must occur by tearing the fitting or bending the fitting at least 45º or removing a section of wall from the main pipe. Failure along the fusion bond line is not acceptable. (Federal regulations require impact tests for procedure qualification, but not for individual qualification.) Refer to ASTM F905.

Figure 5
Saddle Bent Strap Test Specimen



IAMU Procedure #1.5: Joining of Pipe – Electrofusion

NOTE: The following procedure was obtained from the Plastic Pipe Institutes Generic Electrofusion User Guide for Field Joining of Polyethylene Gas Piping TR-49, 2020. All joining must be performed by qualified individuals.

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.

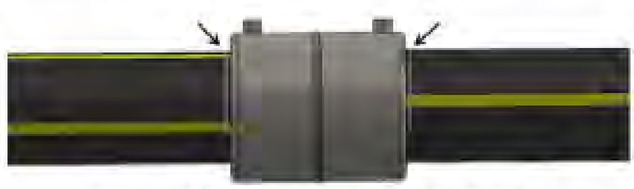


Figure 24: Install fitting to stab depth

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.

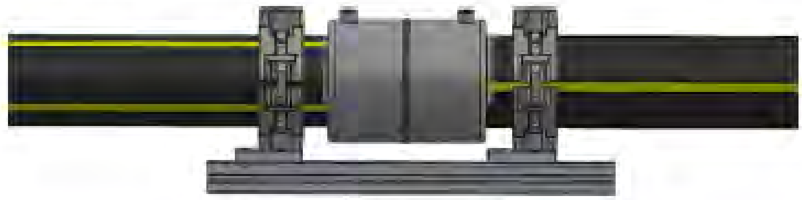


Figure 25: Secure the pipe

8. Connect the fitting to the control box, enter the fusion parameters, and fuse the joint. See "Fusion Parameter" section for details.

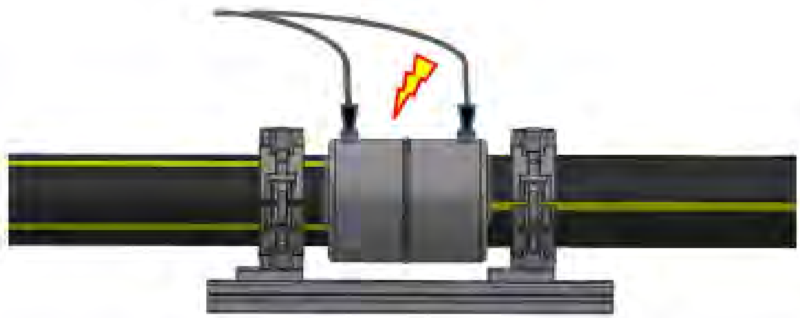


Figure 26: Connect to Control Box

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.**

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.

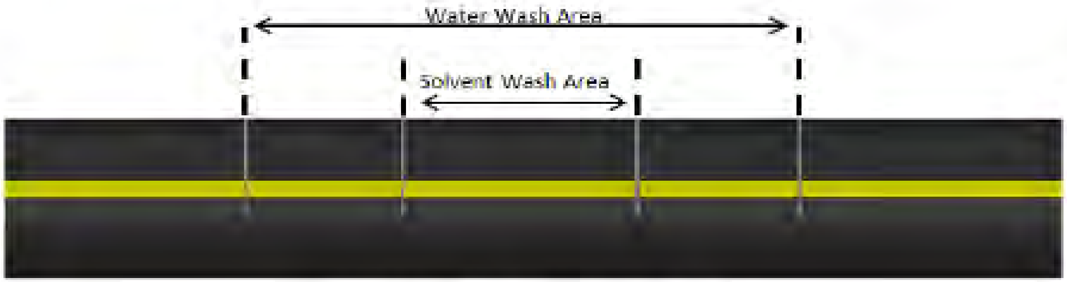


Figure 27: Pipe Wash Areas

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.

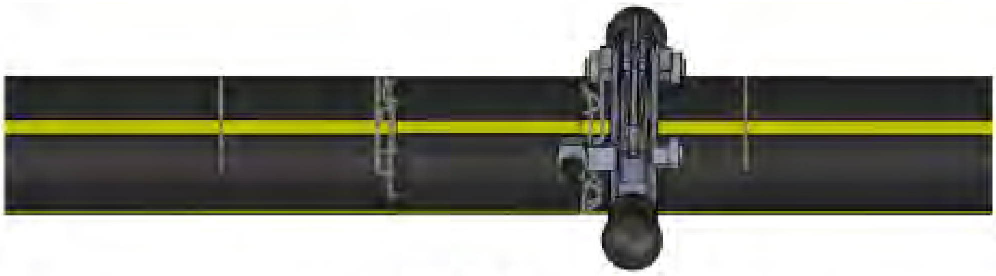


Figure 29: Pipe Scraped Area

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.

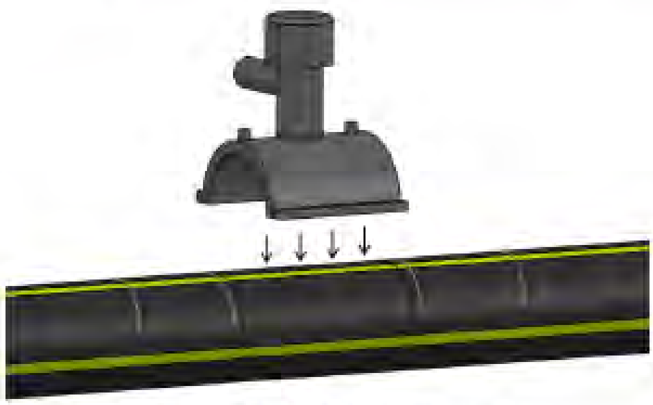


Figure 30: Saddle Placement

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.**

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.

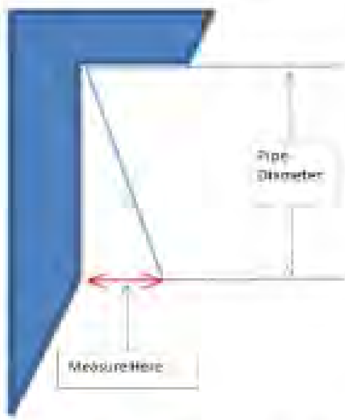


Figure 33: Pipe Square-ness Measurement

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.

Mark insertion depth. Mark entire surface to scrape. Scrape surface. Marks completely removed.

Figure 34: Correct

INCORRECT! Not enough material removed, marks still visible.

Figure 35: Incorrect

- ASSEMBLY/ALIGNMENT/RESTRAINT

Stab depth is correct Alignment clamps used Appropriate saddle clamp used

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.

<u>ASSEMBLY ERROR EXAMPLES</u>

- **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.

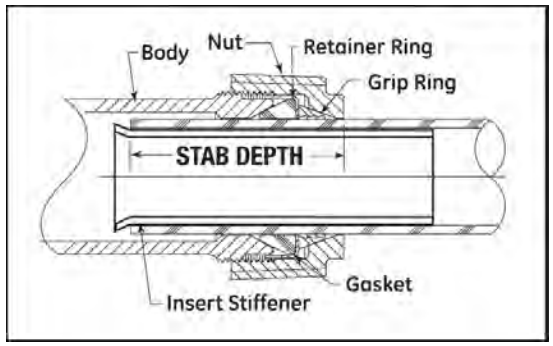
Figure 39: Mis-Cut - Incorrect Assembly

IAMU Procedure #1.6: Joining of Pipe – Threaded Nut Compression End Couplings

NOTE: The following were obtained from Dresser Style Couplings Installation Procedures. All joining must be performed by qualified individuals.

Dresser – Style 90 Universal Couplings and Fittings Installation Procedure

**For PE to PE, PE to Steel, and Steel to Steel (For use on PE Pipe as listed in ASTM D2513)

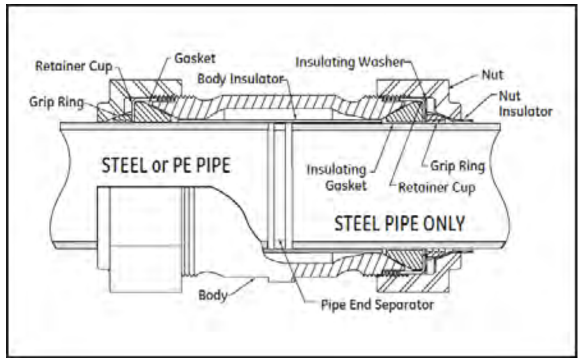


1) Clean steel pipe ends to bare metal removing oil, dirt, loose scale, and rust. PE pipe must be free of dirt, longitudinal scratches, grooves and burrs for a distance of 4" when using 5-inch long middle ring bodies or fitting, and 7" on 10-inch long bodies.
2) On all PE pipe ends, the recommended Dresser insert stiffener must be installed. Before inserting in pipe end, each insert should be checked to ensure that the SDR indicated on the branding corresponds to the SDR of the pipe being used.
3) Remove plastic identification plug from nut, then loosen nut DO NOT DISASSEMBLE coupling. Check inside of the fitting to assure gasket and grip ring are loose and free of dirt or foreign matter.
4) Apply soap-water to the gaskets, only necessary when installing on steel pipe, but also acceptable on plastic pipe (anti-freeze may be added in freezing weather)
5) Mark each pipe a minimum of 2" from pipe end (add ¼" additional stab depth for Plastisol coated fittings). Stab the pipe end into the fitting or coupling until the mark on the pipe is even with the edge of the nut or inside the nut. The insert stiffener must extend beyond the nut as shown in the illustration above.
   CAUTION: A minimum of ½" is required between the pipe ends or pipe end and pipe stop in fitting when connecting steel pipe.
6) Tighten nut(s) independently while holding the body from rotating with a 100 lb. minimum pull on the recommended wrench size as shown in the chart on the right.

Nominal Pipe Size (ID)	Wrench Size (in)
3/4"	14
1"	18
1-1/4"	18
1-1/2"	24
2"	24

Dresser – Style 90 Insulated Restraining Couplings Installation Procedure

**For PE to Steel and Steel to Steel (For use on PE pipe as listed in ASTM D2513)

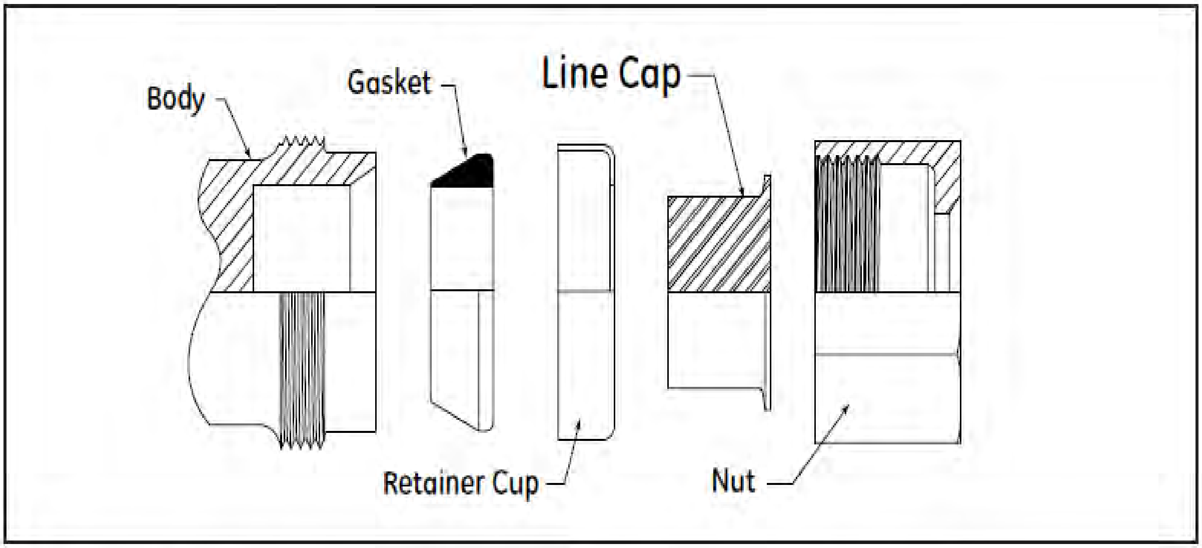


1) Clean steel pipe ends to bare metal removing oil, dirt, loose scale, and rust. PE pipe must be free of dirt, longitudinal scratches, grooves and burrs for a distance of 4" when using 5-inch long bodies.
2) On all PE pipe ends, the recommended Dresser insert stiffener must be installed. Before inserting in pipe end, each insert should be checked to ensure that the SDR indicated on the branding corresponds to the SDR of the pipe being used.
3) DO NOT DISASSEMBLE coupling. Check inside of the fitting to assure gasket, grip ring and insulators are loose and free of dirt or foreign matter.
4) Apply soap-water to the gaskets, only when installing steel pipe (anti-freeze may be added in freezing weather).
5) ON RESTRAINING PIPE END: Mark each pipe 2" from pipe end (add ¼" additional stab depth for Plastisol coated fittings). Stab the pipe end into the fitting or coupling until the mark on the pipe is even with the edge of the nut or inside the nut.
6) ON INSULATED PIPE END: Mark each pipe 2 ¼" from pipe end (add ¼" additional stab depth for Plastisol coated fittings). Stab the pipe end into the fitting or coupling until the mark on the pipe is even with the edge of the nut insulator or inside the nut insulator.
   CAUTION: A minimum of ½" is required between the pipe ends or pipe end and pipe stop in fitting when connecting steel pipe.
7) Tighten nut(s) independently while holding the body from rotating with a 100 lb. minimum pull on the recommended wrench size as shown in the chart on the right.

Nominal Pipe Size (ID)	Wrench Size (in)
3/4"	14
1"	18
1-1/4"	18
1-1/2"	24
2"	24

<u>Dresser – Style 2090 Line Cap Plug Installation Procedures (to be used with Style 90)</u>

**For use during testing, close off of future branch extensions or closure of "dead ends" to seal off abandoned lines.



1. Disassemble fitting end if necessary.
2. Apply soap-water to the gasket, (anti-freeze may be added in freezing weather).
3. Assemble components onto body as shown.
4. Tighten nut while holding the body from rotating. See table for wrench size. Minimum pull is 75 ft. pounds at end of wrench.
5. Pressure rating based on carrier product being used unless otherwise noted.

Nominal Steel Pipe Size (ID)	Wrench Size (in)
1/2"	14
3/4"	14
1"	18
1-1/4"	18
1-1/2"	24
2"	24

In each case, a pull of a minimum 75 pounds must be applied to the end of the wrench.

IAMU Procedure #1.7: Joining of Pipe –Compression Couplings

NOTE: The following was obtained from Dresser Style Couplings Installation Procedures. All joining must be performed by qualified individuals.

Dresser – Style 711 Long Body Couplings Installation Procedure

**For PE to PE, PE to Steel, and Steel to Steel (For use on PE Pipe as listed in ASTM D2513)

1) Clean the steel pipe ends removing oil, dirt, loose scale, and rust; the gasket should seat on bare metal. PE pipe must be fee of dirt, longitudinal scratches, grooves and burrs.
2) On all PE pipe ends, the recommended insert stiffener must be installed. Before inserting in pipe end, each insert should be checked to ensure that the SDR indicated on the branding corresponds to the SDR of pipe being used.
3) Install the proper insert in each PE pipe end.
4) For insertion: PE pipe 6" and smaller should be marked 4" from pipe end; 8" PE pipe should be marked 5" from pipe end. Steel pipe 6" and smaller, mark pipe for minimum pipe entrance of 3-1/2"; for 8" steel pipe, mark pipe for a minimum pipe entrance of 4-1/2"; for 12" steel and PE pipe, mark pipe for a minimum pipe entrance of 6".
5) Check the inside of the coupling to assure that gaskets and grip rings are free of dirt or foreign matter.
6) After gaskets are clean, apply soap-water to gaskets and pipe ends (anti-freeze should be added in freezing weather).
7) Without disassembling, stab coupling to mark on pipe.
8) Stab other pipe to mark located on pipe end.
9) Tighten nuts uniformly and evenly in a crisscross pattern, applying one or two turns to a nut at a time, up to final torque of 35 ft/lbs. minimum on the 1-1/4" size, and 80 ft/lbs. minimum on sizes 2"-12".
10) When field coating, do not box coat with hot enamel coating.

IAMU Procedure #1.8: Joining of Pipe –Stab Fittings

NOTE: The following were obtained from Elster Perfection and Continental Stab Coupling Installation Procedures. All joining must be performed by qualified individuals.

<u>Permasert 1.0 Mechanical Coupling Installation Procedure</u>

**For PE to PE connections.

1. Cut the PE piping so that the end is square.

2. Wipe with a clean dry cloth. Inspect the last several inches of PE piping for damage. If any, cut again to remove damaged area.

3. Use the Elster Perfection chamfering tool for a proper O.D. chamfer. This chamfer permits the PE piping to be completely stabbed without affecting the internal seals.

4. Use a soft felt tip pen, crayon or grease pencil to mark the stab depth as indicated on your Permasert package instructions. The stab depth is the approximate distance from the edge of the fusion bead to the end of the fitting body.

5. Stab the PE piping into the Permasert fitting so that the stab depth mark is visible:

   - Within 1/8" of moisture seal on 1/2" CTS and 1" CTS sizes
   - Within 1/4" on all other sizes through 1-1/4" CTS
   - Approximately 3/8" on 1-1/4" IPS and 2" IPS sizes

   The PE piping must bottom out in the fitting. Pressure test the joint in accordance with your standard procedures. The reference mark can move outward up to an additional 3/8" during pressure testing.

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<u>Permasert 2.0 Mechanical Coupling Installation Procedure</u>

**For PE to PE connections.

- **A** A Permasert 2.0 Coupling: Molded from PE4710 resin. Meets or exceeds US DOT Part 192; ASTM D2513, Category 1; ASTM F1924; NFPA 58; CSA 137.4. IAPMO/UPC listed.
- **B** Spacer Retainer Ring: Centers pipe and provides a redundant activation mechanism for the collet.
- **C** Thrust Washer: Provides even distribution of force on the collet.
- **D** Stiffener: Zinc-plated steel stiffener guarantees proper alignment and adds support for full restraint.
- **E** Seals: BUNA-N (Nitrile) elastomers provide a redundant sealing system.
- **F** Collet: Tapered gripping collet prevents pipe pull-out.

SPECIFICATIONS

COUPLING COMPONENTS

Body: Gas Grade Polyethylene (PE4710)
Collet: Acetal (POM)
Thrust Washer: Polyethylene (PE)
Seals: BUNA-N (Nitrile)
Spacer Retainer Ring: Acetal (POM)
Stiffener: Zinc-Plated Carbon Steel

TESTING

Pull-Out Resistance: ASTM D2513 Category 1

- 0.2 ipm
- 20 ipm
- Full Seal + Full Restraint, PE Yields

Hydrostatic: ASTM D1598

- 670 psi (4.6 MPa) Hoop Stress
- 176°F (80°C)
- Pass

Quick Burst: ASTM D1599

- Pass

PRESSURE RATINGS

Couplings are designed to meet or exceed the maximum allowable operating pressure (MAOP) requirements of the piping system: 125 psig MAOP, or the rating of the installed tubing.

SIZES

½ in. CTS through 2 in. IPS

INSTALLATION PROCEDURE

Note: This quick-install image guide is for reference only. Permasert 2.0 couplings require training on the complete installation procedure before installing any Permasert 2.0 product.

1. Cut the tubing so that the end is square.

2. Wipe the tubing with a dry, clean cloth.
3. Inspect the tubing for surface defects.

4. Insert tube and rotate in chamfer tool until tube bottoms out.

5. Mark the stab depth.

6. Stab tubing into the coupling until it bottoms out.

7. Pressure test the finished joint according to your company's standard operating procedure.

For more information
permasert2.0@honeywell.com

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Certified System — SAI GLOBAL ISO 14001 Environmental
Certified System — SAI GLOBAL ISO 9001 Quality
Certified System — SAI GLOBAL OHSAS 18001 Health & Safety

DS-20-02-ENG | 08/20

THE FUTURE IS WHAT WE MAKE IT

Honeywell

<u>**Permasert Mechanical Repair Coupling Installation Procedure**</u>

**For PE to PE connections.

❶ The Telescoping Permasert coupling outlet makes repairing a damaged service line easier. The specific length of pipe to be cut out is indicated on the "CAUTION" labeled side of the repair coupling and in the instructions included with the repair coupling.

❷ Wipe the remaining pipe ends with a dry, clean cloth. Inspect the last several inches of the pipe ends for damage. Use the Elster Perfection chamfering tool for a proper O.D. chamfer.
This chamfer permits the pipe to be completely stabbed without affecting the internal seals.

❸ Mark stab depths at the proper distance from the chamfered ends. The stab depth is determined by measuring the distance from the end of the coupling outlet to the second fusion bead on the "CAUTION" labeled end of the coupling, and to the fusion bead on the opposite end.

Note: DO NOT pull out stiffener, this will make the coupling outlet nonfunctional.

❹ Stab a pipe end into the "CAUTION" labeled end of the coupling so that the stab depth mark is just visible. The pipe end must bottom out in the coupling.

Note: "CAUTION" labeled end MUST be stabbed first.

To complete the second stab, the Permasert's telescoping stiffener allows the coupling to slide toward the other pipe end and stab the coupling. The stab depth mark on this side will look just like all other Permasert couplings, just visible. Notice how the stab depth mark is several inches away from the coupling on the "CAUTION" labeled end due to the telescoping stiffener.

Pressure test the finished joint according to your standard operating procedure.

www.elster-perfection.com

elster Perfection

Continental Mechanical Coupling Installation Procedure

**For PE to PE connections.

IMPORTANT

For use on:
Polyethylene gas pipe meeting the requirements of ASTM D 2513

Pressure Rating: 125 psig MAOP

Operating Temperature: -20 to 140° F

1 Verify the stab fitting is the correct size for the polyethylene (P.E.) pipe. Verify the SDR (or wall thickness) of the pipe matches the SDR (or wall thickness) printed on the fitting label.

2 Cut pipe ends square.

3 Clean piping thoroughly to assure there is no dirt, grease or oil in assembly area.

4a Chamfer end of pipe using Continental's ID chamfering tool with ID gauge.

or

4b Chamfer end of pipe using Continental's double ended ID chamfering tool.

5 Mark the stab depth by inserting pipe into ID chamfer tool and marking the pipe at the entrance as shown.

6 If using ID chamfer tool with gauge, check for proper chamfer by inserting pipe on gauge up to the o ring. With proper chamfer, o ring will begin to enter pipe.

Proper Chamfer

Improper Chamfer

7 Stab pipe completely into fitting entrance.

8 Stab pipe completely into fitting so that the mark on the pipe is within 1/8" from the fitting entrance.

9 Repeat steps 1 thru 8 for all Con-Stab joints.

10 To assure proper assembly and to comply with 49 CFR 192 Subpart J—Test Requirements, the joint shall be leak tested.

IAMU Procedure #1.9: Joining of Pipe –Mechanical Compression Collar Fittings

NOTE: The following were obtained from Lyco-Fit Mechanical Coupling Installation Procedures. All joining must be performed by qualified individuals.

QRP-100

LYCO® Quick Ratchet Press

Installation Procedure For LYCOFIT® Gas Fittings

IMPORTANT:

1. **DO NOT** apply lubricants to fitting's spigot or sleeves.
2. Squeeze off PE pipe when using coupling for repair OR line extension to insure flow is stopped.
3. The **QRP-100** tool is intended for installing **LYCOFIT®** couplings and fittings only.
4. **LYCOFIT®** couplings are designed to be installed on O.D. controlled polyethylene pipe only. Examine pipe and coupling labels and install coupling and Fittings only to pipe with correct size and wall thickness/SDR dimensions.

INSTALLATION OVERVIEW and PRECAUTIONS

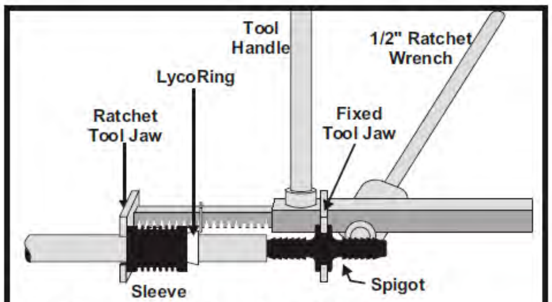


Fig. A Using LycoRing

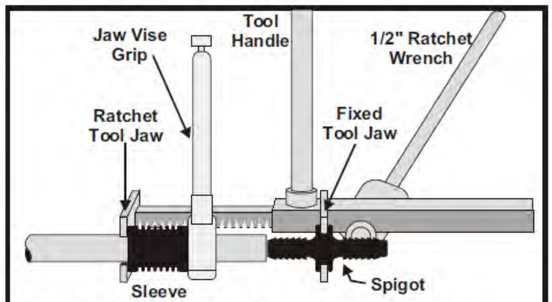


Fig. B Using Jaw Vice Grips (optional)

A The QRP-100 Quick Ratchet Press is for installing **LYCOFIT®** ½" CTS, ¾" CTS, 1" CTS, ½" IPS, ¾" IPS, 1" IPS, and all smaller sized Metric Couplings and Fittings, including Tapping Tee outlets, Field assembled transitions, and Lyall Risers with optional **LYCOFIT®** connections.

B. This manual covers installation of **LYCOFIT®** fittings using the **QRP-100 Tool** and either **LycoRing (Fig. A)** or optional **Jaw Vise Grip (Fig.B)** for PE pipe advancement onto the fitting's Spigot.

C. Before installing PE pipe couplings, screw the tool handle to the top of the tool and attach a long handled 1/2" Ratchet Wrench (not supplied by Lyall.) to the socket on the side of tool. The fitting orientation shown is for illustration purposes only. Nest the fitting in the saddle of either tool jaw (fixed jaw is shown).

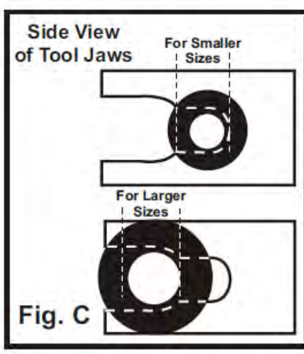


Fig. C

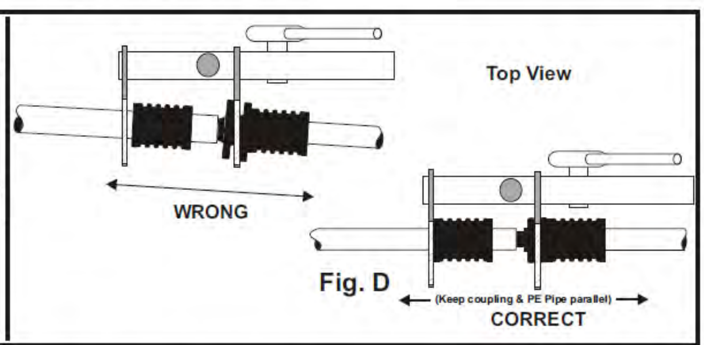
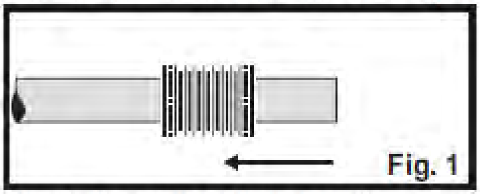


Fig. D

Caution: To prevent possible damage to the PE pipe, ensure that the spigot is fully seated in the tool jaw (see *Fig. C*), and that the tool and pipe/coupling is square (see Fig. D) so that the pipe does not drag on the edges of the tool jaw.

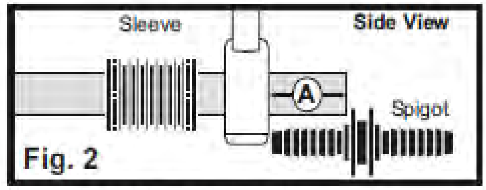
How to install Double Ended Couplings



Step 1 Completion Sleeve Insertion

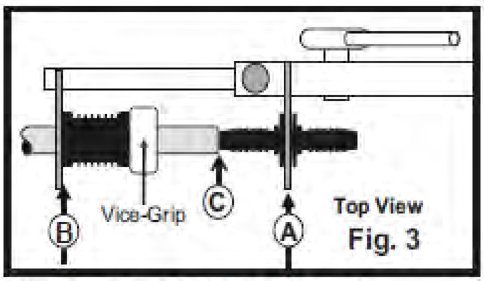
A) Slide the completion sleeve onto end of PE pipe.

Note: Completion sleeves are non-directional and can be slid onto the pipe via either end.



Step 2 Vise Grip Placement

A) Clamp the vise grip jaw on PE pipe at distance "A" as shown in Fig. 2, using the spigot as a measurement guide.

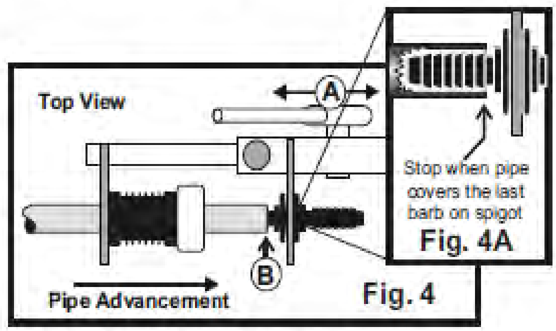


Step 3 Inserting Fitting into Tool

A) Nest the spigot in the saddle of either jaw (spigot shown nested in fixed jaw above).

B) Position tool around the pipe and outside edge of sleeve.

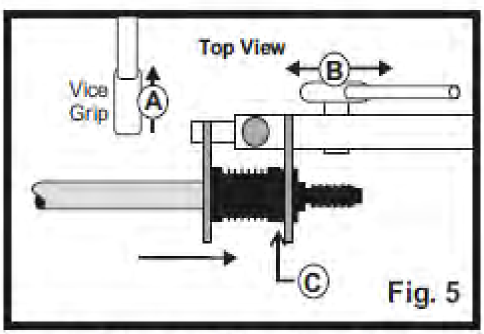
C) Align the pipe to the spigot and push over the spigot end, stopping at the first barb of the spigot (See "C" in Fig. 3).



Step 4 Advancing Pipe over Spigot

A) Operate the ratchet and advance pipe over spigot.

B). Stop advancement when pipe covers the last barb on spigot (See Fig 4A).

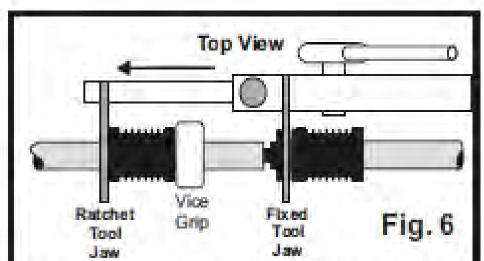


Step 5 Advancing Sleeve over Spigot

A) Release vise grip and remove from pipe area.

B) Advance the sleeve over the pipe and spigot by operating the ratchet.

C) Stop sleeve advancement when the sleeve is fully inserted over the spigot (See "C" in Fig. 5)



NOTE: The spigot is placed back into the tool Jaw for installing opposite end of fitting (spigot shown nested in fixed jaw above).

Step 6 Complete Fitting

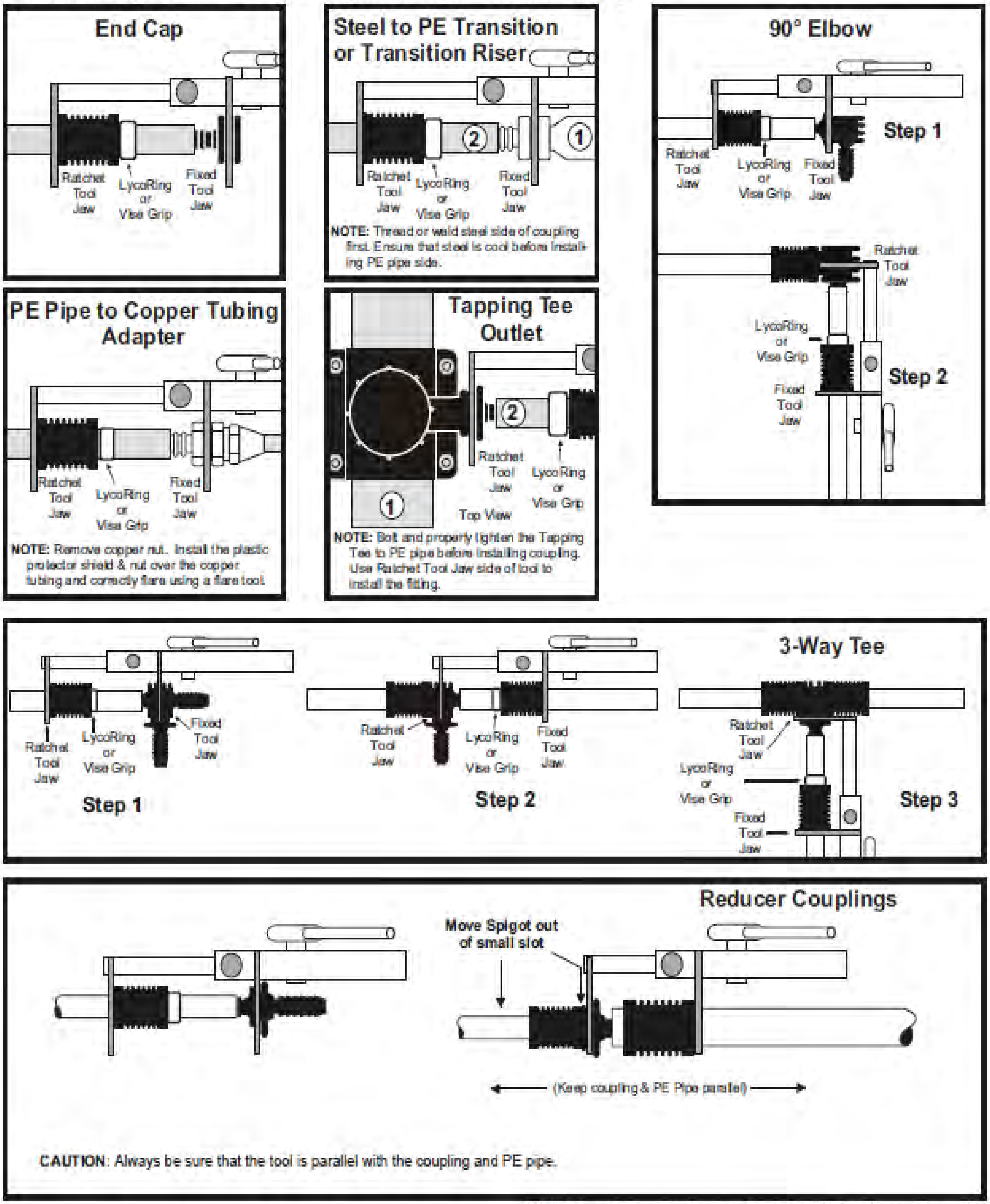
A) To assemble the opposite side of the coupling, repeat steps 1 through 5 above.

Step 7 Test Completed Fitting (For gas fittings)

Pressure test each fitting after installation to comply with the minimum pipeline test requirements as specified in **D.O.T. Title 49, Part 192, Sub Part J-Test Requirements.**

INSTALLING OTHER LYCOFIT® FITTINGS

Please note that the following illustrations are to be used as guides for the proper location of the spigot flange of each type of LYCOFIT® fitting and unless otherwise noted the spigot may be nested in either tool jaw as determined by the installer with no adverse effects to performance. After initial setup, follow Steps 1-5 as outlined on pages 1-3.



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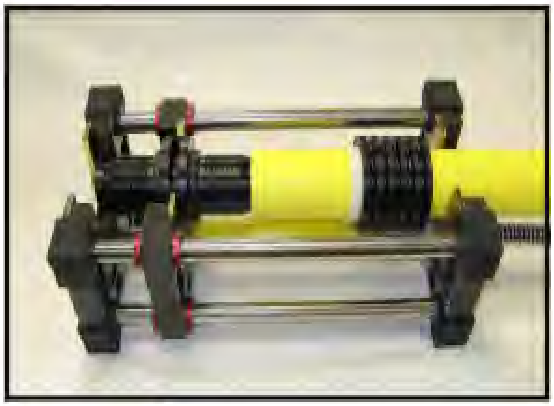


LHP-200

LYCO® Hydraulic Press

Installation Procedure For LYCOFIT® Fittings

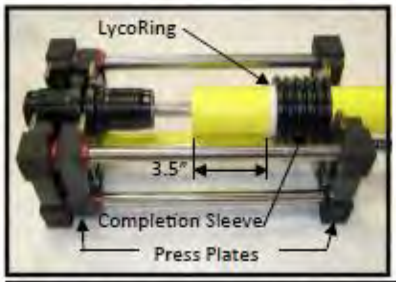
Important:

1. Lubricate **LHP-200** shafts with **non** synthetic lubricant (e.g. 3in1 oil) **ONLY**.
2. **DO NOT** apply lubricants to the fittings, spigots or sleeves.
3. When installing a fitting to repair a pressurized pipe, insure that the area of repair is isolated from the pressure supply before cutting the PE pipe.
4. The **LHP-200** is intended for installing **LYCOFIT®** fittings only.
5. **LYCOFIT®** fittings are designed to be installed only on O.D. controlled Polyethylene (PE) pipe made per ASTM D2513 & ASTM D2619. Examine the pipe print line and fitting labels and install fittings only to pipe with the correct size designation and wall thickness/DR.
6. If the installation is for use in Natural Gas pipe lines, pressure test each assembled joint in compliance with minimum requirements as specified in **D.O.T. CFR Title 49 Part 192, Sub Part J.**

Scope:

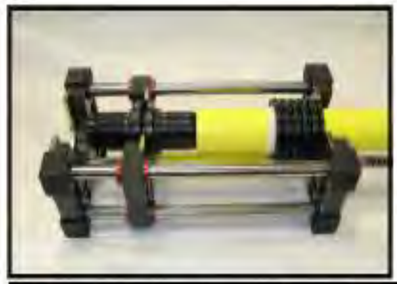
1. These instructions cover the use of the **LHP-200** to install **LYCOFIT®** fittings using LycoRing®.
2. The **LHP-200** Lyco® Hydraulic Press is for installation of **LYCOFIT®** 1-¼ IPS, 1-½ IPS & 2 IPS size fittings, field assembled transitions and Lyall risers with optional **LYCOFIT®** connections.
3. The **LHP-200** requires a hydraulic source to operate. The AHP100 (ENERPAC™ P142) is available through Lyall as a hand pump source for operating the **LHP-200**. Other hydraulic power sources (e.g. ENERPAC PA-133) with an output greater than 5500 psig may be used. The pump source should be limited to an output of 6500 psig to restrict the stress applied to the tool during installation of the fitting. (ENERPAC pump adjustment instructions are available by request from your customer service representative.)

LHP-200 Installation Procedure For LYCOFIT® Fittings Using LycoRing®



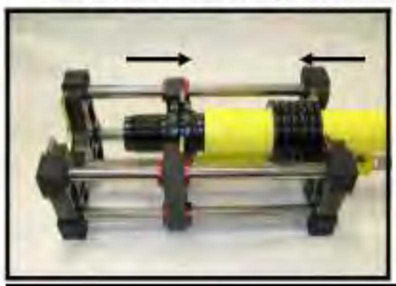
1) Preparing to Assemble First Joint

1. Slide the Sleeve and then **LycoRing®** onto the pipe so that the **LycoRing®** is approximately 3.5" from the end of the pipe.
   Note: (Make sure the pipe is reasonably clean)
2. Nest the fitting in the saddle of either press plate.
   Note: (Movable press plate shown)
3. Place the tool so that the press plate opposite of the fitting is behind the completion sleeve.



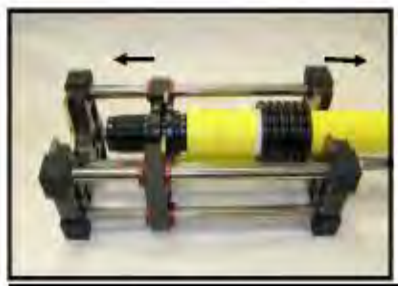
2) Engaging the pipe on the spigot

1. Slide the PE pipe over the nose of the fitting and pump the **LHP-200** until press plate is in contact with the completion sleeve.
   Note: Make sure that the completion sleeve engages the **LycoRing®** and that the **LycoRing®** does not slip along the PE pipe.



3) Advancing the pipe over the spigot

1. Operate the hydraulic pump to move the press plate and advance the spigot into the PE pipe until the pipe covers the last spigot barb.



4) Remove the LycoRing®

1. Release hydraulic pressure and allow the jaw to open enough to pull the sleeve back and expose the **LycoRing®** and remove it by pulling the tab.

5) Complete the Joint

1. Operate the hydraulic pump to move the press plate and advance the completion sleeve over the pipe and spigot. Stop pumping when the sleeve face is in contact with the fitting flange.

6) Complete Second Joint

1. To assemble the opposite side of the fitting, fully open the tool and repeat steps 1 through 5.

CUSTOMER SERVICE: 1 (800) 535-9255

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Page 2

Rev. 1B (130102)

IAMU Procedure #1.10: Joining of Pipe – Bolt-on Tapping Tee

NOTE: The following were obtained from the Continental and Perfection Permalock Bolt-on Saddle Tee Installation Procedures. All joining and hot taps must be performed by qualified individuals.

Continental Steel Mechanical Bolt-on Saddle Tee Installation Procedures

1) DO NOT install tee on a steel pipeline with a wall thickness greater than 0.280".
2) Inspect bolt-on saddle tee for damage to the fitting and its components.
3) Select location on main pipe suitable for installation of tee, remove pipeline coatings from the main and clean pipe to bare metal.
4) Inspect the area where the bolt-on saddle is to be installed and ensure that the elastomer seal is not installed over pits or gouges where the ability to seal might be compromised.
5) Remove the saddle bolt and inspect the elastomer seal for damage or dis-bonding from the upper saddle.
6) Ensure that the saddle punch is fully retracted within the tee.
7) Place saddle on the prepared site on the main.
8) Replace saddle bolt and tighten using a torque wrench to 25 to 40-foot pounds being careful not to move/roll the saddle while tightening as the elastomer seal can be damaged.
9) If a torque wrench is not available, the required torque can be achieved using either a 12" ratchet or a 12" smooth faced wrench.
10) Remove completion cap and if necessary, the coupon retaining punch.
11) Attach the service line pipe to the tee body and extend the service line pipe to the meter valve.
12) Preform a pressure test on the service tee and service line according to IAMU Procedure #5.1 or 5.2 - Pressure Testing Pipelines.
13) Before re-inserting coupon retaining punch, it is recommended that a liberal amount of lubricant be applied to the internal threads of the service tee to greatly increase the tapping efficiency of the punch.
14) Insert punch in service tee and turn clockwise by hand to avoid cross threading.
15) Using a ratchet wrench with Continental drive key and bushing, rotate the punch clockwise until the punch seats on the main. DO NOT stop before the punch fully seats on the main as the coupon may not be retained.
16) To allow gas to the service line, rotate the punch counter-clockwise until the punch is flush with the top of the tee and purge line.
17) Apply thread sealant and install cap. Once tightened, check for leaks with leak solution or CGI.
18) After installation is complete, clean, prime and wrap any bare metal surfaces with an approved pipeline primer &/or coating.

<u>Perfection Perma-lock Tapping Tee Installation Procedures</u>

1) Remove tee assembly and depth tube from the bag and check the tee for tower and saddle O-rings.
   a) A blue colored depth tube is required for 1 ¼" IPS main installation, and a white colored depth tube is required for 2-4" IPS main installation. If you do not have the proper color depth tube, DO NOT install the fitting.
2) Clean surface of the PE main where the tee is be installed. Avoid areas that are gouged or damaged as a proper seal may not be obtained. Lubricate the saddle O-ring and main pipe surface with leak soap solution or silicone grease.
3) Bolt tee onto PE main and tighten until the corners touch using a crossover tightening pattern. A gap between the flanges in the locating pin area is acceptable. DO NOT over tighten!!
4) Attach the service line pipe to the tee body and extend the service line pipe to the meter valve.
5) Preform a pressure test on the service tee and service line according to IAMU Procedure #5.1 or 5.2 - Pressure Testing Pipelines.
6) Place depth tube on top of the cutter assembly. Turn thread cutter assembly downward (clockwise) using a 5/16" hex wrench. Continue threading the cutter assembly downward until it becomes snug. The depth tube is a visual guide and will be approximately flush with the top of the tee tower when the cutter is snug.
7) Thread cutter upward (counter-clockwise) until top of cutter is flush is with the top of the tower. This will now allow gas to flow into the service line and the purged.
8) Remove and discard the depth tube.
9) Install tower cap and hand tighten to cap top. DO NOT over tighten! Test tower cap for leaks using leak solution or CGI.

IAMU Procedure #1.11: Joining of Pipe – Flange Assembly

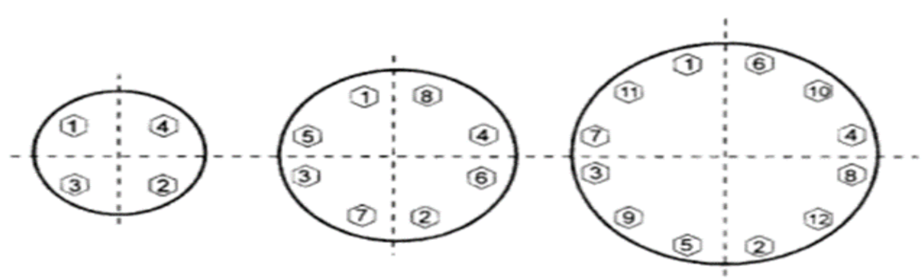
Non-Insulated Flange Installation Procedures

Preparation:

1. Inspect the flange face for any defects that may impair the ability to seal (metal burrs, scratches, gouges, etc.).
2. Clean the faces of the flange until they are free of dirt, rust, scale coating and old gasket material.

Assembly:

1. To ensure a proper fit and seal, the flange faces should be installed parallel to each other and the bolt holes aligned (drift pins or center punches may be necessary to obtain the proper alignment).
2. Ensure that the correct grade, size, and length of bolt or stud bolt is being used for the specific flange being assembled. *Remember: Ensure the bolt extends at least two threads past the nut after final tightening (Standard from ASME/ANSI B 16.5 and MSS SP-44).*
3. Lubricate the bolts or stud bolts with an approved thread lubricant, unless using Teflon coated bolts, then lubrication is not required. DO NOT lubricate the surface of the flange face.
4. Align and center the gasket between the two flange faces.
   a. Depending on the type of gasket being used for the application, it may be necessary to install a bolt or two in the bottom of the flange before aligning the gasket so that the gasket does not slip out of the gap between the flange faces before tightening.
5. Insert all bolts or stud bolts, including washers, one at a time, through the holes in the aligned flange faces and tighten nuts "hand tight".
6. After all bolts are "hand tight", begin lightly tightening, with a wrench, each bolt in a diametrically opposite pattern until all the bolts have been tightened and the gasket begins to depress.
   a. It is critical that during this step, the gap between the flange faces is kept consistent around the flange face as not to damage the gasket or put strain on the joint.



7. Once all bolts have been tightened in the diametrically opposite pattern to the point where the gasket is being depressed, the bolts may be final tightened using a circle pattern until all bolts have been completely secured.
    a. It may be necessary to tighten to a torque specification depending upon the flange and the application of the installation. Always follow the manufacturer's recommended procedures for final tightening of the bolts. DO NOT overtighten.
    b. It may be necessary to check or re-torque the bolts after 24-48 hours has passed.
8. Once final tightening of the bolts has been accomplished, perform a leak check on the flange joint using leak solution or a CGI to ensure the joint is gas tight.
9. If the joint is NOT gas tight and the bolts have been torqued to the required specification, DO NOT continue to tighten bolts as damage may be caused to the gasket or flange. If necessary, unbolt flange, re-inspect gasket and flange faces and repeat installation procedure.

Insulated Flange Installation Procedures

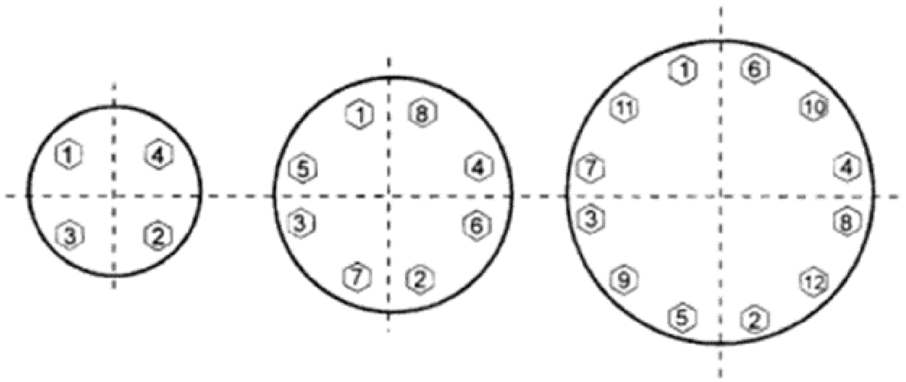
Preparation:

1. Inspect the flange face for any defects that may impair the ability to seal (metal burrs, scratches, gouges, etc.).
2. Clean the faces of the flange until they are free of dirt, rust, scale coating and old gasket material.
3. Check to make sure that all components of the insulating kit (insulating gasket, insulating sleeves and insulating washers) are not damaged. If damaged, components should be replaced before installation.

Assembly:

1. To ensure a proper fit and seal, the flange faces should be installed parallel to each other and the bolt holes aligned (drift pins or center punches may be necessary to obtain the proper alignment).
2. Ensure that the correct grade, size, and length of bolt or stud bolt is being used for the specific flange being assembled. *Remember: Ensure the bolt extends at least two threads past the nut after final tightening (Standard from ASME/ANSI B 16.5 and MSS SP-44).*
3. Lubricate the bolts or stud bolts with an approved thread lubricant, unless using Teflon coated bolts, then lubrication is not required. DO NOT lubricate the surface of the flange face.
4. Prepare bolts with insulting sleeves and insulating washers before inserting into flange by first sliding on the metal washer, then the insulating washer and then the insulating sleeve. The insulating washer should always be between the metal washer and the back of the flange.
5. Insert bottom two bolts with insulating sleeves and washers already prepared into aligned flange faces. This will prevent the gasket from sliding out the bottom side of flange. When inserting the bolts into the flange holes, DO NOT force with a hammer, as you can damage the insulating sleeve or washer.
6. Install and center the new gasket in between the flange faces.
7. Insert the remaining bolts with insulating sleeves and washers already prepared into the flange. Remember, DO NOT force with a hammer.
8. When installing the nuts on the bolts, remember to install the insulating washer first, then the metal washer, then the nut. The metal washer should always be between the nut and insulating washer. This process must be completed on at least one side of the flange face.
9. Initially tighten all nuts and bolts "hand tight".

10. After all bolts are “hand tight”, begin lightly tightening, with a wrench, each bolt in a diametrically opposite pattern until all the bolts have been tightened and the gasket begins to depress.
    a. It is critical that during this step, the gap between the flange faces is kept consistent around the flange face as not to damage the gasket or put strain on the joint.



11. Once all bolts have been tightened in the diametrically opposite pattern to the point where the gasket is being depressed, the bolts may be final tightened using a circle pattern until all bolts have been completely secured.
    a. It may be necessary to tighten to a torque specification depending upon the flange and the application of the installation. Always follow the manufacturer’s recommended procedures for final tightening of the bolts. DO NOT overtighten.
    b. It may be necessary to check or re-torque the bolts after 24-48 hours has passed.
12. Once final tightening of the bolts has been accomplished, perform a leak check on the flange joint using leak solution or a CGI to ensure the joint is gas tight.
13. If the joint is NOT gas tight and the bolts have been torqued to the required specification, DO NOT continue to tighten bolts as damage may be caused to the insulators, gasket or flange. If necessary, unbolt flange, re-inspect gasket and flange faces and repeat installation procedure.
14. After installation is complete and joint is gas tight, perform an electrical test to ensure the joint is insulated.

IAMU Procedure #1.12: Tubing and Fitting Installation (Instrument, Control, and Sampling)

NOTE: This procedure is to be used when installing stainless steel tubing for odorization or for control lines on regulators and reliefs.

Preparation:

1. The tubing end should be cut squarely using a roll type tube cutter.
2. After cutting, the tube end should be deburred on both the inside and outside diameters.

Measurement:

1. If installing a straight piece of tubing, measure from starting point to ending point to get an exact measurement of the total length of tubing needed. You may consider adding a ¼" to the total length to allow for contraction and expansion.
2. If installing tubing that will require bending or offsets adjustment factors should be considered.
   a. Adjustment factors are determined by the radius of the tube bender and the number of degrees in the desired bend. See below for a table of adjustment factors.

Tube O.D.		½"	3/8"	5/16"	¼"
Bend Radius		1 ½"	15/16"	15/16"	¾"
Bend Angle	90°	5/8"	13/32"	13/32"	5/16"
	80°	7/16"	9/32"	9/32"	7/32"
	70°	9/32"	11/64"	11/64"	1/8"
	60°	5/32"	3/32"	3/32"	5/64"
	50°	3/32"	1/16"	1/16"	3/64"
	45°	1/16"	1/32"	1/32"	1/32"

Making the Bend Using Hand Tube Bender:

1. After taking proper measurements, mark the tube at the appropriate locations before bending.
2. Place the tubing into the hand tube bender.
3. Lower the roll dies onto the tubing and align the 0 on the roll support with the 0 on the nameplate.
   a. If making a 90° bend, align your bend mark with the L mark on the roll support.
   b. If making a 45° bend, align your bend mark with the 45° mark on the roll support.
4. Secure the tubing in the hand bender by closing the tube latch.
5. Bend the tubing by pushing the short handle down until the 0 on the roll support reaches the appropriate degree mark on the nameplate. Allow 1°-3° compensation for tubing spring-back.

IAMU Procedure #1.13: Visually Inspect Butt Fused PE Pipe

NOTE: The following procedure shall be used to visually inspect butt fusion joints for indications of proper joining. All joints shall be identified with name/initials, date and time.

Pipe Condition:

1. Ensure that the pipe is clean and free of any imperfections such as scratches or gouges.
2. Check the fusion joint for any dirt or PE shavings within the melt bead.

Pipe Alignment:

1. To verify proper alignment, check for "hi/low". The pipe ends must be within the acceptable range of alignment (15 mils for 2" pipe).
2. Miter joints are NOT allowed.

Melt Pattern:

1. The melt pattern should be uniform around the circumference of the pipe. The bead should be the same height and thickness all the way around.
2. No gaps or voids should exist in the fusion area.

Bead Size:

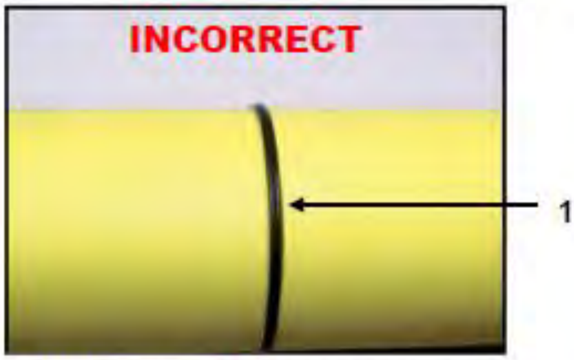
1. Verify that the bead size is within the range specified by the pipe manufacturer.
2. The thickness or roll-back of the joint will depend upon the size of the pipe.

Bead Roll-Back:

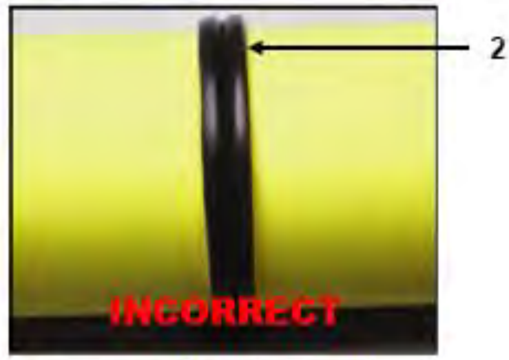
1. The fusion bead should have a two bead (one on each pipe end) roll-back characteristic.
2. The beads should be equal in size, uniform and completely encircle the pipe section.

****See next page for examples of incorrect butt fusion joints****

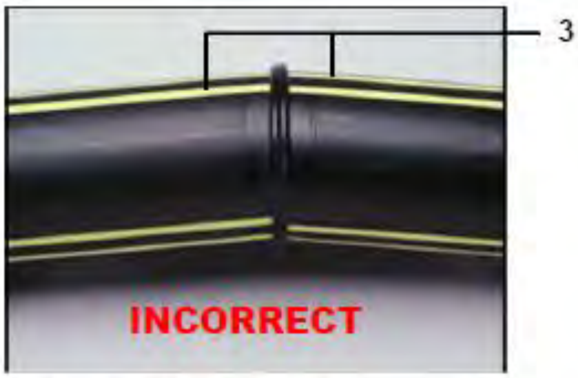
Unacceptable Fusions



1. Insufficient heat time; melt bead too small

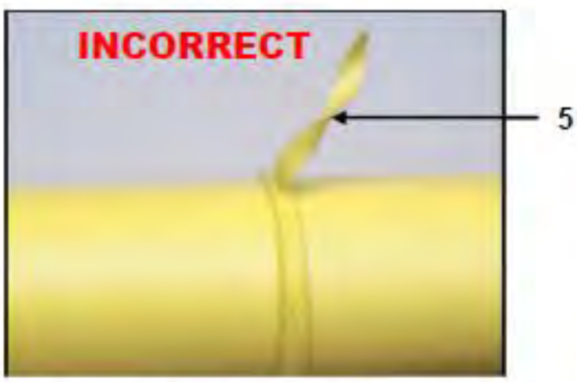


2. Excessive heat time or pressure applies during heating; melt bead too large

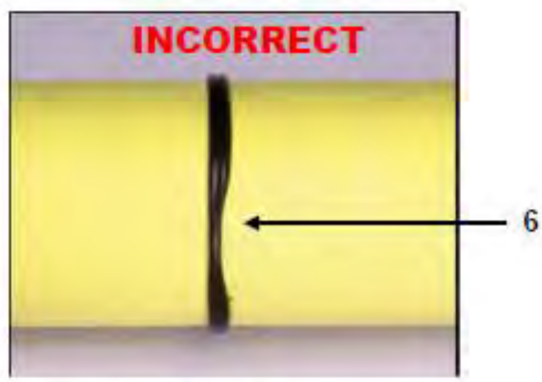


3. Pipe angled into fusion unit

4. Improper "High-Low" alignment



5. Incomplete face off or failure to remove faced off ribbons



6. Incomplete face off

IAMU Procedure #1.14: Visually Inspect Socket Fused PE Pipe

NOTE: The following procedure shall be used to visually inspect socket fusion joints for indications of proper joining. All joints shall be identified with name/initials, date and time.

Pipe and Fitting Condition:

1. Ensure that the pipe and fitting are clean and free of any gouges, scratches, or imperfections.
2. Ensure that the pipe and fitting are of the appropriate size and wall thickness.

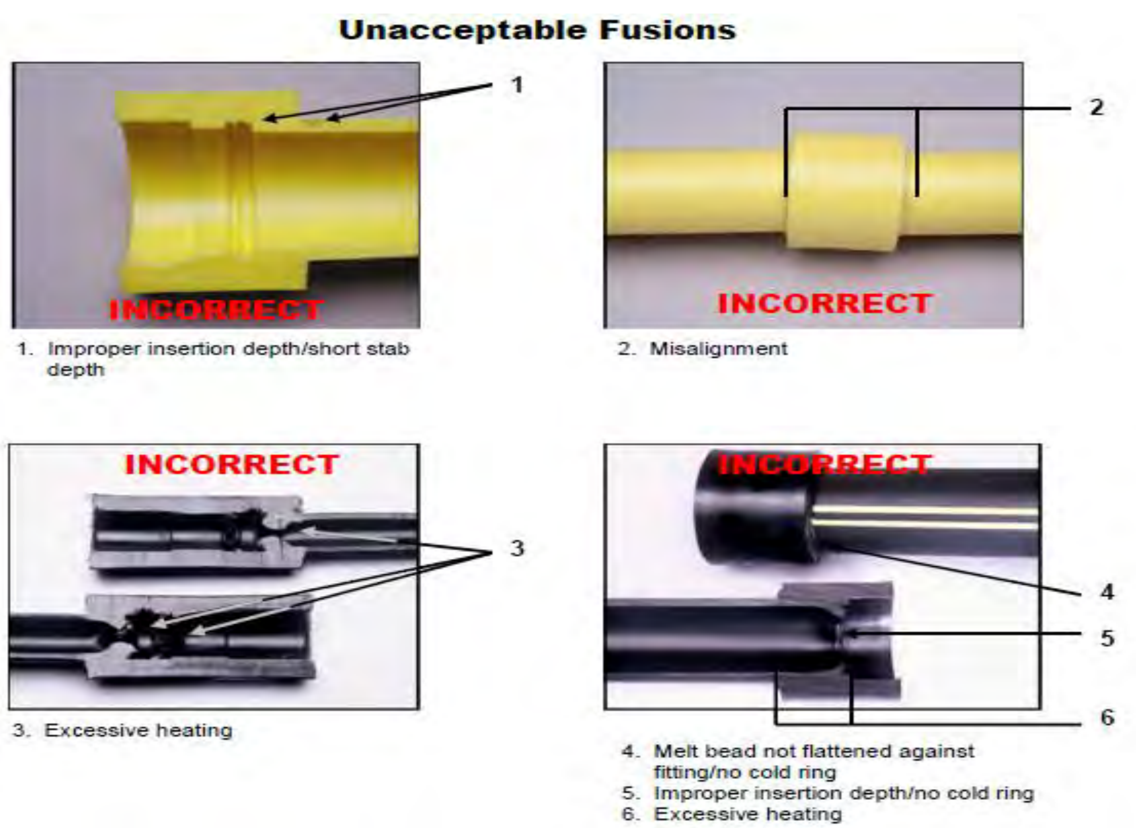
Pipe and Fitting Alignment:

1. Verify that the pipe has been inserted into the fitting to the proper depth with proper alignment.

Melt Pattern:

1. Ensure that the melt bead on the fitting end was flattened by the cold ring clamp.
2. No gaps or voids should exist between the pipe and fitting.
3. The melt pattern should be uniform in size all the way around the pipe and fitting.

<u>****See examples below of incorrect socket fusion joints****</u>



IAMU Procedure #1.15: Visually Inspect Saddle/Sidewall Fused PE Pipe

NOTE: The following procedure shall be used to visually inspect saddle/sidewall fusion joints for indications of proper joining. All joints shall be identified with name/initials, date and time.

Pipe and Fitting Condition:

1. Ensure that the pipe and fitting are clean and free of any gouges, scratches, or imperfections.
2. Look for visual indications that the pipe was properly abraded before joining.

Pipe and Fitting Alignment:

1. The saddle fitting should be properly aligned with the pipe. It should not have the appearance that one side is lower or higher than the other.
2. Ensure that the fitting fits entirely within the pipe melt pattern.

Melt Pattern:

1. Verify that a triple melt pattern has been accomplished around the entire base of the saddle.
2. The three-roll melt pattern should have one bead on the pipe, one on the fitting, and one in between.
3. The overall size of the melt bead must below or parallel with the top of the fitting base.
4. The melt pattern should have no voids or gaps between the fitting and the pipe.

****See examples below of incorrect saddle/sidewall fusion joints****

IAMU Procedure #1.16: Visually Inspect Electrofusion Fittings on PE Pipe

NOTE: The following procedure shall be used to visually inspect electrofusion joints for indications of proper joining. All joints shall be identified with name/initials, date and time.

Pipe and Fitting Condition:

1. Ensure that the pipe and fitting are clean and free of any scratches, gouges, or imperfections.
2. Ensure that the pipe and fitting are of the appropriate size and wall thickness.
3. If possible, look for proper pipe scraping outside of the fusion area. Not all scraping tools will scrape past the fusion area. Scraping should be visible on the pipe surface when visually inspecting electrofusion saddle tee joints.

Pipe and Fitting Alignment:

1. Look for indications of proper stab depth for pipe couplings (a stab depth reference mark may be visible).
2. The joint should not have an "angled or mitered" appearance.

Melt Pattern:

1. It is very difficult to visually detect melt imperfections within the electrofusion joint as all melt indicators are contained within the coupling or saddle.
2. Under no circumstances should a melt pattern be visible outside of the electrofusion coupling or saddle.

IAMU Procedure #1.17: Visually Inspect Mechanical Fittings on PE Pipe

NOTE: The following procedure shall be used to visually inspect mechanical fitting joints for indications of proper joining. All joints shall be identified with name/initials, date and time.

Compression End Fittings (Dresser Coupling)

1. Ensure that the pipe and fitting are clean and free of any scratches, gouges, or imperfections.
2. Ensure that the pipe and fitting are of the appropriate size, wall thickness and pressure rating.
3. Verify that the compression nut end is tight.
4. Look for indications of proper stab depth into coupling. A stab depth reference mark should be visible at the end of the compression nut and within acceptable distance.

Stab-Type Mechanical Fittings (Permasert and Continental)

1. Ensure that the pipe and fitting are clean and free of any scratches, gouges, or imperfections.
2. Ensure that the pipe and fitting are of the appropriate size, wall thickness and pressure rating.
3. Look for indications of proper stab depth. A stab depth reference mark should be visible and within acceptable distance from the end of the coupling.

Mechanical Compression Collar Fittings (Lyco-Fit)

1. Ensure that the pipe and fitting are clean and free of any scratches, gouges, or imperfections.
2. Ensure that the pipe and fitting are of the appropriate size, wall thickness and pressure rating.
3. Verify that the collar (outer sleeve) has been fully inserted over the spigot and completely up to and flush with the stop. No voids or gaps should exist between the collar (outer sleeve) and the stop.
4. Look for indications of proper stab depth. A stab depth reference mark may be visible and within acceptable distance from the end of the coupling.

CITY OF BLOOMFIELD, IOWA

PART TWO

General Construction Requirements for Mains and Transmission Lines

IAMU Procedure #2.0: Damage Prevention During Excavation Activities Conducted by or on Behalf of the Operator

NOTE: The following procedure is to be used any time that an operator or a contractor hired by the operator is performing excavation activities on or near gas pipeline facilities.

Personnel Precautions in Excavated Trenches or Bell-holes:

1) Precaution shall be taken to protect persons entering and exiting excavations from the hazards of the accumulation of vapors, gases and unsafe oxygen levels.
   a) An unsafe accumulation of gas is any reading of 10% LEL or greater.
   b) Any oxygen reading below 19.5% is considered an unsafe atmosphere.
2) If the trench or excavation contains a live gas pipeline a fully charged fire extinguisher should be available on-site.
3) If the trench or excavation contains any gas readings, there shall be at least one other person present to provide aid to the person in the trench or excavation.
4) Entry and exit points should be established, and ladders provided if necessary.
5) When required, emergency rescue equipment such as a breathing apparatus, FR suit, rescue harness, rescue lines, and hoist must be provided at the excavation site.

Before Excavation:

1) Identify proposed excavation area with white flags or paint.
2) Notify Iowa One-Call of proposed excavation.
3) Wait the required 48 hours or until positive response requirements have been met before beginning excavation.
4) Ensure that all buried utilities have been located and marked.
   a) The Iowa One-Call positive response system should also be checked to ensure that all utilities within the proposed excavation have responded with either “marked” or “clear”.
   b) If there are any non-responses, the operator should attempt to contact the utility and verify the location.
5) Plan the excavation ahead of time taking into consideration the location of marked facilities and the direction in which they are traveling (crossing or parallel to proposed excavation).

During Excavation:

1) Always follow OSHA guidelines for trenching and shoring safety.
2) Never dig alone. A spotter should be available at all times and must be able to perform the following:
   a) Give clear and understandable signals and always remain within clear view of the operator.
   b) Be able to safely enter and exit the excavation at all times.

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3) If excavation is to take place within 25 feet of a natural gas transmission pipeline, a representative from the facility owner must be present while excavating near the pipeline.
4) If possible, vacuum excavation should be used prior to digging to verify the exact location and depth of marked facilities along the excavation route.
5) When crossing or digging near facilities located within the tolerance zone (18" either side of the facility) the facility should be exposed and the actual location verified by hand digging or vacuum excavation.
6) Care should be taken during digging, either by hand or machine, that contact is not made with any underground facility.
   a) If at any time, a facility is nicked or damaged due to digging, the facility owner must be contacted so that a representative can be dispatched to assess the damage and make repairs if necessary.
7) If, during the excavation, an unknown or unmarked facility is discovered, an attempt should be made to confirm what the facility is and its general location.

IAMU Procedure #2.1: Damage Prevention Inspection During Third-Party Excavation or Encroachment as Determined Necessary

NOTE: This procedure is to be used any time that the operator is aware that excavations are taking place on or near pipeline facilities or any time there is encroachment on existing easements or rights-of-way.

Inspection During Third-Party Excavations:

1) The operator must provide "stand-by" personnel to all excavations that are taking place within 25 feet of a natural gas transmission pipeline.
2) Ensure that the excavator has a valid One-Call ticket and that all facilities within the area have been located and marked.
   a) If the excavator cannot provide a valid One-Call ticket or states that One-Call has not been notified, STOP the excavation immediately. The excavation should not continue until One-Call has been notified and all facilities have been located and marked.
3) Ensure that the excavator is following OSHA requirements for safe digging practices, taking care not to damage facilities, and hand digging when within the 18" tolerance zone.
4) If the operator is aware that an excavator has exposed any portion of a natural gas pipeline (distribution or transmission) the operator shall inspect the portion of exposed pipeline for signs of damage to the pipeline or the pipe coating according to IAMU Procedure #4.1: Visual Inspection of Buried Pipe and Components When Exposed.
5) When backfilling, ensure that excavator uses proper bedding materials such as sand or soil free of rocks and debris and is carefully placed and tamped to a depth of approximately 1 foot above the pipeline.
   a) It may be necessary for the operator to provide proper backfill material or install rock shield.

Personnel Precautions in Excavated Trenches or Bell-holes:

1) Precaution shall be taken to protect persons entering and exiting excavations from the hazards of the accumulation of vapors, gases and unsafe oxygen levels.
   a) An unsafe accumulation of gas is any reading of 10% LEL or greater.
   b) Any oxygen reading below 19.5% is considered an unsafe atmosphere.
2) If the trench or excavation contains a live gas pipeline a fully charged fire extinguisher should be available on-site and located upwind of the work site.
3) If the trench or excavation contains any gas readings, there shall be at least one other person present to provide aid to the person in the trench or excavation.
4) Entry and exit points should be established, and ladders provided if necessary.
5) When required, emergency rescue equipment such as a breathing apparatus, FR suit, rescue harness, rescue lines, and hoist must be provided at the excavation site.

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Encroachment on Easements or Right-of-Way:

1) The pipeline easement or right-of-way must be maintained in order to perform routine operations and maintenance tasks.
2) The right-of-way should be kept clear of all trees and shrubs that could limit access to the pipeline.
3) Encroachments such as fences, buildings, or other structures must be kept well away from the pipeline.
   a) Buildings or structures are NOT allowed to be constructed on the pipeline right-of-way or easement.
   b) Trees, shrubs or any other vegetation with extensive root growth should not be planted in the pipeline right-of-way or easement.
   c) If, during continuing surveillance activities, encroachments are discovered, the operator must take action to determine the extent of the encroachment and how to best rectify the situation.

IAMU Procedure #2.2: Provide or Ensure Adequate Support During Operator Initiated Excavation Activities

NOTE: This procedure is to be used any time a significant portion of existing pipeline is to be exposed and unsupported requiring that additional support is provided to ensure damage is not sustained.

1) If an excavation results in the removal of soil from underneath the pipeline, causing the pipeline and or tracer wire to remain unsupported at lengths greater than 10 feet (horizontally, along the pipeline), supports should be installed to prevent unintentional lateral movement or vertical sagging.
2) Supports must be placed at intervals so that the pipeline maintains its original position, both vertically and horizontally.
   a) Supports should also be installed on either side, within close proximity, of exposed joints to prevent stresses from being exerted on the joint.
3) When installing supports consideration should be given to the following:
   a) It may be necessary to support the pipe from above using nylon slings attached to excavation equipment or bracing that extend across the top of the ditch.
   b) If the support is placed below the pipeline, it should be made of a material that will not compact under the weight of the pipeline.
   c) The support should be made of a material that will not damage the pipeline.
   d) Install padding or rock shield in between the support and the pipeline to prevent damage to the pipe or the pipe coating.
4) After the pipe has been properly supported, caution should be taken when working around the pipeline so that the pipeline is not knocked off of the supports or the supports destabilized.
5) Before removing the supports, sufficiently compacted backfill must be provided between supports so that when supports are removed the pipeline remains in its original position.
6) Immediately after removing the supports, the pipe and/or pipe coating at the location of the support, must be inspected to ensure that no repairs or replacements are needed.

IAMU Procedure #2.3: Visually Inspect Pipe and Components Prior to Installation

NOTE: All pipe and pipeline components MUST be visually inspected for damage after transportation as well as before and during installation.

1) Once delivered, all pipe and components should be stored and handled according to requirements found in Division 3.7 of Requirements and Recommendations.
2) All product identification markings found on pipe and components must comply with the latest version of the standard to which it was produced. Steel pipe and components must comply with ASTM A53 or API Spec 5L. Plastic pipe and components must comply with ASTM D2513 (see table below for specification marking information).
   a) A record of these identification markings must be kept and maintained for the life of the pipeline. A record may be kept on the Material Installation Record or another suitable means provided by the Operator (electronically, pictures, etc.).

ASTM A53 (Steel)	API Spec 5L (Steel)	ASTM D2513 (PE)
Manufacturer Name	Manufacturer Name	Manufacturer Name
Specification Number	Specification Number	Material Designation
Outside Diameter	Outside Diameter	"GAS"
Wall Thickness	Wall Thickness	Pipe Designation (2406, 2708)
Grade of Steel	Grade of Steel	Wall Thickness (DR)
Type of Pipe (F, E, or S)	Specification Level	Coil or Pack Number
Heat Number	Type of Pipe (CW, HFW, etc.)	Nominal Size
	Inspector Mark	Pipe Category (CEE)
	Heat Number	

3) Steel pipe and component inspections should include but are not limited to the following;
   a) Visually inspect for dents, gouges, grooves, and coating damage or imperfections.
   b) Particular attention must be given to examining the pipe coating for damage or any imperfections. This can be accomplished by completing a detailed visual inspection of the pipe coating surface while using your bare hand to feel along the entire pipe surface.
   c) If available, an electronic holiday detector should be used to detect coating imperfections.
   d) If any coating imperfections are found, they must be repaired or replaced before installation or backfilling.
4) Plastic pipe and component inspections should include but are not limited to the following;
   a) Visually inspect for scratches, gouges, permeation, excessive bending, out-of-roundness, and oxidation.
   b) Any defect that has removed 10% or more of the wall thickness must be cut out and replaced.
   c) The manufacturing date must be verified to ensure that the outdoor UV exposure limits have not been exceeded (see Division 3.7 of Requirements and Recommendations).

IAMU Procedure #2.4: Installation of Pipe in a Ditch

NOTE: This procedure is to be used anytime pipe is being installed by digging an open ditch with the use of excavation or trenching equipment.

Underground Clearance Requirements:

1) All transmission pipelines must be installed with at least 12" of separation from any other underground utility or structure not associated with the transmission line. If this clearance cannot be attained, protection must be provided for the transmission line so damage does not result from close proximity to the other structures.
2) Each main and service line must be installed with 12" of clearance from underground electric lines NOT installed in conduit and also with enough clearance from any other underground structure to allow proper maintenance and protect against damage. Protection may be provided by casing or sleeving.
   a) If 12" of clearance cannot be attained from underground electric lines, it is also recommended that the gas line be installed above the underground electric line.
3) Any plastic pipe being installed below ground near any sources of heat should be insulated or placed no less than 12" from the source of heat.

Depth of Cover Requirements:

Depth of cover is measured as the distance between the top of the pipeline to the top of the ditch at final grade. See the tables below for minimum cover requirements for transmission pipelines, distribution mains and service lines. If minimum cover requirements cannot be obtained, the pipeline must be installed with additional protection to withstand anticipated external loads.

Transmission Pipelines

Location	Normal Soil (in inches)	Consolidated Rock (in inches)
Class 1 locations	30	18
Class 2, 3, & 4 locations	36	24
Drainage ditches of public roads & railroad crossings	36	24
Navigable stream or river	48	24

Distribution Mains

Location	Depth of Cover (in inches)
All locations	24

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Service Lines

Location	Depth of Cover (in inches)
Private Property	12
Right of way, roads or streets	18

Considerations Before Excavation:

1) Determine the best route for pipeline installation taking into consideration the following;
   a) Proposed route should be as straight as possible.
   b) For distribution mains or transmission pipelines, the proposed route should stay out of private property and in an established right-of-way if possible.
   c) Proximity to other below ground utilities or structures.
   d) Proximity to trees or shrubs that have extensive root growth.
   e) Drainage ditches, flood zones and areas prone to excessive ice or snow build-up.
2) If installing in a County or State right-of-way, make sure all required permits have been applied for and granted.
3) Notify customers who are going to be affected by the excavation, taking into account all locations where excavation might take place (adjoining residences, residences across streets, etc.).
4) Perform routine safety check on all excavation equipment.
5) Make sure all utilities have been marked according to Iowa One-Call laws prior to excavation.

Excavating the Ditch or Trench:

1) Always follow OSHA safety protocols for trenching and shoring safety during the excavation process.
2) Dig the ditch as straight as possible to minimize the stresses placed on the pipe and to protect the pipe and pipe coating from damage.
   a) The pipe should fit the ditch so that no external force is needed to hold the pipe in place before backfilling is complete.
   b) The minimum bend radius for plastic pipe must not be exceeded, see Division 8.6 of Requirements and Recommendations for specific details.
   c) Any field bending of steel pipe must comply with requirements found in Division 8.5 of Requirements and Recommendations.
3) The depth of the ditch must meet all minimum cover requirements.
4) The width of the ditch should be such that the pipe does not scrape on the sides of the ditch when being lowered or placed in the ditch.
5) The ditch bottom should be dug as level as possible while maintaining a consistent depth following the contour of the ground.

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6) The ditch bottom should be free of any debris such as rocks, bricks, roots, etc. that may damage the pipe or pipe coating.
   a) If unable to remove all debris that could potentially damage the pipe or pipe coating, a suitable rock guard or rock shielding should be installed prior to lowering the pipe in the ditch. See IAMU Procedure #2.5 – Backfilling, for requirements.

Placing the Pipe in the Ditch:

1) Before placing the pipe in the ditch, the open ends of the pipe should be capped or plugged to prevent moisture or debris from entering the pipe until the final tie-in is made.
2) The pipe should be placed on undisturbed or well compacted soil.
3) If long sections of pipe have been welded or joined together outside of the ditch, the pipe should be lowered, NOT dropped into the ditch. Padded slings or harnesses attached to excavation equipment may be used to lower the pipe into the ditch. The Operator should avoid jerking, dropping, or imposing any additional strain on the pipe while being lowered into the ditch.
4) Before lowering or placing the pipe in the ditch the pipe and/or pipe coating must be inspected for damage and any damage found must be repaired or replaced before backfilling.
5) Plastic pipe must have tracer wire installed according to IAMU Procedure #2.7 – Installing Tracer Wire.
6) Backfill the ditch or trench as soon as practical after installation by following IAMU Procedure #2.5 – Backfilling.

Personnel Precautions in Excavated Trenches or Bell-holes:

6) Precaution shall be taken to protect persons entering and exiting excavations from the hazards of the accumulation of vapors, gases and unsafe oxygen levels.
   a) An unsafe accumulation of gas is any reading of 10% LEL or greater.
   b) Any oxygen reading below 19.5% is considered an unsafe atmosphere.
7) If the trench or excavation contains a live gas pipeline a fully charged fire extinguisher should be available on-site and located upwind of the work site.
8) If the trench or excavation contains any gas readings, there shall be at least one other person present to provide aid to the person in the trench or excavation.
9) Entry and exit points should be established, and ladders provided if necessary.
10) When required, emergency rescue equipment such as a breathing apparatus, FR suit, rescue harness, rescue lines, and hoist must be provided at the excavation site.

Additional Considerations:

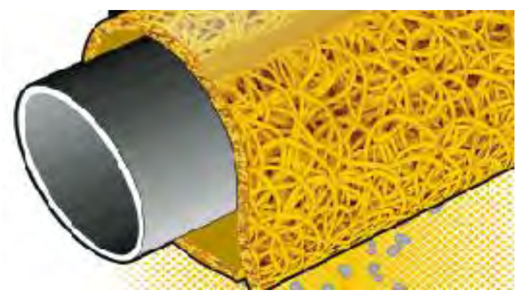
1) Any excavation left unattended should be protected by having barricades, fencing, or caution tape surrounding the excavation site.
2) Any excavation equipment left unattended should be turned off and the key removed to prevent unauthorized operation.

IAMU Procedure #2.5: Backfilling

1) Before backfilling, the pipe and/or pipe coating must be inspected for damage. If damage is found to the pipe and/or pipe coating, it must be repaired or replaced before backfilling.

   REMINDER: For new installations, any damage or imperfection that has caused a wall loss of 10% or more must be repaired or replaced. For PE pipelines already in use, any damage or imperfection that has caused a wall loss of 10% or more must be repaired or replaced. For steel pipelines already in use, any damage or imperfection that has caused a wall loss of 30% or more must be repaired or replaced.

2) The backfill material must be visually inspected for any rocks or debris that may damage the pipe or pipe coating before backfilling.
   a) All rocks, debris, or large chunks of clay or topsoil that could potentially damage the pipe or pipe coating, must be removed prior to backfilling.
3) The initial backfill is critical to protecting the pipe and/or pipe coating. Therefore, the ditch bottom as well as the backfill surrounding the pipe to at least 6" above the pipe must be clean and free of any rocks or debris that are larger than noted in the table above. Sand may be used as an acceptable material if the original backfill material is unsuitable for use.
   a) If the trench bottom contains voids where the pipe would not be supported or would not lay flat, the voids must be filled with clean backfill material and compacted to provide proper support.
4) If sand is unavailable and the Operator is unable to remove all rocks or debris from the backfill material, a suitable rock shielding, should be installed prior to backfilling to prevent pipe coating damage.
   a) Typically, rock shielding is installed using the cigarette wrap method for pipes 20" or less.
      i) The width of the rock shielding to be used should be calculated as the circumference of the pipe plus a 4" overlap. See table below.



Pipe Diameter	Pipe Circumference	Desired Roll Width
2"	7.45"	12"
4"	13.9"	18"
6"	19.6"	24"
8"	27"	32"
10"	33.75"	36"

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    ii) The wrap should be unrolled and draped lengthwise along the top of the pipe.
    iii) The overlap should take place along the bottom side of the pipe at the 6 o'clock position and an overlap of at least 2" is recommended.
    iv) The wrap should be secured in place using a monofilament tape or non-metallic strapping.
    v) The same process should be followed for each roll with a 2" overlap on the previous roll.

5) The Operator should place, not drop, backfill material on top of and around the pipeline.
    a) If available, backfill material should be tamped using a hand tamper, power tamper or vibrator to a depth of approximately 1 foot above the pipe. If that type of equipment is not available, clean backfill material should be placed on top of the pipe to a depth of at least 1 foot above the pipe and then the bucket of the backhoe/trencher may be used to press down and compact the backfill taking care not to damage the pipe or pipe coating.
6) To provide additional protection from future excavation damages, the Operator may choose to install yellow, "Warning, Gas Line Below" tape at a depth of approximately 4-6" above the pipe.
7) As backfilling continues, backfill material should be tamped every 12" to 16" until the trench or ditch is filled and no gaps or voids exist.
8) Final backfill should see the trench or ditch return to original grade or slightly higher than original grade to allow for minor settlement.

IAMU Procedure #2.6: Installation of Pipelines by Trenchless Methods

NOTE: This procedure is to be used anytime pipe is being installed by trenchless methods such as horizontal directional drilling, boring (mole operation), plowing, or any other approved trenchless method.

Underground Clearance Requirements:

1) All transmission pipelines must be installed with at least 12" of separation from any other underground utility or structure not associated with the transmission line. If this clearance cannot be attained, protection must be provided for the transmission line so damage does not result from close proximity to the other structures.
2) Each main and service line must be installed with 12" of clearance from underground electric lines NOT installed in conduit and also with enough clearance from any other underground structure to allow proper maintenance and protect against damage. Protection may be provided by casing or sleeving.
   a) If 12" of clearance cannot be attained from underground electric lines, it is also recommended that the gas line be installed above the underground electric line.
3) Any plastic pipe being installed below ground near any sources of heat should be insulated or placed no less than 12" from the source of heat.

Depth of Cover Requirements:

Depth of cover is measured as the distance between the top of the pipeline to ground level at final grade. See the tables below for minimum cover requirements for transmission pipelines, distribution mains and service lines. If minimum cover requirements cannot be obtained, the pipeline must be installed with additional protection to withstand anticipated external loads.

Transmission Pipelines

Location	Normal Soil (in inches)	Consolidated Rock (in inches)
Class 1 locations	30	18
Class 2, 3, & 4 locations	36	24
Drainage ditches of public roads & railroad crossings	36	24
Navigable stream or river	48	24

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Distribution Mains

Location	Depth of Cover (in inches)
All locations	24

Service Lines

Location	Depth of Cover (in inches)
Private Property	12
Right of way, roads or streets	18

Qualifications for Third-Party Contractors:

1) If using a third-party contractor to install the pipeline by trenchless methods:
   a) A qualified representative from the Utility must be on-site when the pipeline is being installed following "span of control" limitations. "Span of control" limitations can be found for each specific covered task in the Operator Qualification Written Plan.
   b) The contractor may provide proof of their own operator qualification. If so, it must be approved by the Utility prior to installations.
      i) Records of contractor qualification, must be kept on file with the specific installation for tracking and traceability purposes.

Considerations Before Installation:

1) Determine the best route for pipeline installation taking into consideration the following;
   a) Proposed route should be as straight as possible following the shortest possible path.
   b) For distribution mains or transmission pipelines, the proposed route should stay out of private property and in an established right-of-way if possible.
   c) Proximity to other below ground utilities or structures.
   d) Proximity to trees or shrubs that have extensive root growth.
   e) Drainage ditches, flood zones and areas prone to excessive ice or snow build-up.
2) If installing in a County or State right-of-way, make sure all required permits have been applied for and granted.
3) Notify customers who are going to be affected by the excavation, taking into account all locations where excavation might take place (adjoining residences, residences across streets, etc.).
4) Perform routine safety check on all equipment.
5) Make sure all utilities have been marked according to Iowa One-Call laws prior to installation.

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“Weak Link” Requirements:

1) Anytime plastic pipe is installed by mechanically being pulled through a trenchless excavation, a weak link specifically designed for the pipe type (medium or high density) and pipe size must be installed prior to pulling to prevent damage caused by tensile forces being applied. If the pipe can be pulled by hand without resistance, a weak link is not required.
2) If during the mechanized pulling process, the weak link was to fail, a second weak link can be installed and another pulling attempt made. If during the second attempt, the weak link fails in the same approximate location as the first attempt, it is recommended that the Operator excavate the area to determine the cause of the failure.

Considerations for Installations Near Storm Water/Waste Water Mains and Laterals

1) Special attention should be made to the location and depth of storm water and waste water mains and laterals to prevent cross-boring.
2) Unmarked waste water laterals are a serious cause for concern when installing gas pipelines by trenchless methods as the gas pipeline can be installed “through” the lateral without knowledge to the crew on the surface.
   a) If the storm water/waste water main or lateral is pierced during installation processes and the gas pipe is pushed through or pulled back through the main or lateral, there is potential for the gas pipe to “block” the flow. With flow blocked, a process to “unblock” the main or lateral may be utilized that cuts through the gas pipe causing a leak that could potentially migrate through the storm water/waste water mains or laterals creating an emergency situation.
   b) If the exact location of the storm water/waste water main or lateral is not known, it may be necessary to plan for a visual inspection of all known mains and laterals after installation of the gas pipe. Specialized cameras may be utilized to verify that cross-boring has not occurred.
   c) If a cross-bore is found during visual inspection, repairs must be made immediately.

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Installation by Horizontal Directional Drilling or Pneumatic Mole:

1) Make sure that all facilities have been located and marked according to Iowa One-Call requirements.
2) If possible, any existing facilities crossing the proposed pipeline path should be exposed and the location and depth of the facility verified before work begins. This can be accomplished by vacuum excavation (pot-holing).
   a) Consideration should also be made to exposing marked facilities that run parallel to and are within the 18" tolerance zone of the proposed pipeline route.
3) When possible, two holes should be excavated on either end of the proposed pipeline route. One for launching and one for receiving the bore head.
4) Inspect the pipe before installation.
   a) If installing steel pipe, make sure that the coating is approved for installation by trenchless methods (ex. Epoxy coat). All pipe and pipe coatings should be free of any defects, dents, gouges or imperfections. If defects, dents, gouges or imperfections are found, they must be repaired or replaced before installation. See IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation for specific requirements.
   b) If installing plastic pipe, check for the date of manufacture and ensure that the UV exposure limits have not been exceeded. Also check for nicks, gouges, scratches, cuts or other imperfections. If any defects or imperfections are found, they must be repaired or replaced before installation. See IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation for specific requirements.
5) Mechanical couplings are not allowed to be used as a method for joining pipe that is to be installed by trenchless methods. Butt fusions or butt welding is the recommended joining method for pipe being installed by trenchless methods.
   a) When possible, a single, continuous coil of pipe should be installed instead of joining multiple smaller segments of pipe.
6) Before pushing or pulling the pipe through the bore, the open ends of the pipe must be capped or plugged to prevent dirt, debris, or moisture from entering the pipe.
7) If plastic pipe is being installed by being pulled back through the bore, a **weak link** must be installed as stated earlier in this Procedure, so that the pipe does not sustain damage due to tensile forces applied during the pulling process.
8) Tracer wire must also be installed if installing plastic pipe. See IAMU Procedure #2.7 – Installing Tracer Wire for specific details.
9) After pushing or pulling the pipe through the bore hole, ensure that a sufficient amount of excess pipe extends out of the bore so that a visual inspection of the pipe can be completed according to IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation.
   a) If damage is found to pipe or pipe coating that extends back into the bore hole, the extent of the damage must be determined by either excavating or pulling the pipe back.

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b) If the damage extends the entire length of the pipe, every attempt should be made to determine the source of the damage and, if possible, remove the source before another attempt to push or pull the pipe is made.
c) Any damage found on the pipe or pipe coating must be repaired or replaced before another attempt to push or pull the pipe is made.
d) It may be necessary to redo the bore or deviate from the original pipeline route to find a suitable site for installation without damaging the pipe or pipe coating.

10) Before making final tie-ins and/or being put into service, the pipe must be pressure tested according to IAMU Procedure #5.1 & 5.2 – Pressure Testing Pipelines.

Installation by Plowing:

1) First, the Operator must determine if plowing is the best application for the installation process.
   a) If the ground is frozen, rocky, or contains a lot of debris, plowing is not recommended.
2) Make sure that all facilities have been located and marked according to Iowa One-Call requirements.
3) If, after locating, existing facilities are found to cross the pipeline route, the exact location and depth of the existing facility should be verified by exposing the facility prior to plowing. This can be accomplished by vacuum excavation (pot-holing) or traditional excavation practices.
   a) If the depth of the existing facility crossing the pipeline path is not sufficient enough to provide the proper amount of clearance, installation by using the plowing method may not be the best option and alternative methods, such as an open excavation should be considered.
4) Before beginning the plowing method, check all equipment and ensure proper working condition.
   a) If a spool is attached to the plow to feed the pipe and tracer wire, check the pipe chute for rough or sharp edges. If rough or sharp edges are found, they must be removed before the plowing process begins.
   b) Make sure the plow is equipped with a large enough slug or bullet to create an oversized bore hole in comparison with the size of the pipe being installed.
5) If pulling the pipe during the plowing process a **weak link** must be installed prior to installation as stated earlier in this Procedure to prevent damage to the pipe due to tensile stresses.
6) Tracer wire must also be installed during the plowing process according to IAMU Procedure #2.7 – Installing Tracer Wire.
7) Before starting, or during the plowing process, the pipe must be visually inspected according to IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation. To ensure that the pipe has not sustained any damage during storage or transportation.
8) While plowing, only move as fast as the plow can move without tearing up or mounding of the soil.

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9) When nearing the end of the proposed path, slowly raise the plow out of ground while continuing to move forward and pulling the pipe. The final short distance should be installed by open excavation methods.
   a) Pull a sufficient amount of the pipe out of the ground to be able to visually inspect the pipe according to IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation.
   b) If damage is found that extends back into the bore hole, the extent of the damage must be determined by excavating and if necessary, any repairs or replacements made.
10) Before making final tie-ins and/or being put into service, the pipe must be pressure tested according to IAMU Procedure #5.1 & #5.2 – Pressure Testing Pipelines.

IAMU Procedure #2.7: Installing Tracer Wire

All plastic pipe installed below ground must have yellow tracer wire installed to provide a means of locating the pipeline after being buried. The installation of bare copper wire is NOT allowed.

Proper Sizing of Tracer Wire

1) Open trench installation –
   a) #12 AWG CCS with a 302 lbs. minimum break load or a Solid CU with a break load of 180 lbs.
   b) #14 AWG CCS with a 194 lbs. minimum break load or a Solid CU with a break load of 112 lbs.
   c) All tracer wire used in open trench installations should have a minimum HDPE insulation thickness of 30 mil.

2) Horizontal Directional Drilling or Plowing installations –
   a) #12 AWG CCS with a minimum break load of 1,150 lbs.
   b) Multiple 8 AWG Solid copper wire with a minimum break load of 485 lbs.
   c) All tracer wire used in HDD or plowing installations should have a minimum HDPE insulation thickness of 45 mil.

Tracer Wire Connections – Splicing

1) Splicing (making wire to wire connections) – must be completed in a manner that produces an electrically and mechanically sound joint that will not loosen or separate.
   a) If available, the use of lockable connectors specifically designed for direct bury methods that are filled with a dielectric silicone gel is recommended. If lockable connectors are unavailable, the use of non-lockable lugs with or without dielectric silicone gel designed for direct bury methods are allowed.
   b) Using a wire nut or twisting the wires together and securing with electrical tape is NOT allowed.
   c) The manufacturers recommended procedures for the type of connector selected for use shall be followed whenever installed.

Examples of acceptable connectors

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Tracer Wire Connections – Thermite/CAD Welding (Generic Procedure)

1) Safety Precautions
   a) CAD welding may NOT be performed in a gaseous environment as it is a potential ignition source.
   b) A fully charged and manned fire extinguisher should be located upwind of the weld site.
   c) Proper PPE should be worn at all times (leather gloves and eye protection at a minimum).
   d) DO NOT use a wet or damp weld mold as the welding process could potentially produce a violent chemical reaction that may cause serious harm or injury.
2) Pipe Preparation
   a) Prepare a sufficient area of the pipe surface by removing all coating, dirt and debris.
   b) Use a file, rasp, or other approved method on the pipe surface until the metal is bright and shiny.
   c) Avoid touching the prepared surface, so that it does not get contaminated.
3) Tracer Wire Preparation
   a) Using a wire stripping tool, remove a sufficient length (approximately 1 inch) of insulation from the tracer wire to allow the protective copper sleeve to be installed over the bare end of the tracer wire.
   b) Once the wire has been inserted into the protective copper sleeve, the sleeve must be securely crimped into place taking care not to damage the wire.
   c) Wrap the tracer wire around the steel pipe and twist it with the bare end running parallel with the pipeline.
4) Preparing the CAD Weld Mold
   a) Ensure that the correct size and type (vertical or horizontal) of mold is being used for the specific application.
   b) Inspect the mold to make sure it has no physical defects.
   c) Clean the mold, removing any slag, dirt and ashes.
   d) Make sure the mold is completely dry.
   e) Place the provided steel disk in the bottom of the mold.
   f) Unless using electronic CAD Weld, remove the weld shot from the case and carefully dump the contents of the shot into the mold on top of the disk making sure all of the powder is emptied from the shot.
      i) It is important the finer grain powder from the bottom of the shot is emptied out into the mold as this is the starting powder.
   g) Close the mold cover.

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5) Making the CAD Weld
   a) Place the mold in the correct position on the pipe so that the tracer wire is running parallel to the pipe.
   b) Insert the tracer wire with the protective copper sleeve into the mold until it comes in contact with the stop (approximately halfway).
   c) Make sure the lid of the mold is closed and hold the mold firmly against the pipe.
   d) Using a flint type sparking gun, ignite the powder in the mold.
   e) Once ignited, hold the mold firmly to the pipe until the weld has solidified (at least 10 seconds).
   f) Tap the side of the mold lightly and remove the mold with the handle (the mold will be hot).
   g) Test the finished weld by tapping with a hammer to remove slag and to ensure proper weld connection has been made.
   h) Install protective wrap over exposed portions of steel pipe or components.

Installing the Tracer Wire

NOTE: When installing tracer wire with a main or service line, it should NOT be looped. Looping of tracer wire can cause difficulty in locating due to the signal being nullified.

1) Trenching or Direct Burial Installations
   a) When possible, contact between the tracer wire and plastic pipe should be avoided. DO NOT wrap the tracer wire around plastic pipe installations.
   b) A separation of 2” to 6” should be maintained at all times between the pipe and tracer wire.
      i) This can be achieved by laying the pipe in the bottom of the ditch or trench, place clean backfill material above the pipe (approximately 2” to 6” if possible) then install the tracer wire.
   c) When possible, one single continuous wire should be installed. If the use of a single continuous wire is not possible, any splicing must be completed as previously described.
2) Horizontal Directional Drilling, Mole, or Plowing Installations
   a) For these types of installations, contact between the tracer wire and the plastic pipe cannot be avoided.
   b) Ensure that excess tracer wire is being pulled along with the pipe so that connections on either end can be made without additional splicing.

Termination Points for Tracer Wire

NOTE: When installing tracer wire with a main or service line, it should NOT be looped. Looping of tracer wire can cause difficulty in locating due to the signal being nullified.

1) Termination at Service Risers
   a) Consideration should be given to installing a scrap piece of ½” pipe approximately 18” in length should be taped to the riser. Approximately 12” of the ½” pipe should be installed below ground and 6” above ground. This ½” pipe serves as a protective sleeve as well as providing easy access to the wire.

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b) Once the ½" pipe is taped to the riser, the tracer wire should be inserted up through the protective sleeve with approximately 6" of the tracer wire extending out above the end of the protective sleeve.

c) The excess wire extending above the protective sleeve should be bent back over with the cut end of the wire inserted back down into the top of the protective sleeve.

2) Termination at Dead Ends or Stubs with No Above Ground Access

a) If installing tracer wire that will terminate below ground with no above ground access at the termination point, it is recommended that a magnesium anode be attached to the end of the tracer wire and installed no more than 5' from the end of the pipe for proper grounding.

i) This installation practice will aid in the ability of accurately locating the dead end or stub.

3) Termination at Dead End or Stubs with Above Ground Access

a) If installing tracer wire at a dead end or stub and access to the termination point for locating purposes is desired, the following is recommended;

i) The tracer wire should be installed in an approved test station either above ground or at ground level. *See examples below.*



ii) The access point should be installed just off of the end of the dead end or stub, directly above it.

iii) The tracer wire should extend from the end of pipe, directly up into the test station. Excess wire should be provided so that when connecting the wire to the test station lug, the wire is not pulled tight.

iv) An anode should be installed just off the end of the main (no more than 5' from the end) and the anode lead wire brought up through the test station.

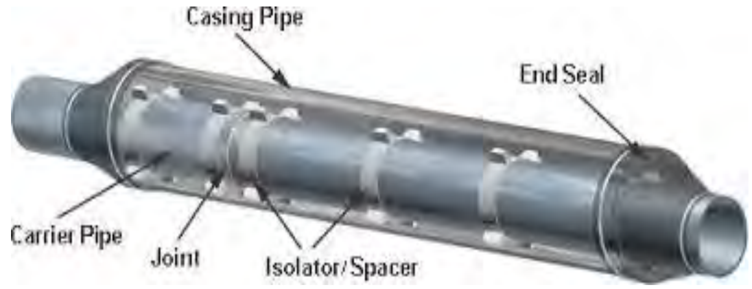
v) The tracer wire and the anode wire should be connected at the same lug point on the test station so that the anode can provide cathodic protection for the tracer wire and provide a ground for better locating purposes.

Verification of Proper Installation

1) Before final backfill operations are completed, the Operator may verify the tracer wire installation by using a pipeline locator at low frequency to ensure the ability to locate.

IAMU Procedure #2.8: Installation and Maintenance of Casings

NOTE: Generally, casings are required to be installed in Iowa on all State highway or railroad crossings. The Operator should check with all local, State and railroad agencies for obtaining the proper permits prior to installation. Once permits have been granted, all requirements listed on the permit must be followed.



<u>Selecting the Proper Casing Size:</u>

1) For a steel pipe casing with plastic pipe being installed as the gas carrier, the casing pipe should generally be one nominal size larger than the carrier pipe. For example, a 2” carrier pipe would require a 4” casing pipe and a 4” carrier pipe would require a 6” casing pipe.
2) For a steel pipe casing with steel pipe being installed as the gas carrier, the casing pipe should generally be two nominal sizes larger than the carrier pipe. For example, a 2” carrier pipe would require a 6” casing pipe and a 4” carrier pipe would require an 8” casing pipe.

<u>Installation of Casing Pipe:</u> (same procedure for either steel in steel or plastic in steel)

1) Follow all Iowa One-Call laws for locating and marking facilities prior to excavation.
2) If possible, the location of any facilities to be crossed by the bore, should be verified by hydro-excavation prior to boring.
3) Following the requirements of the permit for length and depth, a pit should be excavated on each end of the crossing that provides sufficient room to allow for casing and carrier pipe to be pushed/pulled through the bore without exceeding short-term bending radius.
4) The bore being made should be as straight and level as possible to provide for easier installation of the casing and carrier pipe.
5) By either pushing or pulling, install the casing pipe into the bore. If sufficient room is provided, the casing pipe may be welded together and installed as one continuous piece. However, if there is not sufficient room, the casing pipe may be welded together stick by stick as the pipe is being installed into the bore.
    a) All welds completed on the casing pipe must be completed by a qualified welder according to welding procedures found in the IAMU Model Distribution Pipeline Welding Procedures Manual or other qualified welding procedures approved by the Operator.
6) After installing casing pipe into the bore, inspect the ends of the casing pipe for any dents or signs of damage that may affect the insertion of the carrier pipe in to the casing pipe. If significant damage is found to the extent that the damage prevents the carrier pipe with spacers from being inserted into the casing pipe, the bore may need to be shot again and another casing pipe installed.

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a) After visual inspection, the casing ends should be grinded down to remove any rough edges or burrs to prevent damage to the carrier pipe during insertion into the casing pipe.

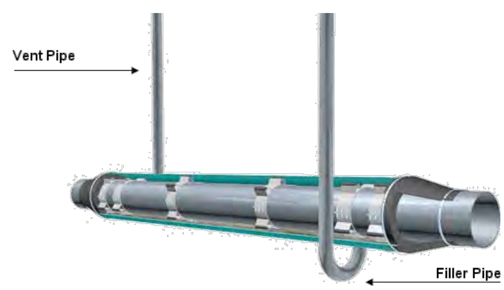
7) Before inserting carrier pipe, the casing vent or vents must be installed.

<u>Installation of Casing Vents:</u>

1) Casing vents should be installed before the carrier pipe is inserted into the casing pipe.
2) Although not required, it is recommended two vents (one on each end) be installed on the casing pipe. With one vent located on the top of the casing and the other vent being installed on the bottom of the casing vent. All casing vents should be made of 2" steel pipe.
3) Vents should be installed as close as practical to the end of the casing pipe.

<u>Top Vent Installations:</u>

1) A cutting torch or other approved cutting device should be used to cut approximately a 2" hole in the center of the top of the pipe.
2) A 2" vent pipe should then be welded to the casing pipe surrounding the hole cut in the top of the casing pipe. The 2" vent pipe should be long enough to extend vertically a minimum of 3' above current ground level. If required by the permit, the vent may extend horizontally below ground to the desired location at the right-of-way and then extended above ground.
3) The top of the vent pipe that extends above ground should terminate pointing downward, by welding two 90° elbows to the top of the vent pipe. This will prevent moisture from entering and accumulating in the casing pipe.
4) A screen must be installed on the end to prevent the vent from being plugged by animals, birds or debris.
5) All bare steel must be coated or wrapped to prevent corrosion.



<u>Bottom Vent Installations:</u>

1) The purpose of a vent being located on the bottom of the casing pipe will allow water to be drawn out of the casing using a pump. This will also provide a location for casing filler to be pumped into the casing, filling the casing, while air is allowed to escape out of the top vent.
2) If the casing pipe was not installed at a true level, the bottom vent should be installed at the lower end of the casing pipe.
3) A cutting torch or other approved cutting device should be used to cut approximately a 2" hole in the center of the bottom of the pipe.
4) A 90° elbow should then be welded to the bottom of the casing pipe surrounding the 2" hole cut in the bottom of the casing pipe.
5) A short section of 2' pipe should then be welded to the elbow and extend horizontally a sufficient distance to clear the casing pipe when the vent pipe is extended vertically.

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6) Another 90° elbow should now be welded to the short section of horizontal 2" vent pipe so that the open end of the elbow is pointed vertically.
7) A section of 2" vent pipe should now be welded to the open end of the elbow and extend vertically at least 3' above current ground level.
8) The top of the vent pipe that extends above ground should terminate as described in steps 3 & 4 of the Top Vent Installation.
9) All bare steel must be coated or wrapped to prevent corrosion.

<u>Inserting the Carrier Pipe:</u>

1) Steel carrier pipe to be inserted into the casing, must be coated and pipe sections joined by welding, mechanical couplings are NOT allowed.
2) Plastic carrier pipe to be inserted into the casing, must be joined by butt fusion methods, electrofusion and mechanical couplings are NOT allowed.
3) The carrier pipe can either be pulled or pushed into the casing pipe. If plastic pipe is being pulled into the casing pipe, a "weak link" must be used to prevent elongation of the plastic pipe.
4) Before or during the process of the carrier pipe being inserted into the casing pipe, spacers or cradles must be installed on the carrier pipe to provide insulation and to center the carrier pipe in the casing pipe.
   a) Multi-piece spacers are recommended for installation on the carrier pipe.

   b) Spacers should be installed on either side of pipe joints of the carrier pipe to provide support and protection to the joint.
   c) Spacers should also be installed between joints along the length of the pipe at a distance so that sufficient support is provided to prevent the pipe from sagging and touching the casing pipe.
   d) Spacers should also be installed on the carrier pipe as close as practical to the entry and exit points of the casing so that the carrier pipe is fully supported and does not contact the casing pipe after backfilling.
   e) The bolts on the multi-piece spacer should be tightened to a point where the spacer does not slide or rotate on the carrier pipe.
5) After insertion of the carrier pipe, exposed pipe ends must be inspected for damage and if steel pipe was inserted the coating must also be inspected for damage. If damage is found that cannot be repaired, it may be necessary to remove the carrier pipe from the casing make repairs or replacements and insert again.
6) If steel pipe was inserted as the carrier pipe, electrical isolation must be verified using a volt meter.

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Installing Casing End Seals:

1) All casing ends must be sealed to prevent water and debris from entering the casing.
2) There are multiple casing seals that can be used depending on the type of installation. The most common is a rubber boot type seal.
   a) The rubber boot type can be installed by sliding the wide end of the seal over the casing pipe end and secured by using stainless steel hose clamps. The small end of the seal should then be secured to the carrier pipe using stainless steel hose clamps.

Additional Considerations and Maintenance:

1) If the carrier pipe being inserted is plastic, a tracer wire should be CAD welded to both ends of the casing pipe to allow for locating.
2) If the carrier pipe being inserted is steel, a 17# magnesium anode may be installed and attached to the carrier pipe providing additional cathodic protection.
3) All above ground casing vents must be painted.
4) All above ground casing vents must be marked meeting the same requirements as pipeline markers.

IAMU Procedure #2.9: Installation of Pipe Above Ground

NOTE: The following procedure should be used when installing pipe and components above ground.

Location:

1) When installing above ground facilities, special consideration should be given to the following location factors to determine the appropriate installation placement;
   a) Proximity to public roads and railroads.
   b) Proximity to driveways or parking areas.
   c) Proximity to overhead powerlines.
   d) Proximity to trees, shrubs, and landscaping.
   e) Terrain features such as steep or shallow ditches, hillsides, etc.
2) If it can be reasonably anticipated that damage could occur at the installation site, barricades, bollards, fencing, or some type of protection should be installed that provides suitable protection for the specific installation.

Corrosion Protection:

1) All piping installed above ground and exposed to the outside air must properly protected from corrosion.
   a) An approved coating (paint, pipe wrap or epoxy coat) must be applied as a protective barrier preventing corrosion at or near the time of installation.
2) Special attention should be given at the pipe-to-soil interface (transition area from below ground to above ground).
   a) Steel risers must have a suitable coating installed on the riser that extends above ground.
   b) Anodeless risers must be installed so that the "crimp line" or "Do Not Bury Above" sticker is located above ground.

Supports:

1) All above ground piping must have enough support so that undue strain is not applied to any of the piping or components.
   a) All supports used on exposed piping must be made of a durable noncombustible material.
   b) If the support is metallic, a dielectric material (Rockshield, piece of plastic or rubber) should be installed between the support and the pipe.
   c) It is recommended that Rockshield or porous material is installed between the pipe and support so that moisture does not accumulate and accelerate the corrosion process.

****See examples of pipe/riser supports on next page****

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Plastic Pipe Above Ground:

1) Uncased plastic pipe may **temporarily** be installed above ground, as long as;
   a) The pipe is installed in a location where damage from external forces is not likely, or protective measures have been installed to prevent damage to the above ground installation.
      i) Protective measures may include barricades, bollards, fencing, caution tape, etc.
   b) The cumulative above ground exposure limits do not exceed the manufacturer's maximum period of exposure or 2 years, whichever is less.
   c) The pipe adequately resists exposure to UV light and extreme high and low temperatures.
2) Plastic pipe may be installed on bridge crossings as long as the following conditions are met;
   a) The pipe is installed in a metallic casing that provides protection from mechanical damage.
   b) The pipe and casing are properly supported to prevent undue strain.
   c) Protected from UV light and not allowed to exceed the pipe temperature limits.

Marking Above Ground Facilities:

1) Pipeline markers must be installed and maintained along any section of any main or transmission line that is installed above ground in a public area.
   a) Specific pipeline marker requirements can be found in IAMU Procedure #8.5 - Install and Maintain Pipeline Markers.
   b) Pipeline markers should also be installed at all TBS and DRS locations.
   c) Consideration should be given to installing pipeline markers at rural farm tap locations.

IAMU Procedure #2.10: Above Ground Supports and Anchors: Inspections, Preventive, and Corrective Maintenance

Requirements:

1) Each above ground pipeline must have enough supports installed to protect the exposed pipe joints from the maximum end force applied by internal pressure, temperature expansion and contraction, and the weight of the pipe.
2) Each pipeline and its associated equipment must have enough anchors or supports to prevent undue strain on piping and equipment and to prevent excessive vibration.

Supports:

1) All above ground piping must have enough support so that undue strain is not applied to any of the piping or components.
   a) All supports used on exposed piping must be made of a durable noncombustible material.
   b) If the support is metallic, a dielectric material (Rockshield, piece of plastic or rubber) should be installed between the support and the pipe.
      i) It is recommended that Rockshield or porous material is installed between the pipe and support so that moisture does not accumulate and accelerate the corrosion process.
2) Pipe supports should be inspected as frequently as necessary to ensure that they are providing adequate support and adjustments made if needed.
3) During atmospheric corrosion inspections, special attention must be given to the area of the pipeline under support. See IAMU Procedure #4.11 – Visual Inspection for Atmospheric Corrosion for specific details.
   a) The pipe support should be removed to allow for a thorough inspection of the area of the pipeline under support.
   b) Consideration should also be given to providing additional protection to this area by installing additional pipeline wrap or coatings to prevent atmospheric corrosion.

IAMU Procedure #2.11: Field Bending of Steel Pipe

NOTE: This procedure is to be used any time that steel pipe is to be bent in the field and not bent by the manufacturer.

Requirements:

1) Each bend made to steel pipe must not impair the serviceability of the pipe.
2) Each bend must have a smooth contour and be free from buckling, cracks, or any other mechanical damage.
3) Circumferential steel pipe welds must be nondestructively tested if located where stress during bending causes a permanent deformation in the pipe.
4) A wrinkle bend may not be made on steel pipe to be operated at a pressure that produces a hoop stress of 30% or more of SMYS.

Field Bending of Steel Pipe:

1) Before bending the pipe, the pipeline coating within the area to be bent should be removed as it will sustain damage during bending and the pipe must be inspected after the bend is made.
2) Field bends must be made by the cold bending method, using a bending shoe and/or bending machine, which result in a smooth uniform bend.
3) The longitudinal weld seam of the steel pipe should be as near as practical to the neutral axis of the bend unless the bend is made with an internal bending mandrel.
4) For the bending of small diameter steel pipe, a bending shoe should be used and the bend made as follows:
    a) Select the appropriate size of bending shoe.
    b) Place the pipe underneath the shoe and within the groove on the shoe.
    c) Pull the ends of the pipe against the shoe, resulting in a smooth bend at the point of contact with the shoe.
    d) Bending of small diameter steel pipe should not exceed a 90° bend.
5) Once the bend has been made, inspect the pipe for any signs of damage or wrinkles that may impair the serviceability of the pipe.
6) Install an approved pipeline coating to the bare steel pipe according to IAMU Procedure #4.15: Coating Application and Repair – Wrapped.

CITY OF BLOOMFIELD, IOWA

PART THREE

Customer Meters, Service Regulators and Service Lines

IAMU Procedure #3.0: Installation of Customer Meters and Regulators

NOTE: All meter and regulator installations should be properly sized, specific to load demand, prior to installation.

General Guidelines for Sizing Residential and Small Commercial Meter Sets

<u>Definitions, Abbreviations & Conversions:</u>

Load Demand = The amount of gas in cubic feet per hour that is required for the specific installation.

Btu = British thermal unit – The amount of heat needed to raise one pound of water 1°F.

Appliance Btu Rating/Value – Expressed through Btu input ratings and are based on a "per hour" basis.

Cfh = Cubic feet per hour (ft^3/hr)

Scfh = Standard cubic feet of per hour

Mcf = Thousand cubic feet

1 M = 1,000 cfg

Mmcf = Million cubic feet

1MM = 1,000,000 cfg

1 cubic foot of gas = 1,000 btu

1 psi = 28" wc or 16 oz.

0.25 psi = 7" wc or 4 oz.

IMPORTANT: In order to accurately size any installation, the load demand and the desired delivery pressure must be known prior to installation. Speak with the homeowner or their licensed plumber for the desired installation requirements. Without this information, service should not be installed.

<u>Meters and Regulators General Information:</u>

1) Meters being installed must have a known Maximum Allowable Operating Pressure (MAOP) stamped on the name plate of the meter. The pressure being delivered to the customer through the meter must never exceed the MAOP of the meter casing.
2) Typically, the size of the meter is stamped on the meter plate in cubic feet per hour.

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3) For regulators being installed, the inlet pressure (distribution system pressure) must be known, as well as the desired outlet pressure being supplied to the customer.
   a) All regulators installed must have a maximum inlet pressure rating higher than the MAOP, plus allowable buildup, of the system to which it is attached.
   b) Must be capable of supplying sufficient capacity while reducing pressure to the pressures recommended for the downstream appliances.
   c) Must have sufficient relief capacity so that downstream appliances are not damaged during an over-pressure event.

<u>**Proper Sizing**</u>

1) In order to accurately size any regulator and meter set installation, the load demand and the desired pressure must be known prior to installation of the regulator and meter.
2) To determine the most appropriate meter and regulator for the installation, the total btu demand of the installation must be calculated.
   a) This is can be done by adding all of the maximum btu ratings for all of the natural gas burning appliances for that installation and converting it to cubic feet of gas.
   b) Divide total btu value by 1,000 to obtain cfh value. *See examples below.*

Residential Example (desired pressure 7" wc)

Appliance	Maximum Btu Rating Per Hour	Cubic Feet of Gas (cfg)
Furnace	125,000	125
Stove	35,000	40
Water Heater	35,000	35
Dryer	20,000	25
Total	**215,000**	**215**

Commercial/Industrial Example (desired pressure 2 psi)

Appliance	Maximum Btu Rating Per Hour	Cubic Feet of Gas (cfg)
Boiler	650,000	650
Stove	125,000	125
Total	**775,000**	**775**

3) Once the total demand is known, it is recommended that approximately 15% be added to the total load demand to account for possible future changes.
4) With the load demand, plus 15% known, refer to the manufacturer's specifications for meters and regulators to determine the appropriate size for the specific installation.

NOTE: If unsure of how to correctly size a meter and/or regulator, it is recommended that contact be made with a manufacturer, supplier, or subject matter expert to provide additional technical support.

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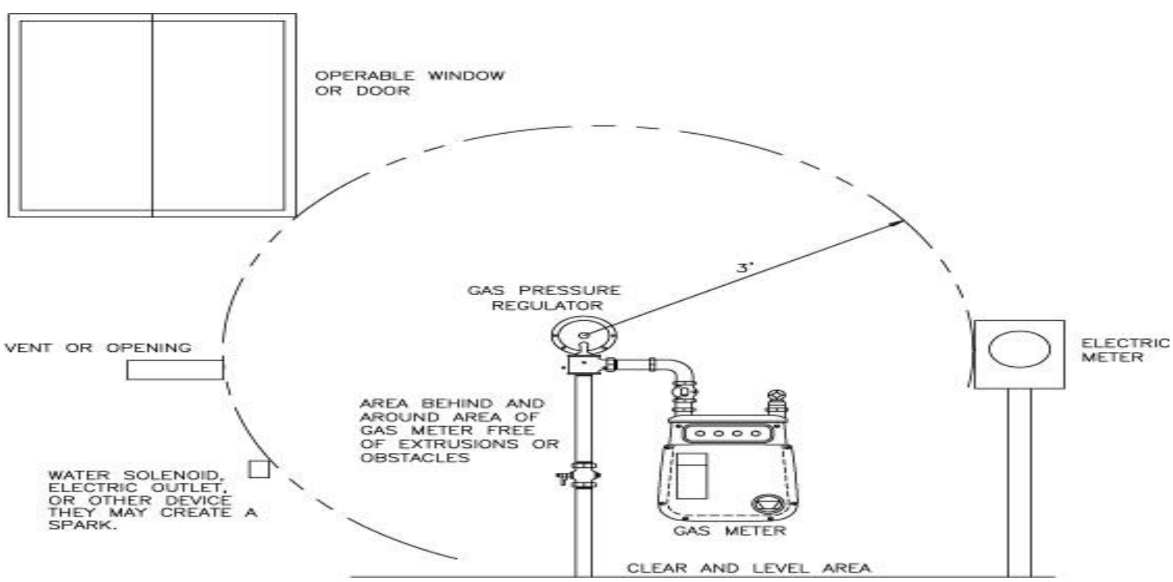
Meter Set Installation Requirements and Procedures

Location of Outdoor Installations

1) Meter sets should be installed outdoors. Only under certain circumstances, when all other options have been considered, may a meter set be installed indoors.
2) Meter sets must be installed in a readily accessible location to allow for the following:
   a) Operation of shut-off valve during emergencies as well as for routine shut-offs.
   b) Meter reading.
   c) Meter change outs.
   d) Inspection, repairs and maintenance.
3) All piping and components must be coated or painted to provide protection against corrosion.
4) Must be installed in a location that provides protection from damage. Consideration should be given to the following:
   a) Protection from falling objects such as snow or ice from a roof.
   b) Protection from reasonably anticipated vehicular traffic.
5) Meter sets must not be installed within 3 feet of the following:
   NOTE: 3 feet is measured from the center of the regulator vent, not the meter.
   a) Potential ignition sources.
   b) Windows, doors, or building openings which may be used as emergency exists.
   c) Air intakes.



6) Meter sets must not be installed in contact with the soil or other potentially corrosive materials.

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Location of Indoor Installations

1) If possible, a readily accessible shut-off valve should be installed outdoors.
2) The meter set must be installed in a readily accessible location.
3) Each service regulator must be installed as close as practical to the point where the service line enters the building. If possible, the service regulator should be installed outdoors.
   a) If the service regulator is installed indoors, the vent must be piped back outdoors unless the service regulator is designed to shut off the flow of gas and is NOT capable of venting gas to atmosphere.
4) The meter set must be installed in a ventilated place and at least 3 feet from any sources of ignition or any source of heat which may damage the meter.
   a) Meters and service regulators should not be installed in confined engine, boiler, heater, electrical rooms, or in living quarters, closets, restrooms, or similar confined locations.
5) If the service regulators are installed in series (double pressure cut) the first regulator in the series must be located outside the building, unless it is located in a separate metering or regulating building.

Service Regulator Vents and Relief Vents

1) Service regulator and relief vents must terminate outdoors and the termination point must be:
   a) Rain and insect resistant.
      i) Pointed down with a screen.
   b) Located at a place where gas from the vent can escape freely into the atmosphere and 3 feet away from any ignition source or opening into the building.
      i) If necessary, to meet the 3-foot requirement, the vent may be piped away from ignition sources or openings into buildings. The vent piping must meet the following requirements:
         (1) The piping must be constructed of black iron, galvanized, or copper piping. PVC or plastic piping may not be used.
         (2) The piping must be at least the same size or larger as the regulator or relief vent. The vent size may not be reduced.
         (3) The piping must terminate pointing downward with a screen installed.
   c) Be protected from damage caused by submergence in areas prone to flooding.
      i) The vent may be piped vertically above the anticipated flood level according to the requirements of b) above.
      ii) If the vent is not piped above the anticipated flood level, the service should be shut-off, the meter and regulator removed and any open piping sealed to prevent water from entering.

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Protection from Vacuum or Back Pressure

1) If the customer's equipment may create either a vacuum or back pressure, a device must be installed to protect the system. The following devices may be installed:
   a) Automatic shut-off valve with manual reset (for decreasing or increasing pressure).
   b) Restricting orifice.
   c) Regulating device set to close at a predetermined value (for decreasing or increasing pressure).
   d) If flow reversal is a possibility, either a check valve or a protective device that provides a gas tight shut-off should be used.

Protection for Pits or Vaults

1) Any pit or vault that contains a customer meter or regulator at a place where vehicular traffic is anticipated must be able to support the weight of that traffic.

Electrical Isolation and Grounding

1) All meter sets must be electrically isolated from other metallic structures.
   a) An insulating device must be installed at the meter set location.
      i) An insulated service valve, meter spud or insulated meter bar must be installed.
2) A homeowner or licensed plumber may NOT install ground wires to any gas facilities. NFPA 54, 7.13.3 states "Prohibited use. Gas piping shall not be used as a grounding conductor or electrode. This does not preclude the bonding of metallic piping to a grounding system."

Installation Practices

1) All meter set installations must contain a readily accessible service valve installed upstream of the regulator and meter. Typically installed on top of the service riser.
2) All meter set installations must provide a safe delivery pressure with adequate capacity to the customer.
3) All meters being installed must meet the following requirements;
   a) If manufactured after November 12, 1970, the meter must have been tested to a minimum of 10 psi.
   b) A meter may not be used at a pressure that is more than 67% of the manufacturer's shell test pressure
   c) A rebuilt or repaired tinned steel case meter may not be used at a pressure that is more than 50% of the pressure used to test the meter after rebuilding or repairing.
4) All meters and regulators must be installed to minimize anticipated stresses on all piping and components. If necessary, the following may be installed:
   a) Meter bars.
      i) Bypass meter bars may be installed as long as the bypass valve is either locked with a company approved lock or designed to be inoperable without special tools.

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ii) If a bypass meter bar is installed, the bypass valve may NOT be considered as the service valve.

b) Adjustable meter/riser brackets or riser posts.

c) Pipe stands, supports, cribbing or hangers.

i) If using metallic stands, supports or hangers, a type of dielectric barrier must be installed to provide separation between the pipe and the pipe stand.

(1) A dielectric barrier is a piece of rubber, rock guard, or some type of non-metallic material placed in between the metallic support and the pipe.

d) Swing joints may also be installed to reduce piping stress.

5) If assembling meter sets with pre-cut nipples and close all-thread nipples are used, the wall thickness remaining after the threads are cut must meet the minimum wall thickness requirements of Division 4.2.2 of Requirements and Recommendations.

6) Connections made of lead or other easily damaged materials may not be used in the installation of meters and/or regulators.

7) Each regulator that might release gas must be vented to the outside atmosphere as described earlier in this procedure.

8) If it can be reasonably anticipated that vehicular damage may be caused to the meter installation, alternate locations may be considered or protective devices should be installed.

a) Protective devices include but are not limited to barricades, bollards, parking bumpers or fencing.

IAMU Procedure #3.1: Install Steel Service Lines

SAFETY NOTE: A fully charged fire extinguisher must be located on-site and readily available for use in case of accidental ignition.

Essential Elements of the Installation Process:

1) Visually survey the site to determine the best proposed pipeline path and meter installation site.
2) Obtain the desired load/capacity of the installation so that the proper size of pipe and components can be installed.
3) If applicable, determine if the installation is going to require an EFV or curb valve.
4) Ensure that all materials (pipe, pipe coating, tap tee, EFV/curb valve, couplings, etc.) are in stock or will arrive before starting the installation process.
5) Notify Iowa One-Call of proposed excavation to ensure all utilities are located and marked prior to excavation.
6) Excavate the main, exposing a large enough area to allow for tap tee installation and additional pipe joining. Also, complete a visual inspection of all exposed pipe and components and document.
7) Excavate or trench the proposed pipeline path. If using trenchless methods, excavate an additional hole at the service line termination point (meter installation site).
8) Inspect all pipe, pipe coatings and components for damage prior to installation
9) Before installing pipe and components, all print line information (identification markings) from the pipe and components to be installed must be documented.
10) Install the tap tee, but DO NOT tap the main at this point.
11) Install the pipe in the trench or by using trenchless methods ensuring that an ample amount of pipe extends past each tie in location (tap tee and/or riser) to allow for expansion and contraction and ease of installation.
12) Install service riser, service valve and, if applicable, EFV or curb valve.
13) Make final tie in joints.
14) Inspect all pipe and components for damage after installation.
15) Perform pressure test and document results.
16) Perform hot tap.
17) Purge service line with natural gas and document purge results.
18) Apply approved pipe coating to all pipe and fittings where the coating has been removed or damaged.
19) Before backfilling take measurements off of permanent structures to generate service line installation map.
20) Backfill and grade.
21) If not immediately installing meter set and establishing service to the customer, cap and lock service valve until service is required.

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Before Installation:

NOTE: Installation of service lines into or through foundation walls and under buildings is NOT allowed.

1) Calculate the desired load and pressure requirements for the specific installation.
   a) By correctly calculating load demand, the appropriate pipe size, excess flow valve or curb valve requirements, regulator capacity, and meter capacity can be determined.
2) Determine the best route for the installation by considering the following;
   a) The proposed route should be as straight as possible from the main to the meter location. Keep in mind that the meter set location should be at least 3 feet from any possible ignition source or opening into the building.
   b) Proximity to other below ground utilities or structures.
   c) Proximity to trees or shrubs that have extensive root structures.
3) Notify all customers who are going to be affected by the excavation, taking into account all locations where excavation might take place (adjoining residences, residences across streets, etc.).
4) Notify Iowa One-Call of proposed excavation and allow 48 hours for locates to be completed as required by Iowa One-Call law.

Pipe Requirements:

1) Steel service lines that are going to operate at a pressure less than 100 psi must be constructed of pipe designed for a minimum pressure of 100 psi.
2) Steel pipe to be installed must be ASTM A53, Grade A or B, Type E or S, or API Spec 5L seamless or electric resistance welded, as specified in ASME B31.8.

Inspection of Pipe and Components:

1) Before installation, the steel pipe and components should be stored and handled so that damage is not caused to the pipe or pipe coating.
2) Before installation, an onsite inspection of the steel pipe and components must be completed according to IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation.

Underground Clearance Requirements:

1) All pipelines must be installed with at least 12” of separation from any underground electric lines.
   a) If 12” separation is not possible the pipeline must be protected from damage that might result from the close proximity of the other utility or structure.
   b) Protection can be provided by installing service line in a casing or by sleeving.

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Depth of Cover Requirements:

Depth of cover is measured as the distance between the top of the pipeline to the ground surface at final grade. The typical service line installation depth is 24", however, the table below details minimum cover requirements described in 49 CFR Part 192.361 for service lines. If minimum cover requirements cannot be obtained, the pipeline must be installed with additional protection to withstand anticipated external loads.

Location	Depth of Cover (in inches)
Private Property	12
Right of way, roads or streets	18

Excavating the Ditch or Trench:

NOTE: If installing using trenchless methods, see IAMU Procedure #2.6 – Installation of Pipelines by Trenchless Methods for specific details.

1) Always follow OSHA safety protocols for trenching and shoring safety.
2) Excavate the ditch or trench as straight as possible to minimize the stresses placed on the pipe and to protect the pipe and pipe coating from damage.
   a) The pipe should fit the ditch so that no external force is needed to hold the pipe in place before backfilling is complete.
   b) Any field bending of steel pipe must comply with requirements found in Division 8.5 of Requirements and Recommendations and IAMU Procedure #2.11 – Field Bending of Steel Pipe.
3) The depth of the ditch must meet all minimum cover requirements.
4) The width of the ditch should be wide enough that the pipe does not scrape on the sides of the ditch when being lowered or placed in the ditch.
5) The ditch bottom should be dug as level as possible while maintaining a consistent depth following the contour of the ground.
6) The ditch bottom should be free of any debris such as rocks, bricks, roots, etc. that may damage the pipe or pipe coating.
   a) If unable to remove all debris that could potentially damage the pipe or pipe coating, a suitable rock guard or rock shielding should be installed prior to lowering the pipe in the ditch. See IAMU Procedure #2.5 – Backfilling, for requirements.

Placing the Pipe in the Ditch:

1) Before placing the pipe in the ditch, the open ends of the pipe should be capped or plugged to prevent moisture or debris from entering the pipe until the final tie-in is made.
2) The pipe should be placed on undisturbed or well compacted soil.

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3) If long sections of pipe have been welded or joined together outside of the ditch, the pipe should be lowered, NOT dropped into the ditch. Padded slings or harnesses attached to excavation equipment may be used to lower the pipe into the ditch. The Operator should avoid jerking, dropping, or imposing any additional strain on the pipe while being lowered into the ditch.
4) Before lowering or placing the pipe in the ditch the pipe and/or pipe coating must be inspected for damage and any damage found must be repaired or replaced before backfilling.

Steel Pipe Joining Requirements:

All below ground steel pipe joints must either be welded by a qualified welder according to approved welding procedures or by using Category 1 mechanical fittings.

1) If a qualified welder is not employed by the Utility, a third-party contractor may be used. The qualification status of the individual must be verified, approved and records retained prior to welding.
   a) If the Utility does NOT have their own approved welding procedures, the welding procedures to be used during the welding, must be verified, approved and records retained prior to welding.
2) Category 1 mechanical fittings are fittings that provide a gas tight seal and are considered full pull-out resistant.

Tap Tee Installation – Making Connections to the Main:

1) Tapping tees can either be welded to the main by a qualified welder or by using a mechanical "bolt-on" tap tee. Installation must be on the top or side of the main.
2) All tapping tees installed to make hot taps, must be designed for at least the operating pressure of the pipeline to which it is attached.
3) Before tapping the main, a pressure test must be performed on all of the service line piping and components according to IAMU Procedure #5.1 & #5.2 - Pressure Testing Pipelines.

Excess Flow Valve (EFV) or Curb Valve Installation Requirements:

1) All service lines operating at or above a pressure of 10 psi with no history of contaminants in the pipeline, require the installation of an EFV or curb valve. Installation requirements are based upon the meter capacity at the time of the installation. See the table below for installation requirements.

Installed Meter Capacity	Installation Requirements
Less than or equal to 1,000 scfh	Excess Flow Valve (EFV)
Greater than 1,000 scfh	Excess Flow Valve (EFV) **OR** Curb Valve

2) For additional details see IAMU Procedure #3.6 - Install Excess Flow Valves or Curb Valves.

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Steel Riser Installation:

1) A piece of service line pipe may be used to fabricate a service riser.
   a) The section of service line pipe used to fabricate a service riser must be long enough to extend a sufficient distance above ground at final grade.
   b) The service line pipe may either be bent, using a pipe bender, to a 90° angle, or a 90° ell may be welded into the service line.
   c) Any bare or uncoated portions of the riser pipe must be coated. The coating should extend a sufficient distance above the pipe-to-soil interface so that bare pipe does NOT come in contact with the soil at final grade or after the installation of landscaping.
   d) The end of the service riser must be threaded to allow for the installation of a service valve.
2) If the service riser is going to extend above ground through a hard surface such as blacktop or concrete a protective sleeve should be installed around the service riser to provide protection against abrasion.
   a) The protective sleeve can be made by cutting approximately 12” of PVC pipe at least one nominal size larger than the service riser and install it so that encircles the service riser at the pipe-to-soil interface. Protective sleeve should extent to at least final grade.

Pressure Testing:

1) All new service line installations must be pressure tested according to the pressure and time requirements described in IAMU Procedure #5.1 & #5.2 - Pressure Testing Pipelines.
2) The pressure test should include all pipe and components from the tap tee to the service valve.
3) A pressure test may not be conducted against a closed valve. All valves must be open and the open end of the pipe either plugged or capped.
4) Pre-testing the pipe alone before the service line installation is not considered a satisfactory test. The tap tee, joints, couplings, riser, and service valve must all be included in the pressure test.

Tapping the Main:

1) All taps made on a pipeline under pressure must be performed by personnel that is qualified to make “hot taps” using manufacturers’ hot tap procedures.
2) Before tapping the main, a successful pressure test of the service line that includes the tap tee must be completed and the test medium (air or nitrogen) bled out of the service line.
3) For manufacturers hot tap procedures see IAMU Procedure #7.1, 7.2 & 7.3 - Tapping Pipelines.

Purging:

1) The service line must be purged after the hot tap procedure is made.
2) Proper purging must be performed to ensure that the proper concentration of gas, not air or nitrogen, is present in the service line.
3) For specific purging procedures, see IAMU Procedure #7.5 - Purge Flammable or Inert Gas.

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Inspection of Pipe and Components After Installation:

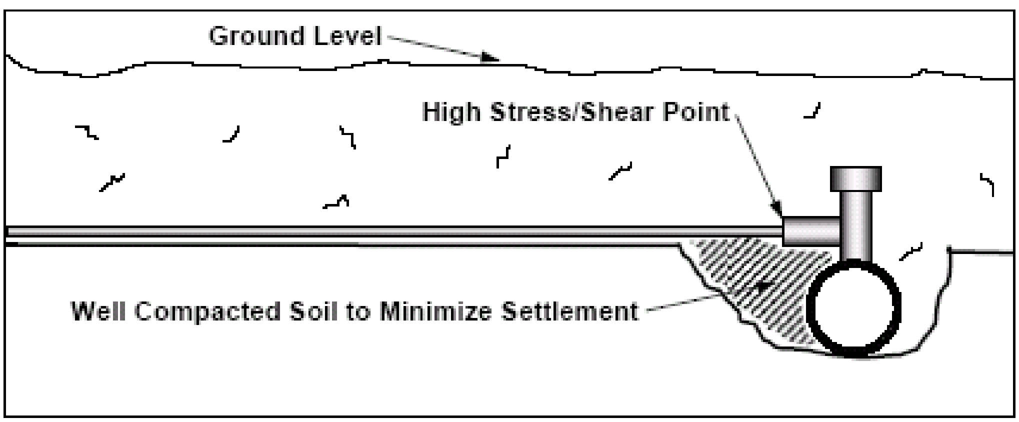
1) After the installation is completed and before backfilling, a visual inspection of the pipe, pipe coatings and pipeline components must be conducted.
   a) If any imperfections are found in manufacturer applied coatings, the coating imperfections must be repaired or replaced.
   b) Any areas where coating was removed during the installation must be repaired or replaced.
   c) Any damage that was sustained during installation by pipe or components must be repaired or replaced.

Ensuring Adequate Cathodic Protection:

1) Before backfilling, cathodic protection pipe to soil potential readings may be taken, using a half cell, at pipe depth and above ground.
2) If the cathodic protection reading is below the -850 mv threshold, an anode should be added or additional remedial measures taken.

Backfilling:

1) Care should be taken during backfilling operations to ensure that damage is not sustained by the pipe and components.
2) Special attention should be given at the "transition area" where the tap tee is connected to the service line as this location is susceptible to shear forces.
   a) Shear forces can be reduced or eliminated by adequately compacting backfill underneath this area allowing the pipe to rest on properly compacted soil.



3) Backfilling of the open excavations or trenches should be completed following IAMU Procedure #2.5 – Backfilling.

Documentation Requirements: All service line installations should be recorded and documented on the Pipeline Installation Report or a form or forms that contains all of the required information and kept for the life of the pipeline.

IAMU Procedure #3.2: Install Plastic (PE) Service Lines

SAFETY NOTE: A fully charged fire extinguisher must be located on-site and readily available for use in case of accidental ignition.

Essential Elements of the Installation Process:

1) Visually survey the site to determine the best proposed pipeline path and meter installation site.
2) Obtain the desired load/capacity of the installation so that the proper size of pipe and components can be installed.
3) If applicable, determine if the installation is going to require an EFV or curb valve.
4) Ensure that all materials (pipe, tap tee, EFV/curb valve, couplings, etc.) are in stock or will arrive before starting the installation process.
5) Notify Iowa One-Call of proposed excavation to ensure all utilities are located and marked prior to excavation.
6) Excavate the main, exposing a large enough area to allow for tap tee installation and additional pipe joining. Also, complete a visual inspection of all exposed pipe and components and document.
7) Excavate or trench the proposed pipeline path. If using trenchless methods, excavate an additional hole at the service line termination point (meter installation site).
8) Inspect all pipe and components for damage prior to installation.
9) Before installing pipe and components, all print line information (identification markings) from the pipe and components to be installed must be documented.
10) Install the tap tee, but DO NOT tap the main at this point.
11) Install the pipe in the trench or by using trenchless methods ensuring that an ample amount of pipe extends past each tie in location (tap tee and/or riser) to allow for expansion and contraction and ease of installation.
12) Install service riser, service valve and, if applicable, EFV or curb valve.
13) Make final tie in joints.
14) Install tracer wire and ensure separation if possible.
15) Inspect all pipe and components for damage after installation.
16) Perform pressure test and document results.
17) Perform hot tap.
18) Purge service line with natural gas and document purge results.
19) If applicable, apply approved pipe coating to all exposed steel pipe and fittings.
20) Before backfilling take measurements off of permanent structures to generate service line installation map.
21) Backfill and grade.
22) If not immediately installing meter set and establishing service to the customer, cap and lock service valve until service is required.

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Before Installation:

NOTE: Installation of service lines into or through foundation walls and under buildings is NOT allowed by this Plan.

1) Calculate the desired load and pressure requirements for the specific installation.
   a) By correctly calculating load demand, the appropriate pipe size, excess flow valve or curb valve requirements, regulator capacity, and meter capacity can be determined.
2) Determine the best route for the installation by considering the following;
   a) When possible, the proposed route should be as straight as possible from the main to the meter location. Keep in mind that the meter set location should be at least 3 feet from any possible ignition source or opening into the building.
   b) Proximity to other below ground utilities or structures.
   c) Proximity to trees or shrubs that have extensive root structures.
3) Attempt to notify all customers who are going to be affected by the excavation, taking into account all locations where excavation might take place (adjoining residences, residences across streets, etc.).
4) Notify Iowa One-Call of proposed excavation and allow 48 hours for locates to be completed as required by Iowa One-Call law.

Pipe Requirements:

1) Plastic (PE) pipe may not be operated at a pressure that exceeds 100 psi.
2) Plastic (PE) pipe to be installed must meet ASTM D2513-12ae1 manufacturing specifications and be either medium density (MDPE 2406/2708) or high density (HDPE 3408/4710).
3) Wall thickness may not be less than 0.062" for any pipe or tubing used during installation.
4) All plastic (PE) pipe must be installed below ground except when installed in a protective casing.

Visual Inspection of Pipe and Components:

1) Before installation, plastic pipe and components should be stored and handled according to requirements found in Division 3.7, of Requirements and Recommendations.
2) Before installation, an onsite inspection of the plastic pipe and components must be completed according to IAMU Procedure #2.3 – Visually Inspect Pipe and Components Prior to Installation.

Underground Clearance Requirements:

1) All pipelines must be installed with at least 12" of separation from any underground electric lines.
   a) If 12" separation is not possible the pipeline must be protected from damage that might result from the close proximity of the other utility or structure.
   b) Protection can be provided by installing the service line in a casing or by sleeving.

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Depth of Cover Requirements:

Depth of cover is measured as the distance between the top of the pipeline to the ground surface at final grade. The typical service line installation depth is 24", however, the table below details minimum cover requirements described in 49 CFR Part 192.361 for service lines. If minimum cover requirements cannot be obtained, the pipeline must be installed with additional protection to withstand anticipated external loads.

Location	Depth of Cover (in inches)
Private Property	12
Right of way, roads or streets	18

Excavating the Ditch or Trench:

NOTE: If installing using trenchless methods, see IAMU Procedure #2.6 – Installation of Pipelines by Trenchless Methods for specific details.

1) Always follow OSHA safety protocols for trenching and shoring safety during the excavation process.
2) Excavate the ditch or trench as straight as possible to minimize the stresses placed on the pipe and to protect the pipe and pipe coating from damage.
   a) The pipe should fit the ditch so that no external force is needed to hold the pipe in place before backfilling is complete.
   b) The minimum bend radius for plastic pipe must not be exceeded, see Division 8.6 for specific details.
3) The depth of the ditch must meet all minimum cover requirements.
4) The width of the ditch should be wide enough that the pipe does not scrape on the sides of the ditch when being lowered or placed in the ditch.
5) The ditch bottom should be dug as level as possible while maintaining a consistent depth following the contour of the ground.
6) The ditch bottom should be free of any debris such as rocks, bricks, roots, etc. that may damage the pipe.
   a) If unable to remove all debris that could potentially damage the pipe, a suitable rock guard or rock shielding should be installed prior to lowering the pipe in the ditch. See IAMU Procedure #2.5 – Backfilling, for requirements.

Placing the Pipe in the Ditch:

1) Before placing the pipe in the ditch, the open ends of the pipe should be capped or plugged to prevent moisture or debris from entering the pipe until the final tie-in is made.
2) The pipe should be installed with slack and placed on undisturbed or well compacted soil.

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3) If long sections of pipe have been joined together outside of the ditch, the pipe should be lowered, NOT dropped into the ditch. Padded slings or harnesses attached to excavation equipment may be used to lower the pipe into the ditch. The Operator should avoid jerking, dropping, or imposing any additional strain on the pipe while being lowered into the ditch.
4) Before lowering or placing the pipe in the ditch, the pipe must be inspected for damage and any damage found must be repaired or replaced before backfilling.

Plastic (PE) Pipe Joining Requirements:

1) All plastic (PE) pipe joining must be completed following heat fusion procedures or with Category 1 mechanical couplings.
2) Category 1 mechanical fittings are fittings that provide a gas tight seal and are considered full pull-out resistant.

Tap Tee Installation – Making Connections to the Main:

1) Tapping tees can either be heat fused to the plastic main, welded to a steel main or by using a mechanical "bolt-on" tap tee. Installation must be on the top or side of the main.
2) All tapping tees installed to make hot taps, must be designed for at least the operating pressure of the pipeline to which it is attached.
3) Before tapping the main, a pressure test must be performed on all of the service line piping and components according to IAMU Procedure #5.1 & 5.2 - Pressure Testing Pipelines.

Excess Flow Valve (EFV) or Curb Valve Installation Requirements:

1) All service lines operating at or above a pressure of 10 psi with no history of contaminants in the pipeline, require the installation of an EFV or curb valve. Installation requirements are based upon the meter capacity at the time of the installation. See the table below for installation requirements.

Installed Meter Capacity	Installation Requirements
Less than or equal to 1,000 scfh	Excess Flow Valve (EFV)
Greater than 1,000 scfh	Excess Flow Valve (EFV) **OR** Curb Valve

2) For additional details see IAMU Procedure #3.6 - Install Excess Flow Valves or Curb Valves.

Anodeless Riser Installation:

1) As of January 22, 2019, all factory assembled anodeless risers used for installations must meet the requirements of ASTM F1973-13 and ensure safe performance under anticipated external and internal loads.
2) The anodeless riser should be installed at a depth so the "DO NOT BURY BELOW" or "MAX BURY DEPTH" sticker is visible above ground. If the riser gets buried below this mark (or the crimp line), the riser will be considered an isolated segment and will require cathodic protection.

(continued on next page)

3) If the anodeless riser is going to extend above ground through a hard surface such as blacktop or concrete a protective sleeve should be installed around the riser to provide protection against abrasion.
    a) The protective sleeve can be made by cutting approximately 12” of PVC pipe at least one nominal size larger than the service riser and install it so that it encircles the riser at the pipe-to-soil interface. The protective sleeve should extend above final grade.
4) Before installing the meter assembly onto the anodeless riser, a riser post or adjustable riser bracket may be installed to provide support to the meter set and to prevent misalignment due to settling or frost heave.

Tracer Wire Installation:

1) All plastic service lines must have a tracer wire installed as means of locating the pipeline after it has been buried.
2) All tracer wire connections must be completed in a manner that produces an electrically and mechanically sound joint that will not loosen or separate.
    a) If available, the use of lockable connectors specifically designed for direct bury methods that are filled with a dielectric silicone gel is recommended. If lockable connectors are unavailable, the use of non-lockable lugs with or without dielectric silicone gel designed for direct bury methods are allowed.
3) Follow IAMU Procedure #2.7 – Tracer Wire Installation for specific details.

Pressure Testing:

1) All new service line installations must be pressure tested according to the pressure and time requirements described in IAMU Procedure #5.1 & 5.2 - Pressure Testing Pipelines.
2) The pressure test should include all pipe and components from the tap tee to the service valve.
3) A pressure test may not be conducted against a closed valve. All valves must be open and the open end of the pipe either plugged or capped.
4) Pre-testing the pipe alone before the service line installation is not considered a satisfactory test. The tap tee, joints, couplings, riser, and service valve must all be included in the pressure test.

Tapping the Main:

1) All taps made on a pipeline under pressure must be performed by personnel that is qualified to make “hot taps” using manufacturers’ hot tap procedures.
2) Before tapping the main, a successful pressure test of the service line that includes the tap tee must be completed and the test medium (air or nitrogen) bled out of the service line.
3) For specific manufacturers hot tap procedures see IAMU Procedure #7.3 - Tapping a Pipeline With a Built-in Cutter.

Purging:

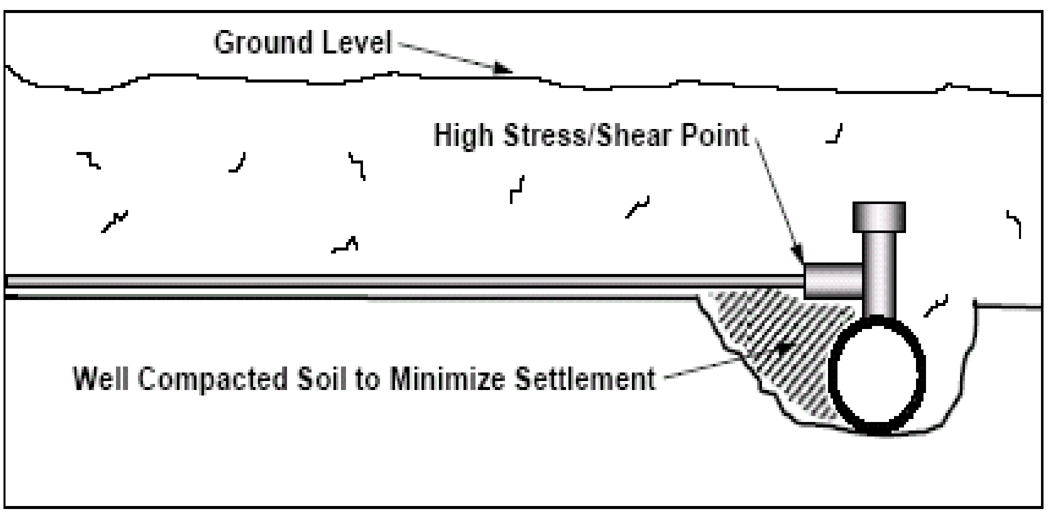
1) The service line must be purged after the hot tap procedure is made.
2) Proper purging must be performed to ensure that the proper concentration of gas, not air or nitrogen, is present in the service line.
3) For specific purging procedures, see IAMU Procedure #7.5 - Purge Flammable or Inert Gas.

Inspection of Pipe and Components After Installation:

1) After the installation is completed and before backfilling, a visual inspection of the pipe, and pipeline components must be conducted.
   a) Any damage to pipe or components that was sustained during installation must be repaired or replaced.
   b) If steel pipe coating was removed to install the tap tee, it must be cleaned and recoated prior to backfilling.

Backfilling:

1) Care should be taken during backfilling operations to ensure that damage is not sustained by the pipe and components.
2) Special attention should be given at the "transition area" where the tap tee is connected to the service line as this location is susceptible to shear forces.
   a) Shear forces can be reduced or eliminated by adequately compacting backfill underneath this area allowing the pipe to rest on properly compacted soil. See image below.



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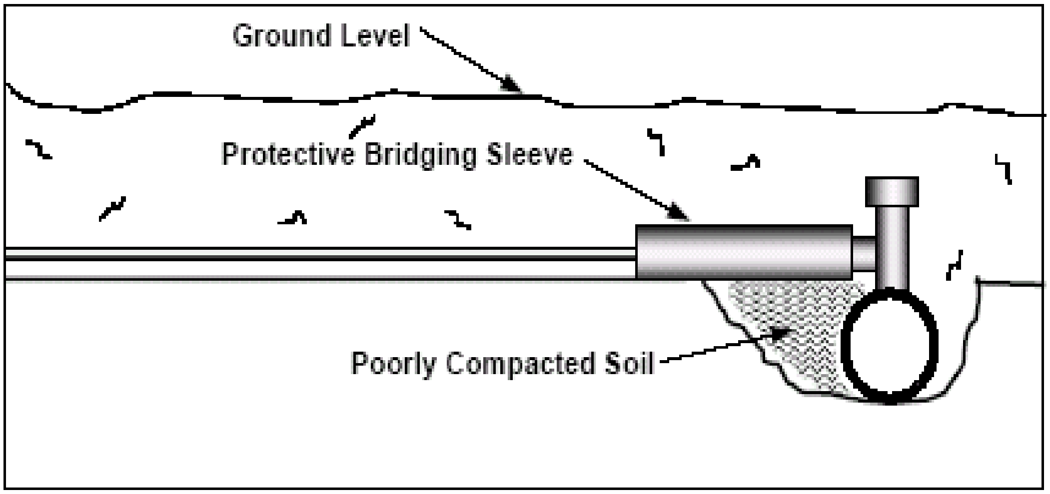
b) Shear forces can also be reduced or eliminated by installing a protective sleeve over the transition area. See image below.



i) If installing a protective bridging sleeve, the sleeve size should be at least one nominal pipe size larger than the service line pipe and must be inserted over the service line before making the tie in joint at the tap tee location.

3) Backfilling of the open excavations or trenches should be completed following IAMU Procedure #2.5 – Backfilling.

IAMU Procedure #3.3: Temporary Isolation of Service Lines and Service Discontinuance

NOTE: This procedure is to be used anytime gas service is to remain inactive, be discontinued due to non-payment or upon customer's request.

1) Upon arrival, verify the correct location and/or address by comparing to what is listed on the service order.
2) Find the location of the meter set installation and, if applicable, verify the number on the meter to the meter number on the service order.
3) Document the final meter reading on the service order for billing purposes.
4) While on site, it is recommended to check the meter installation for signs of vandalism, misuse, tampering, obstructed vents, or leaks.
   a) If signs of vandalism, misuse, or tampering are evident, take pictures and document findings on service order.
   b) If an obstructed vent is found, remove obstruction if possible.
   c) If a leak is found, continue with outside leak investigation until source of leak is found and repaired.
5) To discontinue service to the customer, one of the following three methods may be used;
   a) Close the inlet service valve by turning ¼ to the closed position to prevent the flow of gas through the customer meter. The service valve must be locked with a company approved locking device designed to prevent operation of the valve by persons not authorized by the operator.
   b) A mechanical device or fitting that will prevent the flow of gas to the customer may be installed in the service line or in the meter assembly.
   c) The customer's piping may be physically disconnected from gas supply preventing the flow of gas and the open pipe ends sealed.
6) If the service valve is closed, locked, and the meter and/or regulator are removed, the open end of the service line pipe must be capped or plugged to prevent debris or water from entering piping system.

NOTE: Service discontinuance for non-payment may **NOT** be performed between November 1st and April 1st due to the winter moratorium. If a customer requests gas service be discontinued during these months, you may remind the customer that their water service should be discontinued and pipes should be winterized so that damage does not occur if the pipes were to freeze.

IAMU Procedure #3.4: Install Service Line Valves Upstream of Customer Meter

NOTE: All gas service lines must have a readily accessible shut-off valve located upstream of the customer meter and/or regulator and if feasible located outside. All above ground shut-off valves must have a means of being locked in the closed position to prevent unauthorized use.

Types of Service Line Valves:

1) Insulated ¼ turn shut-off valve.
2) Non-insulated ¼ turn shut-off valve.
3) Sealed (non-lubricating) or lubricating valves.
4) Ball valves or soft rubber core valves.

NOTE: Valves located on bypass meter bars may not be considered as the service line shut-off valve.

Installation of Shut-off Valve on Top of Service Riser:

1) The most common practice is to install a ¼ turn shut-off valve at the top of the service riser, upstream (before) the regulator and meter set.
2) It is recommended that the valve be located 12” above ground with 6” of clearance behind and 36” of clearance in front.
3) The ¼ turn shut-off valve may either be threaded or welded onto the top of the service riser.
4) During service line installation, the shut-off valve must be included in the pressure test. The valve must be left in the open position and plugged so that the valve body is tested.

Installation of Excess Flow Valves (EFV) or Curb Valves:

1) As of April 14, 2017, all service lines operating at or above a pressure of 10 psi with no history of contaminants in the pipeline, require the installation of an EFV or curb valve. Installation requirements are based upon the meter capacity at the time of the installation. See the table below for installation requirements.

Installed Meter Capacity	Installation Requirements
Less than or equal to 1,000 scfh	Excess Flow Valve (EFV)
Greater than 1,000 scfh	Excess Flow Valve (EFV) **OR** Curb Valve

2) If required to install a curb valve, it must be installed in a covered durable valve box or standpipe that provides access to the valve and is supported independently from the service line.
3) For additional details see IAMU Procedure #3.6 - Install Excess Flow Valves or Curb Valves.

IAMU Procedure #3.5: Maintenance of Service Valves Upstream of Customer Meter

Service Valve Lubricating Tools:

1) Although, not required, it is recommended that the Mueller H-11199 Relubricating Tool is used to lubricate meter valves as needed.

Lubricating Procedure for Mueller H-11199

Mueller Co.
Reliable Connections™

H-11199 Relubricating Tool

Relubricating Instructions

1. Unscrew cap from the H-11199 Relubricating Tool.
2. Remove shaft from body and turn handle counter-clockwise to retract shaft until "O" ring and piston are withdrawn into cap.
3. Insert a stick of Mueller Grease (H-853) into the body.
4. Replace and tighten cap.
5. Turn handle clockwise to force grease out of the nozzle opening.
6. Be sure the Luboseal® Stop is in either the FULLY OPEN or FULLY CLOSED position. This aligns the vertical groove in the key with the grease port recess.
7. Remove the grease plug by using the hex wrench on Relubricating Tool handle. Screw tool nozzle into grease plug threads as far as possible.
8. Turn the handle clockwise, forcing the grease into the vertical groove in the key. If immediate resistance is encountered, probably the groove in the key is not aligned with the grease port. Turn the key slightly in either direction until the grease begins to flow.

(continued)

Relubricating Instructions *(continued)*

- The amount of grease required to relubricate a Luboseal® Stop depends upon how hard the stop turns and how much grease must be replaced. The table below shows the number of complete revolutions of the handle required to fully relubricate each size of Luboseal® Stop. The table is based on the assumption that the stop has excessive port leakage and that considerable grease has been dissipated.

Size of Stop	Revolutions of Handle to Fill Stop
3/4"	6
1"	7-1/2"
1-1/4"	10
1-1/2"	13-1/2"
2"	16
2-1/2"	25-1/2"

- **NOTICE:** Do not over lubricate. If the condition of the stop is not too bad, not as many turns of the handle will be required as is indicated in the table. The service technician, after a few trials, should be able to tell by the feel of the handle whether or not the stop is filled with grease. Be sure to use MUELLER GREASE STICKS. They are made especially for MUELLER STOPS.

9. Replace grease plug and tighten, using hex wrench on Relubricating Tool handle.

Phone: (800) 798-3131

By deviating from the above listed instructions, you will void any product warranty and release Mueller Co. and its affiliated entities from any and all liability associated with the installation or use of this product. For details on the product's warranty, terms, and conditions, please visit www.muellergas.com.

Form 9664 05/16

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Replacing/Changing-out Service Line Valve:

If an existing service valve is leaking gas, will not turn, or unable to lock, it is recommended that an approved valve change tool is used to safely change out the existing service valve with a new one.

Mueller "No Blo" Valve Changer Procedure:

Mueller® NO-BLO® Valve Changers

General Information

Capacity and Use

The Mueller® NO-BLO® Valve Changer provides a safe, effective and easy-to-use means for stopping gas flow upstream of the meter valve allowing the valve to be replaced. It also allows the MIP threads on the riser to be refurbished, if necessary.

For complete information on the uses of these machines and the equipment and attachments required, see the latest Mueller Gas Catalog at muellergas.com.

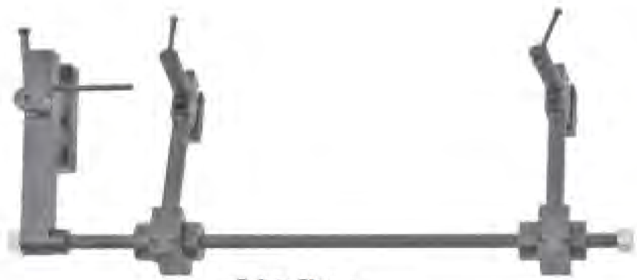
Units for 3/4", 1" or 1 1/4" Valves

- H-17010 Valve Changer for schedule 40 steel pipe, with Safety Clamp and 3/4", 1" and 1 1/4" Plugging Units.
- H-17013 Valve Changer for schedule 80 steel pipe, with Safety Clamp and 3/4", 1" and 1 1/4" Plugging Units.
- H-17016 Plugging Unit for 1/2" CTS PE risers, in 1/2" x 3/4", 1/2" x 1" sizes (Safety Clamp purchased separately) – second number in size refers to the size of valve.
- H-17017 Plugging Unit for 1/2" schedule 40 steel pipe, in 1/2" x 3/4" sizes (Safety Clamp purchased separately) – second number in size refers to the size of valve.
- 581352 Plugging Unit for 3/4" valves installed on 1/2" schedule 40 steel pipe ID risers (Safety Clamp purchased separately).

Working Pressure

- 60psig (414 kPa) Maximum Working Pressure

During the use of this equipment, the line pressure must not exceed the amount indicated.



Safety Clamp

1/2" x 3/4" Plugging Unit (for 1/2" CTS riser shown*)
*1/2" x 1" for 1/2" CTS riser has similar appearance

3/4" Plugging Unit and 3/4" x 1/2" Schedule 40 Steel Pipe Changer has similar appearance

1" Plugging Unit

1 1/4" Plugging Unit

The NO-BLO Valve Changers on this page consist of a Safety Clamp and three Plugging Units, except the H-17016, H-17017 and 581352 which are Plugging Units alone that must be used with a Safety Clamp, provided separately.

Plugging Unit Size	Valve Size	Min. Port Width	Min. Port Height
1/2" x 3/4"	3/4"	13/32"	23/32"
1/2" x 1"	1"	13/32"	23/32"
3/4"	3/4"	13/32"	23/32"
1"	1"	17/32"	31/32"
1 1/4"	1 1/4"	11/16"	1 9/32"

(continued on next page)

Mueller® NO-BLO® Valve Changers

General Information

Units for 1½" or 2" Valves

- H-17012 Valve Changer for schedule 40 steel pipe, with Safety Clamp and 1½" and 2" Plugging Units.
- H-17014 Valve Changer for schedule 80 steel pipe, with Safety Clamp and 1½" and 2" Plugging Units.

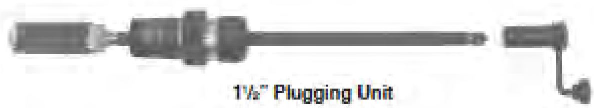
Working Pressure

- 60psig (414 kPa) Maximum Working Pressure

During the use of this equipment, the line pressure must not exceed the amount indicated.

Plugging Unit Size	Valve Size	Min. Port Width	Min. Port Height
1½"	1½"	25/32"	1 19/32"
2"	2"	1 5/32"	2"

Safety Clamp



1½" Plugging Unit

2" Plugging Unit

When Ordering Extra Safety Clamps Or Plugging Units, Use The Part Numbers In The Table Below

PLUGGING UNIT		SAFETY CLAMP	PLUGGING UNIT SIZES						
Catalog No.	Model No.		½" x ¾"	½" x 1"	¾"	1"	1¼"	1½"	2"
H-17010	2	682597	—	—	83962	83963	83964	—	—
H-17012	1	83792	—	—	—	—	—	83805	83928*
H-17013	2	682597	—	—	83962	580530	580531	—	—
H-17014	1	83792	—	—	—	—	—	580630	580750
H-17016	1	682597	H17016-163	H17016-164	—	—	—	—	—
H-17017	1	682597	1701010-250	—	—	—	—	—	—
581352	2	682597	581352	—	—	—	—	—	—

**2" Plugging Unit for H-17012 is Model No. 2.*

(continued on next page)

Assembling the Plugging Unit

A–Preparing Plugging Unit for Use

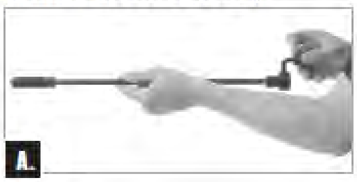
1. Select proper plugging unit according to size of valve to be removed.

2. Close valve to be removed.

3. Purge gas from piping in an accepted manner, preferably from highest point in piping system.

4. Remove enough pipe and fittings from valve outlet to permit easy accessibility.

5. Examine Valve Changer Unit for proper function. Inspect Rubber Plug to be sure it is in good condition. Free up Rubber Plug by partially compressing and relaxing it several times. This is done by holding Shaft Tube in one hand and turning Shaft Crank alternately clockwise & counter-clockwise (**Pic. A**).


A.

6. Lubricate Rubber Plug by applying Mueller Rubber Stopper Lubricant (Part #580657).

7. Lubricate the bleeder O-rings. This is done by applying Mueller Rubber Stopper Lubricant (Part #580657) to outside of machined surface of Stuffing Box and sliding Bleeder Ring up and down while turning it slightly.

8. Lubricate Shaft Tube with Mueller Rubber Stopper Lubricant (Part #580657) and slide Stuffing Box up and down.

9. Measure width of valve port opening to be sure it is equal to or greater than minimum port width for appropriate Rubber Plugging Unit as listed on pages 2 and 3.

NOTE: Cutting of pipe will often form a burr inside pipe. While this burr might not interfere with threading and installation of original valve on the pipe, it can cause problems when replacing a valve with a Valve Changer. This burr can prevent the Rubber Plug on Plugging Unit from entering the pipe, also preventing removal of existing valve in a NO-BLO® Method.

Reamers and special machine adapter nipples are used under pressure with F-1™ Machine to ream inside of pipe and remove burrs before using the Valve Changer.

B–Assemble Plugging Unit To Meter Valve (Pic. B)

1. Fully retract Rubber Plug into Stuffing Box.

2. Thread Stuffing Box fully into outlet of valve to be removed.

3. Close Bleeder Valves by sliding the Bleeder Ring upward while turning it at same time.

4. Open valve fully, carefully lining up valve key with piping.

5. Turn Shaft Tube until small arrow on tapered portion of Shaft Tube is lined up with the valve key. This arrow locates the flat Rubber Plug is in proper alignment to pass through port opening of valve. (It is not necessary to locate arrow when using the H-17016 for PE risers.)

C–Attach Safety Clamp To Pipe (Pic. C)

1. Position Safety Clamp on pipe with its short locating pin just touching inlet of valve to be removed.

2. Tighten Pipe Clamp firmly using hand force only. Never use an extension on handle of Pipe Clamp vise.


B.


C.

(continued on next page)

Mueller® NO-BLO® Valve Changers

Plugging Unit Assembly / Removing Old Valve

3. Adjust bottom Shaft Tube Clamp so that it is aligned with keyway of valve to be replaced.

4. Move top shaft tube clamp approximately 3" down from top nut on the safety clamp and fasten loosely. This will help to place the rubber plug into the riser.

NOTE: It may be necessary to take a manual measurement for proper placement.

5. Applies to 1½" and 2" Safety Clamps only: Adjust each knurled Shaft Clamp positioning sleeve so that Shaft Tube Clamp is approximately in the center of threaded portion of each sleeve.

D–Insert And Expand Rubber Plug (Pic. D)

1. Place Shaft Crank on hexagon shaft nut on top of Plugging Unit.

2. Push Shaft Tube downward through the stuffing box until its tapered portion (with arrow) is just through the top Shaft Tube Clamp. This will move Rubber Plug downward through valve and into inlet pipe, below valve.

D.

3. Hold Plugging Unit in this position and tighten top Shaft Tube Clamp vise firmly using hand force only.

Never use an extension on handle of clamp vise. This vise should seat on smaller diameter portion of Shaft tube, with front edge of vise just above the tapered portion of Shaft Tube (**Pic. E**).

E.

4. Remove Shaft Crank. Count and note number of exposed threads on shaft end. This number will be used later when the plug is relaxed. Replace Shaft Crank.

5. Expand Rubber Plug by turning Shaft Crank **clockwise** until end of threaded shaft is flush with end of Shaft Crank Sleeve.

NOTE: The H-17016 for PE risers will not require more than a few turns to create a stopoff, DO NOT over expand.

6. Open Bleeder Valve by sliding Bleeder Ring downward while turning it slightly. Tightness of the shut-off will also be indicated at this point by absence of continued gas flow.

7. If flow continues from Bleeder Valve, a shut-off has not been effected.

a) Close Bleeder Valve by sliding Bleeder Ring upward while turning it slightly.

b) Rotate Shaft Crank slowly one additional full turn **clockwise**.

c) Again test for tightness using Bleeder Valve.

d) If shut-off has not been effected, continue rotating Shaft Crank one turn at a time, testing with Bleeder Valve after each turn.

IMPORTANT: The limit of travel is when Shaft Nut comes into contact with a shoulder on the shaft. This will occur when end of the shaft is approximately 3/8" to 1/2" beyond end of the Shaft Crank Sleeve (Pic. F).

F.

E–Remove Old Valve

⚠ **CAUTION: DO NOT attempt to remove the old valve without the Safety Clamp being in place.**

1. When a shut-off has been effected, unthread old valve from pipe.

2. Slide the Stuffing Box with valve still attached upward along Shaft Tube (**Pic. G**).

G.

(continued on next page)

3. Swing bottom Shaft Tube Clamp into position onto Shaft Tube of Plugging Unit, and secure so bottom edge of its vise is next to the riser.

4. Tighten Clamp vise firmly using hand force only. Never use an extension on handle of Clamp vise.

5. Remove Shaft Crank (**Pic. H**).

H.

6. Open Clamp vise on top Shaft Tube Clamp and swing it out of position.

7. Slide Stuffing Box with valve as a unit off Shaft Tube, turning the assembly slightly as it is moved along the Shaft Tube (**Pic. I**). Be careful not to drag Stuffing Box O-rings over exposed threads.

I.

8. Remove old valve from Stuffing Box.

9. If necessary, cut off and re-thread the pipe end before installing new Mueller® Meter Valve. See instructions "F". If not necessary to re-thread pipe, skip instructions "F".

F–Re-thread Pipe

1. After old valve is unthreaded from service pipe, examine the riser threads. If it is apparent they have been damaged, thread old meter valve back on pipe WITH STUFFING BOX ATTACHED, then relax Rubber Plug.

2. Loosen Safety Clamp and slide it away from bottom end of valve.

3. Remove short Locating Pin on Safety Clamp and replace it with the long Locating Pin. Slide Safety Clamp upward toward bottom end of valve until Locating Pin touches valve, then tighten Safety Clamp securely.

4. Insert and expand Rubber Plug and remove old valve as was done previously.

5. Measure back 1³/₈" from the end of service pipe.

⚠**CAUTION: This is the maximum amount that can be cut off without damaging Rubber Plug expanded inside the service pipe.**

6. Remove long Locating Pin and cut off old threads. A three wheel type narrow pipe cutter must be used to cut off threads.

7. Slide cut off piece of service pipe and old valve upward so bottom Shaft Tube Clamp can be attached. Once attached, top Shaft Tube Clamp can be disengaged allowing old valve and cut off section of pipe to be removed.

8. Place die head over Shaft tube and engage top Shaft Tube Clamp. Disengage bottom Shaft Tube clamp and proceed to re-thread service pipe. After threads are cut, remove die head in the same manner as was done in instruction 7.

9. Install new valve as described in instructions G.

G–Install A New Mueller Valve

1. Thread Stuffing Box into outlet end of new Mueller Valve.

2. Open valve fully, carefully lining up valve key with piping.

3. Slide valve with Stuffing Box over end of Shaft Tube, being careful not to drag Stuffing Box O-rings over exposed threads. Turn the assembly slightly as it is moved along the Shaft Tube.

4. Swing top Shaft Tube Clamp back into position and tighten the vise.

5. Open vise of bottom Shaft Tube Clamp and swing it out of position (**Pic. J**).

J.

6. Brush and clean the threads on end of pipe and apply non-hardening pipe thread sealant.

7. Move meter valve with Stuffing Box downward and thread valve onto the end of pipe. If possible to do so and make a pressure tight connection, tighten valve until its key is in line with small arrow on Shaft Tube.

NOTE: If valve comes in contact with Locating Pin before making a tight connection with pipe, unthread the valve from piping (without removing it from Valve Changer), remove Locating Pin and then reassemble end valve to pipe.

(continued on next page)

8. Close Bleeder Valve by sliding Bleeder Ring upward while turning it slightly (**Pic. K**).

K.

H–Relax Rubber Plug And Remove Equipment

1. Replace Shaft Crank on Shaft Nut and rotate it **counter-clockwise** until the number of threads noted in step D4 are exposed at end of Threaded Shaft.

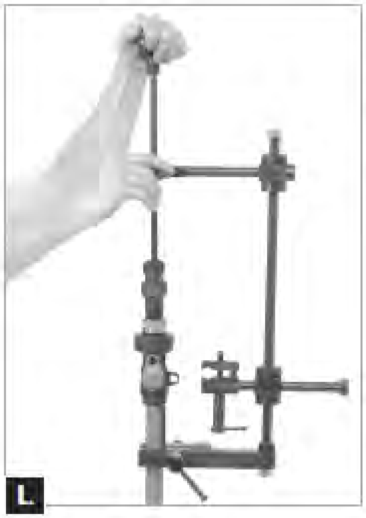
2. IMPORTANT: The pressure inside pipe may tend to force Shaft Tube upward. Hold down on Shaft Tube by placing palm of hand solidly against the face of Shaft Crank (Pic. L). Use other hand to open vise of top Shaft Tube Clamp and slowly slide Shaft Tube upward so Rubber Plug passes through the valve and fully into Stuffing Box. If necessary, turn Shaft Tube so arrow is in line with valve key which aligns the rubber plug with the port opening through the valve (Pic. M).

3. Close valve.

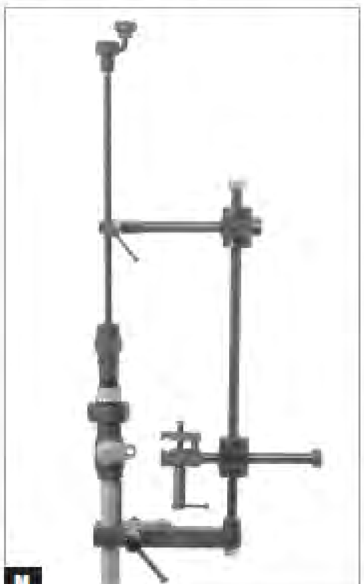
4. Open Bleeder Valve by sliding Bleeder Ring downward while turning slightly, exhausting gas from Stuffing Box.

5. Remove equipment.

6. Re-connect outlet piping, purge, check for leaks and place in service.



L.



M.

I–Replacing The Rubber Plug

NOTE: The rubber plug is subjected to great stress and distortion in normal use. When worn or damaged it must be replaced.

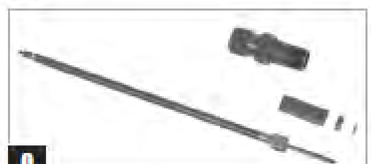
1. Fully relax Rubber Plug by turning Shaft Crank **counter-clockwise**.

2. Remove Shaft Crank and hold Plugging Unit in a vertical position with end of shaft on a table or similar solid support.

3. Grasp Rubber Plug and partially compress the plug by pulling downward. This will disengage the locking feature between the End Ferrule and the Locknut (**Pic. N**).

4. Remove Locknut, End Ferrule, and Rubber Plug (**Pic. O**).

N.



O.

5. Clean shaft and lubricate with Mueller Rubber Stopper Lubricant (Part #580657).

6. Slide on new Rubber Plug and reinstall End Ferrule.

7. Compress Rubber Plug approximately $^{1}/_{16}$" to $^{1}/_{8}$" by pulling downward on End Ferrule.

8. Replace Locknut and align its sides with slot in the end of End Ferrule.

9. Relax Rubber Plug, which will act as a spring forcing End Ferrule into contact with Locknut and prevent it from backing off.

IAMU Procedure #3.6: Install Excess Flow Valves or Curb Valves

NOTE: All excess flow valves must meet the performance standards described in Division 9.21 of Requirements and Recommendations.

EFV Installation Requirements:

1) An excess flow valve (EFV) must be installed on any new or replaced service lines serving the following types of services:
   a) A single service line serving one single family residence (SFR).
   b) A branched service line serving a SFR installed at the same time as the primary SFR service line.
      i) Example – One EFV installed on the primary service line that protects both service lines.
   c) A branched service line to a SFR installed off of a previously installed SFR service line that does NOT contain an EFV.
   d) Multifamily residences with an installed meter capacity NOT exceeding 1,000 scfh (standard cubic feet per hour) at the time of installation.
      i) Example – If a single service line is installed to an apartment complex that contains multiple meter sets, the combined capacity of all installed meter sets must be calculated. If the total capacity is less than 1,000 scfh an EFV must be installed.
   e) A single, small commercial customer served by a single service line with an installed meter capacity NOT exceeding 1,000 scfh at the time of installation.
   f) A replaced service line is defined as a service line where the fitting that connects the service line to the main (tap tee) is replaced or the piping directly connected to the tap tee is replaced.

EFV Installation Exceptions:

1) An excess flow valve is NOT required to be installed if any the following conditions are present:
   a) The service line does not operate at a pressure of 10 psi or greater throughout the year.
   b) Based on prior experience, there are known contaminants in the gas flow that could interfere with EFV operation or cause loss of service to customer.
   c) An EFV could interfere with necessary O&M activities, such as blowing liquids from the line.
   d) An EFV meeting the performance standards found in Division 9.21 of Requirements and Recommendations is not commercially available.

Customers Right to Request an EFV:

As of April 14, 2017, a customer has the right to request an EFV be installed on an already existing service line that does NOT contain an EFV. See Division 9.23 of Requirements and Recommendations for specific details on the customer's right to request notification.

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<u>Curb Valve Installation Requirements:</u>

1) If the installed meter capacity on any new or replaced service line exceeds 1,000 scfh, a curb valve (manual shut-off valve) OR if possible, based on sound engineering and availability, an EFV must be installed.
2) If a curb valve is installed on any new or replace service line, it must be installed to allow access during emergencies so that the flow of gas may be manually shut off, if needed.
3) Curb valves must be installed on the service line as close as practical to the main, unless determined, by sound judgement, that the location nearest the main may possibly hinder the ability to gain access to valve during emergencies.

Guidance Chart:

Installed Meter Capacity	Installation Requirements
Less than or equal to 1,000 scfh	Excess Flow Valve (EFV)
Greater than 1,000 scfh	Excess Flow Valve (EFV) **OR** Curb Valve

<u>Considerations Before Installation:</u>

1) Calculate the load demand (installed meter capacity) of the installation to determine if an EFV is required or if a curb valve is going to be installed.
2) Determine the appropriate location for the installation of the EFV or curb valve. The following location factors may be considered:
   a) If the main is located under a concrete roadway, the EFV or curb valve may be installed just off of the curb line to allow access for operation, maintenance, repairs and replacement.
   b) If the installing a curb valve in a wall-to-wall concrete area, considerations should be given to determining appropriate type of valve box and lid that can withstand external forces.
3) If installing an EFV, the capacity of the EFV must be greater than the maximum calculated load demand (installed meter capacity).
   a) If the EFV capacity is less than the calculated load demand, and the flow demand exceeds the predetermined limit of the EFV, the EFV will close and service may be lost.
4) The pressure rating of the EFV or curb valve being installed must be equal to or greater than the MAOP of the system to which it is attached.

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EFV Installation Procedures:

NOTE: An EFV may be steel or plastic and installed as a coupling, fitting, or built into the tap tee.



1) Visually inspect the EFV for signs of damage or defects that may affect the operation of the EFV or service line.
2) Confirm that the information printed on the EFV matches the requirements for the specific installation.
3) Document and record the printed information (print line) on the EFV for tracking and traceability purposes.
   a) A picture may be taken of the printed information and kept on file with the installation records.
4) All EFVs contain a flow direction arrow that must be pointed in the direction of flow (towards the meter) during installation.
5) The EFV should be installed as close as practical to the main (see "Considerations Before Installation" on previous page for exceptions) using the appropriate heat fusion or mechanical coupling procedures found in Part 1 of this Plan. If installing a steel EFV by welding, the appropriate butt-welding procedure found in the IAMU Welding Procedures Manual must be followed and care taken not to damage the EFV by overheating.
   a) It is recommended that a 12" piece of service line pipe be installed between the tap tee and the EFV so that repairs or replacements of the EFV can be accomplished without the installation of a new tap tee.

After Installation:

1) The EFV must be pressure tested as part of the service line following IAMU Procedure #5.1 & #5.2 - Pressure Testing Pipelines.
2) A tag, sticker, or some sort of identification noting the presence of an EFV in the service line must be installed on the meter set so that it is readily visible and not likely to be damaged or removed.
3) A permanent record and map of the EFV installation must be maintained in records.

NOTE: The total number of EFV's installed during the calendar year as well as the total number of EFV's installed in the system are required to be reported on the PHMSA 7100 Distribution Report.

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Curb Valve (Manual Shut-off Valve) Installation Procedures:

NOTE: A curb valve may be installed on either steel or plastic service lines.

1) It is recommended that sealed, non-lubricating ¼ turn ball valves are selected for curb valve installations.
2) Visually inspect the valve for signs of damage or defects that may affect the safe operation of the valve or service line.
3) Confirm that the information printed on the valve matches the requirements for the specific installation.
4) Document and record the printed information (print line) on the valve for tracking and traceability purposes.
   a) A picture of the information may be taken and kept on file with the installation records.
5) Ensure that the valve box to be installed is appropriate for the specific type of installation.
6) The valve to be installed may have a directional arrow on the valve body. Make sure that during installation the directional arrow points in the direction of flow (towards the meter).
7) The valve should be installed as close as practical to the main (see "Considerations Before Installation") using the appropriate heat fusion or mechanical coupling procedures found in Part 1 of this Plan. If installing a steel valve by welding, the appropriate butt-welding procedure found in the IAMU Welding Procedures Manual must be followed and care taken not to damage the valve core by overheating.
   a) It is recommended that the curb valve NOT be connected directly to the tap tee. A minimum of 12" of service line pipe may be installed between the tap tee and the curb valve to allow for the proper installation of a valve box and for repairs and replacements of the valve without the installation of a new tap tee.

After Installation:

1) The valve must be pressure tested as part of the service line following IAMU Procedure #5.1 & #5.2 - Pressure Testing Pipelines.
2) When installing the valve box, the valve box must be covered, durable and large enough to allow for maintenance and operation activities, extend up to at least ground level at final grade, and allow for the ability to gain access to the valve at all times.
   a) The valve box may not sit or rest on the service line. The valve box must be supported independently from the service line by installing cribbing, blocking, or supported on properly compacted soil.
3) A permanent record and map of the valve installation must be maintained in records.

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Curb Valve Maintenance Requirements:

1) All curb valves installed after April 14, 2017 must be inspected and maintained at least once every 5 years not to exceed 63 months. All curb valves installed prior to April 14, 2017 are NOT subject to these requirements.
2) Inspection and maintenance must include the following:
   a) If located below ground, the valve box must be inspected for alignment and accessibility.
      i) If the valve box is found misaligned to the point it restricts access or if the valve has been covered with debris, remedial action must start within 90 days of discovery to correct the problem.
   b) All curb valves must be operated at least 1/8th of a turn.
      i) If fully operated at the time of inspection, ensure that flow conditions are such that service downstream will NOT be interrupted.
      ii) If fully operated at the time of inspection, the valve should be opened and closed slowly to avoid potential damage to any components located downstream.
   c) If the valve is found to be inoperable, complete repairs or replacement must be completed within 12 months.
   d) Any curb valve requiring lubrication, should be lubricated according to the manufacturer's recommended procedures and care should be taken to avoid over lubrication.

Record Keeping:

1) All curb valve installations and maintenance must be documented and recorded for the life of the pipeline. The Valve Installation & Maintenance Record may be used as a recordkeeping form.

NOTE: The total number of curb valves (manual shut-off valves) installed during the calendar year as well as the total number of curb valves installed in the system after April 14, 2017, are required to be reported on the PHMSA 7100 Distribution Report.

IAMU Procedure #3.7: Check for Irregularities in the Condition of Meter Installations

NOTE: Checking for irregularities in meter installations may be performed during routine maintenance, meter turn on/off, meter reading, patrols, leak surveys, atmospheric corrosion surveys, or just simply making general observations while moving throughout the system.

Check for the following irregularities and factors affecting the safe operation of meter installations:

1) **Meter Misalignment**
   a) Indicated by the meter being tilted (front to back), angled (side to side) or not square/plumb with attached piping.
   b) A meter can read incorrectly if it is titled (front to back) more than 15° off level.
2) **Soil Subsidence**
   a) Causes strain on piping and meter installations by ground settlement or shifting of the soil around the pipeline.
      i) Signs of soil subsidence may include depressions in the soil where the service line was installed, broken or sunken curbs, sidewalks, or driveways, and leaning or tilted meter installations.
3) **Stress on Piping**
   a) Disconnected pipe supports or riser brackets, unsupported meters, and long spans of pipe without supports or hangers are all indications that stress is being placed on pipe and components.
4) **Vandalism**
   a) Indications of vandalism may include, broken index and dials, dented or damaged meter casing, and missing or damaged meter seals.
   b) If indications of vandalism are found, they should be documented and reported to management.
5) **Tampering or Diversion**
   a) Meter tampering or diversions are any attempt by an unauthorized user to alter or interfere with the normal function of a meter by the following:
      i) Removing the meter at intervals during the billing cycle to reduce bill.
      ii) Bypassing a meter in order to receive free natural gas.
      iii) Damaging or altering the meter index to change the meter reading.
      iv) Reversing the meter on its connections.
      v) Removing the teeth from the index drive gears.
      vi) Broken or missing company locking devices.
      vii) Altered company equipment.
   b) If indications of intentional tampering or diversions are found, and an unsafe condition exists, close the shut-off valve, document the findings and report to management.

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6) **Misuse of Riser and Meter Set**
   a) The riser and meter should not be used for any other purpose than it was intended.
   b) Nothing should be leaning or tied to the riser or meter set including the following:
      i) Dog chains (tying dog to riser)
      ii) Bicycles
      iii) Laundry lines
      iv) Garden hoses, electrical drop cords, TV or telephone cables
   c) The riser or meter set may also NOT be used as an electrical ground. NFPA 54, 7.13.3 states "Prohibited use. Gas piping shall not be used as a grounding conductor or electrode. This does not preclude the bonding of metallic piping to a grounding system."
   d) If misuse of the riser or meter set is discovered, document the findings and report to management.
5) **Atmospheric Corrosion**
   a) Examine the pipe and components for deterioration or pitting that has resulted in metal loss.
   b) Close attention should be paid to the pipe-to-soil interface for signs of damaged or disbonded coating on steel risers. For anodeless risers, ensure that the crimp line or "Do Not Bury Below" sticker is visible above ground.
   c) See IAMU Procedure #4.11 - Visual Inspection for Atmospheric Corrosion for additional details.
6) **Leaking Gas**
   a) If any indication of a gas leak is present (odor, dead vegetation, swarm of insects), remember to protect life and property and continue with a leak investigation until the source of the leak has been discovered.
7) **Outside Forces or Acts of Nature**
   a) Be aware for any abnormal operating condition that might have occurred due to the following:
      i) Vehicular (car, truck, lawn mower, etc.) damage.
      ii) Lightning
      iii) Floods
      iv) Tornadoes
      v) Heavy snowfall or ice storms

IAMU Procedure #3.8: Restore Service

NOTE: This procedure is to be used anytime gas service is initially provided to a customer or anytime gas service is being restored during a company or customer planned outage.

1) Company personnel may attempt to try and set up a mutually agreeable date and time, with the customer, to perform the service restoration process as access to the inside of the customer's residence or building may be necessary.
2) Upon arrival, verify the correct location and/or address, serial number of the meter set, the pressure requirements of the installation, and visually inspect the meter installation according to IAMU Procedure #3.7 – Check for Irregularities in the Condition of Meter Installations.
3) After confirming the items listed in 2), if possible, make personal contact with customer, identify yourself and state why you are there.
4) Now proceed back to the meter set location and perform the regulator check for set point and lock-up as well as the meter low flow and no flow test.
5) To conduct the "regulator check", disconnect outlet side of meter set from customer piping, taking care to ensure that no debris enters the meter.
6) Connect test fitting with pressure gauge (unique to company, pressure requirements, and type of meter installation) to outlet side of meter.
   NOTE: Not all meter installations will require a test fitting, some may have built-in testing locations.
7) Unlock service valve located on the riser and slowly turn valve to the open position.
8) Using the test fitting, check the service regulator for pressure set point and lock-up according to the regulator manufacturer's specifications. If necessary, adjust pressure and recheck for lock-up.
   a) If regulator set point or lock-up cannot be maintained, the regulator should be removed and either replaced or rebuilt.
9) After testing service regulator and before connecting the meter to customer piping, the operator may perform a "low-flow" test on the meter. This test may be conducted to ensure that the meter is measuring gas during low flow conditions.
   a) Turn-off service valve located on the riser and disconnect test fitting from the outlet side of the meter.
   b) To perform the "low-flow" test, slowly turn on the service valve until the smallest amount of gas can be heard or felt escaping the outlet side of the meter.
   c) With a small amount of gas escaping, observe the smallest dial hand on the meter (typically the ½ ft. hand) for movement. If movement is observed, the "low-flow" test will be deemed successful. If no movement is observed, even when increasing gas flow, the meter may need to be replaced or additional maintenance performed.
   d) When finishing the "low-flow" test, turn off the service valve (eliminating gas flow) and stop the dial hand on the upswing to aid in completing the "no-flow" test.

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10) A "no-flow" test or shut-in test will now be performed to ensure that the customer piping is gas tight. To complete the "no-flow" test, connect the outlet side of the meter to customer piping and slowly turn the service valve on.
    a) Immediately after turning the service valve on, mark the position of the smallest test dial hand (typically the ½ ft. hand) on the meter index. If continual movement of the test hand is observed after turning service valve on, immediately shut the service valve off so that gas is not continuing to leak inside of the building. If no movement of the test hand is initially observed, continue to test for a minimum of 5 minutes. If no movement of the test hand is observed after the minimum of 5 minutes has elapsed, the no-flow test is considered successful and the system is considered safe for reinstatement.
        i) During the 5-minute wait period, if no movement of the test hand was initially observed, the meter installation should be checked for leaks by using leak solution or a CGI and a bar-hole test may be made next to the riser to ensure no leakage is occurring below ground.
    b) If any slight movement of the test hand was observed, either initially after turning service valve on or during the 5-minute test period, further investigation is needed inside of the building. If access to the inside of the building CANNOT be obtained at this time or is NOT allowed, the service valve must remain in the "off" position and locked until access can be obtained.
11) Once access to the inside is obtained, proceed with locating all gas appliances and gas piping. To aid in this process, you may ask the customer if they know of these locations and ask them to assist you in locating them. If the customer is unsure, an attempt must be made by company personnel to locate all possible gas appliances and piping.
    a) Check all appliances for individual shut-off valves and gas control valves.
        i) For appliances that do NOT have a gas control valve (standing pilots), the individual appliance shut-off valve must be placed in the closed position. If any appliances do NOT have an individual shut-off valve, the customer must be notified, the appliance tagged, and gas service should not be established at that time.
        ii) If the appliance has a gas control valve, leave the appliance shut-off valve in the open position, so that the operation of the control valve may be checked during the no-flow test.
        iii) Ensure that all gas appliances with electronic ignition are in the "off" position.
    b) Check all piping for visible signs of damage, unapproved piping or flex connectors, and ensure that all open ends are capped off.
12) After all appliances and piping have been checked, proceed outside to the meter set location and conduct another no-flow test.
    a) If, during the second no-flow test, no movement of the test hand is observed after the minimum of 5 minutes has elapsed, the no-flow test is considered successful and the system is considered safe for reinstatement.

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b) If, during the second no-flow test, slight movement of the test hand is observed, leave the service valve in the “on” position, continue back inside and conduct an inside leak investigation according to IAMU Procedure #10.1 - Inside Leak Investigation to find the source of the leak. If the source of the leak is found, it should be tagged and the customer notified.

c) If the source of the leak can be isolated from gas supply by closing an appliance shut off valve, close the valve. With the leak isolated from gas supply conduct another no-flow test, if no movement of the test hand is observed, the test is considered successful and the system considered safe for reinstatement as long as the customer has been notified of the leak and it has been tagged for repair. If a leak on customer piping or appliances has been tagged for repair and gas service is to remain on, it is recommended that a signature is attained from the customer. If the customer refuses to provide a signature, the operator may choose to discontinue service at their discretion, based upon the size and type of leak.

Record Retention: A record of all gas service restorations and initial establishments should be documented on the Gas Service “Turn-on” Record or any other company approved document.

CITY OF BLOOMFIELD, IOWA

PART FOUR

Corrosion Control

IAMU Procedure #4.0: Measure Structure to Electrolyte Potential (Pipe to Soil Reading)

Interval Requirements:

Readings/surveys of designated CP test points must be completed at least once each calendar year with intervals not to exceed 15 months.

Documentation & Record Retention:

The Pipe-to-Soil Potential Record may be used to document survey results. A record of all pipe-to-soil potential surveys must be kept and maintained for the life of the pipeline.

Required Tools & Equipment:

1) A voltmeter with at least a 3-digit display.
2) A copper-copper sulfate reference electrode (half-cell).
3) Copper-copper sulfate crystals.
4) Distilled water.

Maintenance and Verification of Half-Cell & Voltmeter:

Before conducting a pipe-to-soil potential survey and as needed throughout the year, the condition and operation of the half-cell and voltmeter should be verified.

Maintenance of Half-Cell:

1) Remove the copper rod assembly from the half-cell by unscrewing the end with the electrical terminal. Dump the excess copper sulfate solution into a container and properly dispose.
2) Remove the porous plug end.
3) Inspect the copper rod, it should appear bright and shiny. If the rod is discolored, clean and sand the copper rod using non-metallic sandpaper or Scotchbrite® until it is bright and shiny.
   a) After cleaning, try to avoid touching the copper rod with your bare hand as this may contaminate the rod.
4) Inspect porous plug end for obvious signs of damage or contamination. If damage or contamination is discovered, discard and replace.
5) Re-install the copper rod assembly into the half-cell tube and hand tighten.
6) Fill the half-cell tube with an appropriate amount of copper sulfate crystals and distilled water to ensure that a saturated solution is created. A properly saturated solution will produce a solution where copper sulfate crystals are still visible or can be heard if shaken.
7) Re-install the porous plug and hand tighten.

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Verifying Half-Cell:

It is recommended, that the half-cell to be used during the completion of the pipe-to-soil potential survey, be tested against an unused half-cell.

1) Using a voltmeter, connect the positive lead to one half-cell and the negative lead to another half-cell.
2) Once connected to the voltmeter, take the half-cells, submerge the porous ends in water and touch the two porous ends together making firm contact.
3) Read the voltage measured between the two half-cells. The difference should not exceed 5 mV plus or minus.
4) If the difference is greater than 5 mV, this indicates that the copper rod, solution, or porous plug is contaminated and must be either repaired or replaced.

Maintenance of Voltmeter:

1) Ensure the voltmeter has fresh batteries installed.
2) Check the overall condition of the voltmeter looking for obvious signs of damage and that the display is functioning correctly.
3) Inspect the condition of the test leads. Test lead wires and connectors should not be corroded, frayed or damaged.

Verifying the Voltmeter:

There are two methods for verifying if the voltmeter is operating correctly. Either method may be used for verification.

Method 1:

i) Purchase a new 9V battery.
ii) Carefully connect the red (+) lead to the (+) terminal on the battery and connect the black (-) lead to the (-) terminal on the battery.
iii) With the leads connected to the battery, the voltmeter should read 9V.

Method 2:

i) Turn the voltmeter on and select the highest resistance range by turning the dial to the highest “ohm” setting.
ii) Touch the (+) and (-) test leads together. The display should read 0 ohms.

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Pipe-to-Soil (Structure to Electrolyte) Potential Procedure:

NOTE: All pipe to soil potential readings should be taken as negative (-) readings.

1) Locate the correct test point as noted on survey records or maps. The test points could be a steel riser, test station, or tracer wire.
2) If performing test on steel riser, ensure that the connection point is upstream (before) any insulating device. It may be necessary to remove paint and/or surface oxidation to provide a suitable spot for proper connection.
3) If performing tests on tracer wire or a test lead found in a test station, it may be necessary to strip back wire coating to provide a suitable spot for proper connection.
4) Remove the protective cover from the porous plug end of the half-cell.
5) Turn the voltmeter to the "on" position and set for reading DC volts.
   a) The setting should appear on the display as "0.000 volts"
6) Connect the (+) lead of the voltmeter to the prepared surface (steel riser, test lead, or tracer wire).
7) Connect the (-) lead of the voltmeter to the electrical terminal found on the half-cell.
8) Place the porous end of the half-cell into the ground in close proximity to the pipeline being tested. Ensure that the half-cell is place securely into the ground. If the soil is extremely dry, it may be necessary to pour a small amount of water onto the ground to lower resistance between the soil and the half-cell.
9) Observe the reading on the voltmeter. The potential reading on the voltmeter should read at least -0.850 V to meet cathodic protection criteria requirements.
   a) Ideally, a reading of -0.950 V to -1.600 V is desired to ensure adequate cathodic protection during extremely dry conditions throughout the year.
   b) If a reading is obtained greater than -2.00 V additional investigation should be conducted to locate stray current sources and corrective measures should be taken.
10) If a potential reading is taken between -0.001 V and -0.849 V cathodic protection is not considered adequate and remedial measures must begin within 90 days and completed before the next scheduled survey.
    a) Additional sacrificial anodes may need to be installed or a cathodic protection short may need to be found and corrected.

Considerations:

1) Potential readings should not be taken on frozen soil or directly above anode locations.
2) If the testing site is covered in pavement or rock, it may be necessary to install a (+) test lead long enough to span from the riser or tracer wire to a location where the half-cell may be placed in soil.
3) If at any time, the operator determines that the extent of any maintenance or repairs required is beyond their scope of knowledge or understanding of the situation, contact should be made with NACE certified corrosion control personnel to determine the appropriate course of corrective action.

IAMU Procedure #4.1: Visual Inspection of Buried Pipe and Components When Exposed

Requirements:

1) Whenever it is known that buried pipe is going to be exposed for any reason, no matter the depth, the exposed portion of pipe must be inspected for signs of corrosion or damage.
2) If unable to be on-site, during or immediately after excavation, arrangements should be made for a qualified company representative to perform a visual inspection before the exposed portion of pipe is backfilled or covered.
3) Pipe or components exposed by means of potholing or hydro-excavation must also be visually inspected as thoroughly as possible.
   a) If access to the bottom side of the pipe or component is limited due to the size of the excavation or pothole, consideration should be given to using a mirror to provide a means of visual inspection.

Documentation & Record Retention:

1) All visual inspections of exposed pipe and components must be documented and recorded. Documentation may be provided on the Exposed Pipe Report and must be maintained for a minimum of 10 years.
2) If multiple excavations or potholes occur on the same segment of pipe, but the excavation is not continuous, a separate record should be completed for each individual excavation or pothole.

Exposed Steel Pipe and Components:

1) Inspect for signs of corrosion and damage to pipe, components, and pipe coating.
2) If evidence of any type of corrosion or damage is found, it must be investigated circumferentially and longitudinally. If the damage or corrosion extends past what can be visually inspected, additional pipe must be excavated and continue until the extent of the corrosion or damage is found.
3) If evidence of corrosion is discovered, follow IAMU Procedure #4.2 - Measure External Corrosion to determine if repairs or replacement is required.
4) If evidence of mechanical damage is discovered, follow IAMU Procedure #8.7 - Measure and Characterize Mechanical Damage on Installed Pipe and Components to determine if repairs or replacement is required.
5) If damage to found to the protective coating on the exposed pipe or component it must be repaired or replaced following IAMU Procedure #4.15 - Coating Application and Repair: Wrapped.

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6) If at any time, the internal surface of the pipe is exposed by removing a portion of the pipeline, an internal corrosion inspection must be conducted according to IAMU Procedure #4.10 - Visual Inspection for Internal Corrosion.

Additional Considerations:

1) Any portion of a buried steel riser that is exposed at the pipe-to-soil interface (to correct atmospheric corrosion deficiencies) must be inspected according to this procedure and documented.
2) A visual inspection of an exposed anodeless riser is NOT required.

IAMU Procedure #4.2: Measure External Corrosion

Requirements:

1) If, at any time, external corrosion beyond the limit shown in the next section, it must be either be repaired or replaced. Repairs and/or replacement is dependent upon the extent of metal loss.
2) Anytime localized corrosion pitting is found on pipe to a degree where leakage might result, it must be repaired or replaced.

External Corrosion on Distribution Piping:

1) The extent of the corrosion must be found by determining the depth, length, and width of the corrosion area. All measurements should be taken and referenced in inches.
2) If less than 70% wall loss is discovered, the overall length and width of the corrosion area should be recorded, but repair or replacement is not necessary.
3) If more than 70% wall loss is discovered, or if the remaining wall thickness is less than what is required for the established MAOP, the pipe must be repaired or replaced.
4) To determine the % of wall loss, a pit gauge, ultrasonic wall thickness gauge, or caliper must be used and the original wall thickness of the pipe must be known.
5) If using a pit gauge or caliper, complete the following:
   a) Zero the instrument over a clean, flat, non-corroded portion of pipe.
   b) Once zeroed, insert the pit gauge or caliper into the deepest corrosion pit or area of metal loss to obtain a measurement.
   c) Then, take the metal loss measurement, divide it by the original known wall thickness, and then multiply by 100 to obtain the % of wall loss.

Example:

- 2", Schedule 40 steel pipe = 0.154 wall thickness
- Metal loss pit gauge measurement = 0.095
- 0.095 divided by 0.154 = 0.616
- Multiply by 100 = 61.6%
- Replacement would NOT be necessary, as 61.6% of wall loss has occurred.

External Corrosion on Transmission Piping:

1) The extent of the corrosion must be found and measured as stated above for distribution piping.
2) If the remaining wall thickness is less than what is required for the MAOP of the pipeline, the pipe must be repaired or replaced or the MAOP lowered to a pressure commensurate to the wall thickness of the corroded pipe according to AMSE/ANSI B31G or AGA PR 3-805.
3) If localized corrosion pitting is found to a degree where leakage may occur, the pipe must be repaired, replaced, or operating pressure lowered to a safe pressure based on actual remaining wall thickness according to AMSE/ANSI B31G or AGA PR 3-805.

IAMU Procedure #4.3: Determine Appropriate Remedial Measures for Corrosion Control and Notification of Proper Personnel

Required Remedial Measures:

1) Any buried or submerged pipeline found to have external corrosion metal loss at or beyond 70% of the total wall thickness must be repaired or replaced.
2) Any metallic pipe that is installed to replace pipe that is removed for external corrosion reasons must be properly coated and cathodically protected.
3) All coatings applied for external corrosion prevention, must be applied on a properly prepared surface as described in IAMU Procedure #4.16 - Pipe Surface Preparation for Coating Application.
4) Any distribution pipe that has a wall loss of 70% or more due to external corrosion must be replaced.
5) Any portion of pipe with localized corrosion pitting to a degree where leakage might occur, must be repaired or replaced.
6) If any deficiency is found during cathodic protection inspections or survey's, remedial action must begin within 90 days from date of discovery and the deficiency corrected by the next scheduled inspection or survey.

Notification of Proper Personnel:

1) If operating personnel are in the process of obtaining corrosion control qualifications and the company does not currently employ any other personnel qualified in corrosion control, contact must be made with qualified corrosion control personnel capable of determining appropriate remedial measures.
2) The following are potential sources for obtaining qualified corrosion control personnel.
   a) Mutual Aid
   b) Third-party Contractors
   c) National Association of Corrosion Engineers (NACE)
3) If at any time, the operator determines that the extent of the maintenance or repairs required is beyond their scope of knowledge or understanding of the situation, contact should be made with NACE certified corrosion control personnel to determine the appropriate course of corrective action.

IAMU Procedure #4.4: Inspect Rectifier and Obtain Readings

Interval Requirements:

Rectifiers must be inspected and readings obtained at least 6 times each calendar year, with intervals not exceeding 2 ½ months.

Documentation & Record Retention:

The Rectifier Inspection Record may be used to document inspection findings. All rectifier inspections and readings taken must be kept on file for the life of the system.

Safety Precautions:

1) While approaching the rectifier, observe for visual indications of damage or vandalism or exposed wiring that might create an electrical hazard.
2) Using a multimeter, ensure that the rectifier cabinet is not energized before touching it.

Rectifier Inspection:

1) Inspect the inside of the case to ensure it is weather tight.
2) Inspect the wires and mechanical connections to ensure proper contact is being made.
3) Ensure the anode lead wire is connected to the positive output terminal of the rectifier.
4) If applicable, record the number on the "hours" meter.
5) Check the tap and/or control settings and record.
6) Using a voltmeter, measure the DC voltage across the plus and minus DC voltage output connections. DO NOT rely on the voltage and amperage meters on the rectifier as they could be inaccurate.
7) Using a voltmeter, measure the millivolt reading across the shunt. Then multiply the shunt millivolt reading by the shunt factor to obtain the calculated current.
8) Additionally, it is also recommended that a pipe-to-soil potential reading is taken at the closest possible location to the rectifier.

Pipe-to-Soil Potential Readings:

1) To ensure adequate cathodic protection, pipe-to-soil readings must also be taken according to IAMU Procedure #4.0 – Measure Structure to Electrolyte Potential at predetermined test locations throughout the system at least once each calendar year, with intervals not exceeding 15 months.

Remedial Measures:

1) If any deficiencies are found during the rectifier inspection process, remedial action must begin as soon as practical and completed before the next scheduled survey.

IAMU Procedure #4.5: Maintain Rectifiers

Safety Precaution:

Ensure that the rectifier is turned off and the disconnect switch ahead of the unit is opened before handling any components.

Maintenance Requirements:

1) Maintenance should be performed according to manufacturer's recommended procedures for the specific rectifier installed. Below is a list of common conditions that may require periodic maintenance or replacement:
   a) Faulty or inaccurate meters
   b) Blown fuses
   c) Loose terminals
   d) Open ground bed leads
   e) Lightning damage
   f) Signs of arcing
2) If the rectifier is supplied power by a local power company and the rectifier is not operational, it may be necessary to visually check the service drop to the rectifier.
   a) Visually check the line and the fuse.
   b) Contact the local power company for repairs to the service drop or fuse if necessary.

Additional Information:

1) If at any time, the operator determines that the extent of the maintenance or repairs required is beyond their scope of knowledge or understanding of the situation, contact should be made with NACE certified corrosion control personnel to determine the appropriate course of corrective action.

IAMU Procedure #4.6: Installation and Maintenance of Mechanical Electrical Connections

Requirements:

1) All test lead wires must be connected securely to the pipeline so that it minimizes stress concentration and is electrically conductive.
2) All test lead wires and metallic areas at the connection points must be coated with an electrical insulating material that is compatible with the pipe coating and wire insulation.

Type of Wire:

1) The wire used to make mechanical electrical connections should typically be #12 gauge, coated, copper wire.

Connections to Steel Pipe:

1) All leads connected to steel pipe should be made by exothermic (thermite) welding. See IAMU Procedure #4.7 - Installation of Exothermic Electrical Connections for specific details.

Connections for Tracer Wire:

1) Underground connections of tracer wire must be completed in a manner that produces an electrically and mechanically sound joint that will not loosen or separate.
   a) If available, the use of lockable connectors specifically designed for direct bury methods that are filled with a dielectric silicone gel are recommended.
   b) If lockable connectors are unavailable, the use of non-lockable lugs with or without dielectric silicone gel designed for direct bury methods are allowed.
   c) Twisting the wires together and securing with electrical tape is NOT allowed.

Test Station Installation:

1) A test station may need to be installed for various reasons such as cathodic protection monitoring or providing a means of locating. Stations can be installed either above ground or at grade level.
2) A typical test station installation will include 3 wires but ultimately depends on the purpose of the installation.
3) All wires installed in a test station should be installed with at least 6" of slack to account for settlement or pulling.

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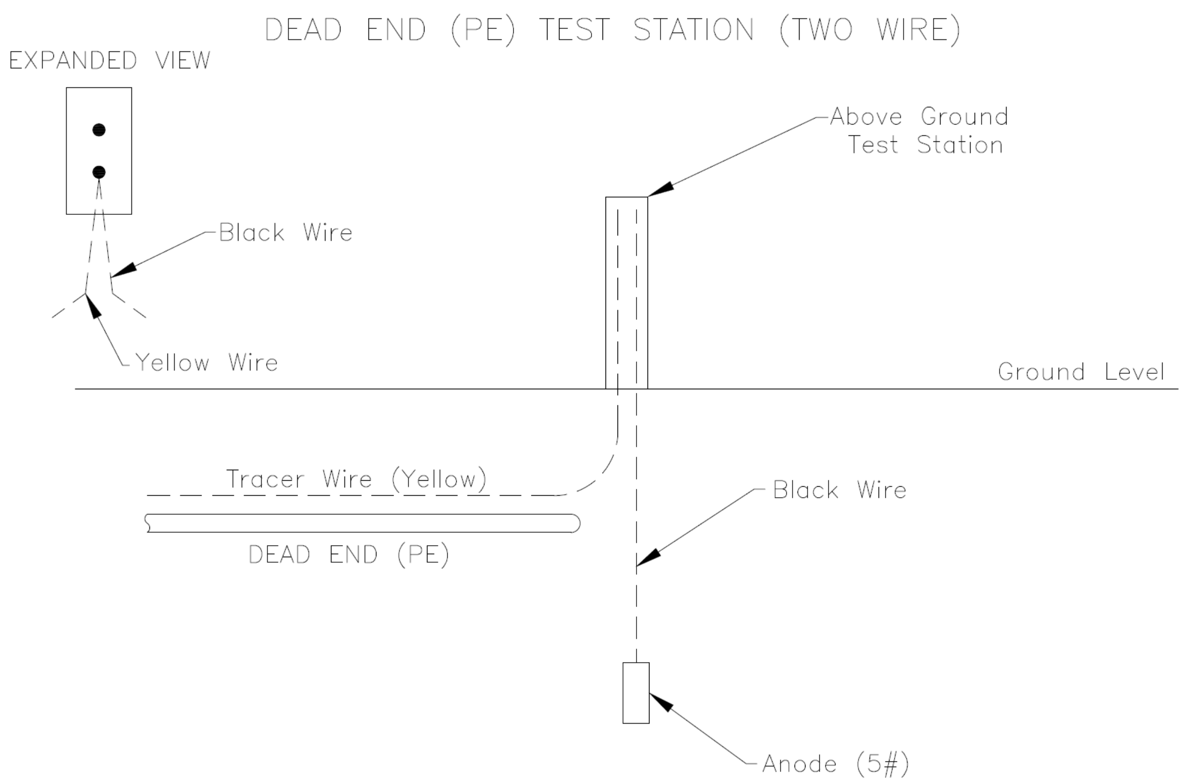
4) All lead wires should be color coded or labeled inside the test station.
5) See diagrams below for examples of how to install above ground test stations.

Test Station Installation Diagrams



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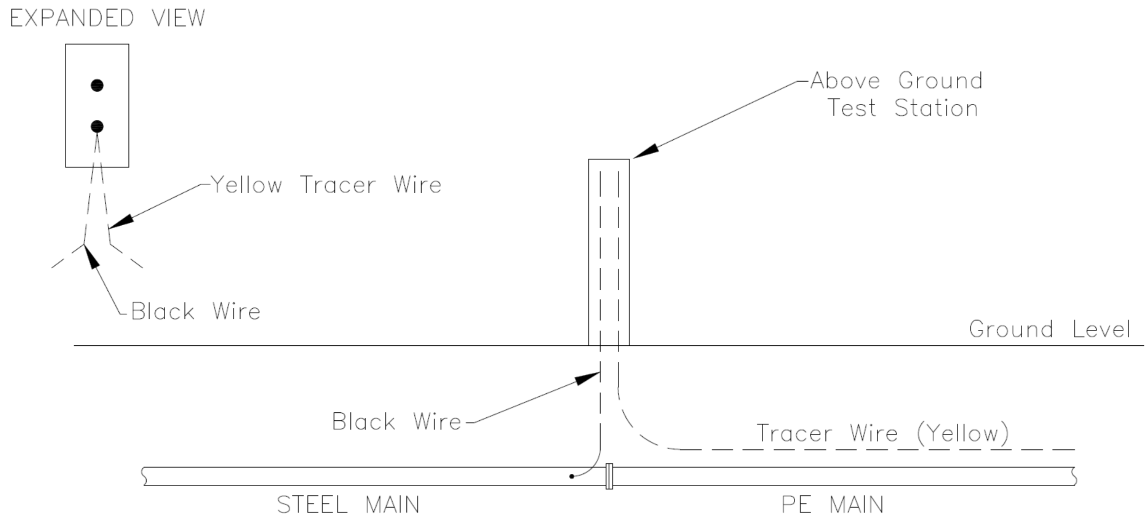
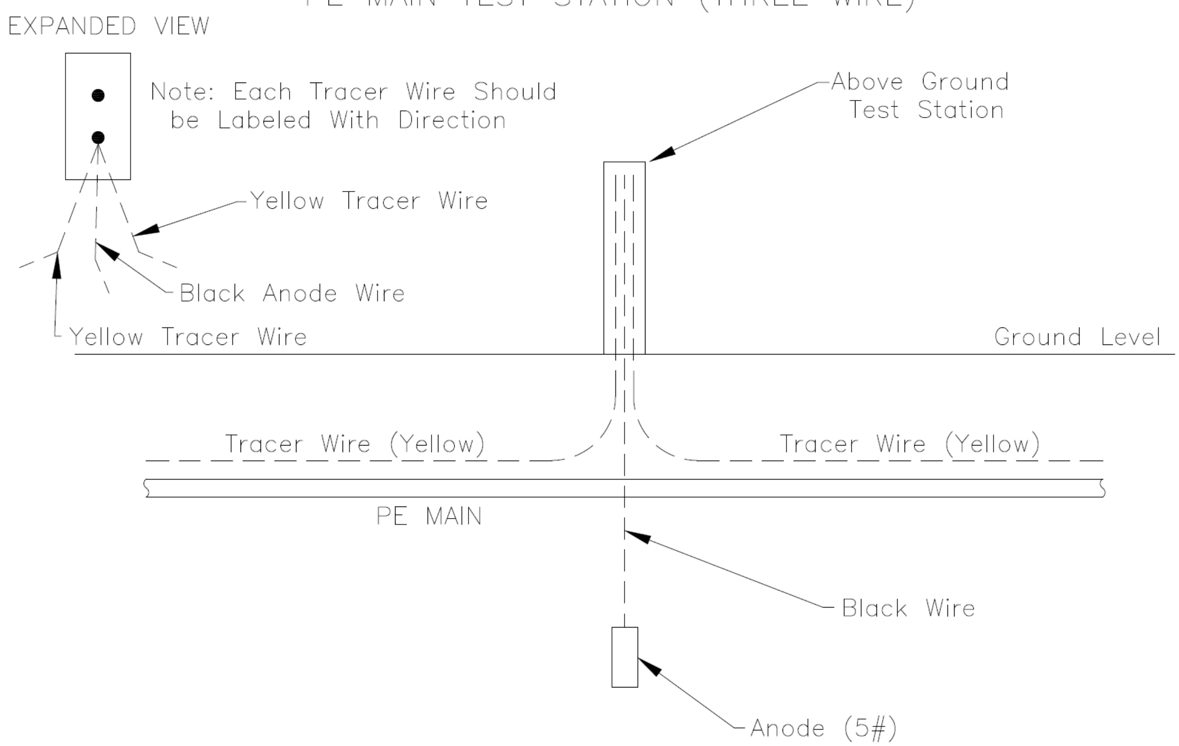
STEEL TO POLY TRANSITION TEST STATION (TWO WIRE)



PE MAIN TEST STATION (THREE WIRE)



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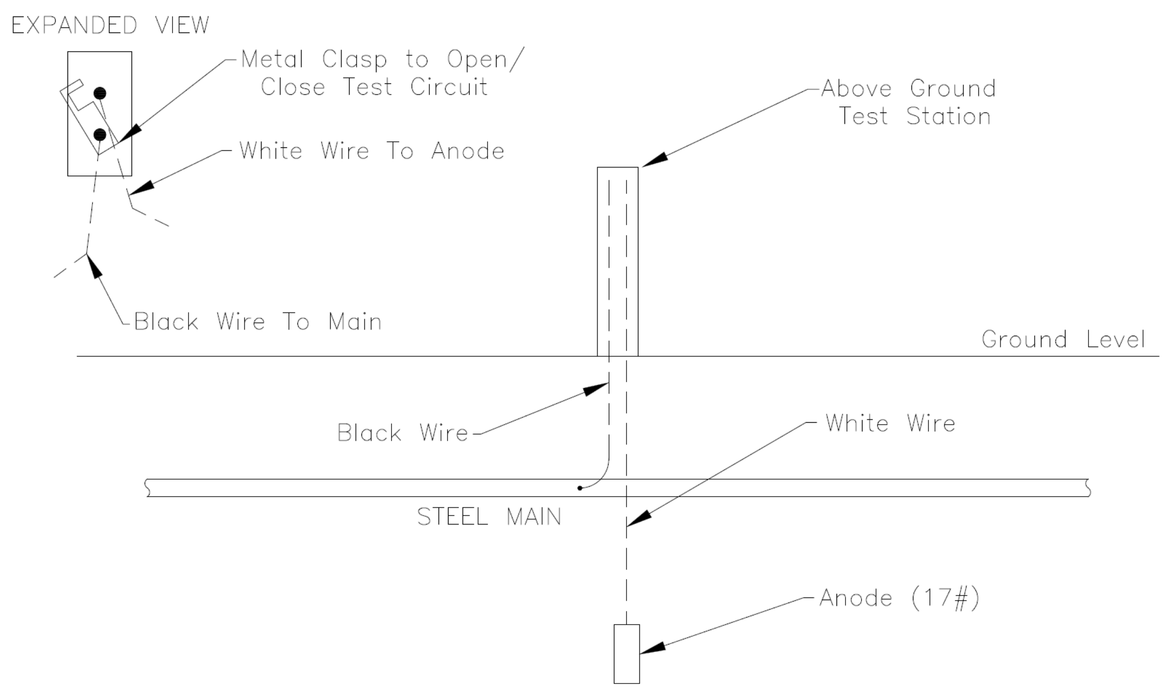
STEEL MAIN TEST STATION (TWO WIRE)



IAMU Procedure #4.7: Installation of Exothermic Electrical Connections (Thermite Welding)

Safety Precautions

1) CAD welding may NOT be performed in a gaseous environment as it is a potential ignition source.
2) A fully charged and manned fire extinguisher should be located upwind of the weld site.
3) Proper PPE should be worn at all times (leather gloves and eye protection at a minimum).
4) DO NOT use a wet or damp weld mold as the welding process could potentially produce a violent chemical reaction that may cause serious harm or injury.

Pipe Preparation

1) Prepare a sufficient area of the pipe surface by removing all coating, dirt and debris.
2) Use a file, rasp, or other approved method on the pipe surface until the metal is bright and shiny.
3) Avoid touching the prepared surface, so that it does not get contaminated.

Lead Wire Preparation

1) Using a wire stripping tool, remove a sufficient length (approximately 1 inch) of insulation from the lead wire to allow the protective copper sleeve to be installed over the bare end.
2) Once the wire has been inserted into the protective copper sleeve, the sleeve must be securely crimped into place taking care not to damage the wire.
3) Wrap the lead wire around the steel pipe and twist it with the bare end running parallel with the pipeline.

Preparing the CAD or AutoCAD Weld Mold

1) Ensure that the correct size and type (vertical or horizontal) of mold is being used for the specific application.
2) Inspect the mold to make sure it has no physical defects.
3) Clean the mold, removing any slag, dirt and ashes.
4) Make sure the mold is completely dry.
5) Place the provided steel disk in the bottom of the mold.
6) Remove the weld shot from the case and carefully dump the contents of the shot into the mold on top of the disk making sure all of the powder is emptied from the shot.
   a) It is important the finer grain powder from the bottom of the shot is emptied out into the mold as this is the ignition powder.
   b) If using AutoCAD, simply install the shot cartridge into the mold.
7) Close the mold cover.

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Making the CAD Weld

1) Place the mold in the correct position on the pipe so that the tracer wire is running parallel to the pipe.
2) Insert the lead wire with the protective copper sleeve into the mold until it comes in contact with the stop (approximately halfway).
3) Make sure the lid of the mold is closed and hold the mold firmly against the pipe.
4) Using a flint type sparking gun, ignite the powder in the mold.
   a) If using AutoCAD, connect the shot cartridge lead wire to the ignition module and press "Start".
5) Once ignited, hold the mold firmly to the pipe until the weld has solidified (at least 10 seconds).
6) Tap the side of the mold lightly and remove the mold with the handle (the mold will be hot).
7) Test the finished weld by tapping with a hammer to remove slag and to ensure proper weld connection has been made.
8) When completed, all exposed portions of steel pipe must have a protective coating installed.

IAMU Procedure #4.8: Inspect or Test Cathodic Protection Electrical Isolation Devices

Requirements:

1) All buried or submerged pipelines must be electrically isolated from other underground metallic structures (foreign pipelines and casings) unless it is intended to be electrically interconnected and cathodically protected as a single unit.

Interval Requirements:

1) Electrical isolation tests from foreign pipelines and casings must be made at least once each calendar year not to exceed 15 months.
2) It is recommended that this test is completed at the same time as the annual pipe-to-soil potential survey as it is common to complete these tests using a copper-copper sulfate reference electrode.

Documentation and Record Retention:

1) It is recommended that this test be added to the Pipe-to-Soil Potential Record or other approved company document that contains the required information.
2) Each record of electrical isolation tests must be maintained for a minimum of 10 years (NOTE: pipe-to-soil potential surveys are maintained for the life of the system).

Determining Electrical Isolation from Foreign Pipelines:

1) This is most commonly completed at the TBS or DRS where electrical isolation is needed and/or provided from the supplier.
2) There are two methods to determine electrical isolation for insulators installed above ground and are as follows:

   Method 1: *Pipe-to-soil potential readings*

   a) Locate the insulator, this is typically an insulating flange at the location where supplier piping ends and company piping begins.
   b) Take a pipe-to-soil potential reading on both sides of the flange following IAMU Procedure #4.0 – Measure Structure to Electrolyte Potential.
   c) Electrical isolation is deemed adequate if the two pipe-to-soil readings differ by at least 100 millivolts (0.10 volts).
   d) If the difference of the two readings is less than 100 millivolts further testing is needed.
      i) Additional testing may include:
         (1) Completing Method 2 of this procedure.
         (2) Contacting natural gas supplier for additional information and assistance.

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Method 2: Using an Insulator Tester (NOT a multimeter)

a) An insulator tester provides a simple "good" or "bad" inspection result by using a radio frequency to test above ground insulators.
b) Locate the insulator, this is typically an insulating flange at the location where supplier piping ends and company piping begins.
e) Turn the unit on and ensure that the batteries in the unit are of sufficient strength.
f) Attach the red lead to one side of the insulator and the black lead to the other side.
   i) It may be necessary to remove paint and/or coating to gain access to bright shiny metal.
g) Proper electrical isolation will be verified if no audible beep is heard or deflection of the meter is noticed.
h) If audible beeping occurs or the meter deflects from right to left, the insulator is considered bad and needs repaired or replaced.

Remedial Action for Shorted or Damaged Insulators:

1) If an insulator is shorted or damaged and electrical isolation cannot be verified by testing, the insulator must either be repaired or replaced before the next scheduled inspection.

Electrical Isolation of Metallic Casings:

1) Electrical isolation of a carrier pipe from a metallic casing must be determined by at least one of the following methods:

   Method 1: Pipe-to-soil potential readings (most common method)

   a) Locate the casing vent or casing test lead and carrier pipe test lead or closest service riser that is within 1100 feet of the casing end.
   b) Take a pipe to soil potential reading on the casing vent pipe or casing test lead following IAMU Procedure #4.0 – Measure Structure to Electrolyte Potential and document reading.
   c) Next, take a pipe to soil potential reading on the carrier pipe test lead or closest service riser following IAMU Procedure #4.0 – Measure Structure to Electrolyte Potential and document reading.
   d) If the difference between the two readings is 100 millivolts (0.10 volts) or more, the casing is considered electrically isolated from the carrier pipe.
   e) If the difference is less than 100 millivolts, additional investigation is necessary to determine if a short exists. Method 2, listed below, is an alternative way to determine if a short exists between casing and carrier pipe.

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Method 2: *Using a Pipe Locator*

a) Using a pipe locator in the conductive mode (inductive mode will not work for this application), connect the transmitter to the pipeline at a test point remote from the casing.
b) Using the receiver, locate the path of the pipeline from the test point across the casing, while monitoring signal strength.
c) If no sudden drop in signal strength is detected, the casing is considered electrically isolated.
d) If a sudden drop in signal strength is detected over the casing pipe, it is considered shorted.

Remedial Action for Shorted Casings:

1) If a casing has been determined to be shorted (not electrically isolated from carrier pipe) the short will be cleared by repairs or replacement, if practical.
2) If it is not practical to clear the short, the casing vents will be monitored with leak detection equipment at the following frequencies, dependent upon location, until proper repairs can be made:

Distribution	**Frequency**
Inside business districts	4 times per year, not exceeding 4 ½ months
Outside business districts	2 times per year, not exceeding 7 ½ months
Transmission	
All locations	4 times per year, not exceeding 4 ½ months

3) A record of the vent monitoring must be completed and include the % gas in air reading obtained by gas detection equipment.

IAMU Procedure #4.9: Install Cathodic Protection Electrical Isolation Devices

Requirements:

1) All pipelines must have a device installed that provides electrical isolation from foreign pipelines, other underground metallic structures, and customer piping, unless it is intended to be cathodically protected as a single structure.

Insulated Flange Installation:

1) Typically, electrical isolation from foreign pipelines (supplier piping) is completed by the installation of an above ground insulated flange.
   a) This electrical isolation point may be installed and maintained by the supplier at the custody transfer point.
2) Additionally, insulated flanges have been known to be installed below ground on main valves to provide electrical isolation between cathodic protection zones.
3) For specific procedures on installing an insulated flange, see IAMU Procedure #1.11 – Joining of Pipe: Flange Assembly.

Insulated Coupling Installation:

1) Typically, an insulated coupling is installed in main pipe where electrical isolation of cathodic protection zones is desired.
2) A weld end insulated coupling or a compression end insulated coupling may be installed to achieve electrical isolation.
3) For the installation of weld end insulated coupling, a qualified welder must follow approved butt-welding procedures for the specific size and type of pipe and ensure that the insulator is not damaged or affected by the heat caused during welding.
4) For the installation of compression end insulating couplings, the manufacturer's recommended procedures must be followed.

Electrical Isolation from Customer-Owned Piping:

1) Depending on the type and size of meter installation, electrical isolation from customer owned piping can be accomplished by installing an insulated shut-off valve, an insulated meter spud, insulated meter bar, or an insulated flange.

IAMU Procedure #4.10: Visual Inspection for Internal Corrosion

Requirements:

1) Anytime the internal surface of a metallic pipe or component is exposed, it must be visually inspected for internal corrosion.
2) A pipe coupon that may be obtained following the completion of tapping and/or stopping procedures must also be visually inspected for signs of internal corrosion.

Documentation and Record Retention:

1) All internal corrosion inspections must be recorded and maintained for the life of the pipeline.
2) The Exposed Pipe Report or other company approved document may be used to record the inspection results.

Visual Inspection Procedure:

1) If possible, clean the inside of the pipe removing any residue, and if applicable, take care not to disturb any scale build-up.
   a) If the metallic pipe or component is completely removed from the system and is not intended to be reinstalled or put back into service, it may be necessary to cut the pipe or component in half longitudinally to gain better access to the inside surface of the pipe.
2) Visually examine the removed pipe or component and the adjacent pipe closely for any signs of metal loss or pitting. Special attention should be given to the bottom half of the pipe as this is where moisture, if any, would accumulate and accelerate the corrosion process.
   a) If metal loss or pitting is discovered, follow IAMU Procedure #4.13 - Measure Internal Corrosion for determining the amount of metal loss and appropriate remedial measures.
   b) If only light surface oxidation (rust) without metal loss is observed no additional investigation is needed.
3) If a pipe coupon is obtained, a visual inspection for internal corrosion must be completed as stated in 2) above.

IAMU Procedure #4.11: Visual Inspection for Atmospheric Corrosion

Definition:

Atmospheric corrosion – is defined as corrosion that causes deterioration or pitting of the pipe surface resulting from a reaction with the atmospheric environment. Surface oxidation is not considered atmospheric corrosion.

Requirements:

1) All pipeline facilities that are installed above ground and exposed to the atmosphere, must be inspected for evidence of atmospheric corrosion.
2) Special attention must be given to pipe at soil-to-air interfaces (where pipe transitions from below ground to above ground), under disbonded coatings, at pipe supports, at deck penetrations, under thermal insulation, in splash zones, and in spans over water.

Interval Requirements:

1) Atmospheric corrosion inspections/surveys must be conducted at the following intervals:

Pipeline Type:	Frequency of Inspection:
Service Lines	At least once every 5 calendar years, not to exceed 63 months, except as stated in "Exception" below.
All other locations	At least once every 3 calendar years, not to exceed 39 months

"All other locations" include but are not limited to; hairpin valves, blow-down valves, regulator stations (DRS & TBS), bridge hangs, and separate telemetering or recording locations.

> **NOTE:** For farm tap installations that contain an above ground hairpin first cut regulator and relief valve, this portion of the pipeline will be considered part of a service line and require a 5-year inspection interval.
>
> **Exception:** If, during the most recent inspection, atmospheric corrosion containing metal loss is discovered on a service line, then the next inspection of that specific location must be conducted within 3 calendar years, not to exceed 39 months.

Documentation and Record Retention:

1) All atmospheric corrosion inspection surveys must be documented and recorded on the Atmospheric Corrosion Inspection Record or other company approved document.
2) The two most recent atmospheric corrosion inspection survey records must be retained for each service line that is being inspected under the 5-year interval (minimum of 10 years).

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Visual Inspection Procedure:

1) If at any time, metal loss is discovered due to atmospheric corrosion, see IAMU Procedure #4.14 - Measure Atmospheric Corrosion for details on how to determine the amount of metal loss and if repairs or replacement is required.

Piping:

a) Visually examine all above ground piping for signs for metal loss due to atmospheric corrosion. Light surface oxidation is NOT considered atmospheric corrosion that requires remedial action. If light surface oxidation is found, consideration should be given to cleaning and painting and/or coating.

Soil-to-Air Interface:

a) Special attention must be given to the area where piping transitions from below ground to above ground.
b) For steel pipe and/or risers:
    i) Inspect for signs of metal loss and condition of pipe coating.
    ii) Proper pipe coating should extend above ground level.
    iii) The existing pipe coating must be properly bonded. If the pipe coating is damaged, cracked, or disbonded, remedial action must take place by removing the coating until good coating is found, inspecting for pitting or metal loss, then cleaning and re-coating.
    iv) If the damaged or disbonded portion of the coating extends below ground additional pipe must be exposed until the extent of the coating damage can be found. The Exposed Pipe Report or other company approved document must be completed if below ground piping is exposed.
    v) For service risers, the service valve that is installed on top of the riser, must be readily accessible and not buried. If the valve is not accessible, buried or partially buried, remedial action must be taken.

c) For anodeless risers:
    i) Inspect for signs of metal loss and that the "crimp line" of the riser is not buried (look for the Do Not Bury Above or Max Bury Depth sticker).
    ii) The "crimp line" of the anodeless riser is the point on the riser where the carrier pipe transitions from plastic (PE) to steel. If the crimp line becomes buried, that portion of steel pipe that is buried would be considered an isolated segment of steel pipe that now requires cathodic protection (anode and pipe coating).

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Supports & Hangers:

a) Special attention must be given to any area of piping that has a supporting device installed.
b) The supporting device should either be removed or loosened to a point where a visual inspection can be completed of the specific portion of pipe under support.
c) If no metal loss is discovered, consideration should be given to cleaning and either painting or re-coating the area under support.

Additional Consideration May Also be Given to the Following:

1) Are locking devices installed where necessary?
2) Are there signs of damage or vandalism to regulators, reliefs, and meters?
3) Are regulator and relief vents rain and insect resistant (pointed down and screened)?
4) Is there any stress on piping and/or components?
5) Does protection need to be installed (bollards, posts, fencing, etc.)?

IAMU Procedure #4.12: Install Sacrificial Anodes

Requirements:

1) All steel piping and/or components installed below ground must be cathodically protected. This includes the following:
   a) All steel mains and service lines.
   b) Isolated steel service lines (steel service lines off of a PE main).
   c) Isolated steel service risers (steel riser at the end of a PE service line).
   d) Isolated metallic fittings (metallic coupling joining two pieces of PE pipe)
2) It is also recommended that anodes be installed on tracer wire to provide additional cathodic protection for tracer wire that may become damaged.

NOTE: It is recommended that anodes be installed on tracer wire at dead end locations to aid in the ability of locating the dead end.

Mapping & Record Retention:

1) All anode installations must be recorded and/or mapped for the life of the pipeline on the Anode Installation Record, Pipeline Installation Record, as-built maps, or other company approved document.

Anode Installation Procedure for Steel Pipe (17# magnesium anode)

1) Anodes may be installed either horizontally or vertically.
2) Anodes must be installed at a greater depth than the pipeline.
3) Anodes should be installed in the ditch or hole as far away from the pipeline as the excavation allows.
4) If installing more than one anode, a distance of 5' is recommended between anodes.
5) Remove the anode from the protective wrap and place the anode in the hole or ditch. DO NOT soak the anode in water before it is backfilled.
6) CAD weld the anode lead wire to the steel pipe using IAMU Procedure #4.7 – Installation of Exothermic Electrical Connections.
7) Apply approved pipeline coating to all exposed metallic surfaces following IAMU Procedure #4.15 - Coating Application and Repair: Wrapped.
8) Backfill around the anode to a depth of approximately 6" and tamp/compact the soil to ensure that there are no voids or gaps around the anode. If installed vertically, use a shovel handle or similar object that allows the soil to be tamped around the anode in the vertical hole.
   a) DO NOT backfill around the anode with rock or sand.

Anode Installation Procedure for Isolated Steel Risers: (1# - 5# magnesium anode)

1) Anode is typically installed in the vertical position.
2) The anode should be installed within 3' of the riser and at least 1' below ground.
3) Remove the anode from the protective bag.
4) If installing a 1# "drive-in" type anode, drive the anode into the ground using a blunt object and hammer to a depth of approximately 1'.
5) If installing a 3# anode, it is recommended that a hole be dug using manual post-hole diggers to a depth so that the top of the anode is approximately 1' below ground.
6) Then, using a spade or similar object, dig a "trench or slot" approximately 6" in depth so that the anode lead wire may run below ground spanning the distance between the anode and the riser.
7) Once the anode lead wire is at the service riser, it is recommended that at least 6" of the lead wire extends above ground allowing for proper connection.
8) Remove paint and or coating from riser in location where lead wire is being attached and file to bright shiny metal.
9) Anode lead wire should be attached to service riser by CAD welding, following IAMU Procedure #4.7 – Installation of Exothermic Electrical Connections.
    a) If CAD welding is not an option, the anode lead wire may be attached to the service riser by using a stainless-steel hose clamp.
10) If necessary, apply approved paint and/or coating.

Anode Installation for Isolated Metallic Fittings (3# - 5# magnesium anode)

1) Anode may be installed either horizontally or vertically.
2) Anode must be installed at a depth greater than the metallic fitting.
3) Anode should be installed in the ditch or hole so that it is located as far away from the fitting as the excavation will allow.
4) Remove the anode from the protective bag and place the anode in the hole or ditch. DO NOT soak the anode in water before it is backfilled.
5) CAD weld the anode lead wire to the isolated metallic fitting using IAMU Procedure #4.7 – Installation of Exothermic Electrical Connections.
6) Apply approved pipeline coating to all exposed metallic surfaces following IAMU Procedure #4.15 - Coating Application and Repair: Wrapped.
7) Backfill around the anode to a depth of approximately 6" and tamp/compact the soil to ensure that there are no voids or gaps around the anode. If installed vertically, use a shovel handle or similar object that allows the soil to be tamped around the anode in the vertical hole.
    a) DO NOT backfill around the anode with rock or sand.

IAMU Procedure #4.13: Measure Internal Corrosion

Requirements:

1) If, at any time, internal corrosion is discovered, the extent of the corrosion must be determined.
2) Anytime localized internal corrosion pitting is found on pipe to a degree where leakage might result, it must be repaired or replaced.

Measuring Internal Corrosion:

1) If internal corrosion metal loss is discovered during visual inspection, it may be necessary to cut the pipe in half, longitudinally, in order to gain sufficient access to the inside of the pipe.
   a) If possible, DO NOT cut in the specific location of the metal loss.
2) The extent of the internal corrosion must be found by determining the depth, length, and width of the corrosion area. All measurements should be taken and referenced in inches.
3) If less than 70% wall loss is discovered, the overall length and width of the corrosion area should be recorded, but repair or replacement is not necessary.
4) If 70% or more wall loss is discovered, or if the remaining wall thickness is less than what is required for the established MAOP, the pipe must be repaired or replaced.
5) To determine the % of wall loss, a pit gauge, caliper, or ultrasonic wall thickness gauge, must be used and the original wall thickness of the pipe must be known.
6) If using a pit gauge or caliper, complete the following:
   a) Zero the instrument over a clean, flat, non-corroded portion of pipe.
   b) Once zeroed, insert the pit gauge or caliper into the deepest corrosion pit or area of metal loss to obtain a measurement.
   c) Then, take the metal loss measurement, divide it by the original known wall thickness, and then multiply by 100 to obtain the % of wall loss.

Example:

- 2”, Schedule 40 steel pipe = 0.154 wall thickness
- Metal loss pit gauge measurement = 0.095
- 0.095 divided by 0.154 = 0.616
- Multiply by 100 = 61.6%
- Replacement would NOT be necessary, as 61.6% of wall loss has occurred.

IAMU Procedure #4.14: Measure Atmospheric Corrosion

Requirements:

1) If, at any time, atmospheric corrosion is discovered, it must be either be repaired or replaced. Repairs and/or replacement is dependent upon the extent of metal loss.
2) Anytime localized corrosion pitting is found on pipe to a degree where leakage might result, must be repaired or replaced.

Measuring Atmospheric Corrosion:

1) The extent of the corrosion must be found by determining the depth, length, and width of the corrosion area. All measurements should be taken and referenced in inches.
2) If less than 70% wall loss is discovered, the overall length and width of the corrosion area should be recorded, but repairs or replacement is not necessary.
3) If 70% or more wall loss is discovered, or if the remaining wall thickness is less than what is required for the established MAOP, the pipe must be repaired or replaced.
4) To determine the % of wall loss, a pit gauge, ultrasonic wall thickness gauge, or caliper must be used and the original wall thickness of the pipe must be known.
5) If using a pit gauge or caliper, complete the following:
   a) Zero the instrument over a clean, flat, non-corroded portion of pipe.
   b) Once zeroed, insert the pit gauge or caliper into the deepest corrosion pit or area of metal loss to obtain a measurement.
   c) Then, take the metal loss measurement, divide it by the original known wall thickness, and then multiply by 100 to obtain the % of wall loss.

Example:

- 2”, Schedule 40 steel pipe = 0.154 wall thickness
- Metal loss pit gauge measurement = 0.095
- 0.095 divided by 0.154 = 0.616
- Multiply by 100 = 61.6%
- Replacement would NOT be necessary, as 61.6% of wall loss has occurred.

IAMU Procedure #4.15: Coating Application and Repair - Wrapped

Requirements:

1) All steel pipe and components installed below ground must have a suitable coating applied for cathodic protection purposes. The installation of bare steel pipe and components is NOT allowed.
2) Any time coatings are removed for installation and/or maintenance activities, the portion of the pipe coating that was removed must be replaced. Anytime that pipeline coatings are damaged for any reason, repairs to the coating must be made.

Coating Procedures:

The following procedures were derived from the manufacturer's recommended practices for each of the products listed below. For all other approved coating products being used, the manufacturers' recommended procedures must be followed.

NOTE: For all types of wrapping applications, if installing on vertical pipe, start at the bottom and work towards the top, giving the wrap a "roof like" overlay so that moisture does not penetrate the lap seams.

Trenton Wax Tape® #1 (non-firming & brown in color)

1) Only for use on below ground pipe and fittings.
2) Clean the surface of the pipe removing all loose coating, dirt, debris, and surface oxidation.
3) Apply a thin film of Wax-Tape® Primer.
   a) If pipe surface is wet, cold or rusty, rub and press on the primer to displace moisture and ensure adhesion.
4) Select the appropriate size of Wax Tape® Wrap and begin wrapping using a 1" overlap. Ensure to start the wrapping process overlapping the existing pipe coating.
   a) On straight pipe, apply slight tension to ensure contact with the pipe surface.
   b) On irregularly shaped surfaces, allow slack so the wrap can be molded into place.
5) Once applied, press and form the wrap so that there are no air pockets or voids under the wrap.
6) Also, press and smooth out the lap seams to ensure that they are sealed.
7) The wrap does NOT require curing or drying time, it may be backfilled immediately.

Trenton Wax Tape® #2 (self-firming & silver in color)

1) For use on above or below ground pipe and fittings.
2) Clean the surface of the pipe removing all loose coating, dirt, debris, and surface oxidation.
3) Apply a thin film of Wax-Tape® Primer.
   a) If pipe surface is wet, cold or rusty, rub and press on the primer to displace moisture and ensure adhesion.

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4) Select the appropriate size of Wax Tape® Wrap and begin wrapping using a 1" overlap. Ensure to start the wrapping process overlapping the existing pipe coating.
    a) On straight pipe, apply slight tension to ensure contact with the pipe surface.
    b) On irregularly shaped surfaces, allow slack so the wrap can be molded into place.
5) Once applied, press and form the wrap so that there are no air pockets or voids under the wrap.
6) Also, press and smooth out the lap seams to ensure that they are sealed.
7) If desired, the wrap may be painted, but allow a few days for it to self-firm.

<u>TapeCoat® (cold applied tape coating systems)</u>

- Tapecoat H35 or H50 – A 35 or 50 mil tape with integrated primer for coating small to moderate diameter pipe, pipe joints, and repair of factory coating. For use above or below ground.
- Tapecoat M50 or M65 – A 50 or 65 mil mesh backed tape with integrated primer for coating small to large diameter pipe, pipe joints, and repair of factory coating. For use below ground only.
- Tapecoat T-Tape – A 65 mil tape with a thin film backing and integrated primer for coating tees and fittings. It can be used as a standalone coating, but in some environments, it may require an outer mechanical layer of tape or Rockshield. For use below ground only unless it is wrapped with a UV stable mechanical coating.

Preparation:

1) Before application, remove all loose surface material, rust, dirt, dust, moisture, grease, oil, sharp edges, burrs, mill scale, welding splatter and any cleaning products.
2) At a minimum, pipe cleaning must meet either SSPC-SP 2 or SSPC-SP 3.
    a) SSPC-SP 2: Hand Tool Cleaning
    b) SSPC-SP 3: Power Tool Cleaning
3) Coating must be applied as soon as practical after cleaning is completed in order to keep dirt, debris, and rust bloom from re-contaminating the pipe surface.
4) Before the coating application, the surface must be dry. Preheating may be required to accomplish this.

Tape Application:

1) If using Omniprime, a thin coating (4 mil wet) applied by a brush is recommended. The primer must be given enough time to dry before the tape is applied. A simple touch test can be used to indicate when the primer is dry. A tacky feel without transfer of the primer to gloved hand is considered a successful test.
2) If needed, Tapecoat Moldable Sealant or T-Tape should be used to fill all step-down areas, irregular shapes and angles. The Moldable Sealant and T-Tape application will create a smooth surface to allow for full bonding of the tape coating.

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3) Tape must be applied with sufficient tension to conform and bond to the pipe surface using either a manual or tape wrap machine method. Remove the release liner as the tape is being applied.
   a) The preferred method is to apply the tape in a spiral wrap with sufficient overlap to ensure a good lap seal.
   b) Cigarette wrap method is allowed when conditions do not allow for spiral wrapping
4) The overlap should be a minimum of 1" or 20% of the tape width, whichever is greater. When conditions require additional protection, a 50% overlap should be used.
5) Field applied tape should extend at least 4" over the factory coating.
6) The tape wrap should be free of voids and wrinkles. When coating a weld joint, added care must be given when wrapping over a factory cutback. If the factory coating is thicker than the joint tape selected, Tapecoat Moldable Sealant or T-Tape should be used to allow for a smooth transition at the cutback.
7) The coating wrap should end on the down side of the pipe between the 1 to 5 o'clock positions.
8) When coating a vertical pipe or riser, always wrap from the bottom to the top.
9) Backfilling may take place immediately and should be free of any large rocks, stones, or debris that could damage the coating.

<u>TapeCoat® 20 (hot applied coal tar coating in tape form)</u>

May be used for pipe pushes and small diameter directional boring as it is a tough, abrasion and impact resistant coating. For use below ground only.

Preparation:

1) Before application, remove all loose surface material, rust, dirt, dust, moisture, grease, oil, sharp edges, burrs, mill scale, welding splatter and any cleaning products.
2) At a minimum, pipe cleaning must meet either SSPC-SP 2 or SSPC-SP 3.
   a) SSPC-SP 2: Hand Tool Cleaning
   b) SSPC-SP 3: Power Tool Cleaning
3) When TC 20 is used as a girth weld coating over a new mainline coating, the mainline coating must meet SSPC-SP 1.
   a) SSPC-SP 1: Solvent Cleaning
4) Coating must be applied as soon as practical after cleaning is completed in order to keep dirt, debris, and rust bloom from re-contaminating the pipe surface.
5) Before the coating application, the surface must be dry. Preheating may be required.

Tape Application:

1) Before coating application, the surface must be dry. Preheating is required to achieve this and to improve the performance of the coating system. The substrate temperature should be preheated to 100-140° F. Be cautious not to damage the existing coating during preheating by always keeping the torch moving.

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2) Stir the Omniprime primer until the product appears uniform using a paint stick or similar tool. A thin (4 mil wet) coating applied by brush is recommended. The primer must overlap existing coatings by a minimum of 4". The primer must be given enough time to dry before the tape is applied. A simple touch test can be used to indicate when the primer is dry. A tacky feel without transfer of the primer to gloved hand is considered a successful test.
3) Unroll about a foot of the tape and heat the adhesive side (not the film side) by quickly moving the torch over the surface until it becomes glossy. Place the heated side onto the primed surface and press with a heat resistant glove. Smooth out wrinkles and ensure a good contact of the tape to the substrate.
4) Unroll an additional 1-2' of tape and heat the adhesive side until it becomes glossy. Apply that section to the pipe and repeat until the area to be coated is covered.
5) Tape must be applied with sufficient tension to conform and bond to the pipe surface using either a manual or tape wrap machine method.
   a) The preferred installation method is the spiral wrap method with sufficient overlap to ensure a good lap seal.
   b) Cigarette wrap tape method may be used when conditions do not allow for spiral wrapping.
6) The recommended overlap should be 50% of the tape width. When conditions require additional protection, a greater overlap or second wrap may be used.
7) Field applied tape should extend at least 4" over the factory coating.
8) The tape wrap should be free of voids and wrinkles. When coating a weld joint, added care must be given when wrapping over a factory cutback. Thick coating should be tapered at the step-down area to allow for a smooth, void free transition.
9) When coating irregular pipe segments, narrower width tape should be used for better confirmability. When necessary, apply hand pressure and increased heat to the coating to insure conformability to the substrate.
10) The coating wrap should end on the down side of the pipe between the 1 to 5 o'clock positions.
11) When coating a vertical or riser pipe, always wrap from the bottom to the top. For transitions from below ground to above ground, the TC 20 will need to be coated with a UV resistant coating.

IAMU Procedure #4.16: Pipe Surface Preparation for Coating Application

Requirements:

1) Before the installation of any approved pipeline coating, the surface must be properly prepared so that the coating properly bonds to the pipeline.
2) For any approved pipeline coating, the manufacturer will specify the type of surface preparation that is required for the type of coating.
3) Surface preparation for coating applications is described in detail for the specific type of coating to be used in IAMU Procedure #4.15 – Coating Application and Repair: Wrapped.

General Cleaning Methods:

Solvent Cleaning:

1) Requires the use of a cleaning solution that removes all visible oil, grease, soil, and other contaminants.
2) Solvent cleaning does NOT remove rust or mill scale.
3) If performing solvent cleaning, rags should be changed frequently so that contamination is not spread to other areas.
4) Some solvents may be hazardous and require proper PPE and ventilation.

Hand Tool Cleaning:

1) Requires the use of a putty knife, wire brush, or similar tool to remove all disbonded or damaged coating, loose mill scale, loose rust, and other loose foreign matter.
2) Hand tool cleaning is not intended to remove adherent mill scale, rust, and paint.

Power Tool Cleaning:

1) Requires the use of a power tool with a wire wheel to remove all oxidation, loose mile scale, loose rust, paint, and other foreign matter.

Power Tool Cleaning to Bare Metal:

1) Requires the use of a power tool with a wire wheel or flap disc (not a cutting wheel) to remove all mill scale, rust, paint, oxidation, oil, grease, dirt, dust, and other foreign material taking care not to damage the pipe or remove wall thickness.
2) If observed under magnification, slight residues of rust and paint may be visible in the lower portions of pits, if pitting is present.

IAMU Procedure #4.17: Inspect Pipeline Coating Using Holiday Detection

Requirements:

1) Holiday detectors must be calibrated according to manufacturers' specifications at a minimum of twice per day and test voltage verified during the calibration.
   a) Calibration may be completed using a holiday detector calibrator or a voltmeter as follows:
      i) Attach the red wire, or positive probe, to the spring coil, and then attach the black wire, or negative probe, to the ground wire on the detector.
      ii) Turn the meter on and adjust the holiday detector as needed by turning the adjustment screw on the detector until you get the specified voltage reading.
2) A holiday detector may be used in addition to visually inspecting pipeline coatings prior to installation.
   a) If used correctly, a holiday detector may be able to detect defects in the pipeline coating that may not be visible to the human eye.

Safety Precaution:

1) HIGH VOLTAGE HAZARD – When using a holiday detector, DO NOT come into contact with the energized pipe or the bare ground wire.
2) DO NOT use in a gaseous environment as there is potential for the holiday detector to spark and be an ignition source.

Holiday Detector Testing Procedure:

1) Always follow the manufacturers' instructions for the use of the specific type of holiday detector in use.
2) Inspect the equipment for any signs of damage.
3) Ensure that the battery is properly charged.
4) Determine the appropriate output voltage to be used for the specific type and thickness of coating.
   a) Refer to manufacturers' instructions or NACE Standard SP0490 recommendations.
5) Remove all dirt, debris and moisture from the pipe coating.
6) Properly ground the pipe to be inspected to the earth.
7) Before attaching the ground wire, wand, and electrode, ensure that the holiday detector is in the OFF position.
   a) The ground wire should be in contact with the ground surface and trail behind the unit.
8) Turn the unit on.
   a) The unit may make a buzzing noise during operation.

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9) After turning the unit on, turn the control knob to the predetermined voltage position as described in step 4).
10) During testing, a moderate rate of travel is recommended.
    a) The electrode should always remain in motion while test voltage is being applied to ensure that damage is not caused to the pipe coating.
11) If a holiday is detected, a spark and/or audible signal should occur.
    a) If the unit is not detecting any holidays, it may be necessary to verify the operation of the unit. This can be accomplished by moving the electrode over an area of pipe coating where a known holiday exists or where the pipe is bare. If the unit does not detect the known holiday, it may be necessary to reduce rate of travel or increase output voltage.
12) If any holidays are detected during the testing process, the exact location should be identified, marked, and repaired before installation.
13) All holidays discovered during detection must be repaired before installation.

CITY OF BLOOMFIELD, IOWA

PART FIVE

Pressure Testing

IAMU Procedure #5.1: Pressure Test–MAOP Less Than 100 psi

Requirements:

1) A pressure test must be conducted on all newly installed, replaced, relocated, and repaired mains and service lines before they are put into service.
2) If any leaks are discovered during the pressure test, they must be repaired and/or eliminated.
3) If a single component is the only item being installed (i.e., a coupling, valve, flange, etc.) a pressure test does NOT need to be conducted if the component has an established pressure rating through ASME/ANSI or MSS that is equal to or higher than the MAOP of the pipeline to which is going to be installed.
   a) Though a pressure test is not required, the component must still be leak checked under normal operating pressure.

Documentation and Record Retention:

1) A record of all pressure tests must be made and retained for the life of the pipeline. At a minimum, the following information must be recorded:
   a) The operator's name, the name of the operator's employee responsible for make the test, and if applicable, the name of any test company (third party contractor) used.
   b) Test medium, test pressure, and test duration.
   c) Pressure recording charts, or other record of pressure readings (initial and final pressure).
   d) Elevation variations, whenever significant for the particular test.
   e) If any leaks and failures were found and their disposition.
2) Consideration should also be given to recording and retaining the following information:
   a) What type of pipeline? Transmission line, distribution main, or service line.
   b) Start and stop time of the test.
   c) Ambient air temperature at the start time and stop time of the test.
   d) Type, size, and print line (manufacturing data) off of all pipe and components.
   e) Length of pipeline being tested (in feet).
   f) Types of joining methods used (electrofusion, butt fusion, compression couplings, etc.).
   g) Create a detailed map (using GPS if possible) noting location of joints, couplings, valves, EFVs, risers, tees, etc.
   h) Calculated MAOP of pipeline tested.
3) Photographs may be taken to capture specific information or to provide a visual reference to the installation.
4) The Pipeline Installation Report, Pre-Installation Pressure Test Report or other company approved document may be used to retain the required information.

NOTE: Depending on the type of installation, it may be necessary to create and retain multiple documents so that all required information is captured.

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Safety Precautions:

1) All steps must be taken to prevent accidental ignition prior to, during, and after the testing.
2) Fire extinguishers and combustible gas indicators should be readily available and located upwind.
3) Assess the area, are there any electrical conductors or other utilities in the testing area?
4) If performing the test in heavily populated area, consideration should be given to restricting access to the area to those not involved in the test by the use of temporary barricades, caution tape, or fencing off the area.
5) If using testing plugs or end caps, inspect them prior to and during the testing to ensure that they are securely connected and leak tight.
6) Consideration should be given to reviewing this procedure, step-by-step, with all personnel involved in the testing prior to performing each pressure test.

Test Pressure and Time Requirements for Steel or Plastic Service Lines & Mains:

NOTE: All steel or plastic service lines must be tested using air or inert gas as the test medium.

Pressure Requirements:

1) If MAOP is less than or equal to 60 psi, a minimum test pressure of 90 psi is required.
2) If MAOP is greater than 60 psi but less than 100 psi, a minimum test pressure of 1.5 times MAOP is required.
   a) Example: If MAOP is 75 psi then the minimum required test pressure would be 112.5 psi.

Time Requirements for Service Lines:

1) All steel or plastic service lines up to and including 2 inch, 200 feet or less, must be tested for a minimum of 15 minutes. For each additional 50 feet of service line (remember to round up), 5 minutes must be added to the total testing time.
   a) Example: A 330-foot service line would require a 30-minute test.
2) If installing a service line larger than 2-inch, it must be tested as a main.

Time Requirements for Mains:

1) All steel or plastic mains up to and including 4 inch, 1500 feet or less, must be tested for a minimum of 1 hour. For each additional 500 feet of main (remember to round up), 15 minutes must be added to the total testing time with a maximum required time of 8 hours.
   a) Example: A 5350-foot main would require a 3-hour test.
2) All steel or plastic mains larger than 4 inch, 1500 feet or less must be tested for a minimum of 1.5 hours. For each additional 500 feet of main (remember to round up), 30 minutes must be added to the total testing time with a maximum required time of 8 hours.
   a) Example: A 5350-foot main would require a 4-hour test.

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Pressure Testing Newly Installed Service Lines

NOTE: All pipe and components of the service line, from the tapping tee to the service valve, must be included in the pressure test.

1) Calculate the required test pressure and time that is specific to the size and length of pipe for the installation. Remember to include the footage of the service riser into calculation.
2) Connect the testing adapter (including pressure gauge) to the top of service riser or the tapping tee.
    a) If testing from the tapping tee towards the service riser, the service valve should be left in the open position and a plug or cap installed. Pressure tests should not be conducted against closed valves.
    b) If testing from the service riser back towards the tapping tee, ensure that the service valve is left in the open position and the tapping tee cap is installed.
3) Connect the air or inert gas supply to the testing adapter.
4) Slowly open the valve from the air or inert gas supply to "energize" the line.
5) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
6) Close the valve from the air or inert gas supply.
7) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
    a) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
8) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
9) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using leak solution.
10) Once the required time period has been met or exceeded, check the pressure gauge and if no drop in pressure is noticed, the test is successful. If pressure has dropped below the required minimum test pressure the test is NOT considered valid and must be completed again.
    a) Before completing a second pressure test, all leaks must be found and repaired.
    b) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using a leak solution to verify that no leaks are present.
11) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
12) Properly document and retain pressure test results.

Pressure Testing Damaged and/or Disconnected Service Lines

NOTE: Each service line temporarily disconnected (due to damage or for repairs or replacement) from the main must be tested from the point of disconnection up to the service valve.

1) Shut-off the gas supply by either closing the tapping tee or by completing squeeze off procedures.
2) Determine what repairs are going to be necessary.
3) If installing only a single repair coupling (not a leak clamp) and no pipe:
   a) A pressure test is NOT required if the component was manufactured under a quality control system that ensures the integrity of the component and it is has a pressure rating of no less than the MAOP of the pipeline to which it is attached. However, the joint must still be leak checked at operating pressure by using a combustible gas indicator or leak solution.
4) If installing a segment of pipe, a pressure test must be conducted from the point of disconnect through the service riser and service valve. Only the final tie-in joint is allowed to be leak checked under operating pressure and not included in the pressure test.
   a) Determine the required test pressure and time that is specific to the size and length of pipe.
   b) Join the repair segment of pipe to the segment of existing service line that is connected to the service riser and valve.
      i) **DO NOT** join the repair segment to the existing service line that is connected to the tapping tee or where the squeeze-off tool is located as pressure testing against these components is not allowed.
   c) Connect a test cap or plug over the open end of the repair segment of pipe that was previously joined to the existing service line.
      i) The air or inert gas supply may be connected directly to an approved test cap or plug and the service riser valve left in the open position and plugged or capped;
      ii) OR, the air or inert gas supply may be connected to the top of the service riser valve and the open end of the pipe plugged or capped.

   d) Slowly open air or inert gas valve to "energize" the line and raise pressure to at or slightly above the minimum pressure required.
   e) Close the air or inert gas supply valve and allow the pressure to stabilize.
      i) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
   f) Start timing the test and allow the test to continue for at least the minimum required time.
   g) Once the time requirement is met or exceeded, check the pressure gauge. If no pressure drop is noticed the test is considered successful.
      i) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using a leak solution to verify that no leaks are present.

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h) If the pressure dropped below the minimum required pressure at any time during the test, the test is **NOT** considered valid and must be completed again.
i) If the pressure drop was found to be caused by leaking pipe or components, they must be repaired before completing a second test.
j) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline and remove the test cap or plug from the repair segment of pipe.
k) The final tie-in joint may now be made with the existing portion of service line that is connected to the tapping tee or is squeezed-off.
l) Once the final joint is made (and allowed to cool if applicable) the joint must be leak checked under operating pressure using leak solution.
m) If no leaks are found, purge out the service line at the service riser and re-establish service if necessary.
n) Properly document and retain pressure test and repair results.

<u>Pressure Testing Newly Installed Mains</u>

NOTE: If installing service lines at the same time as the main, the main and the service lines may be tested as a single unit taking into consideration the required test pressure and amount of time required for the additional amount of pipe being tested.

Reminder: If installing a new main extension to an already existing main, the pressure test may not be conducted against a squeeze-off tool or closed valve that was previously installed within the already existing main.

1) Calculate the required test pressure and time that is specific to the size and length of pipe for the installation.
2) Once all the main piping has been joined, install a permanent cap on the "dead end" of the main while the other end may remain open to allow for the connection of the test fitting or plug.
   a) If both ends of the main are intended to be tied into existing mains, caps or test fittings may be installed on both ends.
   b) Valves that may have been installed at the ends of the main piping may not be closed and be used as stops to pressure test against. All valves must remain in the open position during testing.
3) If the appropriate size or type of test fitting or plug is not available, install a cap on both ends that may be removed or cut-out after the test is completed.
   a) If a test fitting is not available, a tapping tee will need to be installed on the main to provide a means of supplying air or inert gas used for the test.
4) Install test fitting to the open end of the main or the test head adapter to the tapping tee and connect the air or inert gas supply.

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5) Slowly open the valve from the air or inert gas supply to “energize” the line.
6) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
7) Close the valve from the air or inert gas supply.
8) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
9) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
10) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
11) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using leak solution.
12) Once the required time period has been met or exceeded, check the pressure gauge and if no pressure drop is noticed, the test is considered successful. If pressure has dropped below the required minimum test pressure the test is NOT considered valid and must be completed again.
13) Before completing a second pressure test, all leaks must be found and repaired.
14) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using a leak solution to verify that no leaks are present.
15) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
16) If making a tie-in joint with existing main, remove the test fitting or plug from the end of the main, complete the tie-in joint, purge the main with natural gas, and leak check the tie-in joint under operating pressure using a combustible gas indicator or leak solution.
17) If the test was conducted using a tapping tee, remove the test head adapter and cap-off tapping tee unless the tee is to be used immediately for installation of service line.
18) Properly document and retain pressure test results.

Pressure Testing Damaged or Repaired Segments of Mains

NOTE: If a main is damaged and a repair segment of pipe must be installed, the repair segment of pipe and components must be pressure tested. If it is impractical to perform an “in-line” test, a pre-test must be conducted on the pipe and components with exception to the tie-in joints (where the new segment ties into the existing main) which are allowed to be leak checked at operating pressure using a combustible gas indicator or leak solution.

Reminder: Typically, “in-line” testing for repair segments of main will be deemed impractical as a pressure test cannot be conducted against a squeeze-off tool, closed valve, or stopper fitting.

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1) Calculate the required test pressure and time that is specific to the size and length of pipe for the installation.
2) If only installing a single segment of pipe where the only joints will be the tie-in joints, a pre-test must be conducted on the repair segment of pipe only.
3) If installing multiple segments of pipe which will contain multiple joints or components, join all the repair segments of pipe (including components, if applicable) before conducting the test as only the tie-in joints are allowed to be leak checked at operating pressure.
4) Install caps, test plugs, or test fittings over the open ends (tie-in joints) of the repair segment that may be removed or cut out after completing the pressure test.
5) If an approved pressure test fitting or plug is not available, the open-end, tie in joints, must be capped and a tapping tee will need to be installed on the repair segment of main to provide a means of supplying air or inert gas used for the test.
6) Install test fitting to the open end of the main or the test head adapter to the tapping tee and connect the air or inert gas supply.
7) Slowly open the valve from the air or inert gas supply to "energize" the line.
8) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
9) Close the valve from the air or inert gas supply.
10) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
11) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
12) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
13) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using a combustible gas indicator or leak solution.
14) Once the required time period has been met or exceeded, check the pressure gauge if no pressure drop is noticed, the test is considered successful. If pressure has dropped below the required minimum test pressure the test is NOT considered valid and must be completed again.
15) Before completing a second pressure test, all leaks must be found and repaired.
16) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using a combustible gas indicator or leak solution to verify that no leaks are present.
17) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
18) Remove the test fitting or plug from the end of the main, complete the tie-in joints, purge the main with natural gas and leak check the tie-in joints under operating pressure using a combustible gas indicator or leak solution.

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19) If the test was conducted using a tapping tee, remove the test head adapter and cap-off tapping tee unless the tee is to be used immediately for installation of service line or to purge out the repair segment once the tie-ins are completed.
20) Properly document and retain pressure test results.

Pressure Testing Transmission Lines with MAOP Less Than 100 psi and a Hoop Stress Less Than 30% SMYS

1) For all steel or plastic transmission lines that are newly installed, repaired or replaced, the same procedures that were previously provided in this procedure for pressure testing mains and services must be followed with the following exceptions:
   a) All pressure tests that are conducted on transmission pipeline, must be conducted at a pressure no less than 1.5 times MAOP.
      i) Example: If the MAOP of the transmission line is 99 psi, the minimum test pressure would be 148.5 psi.
   b) Pressure tests for segments of transmission lines, regardless of size and length, must be conducted for a minimum of 8 hours. Unless, for repair segments of transmission line where an in-line test is impractical, a pre-test must be conducted for a minimum of 4 hours.
   c) If installing a farm tap, the farm tap is considered a distribution service line NOT transmission requiring the minimum 8-hour test duration.
      i) Even though the farm tap is NOT considered transmission, it must still be pressure tested from the tapping tee to the first cut regulator at a pressure no less than 1.5 times MAOP.
      ii) The time period required for the test, must meet the same requirements for the size and length of line that is previously described in this procedure for distribution piping.

IAMU Procedure #5.2: Pressure Test–MAOP Greater Than or Equal to 100 psi

NOTE: These procedures will typically be used on all transmission lines, high pressure distribution and higher-pressure segments of farm taps that have an MAOP greater than or equal to 100 psi and operate at a pressure less than 30% SMYS.

Requirements:

1) A pressure test must be conducted on all newly installed, replaced, relocated, and repaired transmission lines and farm taps before they are put into service.
2) If any leaks are discovered during the pressure test, they must be repaired and/or eliminated.
3) If a single component is the only item being installed (i.e., a coupling, valve, flange, etc.) a pressure test does NOT need to be conducted if the component has an established pressure rating through ASME/ANSI or MSS that is equal to or higher than the MAOP of the pipeline to which is going to be installed.
    a) Though a pressure test is not required, the component must still be leak checked under normal operating pressure.

Documentation and Record Retention:

1) A record of all pressure tests must be made and retained for the life of the pipeline. At a minimum, the following information must be recorded:
    a) The operator's name, the name of the operator's employee responsible for make the test, and if applicable, the name of any test company (third party contractor) used.
    b) Test medium, test pressure, and test duration.
    c) Pressure recording charts, or other record of pressure readings (initial and final pressure).
    d) Elevation variations, whenever significant for the particular test.
    e) If any leaks and failures were found and their disposition.
2) Consideration should also be given to recording and retaining the following information:
    a) What type of pipeline? Transmission line, distribution main, or service line.
    b) Start and stop time of the test.
    c) Ambient air temperature at the start time and stop time of the test.
    d) Type, size, and print line (manufacturing data) off of all pipe and components.
    e) Length of pipeline being tested (in feet).
    f) Types of joining methods used (electrofusion, butt fusion, compression couplings, etc.).
    g) Create a detailed map (using GPS if possible) noting location of joints, couplings, valves, EFVs, risers, tees, etc.
    h) Calculated MAOP of pipeline tested.

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3) Photographs may be taken to capture specific information or to provide a visual reference to the installation.
4) The Pipeline Installation Report, Pre-Installation Pressure Test Record or other company approved documents may be used to retain the required information.

Safety Precautions:

1) All steps must be taken to prevent accidental ignition prior to, during, and after the testing.
2) Fire extinguishers and combustible gas indicators should be readily available and located upwind.
3) Assess the area, are there any electrical conductors or other utilities in the testing area?
4) Consideration should be given to restricting access to the area to those not involved in the test by the use of temporary barricades, caution tape, or fencing off the area.
5) If using testing plugs or end caps, inspect them prior to and during the testing to ensure that they are securely connected and leak tight.
6) Consideration should be given to reviewing this procedure, step-by-step, with all personnel involved in the testing prior to performing each pressure test.

Test Pressure and Time Requirements for Transmission Lines and Farm Taps:

NOTE: All steel or plastic service lines must be tested using air or inert gas as the test medium. If the required test pressure is in excess of 150 psi, nitrogen is the preferred test medium that should be used.

Pressure Requirements:

1) Where MAOP is greater than or equal to 100 psi, a minimum test pressure of 1.5 times MAOP is required.
   a) Example: If MAOP is 350 psi then the minimum required test pressure would be 525 psi.

Time Requirements for Farm Tap Service Lines:

1) Farm tap service lines up to and including 2 inch, 200 feet or less, must be tested for a minimum of 15 minutes. For each additional 50 feet of service line (remember to round up), 5 minutes must be added to the total testing time.
   a) Example: A 330-foot service line would require a 30-minute test.
2) Farm tap service lines larger than 2-inch, must be tested for a minimum of 4 hours.

Time Requirements for Transmission Lines:

1) Pressure testing must be conducted for 8 hours on transmission lines of all sizes in all locations. Except for fabricated units and short sections of repair pipe where an in-line test is impractical, a pre-installation test must be conducted for a minimum of 4 hours.

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<u>Pressure Testing Newly Installed Farm Tap Service Lines</u>

NOTE: Depending on the type of installation (due to pressure requirements), it may be necessary to conduct two separate pressure tests for the installation of a farm tap. One test may be conducted on the "higher pressure" segment of the farm tap from the tapping tee up to the inlet of the first cut regulator and then a second test conducted on the "lower pressure" segment, from the outlet of the first cut regulator through the service riser and service valve.

Reminder: All pipe and components of the farm tap, from the tapping tee to the service valve, should be included in the pressure test when possible.

1) Calculate the required test pressure and time that is specific to the size and length of pipe for the installation.
2) Connect the testing adapter (including pressure gauge) to the top of service riser or the tapping tee. Ensure that it is rated for the anticipated maximum testing pressure.
   a) If testing from the tapping tee towards the service riser, the service valve should be left in the open position and a plug or cap installed. Pressure tests should not be conducted against closed valves.
   b) If testing from the service riser back towards the tapping tee, ensure that the service valve is left in the open position and the tapping tee cap is installed.
3) Connect the air or inert gas supply to the testing adapter.
4) Slowly open the valve from the air or inert gas supply to "energize" the line.
5) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
6) Close the valve from the air or inert gas supply.
7) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
   a) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
8) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
9) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using a leak solution.
10) Once the required time period has been met or exceeded, check the pressure gauge if no pressure is noticed, the test is considered successful. If pressure has dropped below the required minimum test pressure the test is **NOT** considered valid and must be completed again.
    a) Before completing a second pressure test, all leaks must be found and repaired.
    b) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using leak solution to verify that no leaks are present.

11) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
12) Properly document and retain pressure test results.

Pressure Testing Damaged and/or Disconnected Farm Tap Service Lines

NOTE: Each farm tap service line temporarily disconnected (due to damage or for repairs or replacement) from the transmission line must be tested from the point of disconnection up to the service valve.

1) Determine what repairs are going to be necessary.
2) If, based on pressure requirements, a single repair coupling (not a leak clamp) is going to be installed:
    a) A pressure test is NOT required if the component was manufactured under a quality control system that ensures the integrity of the component and it is has a pressure rating of no less than the MAOP of the pipeline to which it is attached. However, the joint must still be leak checked at operating pressure by using a combustible gas indicator or leak solution.
3) If installing a segment of pipe, a pressure test must be conducted from the point of disconnect through the service riser and service valve. Only the final tie-in joint is allowed to be leak checked under operating pressure and not included in the pressure test.
    a) Determine the required test pressure and time that is specific to the size and length of pipe.
    b) Join the repair segment of pipe to the segment of existing service line that is connected to the service riser and valve.
        i) **DO NOT** join the repair segment to the existing service line that is connected to the tapping tee or where the squeeze-off tool or stopple fitting is located as pressure testing against these components is not allowed.
    c) Connect a test cap or plug with required pressure rating over the open end of the repair segment of pipe that was previously joined to the existing service line.

        i) The air or inert gas supply may be connected directly to an approved test cap or plug and the service riser valve left in the open position and plugged or capped;
        ii) OR, the air or inert gas supply may be connected to the top of the service riser valve and the open end of the pipe plugged or capped.
    d) Slowly open air or inert gas valve to "energize" the line and raise pressure to at or slightly above the minimum pressure required.
    e) Close the air or inert gas supply valve and allow the pressure to stabilize.
        i) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.

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f) Start timing the test and allow the test to continue for at least the minimum required time.
g) Once the time requirement is met or exceeded, check the pressure gauge. If no pressure drop is noticed the test is considered successful.
   i) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using leak solution to verify that no leaks are present.
h) If the pressure dropped below the minimum required pressure at any time during the test, the test is **NOT** considered valid and must be completed again.
i) If the pressure drop was found to be caused by leaking pipe or components, they must be repaired before completing a second test.
j) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline and remove the test cap or plug from the repair segment of pipe.
k) The final tie-in joint may now be made with the existing portion of service line that is connected to the tapping tee or is squeezed-off.
l) Once the final joint is made (and allowed to cool if applicable) the joint must be leak checked under operating pressure using leak solution.
m) If no leaks are found, purge out the service line at the service riser and re-establish service if necessary.
n) Properly document and retain pressure test and repair results.

Pressure Testing Newly Installed Transmission Lines

NOTE: If installing a new extension to an already existing transmission line, the pressure test may not be conducted against a squeeze-off tool, stopple fitting or closed valve that was previously installed within the already existing main.

1) Calculate the required test pressure and remember that all new transmission line installations require a minimum of an 8-hour test.
2) Once all piping has been joined, install a permanent cap on the "dead end" of the pipeline while the other end may remain open to allow for the connection of the test fitting or plug.
   a) If both ends of the pipeline are intended to be tied into the existing transmission line, caps or test fittings with the required pressure rating may be installed on both ends.
   b) Valves that may have been installed in the piping may not be closed and be used as stops to pressure test against. All valves must remain in the open position during testing.
3) If the appropriate size or type of test fitting or plug is not available, install a cap on both ends that may be removed or cut-out after the test is completed.
   a) If a test fitting is not available, a tapping tee will need to be installed on the main to provide a means of supplying air or inert gas used for the test.

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4) Install test fitting to the open end of the pipeline or the test head adapter to the tapping tee and connect the air or inert gas supply.
5) Slowly open the valve from the air or inert gas supply to "energize" the line.
6) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
7) Close the valve from the air or inert gas supply.
8) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
9) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
10) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
11) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using leak solution.
12) Once the required time period has been met or exceeded, check the pressure gauge if no pressure drop is noticed, the test is considered successful. If pressure has dropped below the required minimum test pressure the test is NOT considered valid and must be completed again.
13) Before completing a second pressure test, all leaks must be found and repaired.
14) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using leak solution to verify that no leaks are present.
15) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
16) If making a tie-in joint with existing transmission line, remove the test fitting or plug from the end of the main, complete the tie-in joint, purge with natural gas and leak check the tie-in joint under operating pressure using a combustible gas indicator or leak solution.
17) If the test was conducted using a tapping tee, remove the test head adapter and cap-off tapping tee unless the tee is to be used immediately for installation of a farm tap service line.
18) Properly document and retain pressure test results.

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Pressure Testing Damaged or Repaired Segments of Transmission Line

NOTE: If a transmission line is damaged and a repair segment of pipe must be installed, the damaged portion of the transmission line must be cut out as a cylinder and the repair segment of pipe and components must be pressure tested. If it is impractical to perform an "in-line" test, a pre-test must be conducted on the pipe and components with exception to the tie-in joints (where the new segment ties into the existing main) which are allowed to be leak checked at operating pressure using a combustible gas indicator or leak solution.

Reminder: Typically, "in-line" testing for repair segments of main will be deemed impractical as a pressure test cannot be conducted against a squeeze-off tool, closed valve, or stopper fitting.

1) Calculate the required test pressure and remember that a minimum of a 4-hour test is required for all pre-tested segments.
2) If only installing a single segment of pipe where the only joints will be the tie-in joints, a pre-test must be conducted on the repair segment of pipe only.
3) If installing multiple segments of pipe which will contain multiple joints or components, join all the repair segments of pipe (including components, if applicable) before conducting the test as only the tie-in joints are allowed to be leak checked at operating pressure.
4) Install caps, test plugs, or test fittings over the open ends (tie-in joints) of the repair segment that may be removed or cut out after completing the pressure test.
5) If an approved pressure test fitting or plug is not available, the open-end, tie in joints, must be capped and a tapping tee will need to be installed on the repair segment of main to provide a means of supplying air or inert gas used for the test.
6) Install test fitting to the open end of the main or the test head adapter to the tapping tee and connect the air or inert gas supply.
7) Slowly open the valve from the air or inert gas supply to "energize" the line.
8) Continue to watch the pressure gauge and allow the pressure to slowly increase until the desired minimum pressure is obtained.
9) Close the valve from the air or inert gas supply.
10) After the supply valve is closed, allow a minute or two to pass while keeping a close eye on the pressure gauge. A decrease in pressure may be noticed as the pressure and temperature inside the pipeline stabilizes.
11) If a pressure drop is noticed, it may be necessary to slowly open supply valve and bring pressure back to or slightly above minimum required pressure.
12) Once pressure has stabilized at or slightly above the required minimum pressure and no noticeable drop in pressure observed, start timing the test.
13) While the required time is passing, it is recommended that all joints and piping are leak checked if possible, using a combustible gas indicator or leak solution.

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14) Once the required time period has been met or exceeded, check the pressure gauge if no pressure drop is noticed, the test is considered successful. If pressure has dropped below the required minimum test pressure the test is NOT considered valid and must be completed again.
15) Before completing a second pressure test, all leaks must be found and repaired.
16) If a slight pressure drop is discovered but the pressure remained at or above the minimum requirement, all joints must be leak checked using leak solution to verify that no leaks are present.
17) Once the test has been determined to be successful, slowly bleed off the test pressure until there is no longer any pressure contained in the pipeline.
18) Remove the test fitting or plug from the end of the test segment, complete the tie-in joints, purge with natural gas and leak check the tie-in joints under operating pressure using a combustible gas indicator or leak solution.
19) If the test was conducted using a tapping tee, remove the test head adapter and cap-off tapping tee unless the tee is to be used immediately for installation of farm tap service line or to purge out the repair segment once the tie-ins are completed.
20) Properly document and retain pressure test results.

IAMU Procedure #5.3: Leak Test at Operating Pressure

NOTE: Only final tie-in joints, where an in-line test is impractical, and meter set piping assembled with prefabricated nipples are allowed to be leak tested at operating pressure.

Tie-in Joints:

1) All final tie-in joints made on service lines, mains, or transmission lines must be leak checked at no less than the operating pressure of the pipeline.
   a) The leak check must be conducted by spraying the joint with leak solution and observing for bubbles or by methodically checking all around the joint with a combustible gas indicator.

Meter Set Piping:

1) All meter set piping that is pre-fabricated (such as meter manifolds, or piping that includes welded joints or flanges) must be tested as a service line as described in IAMU Procedure #5.1 – Pressure Testing: MAOP less than 100 psi.
2) All meter set piping that is not considered a pre-fabricated unit (using threaded nipples of appropriate wall thickness), must be leak checked at no less than the operating pressure of the segment of pipeline.
   a) The leak check must be conducted by spraying the joint with leak solution and observing for bubbles or by methodically checking around all joints with a combustible gas indicator.

CITY OF BLOOMFIELD, IOWA

PART SIX

Uprating Pipeline MAOP

IAMU Procedure #6.1: Uprate a Pipeline

Requirements:

1) If it is determined that an uprating is necessary to fulfill capacity or pressure requirements of a distribution system, a licensed engineer or subject matter expert should be contracted to generate the required written plan that meets the requirements of Division 12 of Requirements and Recommendations.
   a) Once a written plan has been generated, it should be submitted to the Iowa Utilities Board for approval before the uprating process may begin.
2) The MAOP of uprated pipelines must meet the pressure test requirements of §192.619(a)(2).
3) For plastic pipe, the MAOP after uprating cannot exceed the test pressure (either a previous documented pressure test or the maximum test pressure during the uprating) divided by 1.5, as required by §192.619(a)(2)(i).
4) For steel pipe to be operated at 100 psi or more, the MAOP after the uprating cannot exceed the test pressure (either a previous documented pressure test or the maximum pressure during the uprating) divided by the appropriate factor from the table in §192.619(a)(2)(ii).

Documentation & Record Retention:

1) The following documents and records associated with an uprating procedure must me retained for the life of the pipeline segment:
   a) The written plan generated for the uprating procedure.
   b) A record of each leak survey and/or leak investigation.
   c) All work performed during the uprating process.
   d) Each incremental pressure test conducted during the uprating process.

General Procedure for Uprating a Pipeline MAOP:

1) Establish a written procedure specific to the type of uprating and ensure that all the requirements of Division 12 of Requirements and Recommendations are met.
2) Review the design, operating, and maintenance history of the pipeline segment to be uprated to ensure that all pipe, components, and previously conducted pressure tests are sufficient for the desired uprating pressure.
   a) If any pipe, components, or previously conducted pressure tests are found to be insufficient for the desired uprating pressure, repairs, replacements, or re-tests must be conducted to ensure the safe operation of the pipeline at the increased pressure.
3) Before uprating, a leak survey must be conducted on the segment of pipeline that is to be uprated and if any leaks are discovered, they must be repaired.

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4) Offsets, bends, and dead ends in pipe joined by compression couplings that are exposed in an excavation, must be reinforced or anchored to prevent failure of the pipe joint.
5) The segment of pipe that is to be uprated must be isolated from any adjacent segments that will continue to be operated at a lower pressure.
   a) **Reminder** – Testing may not be conducted against a closed valve or squeeze-off tool. If a separate segment is to be isolated it must be physically disconnected and capped off during the uprating.
6) If, during the uprating, the pressure in the mains or service lines, or both, is to be higher than the pressure delivered to the customer, regulators must be installed on each service line and the regulators must be tested to determine that it is functioning as desired.
7) If, during the uprating, the pressure in the mains or service lines, or both, is to be higher than the maximum inlet pressure of any regulators previously installed, new regulators must be installed that have a pressure rating higher than that which will be sustained during the uprating.
8) The increase in MAOP must be completed in increments that are equal to 10 psi or 25% of the pressure increase, whichever produces the fewer number of increments. Whenever the requirements of item (6) and (7) listed above apply, there must be at least two approximately equal incremental increases.
   a) **Reminder** – Pressure increases must be made gradually, in increments, and at a rate that can be controlled.
9) At the end of each incremental increase in pressure, the pressure must be held constant while the entire segment of the pipeline being subjected to the uprating is leak surveyed.
10) Each leak that is discovered, must be repaired before the next incremental increase in pressure with the exception that if a non-hazardous leak is discovered, it does not have to be repaired if it is monitored during the pressure increase and it remains non-hazardous.

CITY OF BLOOMFIELD, IOWA

PART SEVEN

Pipeline Tapping, Stopping & Purging

IAMU Procedure #7.1: Tapping a Steel Pipeline – Tap Diameter 2" or Less

NOTE: For the safety of the public and employees, all steps to prevent accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the bell-hole during all tapping and stopping procedures. All hot taps must be performed by qualified crews.

NOTE: The following procedures for tapping pipelines were obtained from the manufacturer. If equipment being used for tapping is different than what is provided, written procedures must be approved or obtained for the specific equipment being used.

<u>The following procedures are for the Mueller E-5 and D-5 Drilling Machines.</u>

MUELLER® E-5™ Drilling Machine

General Information

Capacity and Use

The E-5 Drilling Machine is hand or power operated for drilling holes 1/2" – 2" inclusive, in any size or kind of pipe. (Under certain conditions the maximum size may be increased to 3 3/4".)

Maximum Working Pressure

500psi at 100° F.
375psi at 250° F.
The working pressure or temperature rating is reduced accordingly if any attachment, valve or fitting, subjected to pressure when using the machine, has a maximum working pressure or temperature rating less than that specified above.

Length of Travel – 12 1/8"

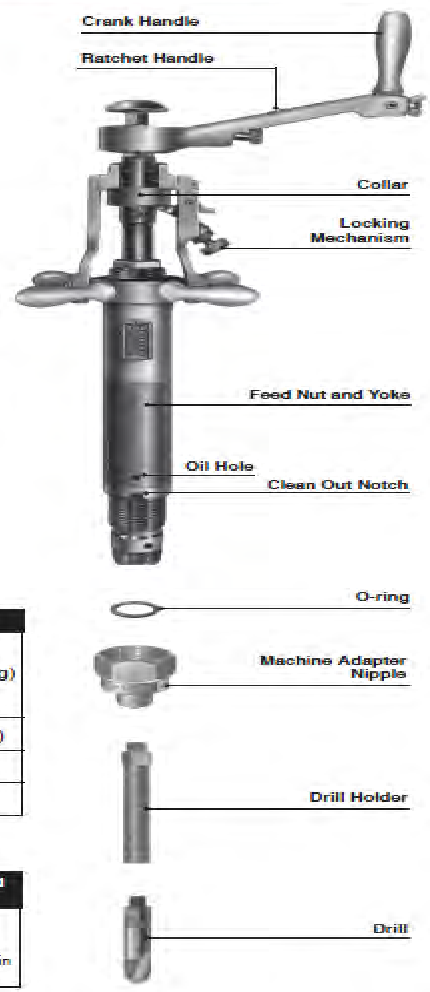
Equipment Furnished with Each Machine

- Ratchet Handle
- Body Gasket
- Adjustable Wrench
- 2 End Wrenches
- Cutting Grease

The machine adapter nipple, drill holder and drill shown at left are not included in the equipment furnished with this machine. These items must be ordered according to the size and type of valve and pipe to be tapped.

3/4" & 1" tools and equipment for this machine are the same as above for the E-4 Drilling Machine in the latest Mueller water and gas catalogs.

For operating instructions see pages 4 – 5 and for E-5 Drilling Machine Parts see page 6.



Shipping Specifications

DESCRIPTION	E-5
Machine and Equipment Furnished in Metal Case	59 1/2 lbs (27 kg)
Machine ONLY	25 lbs (11 kg)
Shipping Length	22"
Extended Length	32"

Small Drilling Machine Selection Guide

Machine	Drill or Cutter Capacity	Maximum Pressure	Operation	Type of Pipe	Recommended Use
E-5 Drilling Machine	7/16" — 1 7/8"	500psig (3450 kPa)	Hand or Power	Cast Iron, Cement-lined Cast Iron, Ductile Iron, Cement-lined Ductile Iron, A-C, Concrete, Steel & PVC	Making main to service connections in pressurized main

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MUELLER® D-5™ Drilling Machine

General Information

Capacity and Use

The D-5 Drilling Machine is hand or power operated for drilling holes ½" – 2" inclusive, in any size or kind of pipe. (Under certain conditions the maximum size may be increased to 3¾".)

Maximum Working Pressure

500psi at 100° F.
375psi at 250° F.
The working pressure or temperature rating is reduced accordingly if any attachment, valve or fitting, subjected to pressure when using the machine, has a maximum working pressure or temperature rating less than that specified above.

Length of Travel – 14"

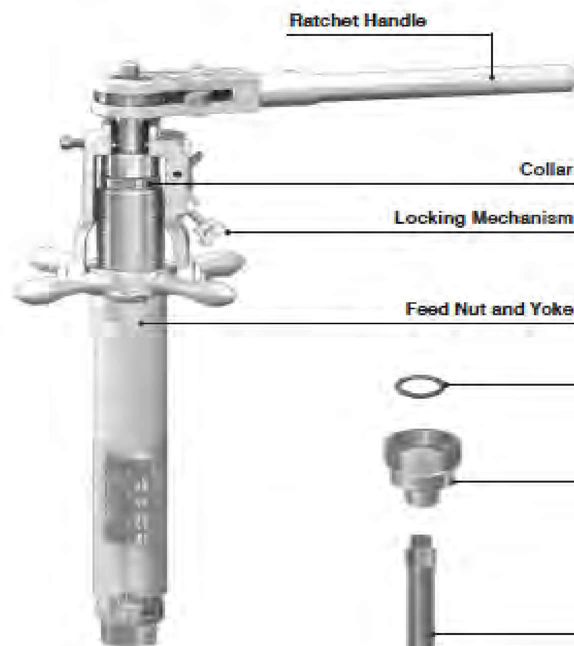
Equipment Furnished with Each Machine

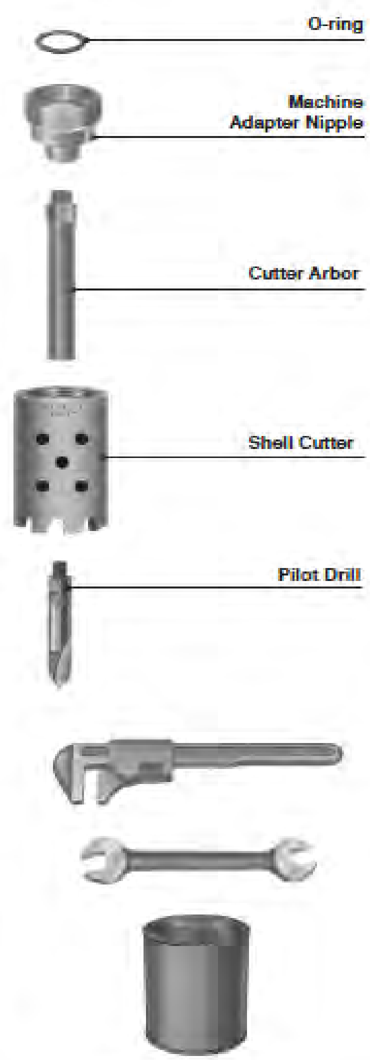
- Ratchet Handle
- Body Gasket
- Adjustable Wrench
- End Wrench
- Cutting Grease

The machine adapter nipple, cutter arbor, shell cutter and pilot drill shown at right are not included in the equipment furnished with this machine. These items must be ordered according to the size and type required.

Tools and equipment for this machine are the same as those listed for the D-4 Drilling Machine in the latest Mueller water and gas catalogs.

For operating instructions see pages 4 – 5 and for D-5 Drilling Machine Parts see page 7.





Shipping Specifications

DESCRIPTION	D-5
Machine and Equipment Furnished in Metal Case	60½ lbs (27 kg)
Machine ONLY	35 lbs (16 kg)
Shipping Length	22½"
Extended Length	37"

Small Drilling Machine Selection Guide

Machine	Drill or Cutter Capacity	Maximum Pressure	Operation	Type of Pipe	Recommended Use
D-5 Drilling Machine	5/8" – 2"	500psig (3450 kPa)	Hand or Power	Cast Iron, Cement-lined Cast Iron, Ductile Iron, Cement-lined Ductile Iron, A-C, Concrete, Steel & PVC	Making main to service connections in pressurized main

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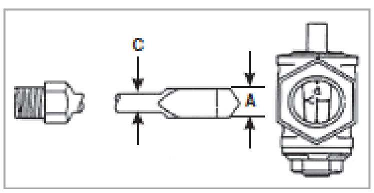
1. Oil all working parts. Keep all threaded surfaces and boring bar well lubricated and free from dirt and foreign material. The feed tube on the E-5 and D-5 is designed to aid in cleaning the threads when advancing or retracting the feed tube and yoke. If equipped, keep the clean-out notch and oil holes of these machines clean at all times. E-5 and D-5 Machines are equipped with O-ring packing. Under normal conditions the only maintenance required for the O-rings is lubrication. If the O-rings should become excessively worn they should be replaced.

2. Advance boring bar until drilling tools may be attached.

3. Attach drilling tools to boring bar. If drilling tools to be used will not pass completely through the machine adapter nipple to be used, attach the machine adapter nipple before attaching the drilling tools (see instruction 5).

Flat drills are used for drilling through straightway or flatway stops. Measure dimensions "A" and "C" on the flat drill to be sure that they are less than minimum dimensions "a" and "c" through the body and key of the stop to be used.



When advancing or retracting the boring bar equipped with a flat drill, make sure that the drill is in the proper position to pass through the port opening in the key and body of the stop being used. (Before advancing the boring bar the correct position can be marked on collar of boring bar.)

4. Coat drill, or shell cutter, and pilot drill thoroughly with Mueller cutting grease. (DO NOT us cutting grease when drilling A-C or concrete pipe.)

5. Attach proper size machine adapter nipple to the body of the machine making sure that the body gasket or washer is in place and in good condition.

6. Retract boring bar to its rearmost position.

7. Attach drilling machine and machine adapter nipple to the valve, stop or fitting that is to be drilled through.

8. Open valve, stop or fitting being used.

9. Advance boring bar until drill or pilot drill contacts the pipe to be drilled.

10. Adjust feed tube and yoke (or feed nut and yoke) so that the yoke is engaged with the top of the friction collar on boring bar. Raise pivot arm of locking mechanism on side of yoke so that it is positioned under friction collar and lock in place with operating screw.

11. Retract boring bar a slight amount.

12. Measure and mark the travel required to complete the drilling operation. (Mark the point on the body that the feed tube will reach when drilling is completed.)

13. DRILL THE MAIN

Power Operated Method Using Mueller H-603 Electric Power Operator, H-604 Air Power Operator, or H-705 Hydraulic Power Operator

The E-5 and D-5 Drilling Machines have been designed to permit the addition of a power operator. The power operator will drive the tools and provide automatic feed during the drilling operation. The power operator consists of a gear case and motor using an electric, air, or hydraulic motor for the power source.

IMPORTANT: When using H-604 Air Motor Power Operator. Install an in-line lubricator as close to the unit as practical and adjust for slight oil mist from exhaust – maintain pressure of 90psig. We recommend the use of a gauge at the throttle to determine the actual pressure of air at the air motor.

The gear case attaches to the machine by the means of two sockets. The inner or small socket drives the boring bar. The outer or large socket drives the feed yoke through a gear reduction as the boring bar is rotated. The resulting feed on the drill is 0.10" per revolution of the boring bar.

The operator takes the torque of the motor resulting from the drilling operation, so the motors are equipped with a squeeze type trigger throttle. If for some reason a drill should stick, the motor can be shut off quickly.

a) Place the gear case and motor on the drilling machine aligning the sockets with the square shanks on the boring bar and feed yoke. Socket which contacts feed yoke should be closed and wing nut securely.

b) Set position of air or electric motor switch to give **clockwise** rotation of boring bar.

NOTE: Feed the yoke by hand when using 1½" and 2" drill bits.

Hand Operation

Drill the hole by operating the ratchet handle **clockwise** and turning the feed tube and yoke (or feed nut and yoke) **clockwise** a little at a time. Use a light, even feed and finish with a light, even feed. The special locking mechanism that locks the boring bar to the feed yoke prevents the drill from spiraling into the hole before the hole is completely drilled. To prevent over-feeding when drilling small holes and also when starting to drill larger holes, apply the feed by gripping the knurled section of the feed tube instead of feed handles.

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This will apply a light, even feed. Feed handles should be used to apply a heavier feed.

NOTE: When nearing the completion of the cut DO NOT over-feed or the cutting tools may be forced through before all the material is drilled or cut out.

The E-5 Machine is now furnished with a combination ratchet and crank handle. When drilling small holes the crank handle should be turned upward and rotated in continuous circles instead of ratcheting.

14. Continue drilling operation until pipe is drilled through completely. This can be determined by the feel of the feeding mechanism, the pull on the ratchet handle or by measuring the advance of the boring bar. If drilling is not completed, retract boring bar slightly and ratchet and feed slowly to remove the remaining metal a little at a time.

15. When drilling operation is completed turn operating screw on locking mechanism **counter-clockwise** to unlock pivot arm. Remove feed-yoke from friction collar and retract boring bar to its rearmost position. Be sure that the drill or pilot drill clears the valve gate or key of stop if a stop is being used.

NOTE: If the pressure in the main is 90psi or over, the locking mechanism on the feed yoke may be used to control the upward movement of the boring bar by leaving it attached until uppermost position is reached, then disconnect as described above.

⚠ **CAUTION: DO NOT reverse rotation of ratchet handle when retracting the boring bar.**

The pressure inside of the drilling machine will tend to raise the boring bar. Hold down on the boring bar or use the feed yoke to control the upward motion of the boring bar thereby preventing shock or damage to the drilling machine.

16. Close valve, stop or fitting being used.

17. Remove drilling machine and machine adapter nipple as a unit.

18. Advance boring bar and remove machine adapter nipple and drilling tools from machine.

19. After being used, clean dirt and foreign material from machine and equipment. Lubricate machine and give drilling tools a light coat of oil to protect them from rust. When not in use, the machine and equipment furnished with each machine should be stored in the box furnished with the machine. The machines should be dis-assembled periodically, and the boring bar and the machine body thoroughly cleaned both inside and out. By doing this, any dirt, grit, chips, or other foreign material that might have possibly accumulated on the boring bar or in the body of the machine may be detected and removed before any damage is done. An accumulation of foreign material on either the boring bar or inside of the body will restrict the reverse travel of the boring bar.

SPECIAL NOTE: In general, the machines should be lubricated as described in instruction No.1. However, due to extreme conditions in some areas (dust, sand, etc.) it may be advisable not to lubricate the feed sleeve or threaded parts of these machines since it would tend to increase the abrasive or wearing action. This procedure, of course, must be at the discretion of the operator.

<u>The following procedures are for the Mueller EH-5 and DH-5 Drilling Machines.</u>

MUELLER® DH-5 / EH-5 Drilling Machines

General Information

DH-5 DRILLING MACHINE

Capacity and Use

The DH-5 Drilling Machine is a hand or power operated machine used for drilling holes 1/8" to 2 1/8" inclusive, in any size or kind of pipe (Under certain conditions the maximum size may be increased to 3 3/4".)

For complete information on the uses of this machine and the tools and equipment required for its use see the latest Mueller Gas Catalog at muellergas.com.

Working Pressure and Temperature Rating

- 1200psig (8273 kPa) Maximum Working Pressure
- 100° F (38° C) Max. Temp. Rating

The working pressure or temperature rating is reduced accordingly if any attachment, valve, or fitting subjected to pressure or temperature during the drilling operation has a maximum working pressure or temperature rating different than that specified above.

Equipment Furnished

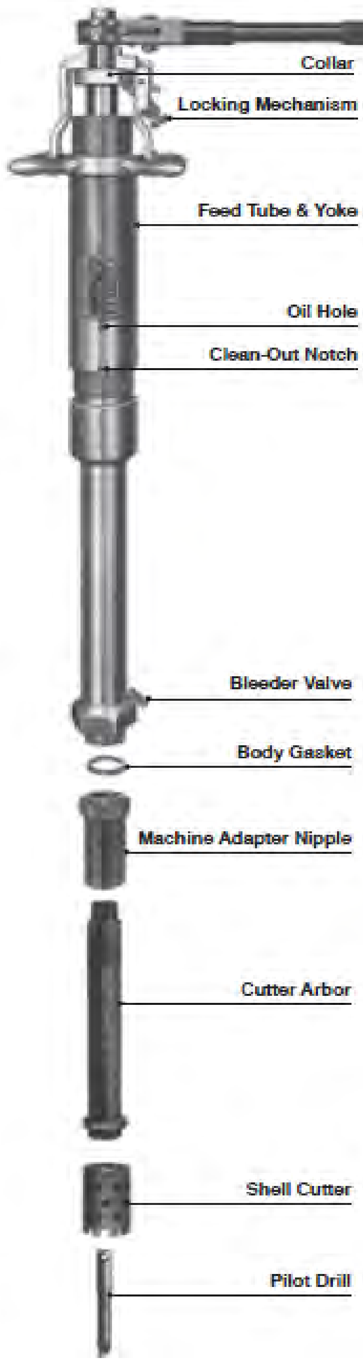
- Wooden Storage Chest
- Reversible Ratchet Handle
- Body Gasket
- Adjustable Wrench
- Double Open-end Wrench
- Cutting Grease
- Operating Instruction Manual

The machine adapter, cutter arbor, shell cutter and pilot drill shown at right are not included in the equipment furnished with this machine. These items must be ordered according to the size and type required.

Length of Travel

DH-5 Drilling Machine has 14" (356 mm) Boring Bar Travel.

NOTE: For Operating Instructions see pages 4 and 5. For DH-5 Drilling Machine Parts see page 6.



Machine Weight Chart

DESCRIPTION	DH-5
Machine & equipment shipped in wooden storage chest	107 lb (48.5 kg)
MACHINE ONLY	67 lb (30.4 kg)

(continued on next page)

EH-5 DRILLING MACHINE

Capacity and Use

The EH-5 Drilling Machine is a hand or power operated machine used for drilling holes 1/8" to 2 1/8" inclusive, in any size or kind of pipe (Under certain conditions the maximum size may be increased to 3 3/4".)

For complete information on the uses of these machines and the equipment and attachments required for their use see the latest Mueller Gas Catalog at muellergas.com.

Working Pressure and Temperature Rating

- 1200psig (8273 kPa) Maximum Working Pressure
- 100° F (38° C) Max. Temp. Rating

The working pressure or temperature rating is reduced accordingly if any attachment, valve, or fitting subjected to pressure or temperature during the drilling operation has a maximum working pressure or temperature rating different than that specified above.

Equipment Furnished

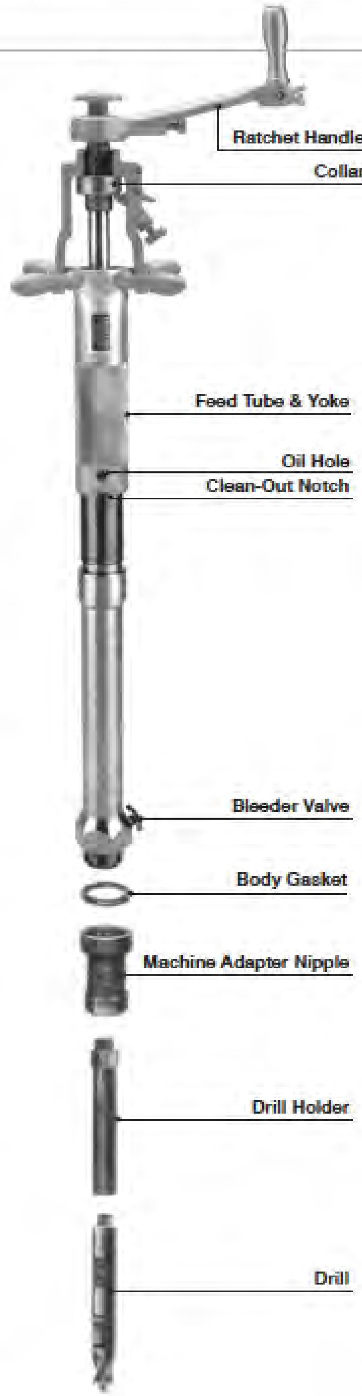
- Wooden Storage Chest
- Reversible Ratchet Handle
- Body Gasket
- Adjustable Wrench
- 2 – Double Open-end Wrench
  - – 9/16" x 11/16"
  - – 3/4" x 13/16"
- Cutting Grease
- Operating Instruction Manual

The machine adapter, drill holder and drill shown at right are not included in the equipment furnished with this machine. These items must be ordered according to the size and type required.

Length of Travel

EH-5 Drilling Machine has 12 1/8" (308 mm) Boring Bar Travel.

NOTE: For Operating Instructions see pages 4 and 5. For EH-5 Drilling Machine Parts see page 7.



Machine Weight Chart

DESCRIPTION	EH-5
Machine & equipment shipped in wooden storage chest	52 lb (23.5 kg)
MACHINE ONLY	24 lb (10.8 kg)

(continued on next page)

OPERATION

1. Oil all working parts, especially the collar on the boring bar. Keep oil treated surfaces and boring bar well lubricated and free from dirt and foreign material. (Invert the DH-5 or EH-5 Machine and lubricate it through both lower and top oil holes in addition to the points mentioned previously.)

DH-5 and EH-5 Machines are equipped with O-ring packing. Under normal conditions the only maintenance required for these O-rings is lubrication. If the O-rings should become excessively worn they should be replaced.

NOTE: Avoid using petroleum-based lubricants.

2. Advance boring bar until drilling tools may be attached.

3. Attach drilling tools to boring bar. If drilling tools to be used will not pass completely through the machine adapter to be used, attach the machine adapter before attaching the drilling tools (see instruction no. 5).

4. Apply a small amount of Mueller® cutting grease to the leading edges of the shell cutter and/or drill.

5. Attach proper size machine adapter to the body of the machine making sure that the body gasket or washer is in place and in good condition.

6. Retract boring bar to its rearmost position.

7. Attach drilling machine and machine adapter to the valve that is to be drilled through.

8. Open valve being used.

9. Advance boring until drill or pilot drill contacts the pipe to be drilled.

10. Retract boring bar a slight amount.

11. Adjust feed tube and yoke so that the yoke is engaged with the top of the friction collar on boring bar. Raise pivot arm of locking mechanism on side of yoke so that it is positioned under friction collar and lock in place with operating screw. Close bleeder located at bottom of the machine before drilling operation is begun.

12. Measure and mark the travel required to complete the drilling operation. (Mark the point on the body that the feed tube will reach when drilling is completed.)

13. DRILL MAIN – POWER OPERATED METHOD USING H-604 AIR OR H-704 HYDRAULIC POWERED OPERATOR.

The DH-5 and EH-5 Drilling Machines have been designed to permit the addition of a power operator. The power operator will drive the tools and provide automatic feed during the drilling operation.

IMPORTANT: When using H-604 air motor power operator, maintain pressure of 90psi. We recommend the use of a gage at the throttle to determine the actual pressure of air at the motor.

The gear case attaches to the machine by the means of two sockets. The inner or small socket drives the boring bar. The outer or large socket drives the feed yoke through a gear reduction as the boring bar is rotated. The resulting feed on the drill is .010" per revolution of the boring bar.

The operator takes the torque of the motor resulting from the drilling operation, so the motors are equipped with a squeeze-type trigger throttle. If for any reason a drill should stick, the motor can be shut off quickly.

a) Place the gear case and motor on the drilling machine aligning the sockets with the square shank on the boring bar and feed yoke. Socket which controls feed yoke should be closed and wing nut tightened securely.

b) Set position of air switch to give **clockwise** rotation of boring bar.

(continued on next page)

13A. DRILL MAIN – HAND OPERATED METHOD

Drill the hole by operating the ratchet handle **clockwise** and turning the feed tube and yoke **clockwise** a little at a time. Use a light, even feed at the start, then a heavier feed and finish with a light, even feed. Due to the balanced pressure design of these machines, the line pressure thrust load will not be transmitted to the boring bar. The special locking mechanism that locks the boring bar to the feed yoke prevents the drill from spiraling into the hole before the hole is completely drilled. To prevent over-feeding when drilling small holes and also when starting to drill larger holes, apply the feed by gripping the knurled section of the feed tube instead of the feed handles. This will apply a light, even feed. Feed handles should be used to apply a heavier feed.

NOTE: When nearing the completion of the cut, DO NOT over-feed or the cutting tools may be forced through before all the metal is drilled or cut out.

The EH-5 Machine is furnished with a combination ratchet and crank handle. When drilling small holes, the crank handle should be turned upward and rotated in continuous circles instead of ratcheting.

14. Continue drilling operation until pipe is drilled through completely. This can be determined by the feel of the feeding mechanism, the pull on the ratchet handle or by measuring the advance of the boring bar. If drilling is not completed, retract boring bar slightly and ratchet and feed slowly to remove the remaining metal a little at a time.

15. When drilling operation is completed, turn operating screw on locking mechanism **counter-clockwise** to unlock pivot arm. Remove feed yoke from friction collar and retract boring bar to its rearmost position. Be sure that the drill or pilot drill clears the valve gate.

⚠ CAUTION: DO NOT reverse rotation of ratchet handle when retracting the boring bar.

16. Close valve being used. Open bleeder valve located at bottom of machine to bleed gas from machine before adapter and machine are removed from valve.

17. Remove drilling machine and machine adapter as a unit.

18. Advance boring bar and remove machine adapter and drilling tools from machine.

19. After being used, clean dirt and foreign material from machine and equipment. Lubricate machine and give drilling tools a light coat of oil to protect them from rust. When not in use, the machine and equipment furnished with each machine should be stored in the box furnished. The machines should be disassembled periodically, and the boring bar and machine body thoroughly cleaned both inside and out. By doing this, any grit, chips, or other foreign material that might have possibly accumulated on the boring bar or in the body of the machine may be detected and removed before any damage is done. An accumulation of foreign material on either the boring bar or inside the body will restrict the reverse travel of the boring bar.

SPECIAL NOTE: In general, the machines should be lubricated as described in instruction No. 1. However, due to extreme conditions in some areas (dust, sand, etc.) it may be advisable not to lubricate the feed sleeve or threaded ports of these machines since it would tend to increase the abrasive or wearing action. This procedure, of course, must be at the discretion of the operator.

IAMU Procedure #7.2: Tapping a Steel Pipeline – Tap Diameter Greater Than 2"

NOTE: For the safety of the public and employees, all steps to prevent accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the bell-hole during all tapping and stopping procedures. All hot taps must be performed by qualified crews.

NOTE: The following procedures for tapping pipelines were obtained from the manufacturer. If equipment being used for tapping is different than what is provided, written procedures must be approved or obtained for the specific equipment being used.

The following procedures are for the Mueller C1-36 Drilling Machine.

MUELLER® C1-36 Drilling Machines

General Information

Capacity and Use

The C1-36 Drilling Machine can be hand or power operated to make cuts from 2" – 12" / DN50 – DN300 inclusive in any size of main.

This machine has a 6:1 feed ratio meaning 6 full turns of the feed crank equals 1" of travel.

The C1-36-99002 Drilling Machine can be hand or power operated to make cuts from 2" – 24" / DN50 – DN600 inclusive in any size of main.

This machine is a "slow feed" where 8 full turns of the feed crank equals 1" of travel.

For complete information on the uses of these machines and the equipment and attachments required for their use, see the latest Mueller Catalogs at muellergas.com or muellercompany.com.

Length of Travel

C1-36 and C1-36-99002 Machines have 36" (915 mm) of travel.

Machine Weight/Length Chart

DESCRIPTION	C1-36
Machine & equipment shipped in strong wooden chest	424 lb (221 kg)
Machine Weight ONLY	270 lb (122 kg)
Machine Length	51½" (1308 mm)

(continued on next page)

Maintenance of Machines and Equipment

OILING (Model 4, 5 & 6) for model 3 or earlier call Mueller Customer Service.

Keep the drive box and rear gear case of torque tube half full of a good grade oil with a Saybolt Universal Viscosity of 200 Sec., at 210°F. Change oil periodically. Drain old oil and replace with 4 pints in drive box and 1.6 pints in rear gear case of torque tube. Mueller Part No. 89347 gear oil is used and needs no thinning in cold weather.

Packing

Boring Bar Packing is the self-adjusting type. If packing leaks. Replace it as follows:

1. Remove hub retaining bolt (Part No. 311866) and nut (Part No. 058849) from boring bar.

2. Remove 4 cap screws (Part No. 055098) from the gland (Part No. 581974).

3. Insert cap screws into the alternative tapped holes in gland and screw them in all the way. This should be done evenly, tightening each cap screw a little at a time. This will cause the gland to move forward evenly out of the gland recess until the gland seal O-ring (Part No. 52162) is exposed.

4. Rotate crank handle (Part No. 88150) **counter-clockwise** and advance boring bar 6 or 8 inches. This will cause the gland to move forward into an exposed position.

5. Remove gland from boring bar.

6. Place gland in a vise or clamp so that packing will not "spring" out of gland when the two retaining pins (Part No. 47092) are removed.

7. Remove retaining pins.

8. Model 3 and prior: Remove concave follower, four packing rings, convex follower, and spring from the gland.

9. Remove any burrs from the boring bar drive lugs. Lubricate the boring bar and inside of the new packing rings with a light film of oil or cutting grease.

10. Remove cap screws from alternate tapped holes in gland.

11. Replace boring bar wiper ring (Part No. 501158) and gland seal O-ring (Part No. 52162) if necessary. Place gland on boring bar being careful not to damage packing ring or the wiper ring.

12. Slide gland into flange recess. Insert and tighten cap screws evenly and securely.

13. Replace hub retaining bolt and nut.

Cutters

SHARPEN CUTTERS AND PILOT DRILLS BY TOUCHING THEM UP WITH AN OILSTONE BEFORE EACH CUT. If the cutters and/or pilot drills dull, return to Mueller Co. Contact Customer Service to arrange reconditioning.

⚠ CAUTION: Keeping cutters and pilot drills sharp assures maximum efficiency in cutting operations. When cutters are dull they not only make cutting more difficult, but place an additional strain on the teeth which can cause tooth breakage. When not in use, keep cutters in the machine chest or other wooden container. *(NOTE: Be careful not to drop cutter and damage cutter teeth.)* If necessary to rest cutter on teeth, place upon wood rather than brick, concrete, or metal.

After Use

Clean dirt, etc., from machine and equipment. Give cutters, drills, and equipment a light coat of oil to protect them from rust.

Storage

When not in use, the machine and equipment furnished with each machine should be stored in the chest furnished with the machine.

NOTE: If the machine is stored or transported in the vertical position. It is recommended that before use it be placed in a horizontal position for a short period of time (1/2 hour), to allow grease to drain back into the rear grease case.

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1. INSPECT CUTTER AND PILOT DRILL TO MAKE SURE THAT THEY ARE SHARP. IF CUTTER IS DULL IT SHOULD BE SHARPENED AS DESCRIBED IN MAINTENANCE INSTRUCTIONS.

2. Bolt proper size adapter to front of machine, being sure machine-to-adapter gasket is in good condition and in place. (All gaskets should be replaced periodically.)

NOTE: Make certain machined recess on adapter and lip on adapter flange and machine flange are flush.

3. Release automatic feed by pulling out automatic feed knob or disengaging with Auto Feed Lever. (Directions are indicated on panel on rear of torque tube.)

4. Advance boring bar by rotating feed crank **counter-clockwise** until hub retaining bolt in boring bar is exposed beyond face of adapter. (Directions are indicated on panel on rear cover of torque tube.) Remove hub retaining bolt.

5. Attach proper drilling equipment to boring bar. Check detent type pilot drills before each operation to make sure the detents will move completely to the submerged position.

a) **1½"– 2" / DN40 – DN50.** Remove the retaining screws from the shank of the drill. Insert the shank into the socket in the boring bar. Align the hole in the end of the boring bar with the tapped hole in the shank of the drill and replace the retaining screws. See instructions under "**CAUTION**" on page 5.

b) **2½"– 3" / DN65 – DN80.** Assemble both the pilot drill and the shell cutter to the cutter arbor. Remove retaining screw from the shank of the arbor. Insert the shank of the arbor into the socket in the boring bar. Align the bolt hole in the end of the boring bar with the tapped hole in the shank of the arbor and replace the retaining screw.

c) **Sizes larger than 3" / DN80.** Assemble shell cutter and cutter hub. Insert the end of the pilot drill into the socket in the boring bar. Slide cutter hub and shell cutter over the end of the boring bar. Align the holes in the cutter hub, boring bar and pilot drill and attach to boring bar with hub retaining bolt and nut.

Apply a small amount of Mueller cutting grease to the lead cutting edges of the shell cutter and pilot drill. DO NOT use cutting grease when cutting AC or concrete pipe.

6. The term "valve", as used in these instructions, refers to whatever type of valving means that is being used between the machine and the main. This might be a tapping valve, standard gate valve or line stopper fitting gate valve. If valve is being used, open completely and measure, or check, the exact size of opening and size of cutter to make sure the entire opening is clear and unobstructed and the cutter will pass freely.

7. Retract boring bar to its rearmost position by rotating feed crank **clockwise**.

8. Place the machine (with adapter and drilling equipment assembled) in drilling position. For horizontal use, support the assembly by blocking up under the machine and valve.

NOTE: Make certain machined recess on adapter and lip on adapter flange and machine flange are flush.

a) Place machine and adapter against valve, allowing cutter to extend into the end of the valve. Cutter must not interfere with operation of the valve. (When machine is used horizontally, the driving spindle should be at a right angle to the main.) Bolt adapter to outlet flange of the valve, making certain that the adapter gasket is in place.

9. Close valve and test between tap sleeve / line stopper ftting and valve for pressure tightness.

10. Set feed indicator to zero. Mark the point on feed indicator that the arrow will reach when cut will be completed. (See pages 7 – 10 for travel chart.)

For Gas applications, see page 10 for calculating the number of turns to contact main.

11. Rotate feed crank **counter-clockwise** to advance boring bar until pilot drill contacts the main. One turn of the feed crank moves the boring bar 1/6" (4 mm) – 6 revolutions equal 1" (25 mm). For C1-36-99002 machine, 8 revolutions equal 1" (25 mm). Back up boring bar 1/4 turn of feed crank **clockwise** to release tension between pilot drill and main.

12. Engage automatic feed by pushing in on automatic feed mechanism.

13. Rotate feed crank **clockwise** until dive key engages. This can be felt when feed crank ceases to freely rotate.

a) **When using the C1-36 Machine and Mueller Air or Hydraulic Motors:**

Refer to Form 12237 for H-614 Air motor, Form 12480 for Hydraulic motor.

If cutting becomes difficult and stalling occurs, follow one of the methods listed in instruction 20.

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14. Continue the cutting operation until the cutter stops cutting or until feed indicator reads the amount shown in the travel chart. (See pages 7–10 for travel chart).

For Gas applications, see page 10 for calculating the number of turns to contact main.

15. Check completion of cut by releasing automatic feed and attempting to advance cutter by rotating feed crank. If it does not advance easily, the cut is not completed and automatic feed knob must be pushed in to engage automatic feed for further cutting.

⚠ CAUTION: **Stop advancing the boring bar when the limit line becomes visible through the drive box drain hole.** See **illustration at bottom of page 5.**

Watch the travel carefully when making a 1½" / DN40 or 2" / DN50 cut. Make sure the front end of the boring bar, which is larger in diameter than the drill, does not hit the valve seat.

16. When cut is completed, release automatic feed and withdraw cutter to its rearmost position by rotating feed crank clockwise.

17. Close valve securely.

18. Unbolt adapter from valve and remove adapter and drilling machine from valve as a unit.

19. Advance boring bar by rotating feed crank counter-clockwise and remove hub retaining bolt, (retaining screw from cutter arbor or retaining screws from shank of solid drill.) Remove cut-out section of pipe, shell cutter, cutter hub or cutter arbor and pilot drill as a unit.

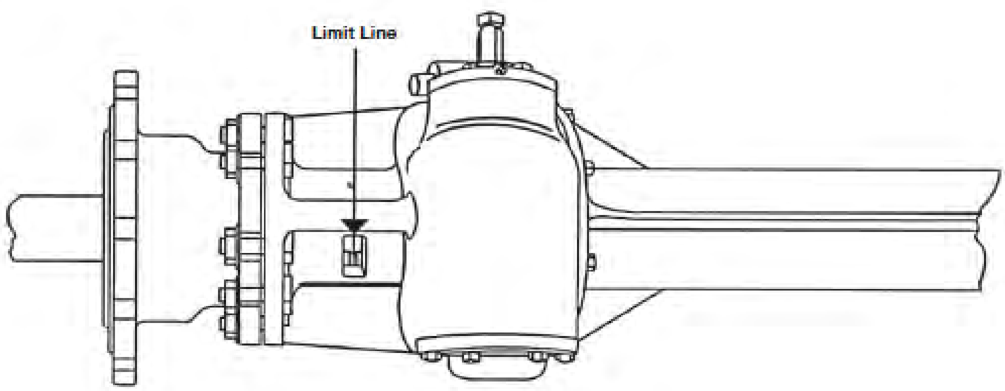
20. If cutting operation becomes difficult, follow one of these methods:

a) If cutter has difficulty in cutting, becomes dull or should stall after the cut is started, withdraw the cutter, close valve, remove machine and sharpen or replace cutter. Reassemble and proceed in the regular manner.

b) If cut is further along, release automatic feed and feed machine by hand by holding back on the feed crank at the rear of the machine a little each half revolution.

NOTE: Automatic feed should be used whenever possible. Automatic feed also provides the correct tool feed.

IMPORTANT: Stop advancing the boring bar if the limit line becomes visible through drive box drain hole. It will result in extensive damage to the machine. This applies to C1-36 machines manufactured prior to September 1, 1995. C1-36 machines manufactured after September 1, 1995, or rebuilt after this date and that have "OT" or Model 6 stamped on the name plate have an overtravel protection feature which is designed to prevent damage should the boring bar be inadvertently advanced too far. Machines should never be allowed to overtravel. Feature does not prevent damage to the feed screw that could occur as a result of using dull drills or cutters.



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Overtravel Feature

Re-engaging Overtravel Feature

To re-engage the boring bar after it has overtraveled while making a cut on a pipe that is under pressure:

1. Turn off the drive unit

2. Disengage the automatic feed by pulling out on the automatic feed knob.

3. Rotate the feed crank in the **clockwise** direction until the pickup of the feed nut is felt.

4. Continue to turn the feed crank in the **clockwise** direction for 18 full revolutions. This will ensure full re-engagement between the feed screw and feed nut.

5. Resume normal operation.

To re-engage the boring bar after it has overtraveled while making a cut on a pipe that is not under pressure, or if the feed screw will not engage the feed nut when the feed crank is turned in the **clockwise** direction:

1. Turn off the drive unit.

2. Disengage the automatic feed by pulling out on the automatic feed knob.

3. Remove the cotter pin from the feed screw nut which is located in the center of the crank hub at the rear of the machine

4. Back off the feed screw nut 3 revolutions only. DO NOT remove the feed screw nut.

5. Rotate the feed crank in the **clockwise** direction until you feel the screw re-engage the feed nut.

6. If the feed screw does not re-engage the feed nut: GENTLY tap on the feed screw nut with a soft mallet and repeat Step (5) above and this Step (6) until it does.

7. Continue to turn the feed crank in the **clockwise** direction for 18 full revolutions. This will ensure full re-engagement between the feed screw and feed nut. Retighten the feed screw nut and replace the cotter pin.

8. Resume normal operations.

IAMU Procedure #7.3: Tapping a Pipeline with a Built-in Cutter

NOTE: For the safety of the public and employees, all steps to prevent accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the bell-hole during all tapping and stopping procedures. All hot taps must be performed by qualified crews.

Mueller Weld-on Auto-Perf Gas Service Tee Installation Procedures:

1) Remove the completion cap and perforator from the tee body. Set these parts aside, taking special care to keep the perforator clean and dry.
2) Remove a sufficient amount of coating on the main where the tee is to be installed taking care not to damage the pipe and properly prepare the surface of the main for welding.
3) The tee should then be welded to the top of the main. The tee must be welded squarely to the main for the perforator to work properly.
4) Attach the service line pipe to the tee body and extend the service line pipe to the meter valve.
5) Pressure-test the service tee and service line according to procedures found in Part 5 of this Plan.
6) Re-insert the perforator into the tee body until the top of the perforator is ¼" below the top of the tee opening. DO NOT APPLY LUBRICANT TO THE PERFORATOR, THE TIP, OR THE TEE BODY.
7) Crimp the top of the tee.
   a) H-18097 Compact Crimping Tool: Fully retract anvil face by turning hex nut counter-clockwise. Apply a light coat of cutting grease or oil to the internal threads of the tool and the anvil face. Thread the tool onto the tee body hand tight. Turn the hex nut clockwise until contact is made with the top of the tee body. Using a suitable smooth jawed wrench, turn the hex nut ¾" to one full turn clockwise to crimp the top of the tee. Turn the hex nut counter-clockwise and remove the tool.
8) Using the Mueller H-18090 NO-BLO Operating Wrench, or similar ratchet drive wrench, to rotate the perforator and pierce the main by rotating the ratchet handle clockwise in 1/4-turn increments. Once the perforator contacts the main, continue turning in this manner until the perforation is complete and the perforator seats tightly in the main. DO NOT stop the operation or attempt to back out the perforator before piercing the pipe. In the event of a failed perforation, DO NOT attempt to use second perforator in the same body.
9) With the perforation complete, rotate the ratchet handle counter-clockwise until the perforator firmly contacts the crimped top of the tee, forming a metal-to-metal seal and remove the tool.
10) Purge the pipeline according to IAMU Procedure #7.5 – Purge Flammable or Inert Gas.
11) Install the completion cap using a good grade of pipe thread sealant and tighten firmly.
12) After installation is complete, clean, prime and wrap any bare metal surfaces with an approved pipeline primer &/or coating.

Continental Steel Mechanical Bolt-on Saddle Tee Installation Procedures:

** Manufacturers recommended procedures are as follows:

1) DO NOT install tee on a steel pipeline with a wall thickness greater than 0.280".
2) Inspect bolt(s)-on saddle tee for damage to the fitting and its components.
3) Select location on main pipe suitable for installation of tee, remove pipeline coatings from the main and clean pipe to bare metal.
4) Inspect the area where the bolt-on saddle is to be installed and ensure that the elastomer seal is not installed over pits or gouges where the ability to seal might be compromised.
5) Remove the saddle bolt(s) and inspect the elastomer seal for damage or dis-bonding from the upper saddle.
6) Ensure that the saddle punch is fully retracted within the tee.
7) Place saddle on the prepared site on the main.
8) Replace saddle bolt(s) and tighten using a torque wrench to 25 to 40-foot pounds being careful not to move/roll the saddle while tightening as the elastomer seal can be damaged.
9) If a torque wrench is not available, the required torque can be achieved using either a 12" ratchet or a 12" smooth faced wrench.
10) Remove completion cap and coupon retaining punch.
11) Attach the service line pipe to the tee body and extend the service line pipe to the meter valve.
12) Pressure-test the service tee and service line according to procedures found in Part 5 of this Plan.
13) Before re-inserting coupon retaining punch, it is recommended that a liberal amount of lubricant be applied to the internal threads of the service tee to greatly increase the tapping efficiency of the punch.
14) Insert punch in service tee and turn clockwise by hand to avoid cross threading.
15) Using a ratchet wrench with Continental drive key and bushing, rotate the punch clockwise until the punch seats on the main. DO NOT stop before the punch fully seats on the main as the coupon may not be retained.
16) To allow gas to the service line, rotate the punch counter-clockwise until the punch is flush with the top of the tee.
17) Purge the pipeline according to IAMU Procedure #7.5 – Purge Flammable or Inert Gas.
18) Apply thread sealant and install cap leak tight.
19) After installation is complete, clean, prime and wrap any bare metal surfaces with an approved pipeline primer &/or coating.

<u>Perfection Perma-lock Tee Installation Procedures:</u>

** Manufacturers recommended procedures are as follows:

1) Remove tee assembly and depth tube from the bag and check the tee for tower and saddle O-rings.
   a) A blue colored depth tube is required for 1 ¼” IPS main installation, and a white colored depth tube is required for 2-4” IPS main installation. If you do not have the proper color depth tube, DO NOT install the fitting.
2) Clean surface of the PE main where the tee is be installed. Avoid areas that are gouged or damaged as a proper seal may not be obtained. Lubricate the saddle O-ring and main pipe surface with leak soap solution or silicone grease.
3) Bolt tee onto PE main and tighten until the corners touch using a crossover tightening pattern. A gap between the flanges in the locating pin area is acceptable. DO NOT over tighten!!
4) Attach the service line pipe to the tee body and extend the service line pipe to the meter valve.
5) Pressure test the service tee and service line according to procedures found in Part 5 of this Plan.
6) Place depth tube on top of the cutter assembly. Thread cutter assembly downward (clockwise) using a 5/16” hex wrench. Continue threading the cutter assembly downward until it becomes snug. The depth tube is a visual guide and will be approximately flush with the top of the tee tower when the cutter is snug.
7) Thread cutter upward (counter-clockwise) until top of cutter is flush is with the top of the tower. This will now allow gas to flow into the service line.
8) Purge the pipeline according to IAMU Procedure #7.5 – Purge Flammable or Inert Gas.
9) Remove and discard the depth tube.
10) Install tower cap and hand tighten to cap top. DO NOT over tighten!

Central Plastics (GF) Tapping Procedure (after electrofusion process is complete)

** Manufacturers recommended procedures are as follows:

1) Electrofusion tapping tees can be tapped after sufficient cooling time has elapsed on pressurized pipe. The tapping tee contains a cutter (punch) that can be threaded downward by removing the cap and using the appropriate tapping tool until it pierces the main pipe. The tapping tool has stop indicators that provide a maximum cutter depth. The cutter retains the pipe coupon and is then retracted to its final service position at the top of the tapping tee chimney. DO NOT REMOVE the cutter from the tapping tee. For a service tee (1" IPS or smaller outlet) the cutter should be positioned flush with the top of the fitting chimney. For a high-volume tapping tee (1 ¼" or 2" IPS outlet), the cutter should be positioned in contact with the upper O-ring seal as described below. Replace the cap HAND TIGHT ONLY.
   a) Cap O-rings are only lightly coated with a dry film lubricant during manufacture to prevent possible contamination of the fusion surface. Additional lubrication of the cap O-rings after the fusion process is an acceptable practice and can be beneficial in achieving the initial seal. Parker O-Lube or Parker Super-O-Lube or their equivalent is recommended.
   b) DO NOT tighten threaded caps with a wrench. Wrenches can cause overtightening and long-term failure of the plastic threads. HAND TIGHT ONLY!
   c) DO NOT exceed the maximum cutter depth of the tapping tool stop. The cutter can bottom out and strip fitting threads.
   d) DO NOT use power tools to tap. Excessive heat from friction can melt or strip fitting threads.
   e) DANGER!! DO NOT remove the self-tapping cutter from the fitting. Personal injury or pipeline release can occur if the cutter is removed with the pipeline is pressurized.
   f) Follow all safety rules and protocols for grounding and static discharge when working in a flammable gaseous environment.

IAMU Procedure #7.4: Stopper (Stopple) Pipe

NOTE: For the safety of the public and employees, all steps to prevent accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the bell-hole during all tapping and stopping procedures. All stopping must be performed by qualified crews.

MUELLER® DH-5 Drilling Machines

Instructions for Installing and Stopping-Off $1\frac{1}{2}$" and 2" Line Stopper Fittings

Installation Instructions

H-17126

A–Attach Line Stopper Fitting

1. Thoroughly clean the pipe where the fitting is to be attached.
2. Remove completion cap and completion plug from the fitting and replace with test cap.
3. Place the two halves of the fitting around the pipe. Check to be sure they are in proper alignment.
4. Tack weld the four corners together with enough space between the two halves so that they can be rotated.
5. Weld both halves of fitting together but free of pipe. The fitting can be rotated so that the side welding is done horizontally on top of the pipe.
6. Locate the fitting in the desired location and weld each end permanently to the pipe.
7. Apply air pressure through the test cap and test for leaks using soapsuds or a leak detection fluid. (**Fig. A**)
8. Remove test cap.

A.

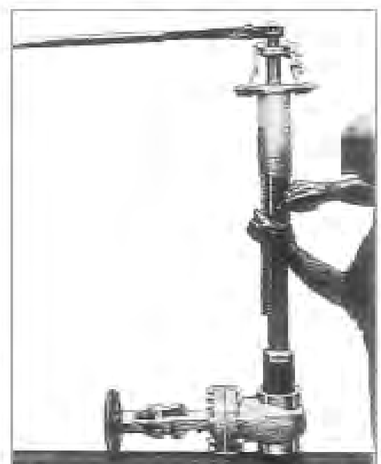
B–Drilling Operations

1. Attach Mueller® control valve to the fitting. Check to be sure control valve is fully open. Attach reducing bushing if required before attaching control valve.
2. Advance boring bar of drilling machine to permit attachment of drilling tools.
3. Attach proper machine adapter nipple to drilling machine making sure gasket is in condition and in place.
4. Attach boring bar extension to the boring bar. Attach proper shell cutter and pilot drill to cutter arbor, then attach to boring bar extension (**Fig. B**). Coat shell cutter and pilot drill with Mueller cutting grease.

B.

5. Retract boring bar to rearmost position and attach Drilling machine and machine adapter nipple to the control valve
6. Advance boring bar until the pilot drill contacts the pipe. Back the pilot drill off the pipe a small amount. Adjust feed tube and yoke so that the yoke is engaged with the top of the friction collar on boring bar. Raise pivot arm of locking mechanism on side of yoke so that it is positioned under friction collar and lock in place with operating screw.
7. Measure and mark the travel required to complete the cut. (Mark the point on the body of the drilling machine that the feed tube will reach when drilling is completed – **Fig. C**). Necessary travel to complete the cut from point of pilot drill contact on $1\frac{1}{2}$" steel pipe is $3\frac{3}{8}$" – For 2" steel pipe – $3\frac{27}{32}$". These dimensions include $\frac{1}{4}$" overtravel.
8. Check to be sure bleeder valve at bottom of drilling machine is closed and begin drilling operation.

When hand operating the drilling machine, using **clockwise** rotation, begin with a light even feed, then a heavier feed and finish the cut with a light even feed (**Fig. D**). When power operating the drilling machine, attach H-604/H-704 power operator.



C.

D.

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NOTE: We recommend the use of a gauge at the throttle of power operator to maintain pressure at 90psi at the air motor. For detailed drilling instructions see operating instructions for DH-5 Drilling Machine, Form 9675.

9. When pipe is completely cut through, turn operating screw on locking mechanism **counter-clockwise** to unlock pivot arm. Remove feed yoke from friction collar and retract boring bar to rearmost position. DO NOT reverse rotation of ratchet handle when retracting boring bar.

10. Close the control valve. Open bleeder valve at bottom of drilling machine to relieve pressure in the machine, then close.

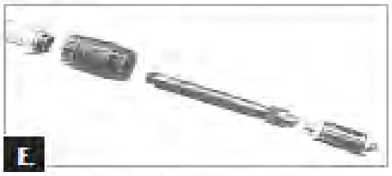
11. Remove drilling machine and machine adapter nipple as a unit.

12. Advance the boring bar and remove drilling tools, boring bar extension and machine adapter nipple.

C–Stopping-Off Operation

1. Attach proper machine adapter to the drilling machine.

2. Advance boring bar and attach stopper inserting tool, and rubber stopper (bypass or solid) to the boring bar (**Fig. E**). Lubricate stopper with Mueller rubber stopper lubricant.



E

3. When using by-pass rubber stopper, mark the collar on the drilling machine so that it is in line with the by-pass on the rubber stopper.

4. Retract boring bar to rearmost position and attach the drilling machine and machine adapter to the control valve.

5. When using two drilling machines, fitting and equipment to stop-off and isolate a section of pipe and using an integral by-pass line – follow these instructions:

a) Assemble a by-pass line between the by-pass connections on the machine adapters.

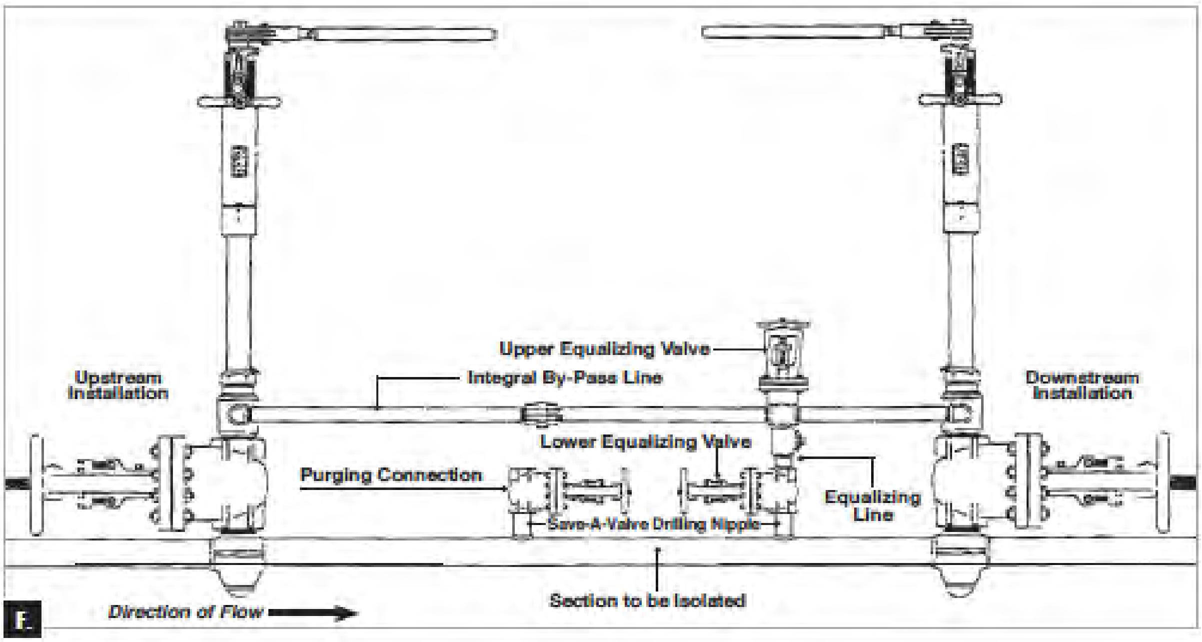
b) Install a Save-A-Valve drilling nipple on the section of pipe to be isolated near the upstream installation to be used a purging connection.

c) Install a second Save-A-Valve drilling nipple on the section of pipe to be isolation near the downstream installation to be used to connect an equalizing line between the isolated section of pipe and the by-pass line (**Fig. F**).

d) To place by-pass line in operation, remove the plug from tee in equalizing line and open upstream control valve slightly.

e) Open upper valve in equalizing line until all air is purged from the by-pass line, then close the valve. Pressure will build up in the by-pass line is now in operation.

f) Open both upstream and down stream control valves fully. By-pass line is now in operation.



F

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6. Insert the stopper into the fitting by advancing the boring bar of drilling machine until the rubber stopper contacts bottom of the fitting.

7. Turn the boring bar so that the mark on the collar is facing away from the isolated section of pipe, this positions the by-pass on the rubber stopper in the proper direction. (Engage feed tube and yoke over the friction collar on the boring bar.)

⚠ **CAUTION: DO NOT rotate ratchet during stopper expansion or contraction.**

8. To expand the stopper, turn feed tube and yoke **clockwise** a little at a time with a short pause after each turn. Continue to expand the stopper until the line is stopped off. Stopper tightness will be indicated by opening the control valve on the purging connection to blow down the isolated section when both stoppers have expanded.

⚠ **CAUTION: Unnecessary damage may be done to the stopper by too much compression. We recommend not compressing the 1½ " and 2" stoppers more than 1". The amount the stoppers are compressed may be easily determined by measuring the downward travel of the boring bar.**

9. Proceed with the work to be done on the isolated section of pipe.

NOTE: When cutting or welding near line stopper fittings containing rubber stoppers, it is recommended that the minimum distance between the face of the stopper and the welding or cutting operation be as follows:

Size of Fitting	Minimum Distance
1½"	7"
2"	8"

Where it is not possible to maintain the minimum distance, other cooling means such as wet burlap or rags should be placed around the fitting to keep the temperature down.

10. When desired work is completed, replace plug in tee of equalizing line and open both control valves in equalizing line.

11. Open control valve on purging connection until all air is purged from isolated section of pipe then close catalog valve. Pressure will build up in the isolated section equalizing pressure necessary to contract rubber stoppers.

12. Contract the stoppers by rotating feed tube and yoke **counter-clockwise** a little at a time with a short pause after each turn.

13. Close both control valves in the equalizing line.

14. Remove feed tube and yoke from collar on boring bar and slowly retract to rearmost position.

⚠ **CAUTION: DO NOT rotate ratchet handle.**

15. Close upstream and downstream control valves.

16. Remove plug from tee in equalizing line and open upper equalizing valve to blow down the by-pass line. When not using a by-pass line, open bleeder valve on drilling machine to relieve pressure.

17. Remove by-pass line, equalizing line and drilling machines and machine adapters.

D–Plug Inserting Operation

1. Remove machine adapter, stopper inserting tool and rubber stopper from drilling machine.

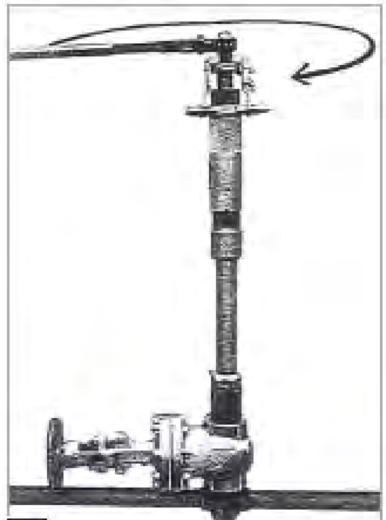
2. Attach proper machine adapter to the drilling machine, and attach boring bar extension to the boring bar. Attach the plug inserting tool to completion plug then to the boring bar extension (**Fig. G**). Apply a heavy lubricant to completion plug threads.

G.

3. Retract boring bar to rearmost position and attach drilling machine and machine adapter to the control valve. Check to be sure bleeder valve on drilling machine is closed.

4. Open control valve and lower completion plug into fitting.

5. Rotate ratchet handle **clockwise** until the plug is securely threaded into fitting (**Fig. H**).



H.

6. Open bleeder valve to relieve pressure in the drilling machine, also check tightness of completion plug in fitting.

7. Turn ratchet handle to **counter-clockwise** and strike handle a sharp blow **counter-clockwise** to release the inserting tool. Continue **counter-clockwise** rotation of the ratchet handle to remove the inserting tool from the completion plug.

8. Retract boring bar to rearmost position and remove drilling machine and machine adapter as a unit. Remove the control valve. Tighten completion plug with completion plug wrench.

9. Apply on-hardening pipe sealant to the fitting threads attach the completion cap – tighten securely.

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MUELLER® DH-5 Drilling Machines

Instructions for Installing and Stopping-Off 1½" and 2" Bottom-Out Line Stopper Fittings

10. Test the entire fitting with soapsuds or a leak detection fluid.

11. Insert plug and attach completion caps to Save-A-Valve drilling nipples. *(See Mueller Gas Distribution Products Catalog or attachments and equipment needed to perform this operation.)*

E–Plug Extracting Operation

1. The completion plug can be removed to re-use the fitting at a future date if necessary using the extracting tool and proper equipment.

2. Remove the completion cap from the fitting, and loosen completion plug slightly using the completion plug wrench.

3. Attach extracting tool adapter to the extracting tool, then attach to the completion plug.

4. Open control valve fully and attach to the fitting. Attach reducing bushing if required before attaching control valve.

5. Attach machine adapter to the drilling machine and retract the boring bar to rearmost position.

6. Attach the drilling machine and machine adapter to the control valve. Check to be sure the bleeder valve is closed on the drilling machine.

7. Lower the boring bar and rotate **counter-clockwise** to attach to threads on extracting tool adapter.

8. Continue **counter-clockwise** rotation of boring bar to remove the completion plug from the fitting

9. Retract boring bar to rearmost position, close control valve and relieve pressure in machine through the bleeder valve.

Remove the drilling machine and machine adapter as a unit.

Proceed with use of the fitting as described in steps under **C–Stopping-Off Operation** and **D–Plug Inserting Operation.**

Installation Instructions for H-17160 and H-17161 Line Stopper Fittings

H-17160

A–Attach Line Stopper Fitting

1. Thoroughly clean the pipe where the fitting is to be installed.

2. Remove completion cap and plug from fitting and replace with test cap.

3. Weld the fittings to the pipe.

4. Weld new piping to the bottom openings of fittings (**Fig. I** – page 7).

5. Test for leaks by applying air pressure and using soapsuds or a leak detection fluid. (Add glycerin to soap suds in freezing weather.) Remove test caps.

6. Weld Save-A-Valve drilling nipple to section of pipe to be isolated and test for leaks.

B–Drilling Operation

1. Follow same instructions as under **B–Drilling Operation**, Page 3.

NOTE: Drill out the pipe through the upstream fitting first. When the pilot drill first penetrates the bottom of the pipe, the bottom-out line is pressurized. Purge the air from the bottom-out line by opening downstream control valve and continue drilling operation.

2. Using proper equipment and attachments for Save-A-Valve drilling nipple – drill out the pipe through the nipple. *(See Mueller Gas Distribution Products Catalog for tool kits which contain attachments needed to perform this operation.)* This will be used to blow down the isolated section of pipe.

C–Stopping-Off Operation

1. Follow instructions 1 – 8 under **C–Stopping-Off Operation**, Page 4.

NOTE: Omit instruction number 5 as it pertains to a by-pass line. When using H-17160 and H-17161 bottom out fittings, the new piping welded to the bottom openings of the fittings serves as a by-pass line.

2. Cut out old section of pipe that has been isolated and weld caps to pipe stubs (**Fig. I** – page 7).

NOTE: When cutting or welding near line stopper fittings containing rubber stoppers, it is recommended that the minimum distance between the face of the stopper and the welding or cutting operation be as follows:

Size of Fitting	Minimum Distance
1½"	7"
2"	8"

Where it is not possible to maintain the minimum distance, other cooling means such as wet burlap or rags should be placed around the fitting to keep the temperature down.

3. When desired work is completed, rotate feed tube and yoke **counter-clockwise** a little at a time with a short pause after each turn, to contract the stoppers.

4. Remove feed tube and yoke from collar on boring bar and slowly retract to rearmost position.

⚠ **CAUTION: DO NOT rotate ratchet handle.**

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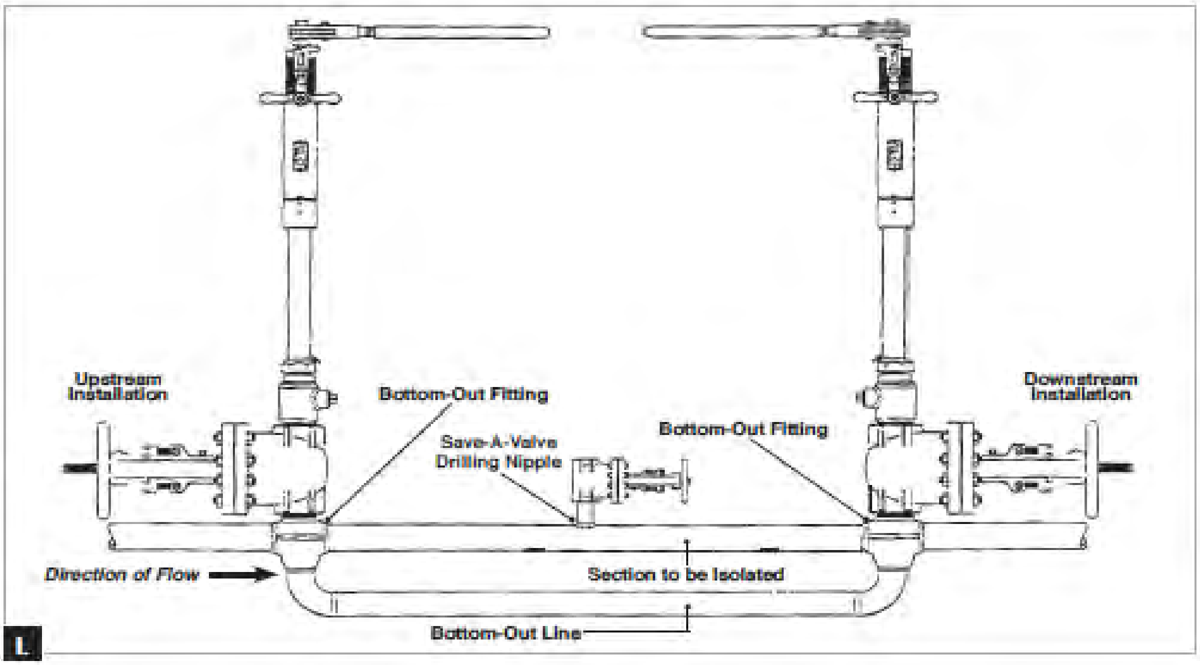
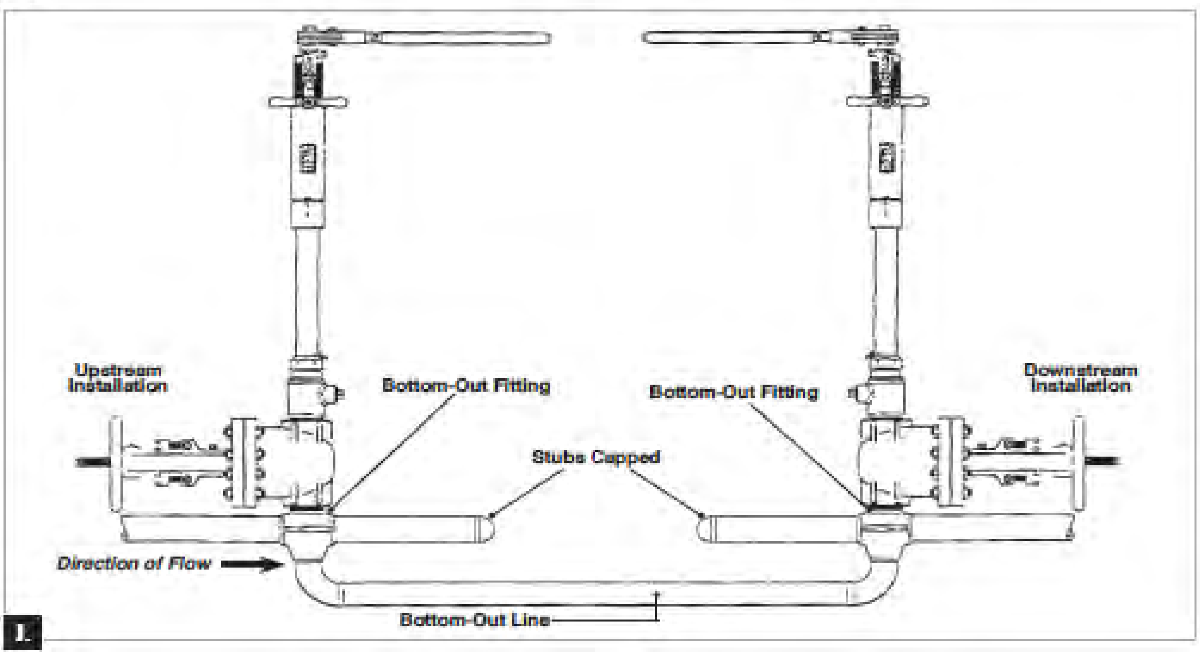
5. Close upstream and downstream installation control valves.

6. Remove drilling machines and machine adapters as a unit.

D—Plug Inserting Operation

1. Follow same instructions as under **D–Plug Inserting Operation** on Page 5.





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MUELLER® DH-5 Drilling Machines

Instructions for Stopping-Off 1½" and 2" Extension Stopper Fittings for Dead-End Extension

Stopping-Off Instructions for H-17140, H-17141, H-17150 and H-17151 Extension Stopper Fittings

H-17150 H-17151

A–Extract Completion Plug

1. To extract the completion plug from these extension stopper fittings, follow the instructions as under **E–Plug Extracting Operation**, Page 6.

B–Stopping-Off Operation

1. Attach by-pass machine adapter to the drilling machine.

2. Advance the boring bar and attach stopper inserting tool, and by-pass rubber stopper to the boring bar of the drilling machine (**Fig. E**). Lubricate stopper with Mueller rubber stopper lubricant.

3. Mark the collar on the drilling machine so that it is in line with the by-pass on the rubber stopper.

4. Retract boring bar to rearmost position and attach the drilling machine and machine adapter to the control valve.

5. Attach a stop in the by-pass opening of the machine adapter and close.

6. Open the control valve.

7. Insert the stopper into the fitting by advancing the boring bar of the drilling machine until the rubber stopper contacts the bottom of the fitting.

8. Turn the boring bar so that the mark on the collar is facing away from the outlet end of the fitting, this positions the by-pass on the rubber stopper in the proper direction.

9. Engage feed tube and yoke over the top of the friction collar on the boring bar.

10. Expand the stopper by turning the feed tube and yoke **clockwise** a little at a time with a short pause after each turn.

⚠ **CAUTION: DO NOT rotate ratchet handle during stopper expansion or contraction.**

11. Continue to expand the stopper until the fitting is stopped-off.

⚠ **CAUTION: Unnecessary damage may be done to the stopper by too much compression. We recommend not compressing the 1½" and 2" stoppers more than 1." The amount the stoppers are compressed may be easily determined by measuring the downward travel of the boring bar.**

12. With the fitting stopped-off, cut off capped end of outlet of fitting and weld new pipe to the outlet. Run the new pipe to nearest available shut-off.

NOTE: When cutting or welding near line stopper fittings containing rubber stoppers, it is recommended that the minimum distance between the face of the stopper and the welding or cutting operation be as follows:

Size of Fitting	Minimum Distance
1½"	7"
2"	8"

Where it is not possible to maintain the minimum distance, other cooling means such as wet burlap or rags should be placed around the fitting to keep the temperature down.

13. Install a Save-A-Valve drilling nipple on the new pipe near the fitting and drill out. *(See Mueller Gas Distribution Products Catalog for attachments and equipment needed to perform this operation.)*

14. Construct an equalizing line between this nipple and the stop in the by-pass opening of the machine adapter.

15. Install a second Save-A-Valve drilling nipple on the new pipe, downstream near the nearest available shut-off and drill out. This nipple will be used as a purging connection.

16. To purge the air from the new line, open the equalizing line and open the control valve on the nipple installed downstream. When all air is purged close the downstream control valve.

17. With the air purged the pressure is also equalized on both sides of the rubber stopper.

18. Contract the rubber stopper by rotating the feed tube and yoke **counter-clockwise** a little at a time with a short pause after each turn.

⚠ **CAUTION: DO NOT rotate ratchet handle.**

19. Remove feed tube and yoke from collar on boring bar and slowly retract the boring bar to rearmost position.

20. Close the control valve.

21. Close the control valve on the Save-A-Valve drilling nipple used as an equalizing connection. Open the bleeder valve on the drilling machine to blow down the equalizing line.

22. Remove the equalizing line.

23. Remove drilling and machine adapter from the control valve as a unit.

C–Plug Inserting Operation

1. For plug inserting operation for these extension stopper fittings, follow instructions under **D–Plug Inserting Operation**, Page 5.

(continued on next page)

MUELLER® DH-5 Drilling Machines

Instructions for Installing and Stopping-Off $1^1/_2$" and 2" Extension Stopper Fittings for Lateral Extension

Installation Instructions for H-17120, H-17142, H-17143, H-17147, H-17152, H-17153, H-17157 and H-17158 Extension Stopper Fittings

H-17157

A–Attach Extension Stopper Fitting

1. Thoroughly clean the pipe where the fitting is to be installed.

2. Attach the fitting to the line at the point where the lateral connection is to be made.

a) When using a fitting with welding inlet, place it in desired position and weld to the pipe line

b) When using a fitting with threaded inlet, attach a service clamp to the line in the desired position, then attach fitting to the service clamp.

3. Remove completion cap and plug.

B–Attach Equipment To Stop-Off

1. Attach 3" control valve to the fitting. Check to be sure it is fully CLOSED. Attach reducing bushing if required before attaching the control valve.

2. Attach proper machine adapter to the drilling machine.

3. Advance boring bar and attach stopper inserting tool and rubber stopper (by-pass or solid) to the boring bar. Lubricate stopper with Mueller rubber stopper lubricant.

4. When using by-pass rubber stopper, mark the collar on the drilling machine so that it is in line with the by-pass on the rubber stopper.

5. Retract boring bar to rearmost position and attach drilling machine and machine adapter to the control valve.

6. Attach a stop or valve to the by-pass opening in machine adapter when using by-pass rubber stopper. Check to be sure this stop or control valve is closed.

7. Screw test cap onto outlet threads of fitting, apply air pressure and test for leaks using soapsuds or a leak detection fluid. (Add glycerin to soapsuds in freezing weather.) Remove test cap.

C–Drilling Operation

For detailed instructions, see operating instructions for D-5 or DH-5 Drilling Machines.

1. Attach proper machine adapter to the drilling machine.

2. Attach boring bar extension to boring bar and attach pilot drill and shell cutter to extension. Coat shell cutter and pilot drill with Mueller cutting grease.

3. Retract boring bar and attach drilling machine and machine adapter to outlet end of fitting.

4. Advance the boring bar until the pint of pilot drill contacts the pipe. Retract boring bar a small amount. Engage feed tube and yoke. Measure and mark the distance required to complete the cut. (Mark the point on the drilling machine body that the feed tube will reach when cut is complete.)

5. Drill out the pipe line and retract the boring bar to rearmost position.

D—Insert Stopper Into Fitting

1. Open control valve on fitting and advance rubber stopper until it contacts bottom of the fitting.

2. Hold boring bar in this position engaging feed tube and yoke.

3. Turn the collar on the boring bar so that the mark is facing away from the new lateral. This positions by-pass on stopper in proper direction.

4. Turn feed tube and yoke **clockwise** a little at a time with a short pause after each turn. Continue to expand stopper until fitting is stopped off.

⚠ CAUTION: **Unnecessary damage may be done to the stopper by too much compression. We recommend not compressing the 1½" and 2" stoppers more than 1". The amount the stoppers are compressed may be easily determined by measuring the downward travel of the boring bar.**

5. With fitting stopped-off, remove drilling machine used to drill out the pipe and machine adapter as a unit.

E—Attach Lateral Piping

1. When using threaded connections, attach lateral pipe to fitting outlet threads.

2. When using welding connections, cut off the threaded end of fitting and weld pipe to outlet end of fitting

NOTE: When cutting or welding near line stopper fittings containing rubber stoppers, it is recommended that the minimum distance between the face of the stopper and the welding or cutting operation be as follows:

Size of Fitting	Minimum Distance
1½"	7"
2"	8"

Where it is not possible to maintain the minimum distance, other cooling means such as wet burlap or rags should be placed around the fitting to keep the temperature down.

(continued on next page)

MUELLER® DH-5 Drilling Machines

Instructions for Installing and Stopping-Off 1½" and 2" Extension Stopper Fittings for Lateral Extension

3. When using a by-pass rubber stopper. Install a Save-A-Valve drilling nipple on the new lateral pipe and connect this nipple with the stop in the by-pass opening of the machine adapter to form an equalizing connection.

4. When using a solid rubber stopper of deferred completion stopper, install a Save-A-Value drilling nipple on the pipe line which is the source of pressure. Install a second nipple on the new lateral pipe line and connect the two nipples together to form an equalizing line. *(See Mueller Gas Distribution Products Catalog for equipment and attachments to install Save-A-Valve drilling nipples.)*

F—Place Lateral Pipe In Operation

1. Extend lateral pipe to nearest available shut-off in the line.

2. When using by-pass stopper, apply pressure to the lateral by opening valve on Save-A-Valve drilling nipple and the stop on machine adapter. New lateral can be purged of air from another nipple installed on the lateral pipe, downstream, near the nearest available shut-off.

3. When using a solid rubber stopper or deferred completion stopper, apply pressure to the lateral by opening valve on nipple installed on the pipe line and open valve on nipple installed on the lateral. New lateral can be purged of air from another nipple installed on lateral pipe, downstream, near the nearest available shut-off.

G—Extract Stopper

1. When pressure has been equalized on both sides of the stopper, the stopper can be contracted by turning feed tube and yoke **counter-clockwise** a little at a time with a short pause after each turn.

2. Remove feed tube and yoke from boring bar and retract boring bar to rearmost position.

3. Close the control valve.

4. When using by-pass rubber stopper, close the control valve on drilling nipple used as an equalizing line. Open bleeder valve on the drilling machine to blow down the equalizing line. Remove the equalizing line.

5. When using solid rubber stopper or deferred completion stopper, close valves on both drilling nipples and remove equalizing line.

6. Remove drilling machine and machine adapter as a unit.

H—Plug Inserting Operation

1. Follow instructions as under **D—Plug Inserting Operation,** Page 5.

MUELLER® DH-5 Drilling Machines

Instructions for Installing 2" Extension Stopper Fittings for Dead-End Extension

Installation Instructions for H-17154 and H-17159 Extension Stopper Fittings

1. When using H-17154 extension stopper fitting, slip fitting over capped dead-end of the pipe until the pipe shoulders against an integral stop within the fitting.

NOTE: Cap weld must be ground flush with pipe O.D. to permit fitting to be slipped over the end of the pipe.

a) Weld fitting to pipe.

b) Weld new piping to outlet of fitting

c) Follow instructions for drilling as under **B—Drilling Operation,** Page 3.

2. When using H-17159 extension stopper fitting, remove completion cap and plug from the fitting and follow instructions for drilling as under **B—Drilling Operation,** Page 3.

3. To insert completion plug into both fittings, follow instructions as under **D—Plug Inserting Operation,** Page 5.

The following procedures are for the installation of a detachable rubber expansion plug:

SAFETY PRECAUTIONS:

1) For the safety of the public and employees, all steps to prevent accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the bell-hole during the installation of expansion plugs on live pipelines.
2) If installing expansion plug in a pressurized pipeline to stop a leak or if using as a plug to pressure test against, NEVER put your body or head directly in line with the end of the pipeline as there is potential for the plug to slip or fail and be projected out of the pipeline and cause injury or death.

Installation Procedure:

1) Rubber expansion plugs may be used to temporarily stop leaks, provide a stop to pressure test against, or to seal pipelines that are being abandoned.
2) Before using any expansion plug, ensure that the pressure rating for the expansion plug to be used is higher than the anticipated pressure of the pipeline to which it is going to be installed.
   a) Rubber expansion plugs, depending on the type and size, can have a pressure rating anywhere between 8 psi – 180 psi. So, it is critical that the proper plug is chosen for the specific installation to ensure the safety of those working on or near the job site.
3) Before installing the plug into the pipeline, visually inspect the plug for signs of wear or damage.
   a) DO NOT use the plug if visual inspection reveals cuts, gouges, abrasions, cracks, and loose or damaged components.
4) If installing into a non-pressurized pipeline, inspect and/or clean the inside surface of the pipe to ensure that foreign matter or burrs don't damage or affect the operation of the expansion plug.
5) Before inserting into the pipe, it may be necessary to loosen the nut, wingnut, or handle to allow the plug to be inserted.
6) Insert the plug into the pipe and hand tighten the nut, wingnut, or handle to expand the plug and provide a tight seal.
7) With pressure applied to the back side of the plug, check for leaks using leak solution. Additional tightening of the nut, wingnut, or handle may be necessary if leaking is discovered.
8) Before removing plug, ensure that the pressure on the back side of the plug is bled off or released.
9) To remove the plug, loosen (do not remove) the nut, wingnut or handle until plug is loose and remove the plug.

IAMU Procedure #7.5: Purge – Flammable or Inert Gas

1) **NOTE:** For the safety of the public and employees, all procedures for preventing accidental ignition must be followed and a fully charged fire extinguisher located on site and upwind of all purging operations. When purging pipelines over 1 mile in length, it is recommended that an engineer be used to develop a plan for the purging process. All purge processes shall be conducted in such a manner to minimize the release of natural gas to the atmosphere.

Requirements:

1) 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.
2) 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 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 air.
3) The purging of service lines and customer fuel lines may NOT be completed indoors unless a hazardous atmosphere will not be created.
   a) If purging indoors, it must be completed through an appliance burner equipped with a continuous source of ignition.
      i) Indoor purging must be monitored with a combustible gas indicator.
      ii) Indoor purging may NOT be conducted in a confined space.
4) All purging must be conducted through a valve capable of controlling or eliminating flow. If a valve is not present on existing piping, one must be installed prior to purging.

Notifications Prior to Purge or Blowdown:

Public Officials:

a) The appropriate public officials (Mayor, council members, public works director, etc..) should be notified prior to a purge or blowdown in 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 blowdown.

Emergency Officials:

a) The appropriate emergency officials (fire chief, police chief, EMS, etc..) should be notified prior to a large volume purge or blowdown so that they are aware of the situation and additional precautions may be taken, if necessary, to ensure the safety of the public and property.

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Public in the Vicinity of the Purging Discharge:

a) The public located near the purging discharge should be notified prior to purging if it is anticipated that the process could affect individuals. Consideration should be given to the volume, noise, odor, or possibility of accidental ignition.
b) It may be necessary to evacuate areas based on wind direction, type, and size of the purging or blowdown.

Purging Service Lines:

1) All procedures for preventing accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the purging area.
2) Before establishing gas service in a new service installation, it is necessary to replace the pressure testing gas (typically air), with natural gas.
3) The service line must be purged from the main through the service riser and service valve.
4) The service valve may be used to control the flow of the purge process. If the service valve is not going to be used, an additional valve must be installed above the service valve to control flow.
5) The point of the purging discharge must be located at least 10 ft. from any ignition sources and openings into buildings (windows, doors) and at least 25 ft. from any mechanical air intakes.
   a) If the point of discharge is within the required distances, a vent stack must be installed prior to purging.
   b) Additional piping must be metallic, plastic piping may NOT be used.
   c) If using a vent stack, it must be grounded.
   d) If additional piping is installed and extended vertically, ensure that it does not discharge directly below the roof line (soffit/eave) of the building where gas could enter through vents. It may be necessary to pipe horizontally.
6) After the main has been tapped, slowly crack open the service valve (purge valve) and allow gas to flow at a moderately fast rate.
   a) If purging a service line containing an EFV, the EFV may trip and close if purged too quickly. If this occurs, close the service valve and wait until the EFV resets (pressure must equalize on both sides of the EFV for it to reset).
   b) The purge discharge must continually be monitored with a combustible gas indicator.
      i) When the gas concentration reaches 90% N, close the service valve or purge valve and stop the purge process. This will ensure the proper concentration of gas has been obtained.
      ii) DO NOT rely on the presence of odor to determine the % of gas present.
7) If a meter is NOT going to be installed at this time, the service valve must remain in the off position, be locked, and the open end plugged or capped.

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Purging Steel Mains:

1) All procedures for preventing accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the purging area.
2) It is essential to replace/remove the pressure test gas in newly installed mains with natural gas prior to putting into service. If the air or inert gas is not replaced with natural gas, an unplanned service outage or hazardous gas/air mixture could be created.
3) Consideration should be given to restricting access to the worksite for all non-essential personnel or for posting signs stating "No Smoking" or "No Open Flames"
4) Ensure that the main to be purged is isolated from other pipelines so that purge gases cannot enter other parts of the system.
5) Install an auto-perf tap tee as close as practical to the end of the main to be purged.
6) Install a vent stack off of the tap tee to ensure that gas is vented up and out of the bell-hole and away from ignition sources.
   a) Consideration must be given to the specific location of the discharge point of the vent stack. The discharge location must NOT vent within 10 ft. of any ignition sources, openings into buildings, or within 25 ft. of any mechanical air intakes.
   b) Vent stacks must be made of metallic piping. Plastic piping may NOT be used.
   c) A valve capable of controlling flow of gas must be installed on the vent stack.
   d) A tee may be installed at a location above the valve and must be above ground level to serve as a sample location for testing the concentration of gas during the purge.
      i) If installing a tee as a sample location, an additional valve must be installed downstream of the tee to control the flow of gas at the sampling point but not affecting the flow of the purge.
   e) The vent stack must be grounded.
   f) Tap the auto-perf tap tee.

NOTE: See diagram of purge fitting/stack on next page.

7) Open the valve on the vent stack and leave in the fully open position until the purging process is complete.
8) Before opening the valve or other shut-off device (stopple fitting) that is separating the newly installed main from the source of gas, ensure that all sources of ignition have been eliminated and all non-essential personnel are at a safe distance from the purging discharge.
9) Slowly open the valve or other shut-off device (stopple fitting) allowing fuel gas to flow at a moderately fast rate.
   a) The flow of fuel gas will be controlled at the source not at the vent stack.
   b) Once started, the flow of fuel gas should remain continuous.
10) The discharge of the vent stack must be continuously monitored with a combustible gas indicator at the top of the vent stack or at the sampling point.
11) The purge should continue until a reading of at least 90% N is obtained.

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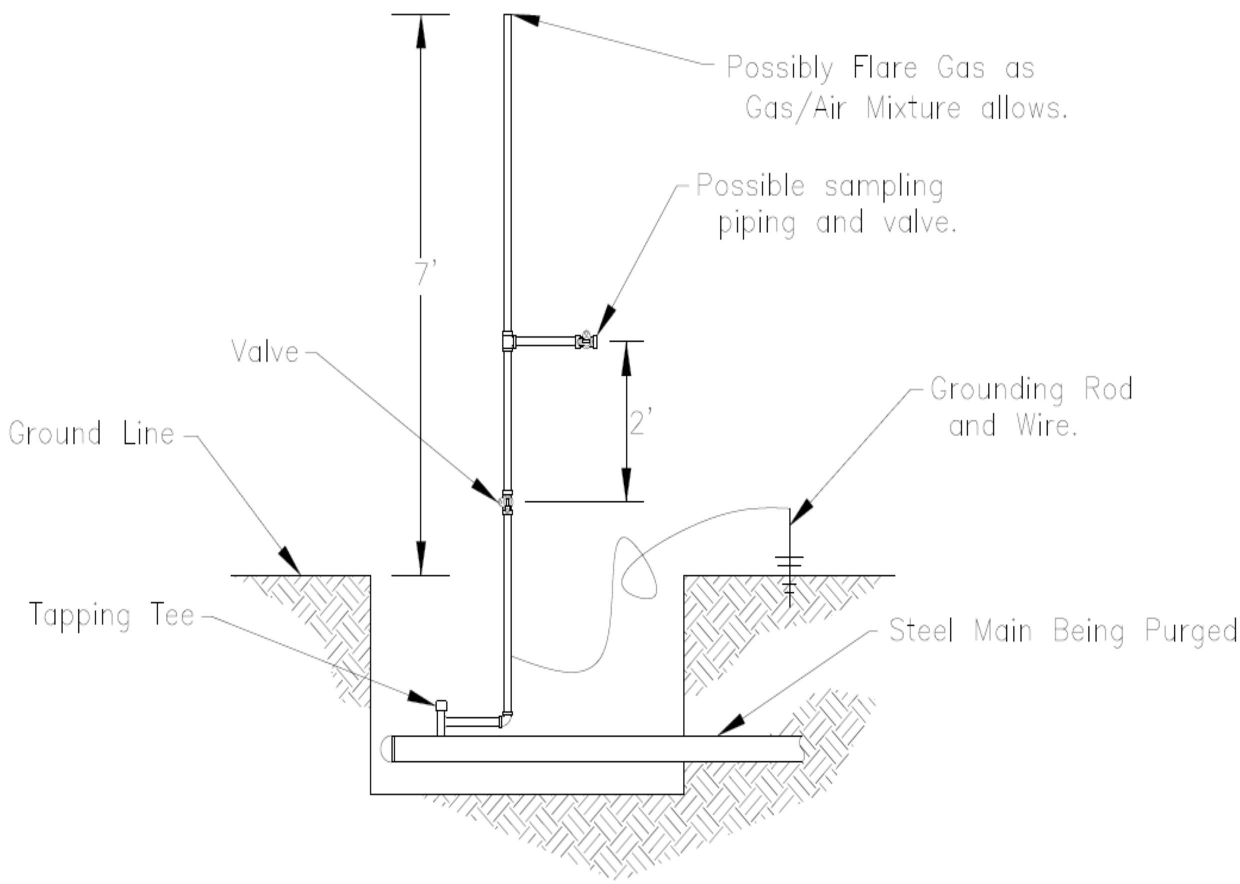
12) Once a minimum of 90% N is observed, continue to purge for a sufficient amount of time and re-test to ensure that a minimum of 90% N is present.
13) With a minimum concentration of 90% N verified, close the valve on the vent stack.
14) Once the vent stack valve has been closed, continue to fully open the valve or other shut off device (stopple fitting) connected to the source of fuel gas to fully pressurize the purged main.
15) Before removing the vent stack, eliminate the flow of gas through the tap tee.
16) Once gas flow has been eliminated through the tap tee, bleed out the remaining fuel gas in vent stack by slowly opening the vent stack valve.
17) Remove the vent stack and cap off the tap tee.



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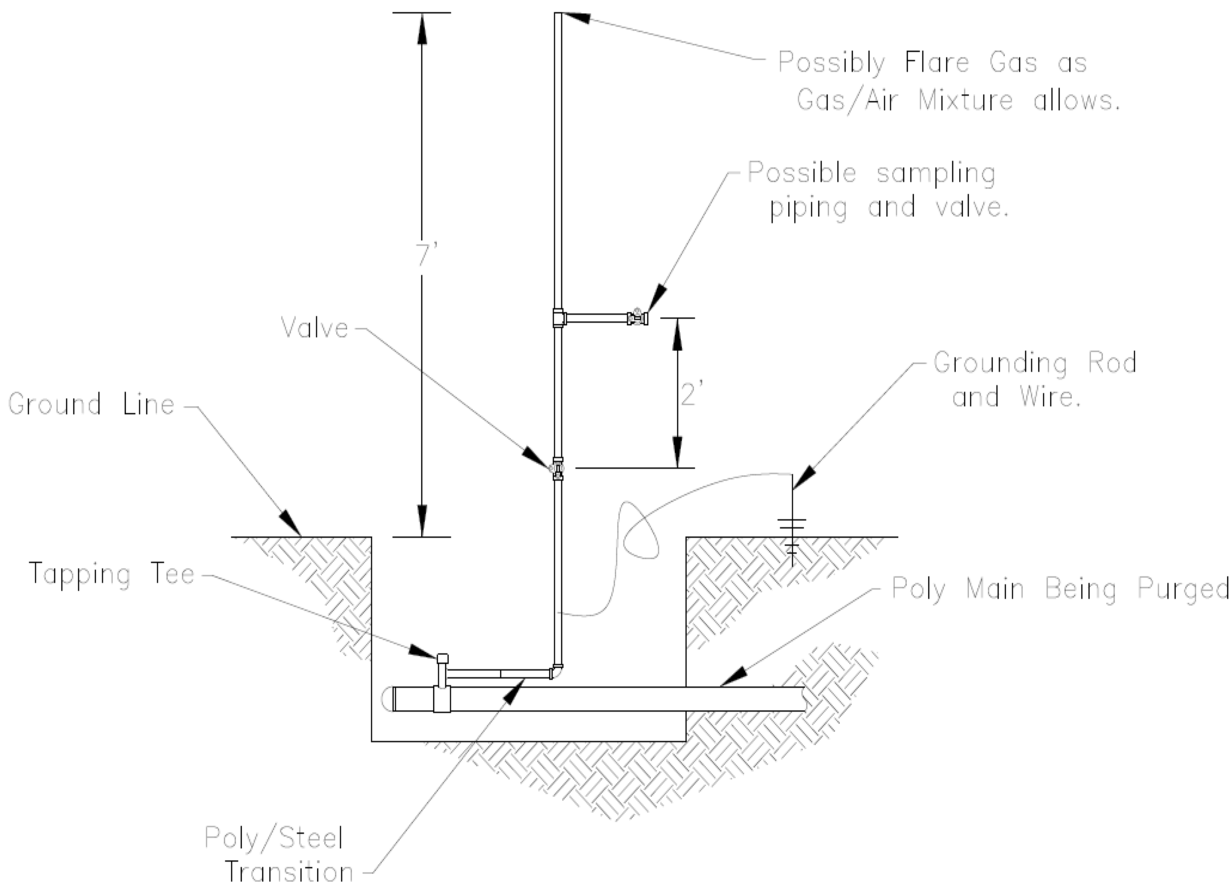
Purging Plastic Mains

1) All procedures for preventing accidental ignition must be followed and a fully charged fire extinguisher must be located on-site and upwind of the purging area.
2) It is essential to replace/remove the pressure test gas in newly installed mains with natural gas prior to putting into service. If the air or inert gas is not replaced with natural gas, an unplanned service outage or hazardous gas/air mixture could be created.
3) Consideration should be given to restricting access to the worksite for all non-essential personnel or for posting signs stating "No Smoking" or "No Open Flames"
4) Ensure that the main to be purged is isolated from other pipelines so that purge gases cannot enter other parts of the system.
5) On the main to be purged, install an auto-perf tap tee (with transition to steel piping) as close as practical to the end of the main or install a purge cap fitting on the end of the main.
6) Install a vent stack off of the tap tee to ensure that gas is vented up and out of the bell-hole and away from ignition sources.
   a) Consideration must be given to the specific location of the discharge point of the vent stack. The discharge location must NOT vent within 10 ft. of any ignition sources, openings into buildings, or within 25 ft. of any mechanical air intakes.
   b) Vent stacks must be made of metallic piping. Plastic piping may NOT be used.
   c) A valve capable of controlling flow of gas must be installed on the vent stack.
   d) A tee may be installed at a location above the valve and must be above ground level to serve as a sample location for testing the concentration of gas during the purge.
      i) If installing a tee as a sample location, an additional valve must be installed downstream of the tee to control the flow of gas at the sampling point but not affecting the flow of the purge.
   e) The vent stack must be grounded.
   f) Tap the auto-perf tap tee.

NOTE: See diagram of purge stack/fitting on next page.

7) Open the valve on the vent stack and leave in the fully open position until the purging process in complete.
8) Before opening the valve or other shut-off device (squeeze-off) that is separating the newly installed main from the source of gas, ensure that all sources of ignition have been eliminated and all non-essential personnel are at a safe distance from the purging discharge.
9) Slowly open the valve or other shut-off device (squeeze-off) allowing fuel gas to flow at a moderately fast rate.
   a) The flow of fuel gas will be controlled at the source not at the vent stack.
   b) Once started, the flow of fuel gas should remain continuous.
10) The discharge of the vent stack must be continuously monitored with a combustible gas indicator at the top of the vent stack or at the sampling point.
11) The purge should continue until a reading of at least 90% N is obtained.

12) Once a minimum of 90% N is observed, continue to purge for a sufficient amount of time and re-test to ensure that a minimum of 90% N is present.
13) With a minimum concentration of 90% N verified, close the valve on the vent stack.
14) Once the vent stack valve has been closed, continue to fully open the valve or other shut off device (squeeze-off) connected to the source of fuel gas to fully pressurize the purged main.
15) Before removing the vent stack, eliminate the flow of gas by shutting off tap tee or if a purge cap fitting was used, it may be necessary to squeeze off the main at a sufficient distance from the purge cap fitting.
16) Once gas flow has been eliminated through the tap tee or to the purge cap fitting, bleed out the remaining fuel gas in vent stack by slowly opening the vent stack valve.
17) Remove the vent stack and cap off the tap tee or if purge cap fitting was used, cap off the main.



CITY OF BLOOMFIELD, IOWA

PART EIGHT

Operations & Maintenance

IAMU Procedure #8.0: Odorization – Odorizer Inspection, Testing, and Preventative Maintenance

NOTE: Periodic inspection, testing, and maintenance of odorization equipment should be conducted as needed and as required by the manufacturer of the specific type of odorizer in use. The procedures listed below are general in nature and not specific to any brand of odorization equipment.

Safety Precautions:

1) Odorants (mercaptan) are flammable and all steps must be taken to prevent accidental ignition.
2) When handling odorant, wear proper PPE such as gloves and safety glasses to prevent contact with skin.
3) Avoid spilling or creating leaks of liquid odorant.
4) If continually exposed to odorant or high vapor concentrations, it may be necessary to wear a respirator or self-contained breathing apparatus.
    a) If exposed to heavy levels of odorant for an extended period of time, it may be necessary to seek medical attention if sickness occurs.

Inspection and Maintenance of Bypass Type Systems:

NOTE: Become familiar with and always follow the manufacturers recommended practices and procedures for the specific brand and type of odorizer in use.

1) Periodically (recommended at least monthly) check the level of odorant in the bypass tank to ensure that odorant is being used and that a sufficient amount of odorant remains in the tank.
    a) Re-fill the tank as necessary.
2) Periodically (recommend at least annually) inspect and maintain the following:
    a) Check all piping into and out of the odorizer for leaks using a CGI or with leak detection solution. If any leaks are found, they should be repaired.
    b) Ensure that all inlet and outlet valves (quarter turn and/or needle valves) are in good mechanical condition and are operational.
        i) It is recommended that valves are at least partially operated. Before operation, note the position and or location of the valve prior to turning so that it may be returned to the same position. If valves are NOT returned to the same position or location, the odorant rate could be affected.
    c) Check for signs of atmospheric corrosion, giving special attention to the pipe-to-soil interface.
        i) Take remedial action as necessary if any corrosion is found.

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Inspection and Maintenance of Injection Type Systems:

NOTE: Become familiar with and always follow the manufacturers recommended practices and procedures for the specific brand and type of odorizer in use.

1) Periodically (recommend at least weekly) check for the following:
   a) Check for the level of odorant in the day tank and/or bulk tank and re-fill as necessary.
   b) Check battery level and/or solar panels, if applicable.
   c) Ensure that pump is stroking and odorant is being injected by manually stroking the pump and visually checking the sight glass at the injection point.
   d) Verify gas pressures to the following, if applicable:
      i) Bulk storage tank.
      ii) Day tank.
      iii) Gas supply to the pump.
2) Periodically (recommend at least annually) perform the following maintenance:
   a) Check all piping, tubing, and fittings for leaks using a CGI or leak detection solution.
   b) Inspect the condition of the pump and rebuild if necessary.
   c) Replace solenoids.
   d) Inspect filters and replace if necessary.
   e) Replace battery.
   f) Check for signs of atmospheric corrosion on all piping and tubing. If any piping or tubing extends underground, special attention should be given at the pipe-to-soil interface.
      i) Remedial action must be taken as necessary if any corrosion is found.

IAMU Procedure #8.1: Odorization – Periodic Sampling (Sniff Tests)

Personnel Requirements:

1) Periodic sampling (sniff tests) must be conducted by qualified individuals with a normal sense of smell.
   a) To determine if an individual possesses a normal sense of smell, it may be necessary to periodically test an individuals' ability to recognize a gas odor using "scratch and sniff" cards.
2) Operators conducting sniff tests should NOT smoke, chew tobacco or gum, or eat spicy foods immediately before or during the completion of the test.
3) An operator conducting sniff tests should NOT have any condition such as a cold or allergies that could affect their sense of smell.

Sampling (Sniff Test) Requirements:

1) Periodic sampling (sniff tests) must be performed at least quarterly using equipment capable of determining the % of gas in air at which the odor becomes readily detectible.
2) The odorant must be readily detectible at concentrations in air of 1/5 of LEL (1% gas in air). If testing reveals that an odor concentration higher than 1/5 LEL (1% gas in air) is present, follow-up action must be taken. See next page for specific follow-up actions.
3) Sniff tests should be conducted in enough locations to ensure that odorant levels are sufficient throughout the system.
   a) When selecting sampling locations, consideration should be given to the following:
      i) The size and configuration of the system (loop feeds, dead ends, flow rates, etc.).
      ii) Extreme ends of the system at points furthest from odorization equipment.
      iii) DO NOT select sampling locations where environmental odors such as cattle lots, hog buildings, feed mills, etc. may affect or mask the smell of the odorant during the test.

Odorant Usage Calculation Requirements:

1) The amount of odorant used or injected must be calculated at least quarterly to ensure that odorization equipment is functioning correctly and not introducing odorant with wide variations of concentration.
2) The amount of odorant used or injected should be calculated in terms of lbs/MMCF (pounds of odorant per million cubic feet of gas).
   a) There is NO requirement to which odorant must be injected or absorbed as long as odorant levels are maintained below 1/5 LEL (1% gas in air).
   b) However, it is widely recognized that the rate of injection or absorption should be approximately 0.75 lbs. of odorant per million cubic feet of gas.

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Equipment Calibration Requirements:

1) The equipment (odorometer) used to conduct sniff tests must be calibrated periodically according to the manufacturer's recommended procedures.

Record Retention Requirements:

Sniff Tests:

1) All sniff tests must be documented and recorded. The Periodic Sampling of Odorant (Sniff Test) form or other company approved document may be used.
2) Records demonstrating compliance must be kept and maintained for at least 10 years.

Odorant Usage:

1) Odorant usage calculations must be documented and recorded. The Odorant Usage Calculation form or other company approved document may be used.
2) Records demonstrating compliance must be kept and maintained for at least 10 years.

Equipment Calibration:

1) Records of odorometer calibration, typically received from the manufacturer, must be kept and maintained for at least 10 years.

Follow-up Action for Sniff Tests Above 1/5 LEL (1% gas in air)

1) If a sniff test results in a reading over 1/5 LEL (1% gas in air) the following actions must take place:
   a) Two additional sniff tests should be conducted at adjacent locations.
      i) If two adjacent locations are unavailable, two locations should be selected that are as close as practical to the initial testing location.
   b) If the two additional sniff tests result in readings below 1/5 LEL (1% gas in air) the odorant level will be considered adequate.
   c) If the two additional sniff tests result in readings above 1/5 LEL (1% gas in air), the odorization equipment should be checked for sufficient levels of odorant and proper working condition.
      i) If there is sufficient odorant in the tank and the equipment is working correctly, the rate of injection or absorption should be increased slightly.
   d) After increasing the injection or absorption rate, wait 2-3 days (could be longer or shorter period of time depending on flow conditions) and then re-take sniff tests at the same locations where the first tests were taken.
   e) Continue this process until sniff tests result in readings at or below 1/5 LEL (1% gas in air).

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Generic Sniff Test Procedures:

NOTE: Always follow the manufacturer's recommended procedures for the specific type of machine used to conduct sniff tests.

1) Ensure that the location selected for the sampling can supply gas at a pressure that the machine is rated for.
2) Ensure that the machine is not out of calibration by verifying the calibration date which can be found on the sticker that may have been placed on the machine by the manufacturer.
3) Check the sampling hose for damage or defects and also sniff the tube and verify that no gas smell is present in the tube. If there is a gas smell present, replace the tube.
4) Connect the sampling tube to the source of gas. DO NOT turn on gas supply at this point.
5) Turn the machine on and open needle valve to the full-open position to purge out any remaining gas from the last test. Wait approximately 10 seconds and sniff the port at a distance of approximately ¾" for any smell of gas. If the smell of odorant is present, wait another 10 seconds and sniff again.
6) Push and hold the read button. While holding the read button the display should read "0.0". If it does NOT read "0.0" use the zero-adjustment knob and make adjustments until "0.0" is visible.
7) Close the needle valve to the full-closed position.
8) Turn on the gas source.
9) Slowly open the needle valve and turn approximately 1-2 full turns.
10) Wait approximately 30 seconds and sniff the port at a distance of approximately ¾".
11) If no odorant is detected at this point, continue to turn the needle valve approximately 1-2 turns at a time until the presence of odorant is detected. Continue this process until it is determined that a readily detectible smell of odorant is present.
12) In between sniffs, the operator should move away from the machine and breathe fresh air so that the sense of smell does not get fatigued.

NOTE: Readily detectible is NOT considered the point at which there is a faint smell of odorant. Readily detectible is when there is no doubt that the smell of odorant is present.

13) Once the odorant is readily detectible, press the read button to display the concentration of gas at which the odorant is readily detectible.
14) Using the reading displayed on the machine, it is necessary convert the reading using the chart on the side of the machine.
15) Document the converted reading on the appropriate form.
16) Turn off the gas source, close the needle valve and leave the machine on for approximately 1 minute to purge out all remaining gas in the machine.
17) Turn the machine off and store in safe location.

IAMU Procedure #8.2: Interpret Pressure Recording Charts and Electrical Devices

Requirements:

1) Any distribution system that is supplied by more than one district pressure regulating station must have telemetering, pressure recording charts, or pressure recording gauges installed to indicate the pressure in the districts.
2) If a distribution system is only supplied by a single district regulator station, it is recommended but not required, that telemetering, pressure recording charts, or pressure recording gauges be installed to indicate pressures.
3) If at any time there are indications of unintended abnormally high or low pressures, the regulating and/or overpressure equipment must be inspected and corrections made.
4) It is recommended that pressure recording charts or pressure data be kept and maintained for a minimum of 10 years to fulfill DIMP requirements and to aid in pipeline compliance audits.

Pressure Recording Charts:

1) If a pressure recording chart has been installed, an operator should complete the following:
   a) The recording chart should be calibrated according to the manufacturers recommended procedures as necessary.
   b) Ensure that the charts being installed contain the correct pressure range for the specific recorder being used.
   c) Ensure that the chart is changed as required (daily, weekly, or monthly).
   d) It is recommended that the following information be clearly marked on the chart:
      i) The date the chart was installed and the date the chart was removed.
      ii) The name or initials of the operator who reviewed the chart.
      iii) If any abnormally high or low pressures are indicated on the chart, they should be circled and notes made on the chart of why or what happened to cause the pressure fluctuation.
   e) Ensure that the recording pen or pens are changed frequently enough so that the ink does not dry out and become unable to record the pressures.

Electronic Recorders or Gauges:

1) If an electronic recorder or gauge has been installed, an operator should complete the following:
   a) The recorder or gauge should be calibrated according to the manufacturers recommended procedures as necessary.
   b) Ensure that the batteries are changes as necessary to ensure that pressures are being recorded.
   c) A periodic review of the pressure data should be conducted and documented.
   d) If any abnormally high or low pressures are contained in the data, they should be identified and notes made of why or what happened to cause the pressure fluctuation.

IAMU Procedure #8.3: Locate Underground Pipelines

Requirements:

1) In order to fulfill the requirements of a damage prevention program, Division 13.8, 13.8.1 & 13.8.2: Damage Prevention, of the O&M Requirements and Recommendations must be followed.
2) All notices of locate requests, including those of your own utility, must be completed within 48 hours of the notice being received excluding weekends and legal holidays.
   a) All marking of utilities must be completed using yellow paint and/or flags to identify the location of the buried natural gas utility.
3) Once the locating and marking has been completed, the operator must complete the positive response requirements within the 48-hour window.
   a) Positive response is the action of notifying One-Call that the marking is complete.
4) Transmission pipeline "Stand-by" requirements are as follows:
   a) Any excavation that is to take place within 25 feet of a transmission pipeline must have a company representative on-site during the excavation process unless otherwise agreed upon by the operator and excavator IN WRITING.

Documentation and Record Retention:

1) Documentation of locate requests and the verification of completion may be kept be electronically through the One-Call website or by printing off a copy of the locate request and documenting the date, time, and name of operator who completed the locate request.
2) The records for locate requests and verification of completion must be kept and maintained for a minimum of 5 years following the date of the request.
3) The Excavation "Stand-by" Report or other company approved document may be used to document any excavation within 25 feet of a transmission pipeline and should be kept and maintained for at least 5 years.

Generic Procedures for Conductive and Inductive Methods of Locating Pipelines:

NOTE: The following procedure is generic in nature and it is recommended that manufacturer's instructions are followed for the specific brand and type of locating equipment being used.

1) Check the locate request for specific address and/or specific location (proposed excavation site should be marked with white paint and/or flags).
   a) If the locate request is unclear of proposed excavation area and white lining has not been completed, it may be necessary to notify excavator or One-Call that more information is needed to be able to complete the locate request.
2) Inspect the locating equipment for signs of damage and ensure that the battery level is sufficient and is in proper working order prior to locating.

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3) Once on-site, check facility maps for the general location of the pipeline to give a better understanding of where to place locating equipment.

Conductive Method *(most reliable and effective method):*

1) The conductive method should be used when a direct connection to the pipeline by means of attaching directly to the pipe or a tracer wire is available.
2) Place the transmitter on the ground approximately 5 feet away from the connection point (pipe or tracer wire) and at a 90° angle from the general pipeline location.
   a) Connect the red lead from the transmitter to the pipe or tracer wire.
3) Insert a ground rod approximately 5 feet away from the transmitter, moving in the same direction away from the pipeline.
   a) Connect the black lead from the transmitter to the ground rod.

NOTE: It may be necessary to pour water at the ground rod location to lower resistance and to provide a better grounding source.

4) Turn the transmitter on and select the lowest frequency that will work for the application.
5) Turn the receiver on and ensure that it is set at the same frequency as the transmitter.
6) Hold the receiver in a vertical position, perpendicular to the pipeline.
7) Make short, sweeping motions with the receiver across the pipeline path.
8) If using the peak mode, listen for the audible peak tone and verify by checking peak signal strength to verify location of pipeline.
9) If using the null mode, the audible tone will dissipate over the pipeline and the signal strength will be the weakest over the pipeline.
10) After verifying location of pipeline using the peak or null mode, it may be necessary to check for depth (by pressing the depth button on the receiver) to ensure that you are locating the correct utility.

Inductive Method *(perform with two people):*

1) The inductive method should be used when there is no direct connection point to the pipeline or tracer wire.
2) Using system maps, find the general location of the pipeline.
3) Turn on the transmitter and receiver on and select the appropriate frequency for the type of pipe being located.
4) The transmitter and receiver should NOT be placed within 35 feet of each other as air lock or air coupling may occur.
5) Maintaining a minimum distance of 35 feet, with the transmitter and the receiver in the vertical position, begin walking toward the general location of the pipeline.
6) As you get closer to the pipeline, the signal strength should increase and be the strongest directly above the pipeline.
7) As you move away from the pipeline, the signal strength will decrease.

IAMU Procedure #8.4: Temporarily Mark Underground Pipelines

Temporary Marking Procedures:

1) When locating pipelines, yellow paint and/or flags must be used to temporarily identify the location of the underground pipeline.
   a) If using flags, it is recommended that the company name and telephone number be printed on the flags to provide an excavator with a contact to call if they have any questions or need additional information.
2) If temporarily marking pipelines during winter months when snow is present or if new snowfall is anticipated, it is recommended that flags, NOT paint, are used to temporarily mark the pipeline route.
3) It may also be necessary to temporarily mark pipelines using taller/longer flags so that they can be visible in deep snow or in locations where taller grass or vegetation is present.
4) The markings or flags should be placed at a reasonable distance apart so that an excavator can easily identify the pipeline route.
   a) Directional changes, tees, and offsets from the assumed pipeline route should be marked so that they can be easily identified by the excavator.
   b) If the proposed excavation area has been white lined, the temporary pipeline markings should extend a reasonable distance beyond the proposed area.

IAMU Procedure #8.5: Install and Maintain Pipeline Markers

Location Requirements:

1) Line markers shall be installed and maintained as close as practical over each buried main and transmission line at the following locations:
   a) Crossings of public roads and railroads, including casing vents, excluding Class 3 & 4 locations.
   b) Wherever necessary to identify the location of the main or transmission line to reduce the possibility of damage.
2) Line markers shall be installed at all above ground sections of mains and transmission lines accessible to the public (town boarder station, district regulator station, hairpin valves, etc.).

Marker Requirements:

1) Although not required, it is recommended that yellow tri-view or round line markers, 6 foot in height, with black writing be installed along the pipeline route where the line marker represents the general location and/or direction of the pipeline.
2) If flat markers or signage are being used, it is recommended that they only be installed at locations where there are above ground sections of mains or transmission lines such as a town boarder station, district regulator station, hairpin valve, etc.
3) The following information must be written legibly on a background of sharply contrasting color on each line marker:
   a) The word "Warning", "Caution", or "Danger" must be in letters at least 1" high with a ¼" stroke.
   b) Type of gas being transported (Natural Gas Pipeline) must be in letters at least 1" high with a ¼" stroke.
   c) The name of the utility.
   d) Telephone number (including area code) where the operator can be reached at all times.
   e) The One-Call telephone number (811) for locate requests.

Installation and Maintenance of Pipeline Markers:

1) When installing pipeline markers, they should be installed as close as practical to the pipeline. However, it may be necessary to install markers next to existing fence lines, utility poles, gate ways, or other places where the marker can be installed in a place where it will not be damaged or removed.
2) Where practical, for transmission lines or distribution mains in rural areas, consideration should be given to installing line markers in locations where there is a line of sight from one line marker to the next.
3) Pipeline markers should be visually examined during routine pipeline patrols.
   a) If a missing, damaged, or faded marker or sign is discovered, it should be repaired or replaced.
4) If new pipelines are installed or an existing pipeline route altered, consideration should be given to installing additional pipeline markers.

IAMU Procedure #8.6: Visual Inspection of Installed Pipe and Components for Mechanical Damage

Definitions:

1) *Mechanical damage* – is localized damage to the pipe or component resulting from contact with an object that can reduce or jeopardize the serviceability of a pipeline.

Requirements:

1) Pipe and pipeline components must be inspected before and after installation.
2) Whenever any portion of a buried pipeline is uncovered, it must be inspected to determine the condition of the pipe coating, examined for damage, and to determine if any external corrosion exists.
   a) This includes both polyethylene and steel pipe and components.
3) If external corrosion or damage to the pipe and/or coating is found beyond what can be examined, additional pipe must be exposed in all directions until the extent of the problem is found.

Documentation & Record Retention:

1) All examinations of exposed steel pipe and components must be documented.
   a) This included mains, services, and risers.
2) Documentation may be provided on the Exposed Pipe Report or other company approved document and must be kept and maintained for at least 10 years.

Inspection Procedures:

NOTE #1: Any damage discovered on polyethylene pipe or pipeline components, must be less than 10% of the original wall thickness or the damage must be cut out and replaced or repaired.
NOTE #2: Any damage discovered on previously installed steel pipe or pipeline components must be less than 70% of the original wall thickness or the damage must be cut out and replaced or repaired.

1) Pipe and components must be visually inspected for the following types of mechanical damage:
   a) Damaged, disbonded, or missing pipeline coating,
   b) Dents, wrinkle bends, buckling in steel pipe,
   c) Surface cracks formed from denting or re-rounding,
   d) Stress corrosion cracking,
   e) Scratches or gouges in pipe,
   f) Elongation or out-of-roundness.
2) If any mechanical damage is discovered, it must be determined if repairs or replacement is required by following IAMU Procedure #8.7: Measure and Characterize Mechanical Damage on Installed Pipe and Components found on the next page.

IAMU Procedure #8.7: Measure and Characterize Mechanical Damage on Installed Pipe and Components

Definitions:

1) *Dent* – May be described as reentrant or non-reentrant. A non-reentrant dent has a positive radius value, meaning the surface retains in convexity. A reentrant dent has a negative radius, indicating a dent deep enough to cause concavity.
2) *Gouge* – A loss of metal, where the metal loss has been rolled up or pushed up toward the side, or at the end of the metal loss area.
3) *Groove* – A loss of metal that is sharper and has the appearance of a "machined" feature.

Requirements:

1) If any mechanical damage is discovered on pipe or components during visual inspection, the necessity of repairs and/or replacement must be determined.
2) If damage to the pipe and/or coating is found beyond what can be examined, additional pipe must be exposed in all directions until the extent of the problem is found.
3) Any damage discovered on polyethylene pipe or pipeline components, must be less than 10% of the original wall thickness or the damage must be cut out and replaced or repaired.
4) Any damage discovered on previously installed pipe or pipeline components must be less than 30% of the original wall thickness or the damage must be cut out and replaced or repaired.

Measuring Mechanical Damage:

1) The extent of the damaged area must be determined and should include the following measurements:
   a) The length of the damaged area as measured along the pipeline.
   b) The width of the damaged area as measured around the pipeline.
   c) The depth of the mechanical damage must be measured using a pipeline pit depth gauge, caliper, or an ultrasonic thickness gauge.
2) If using a caliper or pit depth gauge, perform the following:
   a) Zero the unit on an area of the pipeline that is clean, undamaged, and if applicable, has the pipeline coating removed.
   b) Place the unit over the damaged portion of the pipeline at the point of greatest wall loss.
   c) Take a measurement and record the reading.
3) To measure the depth of a dent, perform the following:
   a) Place a straight edge of sufficient length on the pipeline so that the straight edge spans the dent from one side of the dent to the other along the pipeline.
   b) The depth is then measured at the maximum distance between the dent and the straight edge.

IAMU Procedure #8.8: Install Mechanical Clamps or Sleeves - Bolted

NOTE: Preventing accidental ignition procedures must be followed and a fully charged fire extinguisher must be available on-site and located upwind of the leak area.

Requirements:

1) Mechanical leak clamps or sleeves being installed must be rated for at least the maximum allowable operating pressure of the system to which they are being attached.
2) Mechanical leak clamps or sleeves may NOT be used as a permanent repair method for plastic pipelines.

Installing Leak Repair Band Clamps:

1) Always follow the specific manufacturer's installation instructions for the type of band clamp being installed.
2) It is recommended that ONLY stainless-steel band clamps are installed.
3) Ensure that the band clamp is the appropriate size and pressure range for the application.
4) Prepare the pipe for installation by removing any coatings and cleaning any dirt or debris that may interfere with the sealing of the gasket.
5) Once clean, spray the area where the band clamp is to be installed with soapy water. DO NOT use any oil-based lubricants.
6) Loosen the nuts until they are at the end of the bolts (complete removal of the nut is unnecessary). Release the bolts from the lug ears and open the clamp.
7) Place the clamp around the pipeline, centering the leak area within the clamp.
8) Tuck the tapered gasket in place and rotate clamp in direction of arrow to smooth tapered gasket flap.
9) Engage the bolts in the receiver lugs and hand tighten to hold in place.
10) Using a torque wrench, begin tightening the bolts, starting with the center bolt and moving towards the end of the clamp, alternating one by one on each side of center bolt.
11) Always tighten bolts to the appropriate torque specification for the specific clamp being used.
12) Wait approximately 15 minutes after installation and re-check bolts to confirm that torque levels have been maintained.
13) Check for leaks using a combustible gas indicator or leak detection solution.
14) If installing on a steel pipeline, apply an approved pipeline coating around the entire surface of the band clamp, including nuts and bolts, and extending a sufficient distance onto the pipeline surface.

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Installing Leak Repair Split Sleeves:

1) Always follow the manufacturer's installation instructions for the specific type of sleeve being installed.
2) Ensure that the sleeve is the appropriate size and has the proper pressure rating for the pipeline to which it is being attached.
3) Prepare for installation by removing all coatings, rust, scale, and cleaning the pipe surface where the sleeve seals will contact the pipe.
4) If the sleeve seals will be in contact with any longitudinal or circumferential weld, the weld must be ground flush with the outside diameter of the pipe. The ground area should extent at least 1" beyond either side of the sleeve seals.
5) Remove the nuts from the bolts on the top side of the sleeve and take the two halves of the sleeve apart.
6) If applicable, remove the spacers that were installed to prevent damage to the seals during shipping.
7) Apply approved lubricant (manufacturer's recommendations) to the seals.
8) Install the sleeves on the pipeline centering the leak area within the sleeve and ensuring the seals line up the previously prepared areas of the pipe. The specific leak area should not be closer than ½" from the seals.
   NOTE: If possible, avoid installing the longitudinal seals (bolting area) directly over the leak.
9) Install the nuts on the bolts hand tight to hold the sleeves in place. Ensure that the correct length of bolt is used in the correct location as some bolts may be longer than others depending on the type and size of the split sleeve.
10) Tighten the nuts uniformly around the split sleeve using a torque wrench, applying the specified level of torque.
11) Check for leaks using leak detection solution.
12) If the split sleeve includes a port for venting gas, ensure that the plug in the vent is gas tight.
13) It is recommended that after at least 4 hours, the torque on the nuts is rechecked to ensure proper tightness.
14) If the split sleeve installed is of the insulating type, an anode or jumper wire must be installed on the sleeve to provide cathodic protection.
15) Apply an approved pipeline coating around the entire surface of the band clamp, including nuts and bolts, and extending a sufficient distance onto the pipeline surface.

IAMU Procedure #8.9: Install Composite Wrap

NOTE: Preventing accidental ignition procedures must be followed and a fully charged fire extinguisher must be available on-site and located upwind of the leak area.

NOTE: The following procedure is intended for use with the TridentSeal® Natural Gas Leak Repair Kit. Always follow the manufacturer's recommended procedures for installation of composite wraps.

Installation of TridentSeal®:

1) TridentSeal® composite wrap may be used to permanently repair above ground leaks found on meter set installations with an operating pressure of 60 psi or less. TridentSeal® may also be used to temporarily repair pinhole corrosion leaks found below ground on pipelines with an MAOP equal to or less than 60 psi.
2) Product should always be stored in cool, shaded area. DO NOT expose to temperatures above 110° F or below 40° F.
3) Care must be taken not to puncture the foil pouch. If the pouch is punctured, the resin will harden and the product will be unusable.
4) Protective gloves should be worn when handling as the resin used may adhere to skin, causing irritation.
5) Pinpoint leak area and ensure that pressure is 60 psi or less.
6) Roughen the pipe surface using a wire brush and supplied sanding cloth. Clean and remove any oils, greases, soaps, or foreign matter by using the supplied solvent cleaning wipe.
7) Unroll first 6" from roll of black rubber Pressure Sealing Tape (PTR) and remove backings. Set aside.
8) Remove TridentSeal® Putty from packaging and knead until uniform in color. The maximum mixing time should be 3 minutes with a minimum mixing temperature of 50°F.
   Pinhole Leak: Place a ball of mixed putty which is large enough to fil the void above pinhole.
   Threaded Fitting Leak: Mold putty into a 1/8"-1/4" rope and place around entire circumference of the joint, pressing firmly into place. The rope should not exceed the shoulder of the female fitting.
9) Wrap the black rubber Pressure Sealing Tape (PTR) in overlapping manner in a clockwise direction, working toward putting, pushing it downward into the defect, stretching the PTR to its maximum tension while wrapping DIRECTLY over the putty. This will force the putty firmly into place. DO NOT CHASE THE LEAK, as each wrap provides additional pressure to seal the leak. Use the entire roll of PTR.
10) After applying the PTR, STOP, and check for leaks. If leak is still evident, remove the PTR and putty and repeat steps 1-9.

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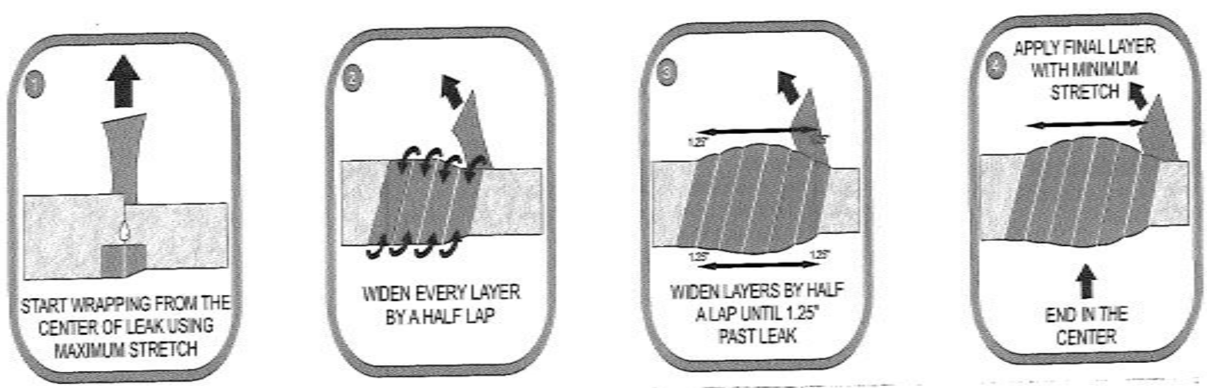
11) Water is needed to activate the TridentGlass Outer Wrap. Put on supplied gloves, open foil pouch and submerge the roll of TridentGlass in water for 10 seconds. 8 layers of TridentGlass are required and must extend 2” on either side of the PTR, covering the entire repair site. To achieve the 8-layer application, apply 4 passes in a clockwise direction using a 50% overlap. Occasionally twisting the TridentGlass as it is applied helps it conform tightly to the pipe surface.
12) Apply 4 layers of clear plastic compression film over the entire composite repair, wrapping in the same direction as the TridentGlass was applied. Using a perforating tool or wire brush, perforate all layers of compression film to allow the gas generated during the curing process to escape. Remove the compression film after 10 minutes.
13) Once the TridentGlass Outer Wrap has reached its initial cure of 30 minutes at 75° F, it should be protected with a UV resistant pipeline coating.

Installation of LLFA® Compression Tape:

1) LLFA® Compression Tape is a self-fusing silicone base tape designed to seal leaks and currently may be used as a temporary or permanent repair for natural gas leaks.
   a) LLFA® Compression Tape is highly UV and ozone resistant and may be used to repair live natural gas leaks on PE, steel, copper, or cast iron that operate at a pressure less than 145 psi and at temperatures between -130°F to 500°F.
   b) There are no storage requirements for LLFA® Compression Tape, but it does have a 4-year shelf life. Before using, ensure that the shelf life of the product has not been exceeded.



NOTE: Always wrap more than one layer of the compression tape.

2) Remove sharp edges from the surface that could cut into the tape under tension. Wrap with 50% overlap, using the white line as a guide.
3) Start wrapping directly over the area to be sealed. Wrap once around at maximum tension until the tape reduces to ½ of its original width.
4) Continue to apply tape at maximum tension. If the tape is not fully stretched while wrapping, the internal pressure may cause the applied wrap to expand and the repair to leak.

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5) Wrap back over the center, continuing past the end of the previous layer on the other side by half a lap.
6) Then repeat, back and forth, increasing the width of the overall wrap on each successive layer. Continue until 1.25” has been covered on either side of the leak area.
7) Wrap a final layer with minimum tension. This layer increases the abrasion resistance of the repair.

IAMU Procedure #8.10: Fit-up of Weld Type Repair Sleeves

NOTE: Preventing accidental ignition procedures must be followed and a fully charged fire extinguisher must be available on-site and located upwind.

Requirements:

1) All welding performed on weld type repair sleeves must be completed using qualified welding procedures performed by a qualified welder.
2) All weld sleeves installed must have a pressure rating at least equal to the MAOP of the pipeline to which it is attached.
3) Always follow the manufacturer's recommended procedures for the fit-up and installation of weld type repair sleeves.

Installation Procedures:

1) Ensure that weld sleeve is the appropriate size, length, type and pressure rating for the intended installation.
   a) Full encirclement sleeves should be at least 4" in length.
2) Remove pipeline coating and clean the pipe, removing all foreign material that may affect the fit between the pipeline and repair sleeve.
3) The welding edges and the pipe surface, where welding will occur, must be clean and prepared to a bright shiny metal.
4) In general, weld type repair sleeves require using fillet welding procedures down the longitudinal seams and seam ends.
5) After welding is complete, check for leaks using a leak detection solution or CGI.
6) Prepare and apply an approved pipeline coating to all bare metal surfaces of the repair sleeve and the pipeline extending a sufficient distance onto existing pipeline coating.
7) If pipe-to-soil cathodic protection readings are below -0.900 volts, consideration should be given to installing an anode to provide additional cathodic protection.

IAMU Procedure #8.11: Squeeze-off of Plastic Pipe

Safety Considerations:

1) The pipe and squeeze-off tool must be properly grounded and all procedures followed for the prevention of accidental ignition.
2) A fully charged fire extinguisher must be available on-site and located upwind.
3) Squeeze-off procedures should be performed in separate bell-holes away from escaping gas so that the squeeze-off may be completed in a gas free atmosphere.
   a) Squeeze-off within the same bell-hole as blowing or escaping gas should only be performed if there is an immediate danger to life or property.
4) Restrict access to the work site for all non-emergency personnel.
5) Wear appropriate personal protective equipment such as a breathing apparatus, flash suit, FR coveralls, gloves, hoods, eye protection, etc.

Requirements:

1) The squeeze-off of pipe MAY NOT be conducted at the same location on the pipe more than one time.
2) The squeeze-off tool must be the correct type and size for the application.
3) Squeeze-off tools should not be used to control, throttle, or restrict flow. Valves or other flow control devices should be installed for those situations.

Squeeze-off Procedures:

1) Determine if the line is part of a "one-way feed" or a "loop feed".
2) Select the appropriate style and size of squeeze-off tool for the application.
3) Inspect the squeeze-off tool, ground cable, and ground rod for signs of damage.
   NOTE: If the ground cable is missing or damaged to a point that could impact its ability to provide a proper ground, it should NOT be used.
4) Before entering the bell-hole, check for the presence of gas using a CGI.
5) If possible, before entering bell-hole spray down the pipe with soapy water or an approved static suppressant to eliminate static.
6) Once in the bell-hole, continue to coat the pipe with soapy water solution or an approved static suppressant until all of the pipe surface has sufficiently been covered. If using soapy solution, it will be necessary to periodically re-coat the pipeline so that it remains constantly wet. DO NOT let the pipe dry out.
7) Wrap the pipe with burlap or cotton cloth soaked in soapy water solution from the point where the pipe enters the ground to the point of the squeeze-off in both directions. Make sure the wet burlap material remains in constant contact with the ground on both sides of the bell-hole.
8) Ground the squeeze-off tool.

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9) The squeeze-off tool shall be located at least 3 pipe diameters, or 12 inches, whichever is greater, from any fusion joint, mechanical fitting, or previous squeeze-off location.
10) Squarely install the squeeze-off tool with the pipe centered in the middle of tool.
11) The squeeze-off tool must be operated at a slow enough rate to allow stress relaxation in the pipe to occur.
    a) ASTM F1041 recommends that a maximum compression rate of 2" per minute is used. For example, it should take no less than 2.25 minutes to fully compress a 4" IPS pipe (4.5"/2 ipm).
12) DO NOT over squeeze the pipe. Squeeze down the tool until it comes in contact with the appropriately sized stops.
    a) If gas flow is not fully stopped, DO NOT try and continue tightening. It may be necessary to loosen and relocate the tool.
13) When removing the squeeze-off tool it is essential that that is done very slowly.
    a) ASTM F1041 recommends that the release rate not exceed 0.5" per minute. For example, it should take no less than 9 minutes to fully release 4" IPS pipe (4.5"/0.5 ipm)

    NOTE: When in colder weather, below 32° F, the release rate and compression rate should be doubled as the pipe is more prone to damage in colder temperatures.
14) After the squeeze-off tool is removed, the pipe should be inspected for signs of damage and DO NOT attempt to mechanically re-round the pipe as it will re-round over time.
15) To prevent the same area from being squeezed-off a second time, mark the location of the squeeze point with electrical tape or some type of pipeline coating designed for burial.
16) Record and map the squeeze-off location.

IAMU Procedure #8.12: Squeeze-off of Steel Pipe

Safety Considerations:

1) The pipe and squeeze-off tool must be properly grounded and all procedures followed for the prevention of accidental ignition.
2) A fully charged fire extinguisher must be available on-site and located upwind.
3) Squeeze-off procedures should be performed in separate bell-holes away from escaping gas so that the squeeze-off may be completed in a gas free atmosphere.
   a) Squeeze-off within the same bell-hole as blowing or escaping gas should only be performed if there is an immediate danger to life or property.
4) Restrict access to the work site for all non-emergency personnel.
5) Wear appropriate personal protective equipment such as a breathing apparatus, flash suit, FR coveralls, gloves, hoods, eye protection, etc.

Requirements:

1) The squeeze-off of steel pipe should only be performed when it is not feasible, due to immediate hazards, to isolate the segment of the system by closing valves or installing line stopple fittings.
2) The squeezed-off section of steel pipe must be replaced before the pipeline is put back into service. DO NOT attempt to re-round the steel pipe and place back into service.

Squeeze-off Procedures:

1) Determine if the line is part of a "one-way feed" or a "loop feed".
2) Select the appropriate style and size of squeeze-off tool for the application.
3) Inspect the condition of the squeeze-off tool, ground cable, and ground rod for signs of damage. It may also be necessary to check hydraulic fluid levels and ensure that the tool is functioning correctly as intended.
   NOTE: If the ground cable is missing or damaged to a point that could impact its ability to provide a proper ground, it should NOT be used.
4) Before entering bell-hole, check for the presence of gas using a CGI.
5) Remove any pipeline coating and clean the pipe.
6) Examine the pipe for the location of longitudinal weld seams, girth welds, joints, and other factors such as corrosion pitting, cracks.
7) Select the proper location for installing the squeeze-off tool. The longitudinal weld seam of the pipe should be placed directly below the upper jaw or directly above the lower jaw. DO NOT perform squeeze-off procedures in the following locations:
   a) Areas with significant corrosion pitting or metal loss.
   b) On, over, or near girth welds, pipe joints, or fittings.
8) Place the squeeze-off tool on the proper location of the pipe and center it.

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9) To begin closing the jaws, close the control valve on the hydraulic pump and start pumping the handle.
10) Continue to pump the handle and slowly close the tool completely against the stops and gas flow has stopped.
    a) It may not be possible to fully stop the flow of gas due to the internal surface conditions of the pipe and/or the presence of contaminants.
11) If, at any time, the pipe shows signs of cracking or weld seam failure, STOP squeezing off.
12) DO NOT release the squeeze-off tool until permanent repairs have been made, line stopple fittings or temporary caps have been installed.
13) Release the squeeze off tool, by opening the control valve on the pump. The jaws will open and the tool can be removed.
14) DO NOT re-round the portion of pipeline that was squeezed-off and return to service. The point of the pipeline where the squeeze-off occurred must be replaced.
15) Document and map location and repairs made for permanent records.

IAMU Procedure #8.13: Abandon/Deactivate Mains

NOTE: Preventing accidental ignition procedures must be followed and a fully charged fire extinguisher must be available on-site and located upwind.

Documentation and Record Retention:

1) All abandoned mains must be documented and recorded on the Abandoned Pipeline Record or other company approved document.
2) All abandoned mains must be identified on current maps for future reference and to aid in providing additional information for locate requests.
3) All maps and records for abandoned mains must be kept and maintained until the abandoned pipe is completely removed.

Procedures for Steel Mains:

1) If applicable, before discontinuing service through the existing main, ensure that all affected customers downstream have been notified of the situation.
2) Determine if the pipeline to be deactivated is a "one way feed" or a "loop feed".
3) If the section of pipeline does NOT contain a valve that can isolate the portion of pipeline to be deactivated, stopple fittings must be installed and IAMU Procedure #7.4: Stopper (Stopple) Pipe must be followed to eliminate the flow of gas.
4) Install a self-tapping tap tee on the pipeline to be deactivated taking into consideration the following:
   a) If the pipeline contains elevation changes from one end to the other, install the tap tee at the point of highest elevation as gas is lighter than air and will travel uphill.
   b) If the pipeline to be deactivated is longer than 100 ft. in length, consider installing tap tees at both ends.
5) With tapping tees installed, follow IAMU Procedure #7.5: Purge – Flammable or Inert Gas for purging out the pipeline to be deactivated.
6) Once the pipeline has been purged of gas and complete shut-off verified, install a bond wire spanning the section of pipe to be cut out following IAMU Procedure#8.15 - Prevent Accidental Ignition.
   a) The installation of a bond wire will aid in the prevention of accidental ignition by providing a point of electrical continuity between the pipe sections being separated by cutting.
7) DO NOT cut the pipeline between the valve or stopple fitting and tap tee.
8) When cutting the pipeline, it is recommended that wheel cutter be used, in an attempt to eliminate sparking.
9) Cut out a sufficient length of pipeline so that end caps or plugs may be installed on the open ends.
10) Before removing the bond wires from the cut section of pipe, check for the presence of gas using a CGI.

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11) On the open pipe ends and the cut-out portion of pipeline, perform an internal corrosion inspection according to IAMU Procedure #4.10: Visual Inspection for Internal Corrosion.
12) On the segment of pipeline to remain in service, install a compression or weld-on end cap over the open end, slowly open isolation valve or retract the stopper plug slowly to allow minimal gas flow and purge out remaining air through tap tee.
13) Close down tap tee and cap off open end.
14) Check for leaks using leak detection solution or CGI.
15) If the deactivated segment of pipe is to remain underground (abandoned) the open ends of the pipe must be sealed so that if a leak occurs on the in-service pipeline, it does not have an opportunity to migrate along the abandoned pipeline.
    a) The ends may be sealed using compression end caps, weld-on end caps, expandable rubber plugs, a Fernco cap, or expansion foam.
16) Clean and apply approved pipeline coating to all bare pipe and fittings to remain in service according to IAMU Procedure #4.15: Coating Application and Repair – Wrapped.

Procedures for Polyethylene Mains:

1) If applicable, before discontinuing service through the existing main, ensure that all affected customers downstream have been notified of the situation.
2) Determine if the pipeline to be deactivated is a "one way feed" or a "loop feed".
3) If the section of pipeline does NOT contain a valve that can isolate the portion of pipeline to be deactivated, squeeze-off tools should be used to eliminate gas flow according to IAMU Procedure #8.11 - Squeeze-off of Plastic Pipe.
4) Install a self-tapping tap tee on the pipeline to be deactivated taking into consideration the following:
    a) If the pipeline contains elevation changes from one end to the other, install the tap tee at the point of highest elevation as gas is lighter than air and will travel uphill.
    b) If the pipeline to be deactivated is longer than 100 ft. in length, consider installing tap tees at both ends.
5) With tapping tees installed, follow IAMU Procedure #7.5: Purge – Flammable or Inert Gas for purging out the pipeline to be deactivated.
6) Once the pipeline has been purged of gas and complete shut-off verified, follow IAMU Procedure #8.15 - Prevent Accidental Ignition for eliminating static electricity before cutting the pipe.
7) DO NOT cut the pipe between the squeeze-off tool and the tapping tee.
8) DO NOT use any electrical device to cut the pipe. It is recommended that a guillotine cutter, wheel cutter, or hand saw is used to cut the pipe.
9) Cut out a sufficient length of pipe so that end caps may be installed on the open ends.
10) On the segment of pipeline to remain in service, install a mechanical coupling end cap, or fusion end cap over the open end.

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11) Slightly open the isolation valve or squeeze-off tool to allow minimal gas flow and purge out remaining air through tap tee.
12) Close down tap tee and cap off open end.
13) Check for leaks using a CGI or leak detection solution.
14) If the deactivated segment of pipe is to remain underground (abandoned) the open ends of the pipe must be sealed so that if a leak occurs on the in-service pipeline, it does not have an opportunity to migrate along the abandoned pipeline.
    a) The ends may be sealed using mechanical end caps, threaded end caps, fusion end caps, expansion plugs or expansion foam.
15) It is recommended that the tracer wires (one for abandoned section and one for in-service section) terminate in a test station or have an anode installed off of the end to aid in future locating. See IAMU Procedure #2.7 - Installing Tracer Wire for additional details on how to terminate tracer wire.

IAMU Procedure #8.14: Abandon/Deactivate Service Lines

NOTE: Preventing accidental ignition procedures must be followed and a fully charged fire extinguisher must be available on-site and located upwind.

Documentation and Record Retention:

1) All abandoned service lines must be documented and recorded on the Abandoned Facilities Report or other company approved document.
2) All abandoned service lines must be identified on current maps for future reference and to aid in providing additional information for locate requests.
3) All maps and records for abandoned mains must be kept and maintained until the abandoned pipe is completely removed.

Procedures for Steel Service Lines:

1) If applicable, before discontinuing service, ensure that all affected customers downstream have been notified of the situation.
2) Determine if the service line to be deactivated is a single service line or a branched service line.

Service lines with "No-Blo®" tapping tee:

1) Remove pipeline coating from tap tee and approximately 16" along the service line.
2) Remove the cap from the top of the tapping tee and install proper tapping equipment.
    i) See IAMU Procedure #7.4: Stopper (Stopple) Pipe for specific procedures on how to extract the completion plug and stop off a No-Blo® tapping tee.
3) With gas flow eliminated at the tap tee, bleed of gas pressure by slowly opening the service valve at the service riser.
    i) Be sure to vent gas at least 10 feet from any ignition sources and openings into buildings. It may be necessary to install a stack on top of the service riser.
4) Once the service line has been bled off and complete shut-off verified, install a bond wire spanning the section of service line to be cut out following IAMU Procedure #8.15 - Prevent Accidental Ignition.
    i) The installation of a bond wire will aid in the prevention of accidental ignition by providing a point of electrical continuity between the pipe sections being separated by cutting.
5) Using a wheel cutter, make the first cut on the service line no further than 12" from the tap tee. Make the second cut (this may be done with a power Sawzall) approximately 12" downstream of the first cut and remove segment of pipe.
6) The open end of the pipe connected to the tap tee, must be capped off by a weld-on end cap, by using a compression end cap with the appropriate pressure rating, or by threading on an end cap. If using a threaded end cap, it is recommended that an expandable rubber plug be installed inside the pipe before capping.

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7) The open end of the pipe to be abandoned must be capped off or plugged using an expandable rubber plug, Fernco cap, threaded end cap, or expansion foam.
8) Using tapping equipment, extract the stopper from the tap tee and re-install completion plug.
9) Re-install cap on top of tapping tower.
10) Check for leaks using leak detection solution or CGI.
11) Clean and apply approved pipeline coating to all bare pipe and fittings according to IAMU Procedure #4.15: Coating Application and Repair – Wrapped.

Service lines with Autoperf® (self-tapping) tapping tee:

1) Remove pipeline coating from tap tee and approximately 16" along the service line.
2) Remove cap from the top of tapping tee tower.
3) Install proper Allen wrench or hex head rod with socket adapter to top of tap punch.
4) Rotate the punch down (clockwise) until the punch is snug or a positive shut-off is made.
   a) As you rotate the punch down to shut-off gas flow, gas pressure from the service line pipe will bleed off back through the tap tee.
5) Slowly open the service valve at the service riser to ensure that gas flow has been eliminated and all pressure has been bled off.
6) Once the service line has been bled off and complete shut-off verified, install a bond wire spanning the section of service line to be cut out following IAMU Procedure #8.15 - Prevent Accidental Ignition.
   a) The installation of a bond wire will aid in the prevention of accidental ignition by providing a point of electrical continuity between the pipe sections being separated by cutting.
7) Using a wheel cutter, make the first cut on the service line no further than 12" from the tap tee. Make the second cut (this may be done with a power Sawzall) approximately 12" downstream of the first cut and remove segment of pipe.
8) The open end of the pipe connected to the tap tee, must be capped off by a weld-on end cap, by using a compression end cap with the appropriate pressure rating, or by threading on an end cap. If using a threaded end cap, it is recommended that an expandable rubber plug be installed inside the pipe before capping.
9) The open end of the pipe to be abandoned must be capped off or plugged using an expandable rubber plug, Fernco cap, threaded end cap, expansion foam or other approved means.
10) If desired, the punch may be rotated back up (counterclockwise) to the top of the tower raising the cutter back out of the main.
11) Re-install cap on top of tapping tee tower.
12) Check for leaks using leak detection solution or CGI.
13) Clean and apply approved pipeline coating to all bare pipe and fittings according to IAMU Procedure #4.15: Coating Application and Repair – Wrapped.

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Procedures for Polyethylene Services:

1) If applicable, before discontinuing service, ensure that all affected customers downstream have been notified of the situation.
2) Determine if the service line to be deactivated is a single service line or a branched service line.

<u>Service lines with a "built-in" cutter:</u>

1) Remove cap from the top of the tapping tee tower.
2) Using proper hex head wrench, turn the punch down (clockwise) until it reaches the built-in stops or it reaches the proper depth as determined by the tap tee manufacturer to stop the flow of gas.
    a) As you rotate the punch down to shut-off gas flow, gas pressure from the service line pipe will bleed off back through the tap tee.
3) Slowly open the service valve at the service riser to ensure that gas flow has been eliminated and all pressure has been bled off.
4) Once the service line has been bled off and complete shut off verified, spray the service line in the location to be cut with anti-static spray or soapy water solution to eliminate the potential for static electricity.
5) Using pipe cutters, make the first cut on the service line no further than 12" from the tap tee. Make the second cut approximately 12" downstream of the first cut and remove segment of pipe.
6) The open end of the pipe connected to the tap tee, must be capped of by using a fusion end cap or with a mechanical end cap with the appropriate pressure rating.
7) The open end of the pipe to be abandoned must be capped off using a fusion end cap, mechanical end cap, or expansion foam.
8) Rotate the punch back up (counterclockwise) to the top of the tower raising the cutter back out of the main.
9) Re-install cap on top of tapping tee tower. DO NOT overtighten.
10) Check for leaks using leak detection solution or a CGI.
11) Cut the service line tracer wire in close proximity to the main tracer wire and install a protective device off of the cut end of the tracer wire to prevent corrosion.

IAMU Procedure #8.15: Prevent Accidental Ignition

NOTE: An operator shall take steps to minimize the danger of accidental ignition of gas in any structure or area where the presence of gas constitutes a hazard of fire or explosion.

Fire Extinguishers:

1) If escaping gas in the area of the work is possible, a fully charged fire extinguisher should be located adjacent to and upwind of the work site.

Preventing the Accidental Ignition of Discharged Gas:

1) Consideration should be given to using the following measures when gas has been discharged in areas open to the public or vehicles:
   a) Post warning signs.
   b) Direct traffic and pedestrians away from the area by the following:
      i) Barricades, fencing, or caution tape.
      ii) Signage (road closed, detour, etc.).
      iii) Use of law enforcement.

No Smoking & Open Flames:

1) Smoking and the use of 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 a gas-air mixture might cause personal injury or property damage.

Prevention of Accidental Electric Arcing:

1) To prevent accidental ignition by electric arcing, consider using the following equipment:
   a) Intrinsically safe flashlights, portable floodlights, extension cords, and any type of electrically powered tool or equipment should be of a type approved for use in hazardous atmospheres. DO NOT make electrical connections and/or disconnections within a hazardous atmosphere.
2) Internal combustion engines should NOT be placed or operated in suspected or known hazardous atmospheres.
3) When cutting or separating steel pipe, a bond wire should be installed according to the following:
   a) Remove pipe coating, tar, paint, etc., and clean to a bright shiny metal to ensure a proper connection can be made.
   b) Connect bonding cables to the pipeline, spanning the area to be cut.
   c) Bonding cables should remain attached until work is completed and the pipe has been capped or reconnected.
   d) Only remove the bonding cables once all of the work has been completed.

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Prevention of Static Electricity on Plastic Pipe:

1) Discharging of static electricity from plastic pipe to ground can cause an arc that will cause ignition if a flammable atmosphere is present.
2) It is necessary to prevent static electricity on plastic pipe when repairing a leak, performing squeeze-off procedures on an open pipe end, cutting the pipe, purging, etc.
3) All tools used on and around plastic pipe when there is a presence of gas should contain a proper ground and be grounded and hand tools in use should be of the non-sparking type.
4) One of the following methods should be used to prevent static electricity on plastic pipe:

Soapy Water Solution:

1) DO NOT use water only. The solution must contain soap to provide uniform coating.
2) If possible, prior to entering bell-hole, spray the soapy water solution on the exposed area of pipe.
3) After entering the bell-hole, check to ensure that all of the pipe surface is coated.
4) While completing the work, it may be necessary to periodically re-spray the pipe surface to ensure that it does not dry out.

Anti-Static Spray (Statikil PE®)

1) Ensure that the date on the product label has not exceeded two years.
2) Shake prior to use.
3) If possible, spray the exposed pipe prior to entering the bell-hole.
4) Spray on entire surface of the pipe until completely and uniformly coated.
5) Once sprayed, the pipe surface will appear gray in color.
   a) Inspect the pipe to ensure that all pipe surfaces appear to have a gray coating.
6) It is not necessary to continually coat with Statikil PE® as it is effective even when dry.

Wrapping Wet Burlap or Cotton Cloth:

1) Soak the burlap or cotton cloth in a soapy water solution. DO NOT use water only.
2) If possible, prior to entering the bell-hole, spray a soapy water solution on the exposed area of the pipe.
3) Once in the bell-hole, wrap the wet burlap or cotton cloth starting at the point where the pipe meets the ground (ensure that wrap is making firm contact with the ground) and continue wrapping towards the work area.
   a) Use this same technique on each side of the pipe in the bell-hole.
4) If working for an extended period of time it may be necessary to dump soapy water solution on the burlap or cotton cloths so that they remain wet. DO NOT let them dry out.
5) The burlap or cotton cloth wrap may only be removed once gas flow has been eliminated and the atmosphere checked for the presence of gas with a CGI.

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Prevention of Accidental Ignition During Welding, Cutting, and Other Hot Work:

1) Prior to welding, cutting or other hot work (tapping/stopping) in or around a structure or area containing gas facilities, a thorough check should be made with a CGI for the presence of a combustible mixture.
2) Prior to entering bell-hole, pipe, tanks, or similar confined spaces, appropriate instruments should be used to ensure a safe, breathable atmosphere.
3) Work should only begin when safe conditions are indicated and the atmosphere should be periodically re-checked for oxygen deficiency and combustible mixtures.

Pipelines Filled with Gas:

1) When a pipeline or main is to be kept full of gas during welding or cutting operations, the following is recommended:
   a) A slight flow of gas should be kept moving toward the cutting or welding operation.
   b) The gas pressure at the site of the work should be controlled by a suitable means.
   c) All slots or open ends should be closed with tape, tightly fitted canvas, or other suitable material immediately after the cut is made.
   d) Two openings should not be uncovered at the same time.

Pipelines Containing Air:

1) Before the work is started, and at intervals throughout the work progress, the atmosphere in the vicinity of the zone to be heated should be tested with a CGI or other suitable means.
2) Unless a suitable means (an air blower) is used to prevent the accumulation of a combustible gas 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.
3) When suitable means such as an air blower are not used, one or more of the following precautions should be followed, depending on the job site circumstances:
   a) The pipe or other equipment upon which the welding or cutting is to be done should be purged with an inert gas.
   b) 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 a combustible mixture does not form in the facility at the work area.

Isolating Pipeline Segments on Planned Work to Minimize the Potential of Ignition:

1) No portion of a pipeline, large-diameter service line, or main should be cut out under pressure, unless the flow of gas has been shut off or minimized by the use of line valves, line plugging equipment, stoppers, or pipe squeeze-off. Where 100% shut off is not feasible, the following precautions are recommended:

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a) Prior to starting work, plan the job to minimize the escape of gas and to limit the time and amount of gas to which personnel are exposed.
b) Ensure that the size and position of the cut allows the gas to vent properly away from personnel even those in the bell-hole.
c) Protect personnel working in a gaseous atmosphere under an overhang, in a tunnel, or in a manhole.

Isolating Pipeline Segments:

1) The operator should conduct a prework meeting to review the following with all personnel involved in the project:
   a) What method of isolation is going to be used.
   b) The purpose of each activity.
   c) Review the procedures, drawings, and schematics of the project as applicable.
   d) What are each individuals' responsibilities, including designation of who is in charge of the operation?
2) Isolation equipment should be checked for appropriate pressure rating and size for application.
3) A positive means should be provided at the work site to alert and protect personnel from unintentional pressuring. Consideration should be given to the installation of the following items:
   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.
6) Isolated segments should be monitored by the following:
   a) Monitoring should be established based on the pressure, volume, closure, and other pertinent factors.
   b) Personnel assigned to operate isolation equipment should have a means to determine pressure buildups, such as gauges and vents.
   c) Personnel monitoring pressure at remote locations should have a means of providing constant communication with the person in charge of the work site and have the authority to shut off of the flow of gas if necessary.

IAMU Procedure #8.16: Recognize and React to Generic Abnormal Operating Conditions

NOTE: Abnormal operating conditions (AOCs) for covered tasks contained in this Plan are identified in the IAMU Operator Qualification Plan for each specific covered task. AOCs listed in the IAMU Operator Qualification Plan are not considered exhaustive, and it may be necessary to identify other potential AOCs and their potential reactions.

Definitions:

1) *Abnormal Operating Condition (AOC)* – A condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may result in a condition exceeding design limits or hazard(s) to persons, property, or the environment.

AOCs Related to Gas Pressure:

Over-pressure Event:

1) If an overpressure event occurs, a hissing or blowing may be heard from a relief valve or it may be discovered by observing the pressures indicated on gauges or charts.
2) In the event of an unintended over-pressure event, the operator should consider the following, as applicable:
   a) Immediately initiate actions to reduce the pressure to at or below MAOP.
      i) This may require notifying gas supplier if they provide overpressure protection.
   b) If necessary, shut off the flow of gas.
   c) If necessary, notify appropriate police, fire, emergency responders, and mutual aid.

Under-pressure Event:

1) If an under-pressure event occurs, it may be discovered by observing pressures indicated on gauges or charts, or by customer complaints of intermittent pilot lights, or incorrect operations of appliances.
2) In the event of an unintended under-pressure event, the operator should consider the following, as applicable:
   a) Check inlet and outlet pressures at regulator stations and make appropriate adjustments if necessary.
      i) If gas supplier provides pressure regulation, it may be necessary to notify them of the situation.
      ii) It may also be necessary to conduct pressure bypass operations, see procedure IAMU Procedure #9.8 – Adjust & Monitor Flow or Pressure (Bypass Operation)
   b) Notify appropriate police, fire, emergency responders if pressure loss is due to line hit or pipeline failure.

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No Pressure Event:

1) In the event of any unplanned shut down or loss of gas service an operator should check the following, if applicable:
    a) Gas pressure provided from the gas supplier.
    b) Outlet pressure gauges or charts at regulator station.
    c) Unintended closure of a valve.
    d) Failure of pipe or fitting.
    e) Pressure limiting device has activated such as a rupture disc or slam shut.
    f) Activated excess flow valve (EFV).
2) If the event is system wide, it may be necessary to seek additional help through mutual aid.

Customer Indicated AOCs

Report of Leak or Gas Odor:

1) A customer report of a gas leak is considered an AOC that requires immediate response and is considered an emergency until proven otherwise.

Report of an Outage or Interruption of Service:

1) An operator must quickly determine the extent of the outage or interruption.
    a) Is it an isolated event or is it a larger area without service?
2) The affected area should be isolated from the gas source and all service riser valves shut off and locked or tagged.

AOCs Related to Pipeline Damage:

1) Any damage to pipe or components from natural disasters, line hits or other potential forces are considered AOCs.
2) If damage is discovered and a hazardous condition exists, the first priority is to protect life.
    a) It may be necessary to shut down or reduce the pipeline pressure to ensure safety of the public and operating personnel.
    b) It may be necessary to evacuate all nonessential personnel from the area and re-route or shut-down traffic into and out of the area.
3) It may be necessary to notify the appropriate police, fire, emergency responders, and mutual aid.
4) Make appropriate repairs and restore service to affected customers.

IAMU Procedure #8.17: Operate Within an Established Maximum Allowable Operating Pressure (MAOP)

Requirements:

1) No steel or plastic pipeline (transmission or distribution) may be operated at a pressure that exceeds MAOP that has been determined by the weakest element, the tested pressure, the highest actual operating pressure during the last 5 years, or the alternative MAOP. See Division 13.12 of Requirements and Recommendations for the specific requirements for MAOP.
2) No segment of high-pressure distribution (above 1 psi) may be operated at a pressure that exceeds 60 psi, the design pressure of the weakest element, joint pressure limits, or the determined maximum safe pressure (with overpressure protective devices).
3) If there is a change in class location due to an increase in population density, MAOP must be confirmed or revised within 24 months of the change in class location in accordance with Division 13.6 of the Requirements and Recommendations.

Documentation & Record Retention:

1) An MAOP calculation should be made and documented for all installations, so that system MAOP may be continually verified.
2) The Determination of MAOP in Natural Gas Pipelines, the Pipeline Installation Report or other approved document may be used to determine and/or record MAOP.
3) Original distribution and/or transmission design and installation documents pertaining to the calculation of MAOP must be kept and maintained for the life of the pipeline.
    a) It is recommended that MAOP documents are stored in multiple medias (paper or electronic) and locations so that if one set of records is destroyed due to fire, flooding, etc., a separate set will still be available for verification.

Procedures for Operating Within MAOP:

1) Systems may not be operated above MAOP.
2) All set points for pressure regulating equipment installed at regulator stations must be set at or below MAOP for the system to which it is attached.
3) All set points for pressure limiting equipment installed at regulator stations must be set at or below MAOP plus allowable build-up for the system to which it is attached.
    a) See table below for the MAOP plus build-up allowance:

MAOP	Allowable Build-up
<12 psi	+ 50%
≥12 psi <60 psi	+ 6 psi
≥60 psi	+ 10%

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4) In the event of an unintended overpressure event, the operating pressure must be reduced below MAOP as soon as possible.
5) If applicable, pressure recording charts and/or gauges must be analyzed for indications of pressures that exceed MAOP.
   a) If pressures exceeding MAOP are indicated, the reason must be investigated and prompt corrective action must take place.

Establishing MAOP on Steel and Plastic Pipelines:

1) DO NOT operate a segment of pipeline at a pressure that exceeds the lowest of the following:
   a) The design pressure of the weakest element as described in Division 4 and Division 5 of the Requirements and Recommendations.
   b) The pressure obtained by dividing the test pressure by the following factors:
      i) For plastic pipe in all locations the test pressure is divided by a factor of 1.5.
      ii) For steel pipe operated at 100 psi or more, the test pressure is divided by a factor found in the following table:

Class Location	Installed before Nov. 12, 1970	Factors		
		Installed after Nov. 11, 1970 and before July 1, 2020	Installed on or after July 1, 2020	Converted under §192.14
1	1.1	1.1	1.25	1.25
2	1.25	1.25	1.25	1.25
3	1.4	1.5	1.5	1.5
4	1.4	1.5	1.5	1.5

      iii) For steel pipe operated at 100 psi or less, the test pressure will be the desired MAOP multiplied by 1.5 but test pressure may not be below 90 psi.
   c) The highest actual operating pressure to which the segment was subjected during the five years preceding July 1, 1970, unless the segment was tested in accordance with paragraph b) ii), after July 1, 1965, or the segment was uprated.
   d) For steel pipe pressure equal to 85% of the highest test pressure to which the pipe has been subjected, whether by mill test or by the post installation pressure test.
   e) The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressure.

IAMU Procedure #8.18: Inserting Polyethylene Pipe as a Liner

Documentation and Record Retention:

1) Any time plastic pipe is inserted through an existing pipeline, the Pipeline Installation Report or other company approved document must be completed and kept and maintained for the life of the pipeline.

Considerations:

1) The replacement of metallic mains or services by the insertion of plastic pipe is a common practice. However, the flow capacity of the pipeline segment will be reduced by inserting a smaller pipeline through the original pipeline. With this in mind, it is recommended that a subject matter expert or licensed engineer be contacted to ensure that the smaller pipe being inserted will fulfill demand requirements.
2) If a main is being replaced by insertion methods, the Operator should not only consider flow demand as described above, but how much difficulty will be encountered if required to cut through the casing pipe to install taps or make repairs.
3) Plastic pipe inserted is more prone to contraction stresses than plastic pipe that is direct buried. For this reason, final tie-ins should only be made using heat fusion procedures or Category 1 mechanical fittings that are pull-out resistant.

Plastic Pipe Insertion Procedures:

1) Notify all affected customers of any planned shut-down and how long they can expect to be without service.
2) Follow all Iowa One-Call regulations for the marking of utilities prior to any excavations.
3) Make excavation large enough to allow for the pipe to be inserted without exceeding the minimum short-term bending radius of the pipe. The size of the excavation will depend on the size of the pipe being inserted.
4) Ensure that gas flow has been stopped by following stopping procedures, closing down a tapping tee, or closing isolation valves if possible.
5) With the gas flow eliminated, purge out the remaining gas in the pipeline following IAMU Procedure #7.5 – Purge – Flammable or Inert Gas.
6) Once purged, cut out and remove a sufficient length of the existing pipeline to be abandoned. This distance will vary depending on the size of the pipe being inserted.
7) After removing the section of steel pipe, a visual inspection for internal corrosion must be conducted and documented according to IAMU Procedure #4.10 – Visual Inspection for Internal Corrosion.

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8) Before inserting, the abandoned pipe must be prepared by completing the following steps.
   a) The open ends of the abandoned pipe must be reamed or filed to remove any sharp edges or burrs. A grinder may also be used if the pipe to be abandoned is large enough.
   b) If necessary, the abandoned pipe may need to be blown out using compressed air to remove any dirt, slag or debris.
9) After properly preparing the ends of the abandoned pipe, if available, a plastic casing bushing should be installed. If a bushing is unavailable, a split piece of plastic pipe of appropriate size and of sufficient length should be inserted along the bottom side of the abandoned pipeline to provide protection. The split piece of pipe should be secured to the abandoned pipeline using tape.
10) The open end of the plastic pipe being inserted must be plugged, capped, or taped closed before insertion.
11) If using coiled pipe, a sufficient amount of the coil should be straightened prior to insertion.
12) If possible, push the pipe through the abandoned pipeline taking care not to damage the pipe during the pushing process.
   a) If required to pull the pipe through the abandoned pipeline, a weak link must be installed on the end being pulled to ensure that elongation of the plastic pipe does not occur.
13) If during the pushing/pulling process, the pipe hits an obstruction that cannot be passed, excavate the specific area and remove the obstruction.
14) Push or pull a sufficient amount of the plastic pipe out of the end of the abandoned pipe so that a thorough visual inspection can be made of the inserted pipe checking for any damage sustained during the insertion process.
15) If any damage is found that has removed 10% or more of the nominal wall thickness and extends back into the abandoned pipeline beyond what can be visually inspected, the pipe must be pulled back, inspected, and if necessary, new pipe inserted.
   a) If the pipe cannot be inserted without sustaining damage that is less than 10% of the nominal wall thickness, the insertion process may NOT be used.

Bridging:

1) If any portion of the abandoned pipeline is cut out to remove an obstruction, the open span between pipeline sections should be bridged or spanned using a split piece of plastic pipe.
   a) This installation practice will reduce shear forces exerted on the pipe as well as provide additional protection from the open cut end of the abandoned pipeline.

After Insertion is Complete:

1) The open (annular) space left between the inserted pipe and the abandoned pipe may be filled with expansion foam that is typically used around windows or doors or some other type of approved filler.
   a) The seal must NOT have the ability to contain pressure.
   b) A seal is only installed to reduce the possibility of gas migration and moisture entering the abandoned pipeline.

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2) Tracer wire must be installed with the plastic pipe according to IAMU Procedure #2.7 - Tracer Wire Installation. The tracer wire can either be inserted along with the pipe or CAD welded to the ends of the abandoned pipeline.
3) A pressure test of the new line must be completed before final tie-ins are made.
4) Final tie-ins should only be made using heat fusion procedures or by using Category 1 mechanical fittings.

IAMU Procedure #8.19: Pipeline Heater – Inspection and Preventive Maintenance

NOTE: Always follow the specific manufacturer's recommended procedures for the inspection and maintenance of pipeline heaters that are installed to prevent the freezing of pipelines and/or pressure regulating equipment.

Requirements:

1) The inspection and maintenance of pipeline heaters should be conducted as often as required by the manufacturer or as often as necessary to maintain proper working condition.

Types of Pipeline Heaters to be Used:

Heat Tracing – A heating cable wrapped around a length of pipe or placed adjacent to the pipeline to heat the pipe and its contents.

Indirect Liquid Heaters (water bath) – Typically a horizontal, cylindrical, fluid-filled tank with a firetube with gas piping weaved through the heated liquid to raise the gas temperature.

Catalytic Heaters – Uses the principle of catalytic combustion to generate radiant, or infrared, energy that can be directed on a particular object or target. Typically used in hazardous locations.

Inspection and Maintenance of Indirect Liquid Heaters (water baths):

1) If heater is in operation, it may be necessary to take it out of operation and allow it to cool before inspecting.
2) Check all piping, components, and joints for leaks using a CGI or leak detection solution.
3) Visually inspect the unit for the following:
    a) Worn, broken, or severely corroded mechanical parts. Replace if needed.
    b) The level of the liquid in the expansion tank. If the fluid level cannot be seen, the appropriate amount of liquid must be added.
    c) All adjustment knobs are freely moving.
    d) Ensure temperature controllers are working correctly.
    e) If possible, check the firetube for soot or debris. Clean out if necessary.
4) Periodically, as determined by the manufacturer, take a sample of the liquid and send it off for analysis, checking for proper pH level, reserve alkalinity, solid content, and water/glycol concentration.
5) Check and adjust, as necessary, the set points of the high and low temperature thermostats to ensure proper working condition.

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6) Periodically, as determined by the manufacturer, it may be necessary to drain down the level of liquid to inspect the pipe coils inside of the water bath for corrosion and/or scale build-up.
7) It may be necessary, as determined by the manufacturer, to periodically replace the liquid in the water bath due to contamination or due to the lab testing results of the liquid.

Inspection and Maintenance of Catalytic Heaters:

1) Visually inspect the closure/containment unit for signs of damage, and worn or severely corroded parts. Replace if needed.
2) Check all pipe, components, and joints for leaks using a CGI or leak detection solution.
3) If a catalytic heater will not start or fails to maintain temperature, check for the following:
   a) The gas supply pressure between the regulator and the heater. This is typically 3.5" W.C. for natural gas.
   b) Check the orifice for obstructions.
   c) Check the catalyst pad for saturation. If wet or saturated, it must be dried out. The heater will NOT function if the catalyst pad is saturated with water.
   d) Inspect or replace the thermocouple.
4) Inspect the safety shut-off control valve and ensure proper working condition.

IAMU Procedure #8.20: Pipeline Security

Requirements:

1) All pipelines installed above ground and accessible to the public must have security measures installed. Security measures may include one or more of the following:
   a) Type of fencing that restricts access to the site with locks installed on all entrances.
   b) If area is accessible to the public, locking devices must be installed on all valves that, if operated, could stop gas flow to or bypass pressure regulating and pressure limiting equipment.
   c) Bollards or barricades installed to prevent accidental damage.
   d) Pipeline warning signs and/or markers.
   e) Cameras or sensing devices.
2) System security should be monitored during routine patrols, while completing inspection and maintenance tasks, and any time a report of suspicious activity has been made by either the public or company personnel.
3) A gas operator may choose to provide additional educational materials to customers and the public through their Public Awareness Program educating those along the pipeline route to be aware of changes and to report any suspicious activity.
4) If any facilities are deemed as "critical", a Security Plan must be developed according to the most current edition of the TSA's Pipeline Security Guidelines.
5) "Critical" facilities, are those facilities that if damaged or destroyed have the potential to:
   a) Disrupt or significantly reduce required service or deliverability to installations identified as critical to national defense.
   b) Disrupt or significantly reduce required service or deliverability to key infrastructure (such as power plants or major airports) resulting in major economic impact.
   c) Cause mass casualties or significant health effects.
   d) Disrupt or significantly reduce required service or deliverability resulting in a state or local government's inability to provide essential public services and emergency response for an extended period of time.
   e) Significantly damage or destroy national landmarks or monuments.
   f) Disrupt or significantly reduce the intended usage of major rivers, lakes, or waterways (for example, public drinking water for large populations or disruption of major commerce or public transportation routes).
   g) Disrupt or significantly reduce required service or deliverability to a significant number of customers or individuals for an extended period of time.
   h) Significantly disrupt pipeline system operations for an extended period of time, i.e., business critical facilities.

IAMU Procedure #8.21: Vault Maintenance

Requirements:

1) Each vault housing pressure regulating and pressure limiting equipment, and having a volumetric internal content of 200 cubic feet or more, must be inspected at least once each calendar year with intervals not exceeding 15 months to determine that it is good physical condition and adequately vented.
2) If gas if found in the vault, the equipment in the vault must be inspected for leaks, and any leaks found, must be repaired.
3) The ventilating equipment must also be inspected to determine that it is functioning properly.
4) Each vault cover must be inspected to assure that it does not present a hazard to public safety.

Documentation & Record Retention:

1) If the operator has determined that a vault meeting the 200 cubic foot capacity is found within their system, documentation of the required inspection and maintenance should be completed on the Vault Inspection & Maintenance Record or other company approved document.
2) The documentation of the inspection and maintenance must be kept and maintained for at least 10 years.

Inspection & Maintenance Procedure:

1) For operators who have pressure regulating or pressure limiting "pits" that do not meet the requirements to be considered a vault, consideration may be given to the following inspection and/or maintenance items:
   a) Inspect the pit cover/lid to ensure that it is in good shape and can handle any anticipated external loads.
   b) Prior to entry into the pit, the operator should check the atmosphere with a combustible gas indicator to ensure that a hazardous condition does not exist.
      i) If a hazardous atmosphere is discovered, entry into the vault/pit should NOT be allowed until the area has been vented and determined to be non-hazardous.
   c) Leak check all piping and components using a combustible gas indicator or leak detection solution. If any leaks are found, they must be repaired.
   d) The walls of the pit should be inspected for signs of damage, cracking, or cave-ins.
   e) The entry and exit points of piping into and out of the pit should be inspected to ensure that the walls of the pit are not placing undue strain on the pipe and/or causing damage to the pipe or pipe coating.
   f) If applicable, inspect all pipe supports for proper engagement.
   g) All piping should be inspected for signs of corrosion and if corrosion with metal loss is discovered, remedial action must take place.
2) Complete the required documentation.

CITY OF BLOOMFIELD, IOWA

PART NINE

Regulator Stations & Valves:

Inspection and Testing

IAMU Procedure #9.0: Spring-Loaded, Pressure-Regulating Device – Inspection & Testing, Preventive and Corrective Maintenance

Requirements:

1) Regulator stations and overpressure protection devices must be inspected at least once each calendar year, with intervals not exceeding 15 months.
2) The following items must be inspected and/or tested:
   a) Area is protected from damage from outside forces (cars, trucks, falling objects, unwanted entry, etc.).
   b) The equipment is in good mechanical condition.
   c) Adequate in capacity and reliability of operation.
   d) Set to function at the desired pressure.
   e) Properly installed to prevent dirt, liquids, icing, and other conditions that might prevent proper operation.
3) All regulator set points must be set to pressure at or below the determined downstream maximum allowable operating pressure (MAOP) and care must be taken during start-up to ensure that MAOP is not exceeded.
4) The capacity of the regulator and overpressure protection device must be verified by testing in place or by sizing calculations.
   a) If no changes to equipment have been made from the previous inspection date, then capacities DO NOT need to be recalculated, but it should be verified with each inspection.
   b) If changes to equipment are made such as installing a new regulator, a different spring, or changing the size of the orifice, new capacity calculations must be made.
   c) If it is determined by the capacity calculations that the overpressure protection device is inadequate, an additional or larger device must be installed to meet the capacity requirements.

Documentation and Record Retention:

1) All records of regulator station inspections may be completed on the Regulator Station Inspection Record or other company approved document and must be kept and maintained for a minimum of 10 years.
2) If pressure regulation and overpressure protection is provided by the gas supplier, the inspection records must be obtained from the gas supplier for each calendar year.

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NOTE: The following procedure is generic in nature and is not intended to be specific to all types of regulator station configurations and manufacturer requirements.

General Station Inspection:

1) When arriving at the station check for the following:
   a) What is the general condition of the station? Does it need to be mowed, sprayed with weed killer, gravel added, etc.?
   b) Is there proper signage? If signage is missing, damaged, or faded, it must be replaced.
   c) Are locking devices installed on appropriate valves or entrance gates?
   d) Does the station need painted?
2) Check all of the pipe to soil interfaces for the condition of the pipe coating. If pipe coating does not extend above ground level or it is damaged or disbonded it should be repaired or replaced.
3) If station piping contains flanges, check all flange bolts for proper thread engagement. There should be at least two threads extending beyond the nuts.
4) Check all pipe supports for proper engagement and that there is a dielectric piece of rubber, plastic, or rock-guard installed between the support and the pipe.
5) If applicable, check the pipeline heater and ensure that it is operating correctly at the desired temperature.

Regulator Inspection Procedures:

1) Examine the regulator for any visible signs of damage or imperfections that could impair its ability to function correctly.
2) Examine the regulator and attached piping for signs of atmospheric corrosion.
   a) If signs of atmospheric corrosion are discovered, paint, repair, or replace as necessary.
3) If applicable, check the regulator vent and ensure that it is pointed down and contains a screen. If the screen is blocked by any foreign material, it must be removed.
4) Locate the nameplate or tag on the regulator and check the spring range to ensure that it is the desired range for the specific installation requirements.

Regulator Testing Procedures:

1) To ensure correct operation, verify the pressure set point and lock-up of the regulator.
2) To verify the correct pressure set point, perform the following:
   a) If a pressure gauge is already present, skip to step e).
   b) If a gauge is not already installed downstream of the regulator, close the upstream valve (before the regulator) and the downstream valve (after the regulator) to stop gas flow and install a gauge at a point between the downstream valve and the regulator.
   c) Slowly open the upstream valve until it is fully open.
   d) Slowly and partially open the downstream valve so that a minimal flow of gas is obtained.

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e) Verify the pressure setting of the regulator under minimal flow conditions by obtaining a reading from the gauge. If the pressure reading obtained is the pressure desired, no adjustments are needed.
   i) If the pressure reading obtained is lower than desired, remove the cap from the adjustment screw on the regulator and slowly and incrementally turn the screw clockwise to increase the pressure to the desired setting.
   ii) If the pressure reading obtained is higher than desired, remove the cap from the adjustment screw on the regulator and slowly and incrementally turn the screw counterclockwise to decrease the pressure to the desired setting.

3) To verify that the regulator locks-up (stops flow of gas at desired pressure), slowly close the downstream valve while keeping an eye on the pressure gauge. Once the downstream valve has been fully closed the regulator should lock-up and stop the flow of gas at a pressure within the manufacturer's specifications for that specific regulator. Depending on the type and size of the regulator, this is typically within 1-2 psi above set point.
4) If the regulator does not lock-up and the pressure continues to climb after the downstream valve is fully closed, make additional attempts to get the regulator to lock-up by slightly opening and then closing the downstream valve.
5) If, after multiple attempts, lock-up within desired parameters is not obtained, it will be necessary to take the regulator out of service and clean, repair, or replace.

General Maintenance Procedures:

1) Check all connections and vents for leaks using a CGI or leak detection solution.
   a) If any leaks are discovered, they should be repaired.
2) Regulator parts and components such as the spring, seat, orifice, and diaphragm are subject to normal wear and must be replaced as necessary depending on the severity of service conditions.
   a) DO NOT attempt to rebuild a regulator unless sufficient training has been completed.
   b) It is recommended that regulator rebuild kits are purchased and are available at any time so that maintenance and repairs can be completed as needed.
   c) Consideration should be made to rebuilding regulators at regulator stations at scheduled frequencies to ensure continuous proper working condition.

IAMU Procedure #9.1: Spring-Loaded, Pressure-Relieving Device – Inspection & Testing, Preventive and Corrective Maintenance

Requirements:

1) Regulator stations and overpressure protection devices must be inspected at least once each calendar year, with intervals not exceeding 15 months.
2) The following items must be inspected and/or tested:
   a) Area is protected from damage from outside forces (cars, trucks, falling objects, unwanted entry, etc.).
   b) The equipment is in good mechanical condition.
   c) Adequate in capacity and reliability of operation.
   d) Set to function at the desired pressure.
   e) Properly installed to prevent dirt, liquids, icing, and other conditions that might prevent proper operation.
3) The capacity of the regulator and overpressure protection device must be verified by testing in place or by sizing calculations.
   a) If no changes to equipment have been made from the previous inspection date, then capacities DO NOT need to be recalculated, but it should be verified with each inspection.
   b) If changes to equipment are made such as installing a new regulator, a different spring, or changing the size of the orifice, new capacity calculations must be made.
   c) If it is determined by the capacity calculations that the overpressure protection device is inadequate, an additional or larger device must be installed to meet the capacity requirements.
4) The set point of the relief valve must be set at or lower than the maximum allowable operating pressure (MAOP) plus build-up for downstream piping and components. See the following table for MAOP plus build-up allowance.

MAOP	Allowable Build-up
<12 psi	+ 50%
≥12 psi <60 psi	+ 6 psi
≥60 psi	+ 10%

Documentation and Record Retention:

1) All records of regulator station inspections may be completed on the Regulator Station Inspection Record or other company approved document and must be kept and maintained for a minimum of 10 years.
2) If pressure regulation and overpressure protection is provided by the gas supplier, the inspection records must be obtained from the gas supplier for each calendar year.

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NOTE: The following procedure is generic in nature and is not intended to be specific to all types of regulator station configurations and manufacturer requirements.

General Station Inspection:

1) When arriving at the station check for the following:
   a) What is the general condition of the station? Does it need to be mowed, sprayed with weed killer, gravel added, etc.?
   b) Is there proper signage? If signage is missing, damaged, or faded, it must be replaced.
   c) Are locking devices installed on appropriate valves or entrance gates?
   d) Does the station need painted?
2) Check all of the pipe to soil interfaces for the condition of the pipe coating. If pipe coating does not extend above ground level or it is damaged or disbonded it should be repaired or replaced.
3) If station piping contains flanges, check all flange bolts for proper thread engagement. There should be at least two threads extending beyond the nut.
4) Check all pipe supports for proper engagement and that there is a dielectric piece of rubber, plastic, or rock-guard installed between the support and the pipe.
5) If applicable, check the pipeline heater and ensure that it is operating correctly at the desired temperature.

Relief Valve Inspection Procedures:

1) Examine the relief valve for any visible signs of damage or imperfections that could impair its ability to function correctly.
2) Examine the relief valve and attached piping for signs of atmospheric corrosion.
   a) If signs of atmospheric corrosion are discovered, paint, repair, or replace as necessary.
3) Check the relief valve vent and if it is pointed upward, ensure that it is capped with a device that is intended to blow off or open when the relief valve vents as intended.
4) Locate the nameplate or tag on the relief valve and check the spring range to ensure that it is the desired range for the specific installation requirements.

Relief Valve Testing Procedures:

1) To ensure correct operation of the relief valve, it must be verified that the relief valve will vent gas at the desired pressure to maintain pressure at or below MAOP plus build-up.
2) If the relief valve piping contains a test port where the relief valve may be isolated from the gas system and tested with air, perform the following:
   a) Shut off valve upstream (before) the relief valve.

   NOTE: Once the pressure relief valve has been isolated from the regulator station by closing the valve, system pressure must be constantly monitored to ensure that pressure does not exceed MAOP plus build-up.

   b) Connect test fitting with gauge to the test port.

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c) Ensure that the initial pressure of the test air is below the previously known set point of the relief valve.
d) Open the valve on the test fitting introducing the test air.
e) While constantly monitoring the pressure gauge, slowly increase the pressure of the test air until the desired set point of the relief valve is obtained.
    i) If no audible hissing is heard at the desired set pressure, it may be necessary to increase pressure by 1-2 psi to overcome the static pressure of the spring inside the relief valve.
    ii) If the test pressure is increased by 2 or more psi above the desired set point and an audible hissing or blowing is still not obtained, it may be necessary to lower the set point of the relief valve by turning the adjustment screw counterclockwise until the relief valve starts to vent.
f) Once the hissing noise from the relief valve is confirmed at the desired set point, slowly decrease the test air pressure back down until the hissing noise is no longer heard and the relief re-seats. If hissing noise does not stop see step 4).
g) Remove the test fitting from the test port.
h) Slowly turn on the valve upstream of the relief valve and return to service.

3) If the relief valve piping does not contain a test port, it will be necessary to use system pressure to test the relief valve as follows:

   NOTE: If using system pressure to test relief valve, it is essential that MAOP plus build-up is not exceeded.

   a) Ensure that a gauge is installed at a point near the relief valve.
   b) Slowly increase system pressure by increasing the set point of the regulator upstream of the relief valve.
   c) While constantly monitoring the pressure gauge, continue to increase pressure until the desired set point of the relief valve is reached.
      i) If no audible hissing is heard at the desired set pressure, it may be necessary to increase pressure by 1-2 psi to overcome the static pressure of the spring inside the relief valve.
      ii) If the pressure is increased by 2 or more psi above the desired set point and an audible hissing or blowing is still not obtained, it may be necessary to lower the set point of the relief valve by turning the adjustment screw counterclockwise until the relief valve starts to vent.
   d) Once the hissing noise from the relief valve is confirmed at the desired set point, slowly decrease the system pressure back down until the hissing noise is no longer heard and the relief re-seats. Continue to decrease pressure of regulator until set point is obtained.

4) If during testing by either air or system pressure the relief valve does not seat off and stop venting, it may be necessary to try and re-seat the relief valve by increasing and decreasing pressure above and below set point in attempt to re-seat.
5) If after multiple attempts, the relief valve will not re-seat, it will be necessary to remove the relief valve from service and clean, repair, or replace as needed.

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General Maintenance Procedures:

1) Check all connections and vents for leaks using a CGI or leak detection solution.
   a) If any leaks are discovered, they should be repaired.
2) Relief valve parts and components such as the spring, seat, and orifice (if applicable) are subject to normal wear and must be replaced as necessary depending on the severity of service conditions.
   a) DO NOT attempt to rebuild a relief valve unless sufficient training has been completed.
   b) It is recommended that relief valve rebuild kits are purchased and are available at any time so that maintenance and repairs can be completed as needed.
   c) Consideration should be made to rebuilding relief valves at regulator stations at scheduled frequencies to ensure continuous proper working condition.

IAMU Procedure #9.2: Pilot Operated, Pressure-Regulating Device – Inspection & Testing, Preventive and Corrective Maintenance

Requirements:

1) Regulator stations and overpressure protection devices must be inspected at least once each calendar year, with intervals not exceeding 15 months.
2) The following items must be inspected and/or tested:
   a) Area is protected from damage from outside forces (cars, trucks, falling objects, unwanted entry, etc.).
   b) The equipment is in good mechanical condition.
   c) Adequate in capacity and reliability of operation.
   d) Set to function at the desired pressure.
   e) Properly installed to prevent dirt, liquids, icing, and other conditions that might prevent proper operation.
3) All regulator set points must be set to pressure at or below the determined downstream maximum allowable operating pressure (MAOP) and care must be taken during start-up to ensure that MAOP is not exceeded.
4) The capacity of the regulator and overpressure protection device must be verified by testing in place or by sizing calculations.
   a) If no changes to equipment have been made from the previous inspection date, then capacities DO NOT need to be recalculated, but it should be verified with each inspection.
   b) If changes to equipment are made such as installing a new regulator, a different spring, or changing the size of the orifice, new capacity calculations must be made.
   c) If it is determined by the capacity calculations that the overpressure protection device is inadequate, an additional or larger device must be installed to meet the capacity requirements.

Documentation and Record Retention:

1) All records of regulator station inspections may be completed on the Regulator Station Inspection Record or other company approved document and must be kept and maintained for a minimum of 10 years.
2) If pressure regulation and overpressure protection is provided by the gas supplier, the inspection records must be obtained from the gas supplier for each calendar year.

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NOTE: The following procedure is generic in nature and is not intended to be specific to all types of regulator station configurations and manufacturer requirements.

General Station Inspection:

1) When arriving at the station check for the following:
   a) What is the general condition of the station? Does it need to be mowed, sprayed with weed killer, gravel added, etc.?
   b) Is there proper signage? If signage is missing, damaged, or faded, it must be replaced.
   c) Are locking devices installed on appropriate valves or entrance gates?
   d) Does the station need painted?
2) Check all of the pipe to soil interfaces for the condition of the pipe coating. If pipe coating does not extend above ground level or it is damaged or disbonded it should be repaired or replaced.
3) If station piping contains flanges, check all flange bolts for proper thread engagement. There should be at least two threads extending beyond the nut.
4) Check all pipe supports for proper engagement and that there is a dielectric piece of rubber, plastic, or rock-guard installed between the support and the pipe.
5) If applicable, check the pipeline heater and ensure that it is operating correctly at the desired temperature.

Regulator Inspection Procedure:

1) Examine the pilot regulator and main body for any visible signs of damage or imperfections that could impair its ability to function correctly.
2) Special attention should be given to pilot line tubing, checking for signs of damage or kinking of the tubing and the tubing connections.
3) Examine the regulator and attached piping for signs of atmospheric corrosion.
   a) If signs of atmospheric corrosion are discovered, paint, repair, or replace as necessary.
4) If applicable, check regulator vents and ensure that it is pointed down and contains a screen. If the screen is blocked by any foreign material, it must be removed.
5) If the regulator contains a restrictor block, it should be checked to verify that it is in the proper position.
6) Locate the nameplate or tag on the regulator and check the spring range to ensure that it is the desired range for the specific installation requirements.

Regulator Testing Procedure:

NOTE: All pressure adjustments made on pilot operated, pressure regulating equipment, is completed by making an adjustment to the pilot regulator adjustment screw.

1) To ensure the correct operation of the regulator or regulators installed in a series, the set point and lock-up pressures must be verified.

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For a Single Pilot-Operated Regulator:

1) Partially close the downstream valve (after the regulator) to restrict flow so that if any pressure adjustments are needed, they can be made under minimal flow conditions.
2) Check gauge for set pressure.
   a) If pressure reading obtained from gauge is at the desired pressure no adjustments are needed.
   b) If pressure reading obtained from gauge is lower than the desired pressure, remove the cap on the pilot adjustment screw and slowly and incrementally turn the adjustment screw clockwise to increase pressure until the desired pressure is obtained.
   c) If pressure reading obtained from gauge is higher than the desired pressure, remove the cap on the pilot adjustment screw and slowly and incrementally turn the adjustment screw counter clockwise to decrease pressure until the desired pressure is obtained.
3) With the regulator now set at the correct pressure, the lock-up pressure of the regulator must now be verified.
   a) Slowly close the downstream valve (after the regulator) to stop the flow of gas.
   b) Once the downstream valve has been fully closed, the regulator should lock-up and stop the flow of gas at a pressure within the manufacturer's specifications for that specific regulator. Depending on the type and size of the regulator, this is typically within 1-2 psi above set point.
4) If the regulator does not lock-up and the pressure continues to climb after the downstream valve is fully closed, make additional attempts to get the regulator to lock-up by slightly opening and then closing the downstream valve.
5) If, after multiple attempts, lock-up within desired parameters is not obtained, it will be necessary to take the regulator out of service and clean, repair, or replace.

For a Wide-Open Monitor Regulator Installed in a Series (Worker/Monitor Configuration):

NOTE: If the regulator station has regulators installed in a series in a worker/monitor configuration, the monitor regulator may be deemed as the overpressure protection device if it has sufficient capacity. Some worker/monitor configurations may have a stand-alone relief valve installed as the single over pressure protection device or to provide additional protection.

1) If the monitor regulator is installed as the overpressure protection device, the set point of the monitor regulator must be at or below maximum allowable operating pressure (MAOP) plus build-up for piping and components located downstream. See the following table for MAOP plus build-up allowance.

MAOP	Allowable Build-up
<12 psi	+ 50%
≥12 psi <60 psi	+ 6 psi
≥60 psi	+ 10%

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1) Partially close the downstream valve (after the regulator) to restrict flow so that adjustments of the regulators installed in a series may be completed under minimal flow conditions.
2) Remove the adjustment caps from the pilot regulators, but DO NOT make any adjustments.
3) Check gauge for pressure reading. The pressure reading obtained will be for what the "working" regulator is initially providing pressure at.
4) To determine the set point of the "monitor" regulator, increase the pressure setting of the "working" regulator by slowly and incrementally turning the adjustment screw clockwise to increase pressure until the "monitor" regulator takes over and provides pressure regulation.
   a) Check the gauge and obtain a reading at the point where the "monitor' regulator takes over. This will be the set-point of the "monitor" regulator.
   b) If the set point of the monitor regulator is higher or lower than desired, make adjustments to the pilot adjustment screw until the desired set point of the "monitor" regulator is obtained.
5) Now check for the lock-up pressure of the "monitor" regulator by slowly closing the downstream valve.
   a) Once the downstream valve has been fully closed, the regulator should lock-up and stop the flow of gas at a pressure within the manufacturer's specifications for that specific regulator. Depending on the type and size of the regulator, this is typically within 1-2 psi above set point.
   b) If the regulator does not lock-up and the pressure continues to climb after the downstream valve is fully closed, make additional attempts to get the regulator to lock-up by slightly opening and then closing the downstream valve.
   c) If, after multiple attempts, lock-up within desired parameters is not obtained, it will be necessary to take the regulator out of service and clean, repair, or replace.
6) With the "monitor" regulator now tested and verified, it is necessary to test the "working" regulator.
   a) With the "monitor" regulator providing pressure regulation, decrease the pressure setting of the "working" regulator by slowly and incrementally turning the adjustment screw counter clockwise until the "working" regulator takes over and provides pressure regulation.
   b) Continue to decrease pressure until the desired set point is obtained. It is recommended that the worker/monitor regulators be set with a pressure difference of approximately 3-5 psi.
7) Now check for the lock-up pressure of the "monitor" regulator by slowly closing the downstream valve.
   a) Once the downstream valve has been fully closed, the regulator should lock-up and stop the flow of gas at a pressure within the manufacturer's specifications for that specific regulator. Depending on the type and size of the regulator, this is typically within 1-2 psi above set point.
   b) If the regulator does not lock-up and the pressure continues to climb after the downstream valve is fully closed, make additional attempts to get the regulator to lock-up by slightly opening and then closing the downstream valve.

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c) If, after multiple attempts, lock-up within desired parameters is not obtained, it will be necessary to take the regulator out of service and clean, repair, or replace.

General Maintenance Procedures:

1) Check all connections and vents for leaks using a CGI or leak detection solution.
   a) If any leaks are discovered, they should be repaired.
2) Pilot regulator and main body parts and components such as the spring, seat, orifice, pilot stem and diaphragm are subject to normal wear and must be replaced as necessary depending on the severity of service conditions.
   a) DO NOT attempt to rebuild a pilot regulator or main body unless sufficient training has been completed.
   b) It is recommended that regulator rebuild kits, for both the pilot regulator and main body, are purchased and are available at any time so that maintenance and repairs can be completed as needed.
   c) Consideration should be made to rebuilding regulators at regulator stations at scheduled frequencies to ensure continuous proper working condition.

IAMU Procedure #9.3: Pilot Operated, Pressure-Limiting Device – Inspection & Testing, Preventive and Corrective Maintenance

Requirements:

1) Regulator stations and overpressure protection devices must be inspected at least once each calendar year, with intervals not exceeding 15 months.
2) The following items must be inspected and/or tested:
   a) Area is protected from damage from outside forces (cars, trucks, falling objects, unwanted entry, etc.).
   b) The equipment is in good mechanical condition.
   c) Adequate in capacity and reliability of operation.
   d) Set to function at the desired pressure.
   e) Properly installed to prevent dirt, liquids, icing, and other conditions that might prevent proper operation.
3) The capacity of the regulator and overpressure protection device must be verified by testing in place or by sizing calculations.
   a) If no changes to equipment have been made from the previous inspection date, then capacities DO NOT need to be recalculated, but it should be verified with each inspection.
   b) If changes to equipment are made such as installing a new regulator, a different spring, or changing the size of the orifice, new capacity calculations must be made.
   c) If it is determined by the capacity calculations that the overpressure protection device is inadequate, an additional or larger device must be installed to meet the capacity requirements.
4) The set point of the relief valve must be set lower than the maximum allowable operating pressure (MAOP) plus build-up for downstream piping and components. See the following table for MAOP plus build-up allowance.

MAOP	Allowable Build-up
<12 psi	+ 50%
≥12 psi <60 psi	+ 6 psi
≥60 psi	+ 10%

Documentation and Record Retention:

1) All records of regulator station inspections may be completed on the Regulator Station Inspection Record or other company approved document and must be kept and maintained for a minimum of 10 years.
2) If pressure regulation and overpressure protection is provided by the gas supplier, the inspection records must be obtained from the gas supplier for each calendar year.

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NOTE: The following procedure is generic in nature and is not intended to be specific to all types of regulator station configurations and manufacturer requirements.

General Station Inspection:

1) When arriving at the station check for the following:
   a) What is the general condition of the station? Does it need to be mowed, sprayed with weed killer, gravel added, etc.?
   b) Is there proper signage? If signage is missing, damaged, or faded, it must be replaced.
   c) Are locking devices installed on appropriate valves or entrance gates?
   d) Does the station need painted?
2) Check all of the pipe to soil interfaces for the condition of the pipe coating. If pipe coating does not extend above ground level or it is damaged or disbonded it should be repaired or replaced.
3) If station piping contains flanges, check all flange bolts for proper thread engagement. There should be at least two threads extending beyond the nut.
4) Check all pipe supports for proper engagement and that there is a dielectric piece of rubber, plastic, or rock-guard installed between the support and the pipe.
5) If applicable, check the pipeline heater and ensure that it is operating correctly at the desired temperature.

Relief Valve Inspection Procedures:

1) Examine the pilot relief, main body, and tubing for any visible signs of damage or imperfections that could impair its ability to function correctly.
2) Examine the relief valve and attached piping for signs of atmospheric corrosion.
   a) If signs of atmospheric corrosion are discovered, paint, repair, or replace as necessary.
3) Check the relief valve vent and if it is pointed upward, ensure that it is capped with a device that is intended to blow off or open when the relief valve vents as intended.
4) Locate the nameplate or tag on the relief valve and check the spring range to ensure that it is the desired range for the specific installation requirements.

Relief Valve Testing Procedures:

1) To ensure correct operation of the relief valve, it must be verified that the relief valve will vent gas at the desired pressure to maintain pressure below MAOP plus build-up.
2) If the relief valve piping contains a test port where the relief valve may be isolated from the system and tested with air, perform the following:
   a) Shut off valve upstream (before) the relief valve.

   NOTE: Once the pressure relief valve has been isolated from the regulator station by closing the valve, system pressure must be constantly monitored to ensure that pressure does not exceed MAOP plus build-up.

   b) Connect test fitting with gauge to the test port.

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c) Ensure that the initial pressure of the test air is below the previously known set point of the relief valve.
d) Open the valve on the test fitting introducing the test air.
e) While constantly monitoring the pressure gauge, slowly increase the pressure of the test air until the desired set point of the relief valve is obtained.
    i) Listen for an audible hissing or feeling of a slight flow of gas from the pilot relief vent.
    ii) If no audible hissing is heard at the desired set pressure, it may be necessary to increase pressure by 1-2 psi to overcome the static pressure of the spring inside the relief valve.
    iii) If the test pressure is increased by 2 or more psi above the desired set point and an audible hissing or blowing is still not obtained, it may be necessary to lower the set point of the relief valve by turning the adjustment screw counterclockwise until the relief valve starts to vent.
f) Once the hissing noise from the relief valve is confirmed at the desired set point, slowly decrease the test air pressure back down until the hissing noise is no longer heard and the relief re-seats. If hissing noise does not stop see step 4).
g) Remove the test fitting from the test port.
h) Slowly turn on the valve upstream of the relief valve and return to service.

3) If the relief valve piping does not contain a test port, it will be necessary to use system pressure to test the relief valve as follows:

   NOTE: If using system pressure to test relief valve, it is essential that MAOP plus build-up is not exceeded.

   a) Ensure that a gauge is installed at a point near the relief valve.
   b) Slowly increase system pressure by increasing the set point of the regulator upstream of the relief valve.
   c) While constantly monitoring the pressure gauge, continue to increase pressure until the desired set point of the relief valve is reached.
       i) If no audible hissing is heard or felt at the desired set pressure, it may be necessary to increase pressure by 1-2 psi to overcome the static pressure of the spring inside the relief valve.
       ii) If the pressure is increased by 2 or more psi above the desired set point and an audible hissing or blowing is still not obtained, it may be necessary to lower the set point of the relief valve by turning the adjustment screw counterclockwise until the relief valve starts to vent.
   d) Once the hissing noise from the pilot relief valve is confirmed at the desired set point, slowly decrease the system pressure back down until the hissing noise is no longer heard and the relief re-seats. Continue to slowly decrease pressure to set point desired.

4) If during testing by either air or system pressure the relief valve does not seat off and stop venting, it may be necessary to try and re-seat the relief valve by increasing and decreasing pressure above and below set point in attempt to re-seat.

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5) If after multiple attempts, the relief valve will not re-seat, it will be necessary to remove the relief valve from service and clean, repair, or replace as needed.

General Maintenance Procedures:

1) Check all connections and vents for leaks using a CGI or leak detection solution.
   a) If any leaks are discovered, they should be repaired.
2) Pilot relief and main body parts and components such as the spring, seat, and orifice (if applicable) are subject to normal wear and must be replaced as necessary depending on the severity of service conditions.
   a) DO NOT attempt to rebuild a pilot relief valve or main body unless sufficient training has been completed through the manufacturer or a third-party source.
   b) It is recommended that pilot relief and main body rebuild kits are purchased and are available at any time so that maintenance and repairs can be completed as needed.
   c) Consideration should be made to rebuilding relief valves at regulator stations at scheduled frequencies to ensure continuous proper working condition.

IAMU Procedure #9.4: Manually Opening and Closing Valves

Requirements:

1) All transmission line valves must be at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
2) All distribution main line valves classified as Emergency Valves, which are essential to the safe operation of the distribution system, must be at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
3) All distribution valves not classified as emergency valves must be operated at least partially (1/8 of a turn) at once each 5 calendar years with intervals not exceeding 63 months.
4) If at any time a transmission valve or distribution main line Emergency Valve is found to be inaccessible or inoperable, the valve must be promptly repaired, replaced or an alternative valve is designated to take its place.

Documentation and Record Retention:

1) Documentation may be provided on the Valve Inspection and Maintenance Record or other approved company document and must be kept and maintained for at least 10 years.

Valve Operation Procedures:

1) Review valve maintenance records and system maps to ensure that the correct valve wrenches or tools are available for operation.
2) Identify the valve location and ensure that the correct valve is going to be operated.
3) Identify the valve type (plug, ball, or gate), material (plastic or steel), and size.
4) Verify the position of the valve as found (open or closed).
5) Before operating the valve, ensure that flow conditions are such that if the valve is fully closed, service downstream will not be affected.
6) If applicable, remove the locking device.
7) Select the appropriate valve wrench or tool to operate the valve.
8) Slowly turn the valve open or closed by applying steady pressure on the valve wrench or handle. DO NOT jerk the valve wrench or tool as this could damage or break the valve body or stem.

NOTE: Plastic ball valves generally turn much easier than steel plug valves and required less pressure to operate the valve.

9) Return the valve to the original as found position.
10) If applicable, install locking device.

IAMU Procedure #9.5: Valve – Visual Inspection and Partial Operation

Requirements:

1) All transmission line valves must be inspected and at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
2) All distribution main line valves classified as Emergency Valves, which are essential to the safe operation of the distribution system, must be inspected and at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
3) All distribution valves not classified as emergency valves must be operated at least partially (1/8 of a turn) at once each 5 calendar years with intervals not exceeding 63 months.
4) If at any time a transmission valve or distribution main line Emergency Valve is found to be inaccessible or inoperable, the valve must be promptly repaired, replaced or an alternative valve may be designated to take its place.

Documentation and Record Retention:

1) Documentation may be provided on the Valve Inspection and Maintenance Record or other approved company document and must be kept and maintained for at least 10 years.

Visual Inspection of Above Ground Valves:

1) Inspect for the following, if applicable:
   a) Is the valve accessible?
   b) Check for signs of damage that could prevent the valve from operating correctly.
   c) Check for signs of atmospheric corrosion.
   d) Is there a locking device, if not, should there be?
   e) Check for leaks using a CGI or leak detection solution.

Visual Inspection of Below Ground Valves:

1) Inspect for the following, if applicable:
   a) Is the valve accessible?
      i) This may include the valve lid, valve box, valve stem, or valve body.
      ii) Is the valve box damaged, misaligned, or full of dirt?
   b) Check for signs of damage that could prevent the valve from operating correctly.
   c) Check for signs of external corrosion.
      i) If signs of external corrosion are found it may be necessary to dig up the valve to conduct further investigations.

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d) Check for leaks using a CGI.
    i) Indications of a leaking valve may also include a white "mold like" substance found on the valve lid or valve box.

Valve Operation Procedures:

1) Review valve maintenance records and system maps to ensure that the correct valve wrenches or tools are available.
2) Identify the valve location and ensure that the correct valve is going to be operated.
3) Identify the valve type (plug, ball, or gate), material (plastic or steel), and size.
4) Verify the position of the valve as found (open or closed).
5) Before operating the valve, ensure that flow conditions are such that if the valve is fully closed, service downstream will not be affected. If unable to fully close the valve due to conditions downstream, the valve must at least be partially operated 1/8th of a turn.
6) If applicable, remove the locking device.
7) Select the appropriate valve wrench or tool to operate the valve.
8) Slowly turn the valve open or closed by applying steady pressure on the valve wrench or handle. DO NOT jerk the valve wrench or tool as this could damage or break the valve body or stem.

NOTE: Plastic ball valves generally turn much easier than steel plug valves and required less pressure to operate the valve.

9) Return the valve to the original as found position.
10) If applicable, install locking device.

IAMU Procedure #9.6: Valve – Preventive and Corrective Maintenance

NOTE: Always follow the manufacturer's recommended procedures for performing preventive and corrective maintenance on main line valves.

Requirements:

1) Preventive and corrective maintenance on line valves must be completed as often as necessary to ensure proper working condition or at intervals required by the manufacturer's recommended procedures.

Steel or Polyethylene Floating Ball Valve Preventive Maintenance:

1) Sealed, non-greaseable, floating ball valves DO NOT require regularly scheduled maintenance to maintain proper operation or sealing.
2) Although routine maintenance is NOT required, if the valve is a transmission line valve or a distribution system emergency valve, it must still be inspected and at least partially operated as described in IAMU Procedure #9.5: Valves – Visual Inspection and Partial Operation.

Steel or Polyethylene Floating Ball Valve Corrective Maintenance:

1) Corrective maintenance may not be performed on polyethylene floating ball valves. If corrective measures are needed, the valve must be replaced.
2) If a steel floating ball valve is found to be leaking, a seal kit may be installed to repair the valve or a new valve may be installed.
   a) If installing a new seal kit to correct the leak, the manufacturer's recommended procedures for that specific valve must be followed.

Steel Plug Valve Preventive Maintenance:

1) In general, the only periodic maintenance required for steel plug valves is the application of sealant, if needed, during the completion of valve inspections and partial operation.
2) Although it is recommended that sealant is injected into the valve annually during valve inspections and partial operation, care should be taken not to over grease the valve and force excess grease down into the main line.
3) The following procedure for injecting sealant with a high-pressure hand gun is generic in nature and does NOT apply to all brands and sizes of plug valves. Always follow the manufacturer's recommended procedures.
   a) Inspect the high-pressure hand gun for signs of damage, check the gauge for proper working condition, and ensure that the gun contains a sufficient level of sealant.

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b) Clean all dirt and debris from the top of the fitting (button) on the valve and the coupler located on the end of the hose found on the gun.
c) Check to make sure that the valve having sealant applied to is in the fully OPEN position.
d) Ensure that the gun is NOT under any pressure by opening the pressure release valve on the side of the gun.
e) Install the coupler over the fitting (button) on the valve and ensure that it is fully engaged.
f) Close the pressure release valve on the side of the gun.
g) Pump the handle on the gun while continually watching the pressure gauge.
   CAUTION: DO NOT exceed 4,000 psi on valves 4" or smaller and 6,000 psi on valves 6" or larger.
h) As you pump the handle, pressure should steadily increase until the pressure is high enough to unseat the plug, which at that point, the pressure on the gauge should drop off indicating a fully pressurized system. This point may also be noticed by a decrease in the effort needed to stroke the handle.
   REMINDER: It takes approximately 350 strokes of the handle to pump 8 ounces of sealant.
i) At this point, no additional pumping of the handle is needed unless the valve continues to leak.
   i) Any additional sealant added will be forced into the line. unless the valve body continues to leak.
j) Open the pressure release valve on the gun and remove the coupling.
k) Turn the valve and check for ease of operation. If the valve is extremely hard to turn it may be necessary to add more sealant or operate the valve back and forth until the valve becomes easier to turn.
l) Return valve to as-found position.

Steel Plug Valve Corrective Maintenance:

1) If a steel plug valve is extremely hard to turn, will not turn, and will not accept any sealant with the use of high-pressure gun, to may be necessary to use a "valve flush" to correct the problem.
   a) Valve flush is designed to loosen the older sealant inside the valve so that it may be exercised and new sealant added.
   b) Always follow the manufacturer's recommended procedures for using a "valve flush".
      REMINDER: If used in close proximity to downstream regulators and/or relief valves, care should be taken not to send grease or flush downstream from the valve damaging the downstream equipment.
2) If a plug valve is found to be leaking and is not corrected by adding sealant and/or operation, it may be necessary to check valve gland and make adjustments as required.
3) All valve gland adjustments must be made following the manufacturer's recommended procedures for that specific band and size of valve.

IAMU Procedure #9.7: Inspect Emergency Valves

Requirements:

1) All transmission line valves must be inspected and at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
2) All distribution main line valves classified as Emergency Valves, which are essential to the safe operation of the distribution system, must be inspected and at least partially operated (1/8 of a turn) at least once each calendar year with intervals not exceeding 15 months.
3) If at any time a transmission valve or distribution main line Emergency Valve is found to be inaccessible or inoperable, the valve must be promptly repaired, replaced or an alternative valve may be designated to take its place.

Documentation and Record Retention:

1) Documentation may be provided on the Valve Inspection and Maintenance Record or other approved company document and must be kept and maintained for at least 10 years.
2) If the gas supplier owns and operates the only emergency valve at the take point, a record of the required inspection and maintenance must be obtained from the gas supplier.

Inspection of Above Ground Valves:

1) Inspect for the following, if applicable:
   a) Is the valve accessible?
   b) Check for signs of damage that could prevent the valve from operating correctly.
   c) Check for signs of atmospheric corrosion.
   d) Is there a locking device, if not, should there be?
   e) Check for leaks using a CGI or leak detection solution.

Inspection of Below Ground Valves:

1) Inspect for the following, if applicable:
   a) Is the valve accessible?
      i) This may include the valve lid, valve box, valve stem, or valve body.
      ii) Is the valve box damaged, misaligned, or full of dirt?
   b) Check for signs of damage that could prevent the valve from operating correctly.
   c) Check for signs of external corrosion.
      i) If signs of external corrosion are found it may be necessary to dig up the valve to conduct further investigations.
   d) Check for leaks using a CGI.
      i) Indications of a leaking valve may also include a white "mold like" substance found on the valve lid or valve box.

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Valve Operation Procedures:

1) Review valve maintenance records and system maps to ensure that the correct valve wrenches or tools are available.
2) Identify the valve location and ensure that the correct valve is going to be operated.
3) Identify the valve type (plug, ball, or gate), material (plastic or steel), and size.
4) Verify the position of the valve as found (open or closed).
5) Before operating the valve, ensure that flow conditions are such that if the valve is fully closed, service downstream will not be affected. If unable to fully close the valve due to conditions downstream, the valve must at least be partially operated 1/8th of a turn.
6) If applicable, remove the locking device.
7) Select the appropriate valve wrench or tool to operate the valve.
8) Slowly turn the valve open or closed by applying steady pressure on the valve wrench or handle. DO NOT jerk the valve wrench or tool as this could damage or break the valve body or stem.

NOTE: Plastic ball valves generally turn much easier than steel plug valves and required less force to operate the valve.

9) Return the valve to the original as found position.
10) If applicable, install locking device.

IAMU Procedure #9.8: Adjust and Monitor Flow or Pressure – Manual Valve Operation (Manual By-pass Operation)

NOTE: This procedure is generic in nature and is not intended to apply to all types and configurations of pressure regulating stations:

Manual By-pass Procedures:

1) Any time it is necessary to maintain gas service at or below maximum allowable operating pressure (MAOP) due to a failure or changing out of meters and pressure regulating or pressure limiting equipment it may be necessary to manually by-pass the equipment by operating by-pass valves.

   REMINDER: Once it has been determined that the system will be supplied and controlled through the manual by-pass valve and not by pressure regulating or limiting equipment, qualified company personnel must remain on-site, continually monitor pressures, and have the authority to shut the system down if pressure increases above MAOP.
2) Locate the manual by-pass valve and pressure gauge to allow for continual monitoring of the downstream pressure.
   a) If the downstream pressure gauge is NOT within clear sight of the person manning the bypass valve, additional personnel must be placed at the pressure gauge to monitor pressure and must remain in constant contact with the person operating the bypass valve.
3) Turn off the inlet and outlet valves eliminating flow into and out of pressure regulating and pressure limiting equipment.
4) While monitoring the downstream pressure gauge, very slowly and incrementally begin opening the by-pass valve.
5) Once the valve has been partially opened to a point where the downstream pressure has stabilized at a point at or below MAOP, stop opening the valve and leave it in the current position.
   a) It may be necessary to continually slightly open or slightly close the valve based on flow conditions to maintain pressure at or below MAOP.
   b) It is essential that during by-pass operation, the valve be continually manned by qualified personnel to ensure that downstream pressures DO NOT exceed MAOP plus build-up.
6) Once it has been determined that the system can safely be put back under control of pressure regulating or limiting equipment, the by-pass valve must be fully closed and if applicable, a locking device installed.

CITY OF BLOOMFIELD, IOWA

PART TEN

Leak Investigations, Surveys & Patrols

IAMU Procedure #10.0: Classifying Leaks

NOTE: All reports of leaks must take priority over all other work and considered emergencies until deemed otherwise after investigation. The main priority during any report of a leak is the protection of life and then property.

Requirements:

1) All leaks and/or reports of leaks must be investigated and classified.
2) Leak classification must be completed using a calibrated combustible gas indicator (CGI).

Documentation and Record Retention:

1) All leak investigations and leak classifications must be documented and recorded on the Leak Record or other company approved document and must be kept and maintained for at least 10 years.

Leak Classifications and Action Criteria:

Grade 1 Leak: 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.

1) Once it has been determined that a Grade 1 leak exists, operating personnel must continually remain on the scene to ensure the safety of the public.

Examples of Grade 1 Leaks	Action Criteria
1. Any leak, which in the judgement of the operating personnel on the scene, is regarded as an immediate hazard. 2. Any leak that can be seen, heard, or felt, and which is in a location that may endanger the general public or property. 3. Escaping gas that has ignited. 4. Any indication that gas migrated into or under a building or tunnel. 5. Any reading of gas at the outside wall of a building, or where gas would likely migrate to an outside wall of a building. 6. Any reading of 80% LEL or greater in a confined space. 7. Any reading of 80% LEL or greater in small substructure (other than gas associated substructures) from which gas would likely migrate to the outside wall of a building.	1. Provide prompt and continuous action to protect life and property until the condition is no longer hazardous. 2. Implement the Emergency Plan and Procedures. 3. Stop the flow of gas by closing valves or by other means. 4. Eliminate ignition sources. 5. Notify emergency responders. 6. Evacuate premises. 7. Block off the area. 8. Reroute traffic. 9. Vent the area by removing manhole covers, bar-hole venting, or by other means.

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<u>Grade 2 Leak:</u> A leak that is recognized as being non-hazardous at the time of detection, but could become hazardous, and requires scheduled repair.

1) In general, all leaks, regardless of Grade, should be repaired as soon as practical after discovery. If not repaired when found, Grade 2 leaks must be re-evaluated every 6 months and repaired, eliminated or reclassified within one calendar year, but no later than 15 months from the date it was discovered.

<table>
<tr><th>Examples of Grade 2 Leaks</th><th>Action Criteria</th></tr>
<tr><td>1. Any leak which, in the judgement of operating personnel at the scene, is of sufficient magnitude to justify scheduled repair.
2. Any leak which, under frozen or other adverse soil conditions, would likely migrate to the outside wall of a building.
3. 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.
4. 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.
5. 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.
6. Any reading between 20% LEL and 80% LEL in a confined space.
7. Any reading on a pipeline operating at 30% SMYS, or greater, in a Class 3 or 4 location, which does NOT qualify as a Grade 1 leak.
8. Any reading of 80% LEL, or greater, in a gas associated substructure.</td><td>1. In determining repair priority, criteria such as the following should be considered:
a) Amount and migration of gas.
b) Proximity of gas to buildings and subsurface structures.
c) Extent of pavement.
d) Soil type and soil conditions, such as frost cap, moisture, and natural ability to vent.
2. If not repaired immediately, Grade 2 leaks must be re-evaluated at least once every 6 months until cleared or reclassified. The frequency of re-evaluation should be determined by the location and magnitude of the leakage condition.
3. Grade 2 leaks may vary greatly in degree of potential hazard. Some Grade 2 leaks, when evaluated by the above criteria, may justify scheduled repair within the next 5 working days. Others will justify repair within 30 days.
4. On the other hand, many Grade 2 leaks, because of their location and magnitude, can be scheduled for repair on a normal routine basis with periodic re-inspection as necessary.
5. If during re-evaluation it is determined that the leak should be upgraded to a Grade 1 leak, prompt and continuous action must now take place to protect life and property until the leak is repaired or conditions are no longer hazardous.</td></tr>
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<u>Grade 3 Leak:</u> A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous.

1) In general, all leaks, regardless of Grade, should be repaired as soon as practical after discovery. If not repaired when found, Grade 3 leaks must be re-evaluated during the next scheduled survey, or within 15 months of the date reported, whichever occurs first, until the leak is regraded or no longer results in a reading.

Examples of Grade 3 Leaks	Action Criteria
1. Any reading of less than 80% LEL in a small gas associated substructure. 2. Any reading under a street 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.	1. If not repaired immediately, Grade 3 leaks must be re-evaluated during the next scheduled survey, or within 15 months of the date reported, whichever occurs first. 2. If during re-evaluation, it is determined that the leak should be upgraded to a Grade 2 leak, the Grade 2 leak classification and action criteria will now apply.

IAMU Procedure #10.1: Inside Leak Investigation

Requirements:

1) During any emergency situation, the first priority is to protect life and then property.
2) All reports of leaks must take priority over all other work. Once the report of leak has been received, it must be responded to immediately.
3) All reports of leaks must be investigated and classified using a calibrated combustible gas indicator.

Calibration Requirements and Documentation:

1) All combustible gas indicators must be calibrated periodically not exceeding manufacturers' recommendations.
2) Documentation of calibration may be kept on the Combustible Gas Indicator Calibration Record or other company approved document and must be kept and maintained for 10 years.

Documentation and Record Retention Requirements:

1) All reports of leaks and leak investigation results must be documented whether the presence of gas was found or not.
2) Documentation may be completed on the Leak Record or other company approved document and must be kept and maintained for 10 years.
3) Documentation must include time the leak was reported, time personnel were dispatched, and time of arrival at leak location.

Inside Leak Investigation Procedure:

The following 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 are no more leaks.

1) When arriving at leak location, if possible, park vehicle in a location upwind of suspected leak area. Ensure that vehicle is NOT parked on top of storm drains, sanitary sewer manholes, or other locations where gas could be accumulating or escaping.
2) Leave cell phones, pagers, and other unsafe devices that may cause sparks in the vehicle.
3) Turn on combustible gas indicator outdoors and allow the unit to zero in a gas free atmosphere before entering the building.
4) KNOCK on the door. DO NOT use the doorbell.
5) Upon admittance to the premises, test free air immediately (first test near the ceiling).
6) If a reading of 30% LEL or higher is obtained at any time while testing free air, all occupants must be evacuated before proceeding to the next step.

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7) If at any time, a free air reading is obtained at or above 5% N, immediately evacuate, shut-off the meter set, eliminate ignition sources (have electric provider cut the power to the building, and from a safe distance dial 911 and allow emergency responders to ventilate.
8) Speak with customer and ask of probable location of leak and probable locations of gas piping and appliances.
   a) Remind customer to not turn on lights, switches, appliances, use the telephone, etc., until a determination has been made that there is no explosive condition.
9) If applicable, test air at top of basement stairwell. This check should be made as soon as possible after gaining admittance as this is an area for potential collection.
10) If customer provides the specific location of the source of the gas smell, proceed directly to that area.
11) Using combustible gas indicator, continually take samples of free air throughout the building and at the following locations:
   a) All gas piping, pipe joints, valves, appliances, appliance piping, and appliance vents.
   b) Cracks in basement walls, crawl spaces, floor joists, and dead air spaces.
   c) Sewer openings and floor drains.
   d) All underground entrances of utilities (gas, water, electricity, telephone, TV, internet, etc.).
   e) All other locations where gas might accumulate.
12) If at any time, a gas leak is found indoors on customer piping or appliances, the leak location should be "Red Tagged", the customer notified of the condition, and if applicable, isolated by turning off an individual appliance valve. If, determined by the operator, an unsafe condition could develop due to the severity of the leak and it cannot be isolated by shutting off an appliance valve, the gas meter may be shut-off and locked until the leak has been repaired.
13) If the gas meter is outside, take samples at the following locations.
   a) The meter set, components, piping and pipe joints, including any customer owned piping accessible downstream of the meter set.
   b) Bar-hole by the gas riser within 1 foot of the basement wall and twice on every wall around the building to ensure that gas is NOT migrating into or near the building from an underground source.
   c) It may be necessary to check meter sets and piping of adjacent buildings for the source of the leak.
   d) If any presence of gas is found below ground at the foundation wall during bar-hole testing, bar-hole testing must continue at a maximum of 10-foot intervals in all directions until 0% gas is found to find the spread boundary of the leak.

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14) If a leak is still not evident, perform a "No-Flow" test through the meter on customer owned piping and appliances.
    a) If the "No-Flow" test fails, go back inside and re-sample all accessible customer owned piping and appliances to find the source of the leak.
    b) If the "No-Flow" test is successful and all other steps included in this procedure have been completed, attempt to identify any sources of related odors.
15) When leaving the customer's premises, assure the customer that their complaint has not been a nuisance and that any future indication of a gas odor should be reported immediately.

<u>**Additional Procedures for Investigating a Report of Carbon Monoxide:**</u>

NOTE: Investigating for the presence of carbon monoxide must be conducting using a combustible gas indicator or other device capable of measuring concentrations of carbon monoxide in parts per million (PPM)

1) Ensure that the sampling device is calibrated, turned on, and zeroed in free air before entering premises.
2) KNOCK on the door, DO NOT ring the doorbell.
3) Speak with the customer and ask them if they are feeling any symptoms of CO poisoning such as a headache, nausea, dizziness, tiredness, etc.
    a) If the customer is feeling symptoms or shows signs of CO poisoning, ask them to please step outside at a safe distance and if they would like you to call 911 for emergency assistance.
    b) If not feeling or showing signs of CO poisoning ask them if they know the specific area in which they suspect a CO leak or if a CO detector has gone off alerting them of the situation.
4) Since carbon monoxide is relatively the same specific gravity as air, it will be necessary to take samples at all levels (floor, head height, and ceiling height) throughout the premises.
    a) If CO levels of 10-35 PPM are discovered in free air, recommend that the occupants leave the building until the problem has been corrected and the atmosphere has been rechecked and found clear.
    b) If CO levels over 35 PPM are discovered in free air, the occupants will be required to leave the building until the problem has been corrected and the atmosphere has been rechecked and found clear. If occupants refuse to leave the building, shut-off the gas, lock the meter, and Red Tag any known offending appliances.
    c) If no CO is detected, start gas appliances and recheck atmosphere. It is also necessary to check flue conditions for proper ventilation.
        i) If any appliance or appliance flue is found to be source of the excessive CO, shut off and Red Tag the specific appliance.
5) When leaving the customer's premises, assure the customer that their complaint has not been a nuisance and that any future indication of carbon monoxide should be reported immediately.

IAMU Procedure #10.2: Outside Leak Investigation

Requirements:

1) During any emergency situation, the first priority is to protect life and then property.
2) All reports of leaks must take priority over all other work. Once the report of leak has been received, it must be responded to immediately.
3) All reports of leaks must be investigated and classified using a calibrated combustible gas indicator.

Calibration Requirements and Documentation:

1) All combustible gas indicators must be calibrated periodically not exceeding manufacturers' recommendations.
2) Documentation of calibration may be kept on the Combustible Gas Indicator Calibration Record or other company approved document and must be kept and maintained for 10 years.

Documentation and Record Retention Requirements:

1) All reports of leaks and leak investigation results must be documented whether the presence of gas was found or not.
2) Documentation may be completed on the Leak Record or other company approved document and must be kept and maintained for 10 years.
3) Documentation must include time the leak was reported, time personnel were dispatched, and time of arrival at leak location.

Outside Leak Investigation Procedure:

The following 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 are no more leaks.

1) When arriving at leak location, if possible, park vehicle in a location upwind of suspected leak area. Ensure that vehicle is NOT parked on top of storm drains, sanitary sewer manholes, or other locations where gas could be accumulating or escaping.
2) Leave cell phones, pagers, and other unsafe devices that may cause sparks in the vehicle.
3) Turn on combustible gas indicator outdoors and allow the unit to zero in a gas free atmosphere before entering the building.
4) Before investigating outdoors, the inside the building must be deemed safe for occupancy and ensure that gas is not migrating indoors.
5) KNOCK on the door. DO NOT use the doorbell.
6) Upon admittance to the premises, test free air immediately (first test near the ceiling).
7) If a reading of 30% LEL or higher is obtained at any time while testing free air, all occupants must be evacuated before proceeding to the next step.

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8) If at any time, a free air reading is obtained at or above 5% N, immediately evacuate, shut-off the meter set, eliminate ignition sources (have electric provider cut the power to the building), and from a safe distance dial 911.
9) Speak with customer and ask of probable location of leak and remind customer to not turn on lights, switches, appliances, use the telephone, etc., until a determination has been made that there is no explosive condition.
10) If applicable, test air at top of basement stairwell. This check should be made as soon as possible after gaining admittance as this is an area for potential collection.
11) If it has been determined that the inside of the building is safe for occupancy and the source of the leak is NOT indoors, proceed outside and take samples at the following locations:
    a) The meter set, components, piping and pipe joints, including any customer owned piping accessible downstream of the meter set.
    b) Bar-hole around the gas riser within 1 foot of the basement wall and thoroughly on every wall around the building to ensure that gas is NOT migrating into or near the building from an underground source.
    c) If any presence of gas is found below ground during bar-hole testing, bar-hole testing must continue at a maximum of 10-foot intervals in all directions until 0% gas is found to find the spread boundary of the leak.
        i) Bar-hole the service line at 10-foot intervals from the riser to the main.
        ii) Bar-hole along the main in both directions.
    d) Check all meter sets, above ground piping, and thoroughly bar-hole all sides of the buildings adjacent to or across the street from the area where the complaint originated.
    e) Take samples of all manholes, catch basins, sewers, etc., in the area.
    f) Check all other above ground utility facilities.
12) If a leak is still not evident, reset/re-calibrate/change-out gas detection equipment and complete an additional inside leak investigation to ensure that gas is not present indoors or below ground at the foundation wall.
13) If it is not possible to identify gas as the source of the odor at this point and all possible checks have been made, attempt to identify the source of any related odors.
14) When leaving the customer's premises, assure the customer that their complaint has not been a nuisance and that any future indication of a gas odor should be reported immediately.

IAMU Procedure #10.3: Walking Gas Leakage Survey

Requirements:

1) All gas leak survey's must be conducted using gas detection equipment.
2) All gas detection equipment must be calibrated according to the manufacturer's recommended procedures.
   a) Although it is not required, it is recommended that gas detection equipment being used to conduct leak surveys be calibrated at the beginning of each day of use.
3) Leak surveys must be completed at the intervals prescribed in the table below:

Distribution Facilities	Required Interval
Business Districts	At least once each calendar year not to exceed 15 months
Outside of Business Districts	At least once every 5 calendar years not to exceed 63 months.
Indoor Meter Sets	At least once each calendar year not to exceed 15 months.
Transmission Facilities	**Required Interval**
All Transmission Facilities	At least once each calendar year not to exceed 15 months.
Class 3 Locations	At least twice each calendar year not to exceed 7 ½ months
Class 4 Locations	At least four times each calendar year not to exceed 4 ½ months
Completion of Special One-Time Surveys	
• Exceedance of maximum allowable operating pressure (MAOP) plus allowable build-up. • After a natural disaster (tornado, flood, earthquake, etc.) • Any situation where an excavation has included blasting.	
Additional Considerations for Increased Frequency of Leak Surveys	
• It may be necessary to increase the frequency of completing leak surveys based on known leak history, age and type of system materials, and/or DIMP requirements.	

Documentation & Record Retention:

1) The results of all leak surveys and gas detection equipment calibration must be documented and recorded. The Leak Survey Record or other company approved document may be used.
2) Records must identify specifically what facilities were surveyed with completion dates.
3) If any leaks are discovered during the leak survey, additional Leak Records or other company approved documents should be completed for each individual leak.
4) All leak survey and leak investigation records must be kept and maintained for a minimum of 10 years.

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Leak Survey Procedure:

1) It is recommended that leak surveys, other than special one-time surveys, be completed during spring and summer months. It is NOT recommended that leak surveys be conducted during winter months as frost will hinder the ability to detect leaks.
2) Before performing a leak survey, check weather conditions, if it going to rain or if winds are going to exceed 10 mph it is recommended that the survey be rescheduled, if possible
3) Inspect gas detection equipment for any signs of damage, check battery life, and ensure that it is proper working condition.
4) Ensure that the gas detection equipment is calibrated prior to conducting survey.
5) If the location of all underground facilities to be surveyed is not known, it may be necessary to locate the facilities prior to conducting the survey.
   a) If system maps are available, up to date, and accurate, they may be used to determine the location of facilities during the completion of the survey.
6) As applicable, the following facilities must be included in the survey:
   a) All above ground and below ground mains.
   b) All service lines.
   c) DRS and TBS facilities (including odorizers, heaters, piping, etc.).
   d) Vaults or pits.
   e) Below ground valves with lids or boxes.
   f) Other utility boxes, pits, vaults, pedestals, etc.
   g) Meter sets up to the outlet side of the meter.
7) If the mains and service lines are located under concrete or in a wall-to-wall paved area, the survey must include testing the atmosphere of all utility manholes, storm sewer inlets, cracks in pavement and sidewalks, along building foundations, and other locations providing an opportunity for finding leaks.
8) While conducting the survey, observe for visual indications of leaks such as dead vegetation on or near the pipeline route, bubbling in water, and swarms of insects on above ground facilities.
   a) Also, be alert for the smell of gas and for audible hissing sounds.
9) If at any time, a leak is discovered during the survey, immediately stop conducting the survey, and perform a leak investigation using a combustible gas indicator to determine the severity of the leak. If the leak is determined to be a Grade 2 or Grade 3 leak, the survey may continue. If the leak is determined to be a Grade 1 leak, immediately repair or take continuous action until the leak is either downgraded to a Grade 2 or until conditions are no longer hazardous.
   NOTE: All leaks must be investigated, classified, and documented.
10) Upon completion of the survey, ensure that all documentation is completed.

IAMU Procedure #10.4: Inspect Pipeline Surface Conditions – Patrol Right-of-Way or Easement

Requirements:

1) A patrol (visual inspection) of the pipeline surface conditions and right-of-way must be completed where mains are in places or located on structures where anticipated physical movement or external loading could cause failure or leaks. Patrols should be conducted on the following facilities:
   a) Pipelines installed on bridges.
   b) Railroad or highway crossings.
   c) Pipeline casings.
   d) Rivers, creeks, or major waterway crossings.
   e) Areas susceptible to erosion or land-slides.
   f) Areas susceptible to soil subsidence (cave-ins).
   g) Areas of construction activity.
2) Patrols must be conducted at the frequencies prescribed in the following tables:

Distribution Facilities	Required Interval
Areas Inside of Business Districts	At least four times each calendar year with intervals not exceeding 4 ½ months
Areas Outside of Business Districts	At least twice each calendar year with intervals not exceeding 7 ½ months

Transmission Facilities		
	Required Interval	
Class Location	At Highway and Railroad Crossings	At All Other Locations
1 & 2	Twice each calendar year with intervals not exceeding 7 ½ months	At least once each calendar year with intervals not exceeding 15 months
3	Four times each calendar year with intervals not exceeding 4 ½ months	Twice each calendar year with intervals not exceeding 7 ½ months
4	Four times each calendar year with intervals not exceeding 4 ½ months	Four times each calendar year with intervals not exceeding 4 ½ months

3) Consideration should be given to conducting patrols at increased frequencies if a known section of pipeline is exposed, after natural disasters such as floods or tornados, or during roadway or right-of-way construction activities.

Documentation & Record Retention:

1) All patrols and their results must be documented on the Pipeline Patrol Record or other company approved document and must be kept and maintained for at least 10 years.

(continued on next page)

Pipeline Patrol Procedure:

1) Determine what facilities, if any, are to be patrolled and the frequency for which the patrol needs to be conducted.
2) Pipeline patrols, in general, are visual examination of pipeline conditions adjacent to or along the right-of-way or easement.
3) Patrols may be completed by walking or slowly driving the pipeline route. If driving, it may be necessary to exit vehicle to take a closer look at certain conditions.
4) While patrolling the pipeline route visually inspect for any indications of leaks, soil subsidence, soil erosion, pipeline exposures, construction activities, right-of-way encroachments, excavations, and any other factor that could affect the safety and integrity of the pipeline.
   a) If at any time a leak is discovered during a patrol, immediately stop the patrol and conduct a leak investigation.
5) If the patrol area contains pipeline casing vents, the vents must be checked for leaks using a combustible gas indicator.
6) If an unplanned or unknown excavation is discovered during the patrol, it is recommended that contact is made with the excavator to provide proof a valid One-Call ticket. If the excavator cannot provide proof of a valid One-Call ticket, the excavation should cease until One-Call is notified of the excavation and all utilities have been located and marked.
7) If construction activity is discovered along a transmission pipeline route, the operator should consider class location factors and determine if the new construction activity will change existing class location, create a high consequence area, or create a moderate consequence area.
8) During patrols, pipeline markers should be checked for the following:
   a) Are there any damaged or missing markers? If so, they should be replaced.
   b) Are there enough markers along the route or should some be added?
   c) Is the marker visible?
   d) Is the marker content visible, or is it faded?
   e) Is all the information on the marker correct and up to date?
9) Document and record any problems or issues discovered during the patrol on the appropriate company document.

CITY OF BLOOMFIELD, IOWA

PART ELEVEN

Record Keeping Documents & Forms

HEAT FUSION EQUIPMENT MAINTENANCE RECORD

Heat fusion equipment maintenance & calibration must be completed as required according to the manufacturer's recommended practices. A record of the maintenance &/or calibration must be kept to satisfy the requirements of 49 CFR Part 192.756

Type of Machine (butt, socket, saddle, etc.):____________________________________

Name of Machine:____

Manufacturer:____

Serial # (if applicable):____

Maintenance performed as required? ☐ Yes ☐ No

What items were inspected &/or maintenance performed on?_________________________

____

____

Any issues or problems found?____

____

Maintenance Performed By:_______________________________ Date:_____________

Type of Machine (butt, socket, saddle, etc.):____________________________________

Name of Machine:____

Manufacturer:____

Serial # (if applicable):____

Maintenance performed as required? ☐ Yes ☐ No

What items were inspected &/or maintenance performed on?_________________________

____

____

Any issues or problems found?____

____

Maintenance Performed By:_______________________________ Date:_____________

GAS SERVICE "TURN ON" RECORD

Date: ______________________ Customer/Contractor Available for Meeting: ☐ Yes ☐ No

Scheduled Time of Meeting/Service: ____

Special Instructions: ____

____

Customer Information

Customer/Contractor Name: ____

Location/Address: ____

Meter Number: ____

Location Information

Allowed access to inside? ☐ Yes ☐ No

Any issues found on customer appliances and or piping? ☐ Yes ☐ No

If issues found, was customer notified of situation? ☐ Yes ☐ No

Describe any problems discovered? ____

____

Meter Set Information

Meter Reading: _____________________

Service Regulator: Pressure set point as found___________________

Pressure set point as left__________________

Lock-up pressure__________________

Regulator vent pointed down and screened? ☐ Yes ☐ No 3 ft from openings? ☐ Yes ☐ No

Meter "low flow" test: ☐ Pass ☐ Fail

Meter "no-flow" test: Time Start_____________ Time Stop_______________ ☐ Pass ☐ Fail

Additional Comments/Problems/Concerns: ____

____

____

Signature: ____ Date: _____________________

COMBUSTIBLE GAS INDICATOR CALIBRATION RECORD

Instrument Serial Number: ___________________________________

NOTE: Calibration on each CGI is to be performed at least quarterly. The following table is to be completed each time calibration is performed. The table is to be completed with a "YES", "NO" or "NA" response to each of the 5 calibration items. If a "YES" response is entered, calibration was successful. If a "NO" response is entered, calibration was not successful and the unit must be taken out of service, repaired or recalibrated. If an "NA" response is entered, that calibration item is "not applicable" to your machine.

		CALIBRATION ITEMS				
DATE	**OPERATOR NAME**	**LEL**	**UEL**	**CO**	**H2S**	**PROPANE**

LEAK RECORD

NOTIFICATION AND DISPATCH INFORMATION

Notification Received by:____

Date Received:________________________ Time Received:__________________ (AM/PM)

Reported by:____________________________________Address:______________________________________

City/State/Zip:____Phone No.:__________________________

Person reporting is: ☐ Customer ☐ General Public ☐ Other:____________________________________

Location of suspected leakage: ☐ Inside ☐ Outside

Person dispatched to:____

Date:________________________ Time:______________________ (AM/PM)

LEAK INVESTIGATION INFORMATION

Time arrived at location: _____________ (AM/PM) Instrument (CGI) Serial #: ______________________

Leak found: ☐ In House ☐ Outside ABOVE Ground ☐ Outside BELOW Ground ☐ NO LEAK

Leak Classification: ☐ 1 ☐ 2 ☐ 3 Gas % found:_____________ CO PPM found:________________

Completed bar-holes ☐ Yes ☐ No Map of leak migration pattern completed? ☐ Yes ☐ No

Any appliances or piping Red Tagged: ☐ Yes ☐ No Gas shut-off at appliance valve? ☐ Yes ☐ No

Customer notified of problem? ☐ Yes ☐ No Gas service shut-off and locked? ☐ Yes ☐ No

Return/re-check needed after repairs made by plumber: ☐ Yes ☐ No

RESULTS

Additional Comments/Repairs Made ____

____

____

____

Date of re-check:______________________ Appropriate repairs made and/or leak corrected? ☐ Yes ☐ No

Meter "no-flow" Test: Time Start: ______________ Time Stop: _______________ ☐ Pass ☐ Fail

Signature:____

Page 1 of 2

MAP OF LEAKAGE AREA

(Bar-hole mapping is required for all underground leaks)

NOTE: Map information should include at a minimum, bar-hole locations with CGI readings to determine the boundaries of the spread migration.

Page 2 of 2

LEAK SURVEY RECORD

Note: It is recommended that if the leak survey is conducted over multiple dates, this form should be completed for each individual date.

Date Completed: ______________________________

Completed by (Surveyor): ____

Guide (if applicable): ____

GENERAL INFORMATION

Survey conducted on: ☐ Distribution ☐ Business District ☐ Transmission

Survey conducted with: ☐ Flame Pack ☐ RMLD ☐ CGI ☐ Other

Instrument serial number: ____

Instrument date of calibration: ____

DESCRIPTION OF AREA COVERED

Provide a detailed description of the area covered: ______________________________________

____

____

____

____

LEAK SURVEY RESULTS

Total number of leaks discovered during survey: ______________________

Grade 1: ________________

Grade 2: ________________

Grade 3: ________________

Note: It is recommended that a leak record be completed and attached to this document for each individual leak discovered during the survey.

Additional Comments: ____

____

____

____

EXCAVATION DAMAGE FOLLOW-UP REPORT

NOTE: This report is to be used any time excavation damages resulted in the repair or replacement of line pipe or components (excluding coating damage) with or without the release of gas.

Completed by: ____ Date: __________________

Excavation Information:

Date excavation damages occurred: __________________

Excavating company or individual who caused damage: __________________________________

Did the excavator have a valid One-Call ticket for the proposed excavation? ☐ Yes ☐ No

One-Call Ticket Number: ____

Had excavator waited the required 48 hours prior to excavation? ☐ Yes ☐ No

What was the root cause of the excavation damage (select one or more of the following)?

☐ Failure to follow One-Call laws ☐ Failure to locate facilities by Operator

☐ Facilities mislocated ☐ Locating equipment malfunction ☐ Digging without spotter

☐ Failure to hand dig within 18" of facility ☐ Hand digging caused damage ☐ Other

Did damage result in the escape of gas? ☐ Yes ☐ No

Did the excavator notify 911? ☐ Yes ☐ No

Additional information (if necessary): ____

____

____

____

Response Information:

Were all appropriate emergency procedures followed correctly? ☐ Yes ☐ No ☐ NA

Were procedures followed for preventing accidental ignition? ☐ Yes ☐ No ☐ NA

Documentation, including leak investigations properly completed? ☐ Yes ☐ No ☐ NA

Did the damage result in a State or Federally reportable incident? ☐ Yes ☐ No

What could be done to minimize the possibility of recurrence? ______________________________

____

____

____

____

EXCAVATION "STAND-BY" REPORT

NOTE: This report should be completed any time that a known excavation takes place within 25 feet of a natural gas transmission pipeline.

Completed by: ____ Date: ______________________

TICKET INFORMATION:

One-Call ticket number: ____

Name of Company or individual performing excavation: ____

Name of contact provided on One-Call ticket: ____

Contact number provided on One-Call ticket: ____

Date & time locate is to be completed: ____

OPERATOR INFORMATION:

Locating completed by: ____

Date & time locate completed: ____

List all facilities located: ____

ADDITIONAL INFORMATION:

Was proposed excavation site "white lined" as required? ☐ Yes ☐ No

Approximate distance of pipeline to "white lined" area. ____

Was contact made with the excavator and a meeting scheduled? ☐ Yes ☐ No

Date and time of meeting &/or scheduled excavation: ____

Was the meeting arrangement &/or excavation schedule followed? ☐ Yes ☐ No

Were all One-Call laws followed? ☐ Yes ☐ No

Did excavator follow safe digging practices around all underground utilities? ☐ Yes ☐ No

Were any facilities damaged during excavation or backfilling activities? ☐ Yes ☐ No

If damages did occur, was there a release of gas? ☐ Yes ☐ No

If so, give brief description: ____

____

____

If excavator failed to follow One-Call laws or damaged the underground facilities, was the Attorney General's Office notified and report filed? ☐ Yes ☐ No

If not, why? ____

____

If the pipeline was exposed, was a visual inspection performed and documented? ☐ Yes ☐ No

EXPOSED PIPE REPORT

Completed by: ____ Date: _________________

Location/Address: ____

GENERAL INFORMATION

Material Type: ☐ Steel ☐ PE

Designation: ☐ Main ☐ Service Line ☐ Riser Pipe

Size: _________________ Excavation type: ☐ Open bell-hole ☐ Pot-hole ☐ Hand digging

% gas reading obtained with CGI: ____

STEEL PIPE &/OR COATING CONDITION

Coating Type: ☐ X-tru Coat ☐ Coal Tar Enamel ☐ Epoxy ☐ Hot Wrap ☐ Wax Wrap

Other: ____

Coating Condition: ☐ Good ☐ Disbonded ☐ Damaged

Pipe Condition (if applicable): ☐ NA ☐ Good ☐ Damaged ☐ Corrosion Discovered

If corrosion was discovered, was it general or localized? _________________________________

Corrosion pitting discovered? ☐ Yes ☐ No Pitting depth? ________________________

Internal surface of pipe exposed? ☐ Yes ☐ No Internal corrosion discovered? ☐ Yes ☐ No

Pipe to soil potential reading taken? ☐ Yes ☐ No Reading: _______________________

PE PIPE CONDITION (if necessary)

Pipe Condition: ☐ Good ☐ Damaged ☐ Out-of-round

If damage was discovered, what was the depth of the wall loss? ___________________________

Any damage discovered on tracer wire (if applicable)? ☐ Yes ☐ No

CORRECTIVE MEASURES (if required)

Describe what maintenance was performed, and materials used: ____________________________

____

____

____

____

____

PIPELINE PATROL RECORD

Completed by: ____ Date: ________________

Facility Type:

☐ Distribution inside business districts ☐ Distribution outside of business districts

☐ Transmission pipeline

Areas Inspected:

Highway and railroad crossings: ☐ Yes ☐ No ☐ NA

Creek/river crossings: ☐ Yes ☐ No ☐ NA Drainage Areas ☐ Yes ☐ No ☐ NA

Casing vents: ☐ Yes ☐ No ☐ NA CGI reading (% gas found): ____________________

Bridge crossings/hangs: ☐ Yes ☐ No ☐ NA

Any unknown excavation or construction activities found? ☐ Yes ☐ No

If so, what and where? ____

____

____

Any erosion or subsidence found? ☐ Yes ☐ No

If so, what and where? ____

____

____

Any indications of pipeline leaks? ☐ Yes ☐ No

If so, was leak investigation completed and documented? ☐ Yes ☐ No ☐ NA

Any new high consequence areas (transmission only)? ☐ Yes ☐ No

Any new moderate consequence areas (transmission only)? ☐ Yes ☐ No

Any change in class location? ☐ Yes ☐ No

Pipeline markers visible and contain correct information? ☐ Yes ☐ No

Any pipeline markers need replaced or added? ☐ Yes ☐ No

Additional comments or safety concerns: ____

____

____

REGULATOR STATION INSPECTION RECORD

Completed by: ____ Date: ________________

Location: ____

MAOP of downstream system: ______________________ MAOP plus buildup: ______________

General Station Inspection:

Area clean of weeds and grass? ☐Yes ☐No ☐NA Signage installed, and correct? ☐Yes ☐No

Pit clean and dry? ☐ Yes ☐No ☐NA

Locking devices installed at all appropriate locations? ☐Yes ☐No

Pipe supports installed where required? ☐Yes ☐No Are supports rigid? ☐Yes ☐No

Coating condition at pipe-to-soil interface: ☐ Good ☐Needs attention

Any atmospheric corrosion metal loss discovered? ☐Yes ☐ No

Station piping need cleaned and painted? ☐ Yes ☐No

Full thread engagement on all flange bolts? ☐ Yes ☐ No

Regulator Inspection #1

Run Type: ☐Primary ☐Secondary Function: ☐Worker ☐Monitor ☐Primary cut ☐Secondary cut

Serial number: ____

Model: ____ Body size: ________________

Pilot: ☐Yes ☐No Spring Range: _________________ Orifice Size: ____________________

Capacity: __________________________ Capacity verified from previous inspection? ☐Yes ☐No

Set point as found: ________________ Set point as left: ________________

Was regulator lock up obtained? ☐Yes ☐No At what pressure? _____________________

Regulator Inspection #2

Run Type: ☐Primary ☐Secondary Function: ☐Worker ☐Monitor ☐Primary cut ☐Secondary cut

Serial number: ____

Model: ____ Body size: ________________

Pilot: ☐Yes ☐No Spring Range: _________________ Orifice Size: ____________________

Capacity: __________________________ Capacity verified from previous inspection? ☐Yes ☐No

Set point as found: ________________ Set point as left: ________________

Was regulator lock up obtained? ☐Yes ☐No At what pressure? _____________________

Regulator Inspection #3 (if applicable)

Run Type: ☐ Primary ☐ Secondary   Function: ☐ Worker ☐ Monitor ☐ Primary cut ☐ Secondary cut

Serial number: ____

Model: ________________________________ Body size: ______________

Pilot: ☐ Yes ☐ No   Spring Range: _____________   Orifice Size: ______________

Capacity: ____________________ Capacity verified from previous inspection? ☐ Yes ☐ No

Set point as found: ____________ Set point as left: ____________

Was regulator lock up obtained? ☐ Yes ☐ No   At what pressure? ______________

Regulator Inspection #4 (if applicable)

Run Type: ☐ Primary ☐ Secondary   Function: ☐ Worker ☐ Monitor ☐ Primary cut ☐ Secondary cut

Serial number: ____

Model: ________________________________ Body size: ______________

Pilot: ☐ Yes ☐ No   Spring Range: _____________   Orifice Size: ______________

Capacity: ____________________ Capacity verified from previous inspection? ☐ Yes ☐ No

Set point as found: ____________ Set point as left: ____________

Was regulator lock up obtained? ☐ Yes ☐ No   At what pressure? ______________

Relief Valve Inspection (if applicable)

Serial number: ____

Model: ________________________________ Body size: ______________

Vent stack size: ________________   Approved cap/lid on vent stack? ☐ Yes ☐ No

Pilot: ☐ Yes ☐ No   Spring Range: _____________   Orifice Size: ______________

Capacity: ____________________ Capacity verified from previous inspection? ☐ Yes ☐ No

Set point as found: ____________ Set point as left: ____________

Additional Information

Any repairs or additional maintenance required? ______________________________

____

Additional comments/notes: ____

____

____

FARM TAP INSPECTION RECORD

Completed by: ____ Date: ________________

Location: ____

General Inspection:

Pipe properly supported or rigid? ☐Yes ☐No

Coating condition at pipe-to-soil interface: ☐ Good ☐Needs attention ☐ NA

Any atmospheric corrosion metal loss discovered? ☐Yes ☐No

Full thread engagement on all flange bolts? ☐ Yes ☐ No ☐NA

Regulator Inspection #1

Serial number: ____

Model: ____ Body size: _________________

Pilot: ☐ Yes ☐No Spring Range: ________________ Orifice Size: __________________

Capacity: _________________________

Set point as found: _______________ Set point as left: _______________

Was regulator lock up obtained? ☐Yes ☐No At what pressure? ____________________

Regulator Inspection #2 (if applicable)

Serial number: ____

Model: ____ Body size: _________________

Pilot: ☐ Yes ☐No Spring Range: ________________ Orifice Size: __________________

Capacity: _________________________

Set point as found: _______________ Set point as left: _______________

Was regulator lock up obtained? ☐Yes ☐No At what pressure? ____________________

Relief Valve Inspection (if applicable)

Serial number: ____

Model: ____ Body size: _________________

Vent stack size: ____________________ Approved cap/lid on vent stack? ☐Yes ☐No

Pilot: ☐Yes ☐No Spring Range: ________________ Orifice Size: __________________

Capacity: _________________________

Set point as found: _______________ Set point as left: _______________

GAS PIPELINE PRE-INSTALLATION CHECKLIST

Permitting:

Are permits going to be needed from the State, County or Railroad?________________________________

General Information:

Installing a service line, distribution main, or transmission line?____________________________________

If installing transmission, does design allow for internal inspection devices?_________________________

Installing polyethylene or steel pipe and fittings?____

MAOP of existing facilities to which the pipeline will be connected?________________________________

Pipeline Sizing:

Projected size of pipe?____

Projected length of pipeline installation?____

At what pressure will the installation operate?____

What is the maximum capacity of the projected pipeline at operating pressure?_______________________

What is the projected maximum customer load?____

Does the projected pipeline have enough capacity for the load potential at the desired operating pressure?____

Meter & Regulator Sizing:

How much pressure has the customer requested? (2 psi, 7" water column, etc..)______________________

What type and size of regulator will be installed?____

What orifice size will be used in the regulator?____

Does the regulator have sufficient capacity for the load demand?____________________________________

What type and size (capacity) of meter will be installed?____

Does the meter have sufficient capacity for the load demand?______________________________________

Page 1 of 3

EFV & Curb Valve Information:

Will an EFV or Curb Valve be installed?____

If an EFV is required, what size (capacity) will be installed?_______________________________

If a curb valve is required, what size (OD) will be installed?_______________________________

If the main is under pavement will the EFV/curb valve be installed as close to the main as possible or at the curb line allowing easier access?____

Additional Information:

What size & type of tap tee will be used? (weld-on, bolt-on, fusion)_________________________

What type of riser will be used? (anodeless or steel)_____________________________________

How many joints will there be? (pipe to pipe, pipe to tap, pipe to riser, etc…)______________________

Are joints going to be welded, fused, or are couplings going to be used?_______________________

If couplings are used, what type? (compression, stab, etc..)_________________________________

Is tracer wire going to be installed?____

Does the meter set need additional protection? (barricades)_______________________________

Is the projected site for the installation of the meter set at least 3' away from any potential ignition source or any openings into the building?____

Pressure Testing Requirements:

Installing a service line, distribution main, or transmission line?_____________________________

What size of pipe is going to be installed?____

What is the projected length of the pipeline? (add riser length if installing service line)_______________

At what pressure will the pressure test be conducted? (90 psi minimum)_______________________

How long will the pressure test be conducted?____

Does the pressure test meet MAOP & O&M requirements?_________________________________

Projected Pipeline Route (map of projected installation)

Additional Installation Comments:____

____

____

____

____

PIPELINE INSTALLATION REPORT

Date of Installation:___________________________

GENERAL INFORMATION

Location/Address:____

Installing (check all that apply): ☐ Main ☐Transmission ☐Service Line Type of Pipe: ☐PE ☐Steel

Pipe Diameter:_____________ Wall Thickness / SDR:_____________ Length of Pipe:_________________

MAOP of System Segment:__________ Test Pressure Required:____________ Test Time Required:___________

INSTALLATION INFORMATION

Type & Size of Tap Tee:____ Date Installed:________________

EFV Installed: ☐ Yes ☐ No Curb Valve Installed: ☐Yes ☐ No EFV ID Tag Installed: ☐ Yes ☐ No

EFV Capacity or Size of Curb Valve Installed:________________________ Meter Capacity:________________

Visual Inspection of Pipe & Components Prior to Installation: ☐ Yes ☐ No

Pressure Test Date:___________ Time Start:_________________ Pressure Start:__________________

Time Stop:_________________ Pressure Stop:__________________

Total Time:_________________ Total Pressure Loss or Gain:_____________

Test Medium: ☐Air ☐Nitrogen ☐ Water ☐ Natural Gas Other:____________________________

PURGING INFORMATION

Date of Purge:_____________ Size of Purge Fitting:_____________ Type of Purge Gas:__________________

Time Start:___________________ Time Start:___________________ % Gas Obtained:___________________

EXPOSED PIPE / CORROSION INFORMATION

Exposed Pipe: ☐ Main ☐Service Type of Exposed Pipe: ☐ Steel ☐ PE Size of Exposed Pipe:___________

Type of Coating: ☐X-Tru Coat ☐ Epoxy ☐ Coal Tar Enamel Other:_________________________________

Condition of Coating:___________________ Condition of Pipe (if applicable):____________________________

Any Corrosion Found: ☐ Yes ☐No Type of Corrosion: ☐General ☐Localized

Pitting Found: ☐ Yes ☐ No Depth:________________ Gouges Found: ☐Yes ☐ No Depth:______________

VOLTAGE READINGS TAKEN: Above Ground:__________ Pipe Level:_____________ IR Drop:__________

Page 1 of 2

Type of Wrap/Coating Used During Installation or Repairs (if applicable):________________________________

Internal Section of Pipe Exposed: ☐ Yes ☐ No   Any Internal Corrosion Found: ☐ Yes ☐ No

ADDITIONAL INFORMATION

Depth of Pipeline Installation:__________________   Type of Backfill Used:____________________________

Tracer Wire Installed: ☐ Yes ☐ No

Anode Installed for Additional Cathodic Protection: ☐ Yes ☐ No   Size of Anode Installed:__________________

Fire extinguisher located on site and procedures were followed to prevent accidental ignition. ☐ Yes ☐ No

MAPPING INFORMATION

SIGNATURE:____

Page 2 of 2

PRE-INSTALLATION PRESSURE TEST REPORT

GENERAL INFORMATION

Location of installation (if applicable): ____

Purpose of pre-test: ____

____

____

List of pipe and/or components included in test (this information may be included on the Material Installation Record and attached to this report): ________________________________

____

____

____

PRESSURE TEST INFORMATION

Test Date: ______________________________

Time Start: ___________________________ Pressure Start: _________________________

Time Stop: ___________________________ Pressure Stop: _________________________

Total Time: __________________________

Test Medium Used: ☐ Air ☐ Nitrogen ☐ Water ☐ Natural Gas Other: __________________

Test Conducted by: ____

DIAGRAM OF PIPE &/OR COMPONENTS (if necessary)

MATERIAL INSTALLATION RECORD

Note: The "print line" or manufacturing data that is stamped on or included in the packaging of the pipe and/or components used during installation must be **documented** and maintained.

Date of Installation: ___________________________________

Job Number or Address of Installation: ____

____

Pipe Information (as applicable)

Material Type & Grade: ____

Subcategory (coiled or stick): ____

Lot #: ____

Production Date: _____________________________________

Diameter: ___________________________

Wall Thickness or SDR: ___________________________________

Manufacturer: ____

Tap Tee Information (as applicable)

Material Type & Grade: ____

Subcategory (Example, electrofusion by stab outlet): ____

Lot #: ____

Production Date: ____________________________________

Diameter 1 (main connection size): ______________________

Diameter 2 (outlet connection size): ______________________

Wall Thickness or SDR: ___________________________

Manufacturer: ____

Page 1 of 2

EFV or Curb Valve Information (as applicable)

Material Type & Grade: ____

Category (EFV or curb valve): ________________________________

EFV capacity (if applicable): __________________________________

Lot #: ____

Production Date: _______________________________

Diameter: _______________________

Wall Thickness or SDR: _____________________________

Manufacturer: ____

Coupling Information (as applicable for each coupling used)

Material Type & Grade: ____

Subcategory (electrofusion, stab, etc.): ___________________________________

Lot #: ____

Production Date: _______________________________

Diameter: _______________________

Wall Thickness or SDR: _____________________________

Manufacturer: ____

Riser Information (as applicable)

Material Type & Grade: ____

Subcategory (anodeless): ___________________________________

Lot #: ____

Production Date: _______________________________

Diameter: _______________________

Wall Thickness or SDR: _____________________________

Manufacturer: ____

Page 2 of 2

ABANDONED FACILITIES REPORT

NOTE: Facilities that are deactivated and physically removed from the system are not considered abandoned. Only facilities that are deactivated and remain in the system are considered abandoned.

GENERAL INFORMATION

Date of Abandonment: ______________ Completed by: ___________________________________

Address/Location: ____

____

Facility Type: ☐ Main ☐ Service Line ☐ Other: ______________________________________

Material Type: ☐ PE ☐ Steel ☐ Other: ____

Material Size: ____________________________________

CORROSION INFORMATION

External Corrosion: ☐ Yes ☐ No ☐ NA Pitting: ☐ Yes ☐ No If yes, depth: ____________

Internal Corrosion: ☐ Yes ☐ No ☐ NA Pitting: ☐ Yes ☐ No If yes, depth: ____________

Additional Comments/Concerns: ____

____

____

ABANDONMENT INFORMATION

Fire extinguisher located on-site and procedures followed to prevent accidental ignition? ☐ Yes ☐ No

Pipe bled &/or purged of natural gas? ☐ Yes ☐ No

Method of closure for open ends of pipe? ☐ End Cap ☐ Plug ☐ Spray Foam ☐ Other

If other, describe closure type: ____

Amount of pipe abandoned (measured in feet): _____________________________

Anode installed for additional cathodic protection? ☐ Yes ☐ No ☐ NA Size: ______________

Additional Comments: ____

____

____

____

NOTE: All abandonments must be mapped and should be retained for future reference until the pipe and/or components are removed from the system. See next page for mapping.

MAPPING INFORMATION

Page 2 of 2

VALVE INSPECTION & MAINTENANCE RECORD

Valve Number: ___________________________

Valve Location/Address: ____

____

Facility: ☐ Distribution ☐ Transmission Valve Type: ☐Plug ☐Ball ☐Gate

Material Type: ☐ Steel ☐ PE Valve Size: _______________________________

Valve classified as: ☐ Emergency valve ☐Non-emergency valve ☐Curb valve

NOTES: ____

____

____

NOTE: A "Yes", "No", or "NA" should be provided in the appropriate columns.

Date	Accessible	Operated	Greased	Completed by

Page 1 of 2

MAP OF VALVE LOCATION

Valve Number: _______________

3 - YEAR ATMOPSHERIC CORROSION INSPECTION RECORD

Inspection Interval for Pipelines Other Than Service Lines

Date(s) completed: ____

Completed by: ____

Area/section/location inspected: ____

Facility type: ☐ Distribution ☐ Transmission

The following areas and/or items were inspected on all above ground piping, as applicable, during the completion of the survey:

1) Atmospheric corrosion metal loss
2) Pipe-to-soil interface
3) Disbonded and/or damaged pipeline coatings
4) Areas under pipe supports
5) Areas under thermal insulation
6) Surface oxidation that may require cleaning and/or painting
7) Regulator vents pointing down and contain a screen
8) Relief valve vents pointed down or contain an approved vent cap

NOTE: All locations that require remedial action are listed below. For all locations not listed below, all atmospheric corrosion inspection items were found to be satisfactory at the time of inspection.

Address/Location	Problem Found	Date Corrected

5 - YEAR ATMOPSHERIC CORROSION INSPECTION RECORD

Inspection Interval for Service Lines

Date(s) completed: ____

Completed by: ____

Area/section/location inspected: ____

Facility type: ☐ Distribution ☐ Transmission (farm taps)

The following areas and/or items were inspected on all above ground piping, as applicable, during the completion of the survey:

1) Atmospheric corrosion metal loss
2) Pipe-to-soil interface
3) Disbonded and/or damaged pipeline coatings
4) Partially buried meter and/or service valve
5) Areas under pipe supports
6) Areas under thermal insulation
7) Surface oxidation that may require cleaning and/or painting
8) Regulator vents pointing down and contain a screen

NOTE: All locations that require remedial action are listed below. For all locations not listed below, all atmospheric corrosion inspection items were found to be satisfactory at the time of inspection.

Address/Location	Problem Found	Date Corrected

PIPE TO SOIL POTENTIAL RECORD

Note: Readings shall be taken at least once every calendar year not to exceed 15 months. Avoid taking readings on top of or near anodes where possible. All readings shall be -0.85 V or greater. If not, corrective action must begin within 90 days and be remedied by the next survey cycle.

CP readings taken by:____

DATE	TEST LOCATION	P/S READING	CORRECTED P/S READING (if needed)	DATE

ANODE INSTALLATION REPORT

NOTE: This report should be used when the installation of an anode is the only operation or maintenance task being performed.

GENERAL INFORMATION:

Date of Installation: ________________________________

Installed by: ____

Location/Address: ____

____

ANODE INFORMATION:

Anode installed on: ☐ Main ☐ Service Line ☐ Riser Pipe ☐ Isolated Fitting

Size of anode installed: ☐ 17# ☐ 5# ☐ 3# ☐ 1#

Type of soil at installation location: ☐ Top Soil ☐ Clay ☐ Sand ☐ Mixture

Soil condition: ☐ Wet ☐ Dry

Pipe to soil potential before installation: ___________________ After installation: __________________

EXPOSED PIPE / CORROSION INFORMATION

Exposed Pipe: ☐ Main ☐ Service ☐ Riser ☐ Isolated Fitting

Size of Exposed Pipe/Fitting:___________________

Type of Coating: ☐ X-Tru Coat ☐ Epoxy ☐ Coal Tar Enamel ☐ Hot Wrap ☐ Wax Wrap

Other:____

Condition of Coating: ☐ Good ☐ Damaged ☐ Disbonded

Condition of Pipe (if applicable): ☐ Good ☐ Damaged ☐ Corrosion Found

Type of Corrosion: ☐ General ☐ Localized ☐ None Found

Pitting Found: ☐ Yes ☐ No Depth:__________________

Gouges Found: ☐ Yes ☐ No Depth:__________________

Internal Section of Pipe Exposed: ☐ Yes ☐ No Any Internal Corrosion Found: ☐ Yes ☐ No

Type of coating installed after anode installation: ____

Page 1 of 2

MAPPING INFORMATION:

NOTE: Anode installations must be mapped and recorded. The following grid pattern may be used to map installation.

Page 2 of 2

RECTIFIER INSPECTION RECORD

Note: Rectifiers must be inspected and readings obtained at least 6 times each calendar year with intervals not exceeding 2 ½ months.

GENERAL INFORMATION:

Date of Inspection: ______________________________

Completed by: ____

INSPECTION ITEMS:

Any visual indications of damage or vandalism to cabinet or exposed wiring? ☐ Yes ☐ No

If yes, describe the problem: ____

____

____

____

Are all mechanical electrical connections tight? ☐ Yes ☐ No

Are the anode lead wires connected to the positive output terminal? ☐ Yes ☐ No

What is the output or control dial setting? _____________________________

"Hour" meter reading: ____

AC voltage reading (taken with multimeter): ____

DC voltage reading (taken with multimeter): ____

Millivolt reading across the shunt (reading multiplied by shunt factor): ______________________________

Pipe to soil potential reading at closest possible test location to the rectifier:

Instant "on" reading: ____________________________

Instant "off" reading: ____________________________

ADDITIONAL COMMENTS:

List any additional maintenance or concerns below: ____

____

____

____

Signature: ____

ODORANT USAGE REPORT

Date: ____________________ Completed by: ____

AMOUNT OF ODORANT USED

How many lbs. of odorant was used during this period?

______________ LBS

AMOUNT OF GAS DELIVERED

1) Meter Reading (this report) _________________________________MCF

2) Meter Reading (last report) _________________________________MCF

3) Delivered Gas (line 2 - line 1) __________________________________MCF

4) Convert MCF to MMCF (MCF / 1000) _______________________________MMCF

ODORIZATION RATE

Calculate rate of odorization in lbs/MMCF. Divide lbs. of odorant used by total delivered gas in MMCF.

________________ lbs./MMCF

ADDITIONAL INFORMATION (if necessary)

____

____

____

____

PERIODIC SAMPLING OF ODORANT

(Sniff Test)

Date: ________________________

Completed by: ____

Location of Test: ____

____

Time test was taken: ___________________________________

Odor level (% gas) when odorant is readily detectable: _____________________________

Comments: ____

____

____

____

Date: ________________________

Completed by: ____

Location of Test: ____

____

Time test was taken: ___________________________________

Odor level (% gas) when odorant is readily detectable: _____________________________

Comments: ____

____

____

____

VAULT INSPECTION & MAINTENANCE RECORD

NOTE: All vaults with an internal volume of 200 cubic ft. or more must be inspected at least once each calendar year with intervals not exceeding 15 months.

Completed by: ____ Date: ____________________

INSPECTION ITEMS

Condition of lid/cover: ☐ Good ☐ Damaged Are repairs needed: ☐ Yes ☐ No

CGI reading of atmosphere before entry into vault (% gas): ________________________

Any leaks found on piping or components contained in the vault? ☐ Yes ☐ No

If leaks are found, were the leaks fixed? ☐ Yes ☐ No

Condition of vault walls: ☐ Good ☐ Damaged ☐ Cracked ☐ Caved-in

Is there standing water in the vault? ☐ Yes ☐ No

Condition of entry and exit points of pipe through the vault walls: ☐ Good ☐ Needs attention

If entry and exit points need attention, describe the what remedial action is needed: __________________

____

____

____

Are pipe supports properly installed and rigid? ☐ NA ☐ Yes ☐ No

Any signs of corrosion metal loss? ☐ Yes ☐ No

If corrosion metal loss is discovered, what is the depth of metal loss? _____________________________

Piping and components need cleaned and painted? ☐ Yes ☐ No

Additional comments/concerns: ____

____

____

____

CUSTOMER OWNED PIPING & EFV NOTIFICATION RECORD

The following individuals received a copy of the "Customer Owned Piping" & “EFV” notification the same date they signed up for service and received the New Customer Packet

Customer Name (Print)	Customer Signature	Date