Gas Operations

Construction and Service Manual

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Gas Engineering Standards
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018	06-01-2006	SSC	055	05-01-2014	JLM
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029	04-30-2008	JLM	066	08-01-2017	JLM
030	07-31-2008	JLM	067	11-01-2017	JLM
031	09-01-2008	JLM	068	02-01-2018	JLM
032	12-19-2008	JLM	069	05-01-2018	JLM
033	04-30-2009	JLM	070	08-01-2018	JLM
034	07-31-2009	JLM	071	11-01-2018	JLM
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Rev. No.	Rev. Date	Initials
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078	04-01-2020	TB
079	05-01-2020	TB
080	07-01-2020	TB
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090	12-02-2024	TB
091	01-07-2025	TB
092	01-23-2025	TB
093	03-04-2025	TB
094	04-04-2025	TB
095	04-15-2025	BB
096	05-01-2025	BB
097	08-01-2025	BB
098	08-05-2025	BB
099	08-26-2025	BB
100	11-18-2025	BB

Rev. No.	Rev. Date	Initials

Table of Contents

B-3 Steel Procedures

B-4 Plastic Procedures

B-5 Welding

C Service Procedures

C-1 General

C-2 Meters and Regulators

C-3 Turn Ons

C-4 Turn Offs

D Other Procedures

E Appendices

E-1 Tables

Preface

This Manual is intended for use by all employees engaged in the Construction, Service and Leak Investigation operations of CenterPoint Energy Transmission and Distribution systems. It provides for safe, efficient and standardized operations.

The provisions in this manual comply with the D.O.T., Office of Pipeline Safety Requirements as documented in the federal standards 49 CFR, Part 191 and 192 and subsequent state pipeline safety regulations.

It will be the responsibility of management to update, distribute, and train to assure that each employee is knowledgeable in the portions of this manual that apply to their work assignments.

The employee is responsible for maintaining their current copy and for understanding and implementing revisions related to their work assignments.

Duplication or reproduction of any portion of this manual outside of our Company is prohibited without written consent.

Update Procedures

This manual is by its nature dynamic. As the needs of our customers, employees, technology, and Federal / State Pipeline Safety regulations change, these guidelines and procedures will need to address those changes. Any additions, deletions, or revisions of procedures in this manual must be approved by the Our Company Gas Standards Group prior to being implemented by Gas Operations. The Gas Standards Group will work together with the Gas Operating Regions to implement any changes.

Our Gas Standards Group will issue all updates via our Company Intranet Web page.

Safety Precautions

When performing construction or other work, the first priority is to protect Life and Property

When arriving at a job site the first thing to do is to inspect the area. Perform a site evaluation upon arrival and prior to leaving the site. A proper site evaluation will help determine the appropriate safety precautions. Form CNP 8327 Job Safety Briefing located in Power Forms can be used for this purpose.

Appropriate Company approved PPE will be worn. Refer to Section 3 of the Safety and Health Manual.

Clothing – Clothing worn under Flash Fire Resistant suit must be a Flame Resistant (FR) uniform (properly tucked and sleeved buttoned). Refer to Section 4.3 of the Safety and Health Manual.

Safety of the employees, general public and their property will always be considered.

Eliminate ignition sources. Some ignition sources include gaslights, flashlights, emergency lights; automobiles, trucks, backhoes or excavators; electric machinery, tools, and equipment (transformers, rectifiers, streetlights, etc.); diesel engines and hot engine parts; static electricity; lighted tobacco products; cell phones and tablets.

When working around blowing gas see Special Considerations For Gaseous Atmospheres CS-D-2.140.

Treat electrical equipment as a potential source of ignition and follow proper practices when using electrical equipment near a gaseous atmosphere.

Precautions should be observed around electrical equipment. Refer to Section 16.4(11) of the Safety and Health Manual.

Do not park or operate vehicles or equipment in the gaseous or any potentially gaseous area.

Revision History: 05-03-21 (Rev. 084, MOCR2144); 01-17-25 (Rev. 091, MOCR3124)

Gauging

This section provides guidance on gauge calibration and selection.

Calibration

All pressure measuring instruments (gauges, recording charts, manometers, etc.) should be verified for accuracy and documented within the last 12 months.

Selection

Gauge selection should be made based on the expected pressure range to be experienced during use and should be within midrange of the gauge scale. When in doubt of expected pressure range, select a gauge with a scale that equals or exceeds the system MAOP. If the actual pressure reading is significantly less than the midrange of the scale, select a gauge with a lower scale to ensure accurate pressure reading. Ensure the selected gauge has a scale appropriate for the expected pressure change. In the event a gauge is over-pressured, remove the gauge from service and verify gauge accuracy and operability.

Gauge selection can vary depending on the application. Both analog and digital gauges can be used interchangeably. For system or station monitoring, ensure gauge visibility (size and sight) is clear. Gauge location during system monitoring (tapping and stopping, regulator station bypassing, etc.) is important to ensure both upstream and downstream pressures are monitored. Digital gauges with back lit screens may help during low light situations. During extended periods of monitoring, ensure digital gauges have ample battery life. Liquid filled or digital gauges are ideal for locations with vibrations. For confirming customer delivery pressures, ensure gauge has units applicable for set pressure (inches WC, psig).

Revision History: 05-03-21

Valve and Pressure Change Operations

Operation of a valve, pressure control equipment, pressure control fitting (stopper), squeeze or any other task/operation that changes the pressure or introduces pressure to a facility should never occur unless the expected pressure change is known.

Revision History: 05-03-21

Construction Safety Precautions

In addition to the Safety Precautions (CS-A-3) and General Considerations (CS-A-4), the following should be observed and considered.

The work area should be secured to keep out unauthorized persons. The use of police or fire department personnel may be necessary to assist with this.

A 20-30-lb BC fire extinguisher will be readily accessible.

On plastic see Static Electricity (CS-B-4.200)

When necessary see Welding Safety Considerations CS-B-5.110.

Employees working around welding operations must take caution not to directly observe the welding arcs.

Electrofusion output cables must be de-energized when connecting to or disconnecting from fitting.

Generator, control box and supply line junction **must** be located out of the trench.

Use a Ground Fault Circuit Interrupter on all portable generators or when plugging into temporary power poles around new construction.

Use only UL listed grounded or double insulated equipment or tools.

Because large forces are required for squeeze-off, particularly for larger main sizes, precautions should be taken to prevent damage to the squeeze tool and pipe while achieving adequate pressure control. See CS-B-4.190.

Each length of pipe and each other component must be visually inspected at the site of installation to ensure that it has not sustained any visually determinable damage that could impair its serviceability.

Additional Safety Precautions for Emergency Repairs

During an emergency, extra precautions must be taken while the employees assess the situation. Work cannot be performed safely until an assessment has been completed in accordance with CS-B-1.180.

All construction safety precautions listed above still apply.

Determine the following through engineering records and/or on-site verification before taking any actions. This will dictate what methods and components can be used to control releases and make repairs.

- Pipe size, material and method used to join the pipe and system feeds
- Location of nearby valves or existing pressure control fittings
- Pressure classification of the pipeline (UP, IP, HP) and whether it is part of a distribution or transmission system

  Note: If the damage is on a high pressure distribution or transmission system, verify the system MAOP, wall thickness of any pipe and review the data and repair plan with the Operations Supervisor. Consult with a pipeline integrity engineer for transmission lines for any additional precautions or requirements.

Inspect and evaluate the pipe or fitting to be repaired to determine the extent of any damage or conditions not related to the emergency, such as corrosion. Determine the appropriate repair method based on Company standards and policies.

Abandoning Mains and Services

Note: Refer to Construction Safety Precautions section.

Piping that is abandoned must be rendered safe by making sure the contents are non combustible and by sealing all openings.

See CS-B-1.330 for procedures to follow if the coating on the pipe to be removed or abandoned may contain asbestos.

Environmental personnel must be contacted for instructions if there is a possibility that the pipe may be contaminated with PCB's.

Steps:

1) Verify the proper main or service to be abandoned. Also verify that no active meters exist on lines to be abandoned.

2) Depressurize the line. See Section B-1.230, Depressurize.

3) Disconnect line from all sources and supplies of gas. Service lines should be disconnected at main if practical. Service lines abandoned with a main being abandoned do not need to be disconnected from that main.

4) Purge the following from natural gas to air:

   - All mains if the volume of gas remaining poses a potential hazard
   - Services 2 inches and larger
   - Services smaller than 2 inches and longer than 500 feet
   - For pipe sizes larger than 14 inches, see the design for procedures to follow, or contact engineering if no procedures have been specified

   If purging is required, it will be done using air or inert gas. See Section B-1.230, Purging Natural Gas To Air.

5) Abandoned piping must be sealed at the ends. Acceptable methods of sealing mains and service for abandonment include the following:

   - Close ends with fittings by welding, fusing or mechanical means.
   - Seal opening by injecting polyurethane foam into pipe ends.

6) Abandoned vaults will be filled with suitable compacted materials.

7) Exposed piping that is abandoned should be cut out ,removed and disposed of in the proper manner.

8) Soap test all remaining active connections at line pressure. If plastic, rinse soap off pipe surfaces with clean water.

9) At the point where the pipe abandoned was disconnected, use approved pipe wrap or other approved coating material as needed to protect pipe remaining in service.

See DOT § 192.727

Bending and Earth Loading

Consideration must be given to the installation of all plastic piping systems to avoid failures caused by “external stress.” See Direct Burial of Plastic Pipe for more information on minimum bending radius for plastic pipe.

Care must be taken to avoid induced bending stresses to the pipe when backfilling, compacting and settling of fill materials.

Mains and services should be supported by a firm material. Relatively compactible and clean fill material should be used to fill voids beneath transitions and service connections. Protective sleeves (bridging sleeves) should be used on plastic service connections at the main to help support and protect from bending stresses caused by subsidence.

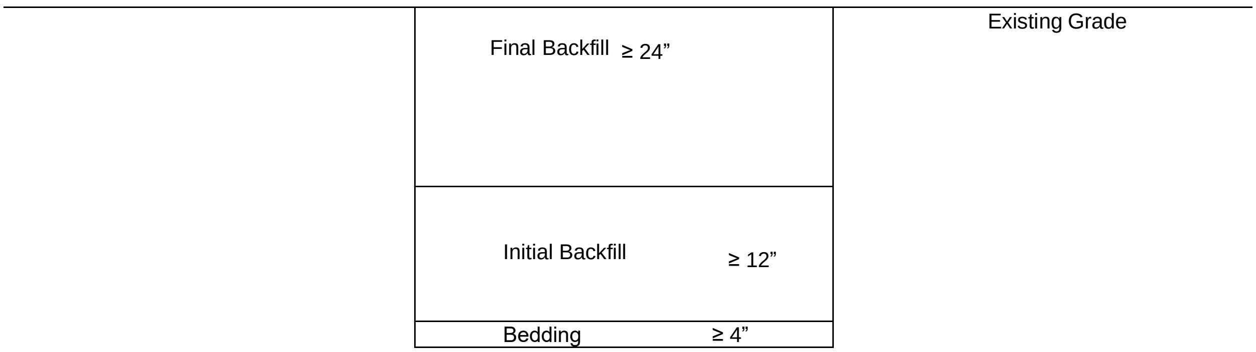
Where rock or other debris could damage the pipe or coating, the first 4” of fill material should be compacted and free from rocks or other debris that could damage the pipe. Contact Engineering Dept. in special cases when a rock shield or other protective device may be needed. The final backfill material should not have material greater than 4” in diameter. The job supervisor or inspector should determine the acceptability of the material.

Backfill material must be sufficiently compacted to support anticipated loading above the pipe, particularly where the pipe will be under pavement. Engineering will specify specific requirements for compaction to meet local or state codes or standards.

The following chart and drawing provide general guidance for content of the material and thickness of the various zones.

Maximum Particle Size by Trench Zone

Bedding	Initial Backfill	Final Backfill
≤ ½”	≤ ½”	Clean fill material, using spoil where suitable.



Transmission Coating Assessment After Backfill

For onshore transmission line installations that results in 1,000 feet or more of continuous backfill length along the pipeline, a coating damage assessment must occur within 6 months of the backfill to confirm the integrity of the coating using direct current voltage gradient (DCVG), alternating current voltage gradient (ACVG), or other technology[1] that provides comparable information. The coating damage assessment is exempt where geographical, technical, or safety reasons preclude the activity. For any coating deficiencies found during this assessment, a remedial action plan will be developed and apply for any necessary permits within 6 months after completing the assessment.

Coating damage classified as severe[2] will be repaired within 6 months of the assessment or as soon as practicable after receipt of permits, not to exceed 6 months.

Records documenting the coating assessment findings and any remedial actions performed under this section will be retained for the life of the pipeline.

[1] Notification to PHMSA must occur at least 90 days in advance. Refer to O&M Section 1.5.
[2] 60 percent for DCVG or 70 dBµV for ACVG, or those values defined as “severe” in the version of NACE SP0502, Section 4 incorporated by reference in 49 CFR 192.

Bar Hole Test

Note: Refer to Construction Safety Precautions section.

Additional Safety Precautions:

- Do not exceed the safe operating pressure of any pneumatic tool
- Never use an air hose as a lifting rope
- Shut off and bleed down the air supply to any pneumatic tool before making adjustments or changing tools.
- Do not use a tool with an attachment that doesn't have a safety clip or retainers securely installed to prevent the attachment from flying off.
- Probe bar must be insulated to withstand electrical current.
- Do not use a hammer on your probe bar to force the probe through the ground. When hammering is required, use a knocker bar.

Steps:

1) Initial bar hole test activities include reviewing maps and records and locating underground facilities to understand what natural gas facilities are in the area where leaking methane is suspected. Request locates of the area to identify if and where other utilities are located. Additional locating area may be included to minimize delays in leak location verification and repair. Natural gas facility location and depth may impact a first responders' ability to perform adequate bar hole testing without requesting additional resources to do so.
2) Bar hole test should begin at the most obvious location depending on initial findings, including dry dirt, dead vegetation or plants, fire ant mounds, bubbling, hissing sounds, and soil discoloration. In general, bar hole test can begin at the gas service riser location and along the foundation adjacent to the gas service and the gas main facing side of the structure. The remaining sides of the structure foundation should be checked if CGI readings indicate it is appropriate to do so. Bar hole test other underground natural gas facilities where appropriate and based on CGI test results, including natural gas mains and services, foreign utilities, and other structures where indications of methane are found during initial air sampling activities.
   a) For bar hole testing, spacing for the bar holes should start at approximately 10' of separation between bar holes until methane readings in bar holes are established. When below-grade methane has been detected with a CGI, bar hole spacing distance should decrease in separation until the location of the strongest below-grade methane concentration is determined.
   b) Bar hole spacing around structure foundations should be spaced approximately 18" from foundation to avoid false positive methane testing results due to foundation and structure materials that could leach contaminants into surrounding soils.
   c) Consideration should be given to sustained readings of percent gas when determining potential leak locations. Consistent CGI readings in bar hole test would likely indicate proximity to leak location.

3) Establishing the 0% perimeter of a below-grade methane leak and the area of highest below-grade methane concentration(s) are appropriate for determining hot and cold zones. Hot zones are the area from the highest concentration of methane out to the 0% perimeter. Cold zones are the area beyond the 0% perimeter where below-grade leaking methane has not been detected.
4) Use CGI to take gas samples in the holes. Refer to manufacturer's written instruction for proper operation of gas detecting equipment. All leak investigation equipment used shall be confirmed to have a current calibration before use.
5) Bar hole test for services should be approximately 18" – 24" in depth. Bar hole test of mains should be approximately 24" to 36" in depth. Consider bar hole testing difficulties such as frost, blacktop, concrete, high water table, depth of facilities, etc. when choosing how best to perform bar hole testing, as some of these difficulties may call for additional employee assistance and/or become part of secondary response activities. Natural gas facilities deeper than 36" will require additional tooling and assistance to bar hole test.

Note Use caution when bar hole testing to not make bar holes directly above natural gas facilities and foreign utilities.

6) Document all bar hole locations as indicated below. Bar hole locations should be represented by numeric values beginning with the number 1 for the first bar hole. It is appropriate to mark the location of each bar hole so they are visible for all follow-up activities, however, do not mark methane concentrations on the ground that could be misinterpreted and create issues with non-employees. These readings should only be noted on the form documenting bar hole locations. On the form, consider documenting the following when appropriate:
    - Addresses, street names, intersections, etc.
    - Bar hole number
    - Time reading was taken and % concentration of methane in each bar hole
    - Distance apart from each bar hole
    - Distance of bar hole from identifying objects, such as foundation, street, curb, etc.
    - Distance between highest concentration and edge of 0% perimeter
    - Any additional information appropriate to bar hole testing activities for the leak
7) It may be necessary to drill or probe more holes between the existing bar-holes to help pinpoint the leak.
8) Where large concentrations of gas are encountered it may be necessary to ventilate holes, by using natural ventilation or air moving devices. Be sure to allow approximately 30-60 minutes for the bar hole test to ventilate/air out before taking CGI readings.
9) The bar-hole with the highest sustained gas reading "should" indicate the location of the gas leak. This will be the initial excavation point. However, additional investigation and 360-degree probing may be required following excavation activities if the leak is not confirmed, or to verify there are no other leaks in the area once a leak is confirmed, and repairs are completed.

Bypassing Mains

General Information

Bypasses can be run through pressure control fittings, plugging machines etc. Materials for bypasses must be gas approved such as steel pipe, plastic pipe or specially rated rubber hoses.

Plastic pipe and hoses shouldn't be left above ground over night unless the pipe is located where damage by external forces is unlikely or is otherwise protected against such damage.

Bypasses installed between two sections of pipe operated at different pressures or with different MAOP's must be continuously monitored.

Steps:

1) The bypass device must be of appropriate size to deliver the necessary amount of gas through it. The engineering department should be consulted if the line is a primary source of supply to a system or large customer or during periods of high demand.

2) For fittings and machine bypasses, the fittings or tees should be installed first. Refer to the appropriate Welding or Fusion Procedure for installation.

3) Connect the bypass with appropriate purge device prior to shutting down the line.

4) Insure that bypass device is safe from damage from external forces and precautions taken against such damage.

5) Install a gauge at an upstream connection. Use a gauge that will operate at approximately midrange during the bypassing operation.

6) Install gauge on a riser or fitting downstream from the bypass connection.

7) Open valves and purge bypass device and bring bypass on line.

8) Plug or squeeze line. When plugging make sure stoppers are aligned properly to allow gas flow.

A purge device may need to be installed downstream of the bypass and blown for an appropriate amount of time to notice a drop in the gauges. This will indicate if the bypass is adequate enough to maintain the line pressure while the work is performed.
Note: If after closing purge device pressure does not return to normal levels, raise squeezers or plugging machines and consult your supervisor.

9) Monitor gauges during the job.

10) When work is complete turn off valves, purge, remove bypass and complete pressure control fittings.

See DOT §192.627

An EFV is required if the total load is less than 1000 SCFH based on the capacity of the meter. When a branch service or multifamily service is installed, the capacity of all meters downstream of the EFV must be added together. Consideration must be given for increased meter capacity where the customer is delivered gas at elevated pressures. Contact Engineering for assistance determining the capacity of a meter.

The EFV should be located in an accessible location as near as practical to the fitting connecting the service line to the mainline. It should not be installed underneath pavement if a practical alternative location is available. If this is not possible, it should be installed in a location that is determined to be the most accessible in the future when considering the space necessary to replace it. This location must be clearly and precisely documented on the order.

Engineering will size EFV according to customer load following manufacturer's recommendation.

Record the lot number of excess flow valve on the service line order form.

The presence of an excess flow valve will be identified on the customer meter set by attaching the metal tag provided by the excess flow valve manufacturer on the riser just below the service valve.

Branch Service Lines

If an EFV was installed on the primary service line then the branch should only be made if the EFV has sufficient capacity to handle both the existing and added loads. If it does not, a new EFV with sufficient capacity must be installed or a new service must be run.

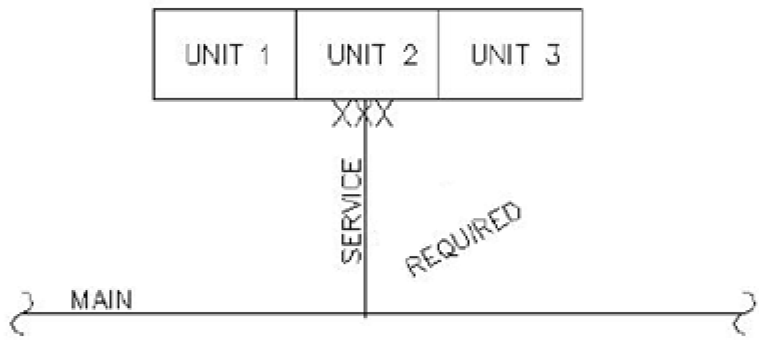
If the primary service has no EFV, an EFV must be installed either downstream of the branch to protect the new service or at the original tap, sized for both the existing and added loads.

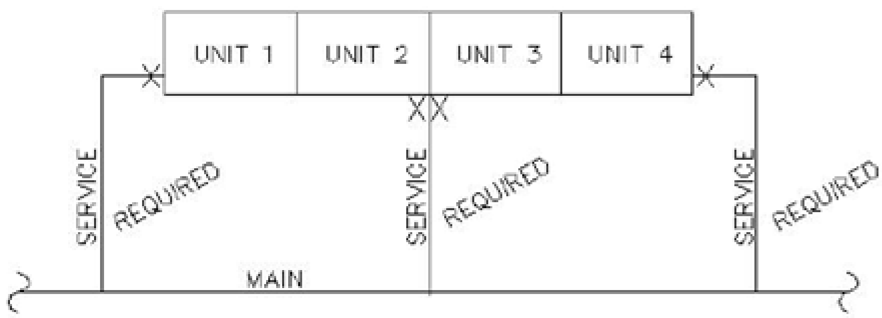
Existing Service Lines

The installation of an EFV on an existing service line will only be required if the fitting connecting the service line to the main is exposed while conducting construction activities and the flow of gas to the customer is turned off for reasons other than to install an EFV.

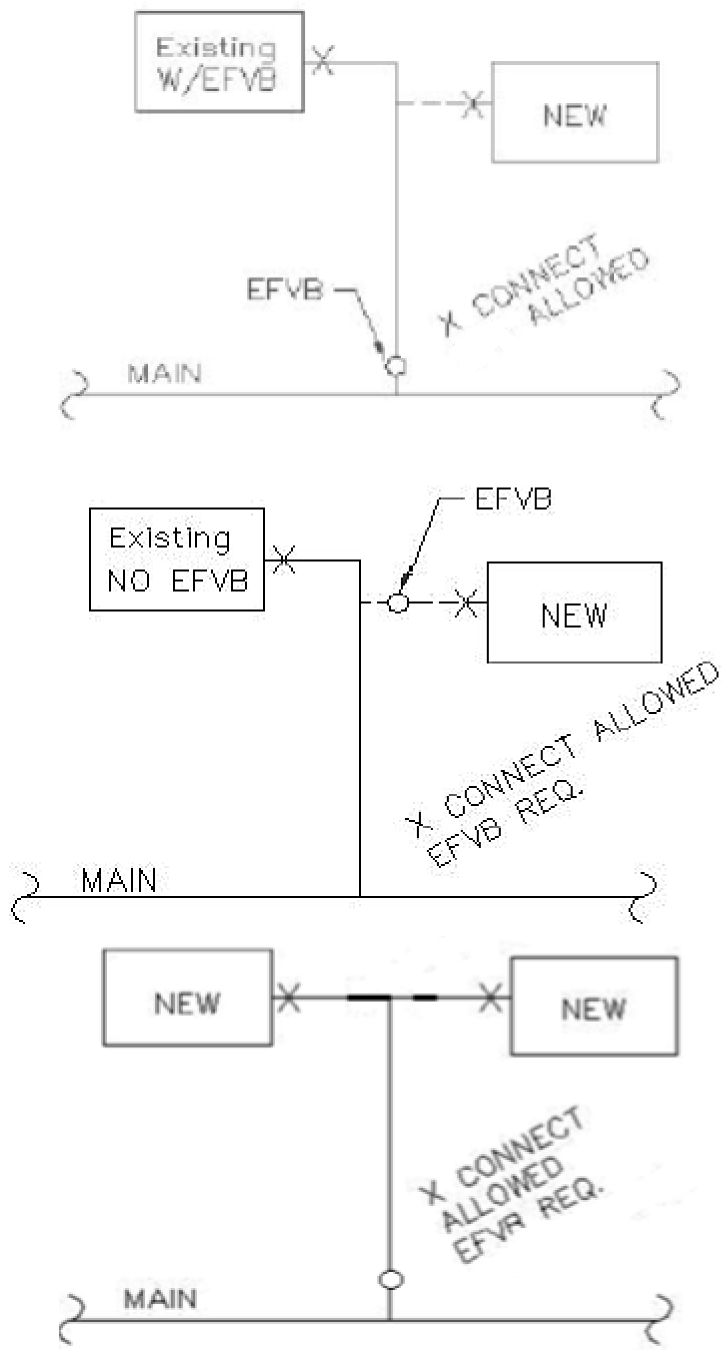
Examples of typical EFV installations

Multifamily





Cross-Connect



EFVs <u>should not</u> be installed if any of the following conditions exist on the individual system and prior approval has been obtained from the Division Engineering:

- Where prior experience indicates that contaminants in the gas stream could cause a malfunction of the EFV.

- Where the installation of an EFV could interfere with necessary operation and maintenance activities on the service line, such as blowing liquids from the mainline or service line.

- In areas where the Company has experienced pressure drops during peak demand or seasonal usage that may cause service pressures to fall below 10 psig.

- Where an EFV meeting the required design standards is not commercially available.

  Record on the service line order when and why an EFV is <u>not</u> installed.

<u>Internal Bypass Type Installation/Resetting Steps (EFVB)</u>:

1) Install EFVB (internal bypass style) in line with the gas service with flow direction arrow pointing towards the riser.

2) Fuse inlet side first. If service line requires blowing out dirt or debris with compressed air, it must be performed before fusing the service line to the EFVB outlet.

3) Close the service valve on the riser.

4) Tap out service tee and slowly raise the cutter.

5) Purge service line by opening the service valve a small amount. If the EFVB shuts-off, close the service valve and wait until the bypassing gas equalizes across the device and resets (opens). This may take several minutes depending on the length of service. Slowly re-open service valve and continue purging.

6) Mark the riser for future identification. Use the manufacture's supplied metal tag just below the stopcock. Document on paperwork the line pressure and that an EFVB was installed at this address.

External Bypass Type - (also known as Positive Shut-Off) Resetting Steps

This type of EFV will have a field fabricated permanent by-pass attached. There will be a valve attached to this by-pass. The valve will normally be left in the closed position and will only be used when the EFV closes.

1) **(Valve Reset)** Close service valve on riser and open by-pass valve to allow pressure to equalize on the downstream side of the EFV.

2) Close By-pass valve.

3) The service valve on riser should be throttled opened gradually, about a ¼ turn every 15 - 20 seconds.

   If EFV does not open consult your supervisor.

Manual Service Line Shut Off (Curb) Valve

For new or replaced services lines with meter capacities exceeding 1,000 scfh and an EFV cannot be installed due to one of the criteria listed above, use of manual service line shut-off valves (curb valves) is required. The valve must be accessible to accommodate required maintenance and operation. This can be accomplished by stacking the valve, installing it above ground or any other acceptable method approved by the Engineering department. The location of the valve must be chosen so that it can be accessed in the event of an emergency.

Installing Casings

Casings are to be used only where required by the authority having jurisdiction. Certain railroads and highway departments require them but only for special conditions.

Any steel carrier pipe installed in a casing should be electrically isolated from it by insulating spacers that can double as skids during insertion of the carrier pipe.

Steps:

1) The casing size is to be specified by the engineering department.

2) Vents should be installed when and where required. If 2 vents are required put one at each end, one must be installed to the bottom and one to top of the casing. Vents must be protected from the weather to prevent water from entering the casing.

3) If welding on the casing is necessary it must be completed before inserting carrier pipe.

4) On steel pipe one test wire should be connected to the carrier pipe and one to the casing. The wires should be brought above ground to a CP test station. Both before and after backfilling the installation should be checked with an ohmmeter or other electrical device to insure that the steel carrier pipe is not shorted to the casing. This test is not necessary on plastic pipe.

5) When inserting steel carrier pipe spacers will be used every +/- 10’. (equally spaced if possible)

6) Casing ends, with steel carrier pipe, must be sealed. Sealing is not necessary with plastic carrier pipe.

7) All test wires, anode wires and wires on insulating fittings should be tested as soon as possible after backfilling and brought up into a test station.

See DOT §192.323

Installation Requirements for Mains and Services

Mainline Location Depth and Clearance

- Mains should be installed in locations that are least likely to be paved. Locations such as behind street curbs, in alleys and in public and private easements are desirable.

- Existing and probable water mains, sewers, telephone and power cables, and other underground structures should be considered in locating mains.

- Mains must be installed with no less than-24” (2’) of cover. Transmission lines must be installed with no less than 36” (3’) of cover in normal soil, and 24” (2’) in consolidated rock. If the stated cover cannot be obtained in the construction of a new main or transmission line, the Engineering Department shall be consulted for special instructions.

- Each main must be installed with enough clearance from any other underground structure to allow proper maintenance and to protect against damage that might result from proximity to other structures.

- Transmission lines must be installed with at least 12 inches of clearance from any underground structure not associated with the transmission line. If the stated clearance cannot be obtained in the construction of a transmission line, the Engineering Department shall be consulted for special instructions.

- All pipe installed in a navigable river, stream, or harbor must be installed with a minimum cover of 48” (4’) in soil or 24” (2’) in consolidated rock.

- Each aboveground transmission line or main must be protected from accidental damage by vehicular traffic or other similar causes, either by being placed at a safe distance from the traffic or by installing barricades.

Service Line Location Depth and Clearance

- A service line should be constructed in a straight line at a right angle with the main.
- A service line street crossing should be constructed in a straight line at a right angle with the street.
- A service line installed through the outer foundation or wall of a building shall be encased and sealed to prevent leakage into the building.
- Install a sleeve or block out forms around a riser when asphalt or concrete is or is expected to be poured around it.
- No service line will be installed under any building.
- Service lines must be installed with at least:

  a) 12” (1’) cover in private property

  b) 18” (1.5’) cover in streets and roads

Backflagging

On all newly installed mains or services, personnel should install temporary markers in addition to any required permanent markers. This will assist in identifying these facilities for other excavators who may still be working under a valid locate ticket that was requested prior to the new facilities being installed.

Installing Uncased Plastic Pipe Temporarily Above Ground

Uncased plastic may be installed temporarily above ground under the following conditions.

Exposure to sunlight

Plastic pipe cannot be exposed to sunlight for more than two years. The remaining exposure time must be reduced by previous unprotected exposure of the pipe. The date of manufacture printed on the pipe is presumed to be the start date unless there are records available proving that the pipe was protected from exposure for a period of time. Document the remaining exposure time.

Protection from external forces

The exposed pipe must be protected in one or more of the following manners as the situation dictates. The protection must be placed to adequately locate and protect the entire span of pipe. The manner selected must be able to remain in service and always visible during the exposure period.

- Stakes with caution tape
- Barricades
- Fencing
- Signs or markers indicating the presence of a gas line
- Planks
- Sleeves
- Other methods to fit the situation

Customer notification for service lines

If the temporary line is installed on a customer's property, that customer shall be notified that the line is active and be warned to avoid contact with the line. The notification must be documented.

Periodic Inspections

Installations shall be inspected at least once each calendar month.

Mainline Valves

- The Division Engineering Department shall specify the location of all main valves and shall designate any valve that is essential to the safe operation of the system as a key valve.

- Each underground key valve shall be covered with a valve box as illustrated in Figure 5 in this section.

- Each valve box shall be supported so that it cannot bear upon either the piping or the valve.

- Each valve installed must be designed so as to protect the material against excessive torsional or shearing loads when the valve or shutoff is operated, and from any other secondary stresses that might be exerted through the valve or its enclosure.

- The valve and valve box should be labeled as “Gas” in an appropriate manner. An example of this is the use of a warning tube of 2” plastic pipe labeled Gas should be slipped over the operating nut in each newly installed valve box. Details are shown in *Figure 5*.

Service Line Valves

- Each service line shall include a tamper proof service valve upstream of the regulator in a customer’s meter installation, or upstream of the meter if there is no regulator.

  The Engineering Department must be consulted when installing service lines 2” or larger to determine if a remote shut off valve should be installed.

  Where the meter is installed inside of a structure or in a location that is not readily accessible, a shut off valve shall be installed in the service line outside in an accessible location. .

  If it is not feasible to install the valve outside, the Engineering Department must be consulted for possible alternative configurations.

- Each underground service line valve or shut off valve shall be covered with a valve box as illustrated by Figure 5 in this section.

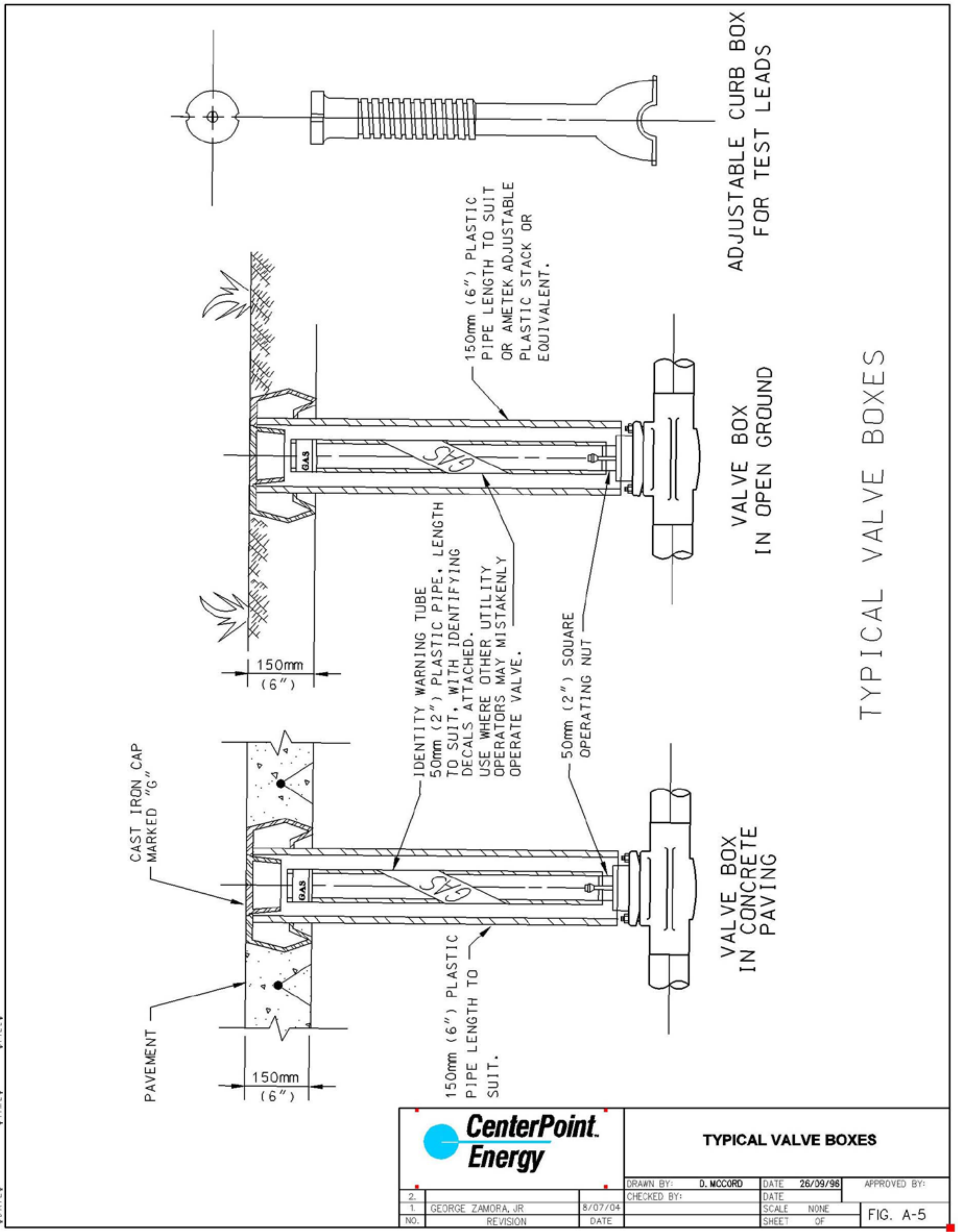
- On each service line operating at greater than 60 psig, either a valve or service tee shall be installed at the connection to the main.

- Each valve box shall be supported so that it cannot bear upon either the piping or the valve.

- Each valve installed must be designed so as to protect the material against excessive torsional or shearing loads when the valve or shutoff is operated, and from any other secondary stresses that might be exerted through the valve or its enclosure.

- If the service riser is installed without the meter set, the service valve must be plugged to prevent moisture from entering the valve body. Service valves found installed without plugs shall be checked and replaced if necessary.

See DOT §192.319, 192.325, 192.327, 192.361, 192.363, 192.365, 192.379


ADJUSTABLE CURB BOX FOR TEST LEADS
150mm (6") PLASTIC PIPE LENGTH TO SUIT OR AMETEK ADJUSTABLE PLASTIC STACK OR EQUIVALENT.
VALVE BOX IN OPEN GROUND
TYPICAL VALVE BOXES
IDENTITY WARNING TUBE 50mm (2") PLASTIC PIPE, LENGTH TO SUIT, WITH IDENTIFYING DECALS ATTACHED. USE WHERE OTHER UTILITY OPERATORS MAY MISTAKENLY OPERATE VALVE.
50mm (2") SQUARE OPERATING NUT
150mm (6")
CAST IRON CAP MARKED "G"
GAS
VALVE BOX IN CONCRETE PAVING
PAVEMENT
150mm (6") PLASTIC PIPE LENGTH TO SUIT.
150mm (6")
CenterPoint Energy
TYPICAL VALVE BOXES
DRAWN BY: D. MCCORD
DATE 26/09/96
APPROVED BY:
CHECKED BY:
DATE
SCALE NONE
SHEET OF
FIG. A-5
2.
1. GEORGE ZAMORA, JR 8/07/04
NO. REVISION DATE
$DATE$ $TIME$ $FILE$

Qualified Personnel will evaluate pipeline defects, and as required develop a plan for repairs. Qualified Personnel will ensure documentation is completed and submitted as part of the completed plan.

Evaluation

Take immediate action to protect the public, company personnel and environment when a safety concern is identified. Make safety the primary consideration when evaluating a pressurized pipeline.

Information that should be considered for transmission lines includes condition of the pipeline and the proximity of the pipeline to High Consequence Areas to include buildings, property, roads and any place where people live or gather.

Perform a preliminary assessment of the defect:

- Consider defects that are long and/or deep as potentially the most severe. The depth and longitudinal extent of the defect will provide the best guideline for determining the severity of the defect.
- Consider the age and type of the defect. Take caution when evaluating defects that are subject to cracking such as sharp mechanical damage, dents, old defects and/or defects that have been in service for an unknown length of time. Defects such as sharp or deep gouges and dents may have cracked during service and need to be handled with caution.
- The overall extent of the defect should also be considered.
- Reduce the pressure in the pipeline to a safe pressure based on the preliminary evaluation, as required.

Perform the following general steps for evaluation of all defects:

- Defects repaired by grinding and/or sanding, installing a Type “A” sleeve, Type “B” sleeve, weld over sleeves, leak clamps, composite reinforced sleeve or replacing the affected pipe as a cylinder are all permanent repairs. **Bolt-on leak clamps or mechanical repair clamps can be considered permanent repairs on gas pipelines operated equal to or below 40 percent of Specified Minimum Yield Strength (SMYS).** Bolt-on leak clamps or mechanical repair clamps used onshore are considered temporary repairs for gas pipelines operating above 40 percent SMYS therefore; replace them with a permanent repair as soon as feasible or with approval of Engineering.

- Prepare the site and pipeline for a detailed evaluation of the defect after it has been determined it is safe to work on the pipeline. This includes removing cover to expose the pipe and stripping the coating, to ensure the entire defect is exposed in order to obtain detailed measurements.

Defect Type	Evaluate and select repair options	Caution
Corrosion	A. Review data collected from in-line inspection runs requiring corrosion evaluation to ensure the structural integrity of the Company's pipeline systems and reduce any potential risk to the public B. Ensure the Maximum Allowable Operating Pressure (MAOP) of the company's pipeline system is maintained when defective pipe is found or when repairs or replacements must be made due to corrosion C. Notify the Corrosion Department for assistance with repair options when internal corrosion is found or suspected.	Cleaning or removal of corrosion reduce wall thickness and could lead to an un-planned release of natural gas. Lowering the pressure is recommended when evaluating areas of severe corrosion
Pipe body gouges and/or mill defects	A. Measure the defect circumferential width, length and depth at the deepest point and several other points along its length. Measure the angle, when applicable, of the defect relative to the run of the pipeline. B. Document the general shape of the defect in the "o'clock" position relative to the circumference of the pipeline.	Defects such as sharp or deep gouges and dents may have cracked during service and need to be handled with caution. Lowering the pressure is recommended when evaluating and repairing.
Dents	A. Measure the dent area (the length and circumference and depth at the deepest point). Examine the bottom of the dent for gouges, scratches or heavily work-hardened material. Measure gouge, if present, length and depth at the deepest point along its length.	Defects such as sharp or deep gouges and dents may have cracked during service and need to be handled with caution. Lowering the pressure is recommended when evaluating and repairing.
Arc burns	A. Examine arc burns for cracking and depth and document	If the Arc Burn is on a new line under construction, the Arc Burn shall be removed as a cylinder.

Defect Type	Evaluate and select repair options	Caution
Weld defects:	Evaluate and repair weld defects of out of service pipe in accordance with *The Company's Construction Service Manual Section B-5 "Welding Procedures"*	
Stress Corrosion Cracking (SCC):	A. Examine pipe for Stress Corrosion Cracking (SCC) by dye penetrate or magnetic particle inspection of the surface in the area of concern. Document the findings with photographs, when possible, of the area affected. Document the length, density, spacing and general location of the cracks relative to other surface conditions such as longitudinal and joint welds. B. Notify Engineering for assistance with repair options when SCC is found or suspected.	
Hard Spots	A. Measure hard spot area (the length and circumference) and map the hardness using calibrated portable testing equipment. B. Measure the hardness and make a sketch showing the hardness distribution. C. Repair all hard spots when the maximum hardness exceeds Rockwell C35.	

Table 1

Evaluating Permanent Repair Options for Defects:

This Table outlines the preferred method (X), optional (O) methods, of repairing imperfections or defects. The methods that are not permitted (N) are also indicated. The optional methods listed do not represent all optional methods but identify normally accepted options. A temporary repair may be made using any method deemed suitable using sound engineering judgment.

Repair Method Defect Type	Re-coat Only	Grind /Sand	Type "A"(1)	Type "B"(2)	Leak Clamp (3)(4)	Composite	Weld over sleeve/ Fabricated(3)	Cutout
Leaking External Defect (> 20% SMYS)	N	N	N	O	N	N	N	X
Leaking External Defect (< 20 % SMYS)	N	N	N	O	X	N	O(4)	O
Leaking Internal Defect	N	N	N	O	N	N	N	X
Leaking Mechanical (Dresser) Coupling	N	N	N	O	N	N	X	O
Corrosion<12.5% Nominal Wall	X	N	O	O	N	O	O	O
Corrosion > 12.5% Nominal Wall and passes LAPA pressure assessment or other approved engineering method used for calculating the Remaining Strength of Corroded Pipe	X	N	O	O	N	O	O	O

Repair Method Defect Type	Re-coat Only	Grind /Sand	Type "A"(1)	Type "B"(2)	Leak Clamp (3)(4)	Composite	Weld over sleeve/ Fabricated(3)	Cutout
External Corrosion fails LAPA pressure assessment or other approved engineering method used for calculating the Remaining Strength of Corroded Pipe	N	N	O	X	N	O	N	O
Internal Corrosion fails LAPA pressure assessment or other approved engineering method used for calculating the Remaining Strength of Corroded Pipe (Repair option based on results and thoroughness of the defect inspection)	N	N	O	X	N	N	N	O
External Corrosion>80% of Wall	N	N	N	X	N	N	N	O
Internal Corrosion>80% of Wall	N	N	N	O	N	N	N	X
Corrosion > 12.5% at Seam Weld	N	N	N	X	N	N	N	O

Repair Method Defect Type	Re-coat Only	Grind /Sand	Type “A”[1]	Type “B”[2]	Leak Clamp (3)(4)	Composite	Weld over sleeve/ Fabricated(3)	Cutout
Dent (no metal loss) >2% of OD on OD’s > 12.75”’ OR > 0.25” on OD less than or equal to 12.75”	N	N	O	X	N	N	N	O
Dent (no metal loss) <2% of OD on OD’s > 12.75”, OR < 0.25” on OD less than or equal to 12.75”	O	N	O	X	N	N	O	O
Dents with a scratch, gouge, groove, stress riser, or metal loss	N	N	N	N	N	N	N	X
Dents on girth or seam welds	N	N	N	N	N	N	N	X
Arc Burn	N	X	O	N	N	N	N	O
Hard Spot	N	N	X	O	N	N	N	O
Gouges, scratches, or grooves with < 12.5% metal loss	O	X	N	O	N	N	O	O
Gouges, scratches, or grooves with > 12.5% metal loss	N	N	N	N	N	N	N	X
Crack in pipe body or weld seam	N	N	N	X	N	N	N	O
Buckling		Repair by cut out, weld over sleeve (pumpkin) or call Engineering for assistance.						
SCC Suspected		Call Pipeline Integrity for assistance						

Repair Method Defect Type	Re-coat Only	Grind /Sand	Type "A"(1)	Type "B"(2)	Leak Clamp (3)(4)	Composite	Weld over sleeve/ Fabricated(3)	Cutout
Mechanical leaks (Valves & fittings)		Repair in accordance with manufacturer's guidelines or cut out and replace.						

(1) Type "A" sleeve: non-pressure containing.

(2) Type "B" sleeve: pressure containing

(3) Weld Over Sleeves are the preferred method of reinforcement for mechanical fittings and covering leak clamps leak clamps.

(4) Leak clamps are considered a temporary repair on pipelines operating at or > 40% SMYS, when Leak clamps are used it is preferred that a weld over sleeve be applied to cover the clamp and enhance the repair on pipelines operating < 40% SMYS.

Pipe, couplings, repair clamps and other fittings must be designed to fit the particular type of pipe and/or fittings being repaired and to withstand the system operating pressure. Only company approved materials will be used for repairs.

Safety Considerations:

1) Test leak area for gaseous atmosphere and oxygen deficiencies.
   Refer to Testing for Gaseous Atmosphere
   Refer to Testing for an Oxygen Deficient Atmosphere
2) Protect public from entering work area.
3) Take caution to ensure the site is safe, including capturing or dispersing the product to ensure there is no chance of fire or explosion. This could also include lowering the pipeline pressure, blowing the pipeline down, draining the pipeline, setting stopples and/or purging the pipeline with nitrogen.
4) Follow "Hazard Tree" on working in gaseous and non- gaseous environments.
5) Continue monitoring the work area for gaseous atmosphere and oxygen deficiencies until work is completed.
6) Upon repair of leak, recheck the area near the work site for additional leaks, if no other leaks are detected the work is completed. If another leak is found it is to be repaired, or scheduled to be repaired.
7) If there is no indication of gas present, the leak repair report will be completed to show permanent repair.
8) If there is still indication of gas present in the immediate area of the repair and a source cannot be found, the repair report will be completed as a permanent repair and the area will be monitored at frequencies to be determined by the operating conditions but at least every 30 days until the area clears. If the area does not clear, within 90 days, a new leak will be graded and a new leak repair order issued.
9) The new leak order will be repaired following the leak action criteria guidelines and the instructions in the leak investigation section.

REPAIR METHOD	PROCEDURE	CAUTION
Grinding and/or Sanding	• Remove the defect by grinding and/or sanding. After grinding or sanding, if the wall thickness is less than 88 percent of nominal, reevaluate the integrity of the pipeline and grind area and install a reinforcing sleeve if necessary. The transition from the area where the defect was removed to the surrounding undisturbed material shall be smooth. • Nondestructively inspect all areas where defects have been removed by grinding, using magnetic particle or dye penetrant inspection method to ensure the entire defect has been removed. During Non Destructive Testing (NDT), pay particular attention to any indications of cracking. • If the remaining wall thickness passes criteria, the area does not require sleeving and should be properly recoated. • If the remaining wall thickness is less than required by Guideline For Pipe Replacement, perform a repair. • The area does not require blend grinding or sanding when the defect requires Type “A” or Type “B” sleeving.	Prior to performing any grinding or sanding on a live line, evaluate the defect to be repaired. If it is estimated that the defect is potentially greater than 10 percent of the nominal wall thickness, do not perform any grinding or sanding operations and immediately refer to Table 1 to determine the appropriate repair method, such as installing a sleeve.

REPAIR METHOD	PROCEDURE	CAUTION
Type “A” sleeve (non-pressure containing)	• Prepare the pipeline to install the Type “A” sleeve by removing all of the coating and thoroughly power brush or blast clean the pipe surface in the area the sleeve will cover. • Fabricate or obtain a sleeve with the same or greater overall strength (wall thickness x yield strength) as the pipeline being repaired. • Check the pipeline for straightness where the sleeve will be installed. The pipe must be straight to ensure proper fit of the sleeve. • Use a sleeve that is at least one (1) pipe diameter in length. Ensure that the sleeve covers the defect(s) plus a minimum of six (6) inch past the defect on each end. • Clean the inside and outside surface of the sleeve by thoroughly power brushing or abrasive blasting. • Apply a hardenable filler material such as an epoxy in dents, corrosion pits, and/or adjacent to the long seam of the pipe to completely fill void areas before installing the sleeve. • Apply sleeve to pipeline ensuring it is tight. The effectiveness of the sleeve depends on its snugness around the pipe. When sleeving defects that are near	

REPAIR METHOD	PROCEDURE	CAUTION
	failure pressure during normal operation, it is suggested that pressure be reduced by 33 percent to improve the effectiveness of the sleeve. When the defect is not near failure, you can install the sleeve at full line pressure. • Apply the sleeve to pipeline ensuring a snug fit and weld. • Requires radiograph of the long seams. Comply with API 1107, Standard • Seal the ends of the steel sleeve with an approved filler material, then coat the exterior of the sleeve.	
Type “B” (Equalized Pressure method)	• Prepare the pipeline to install the Type “B” sleeve by removing all the coating and thoroughly power brush or blast clean the pipe surface in the area the sleeve will cover. • Check the pipeline for straightness where the sleeve will be installed. The pipe must be straight to ensure proper fit of the sleeve. • Fabricate or obtain a sleeve with the same or greater overall strength (wall thickness x yield strength) as the pipeline being repaired. • Use a sleeve that is at least one (1) pipe diameter in length. Ensure that the sleeve covers the defect(s) plus	

REPAIR METHOD	PROCEDURE	CAUTION
	a minimum of 6-inch past the defect on each end. • Inspect the full circumference of the pipeline where the sleeve ends are to be welded to the pipeline using an ultrasonic thickness instrument and a magnetic particle inspection technique. Ensure there are no surface cracks, laminations or thin wall that could affect the integrity of the weld or sleeve. • Clean the inside and outside surface of the sleeve by thoroughly power brushing or abrasive blasting. • Apply a hardenable filler material such as an epoxy in dents, corrosion pits, and/or adjacent to the long seam of the pipe to completely fill void areas before installing the sleeve. • Apply the sleeve to pipeline ensuring a snug fit and weld. • Coat the exterior of the sleeve. • Does not require leak test, x-ray or mag particle.	

<table>
<tr><th>REPAIR METHOD</th><th>PROCEDURE</th><th>CAUTION</th></tr>
<tr><td>Weld Over Sleeve</td><td>

Prepare the pipeline to install the Weld Over Sleeve by removing all the coating and thoroughly power brush or blast clean the pipe surface in the area the sleeve will welded to the pipeline.
Check the pipeline for straightness where the sleeve will be installed. The pipe must not have more than 20° deflection to ensure proper fit of the sleeve.
Obtain a manufactured sleeve (preferred) or fabricate a sleeve with the same or greater overall strength (wall thickness x yield strength) as the pipeline being repaired (consult with Engineering as necessary).
NOTE: When pipe and fittings are used to fabricate a weld over sleeve the fabricated sleeve shall be pretested (to establish the same MAOP as the pipeline) and be of material equal or greater SMYS than the pipeline being repaired. Weld endcaps will be used in the fabrication of weld over sleeves.
Ensure the sleeve extends far enough away from any sealing components of the fitting being covered as not to melt them; when this is not possible use Heat Fence™ to protect sealing components of fitting.
Visually inspect the pipeline where the sleeve ends are to be welded; look for damage, cracks, external corrosion, when possible, use an ultrasonic thickness instrument to confirm remaining wall thickness.

</td><td>Coating could contain asbestos follow guidance in CS-B_1.330.

Contact engineering for alternate repair method if more than 20° deflection

Use only company approved materials

Rubber gaskets and seals could meltwhen exposed to heat from welding

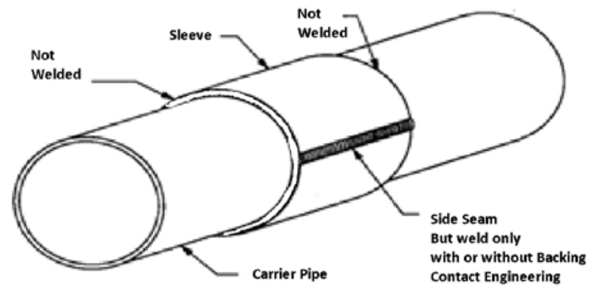
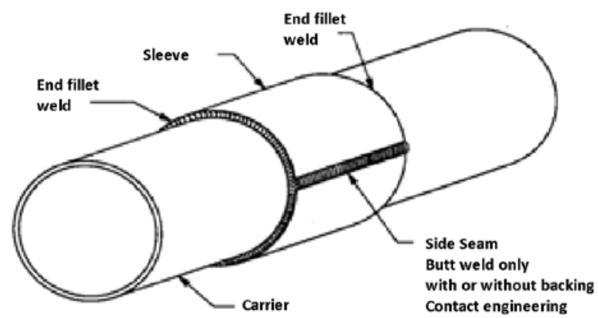
Paint or pipe coatings could lead to contamination of completed welds</td></tr>
</table>

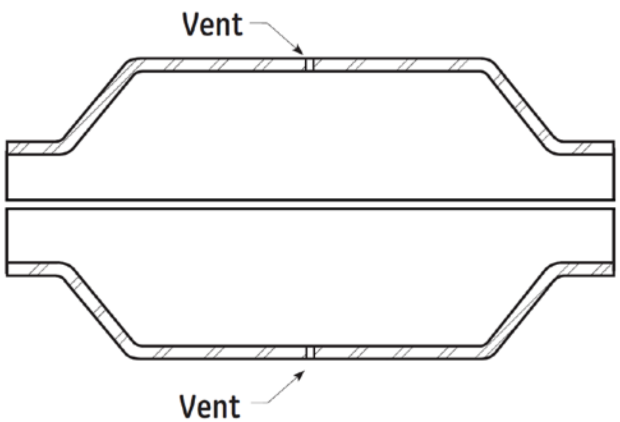
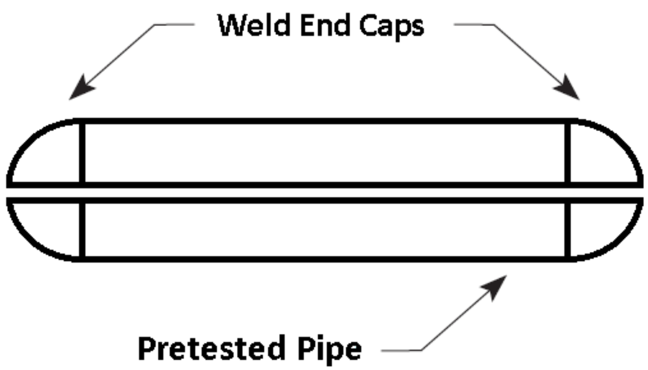
REPAIR METHOD	PROCEDURE	CAUTION
	• Install a weld coupling of desired diameter over weep hole/s on sleeve; when one coupling is used weld the other weep hole shut. If using a fabricated sleeve drill or torch cut weep hole/s and install coupling/sat this time.	Gas venting from weep hole could be combustible; extend vent from coupling with steel pipe nipples to a safe distance above the welder when conditions warrant.
	• Apply the sleeve to pipeline ensuring a snug fit and weld. It may be necessary to apply a buttering pass to the sleeve or pipeline in instances of coupling misalignment or pipe deflection.	Applying a buttering pass to the sleeve is preferred to applying it to the pipeline.
	• Upon completion of welding; allow sleeve to cool naturally.	Cooling with soap or water will lead to a crack.
	• Perform a soap test at the current operating pressure of the pipeline using nitrogen (or natural gas if a convenient source is available) to confirm the welds are not leaking.	
	• Install a STEEL screw in plug into weld coupling/s if desired weld in place.	Paint or pipe coatings could lead to contamination of completed welds
	• Coat exterior of sleeve.o confirm the welds are not leaking.	

REPAIR METHOD	PROCEDURE	CAUTION
Composite Reinforced Sleeve	• Do not use composite sleeve to repair leaks, cracks, or weld defects. • A qualified person must install composite sleeves. • Prepare the pipeline to install the composite reinforced sleeve(s) in accordance with the manufacturer's specifications. • Install the composite sleeve per manufacturer's specific requirements and specifications. • Install metallic banding at one (1) foot intervals on the sleeve for the purpose of In-Line Inspection (ILI) tool identification. • Coat the sleeve and surrounding area.	Do not use composite sleeves to repair leaking defects or cracking.
Bolt-on mechanical clamp	• Install properly designed full encirclement bolt-on mechanical clamp by covering the defect. • Follow all manufacturers' instructions when installing bolt-on mechanical clamp. • If the leak is due to a corrosion pit, install a properly designed bolt-on mechanical clamp, which is considered a permanent repair pipelines operating at or below 40% SMYS.	

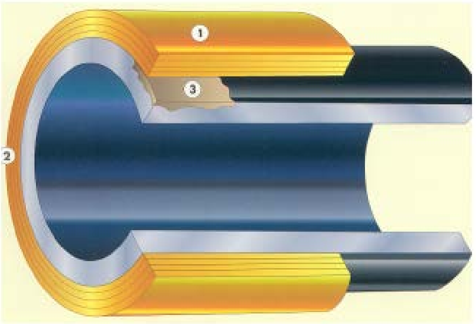
REPAIR METHOD	PROCEDURE	CAUTION
Cutting out a cylinder of pipe and replacing it with new pipe	• Remove pipe or fitting containing the defect as a cylinder. • Ensure that the length of the replacement pipe is two (2) feet or three (3) pipe diameters in length whichever is greater. • The replacement pipe or fitting shall have a greater than or equal design pressure as the existing pipe or fitting and shall be pre-tested in accordance with Pressure Testing, Manual Section B1.220	
Composite Wrap (Trident-Seal)	• Detailed instructions for applying the product are included in each kit. • Used to permanently seal active leaks, up to 60 psi without interruption to service. • Application Temperature: 32 to 150°F (10 to 65°C) • Shelf Life: 24 Months with recommended storage methods • One kit contains enough material to repair a pinhole or threaded fitting on diameters up to 6 inches.	Do not use composite sleeves to repair leaking defects or cracking.

Examples of Common Repair Fittings

Name	Model #	Visual Representation
Type “A” Sleeve AKA sole sleeve	• Dresser Style 115 • Fabricated in the field	
Type “B” Sleeve AKA sole sleeve	• Dresser Style 115 • Fabricated in the field	

Weld Over Sleeve	Dresser Style • 220, • 220-S, • 110 • Fabricated	
Fabricated Sleeve	As Built	

Bolt on Leak Clamp	Dresser Style 360	
Mechanical Repair Clamp	Dresser Style 96	

Composite Reinforced Sleeve	Clock Spring	

Line Markers

Additional Safety Considerations:

Line markers should not be placed where they could impede pedestrian or vehicular traffic.

Line Markers, General Information

For the protection of the public and our distribution mains, a line marker with the company name and a 24 hour telephone number must be placed and maintained as close as practical over each buried main and transmission line at:

- each crossing of a public road or railroad,
- each section of a main or transmission line that is located above ground in an area accessible to the public
- any other location if necessary to reduce the possibility of damage or interference..

Exceptions for buried pipelines

- Line markers are not required for mains in Class III or IV locations where a damage prevention program is in effect.:
- Line markers are not required for transmission lines in Class III or IV locations where placement of a line marker is impractical.

Factors to consider when determining if it is impractical to install a line marker:

- Roadways, driveways or sidewalks arranged in such a way that line markers could impede vehicular or pedestrian traffic,
- structures situated at or near the ROW line, or
- the location is otherwise not suitable for the placement of a marker.

Use only approved line markers. Refer to Material Standard 54-15.

Pipelines Crossing Navigable Waterways

Signs should be installed where required by law or by the permit. The specifications for the sign should also match the law or permit requirements if different than the Company standard.

Lock-Out Tag-Out of Gas Valves

The following procedures are to be used when it becomes necessary to turn off a main line valve.

1) Contact Engineering, Gas Control and/or Operations departments before operating any valves.

2) Utilize the proper range pressure gauge to monitor pressures then close the valve.

3) For a valve to be attended, an authorized person will be stationed nearby with instructions to insure that no one operates the valve. An attended valve does not need to be locked out.

4) Unattended valves must be locked out.

   - **Above Ground:** Install a locking device that will not allow the unauthorized operation of the valve. (A suitable locking device may be homemade or manufactured with a safety lock out hasp and a keyed lock.)

   - **Below Ground:** Install a blocking device that will not allow the unauthorized operation of the valve. (A suitable blocking device may be a stake, pipe, bar or a manufactured device with a safety lock out hasp and a keyed lock.) The top of the device must be no more than 6” from the top of the stack.

   - A “Do Not Operate” lock out tag will be used on all blocking devices and keyed locks. Tags should be secure, legible and written with a non-smear marker.

   - The lockout tag will contain the following information:

     a) The reason the valve is closed

     b) The signature and phone numbers of the person placing the tag.

     c) Location of work being performed.

     d) If valve is open or closed

     e) Time and date

- In a fenced regulator site, in addition to locking and tagging each valve, a lock out tag will be placed at the entry gate with all the appropriate information on it.

5) During tapping and plugging operations, no valves are to be operated and no plugging units will be lowered or raised without authorization of the person in charge of the job site.

6) When work on the isolated gas line is complete, locks will be removed by the person who installed them or their designee.

7) Monitor the proper range pressure gauge, then open the valve following standard operating procedures for the type of valve(s) involved.

Pressure Testing

Applicability

This procedure applies to Distribution Pipelines operating under 100 psig. Engineering is to specify any other pressure testing procedures.

Safety

The CenterPoint Energy or Contract crew should provide for the safety of pipeline construction personnel and the general public during pressure test with the following measures:

- Contact Transmission Integrity Management to conduct a threat review or analysis for each testing scenario being applied to existing transmission and high pressure distribution facilities. Transmission Integrity Management should consider threats specific to the pipeline(s) and main(s) being tested along with the proposed test medium (water, inert gas, gas, etc.).
- Restrict access to the immediate test areas (i.e., test shelter, manifolds, pressure pumps, instruments, etc.) to only those personnel engaged in the testing operation.
- While pipeline facilities are being pressurized and during testing, personnel not required for test operations (checking for leaks, tightening gaskets, checking valve status, operating pumps, recording data, etc.) should be restricted from testing area.
- Patrol the pipeline path as you're testing to ensure conditions have not changed and no one has entered right-of-way.
- Communication with local emergency responder agencies as well as people living or working in the vicinity of the pipeline before starting the test should be considered.
- Notification of the public is the responsibility of the Company; however, the Contractor may provide assistance as requested by the Authorized Company Representative.
- CenterPoint Energy or Contract Crew may be required to place warning signs in or near populated areas.
- Major pipeline work around the sections being tested should be prohibited when such work is not directly associated with test operations.
- Precautions should be taken for the safety of persons present during the test.
- Provide and maintain a reliable transportation and communication system during the test operations for personnel directly involved in the test.

- Test media, debris, and gas should be diverted away from sources of ignition and neighboring structures.
- CenterPoint Energy or Contract Crew should place a heavy piece of construction equipment between the exposed test end and all personnel on site, particularly during pneumatic testing.
- When pressure-testing sections of pipe on top of the ground secure the pipe at intervals to prevent whipping of the pipeline should sudden pressure release occur.
- Check hoses, fittings, connectors, and valves for proper pressure rating.
- Restrain and secure fill and discharge lines/hoses.
- Inspect temporary welds subject to the pressure test.

General Requirements

When required by pipeline safety regulations, no person may operate a new segment of pipeline, or return to service a segment of pipeline that has been relocated or replaced, until it has been pressure tested and each potentially hazardous leak has been located and eliminated. The test medium must be liquid, air, natural gas, or inert gas that is compatible with the pipeline material, relatively free of sedimentary materials, and non-flammable (except for natural gas).

A pressure test is considered satisfactory only if there is no detectable loss of pressure during the test period that cannot be attributed to temperature variation.

The test medium is to be disposed of as required by regulations and laws. For questions on proper disposal contact the environmental programs department.

Intermediate piping between regulators in a monitor regulator set will be tested at the same pressure as the upstream (higher pressure) piping.

Test Duration

When testing segments of various sizes as a single test, the total test duration may be determined by the Individual Segment Method or the Largest Diameter Method, whichever produces the shortest duration. However, either method is valid and may be used.

- <u>Individual Segment Method:</u> Add the duration of the individual segments together.
- <u>Largest Diameter Method:</u> Add the total of all footage to be tested together and use the largest diameter to find the duration in the table. For an example of

1,000’ of 6” PE + 4,000’ of 2” PE, find the duration in the table assuming all 5,000’ of pipe is 6” PE.

EXAMPLES:

- For 1,000’ of 6” PE + 4,000’ of 2” PE: Individual Segment Method would be an 8-hour test (1,000’ of 6” PE + 4,000’ of 2” PE = 5 hrs + 3 hrs = 8 hrs) and the Largest Diameter Method would be a 23-hour test (4,000’ of 6” PE + 1,000’ of 6” PE = 18 hrs + 5 hrs = 23 hrs). The duration for the test would be the shortest of the two at an 8-hour test.
- For a tie-in at an intersection with 30’ of 4” PE, 10’ of 6” PE and 10’ of 8” PE: Individual Segment Method would be a 1-hr 45-min test (15 min + 30 min + 1 hr = 1 hr 45 mins) and the Largest Diameter Method would be a 1-hr test (50’ of 8” PE = 1 hr). The duration for the test would be the shortest of the two at a 1-hr test.

For test durations greater than 24 hours, consider testing shorter sections to reduce the test duration.

Steel Main Requirements

Pressure tests on pipelines that operate below 100 psig must be tested according to the following:

- Each main that is to be operated at less than 1 psig, must be tested to at least 10 psig, or 1.5 times the MAOP, whichever is greater.
- Each main that is to be operated at or above 1 psig must be tested to at least 90 psig, or 1.5 times the MAOP, whichever is greater.

Steel Service Line Requirements

Each segment of a steel service line must be leak tested before being placed in service. If feasible, the service line connection to the main must be included in the test; if not feasible, it must be given a leakage test at the operating pressure when placed in service.

Each segment of a steel service line to be operated at a pressure of at least 1 psig, but not more than 40 psig, must be given a leak test at a pressure of at least 50 psig, or 1.5 times the MAOP, whichever is greater.

Each segment of a steel service line to be operated at pressures of more than 40 psig must be tested to at least 90 psig, or 1.5 times the MAOP, whichever is greater.

Plastic Main and Service Requirements

The test pressure for plastic mains and services must be at least 1.5 times the MAOP or 50 psig, whichever is greater. During the test, the temperature of the thermoplastic material may not be more that 100 F. The pressure test should not begin until the last fusion made has cooled for the appropriate time.

> **Compressor Note:** When using air compressors, traps or filters should be used on the discharge side of the compressor to minimize the amount of contamination. Oil can decrease the strength of the plastic pipe where high concentrations of oil are absorbed by the plastic.

Steps:

1) All mains, services and fittings will be tested with compressed air, water, natural gas or an inert test medium.
2) Install the appropriate test device and appropriate range test gauge for the test to be performed. For tests 8 hours or longer, use a Pressure Recording Device.
3) The test periods for mains and services using air, inert gas, or natural gas as the test medium are shown in the table following the procedure. Engineering is to specify any pressure testing procedures for pipelines operating at or above 100 psig.
4) To minimize the effects of temperature, the sections of pipe tested should not have a significant portion of the pipe exposed to direct sunlight.
5) The tie-in joint or joints should be soap tested at line pressure. If plastic, rinse soap off pipe surfaces with clean water.
6) The results of all pressure tests must be permanently filed with the construction records. The record will consist of:
    - Operator's name
    - Name of Contractor performing work for the operator
    - Name of the operator or contractor employee responsible for making the test
    - Name of any other testing company used
    - The test medium used
    - Test pressure

- Test duration
- Pressure recording charts or other record of pressure
- Elevation variations, whenever significant for the particular test (Where the elevation differences in the section tested exceeds 100 feet. A profile of the test section should also be included.)
- Leaks and failures noted and their dispositions. Include an explanation of any pressure discontinuities, including test failures, that appear on the pressure recording charts

Other items that can be included if deemed important by the engineer or field personnel:

- Test Instrument calibration data
- Date and time of the test
- Description of the facility tested
- Description of the test equipment used
- Ambient temperatures

See DOT §192.371, 192.503 192.505, 192.507, 192.509, 192.511 192.513 192.515, 192.517

Pressure Test Chart for Steel Distribution Pipelines Operating Below 100 psig
Minimum Time Requirements when Using Air, Natural Gas or Inert Gas

			Length of Pipe (in feet)														
Pipe Diameter	**Pipe ID**	**Unit Volume**	**0-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-600**	**601-700**	**701-800**	**801-900**	**901-1000**	**1001-1500**	**1501-2000**	**2001-3000**	**3001-4000**	**4001-5000**
Steel Sizes																	
3/4"	0.824	0.004	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	1 hr
1"	1.049	0.006	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 in	30 min	1 hr	1 hr
1-1/4"	1.52	0.013	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	30 min	1 hr	1 hr	2 hr	2 hr	2 hr
2"	2.067	0.023	15 min	15 min	15 min	30 min	30 min	30 min	30 min	1 hr	1 hr	1 hr	1 hr	2 hr	2 hr	3 hr	4 hr
3"	3.068	0.051	15 min	30 min	30 min	1 hr	1 hr	1 hr	1 hr	2 hr	2 hr	2 hr	3 hr	3 hr	5 hr	6 hr	7 hr
4"	4.026	0.088	15 min	30 min	1 hr	1 hr	2 hr	2 hr	2 hr	2 hr	3 hr	3 hr	4 hr	5 hr	8 hr	10 hr	12 hr
6"	6.065	0.201	1 hr	2 hr	2 hr	3 hr	3 hr	4 hr	4 hr	5 hr	5 hr	6 hr	9 hr	11 hr	17 hr	22 hr	24 hr
8"	8.071	0.355	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	7 hr	8 hr	9 hr	10 hr	15 hr	20 hr	24 hr	24 hr	24 hr
10"	10.192	0.567	2 hr	4 hr	5 hr	7 hr	8 hr	10 hr	11 hr	13 hr	14 hr	16 hr	24 hr	24 hr	24 hr	24 hr	24 hr
12"	12.09	0.797	3 hr	5 hr	7 hr	9 hr	11 hr	13 hr	16 hr	18 hr	20 hr	22 hr	24 hr	24 hr	24 hr	24 hr	24 hr
16"	15.25	1.268	4 hr	7 hr	11 hr	14 hr	18 hr	21 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
20"	19.25	2.021	6 hr	11 hr	17 hr	22 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
24"	23.25	2.948	9 hr	17 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
Pipe Diameter	**Pipe ID**	**Unit Volume**	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**1500**	**2000**	**3000**	**4000**	**5000**
			Length of Pipe (in feet)														

For longer lengths, you may simply add times together (if greater than 24-hr, consider shorter test segments)

Pressure Test Chart for Plastic Distribution Pipelines
Minimum Time Requirements when Using Air, Natural Gas or Inert Gas

			Length of Pipe (in feet)														
Pipe Diameter	Pipe ID	Unit Volume	0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000	1001-1500	1501-2000	2001-3000	3001-4000	4001-5000
Plastic Sizes																	
1/2" CTS	0.501	0.001	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min
3/4" CTS	0.751	0.003	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	30 min
1" CTS	1.001	0.005	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	1 hr	1 hr
1 1/4" CTS	1.251	0.009	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	1 hr	1 hr	2 hr
1/2" IPS	0.66	0.002	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min
3/4" IPS	0.86	0.004	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	1 hr
1 1/4" IPS	1.324	0.010	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	15 min	30 min	30 min	1 hr	1 hr	2 hr	2 hr
2" IPS	1.943	0.021	15 min	15 min	15 min	15 min	30 min	30 min	30 min	30 min	1 hr	1 hr	1 hr	2 hr	2 hr	3 hr	3 hr
3" IPS	2.892	0.046	15 min	15 min	30 min	30 min	1 hr	1 hr	1 hr	1 hr	2 hr	2 hr	2 hr	3 hr	4 hr	5 hr	7 hr
4" IPS	3.718	0.075	15 min	30 min	1 hr	1 hr	2 hr	2 hr	2 hr	2 hr	2 hr	3 hr	4 hr	5 hr	7 hr	9 hr	11 hr
6" IPS	5.473	0.163	30 min	1 hr	2 hr	2 hr	3 hr	3 hr	4 hr	4 hr	4 hr	5 hr	7 hr	9 hr	14 hr	18 hr	23 hr
8" IPS or larger	Var	var	1 hr	2 hr	2 hr	3 hr	4 hr	5 hr	5 hr	6 hr	7 hr	8 hr	12 hr	15 hr	18 hr	18 hr	24 hr
Pipe Diameter	Pipe ID	Unit Volume	100	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
			Length of Pipe (in feet)														

For longer lengths, you may simply add times together (if greater than 24-hr,consider shorter test segments)
Ex: 9,000' of 2" IPS PE= 4,000'+ 5,000'= 3 hrs + 3 hrs = 6 hrs

Purging

Definitions:

Depressuring: The act of removing pressure from a pipe segment or container to atmospheric pressure or a gauge reading of 0 psig.

Purging: The act of removing the content of a pipe or container and replacing it with another gas or liquid.

Purging out of service: The act of removing the natural gas within a pipe or container and replacing it with air or inert gas.

Purging into service: The act of removing the air or inert gas within a pipe or container and replacing it with natural gas.

Safety:

Ensure proper Personal Protective Equipment (PPE) is worn at all times. Refer to Construction Safety Precautions (CS-B-1.100) and Section 3 of the Safety and Health Manual.

In conjunction with the Job Safety Briefing, the individual responsible for the purging operation should conduct a meeting with field personnel and supervision as required to review hazards, unsafe conditions, work details, and environmental considerations.

Eliminate or avoid all possible sources of ignition at the point where the air and gas are vented to the atmosphere. A fire extinguisher is to be kept near the purging point.

Follow all procedures relating to gaseous environments:

- Refer to Testing for Gaseous Atmosphere (CS-B-1.250)
- Testing for Oxygen Deficient Atmosphere (CS-B-1.260)
- Hazard Tree (CS-D-2.120)
- Gaseous Atmospheres (CS-D-2.170)

General Requirements:

All purging activities shall follow the procedures outlined in this manual, including but not limited to this Purging procedure, Lock Out Tag Out of Gas Valves, and any other procedures referenced or necessary to carry out the steps outlined below. Additionally, follow job-specific written procedures such as system flow control plans (Gas Flow Interruption Plan, Gas Control Plan, System Operation Plan, etc.) or any other plan as may be provided by Engineering. For systems monitored/controlled by Gas Control, notify Gas Control prior to initiating the work.

Purging of natural gas pipelines may only be conducted by qualified personnel with the proper Operator Qualifications.

Determine the amount and type of purging medium to complete the purging operation.

Ground the purge vent stack during purging operations.

If the volume of gas to be purged to atmosphere exceeds 1 ton (over 40 MCF) or the purge point is within 1000 feet of a system odorized delivery point, then flaring or an acceptable alternative defined above, is required. If flaring cannot be done safely, or for any other reason, the Operations Manager must be consulted. When purging to atmosphere, contact the Gas Control Department for assistance with determining the weight or volume of gas expected to be purged.

Venting gas volumes greater than 500 CF must be reported. Contact Engineering before venting more than 4,500’ of 2”, 1,000’ of 4”, 500’ of 6”, or any larger pipe; or consider cross compression or flaring.

No work is to take place in bell holes during purging process.

A Combustible Gas Indicator (CGI) must be used unless the volume being displaced is insignificant, such as minor offsets or repair sections.

Considerations:

In new steel lines, consideration should be taken to add enough odorant to compensate for atmospheric absorption of the odorant.

- allowing normal system load to consume line pack to minimum acceptable operational levels to minimize the volume purged.
- utilize valves, stopper fittings, or squeeze points to reduce the volume purged

Considerations:

Prior to purging gas to atmosphere or flaring, responsible personnel will consider:

- allowing normal system load to consume line pack to minimum acceptable operational levels to minimize the volume purged.
- utilize valves, stopper fittings, or squeeze points to reduce the volume purgedas an alternative, utilize approved compression equipment (or other approved transfer device) to transfer gas from the isolated pipeline segment to an adjacent pipeline segment or approved storage vessel of an appropriate pressure rating.

In consideration of alternatives, if purging a significant volume of gas or an odor concentration that may pose a nuisance to the public, flaring is required.

Depressurize

1. Isolate pipe segment to be purged by closing valves, use of stop off equipment, squeeze tools, actual detachment (removal of fittings or sections of pipe and capping, blanking or plugging off the open ends, etc.).

2. Install blowoff valves and purge vent stacks near ends of piping if needed. The purge vent stacks will be metallic and grounded. The top of the purge vent stacks must be at least 6 feet above ground level and directed away from any structure, traffic, transformer or electric conductor, enclosed space, or other potential ignition source.

   ALTERNATE: If utilizing approved cross compression equipment, install appropriate fittings on the isolated pipe segment and the adjacent main/pipeline. Connect cross compression equipment according to manufacturer’s procedures then proceed to Step 4.

3. Blow down the isolated segment of pipe to near atmospheric pressure. (Note: No air should be allowed to enter the blow off prior to cutting out the access coupon or “cold cutting” or “hot cutting” the pipe).

4. If required, proceed to the appropriate purging procedure below. If utilizing cross compression equipment, follow manufacturer’s procedures to transfer the volume of natural gas from the isolated segment to the adjacent main/pipeline, verifying downstream MAOP to prevent overpressure.

Purging Services

Purging Into Service Steps:

1. If necessary, install a purge vent stack to direct natural gas flow away from buildings or vehicles and purge line.

2. When purging services to inside meters, purge gas must be vented to outside the building and into an open and unconfined area away from windows and building vents. Do not release gas into closed basements or buildings.

3. Purge service lines according to section CS-C-3.800 Purging House Lines.

   - Services 2" in diameter and larger should be purged according to the instructions for mains.

   - All services less than 2" in diameter and over 500 feet long should be purged for the times shown for mains or until an acceptable CGI reading is obtained.

Purging Out of Service Steps:

- Services 2" and larger should be purged according to the instructions for mains.

- All services less than 2" in diameter and over 500 feet long should be purged according to the instructions for mains.

- Air compressors may be used for services less than 2" in diameter and less than 500 feet long.

Purging Mains

Purging Into Service Steps:

1. Verify that the segment being purged is isolated from any other segment and that all pipe ends are secured against leakage.

2. Install a pressure gauge downstream of and near the inlet valve or squeezers.

3. Install a blowoff valve and purge vent stack near end of piping if needed. The purge vent stack will be metallic and grounded. The top of the purge vent stack must be at least 6 feet above ground level and directed away from any structure. The stack valve must be accessible.

4. Before starting to purge, determine the constant pressure that must be maintained at the inlet pressure tap. Verify that the pressure does not exceed the MAOP of the pipe. Use the table on page 7 as a guide to estimate the time it should take. For sizes larger than 14”, engineering to provide procedures.

5. Open the valve or squeeze-off tool at the downstream end of the piping.

6. While monitoring the pressure gauge, open the inlet valve or squeeze off tool wide enough to quickly establish the Minimum Constant Inlet Pressure and maintain it throughout the Initial Purge Time, throttling the flow if necessary.

   Safety Note: In the event of an emergency, the inlet valve or squeeze off tool could be utilized to regain control of the escaping gas.

7. Use the CGI readings as necessary to determine a complete purge. Close the inlet valve or squeeze-off tool, but leave open the valve or squeeze-off tool near the downstream end of the section.

8. Finally close the valve or squeeze-off tool near the downstream end of the section at the end of this blow down interval and re-open the inlet valve or squeeze-off tool to pressure the main.

Purging Out of Service Steps:

Note: Reduce pressure in a segment to be purged as low as possible prior to beginning purge operations. The engineering department will need to provide procedures for pipe sizes larger than 14”.

With Air Compressors:

1. Depressurize the main according to the Depressurize procedure above.

2. Find the initial purge time required according to the Chart on page 8. A CGI must also be used. Use air compressor to blow trapped gas to atmosphere. Allow gas to vent through the blowoff valves near the downstream ends of the section. Monitor the exhaust gas vent with a CGI until the exhaust air is at essentially 0% methane for 2 minutes.

With Air Movers:

1. Depressurize the main according to the Depressurize procedure above.

2. Select air mover model and size to obtain a minimum purge velocity and corresponding injection rate to limit stratification. Refer to air mover product specification and installation requirements. Use Table 1 to find a minimum purge velocity and corresponding injection rate.

3. Install air movers on blowoffs per design to move combustible gas through the pipe toward the air mover. Create air inlet(s) at appropriate location.

   (Note: If a single air mover is utilized to purge a continuous section of pipeline, the opening at the inlet to the line being purged must be at least as large as the air mover being used to produce a successful purge with a minimum amount of mixing). Install shunt wires and ground at the work.

4. Monitor discharge air and continue operation on air mover(s) until essentially 0% methane is reached. Use Combustible Gas Indicator (CGI).

5. Cold cut the main at the designated cut off points while continuously operating the air mover. Monitor the environment at the cut off point with a CGI to verify that non-hazardous conditions exist.

6. Monitor the environment at the tie-in points with a CGI prior to any welding operations. Adjust the air flow rate to minimize welding problems. In case an installation of temporary weld caps is required, temporary weld caps shall have valves to facilitate evacuation of the line for the final tie-in.

See DOT §192.629

INITIAL PURGE TIME
(Min: Sec)

Blowoff (*) Size	Main Size	MINIMUM CONSTANT INLET PRESSURE – PSIG											
		5			**10**			**15**			**20**		
		Main Length Thousands of Feet			**Main Length Thousands of Feet**			**Main Length Thousands of Feet**			**Main Length Thousands of Feet**		
		0-1	1-5	5-10	0-1	1-5	5-10	0-1	1-5	5-10	0-1	1-5	5-10
¾" With ½" Valve "T"	**2"**	01:45	09:15	20:00	01:15	06:15	13:15	01:00	04:45	10:00	00:45	04:00	08:30
	4"	-	-	-	04:30	21:45	43:30	03:30	16:45	33:30	02:45	13:45	27:15
¾"	**2"**	01:00	06:15	15:00	00:45	04:15	10:00	00:30	03:15	07:30	00:30	02:45	06:15
	4"	04:00	20:00	40:00	02:45	13:00	26:00	02:00	10:00	20:00	01:45	08:15	16:30
	6"	-	-	-	-	-	-	04:15	21:15	42:30	03:30	17:30	35:00
1"	**2"**	00:45	05:00	12:30	00:30	03:15	08:30	00:30	02:30	06:30	00:30	02:00	05:30
	4"	02:15	11:15	23:00	01:30	07:30	15:00	01:15	05:45	11:30	01:00	04:45	09:30
	6"	-	-	-	03:15	15:45	31:15	02:30	12:00	24:00	02:00	09:45	19:30
	8"	-	-	-	-	-	-	04:15	20:30	41:00	03:30	17:00	34:00
2"	**4"**	00:30	03:30	08:30	*00:30*	*02:15*	*05:45*	*00:15*	*01:45*	*04:30*	*00:15*	*01:30*	*03:30*
	6"	01:00	05:15	11:15	*00:45*	*03:30*	*07:15*	*00:30*	*02:45*	*05:45*	*00:30*	*02:15*	*04:45*
	8"	01:45	08:30	17:15	*01:15*	*05:45*	*11:30*	*01:00*	*04:15*	*08:45*	*00:45*	*03:30*	*07:15*
	10"	02:45	13:00	26:00	*01:45*	*08:45*	*17:15*	*01:30*	*06:45*	*13:30*	*01:15*	*05:30*	*11:00*
	12"	03:45	18:30	37:00	*02:30*	*12:15*	*24:15*	*02:00*	*09:15*	*18:30*	*01:30*	*07:45*	*15:30*
	14"	04:30	22:30	45:00	*03:00*	*14:45*	*29:30*	*02:15*	*11:30*	*22:45*	*02:00*	*09:15*	*18:30*

Table 1

PURGE USING AIR MOVERS
MINIMUM PURGE VELOCITY AND CORRESPONDING INJECTION RATE

PIPE SIZE (INCH)	PIPE OD (INCH)	PIPE WALL THICKNESS (INCH)	PIPE INSIDE AREA (Sq. ft)	MINIMUM PURGE VELOCITY (ft/min)	INJECTION RATE (Standard CFM)
4	4.5	0.156	0.096	125	11
6	6.625	0.156	0.217	130	29
8	8.625	0.188	0.376	150	56
10	10.750	0.188	0.587	165	96
12	12.75	0.219	0.826	180	149
16	16	0.250	1.311	210	273
20	20	0.250	2.073	235	489
24**	24	0.250	3.011	255	773

** Interpolated – reference Table 5-4 of Purging Principles & Practice, AGA Third Edition 2001

Note: Pipe wall thicknesses are extracted from API Specification 5L, 43rd Edition. Pipe wall thicknesses and inside area may vary.

Example: Purge 12" steel pipe out of service. The air mover will be installed using 2" TOR nipple and 2" full port ball valve.

See TYPICAL PROCEDURE FOR REPLACEMENT OF NATURAL GAS WITH AIR USING AIR MOVERS.

1. Use **Table 1** to select **minimum purge velocity and injection rate:**

- As shown in Table 1, recommended minimum velocity is 180 ft/min.
- To reach desirable velocity of air injection rate is 149 cu ft/min.

2. **Select Air Mover model type, size and pressure to obtain desired minimum velocity and minimum injection rate**. Request product specification from Air Mover supplier.

- ALLEGRO Ventury Type 9518-03 air mover is available**.** Compressed air will be used to operate the air mover. Below is a table provided by ALLEGRO Air Mover supplier*.
- Verify if air mover capacity is adequate to obtain desired 180 ft/min minimum velocity and 149 CFM minimum injection rate.
  - Per ALLEGRO Type 9518-03 product specification (3" access hole): At 80 psig pressure total air flow (discharged air) is equal 1482 CFM, and air consumed to operate air mover is 62 CFM.

    Induced air: 1482 – 62 = 1420 CFM
    12" steel pipe 0.219 wall, 12.75" OD
    Inside area =0.83 sq.ft
    Velocity of air: 1420 x /0.83= 1710 ft/min
  - If the 3" air mover is mounted on the 2" vent stack & ball valve, the air mover capacity will be reduced approximately to 30% of induced air rate through full access hole:

    Velocity of air: 1420 x 0.3/0.83 = 513 ft/min
    Corrected velocity is higher than recommended minimum velocity of 149 ft/min.
  - Per ALLEGRO Type 9518-03 product specification: At 40 psig pressure total air flow (discharged air) is equal 1017 CFM, and air consumed to operate air mover is 36 CFM.

    Induced air: 1017 – 36 = 981 CFM
  - If the 3" air mover is mounted on the 2" vent stack & ball valve:

    Velocity of air: 981 x 0.3/0.83 = 355 ft/min

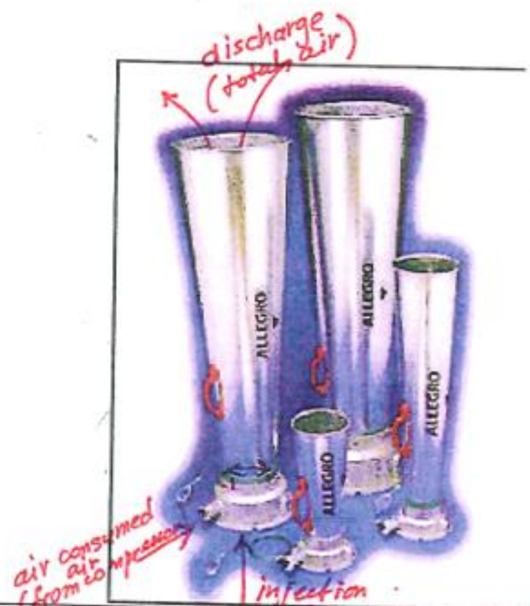
Corrected velocity is still higher than recommended minimum velocity of 149 ft/min.

- ALLEGRO Ventury Type 9518-03 air mover with air supply at 40 psig or higher pressure can be used for purging. The 2” vent stack and 2” ball valve will be appropriate to use for the air mover installation.

*Velocity of air = (Total Air Flow – Air Consumed)/Inside pipe area

NOTES*

- A table below is specific for Allegro Ventury Type Air Movers for full size access hole. If access is restricted, corrected volume of induced air, or total air flow minus air consumed, will be reduced accordingly (70% reduction in the example above). For purging pipe sizes 12” and smaller using Allegro Ventury Type Air Mover, minimum pressure at the air compressor shall be 40 psig, and maximum pressure shall not exceed 100 - 110 psi.
- When air mover is mounted on a plug valve, corrected volume of induced air will be reduced by 40%.
- If natural gas is used as a supply, corrected volume of induced air will be reduced by 60%.



BLOWER DIMENSIONS								AIR FLOW					
								AIR CONSUMED (CFM)			TOTAL AIR FLOW (CFM)		
Part No	Overall Length	Base Diameter	Diameter Top of Horn	Thread (NPT)	Bolt Circle Diameter	Basic Slot Diameter	Net Weight (lb.)	40 PSIG	60 PSIG	80 PSIG	40 PSIG	60 PSIG	80 PSIG
9518-03S	16.75"	7.31"	6.0"	1/2"	6.56"	0.4	5.5	36	50	62	815	981	1182
9518-03	30.5"	7.31"	7.0"	1/2"	6.56"	0.4	8.5	36	50	62	1017	1231	1482
9518-06	44.25"	11.25"	12.5"	1"	10.50"	0.4	22.3	73	98	124	2385	2885	3347
9518-08	46.06"	14.37"	14.25"	1"	13.62"	0.5	36	114	152	193	3152	4152	4929

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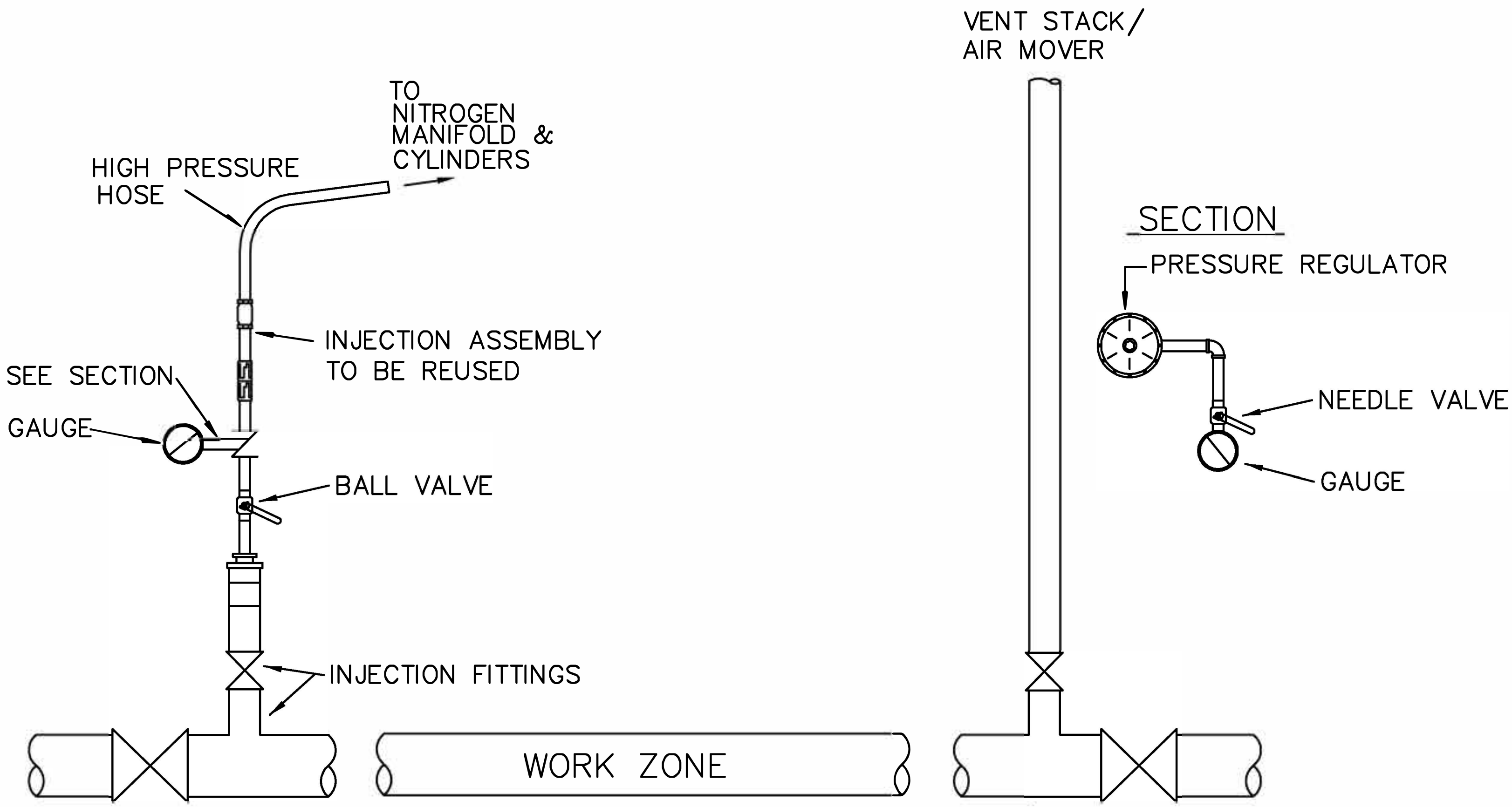
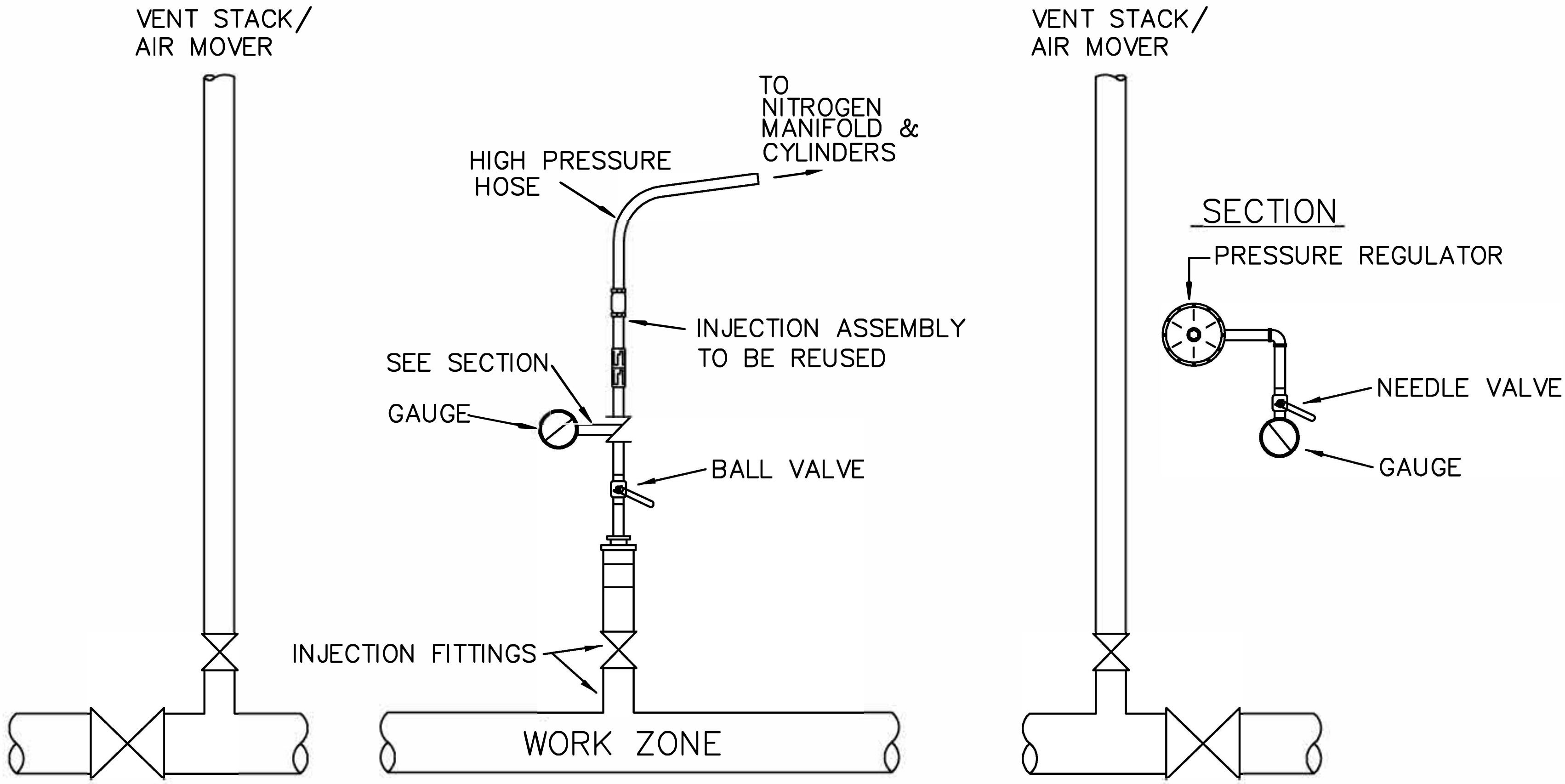
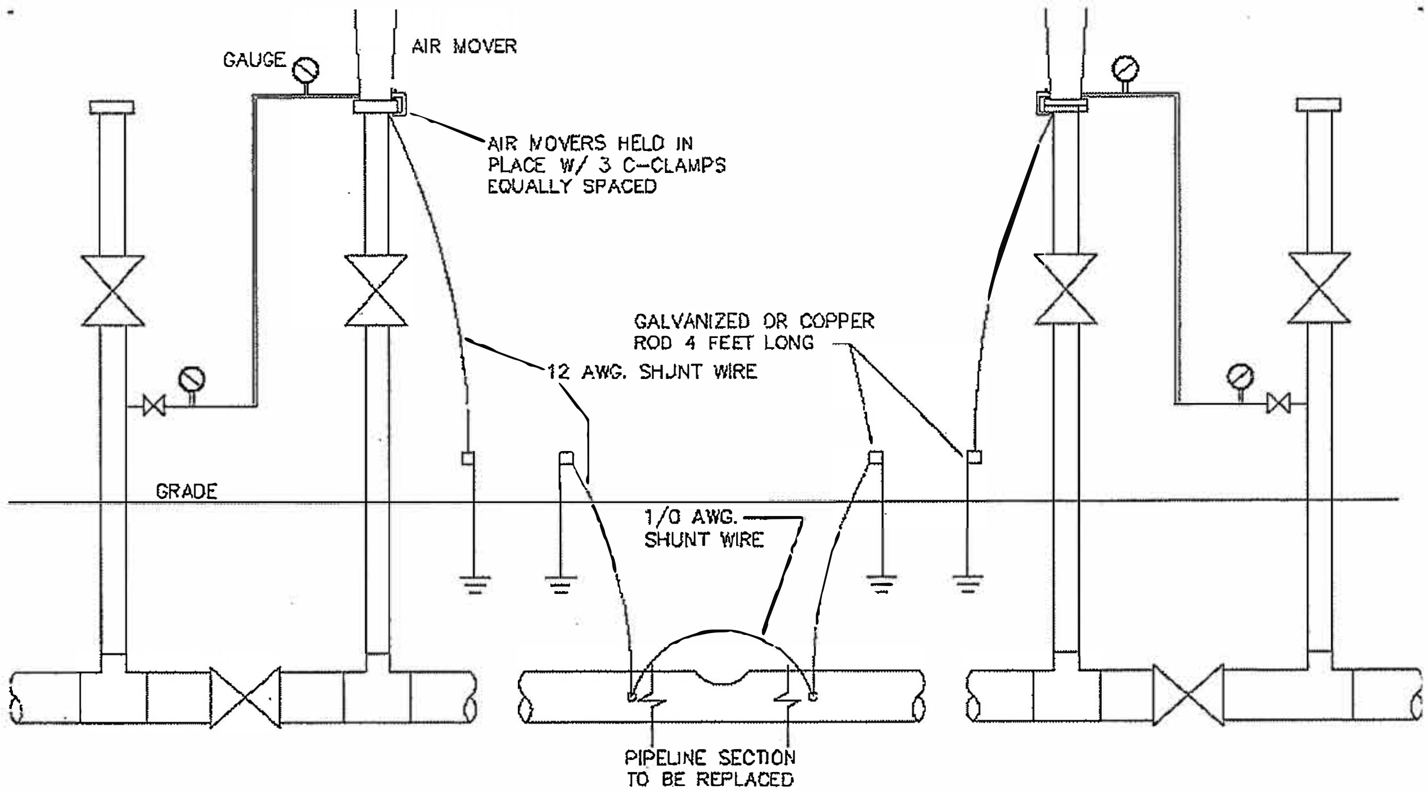


TYPICAL DETAIL FOR REPLACEMENT OF
AIR WITH NATURAL GAS UTILIZING SLUG PURGE

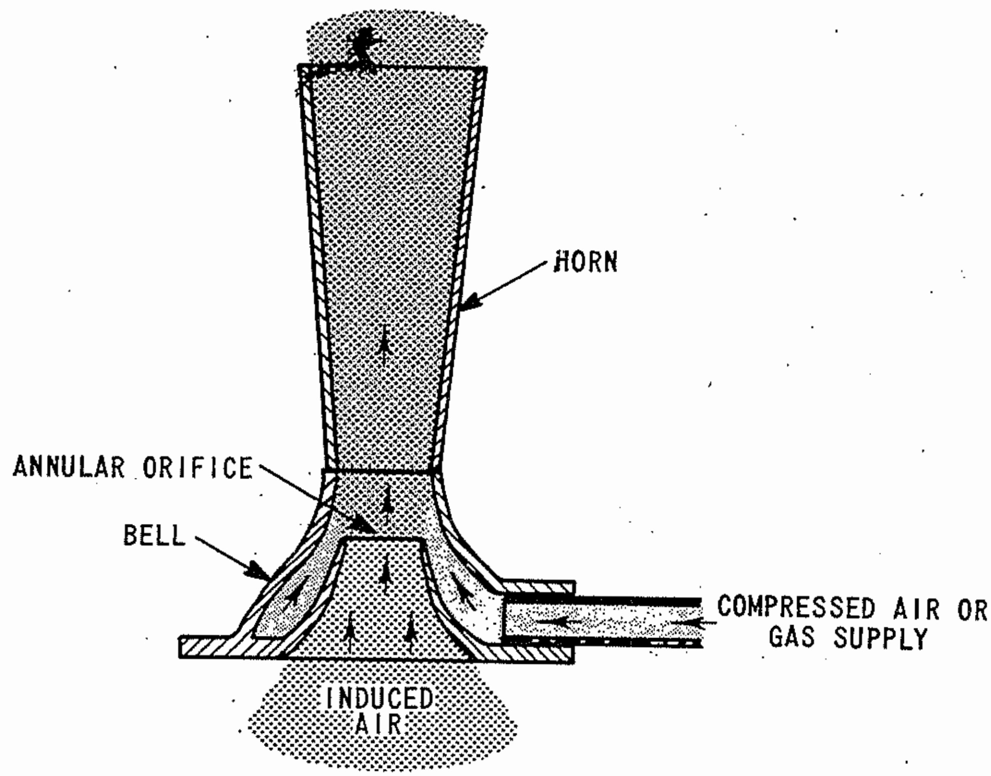


TYPICAL DETAIL FOR REPLACEMENT OF
NATURAL GAS WITH AIR UTILIZING SLUG PURGE



TYPICAL AIR MOVER INSTALLATION

AIR MOVER DIAGRAM



Reinstating Abandoned Lines

Reinstating Lines Additional Information:

It is recommended to insert or install new pipe instead of reinstating abandoned lines.

Corrosion department should be consulted before reinstating steel mains and services 2” and larger.

Steps:

1) Verify the main or service line to be reinstated.

2) Pig the line if required. See B-1.320, Pigging Pipelines.

3) Pressure test line to be reinstated.
   Refer to Pressure Testing Procedure

4) Repair all leaks and retest line, if no leaks go to step 5.

5) Make Tie- in after air tests holds.
   Refer to Tie -Ins Procedure

6) Pressure test fittings and soap tie- ins with line pressure. If plastic, rinse soap off pipe surfaces with clean water.

7) Purge line according to procedure.
   Refer to Purging Procedure

8) Connect tracer wire if line is plastic.
   Refer to Tracer Wire Procedure

9) If steel pipe, see field applied coating procedure.
   Refer to Field Applied Coatings Procedure

See DOT §192.725

Testing for Gaseous Atmosphere

See Gaseous Atmosphere Supplement Section 2.2 for procedures.

Testing for Oxygen Deficient Atmosphere

See Gaseous Atmosphere Supplement Section 2.3 for procedures.

See DOT §192.605

Tie Ins

The ends of steel mains should be terminated with a weld cap. Some dead end steel mains may have been constructed with a stopper fitting within 3' of the capped end for insertion of a stopper when the line is to be extended. If this type of fitting is not found on a line to be extended, it will be necessary to install one before making a tie-in, unless a valve is conveniently located allowing a cold tie-in.

In-Line Extension Procedure for Steel

1) Weld on approved stopper fitting per manufacturer's recommendation. If fitting is already in line go to step 4.

2) Pressure test fitting.
   Refer to Pressure Testing Procedure.

3) Tap out fitting and remove tapping equipment
   Refer to Tapping and Stopping Procedure

4) Insert stopper and plug fitting.
   Refer to Tapping and Stopping Procedure

5) Prepare pipe ends, align and make Tie- In weld.

6) Purge line according to procedure.
   Refer to Purging Procedure

7) Remove stopping equipment.

8) Install completion plug and cap.

9) Soap-test fitting and welds at line pressure.

10) Refer to Field Applied Coating Procedure B-3.110

In-Line Extension Procedure for Plastic

1) Squeeze plastic main.
   Refer to Squeezing Plastic Pipe Procedure

2) Prepare pipe ends, align and make Tie- In with fusion or mechanical fitting.

3) Purge line according to procedure.
   Refer to Purging Procedure

4) Remove Squeezers and wrap squeezed area with tape.
   Refer to Squeezing Plastic Pipe Procedure

5) Soap-test connection at line pressure.

6) Connect tracer wire.
   Refer to Tracer Wire Procedure

Lateral Extension Procedure for Steel

1) Weld on approved stopper fitting per manufactures recommendation.

2) Pressure test fitting and new lateral piping when a 3-way tee is installed.
   Refer to Pressure Testing Procedure.

3) Tap out fitting and remove tapping equipment. When a 3-way tee is used and all tie in welds are complete go to step 6.
   Refer to Tapping and Stopping Procedure

4) Insert stopper and plug fitting.
   Refer to Tapping and Stopping Procedure

5) Prepare pipe ends, align and make Tie- In weld.

6) Purge line according to procedure.
   Refer to Purging Procedure

7) Remove stopping equipment.

8) Install completion plug and cap.

9) Soap-test fitting and welds at line pressure.

10) Refer to Field Applied Coating Procedure B-3.110

Lateral Extension Procedure for Plastic

1) A High Volume Tee is recommended. Pressure test High Volume tees before tapping. Tap out High Volume Tee using appropriate tapping tool.
   Refer to Pressure Testing Procedure

2) When an In-Line tee is utilized and there is not a two way feed (See verifying feed of mains procedure.) then by-passing will be necessary if continued service is desired. This will be accomplished by installing properly sized service tees on either side of the in-line tee proposed location and connecting a temporary bypass. Soap test In-line tees with line pressure. All new piping will be pressure tested. Refer to Bypassing Procedure and Squeezing Plastic Pipe Procedure.

3) Install tees using appropriate fusion procedure.
   Refer to appropriate Fusion Procedure

4) Make all Tie Ins.
   Refer to appropriate Fusion or Mechanical Procedure

5) Purge line according to procedure.
   Refer to Purging Procedure

6) When an In- Line tee is used remove squeezers and wrap squeezed area with black tape.
   Refer to Squeezing Plastic Pipe Procedure

7) Soap-test connections at line pressure. If plastic, rinse soap off pipe surfaces with clean water.

8) Connect tracer wire.
   Refer to Tracer Wire Procedure

Transition Fittings

1) The steel side of the transition fitting must be installed first.

2) When steel end is welded, precautions should be taken to prevent the polyethylene part of the fitting from being overheated. This can be accomplished by wrapping the steel portion of the fitting near the transition with a wet cloth. Allow weld to cool before removing the wet cloth.

3) During installation of service fittings the protective sleeve should be placed on the service line before the service pipe is fused to the transition fitting. After making the connection, the sleeve can be positioned properly on the transition fitting. During installation of main size fittings by butt fusion the same technique discussed above should be used. However, for main installations by socket fusion the sleeve should be placed over the steel section of the transition fitting during fusion since the coupling being installed is larger than the sleeve inside diameter

4) Polyethylene pipe is joined to the plastic side of the transition fitting.
Refer to Plastic Pipe Fusion Procedures
Refer to Mechanical Fitting Plastic Procedure

5) The sleeve must be firmly bedded to its final line and grade in suitable backfill material, sand or a sand-gravel-clay mixture. The bellhole or trench should be manually backfilled in the area of the transition fitting to assure that the sleeve is centered and that the pipe and transition fitting are well supported.

Verifying Feed of Mains

When performing routine maintenance or emergency repair work on a system, a bypass must be installed unless the crew can verify that there is a two way feed capable of maintaining sufficient pressure to both sides of the section being taken out of service.

Maps can be used to assist with verifying the feed of mains, but the sizes and lengths of loops must be reviewed for adequate capacity and they cannot be relied on as the sole source of verification. The system MAOP, normal operating pressure and the location within the system must all be taken into consideration.

Gauges must be used in all cases to monitor the actual pressures.

The gas control group should be consulted or notified when the system is monitored by such a group.

The following procedure, or a variant of it directed by engineering, allows a crew to use existing fittings to verify feed.

Steps:

1) To verify adequate two-way feed, use the intended purge device to verify feed.

   Refer to Tapping and Stopping Procedure

2) Tap out purge fitting if necessary

3) Install purge stack.

   Refer to Purging Procedure

4) Install *pressure gauge* on each plugging unit, fitting or convenient riser downstream and upstream of the squeezers or plugging units.

5) Pressurize the gauges.

6) Plug or squeeze down one side.

7) Monitor the pressures on both sides of the plug for a minimum of 20 minutes to verify that the pressure is holding fairly constant. If deemed necessary, blow purge device until there is a noticeable drop on your gauge. Then close the purge device and verify that the system recovers to original pressure. If system pressure does not recover, close purge and raise plugging unit or squeezers and install by-pass.

8) If system recovered raise plug or squeezer to repeat operation on the other end.

See DOT §192.627

Mechanical Fittings

Note: Welding is the preferred method for joining sections of steel pipe. Mechanical fittings should only be used when welding is not practical. When mechanical fittings are used for joining steel pipe, the installation should be reinforced using a weld over sleeve or installing straps following the procedure below. When existing mechanical fittings are exposed due to excavation and other maintenance activities on the pipe, reinforcement should be considered. Check with Engineering when there is a question as to whether joint reinforcement is required.

Steps:

1) Identify proper fitting to be installed.
2) Install fitting according to manufacturers written procedures.
3) Inspect completed mechanical joint to make sure installation was performed in accordance with manufactures procedures.
4) Test Fitting.
   Refer to Pressure Testing Procedure

Weld Over Sleeves

A weld over sleeve is the preferred form of reinforcing mechanical fitting installations..

All internally fabricated weld over sleeves should be pressure tested according to guidance found in the Construction and Service Manual, Section CS-B-1.185, Page 6 of 13, prior to installation on the pipeline. All pre-manufactured and internally fabricated weld over sleeves should have all final welds soap tested after installation on the pipeline according to the installation procedure guidance found in the Construction and Service Manual, Section CS-B-1.185, Page 7 of 13, and the Gas Material and Tooling Standard, Section 6.12, Page 27 of 45

Strapping Procedures

Straps may be used where alignment, fit-up, or space considerations to install a weld sleeve prohibit its installation. Lug harnesses are used when reinforcing across insulated mechanical fittings, or across fittings that are used on cast iron and require reinforcement.

Install flat steel straps over mechanical fittings at tie-in points, bends/offsets, near main ends, and where pipe movement out of coupling might occur.. Distances from bends or ends of mains where couplings should be strapped or where joints should be welded varies with the pipe size. Straps should be fillet welded on both lateral sides and on ends. If lug harnesses are used, they must be fillet welded to pipe at all inside and outside edges. Refer to the main anchorage table later in this section.

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Where multiple bends/offsets are present, their degrees of bend/offset are accumulative and should be added and the total degree of bend/offset will be used with the main anchorage table to determine the number of anchors required. For example: a 45 degree and 20 degree ell add up to 65 degrees; therefore, its necessary to round to the next higher degree listed in the in the anchorage table (in this example the 90 degree column would be used). When using more than one strap or insulating lug joint harness, it is important that they all are installed equally spaced about the circumference of the pipe for equal distribution of stress. Record the number and size of straps or insulated lug joint harnesses in the field notes.

See DOT §192.273, 192.367

Main Anchorage to Prevent Pullout from Bolt Type Couplings
175 psig or Lower

Pipe Size	Insulating Assembly	Strap Size	Length of Weld	Number of Straps or Insulating Lug Assemblies Required on Couplings at Various Distances from 90 Degree Ells or Main Ends								Number of Straps or Insulating Lug Assemblies Required on Couplings at Various Distances from 45 Degree Ells	
				8	7	6	5	4	3	2	1	2	1
				Distance in Feet								Distance in Feet	
24"	Heavy (3/4" Lugs)	2" x 1/4"	6" at each end	0-20	20-40	40-80	80-100	100-120	120-160	160-200		0-65	
20"						0-10	10-40	40-70	70-100	100-150		0-50	
16"								0-25	25-60	60-110		0-35	
12"										0-75		0-25	
10"										0-55		0-20	
8"	Light (5/8" Lugs)	1" x 1/4"	3" at each end							0-40		0-15	
6"										0-30		0-10	
4"										0-15		0-10	
3" and Smaller											0-15		0-10

Example: A 20” coupling located 56 feet from a 90 degree Ell will require 4 – 2” x ¼” straps or 4 heavy insulating lug assemblies with 6” minimum weld at each end of each strap or lug assembly.

Marker Ball Installation

The marker ball may be used to electronically mark buried facilities for relocation at a later time. They produce a spherical electrical field that allows the marker ball to operate in any orientation and can be located from up to 5 feet away. They contain no moving or floating parts, and contain no hazardous chemicals. When relocation is required, the marker ball will produce a wide field that is easy to find, with the signal peaking directly above the marker for precise location within inches.

The marker balls are reusable.

Marker balls can be used to locate the following facilities and other locations as specified by Engineering:

- Control Valves
- Pressure Control Fittings ($\geq$ 4")
- Road Crossings
- Temporary Repairs
- Valve Stacks (Roadway, Valve Box)
- Pipe Ends
- Service Taps
- Service Stubs

Steps:

1) Determine if the marker ball needs to be secured to the object being marked. If so, attach the marker with cable ties or use a 3/8" nylon strap.

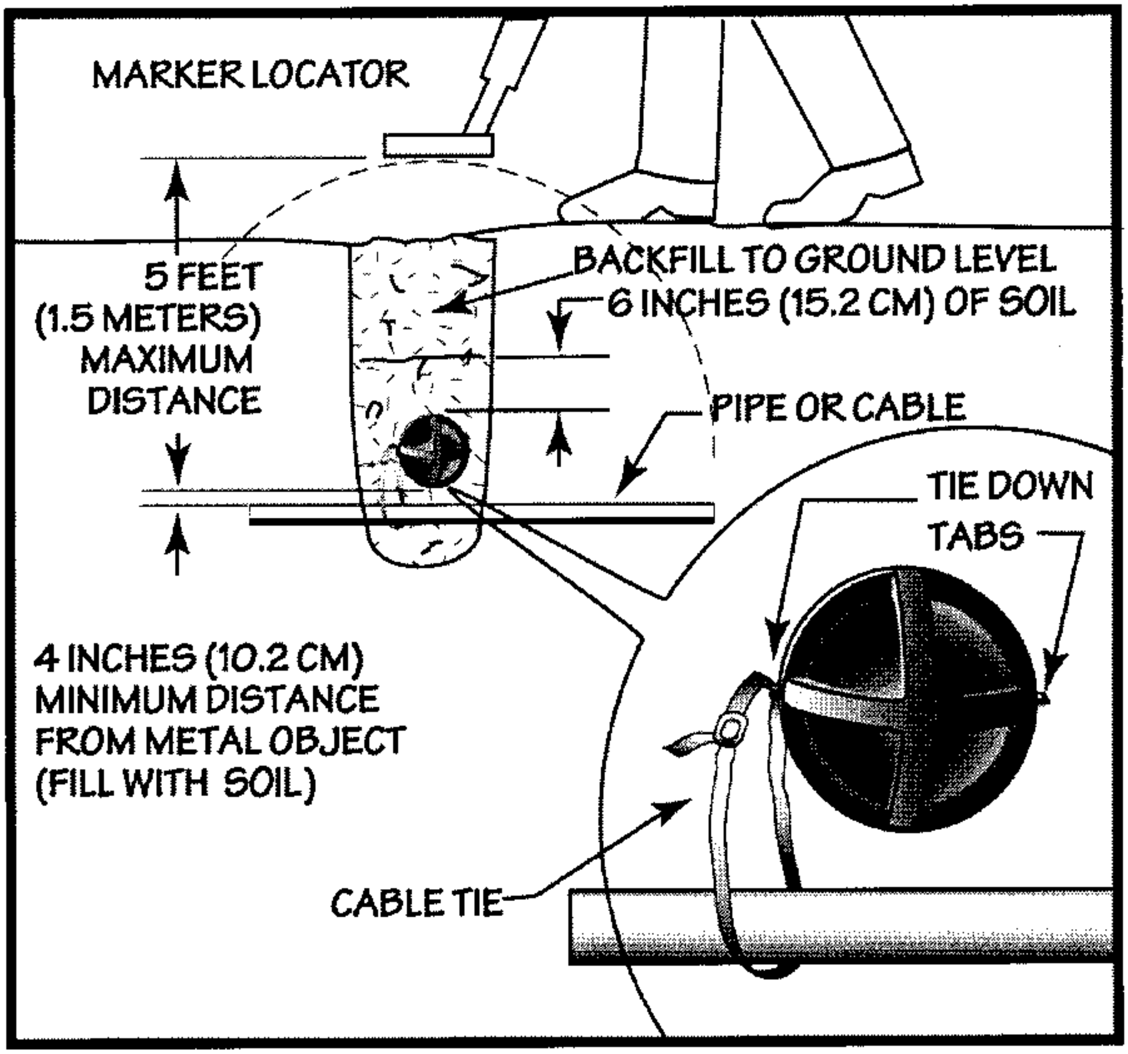
2) If the object being marked is metallic, the marker should be placed at least 4" above the object and the space between should be filled with soil. If the object being marked is non-metallic, the marker can be placed directly over the object.

3) Place the marker over the object to be marked as shown on the following page. The marker can be buried in any orientation. If the object being marked is a valve stack, do **not** place the marker ball inside the valve stack. Simply place the marker ball outside of the valve box. Placing the marker ball inside the valve box may cause future problems in accessing the valve.

4) The marker ball can be reliably detected if the distance between the locator and the marker is 5 feet or less. Do **not** bury the marker deeper than 5 feet.

5) Cover the marker ball with 6" of soil to prevent movement during backfill.

6) Backfill the hole or trench. See Backfilling and Compaction Procedure.


MARKER LOCATOR
5 FEET
(1.5 METERS)
MAXIMUM
DISTANCE
BACKFILL TO GROUND LEVEL
6 INCHES (15.2 CM) OF SOIL
PIPE OR CABLE
TIE DOWN
TABS
4 INCHES (10.2 CM)
MINIMUM DISTANCE
FROM METAL OBJECT
(FILL WITH SOIL)
CABLE TIE

Pigging Pipelines

General Information

Newly constructed pipelines should be pigged for debris and/or liquid removal from the pipe interior. The following charts are based on lines with a typical amount of debris and/or liquid. Lines that are known to be free of debris and/or liquid need not be pigged. In the case of a line that needs pigging, a debris and/or liquid free run should be achieved. A fine dust is normally present at the exit of a satisfactory run and is considered acceptable.

Steps:

1) Insert selected pig into the constructed pipeline and seal off end. Examples of assemblies used to seal off the end include a weld cap with a nipple or a flanged connection with a nipple.

2) Place the pig catcher at the receiving end of the pipe.

   Note: If a restraining device is not provided, the pig can become a projectile propelled by the compressed air behind the pig. This can cause damage to property or injury to people. Always use caution when pigging.

3) Connect air compressor to the nipple at the sealed end.

4) Turn on the air compressor so that the pig will begin moving through the pipeline.

5) After the pig is caught at the exit point, turn off the air compressor and inspect the pipeline. If debris and/or liquid is still present, another pig run is needed. Go to step 2. If there is no debris and/or liquid, the pigging is complete. The following charts show the typical number of runs that are needed depending upon pipe size and material.

Steel Pipelines

This guideline is based on using a poly pig with an abrasive coating.

# of Runs Needed				
Diameter	**0-1,000’**	**1,000’ – 5,000’**	**5,000’ – 10,000’**	**10,000’ – 20,000’**
2” – 4”	1 – 2	1 – 3	2 – 4	3 – 5
6” – 8”	1 – 3	2 – 4	3 – 5	4 – 6
10” – 12”	1 – 4	3 – 5	4 – 6	5 – 7

Plastic Pipelines

This guideline is based on using a poly pig with a urethane coating.

# of Runs Needed				
Diameter	**0-1,000’**	**1,000’ – 5,000’**	**5,000’ – 10,000’**	**10,000’ – 20,000’**
2” – 8”	0 – 2	1 – 3	2 – 4	2 – 5

Removal of Asbestos Containing Gaskets

This procedure is for the removal of gaskets that are Asbestos Containing Material (ACM) or Presumed Asbestos Containing Material (PACM). If there is a possibility that the gasket may contain asbestos, it is to be classified as PACM and treated as asbestos per this procedure until proven otherwise.

1. Don Personal Protective Equipment (PPE); eye protection and dust mask.

2. Demarcate the area in a manner that minimizes the number of persons within the area. Access should be limited to authorized persons. Employees should not eat, drink, smoke, chew tobacco or gum or apply cosmetics in the regulated area. Contain the area using impermeable drop cloths and plastic barriers.

3. Place an asbestos-labeled plastic bag under the area where the gasket is to be removed.

4. Evaluate the gasket to determine whether it appears likely to be removed intact. If on inspection the gasket appears intact, i.e. not badly torn, separated, flaky or crumbly and it can be removed gently without causing it to disintegrate, then follow the procedures set forth below. If not, follow Potentially Friable Gasket Removal Procedures (below).

5. Wet gasket with leak detection solution during removal.

6. Remove the gasket; if it is stuck remove by cutting or scraping, any scraping must be performed wet.

7. Immediately place the gasket material in the asbestos-labeled plastic bag.

8. Vacuum any residue with a HEPA-filtered vacuum.

9. Mark the flange as a non-asbestos gasket, or document as non-asbestos in the construction record.

10. No later than the end of the shift, seal the asbestos-labeled bag(s) with tape and place them in the designated asbestos waste barrel in the satellite waste storage area.

NOTE: No grinding drilling, cutting, abrading, sanding, chipping, breaking or sawing shall take place on the gaskets.

Potentially Friable Gasket Removal Procedures (for use with gaskets that may not remain intact upon removal)

There are two options when addressing an asbestos gasket that cannot be removed intact:

Option 1: Do not remove the gasket, but instead restore the fitting with the gasket intact and contained. Cut the pipe on both sides of the fitting, leaving the gasket contained and intact. Dispose of the section of pipe as asbestos containing material.

Option 2: Contact an asbestos abatement contractor to remove the gasket pursuant to Glove Bag procedures.

Removal of Asbestos Containing Pipe Coating

This procedure is for the removal of pipe coating that is Asbestos Containing Material (ACM) or Presumed Asbestos Containing Material (PACM). If there is a possibility that the pipe coating may contain asbestos, it is to be classified as PACM and treated as asbestos per this procedure until proven otherwise.

1. Don Personal Protective Equipment (PPE); eye protection and dust mask.

2. Demarcate the area in a manner that minimizes the number of persons within the area.

3. Place plastic sheeting under the section of pipe where the coating is to be removed.

4. Wet coating with leak detection solution during removal, exposed edges of coating should be kept wet.

5. Remove coating with a brass hammer to break off large pieces, then use a scraper or knife to continue removal.

6. To finish preparation for repair, buffing is allowed. Wet the area with leak solution to minimize dust. Wear eye protection and dust mask when buffing.

7. Once removal is complete and repairs are made, make sure edges of old coating are sealed with the coating used for repair.

8. Upon completion of the job, roll up the plastic sheeting containing the coating pieces, tape the sheeting closed, and place the sheeting into an asbestos-labeled plastic bag.

9. At the end of the shift, seal the asbestos-labeled bags with tape and place them in the designated asbestos waste barrel in the satellite waste storage area.

10. If large amounts of coating or long sections of pipe need to be removed, consult with engineering, safety, and environmental personnel to determine the appropriate method of removal and disposal.

NOTE: **No grinding shall take place on the pipe coating or gaskets.**

Removal of Pipe with Asbestos Containing Pipe Coating

This procedure is for the removal of pipe coated with Asbestos Containing Material (ACM) or Presumed Asbestos Containing Material (PACM). If there is a possibility that the pipe coating may contain asbestos, it is to be classified as PACM and treated as asbestos per this procedure until proven otherwise.

Orders issued from Engineering involving existing pipe

Engineering will furnish a copy of the construction orders marked with the locations with asbestos containing coating along with the tracking document. (See PowerForms CNP 912A – Pipe Coating Sampling Request and Pipe Tracking Form)

Jobs where no orders have been issued beforehand

The construction crew may remove short sections of pipe as a result of leak repair, damage repair or short offsets. Unless there has been a known test confirming that the coating does not contain asbestos, it is to be handled according to this procedure.

Procedure

Use the procedure listed above to remove any asbestos containing pipe coating.

Construction personnel will obtain a tracking document (See PowerForms CNP 912A – Pipe Coating Sampling Request and Pipe Tracking Form) from Environmental if one is not included with the orders. The disposition of the pipe shall be noted on the tracking document (See PowerForms CNP 912A – Pipe Coating Sampling Request and Pipe Tracking Form). The completed tracking document will be forwarded to Environmental. The choices for disposition are:

- Pipe coating does not contain asbestos material.
- Pipe coating contains asbestos or is presumed to contain asbestos, and
  - pipe was abandoned in place; or
  - pipe was partially removed (with specific comments), or
  - pipe was completely removed.

Pipe removed is to be cut into manageable pieces and can be put into containers brought to the job site or located elsewhere. If no container is used to temporarily store the pipe, the pipe must be covered to prevent deterioration of the coating from exposure to the sun.

The Environmental department shall be notified when the pipe is available for ultimate disposal.

Trenchless Installations

GENERAL REQUIREMENTS

There are various methods of trenchless installations that may be used. The following may apply to some or all of them.

- A general working knowledge of the soil conditions for the specific application should be known. If unknown, the engineer should order test holes at or near the location.

- Adequate clearance of utilities and underground obstacles shall be considered.

- Insure that “one call” is made.

- Sewer laterals will be cleared using either:
    a. Confirmed Elevations
    b. Maps and Records
    c. Exposed Excavation
    d. Camera Bore
    e. Post Construction Camera
    f. Relative Elevation (permitted only for clearing sewer laterals that exit full basements on level lots)

- Installation crews will document the use of trenchless technology and at a minimum, the method used to clear sewer laterals.

- In the event a sewer lateral cannot be cleared utilizing one of the approved methods, the manager responsible for crews performing the trenchless installation or a manager above that person must approve placing gas on system assets where a sewer lateral was not cleared due to “No Access”. Additional efforts should continue to gain access until the sewer lateral is cleared and documented.

- Pilot bore should be performed to gain information for the pre-reaming need verification, back ream operation, reamer size and style selection, use of the proper drilling fluids and additives and drilling fluid rate.

- Back reaming shall be used to enlarge the bore hole and provide appropriate mixing to create a slurry. Size of the reamer should be approximately 1.5 times the outside diameter of the product pipe. On pipes 10" and larger a reamer 1.3 times is usually sufficient. Larger reamer may be desired to reduce the risk of damage to product pipe in areas of rock. Reamer style selection shall be based on soil type and ground condition. Pre-reaming of the bore path in case of the hard ground conditions.

- An appropriate mixture of environmentally safe drilling fluids shall be used to avoid damaging pipe and/or pipe coating. The drilling fluid pressure shall be closely monitored and adjusted to reflect changes in the bore path conditions.

- A written record of line and depth at intervals not to exceed 30 lineal feet shall be maintained for each directional bore when the depth of pipe is greater than 5 feet. This record shall be completed, signed and dated by the installer and supplied to company inspector. All depth information needs to be recorded in our GIS.

PE PIPE

1. A weak link shall be used to pull PE pipe by mechanical means through any bore hole, including directional bores (see CS-B-4.100 for sizes and limitations).

2. Pre-reaming of the bore path is required.

3. Inspect the PE pipe after installation by checking the surface of the PE at the point of exit from the bored hole. Damage or scratches beyond 10% of the wall thickness of the PE as outlined in section CS B-4.100 shall be grounds for rejection of the entire bore.

4. When installing PE pipe, thermal expansion and contraction must be considered. The pipe should be cut to length only after it is in thermal equilibrium with the surrounding soil. The pipe should be pulled out 3% to 4% longer than the total length of the pull and the pipe should be allowed to recover prior to tie-in (see section CS B-4.100)

STEEL PIPE

1. Care must be taken to protect the pipe coating from damage for all directional bore installations.

2. Weld joints shall be coated to protect the weld and the pipe and to avoid disbondment of the manufacturer-applied pipe coating during installation. High abrasion resistant product (recommended by our company Standards Group) for the girth weld coating should be used. Adequate curing time for the girth weld coating shall be allowed.

3. All steel pipe sections shall be assembled from full pipe length to minimize joints.

4. All steel pipe and pipe coating shall be monitored for holidays or other damage at the point of entry into the bore.

5. All steel pipe shall be inspected for the condition of the coating at the point of exit from the bored hole. Pipe may be pulled to the first weld joint. Before pulling steel pipe, a “control test wrap” should be installed near the pull head cap that will assure the wrap will be exposed in the exit hole for inspection, and not have to pull all the way to the next wrapped weld joint. While pulling the pipe, due to changes in incline or direction, the front end of the pipe is exposed to most friction damage. If “test wrap” at this location is good after the pull, then the other

wrapped joints should be intact. Recommend shrink sleeves be used over the other applied wraps. If any question of coating integrity exists, the pipe shall be exposed and inspected at periodic test holes until acceptable coating is found. Holidays shall be adequately repaired. If the pipe is inaccessible, the corrosion department may be requested to perform a close interval survey (direct assessment tool) to detect any possible holidays to the coating and apply additional cathodic protection to the installed pipe.

As an alternate to the shrink sleeve method:

In addition to a dual layer epoxy coating system for bored pipe, girth welds will also be coated with an abrasion resistant, liquid epoxy product suitable for underground pipeline application. The final girth weld coating thickness will equal or exceed that of the dual coat.

Steel Casing Removal Guidelines

Equipment: Inspect cutting equipment before each cut and as often as necessary to ensure tools are in good operating condition. Cutting tools with depth limiting devices must be carefully inspected to ensure stops, mechanisms, welds, connections, and fasteners are functioning properly and are in good condition.

Cutting Tool Requirements: Tool used to make the cut must be capable of maintaining a constant depth of cut. Positive stops, locking, pinning, or redundant clamping for blade depth is required such that pressure applied downward onto the tool will not alter the depth of cut. Grinding away coating and surface debris is permitted until polished casing metal is exposed. Grooving (operating the grinding wheel on edge) to provide a blade pathway is not permitted.

Safety: Electric tools should not be used in a gaseous environment. Refer to Construction Safety Precautions section. Observe all excavation and shoring requirements within the Excavation and Trenching Policy.

Notifications: Notify the Engineering Manager of this work one week in advance so the emergency Gas Flow Interruption Plan (GFIP) action can be considered. Notify the Pipeline Integrity Engineer one week in advance to ensure personnel will be available for direct examination activities, as needed.

Procedure:

1. Clean the area to be cut using grinder removing only exterior material (dirt debris, oxidation) exposing shiny steel. Do not remove casing wall thickness in the cleaning process.

2. Grind flat any interfering weld seams (such as spiral welded steel) to allow the saw to pass without interference.

3. Verify casing wall thickness by direct measurement. Remove end seals as needed to accomplish this. This measurement should be verified with drill hole measurements of step 4.

4. Verify that there is annular spacing between the casing and gas carrier by drilling holes in the casing at lengths no greater than 4 feet along the axis of the pipe or by drilling a minimum of 4 equal spaced holes around the perimeter of the pipe. The drill must be equipped with a stop or step which limits the depth of penetration and will not damage the gas carrying pipe. Probe to verify separation of the two pipes.

5. Prepare and fix saw depth to the measured casing wall thickness measured to the longest point on the cutting blade teeth.   At no time will the cutting edge of the saw blade be allowed closer than ½” to the carrier pipe.

6. Make a circumferential cut no further than 15 feet from the end of the casing. Support the casing on both sides of the proposed cut prior to cutting.

7. Separate the casing axially at the circumferential cut. Insert wedges or blocking to maximize the clearance between casing and carrier pipes at both end of pipe to be split (minimize damage to the carrier coating). Casings may have metal or plastic spacers that may inhibit this blocking step. Investigate for the existence of these spacers and adjust this procedure so that no damage is done to the carrier by process interaction with these spacers.

8. Begin the longitudinal cut by verifying the correct depth of the blade at the starting edge of the casing. Typically, make these cuts at the top of the pipe.

After the first cut is made, rotate the pipe 180 degrees to make the second cut. Adjust blocking as necessary to prevent damage to the carrier coating, pipe wall, or metal spacers welded to the carrier when the casing is rotated. Restrain casing halves as needed with straps, chains and/or blocking, prior to final cuts, to protect personnel and carrier from the split halves falling.

9. Remove the split casing halves from the carrier pipe. Generally, the casing is rotated 90 degrees so that one of the halves can be lowered straight down and the other half lifted straight up.

10. Inspect carrier pipe after casing halves are removed for any signs of damage from the removal process.

11. Repeat steps 1 thru 10 until full length of casing is removed.

PROCESS TO DETERMINE IF A DISTRIBUTION MAIN IS ABANDONED OR LIVE

GENERAL SAFETY GUIDELINES:

- You must validate that the pipe in question is a company facility prior to performing any work. If you <u>cannot</u> confirm the pipe is a company facility, advise the excavator and do **<u>not</u>** perform any further work.
- All work will be performed using our Standard Safe Work Practices for each job; i.e., use of appropriate PPE for the job, using the hazard tree and adhering to standard procedures for each task.
- Performing this work safely requires a minimum of a two (2) person crew.
- When determining if a main is abandoned or live, treat the abandoned or exposed main as though it may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main until proven otherwise.

VERIFICATION OF ABANDONED FACILITIES:

If Records, Maps, Engineering or other resources state that a main has been abandoned, confirm using one of the following appropriate procedures.

PLASTIC MAINS:

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Clean pipe, place leak clamp on main, follow static removal procedures.

Step 4: Drill 1/8" hole with intrinsically safe tool (hand drill or air motor drill).

Live: slide leak clamp over the hole. Perform permanent repair (See Plastic Repair Matrix CS-B-4.170). **Notify Engineering.**

Dead: remove leak clamp, plug drill hole.

Step 5: Document work and update records.

Option 2

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspectors.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Install tap tee with short piece of pipe (1' long), air test & cut end cap off. Install squeeze off (See CS-B-4.190). Tap the tee.

Live: run tap down, seal main and install cap on outlet of tee. **Notify Engineering.**

Dead: abandon tee in place.

Step 4: Document work and update records.

**All C&M crews can install tap tees on any size & type of PE main.

PVC MAINS:

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspectors.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Install tap tee with short piece of pipe (1' long), air test & cut end cap off. Install squeeze off (See CS-B-4.190). Tap the tee.

Live: reinstall end cap & abandon tee in place. **Notify Engineering.**

Dead: abandon tee in place.

Step 4: Document work and update records.

STEEL MAINS: MAOP less than 60 psig

4” or SMALLER

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: If using a drift pin, have brass hammer ready. If using a service saddle or threadolet, remove coating and install service saddle or threadolet on main. Air test. Have screw plug ready.

Step 4: Drill 1/8” hole in main or in center of service saddle or threadolet with hand drill or air motor drill.

Live: drive drift pin into hole with brass hammer or install screw plug in service saddle or threadolet. **Notify Engineering.**

Dead: pull service saddle, plug drill hole.

Step 5: Document work and update records.

LARGER THAN 4”

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: If using a drift pin, have brass hammer ready. Otherwise, remove all coating, weld on threadolet (steel ½ coupling). Have screw plug ready.

Step 4: Drill 1/8” hole with hand drill or air motor drill.

Live: drive drift pin into hole with brass hammer or install screw plug in coupling. **Notify Engineering.**

Dead: abandon in place.

Step 5: Document work and update records.

Option 2

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Remove coating to install a tap tee.

Step 4: Install tap tee—welder.

Step 5: Tap the tee, raise tap slowly.

Live: seat the tap into the main and abandon in place. **Notify Engineering.**

Dead: abandon tee in place.

Step 6: Document work and update records.

STEEL MAINS: HIGH PRESSURE—MAOP Greater than 60 psig

ANY SIZE

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Remove coating to install a tap tee.

Step 4: Welder--Install tap tee & air test to 1 ½ times operating pressure.

Step 5: Tap the tee, raise tap slowly.

Live: seat the tap into the main. Abandon in place install dome per engineering requirements. **Notify Engineering.**

Dead: abandon tee in place, follow doming procedures where applicable (Class 8 and higher, MN Addenda MA-300).

Step 6: Document work and update records.

<u>CAST IRON MAINS</u>: (C&M Crews Only)

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Remove all scale for the entire length of service saddle or threadolet.

Install service saddle and air test.

Step 4: Drill out in center of service saddle with hand drill or air motor drill.

Live: install plug into service saddle. **Notify Engineering.**

Dead: pull service saddle, plug drill hole.

Step 5: Document work and update records.

Option 2

Step 1: Review all records & contacts: system mapping, asset documents, main station, Engineering, other forepersons, construction schedule/inspector.

NOTE: Consider that the exposed main may be a casing/sleeve, may have been previously inserted, and may contain a live carrier main.

Step 2: Attempt locating by inductive or conductive method (info only).

Step 3: Locate the nearest tap for a service, request the vac-truck to excavate safely without locates.

Step 4: Raise tap and verify.

Live: lower tap. **Notify Engineering.**

Dead: abandon in place.

Step 5: Document work and update records.

Required Tools:

Hand Drill or air motor drill
Vice grip style clamping device
Brass Hammer

Note: The effective date for this section has been delayed indefinitely. Compliance is not required at this time.

Inspectir ... ransmission Lines

Section 192.305 of the federal pipeline safety regulations requires that construction work performed on mains and transmission lines must be inspected to ensure that the work was done in accordance to the requirements of Part 192, Subpart G. It further requires that the person performing the inspection did not participate in the performance of the task.

Definitions used in this section:

> Construction Task: An action or series of actions taken in a construction procedure that affects the configuration or the integrity of the piping system. A construction task is something that must be completed before further actions can be taken.
>
> Inspection: An examination of the results of a task to determine if it was accomplished in a satisfactory manner allowing ensuing procedures to be performed. This can include a review of actions taken when performing the task.

The person in charge of a crew will be responsible to assign construction tasks so that someone will be available to inspect the work performed who did not participate in the performance of the task.

An inspection can be performed by any person who by training or experience can determine by visually examination that a construction task was accomplished in a satisfactory manner. That person can be assigned other duties while the task is being performed. The person making the inspection can ask questions about the performance of the task to verify that procedures were followed.

Examples of construction tasks subject to this section:

- Quality and condition of materials before and after installation
- Excavation/ditch conditions
- General pipe support
- Depth
- Joint preparation
- Field bends
- Miter joints
- Welds

- Fusions
- Mechanical joining
- Tracer wire installation
- Installations in casings
- Clearance with other underground structures
- Coatings
- Backfill material and compaction

By completing an order, the person in charge of the crew certifies that the requirements of this section were met. The names of any person performing one of the required inspections will also be listed.

Revision History: 10-01-15 (Rev. 059)

Cast Iron Repair

When an operator has knowledge that the support of the buried cast iron is disturbed, the segment of pipeline must be protected as necessary against damage by earth movement, impact forces, vibrations, future excavations near the pipeline and foreseeable outside forces which will cause bending stress.

If vibrations, demolition or construction activities occur across, parallel, under or near the pipe then consideration should be made to replace the cast iron pipe. If a parallel excavation is made and the excavation is close enough to cause more than half the pipe diameter to lie within the zone of possible soil movement, consideration should be made to replace to the pipe. Do not attempt to realign cast iron pipe if it is disturbed. Due to the mechanical properties of cast iron pipe, uneven stress may result in a circumferential break. The pipe should be replaced if it is misaligned.

When exposed by excavation each cast iron caulked bell and spigot joint must be sealed by an approved method.

Cast iron pipe may not be joined by brazing or threading. Each segment of cast iron pipe on which general graphitization is found, where leakage might result, must be replaced. Localized graphitization must be replaced, repaired or an internally sealed method used to adequately prevent leakage. If necessary samples may be sent to a laboratory to determine the extent of graphitization.

Stopper and Plugs

They should be limited to utilization pressure mains of 8 oz. (14” w.c.) or less. Besides this relatively low-pressure limitation on stoppers, there is the potential safety hazard of some gas blowing from the insertion hole. On utilization pressure mains, with pressure usually less than 8 psig, this hazard is minimal and the gas is kept from escaping through a stopper insertion hole (tap) by restricting the gas flow between operations requiring the hole to be open. During bell hole or other operations, all applicable safety measures should be exercised including fire extinguisher at hand.

After using, the stopper should be wiped cleaned, stored in a cool dry place and wrapped in an airtight cover. They should be inspected and tested frequently, always before inserting in a main. Therefore, a stopper should withstand testing at approximately 1.25 times the pressure recommended for use in a main. A stopper can also be lost in the main during installation unless inserted, inflated and anchored very carefully.

Cast iron line will be supported when long lengths of line are exposed. The low pressure service lines should be graded upward from the main so that no liquid traps are created.

See DOT §192.275

Cast Iron Bell Joint Repair

Jute (Rope Packing) and Plaster of Paris

Steps:

1) Locate cast iron line.
2) Locate Bell Joint
   Refer to Locating Bell Joint Procedure
3) Dig up bell joint that is leaking.
4) If there is an old bell joint clamp remove it.
5) If there is no bell joint clamp or the existing bell joint clamp is leaking, you will need to install a shrink sleeve (U.P only), encapsulation kit or a replacement bell joint clamp. Manufacturers written procedure for installing shrink sleeves, encapsulation kits, and anaerobic sealants must be followed.
6) For clamp installation, clean pipe and bell area where the new clamp will be installed with pneumatic scaler or sand blasting. Filing may be necessary to remove any rough areas that would affect the seal of the rubber.
7) Remove old caulking and replace rope packing (jute) if needed. Jute will need to be well wetted before inserting. Jute will need to be recessed ¾" away from the face of the bell. Use caulking tool to pack rope then apply a layer of plaster of paris recessed about ¼" away from face. When installing a bell joint clamp leave a small leak in order to check clamp for leaks after installation.
8) Follow manufacturer procedure for installing bell joint clamp.
9) Install bell ring first and adjust to fit snugly.
10) Install spigot ring and adjust to fit snugly using spacers if necessary.
11) Cut rubber gasket to fit pipe with a ¼" gap between the ends.
12) Generously lubricate the gasket with soapy water. The rubber gasket will be held in place while installing clamp using tongs.
13) Connect bell ring and spigot ring with bolts. Tightening evenly and draw spigot ring snugly against rubber gasket.
14) Tighten clamp according to manufacturer recommendation.
15) Release tongs on rubber gasket.
16) Torque bolts to manufacturer recommendation. Tap head of bolts with a hammer, then re-torque again.
17) Soap fitting for leak.
18) Coat Fitting.

Wool Lead

Steps:

1) Locate cast iron line.
2) Locate Bell Joint
   Refer to Locating Bell Joint Procedure
3) Dig up bell joint that is leaking.
4) If there is an old bell joint clamp remove it.
5) If there is no bell joint clamp or the existing bell joint clamp is leaking, you will need to install a shrink sleeve (U.P only), encapsulation kit, anaerobic sealant, or a replacement bell joint clamp. See manufacturers written procedure for installing shrink sleeves. Encapsulation work is usually contracted out, follow manufacturers written procedure for installation.
6) Clean pipe and bell area where the new clamp will be installed with pneumatic scaler or sand blasting. Filing may be necessary to remove any rough areas that would affect the seal of the rubber.
7) Add or cut out lead packing as needed to maintain a ¼" recess away from face. Thoroughly clean all excess lead packing out of the recess to prevent leaks. Leave a small leak in order to check clamp for leaks after installation.
8) Follow manufacturer procedure for installing bell joint clamp.
9) Install bell ring first and adjust to fit snugly.
10) Install spigot ring and adjust to fit snugly using spacers if necessary.
11) Cut rubber gasket to fit pipe with a ¼" gap between the ends.
12) Generously lubricate the gasket with soapy water. The rubber gasket will be held in place while installing clamp using tongs.
13) Connect bell ring and spigot ring with bolts. Tightening evenly and draw spigot ring snugly against rubber gasket.
14) Tighten clamp according to manufacturer recommendation.
15) Release tongs on rubber gasket.
16) Torque bolts to manufacturer recommendation. Tap head of bolts with a hammer, then re-torque again.
17) Soap fitting for leak.
18) Coat Fitting.

Locating Bell Joint

Steps:

1) Locate cast iron line.
2) When locating cast iron bell joints, most sections will be 12 or 16 ft in length
3) Locate at least one bell joint as a starting point.
4) Use the probing rod to assist in the location of bell joints. After locating the line, drill or probe bar holes over the line 3" apart. Probe all holes while marking the depth of the line on your probing rod.
5) The bell joint is about 4" higher than the main. When there is a noticeable difference in the depth marks on the probing rod you should be on the bell joint.
6) Once the initial bell joint is located, the next bell joint could be 12'or 16' away.
7) Then measure 12' and probe to see if there is a bell joint at this location. If not, probe again at 16'.

Clamping Cast Iron

Steps:

1) Locate cast iron line.
2) When pinpointing leaks on cast iron joints that have been previously clamped. It is important to aerate around joint before digging.
   Refer to Bar-Hole Testing Procedure
3) Excavate and expose pipe.
4) Clean pipe thoroughly and install leak clamp. For circumferencial breaks install full seal clamps or mechanical split sleeve.
   Refer to Installing Leak Clamp Procedure
5) Soap test for leaks
6) If the joint is deteriorated, install a Dresser 126A repair sleeve.

See DOT §192.275

Tapping and Plugging Cast Iron

Tapping Cast Iron

Additional Safety Precautions:

Cast iron line will be supported when long lengths of line are exposed.
Tap size cannot exceed more then a ¼ of the diameter of the pipe without use of a reinforcing sleeve. A reinforcing sleeve will be used on taps larger than 2”.
Do not make taps on pipe that is showing signs of graphitization.

Steps:

1) Locate cast iron line.
2) Excavate and expose pipe.
3) Clean pipe, use a pneumatic scaler or sand blasting when installing a fitting.
4) Install appropriate fitting in remote bellhole and test.
5) Install tapping machine and tap out line. When tapping, the pipe should be properly supported to carry the weight of the machine. The tapping and plugging operations should not be in the same hole as the cut.
   Note: Follow manufacturers written procedure for tapping and stopping.

Plugging Cast Iron

Additional Safety Precautions:

Cast iron line will be supported when long lengths of line are exposed. It is recommended when plugging IP lines, to plug the line in a separate bellhole from where the line will be repaired.
Do not make taps on pipe that is showing signs of graphitization.

Steps:

1) After tapping out the pipe install stopper unit.
2) Stop off line according to manufacturers written procedure.
3) Cast iron pipe can be cut with 4 wheel cutters with cast iron cutter wheels or hydraulic chain cutters made for cast iron.

See DOT §192.369, 192.627

Cutting Steel Pipe

This procedure is for cutting steel pipe with a cutting tool. When cutting pipe with a torch see welding section.

Jumper wires are installed during the cutting operation to prevent the accidental ignition of gas. Steel pipe can carry an electrical charge that could arc and be a source of ignition when the pipe is initially separated or joined.

Caution should be taken when cutting pipe that is in a bind (example: close to squeezers or tie-ins). Pipe should be braced or supported before cutting.

Verify that steel pipe is not casing pipe inserted with steel or plastic pipe before cutting.

Steps:

1) Select appropriate size cutting tool for the pipe to be cut.

2) Clean excess coating from the pipe before cutting.

3) For mains and services install a jumper wire across the section to be removed before cutting. The jumper wire will be made of at least a #6 welding cable 600 volts AWG-6.

4) Cut pipe square to assure line up of pipe to be replaced.

   Note: The wheels on the cutting tool can be damaged if the tool is over tightened.

5) Remove jumper wire at appropriate time.

Field Joint Coatings

Field Joint Coatings General Information

Types and Uses of Field Applied Coatings are shown in the following table.

Pipe or fittings to be coated	Black Mastic	Cold Applied Tape W/ Backing	Moldable Tape W/O Backing	Hot Applied Tape	Hot Melt Compound	Two Part Epoxy Coatings	Shrink Sleeves*/ Shrink Wrap*/	Wax Petrolatum Tapes	Fiber-glass Overwrap
Irregular Shaped Metal Fittings	X							X	
Bolt Type Compression Couplings	X							X	
Service Tees		X						X	
Sweat Joints		X							
Metal Fittings on PE & Copper Services		X	X					X	
Uncoated Transition Fittings		X						X	
Bare Steel Pipe On Repair Jobs		X		X				X	
Weld Joints		X		X		X	X	X	
Weld Joints (Through Bores)				X		X	X		X
Weld Fittings		X		X		X		X	
Compression Nut Type Couplings		X		X				X	
Damaged Mill Applied Coatings		X		X	X			X	
Copper Wire Splices			X						
Sealastic Fittings		X	X					X	
Amp-Fits or Met Fits		X	X					X	
Above Ground Piping/Weld Joints								X	
Edges Of Insulating Flanges			X					X	

* - Shrink Sleeves or Shrink Wrap is to be specified or approved for use by Engineering.

Follow the manufacturer's instructions for application of coatings.

Document that the specifications were met using appropriate measurement tools. These may include tools to measure temperature of pipe surface, ambient temperature and humidity, surface anchor profile and cure time prior to backfill.

Installing Leak Clamps

Repair clamps must be designed to fit the particular type of pipe and/or fittings being repaired and rated to withstand the system MAOP.

Note: Use a grounding cable to ground the sleeve when installing on plastic pipe.

Temporary repairs with clamps include:
- Clamping steel and cast iron above ground inside buildings.
- Clamping plastic pipe
- Could be used for dents in pipe

Permanent repairs with clamps include:
- Clamping steel and cast iron above ground (except on piping inside buildings) or below ground with an appropriately rated clamp.

Steps:

1) Thoroughly clean pipe, removing all coating, scale or other material.
   Note: For Cast Iron, use either a pneumatic scaler or sandblaster to clean pipe.

2) Determine clamp size, type and length to be used.

3) On full seal clamps, soaping the rubber inside of the clamp will assist with installation.

4) Center clamp over leak or corrosion pit.

5) Tighten clamp to manufacturer's recommendation and check with soap to ensure that leak is stopped.

6) Wait several minutes to allow rubber gasket to seat. Re-soap and tighten if needed.

7) For permanent repairs, wrap clamp and pipe using approved tape.

See DOT §192.309

Pressure Testing Stations

General Information

This procedure applies to the initial pressure testing of City Gate Stations, Town Border Stations, District Regulator Stations, Industrial Meter Stations, etc.

Steps:

1) Determine the design, sections to be tested and the test pressure(s) specified by the engineering department.

2) Before testing begins, review the design and testing process with your supervisor.

3) Verify that specified materials have been utilized.

4) Verify the design pressure of the components against the proposed test pressures. **Note**: Components supplied by manufacturers that have already qualified to the test pressure, need not be 'bolted up' into the station for testing (i.e. meters, regulators, strainers etc.)

5) If the station needs to be tested in sections to different pressures, use blind flanges or spools of the proper rating to cap off sections for testing.

6) The station or portions of a station to be tested should be tested in incremental steps as specified by engineering until the final test pressure is reached.
   Note: If needed, contact the Engineering Department for further clarification.

7) Any time leakage is detected the pressure test should be discontinued and blown down before attempting to tighten or adjust fittings or components.

8) Document test time(s) and pressure(s) on the work order.

See DOT §192.503, 192.505, 192.507

Squeezing Steel Pipe

Notes:

Hydraulic Squeeze tools must have a lock down device to prevent the accidental release of pressure.

Utilize “Lock – Out Tag – Out” procedure if squeezers are to be left unattended.

Steps:

1) The location on steel pipe to be squeezed must be stripped of coating and the squeeze point selected after the bare pipe has been examined to locate seam or girth welds, excessive pitting, visible defects or obvious weak spots that should be avoided.

2) The squeeze tool must be centered and positioned across the pipe seams when the pipe is squeezed shut. During the time the squeeze tool remains on the pipe, its weight must be fully supported by blocking or other effective methods.

3) Slowly squeeze pipe according to manufacturer procedures.

4) Caution will be taken to avoid over-squeezing of the pipe.

Note: Any steel pipe that has been squeezed is considered damaged pipe and should be replaced.

Tapping and Stopping Steel Pipe

Only qualified personnel shall be permitted to operate line stopper equipment. All line stopper equipment shall be operated in accordance with the manufacturers written procedures.

If it becomes necessary to temporarily shut off the gas supply to a section of distribution mains, each customer must be notified, preferably several hours in advance of the proposed time. Planned shutdowns should be scheduled that will least inconvenience the customers.

Note: Constantly monitor the upstream and downstream pressures while operating tapping equipment.

Special considerations may need to be given during warm weather or low flow conditions.

Steps:

1) Select appropriate tapping and stopping equipment and fittings needed for the job. Base decision upon size and type of pipe, pressure rating of the pipe and available equipment.

2) Weld on line stopper fittings. If needed, weld on a purge device,(i.e. Sav-a-Valve, Service punch tee, etc). A purge device is always needed if 2 line stopper fittings are installed. The line stopper fitting should be at least 18" away from the weld area. There should be a minimum of 24" between the purge fitting and the line stopper fitting.
   Refer to the appropriate Welding Procedure

3) Pressure Test Fittings for possible leaks.
   Refer Pressure Testing Procedure

4) If no leaks, install valves in the open position.

5) Install tapping machine, and tap out line stopper fitting(s) and purge fittings if necessary. Follow the specific manufacturers written procedure for tapping out line stopper fitting(s).

6) Sweep tap shavings clear of the line stopper fitting. Follow the specific manufacturer's written procedure for sweeping line stopper fitting(s).

7) Install stopping machines and by-pass if needed.
   Refer to Bypass Procedure
   Refer to Verifying Feed Procedure

8) Plug off line stopper fittings. Follow the specific manufacturers written procedure for plugging off line stopper fitting(s).

9) Purge line of existing gas through the purge device.
   Refer to Purging Procedure

10) Complete planned work. i.e. Cut out dresser coupling, install offset, etc.

11) Open the upstream stopper slightly and purge air through purge device.
    Refer to Purging Procedure

12) Raise stoppers and close the valves.

13) Install completion machines and insert completion plugs in the line stopper fittings. Follow the specific manufacturers written procedure for completion of line stopper fitting(s).

14) Install completion cap and test for leaks.

See DOT §192.627

Tapping Steel Service Tees

Important: Do not poor water on weld or cool artificially in any manner.

Steps:

1) Remove the punch valve from tapping tee and replace cap. Do not remove the steel dirt and splatter shield from the inlet.
2) Clean the pipe surface of all coating, rust, dirt, etc., in the area where the service tee is to be welded.
3) Weld service fitting to pipe according to welding procedure. For Transition type weld tees **DO NOT** connect plastic service until step 4 is complete.
   Refer to the appropriate welding procedure
4) Make the service connection after allowing the fitting to cool.
5) After the weld has cooled, complete the service connection.
6) Pressure test service tee and service line and all components.
   Refer to Pressure Testing Procedure
7) It is recommended to check that a small amount of lubricant is applied to the internal threads of the service tee to greatly increase the tapping efficiency of the punch.
8) Insert the punch valve and screw down at least two turns by hand to prevent cross threading.
9) Use ratchet and appropriate tapping tool to make the tap. **Important:** To insure retention of the coupon, coupon retaining punch valves should be run all the way down until punch valve seats on the main.
10) Back punch valve up until it is flush with the top of tee.
11) Apply thread sealant to the tee and screw down on the cap until it is leak tight.
12) Soap cap for leaks.

    Note: Punch valve may be used to shut off gas to service if necessary.

See DOT §192.367, 192.627

COATING INSPECTION

The most common type of coating inspection is a visual inspection. In conjunction with visual inspection, a “holiday detector” or “jeep” if often used.

Holiday detectors shall be used in accordance with the manufacturer’s recommendations for safety, operation, and care of equipment. Exploring electrodes shall be of a type designed for the size of pipe and application. Exploring electrodes shall be in contact with the coating surface at all times during operation. The pipe coating shall be free of debris, contamination, or moisture which could lead to inadequate contact or false signals. Travel speed of the electrode will be appropriate for the type of detector and operating conditions. Holiday detection and corresponding test voltages can be influenced by many factors such as: coating thickness, atmospheric conditions, electrode type and grounding. Typical test voltages for pulse or continuous DC Holiday detectors will be on the order of 1950 V for our single layer FBE coatings (14 mil thick) and 2900 V for our dual layer FBE coating (30 mil thick). Operating parameters for other types of equipment or coating thicknesses shall be verified with the Corrosion Department.

Daily field calibrate a detector in the following manner:

1) create a holiday through the coating to the steel (1/32 in. dia. pinhole recommended),
2) starting at low voltages, repeatedly jeep the pipe and incrementally raise the voltage until the intentional holiday can be reliably detected, perform this calibration at normal operating speeds and grounding conditions. If the frequency of holidays detected changes during the day, recalibrate the unit. Do not jeep pipe surfaces above 195 F.

See DOT §192.461

Direct Burial of Plastic Pipe

Trenching

1) Where appropriate, physically expose all underground foreign utilities that are electronically located before starting project.

2) Trench bottoms should be relatively smooth, continuous and free of rocks and other debris.

3) When ledge rock, hard pan or boulders are encountered, the bottom of the trench should be padded with sand or other fine grained fill materials.

4) The trench should be wide enough to allow:

   a) fusion in the ditch if required

   b) snaking of the pipe along the bottom of the trench if needed

   c) filling and compaction of side fills for larger diameter pipes. Minimum trench widths can be utilized in most instances by joining the pipe before lowering it into the trench.

Pipe Placement in Trenches

1) Care should be taken to avoid buckling, gouging, and other mechanical damage when lowering the pipe into the ditch. Each imperfection or damage that would impair the serviceability of plastic pipe must be removed.

2) The minimum bending radius for PE pipe or tubing is 20 times the outside diameter, when there are no fusion joints or mechanical fittings in the bend area. If there is a joint in the bend, the minimum bending radius is 125 times the outside diameter. The tables at the end of this section show a method of measuring the bending radius using two straight edges.

3) Align all pipe and fitting joints true to line and grade. Because plastic pipe contracts as it cools, it is desirable in warm weather to snake the pipe in the bottom of the trench. This provides for “slack” in the pipeline to be taken up as the pipe cools and contracts in the ditch prior to backfilling.

4) Protective sleeves should be installed at all service branches and transition fittings to protect against bending and shear forces.
5) Plastic pipe should be buried far enough away from steam lines, hot water lines, power lines and other sources of heat to avoid temperatures in excess of 140° F.

6) Install plastic pipe with locating wire. See Tracer Wire Procedure.

Installation of Plastic Pipe by Plowing-Planting Method

In the planting method the PE is installed in a plowed trench by inserting the PE through a chute at the rear of the plow.

1) Locate all underground utilities before starting project.

2) Check the soil conditions. If the soil is rocky, check with your supervisor to determine if another installation method should be used.

3) Select a plow with a chute diameter that will allow the PE to freely pass through it. Make sure the bend radius of the chute is no less than 15 times the outside diameter or 24 inches, whichever is greater, of the PE to be installed.

4) The pipe can be fed into the chute from a coil carried on the plow or a reel trailer running beside the plow. The pipe can also be strung out ahead of the plow and fed overhead into the chute. Avoid kinking of the pipe as it is fed overhead into the chute.

5) Plant the PE with locating wire. See Tracer Wire procedure.

6) Pipe that has been planted will contract as it cools and recovers from any stretching which occurred during installation. Sufficient overlap must be provided at locations where connections are to be made to allow for such shrinkage. Allow the pipe to relax for a period of time, at a minimum, equal to the duration of the plowing before making any tie ins.

7) Inspect exposed portions of the pipe during and after the installation for damage. Each imperfection or damage that would impair the serviceability of plastic pipe must be removed.

Installation of Plastic Pipe by Plowing-Pulling Method

In the pulling method the PE is pulled through a hole created by the plow.

1) Locate all underground utilities before starting project.

2) In the pulling method, the pipe is pulled into the ground through an oversized borehole created by a mole on a subsoiler. The maximum length of pipe to be pulled is 1000 ft.

3) Install a weak link between the pulling head and PE to be installed. The weak link should have a maximum load capability no greater than 65% of the force required to yield the PE being installed. The weak link can be of two basic designs; the next smaller PE size or a section of PE of the same size, density and SDR being installed that is weakened by placing holes through the wall. The following tables list requirements for both:

Weak Link - Reduced Size Pipe Design

PE Size Being Installed	Weak Link PE Size	Nipple Length of Weak Link Minimum
½”	None Available	
¾”	None Available	
1 1/8”	¾”	4”
1 ¼” IPS	1 1/8”	6”
2” IPS	1 ¼” IPS SDR 10	8”
3” IPS	2” IPS SDR 11	10”
4” IPS	3” IPS SDR 11.5	12”
6” IPS	4” IPS SDR 11.5-9.33	20”
8” IPS	6” IPS (Same Density)	20”

The use of a weak link shall be documented on the order and as required in mobile data.

Weak Link – Weakening Holes Design

PE Size	Number of .375" Holes or Greater Diameter	Hole Spacing +/- 1/16"
½"	2	Opposite
¾"	2	Opposite
1 1/8"	4	7/8"
1 ¼"	6	7/8"
2" IPS	8	15/16"
3" IPS	12	15/16"
4" IPS	15	15/16"
6" IPS	24	7/8"
8" IPS	27	1"
12" IPS	50	13/16"
12" IPS	30 – 0.5" holes	1-5/16"

4) Install the PE with locating wire. See Tracer Wire procedure.

5) Inspect the lead pipe for damage. Each imperfection or damage that would impair the serviceability of plastic pipe must be removed.

6) Pipe that has been pulled will contract as it cools and recovers from any stretching which occurred during installation. Sufficient overlap must be provided at locations where connections are to be made to allow for such shrinkage. Allow the pipe to relax for a period of time, at a minimum, equal to the duration of the pull before making any tie ins.

7) Remove the lead section of plastic pipe.

Installation of Plastic Pipe by Boring

Boring is an approved method for installing pipe when open trench excavating is not feasible. Examples include bores under paved roads or driveways.

1) Locate all underground utilities before starting project.

2) Check the soil conditions. If the soil is rocky, check with your supervisor if another method should be used to prevent excessive scratching and gouging of the pipe.

3) Install a pulling head ahead of the lead end of the pipe to enlarge the hole to at least 1 1/3 times the PE's outside diameter. The minimum pulling head sizes are shown below.

PE Size	Minimum Pulling Head Size
½" CTS	7/8" OD
¾" CTS	1-1/4" OD
1" CTS	1-1/2" OD
½" IPS	1-1/4" OD
¾" IPS	1-1/2" OD
1-1/4" IPS	2-1/4" OD
2" IPS	3-1/4" OD
3" IPS	4-3/4" OD
4" IPS	6" OD
6" IPS	9" OD

4) Assemble a weak link between the pulling head and the PE to be installed as described above in the Pull In Method of plowing.

5) Pull in the PE along with locating wire, in a slow and uniform application of force. Avoid periods exceeding ½ hour where the PE is not moving through the ground if it contains couplings or other fittings. See Tracer Wire Procedure.

6) After installation inspect the lead end of the PE for damage. Reject the installation if damage is excessive or if scratches exceed 10% of the wall thickness of the PE. If the weak link breaks or deforms during the pulling operation, discontinue pulling that section and restart the pulling operation using a new weak link assembly and new PE.

7) Allow the PE to relax for a period of time, at a minimum, equal to the duration of the pull before making tie ins.

8) Remove the lead section of plastic pipe.

PE Bending Radius

See Field Bending Supplement for guidelines and procedures.

Electrofusion Joining

General Notes

Once the fitting has been connected and fusion started, do not handle output cables or connectors until fusion is completed and cables are de-energized.

Be sure to rinse soap off pipe surfaces with clean water after all soap tests.

If the processor shuts down the fusion for any reason before the full cycle is complete, the fitting must be cut out and new fittings installed.

Refer to manufacturers recommendations for voltage and wattage required for the electrofusion processor.

Approximately 5 to 15 mils (0.005 to 0.015 inches) of material must be removed from the pipe surface at the fusion site to prepare the pipe for fusion. Only approved tools are to be used to do this.

Keep electrofusion fittings in manufacture's packages/bags until you are ready to fuse. If the package/bag is open prior to the installation, or the fusion area of the fitting is suspected of being contaminated, wipe its fusion region with isopropyl alcohol (90% or greater preferred), using a new untreated paper towel, or a clean cotton cloth and allow to dry.

Electrofusion Equipment Maintenance

Electrofusion processors must be calibrated and/or updated according to manufacturers' recommended intervals.

AC Processors:

Maintain the processor by performing the following services each time it is used:

1) Clean processor with a slightly damp cloth; the processor should never be cleaned by spray or immersed in water nor cleaned with compressed air.

2) Clean the area around the Temperature Sensor by wiping it with a soft dry towel.

3) Inspect fusion cables for any damage. Make sure the fitting adaptors are clean and properly attached. If cables need repair or replacement notify your supervisor/manager.

4) Inspect power cord and plug for any damage. If cord needs repair or replacement notify your supervisor/manager.

5) Inspect barcode scanner for any damage. If scanner needs repair or replacement notify your supervisor/manager.

Battery Processors:

Maintain the processor by performing the following services each time it is used:

1) Clean processor with a slightly damp cloth; the processor should never be cleaned by spray or immersed in water nor cleaned with compressed air.

2) Clean the area around the Temperature Sensor by wiping it with a soft dry towel.

3) Inspect fusion cables for any damage. Make sure the fitting adaptors are clean and properly attached. If cables need repair or replacement notify your supervisor/manager.

4) The battery pack should always be stored fully charged in a cool dry place. Do not store the battery pack at temperatures below 41°F or above 104°F. Battery should be securely mounted by the steel mounting bracket attached to the back of the processor's carrying case.

5) Inspect barcode scanner for any damage. If scanner needs repair or replacement notify your supervisor/manager.

Peelers (all types):

Peelers should only be used when it is in perfect working order. Report any time peeler is not working properly to supervisor/manager immediately for replacement.

Instruction manual should be kept in vicinity of the tool.

Maintain the peeler by performing the following services each time it is used:

1) Inspect daily for visible signs of damage or defects. Have damage or defects repaired immediately.

2) The peeler blades should be rotated or changed when the peeler starts to skip or gouge plastic.

3) During each use monitor peelings by assuring peelings form a continuous ribbon with a thickness between 5 and 15 mils (0.005 to 0.015 inches) measured with a Vernier caliper.

4) Clean roller or change roller if peeler does not track forward on rotation.

Clamps:

Check Clamps for overall condition each day before it is used for any visible signs of damage or defects. Clamps should be cleaned regularly and kept in good working condition. Report any damage or defects to your supervisor/manager for repair or replacement.

Electrofusion Coupling Procedure

Steps:

1) Cut both pipe ends squarely with an approved pipe cutter.

2) Clean both pipe ends with isopropyl alcohol (90% or greater preferred) using a new untreated paper towel or a clean cotton cloth for a distance equal to at least 2 coupling lengths on each pipe end. The pipe ends must be dry before proceeding. Allow any alcohol to evaporate. If a butt fusion fitting will be used in the coupling, prepare it in the same way as pipe.

3) Mark each pipe end at a distance slightly more than one coupling length from the pipe end. Using the coupling in its protective packaging is a good way to locate the stab depth.

4) Sections of pipe with gouges deeper than 10% of the pipe wall thickness must be removed. (See Table 1)

5) A visual indicator of sufficient removal of the pipe surface must be used. After cleaning pipe (or butt fusion fitting) surfaces, use a permanent wide felt tip marker to mark the cleaned fusion zone completely around the circumference of the pipe (see photo on page 6 of this section).

6) Immediately before fusing, completely remove the outer surfaces of both pipe ends for the distances marked in step 3 using an approved tool. All markings made in step #5, **as well as the printline must be removed**. <u>No signs of the marker or printline should be visible after this has been done.</u> Carefully remark stab depth on pipe ends as needed.

7) After the first pipe end has been prepared, protect the prepared surface from contamination by slitting one end of the coupling's protective packaging and sliding the coupling over the prepared area. **Do not touch the coil on the inside surface of the coupling.**

8) If the fusion surfaces become contaminated, wipe surface with an isopropyl alcohol wipe (90% or greater preferred). Allow alcohol to completely evaporate.

9) Select appropriate line-up clamp to hold the pipe in place.

10) If necessary, use temporary blocking under pipes for extra support

11) Remove coupling's protective packaging, taking care not to touch the inside coil of the fitting.

12) Adjust position of coupling on the pipe that has been prepared for fusion for one coupling length till it is exactly flush with pipe end.

13) Position pipe, center coupling over pipe ends and install clamp according to manufacturer's recommendations.

14) With control box located outside of trench and away from fusion area, position connectors onto coupling lock-posts.

15) Check generators fuel supply; to make sure generator has enough fuel to complete the electrofusion cycle. Open the throttle all the way (in anticipation of power draw). Start generator. Connect control box supply line to 120 VAC outlet of generator.

16) Make sure that the coupling and pipe are close to the same temperature before turning switch to “ON” position.

17) Verify adequate electrical connection and appropriate fitting selection per manufacturer’s recommendations.

18) Start fusion.

19) Monitor control box outputs for information regarding fusion time and when the cycle is complete. If the processor shuts down the fusion for any reason before the full cycle is complete, the fitting must be cut out and new fittings installed.

20) Visually inspect fitting for proper fusion per manufacturer’s recommendations.

21) Keep fitting clamped and undisturbed for the cooling time recommended by manufacturer.

22) Remove leads, clamps and any temporary blocking used to support joint during fusion.

23) Soap-test fitting. Rinse soap off pipe surfaces with clean water and backfill.

Electrofusion Saddle Procedure

Steps:

1) Clean pipe surface with isopropyl alcohol (90% or greater preferred) and new untreated paper towel or a clean cotton cloth, for a length 2-3 times greater than the saddle base. The pipe must be dry before proceeding. Allow any alcohol to evaporate.

2) Sections of pipe with gouges deeper than 10% of the pipe wall thickness must be removed (see Table 1).

3) Center fitting on pipe to determine required fusion area. Mark the pipe an equivalent length.

4) A visual indicator of sufficient removal of the pipe surface must be used. After cleaning pipe surfaces, use a permanent wide felt tip marker to mark the cleaned fusion zone completely around the circumference of the pipe (see photo on page 6 of this section). **Do not touch the coil on the base of the tee.**

5) Completely remove the outer surface of the pipe OD with the approved tool removing all markings made in step #4, **as well as the printline**. The outside surface of the pipe must be removed completely around the pipe. <u>No signs of the marker or printline should be visible after this has been done.</u>

6) Position the saddle on freshly prepared surface and attach and tighten clamp or understrap according to manufacturer's instructions.

7) With control box located outside of trench and away from fusion area, position connectors onto saddle fitting terminals.

8) Check generators fuel supply; to make sure generator has enough fuel to complete the electrofusion cycle. Open the throttle all the way (in anticipation of power draw). Start generator. Connect control box supply line to 120 VAC outlet of generator.

9) Make sure that the saddle fitting and pipe are close to the same temperature before turning switch to "ON" position.

10) Verify adequate electrical connection and appropriate fitting selection per manufacturer's recommendations.

11) Start fusion.

12) Monitor control box outputs for information regarding voltage, fusion time and when the cycle is complete. If the processor shuts down the fusion for any reason before the full cycle is complete, the fitting must be cut out and new fittings installed.

13) Visually inspect fitting for proper fusion per manufacturer's recommendations.

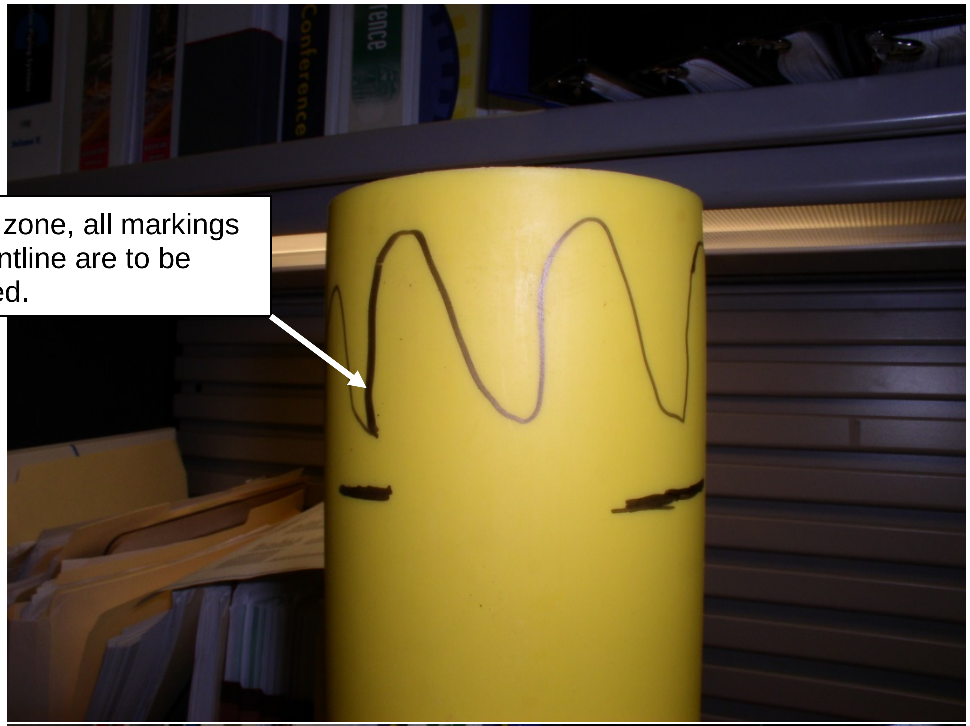
14) Keep fittings clamped and undisturbed for the cooling time recommended by manufacturer.

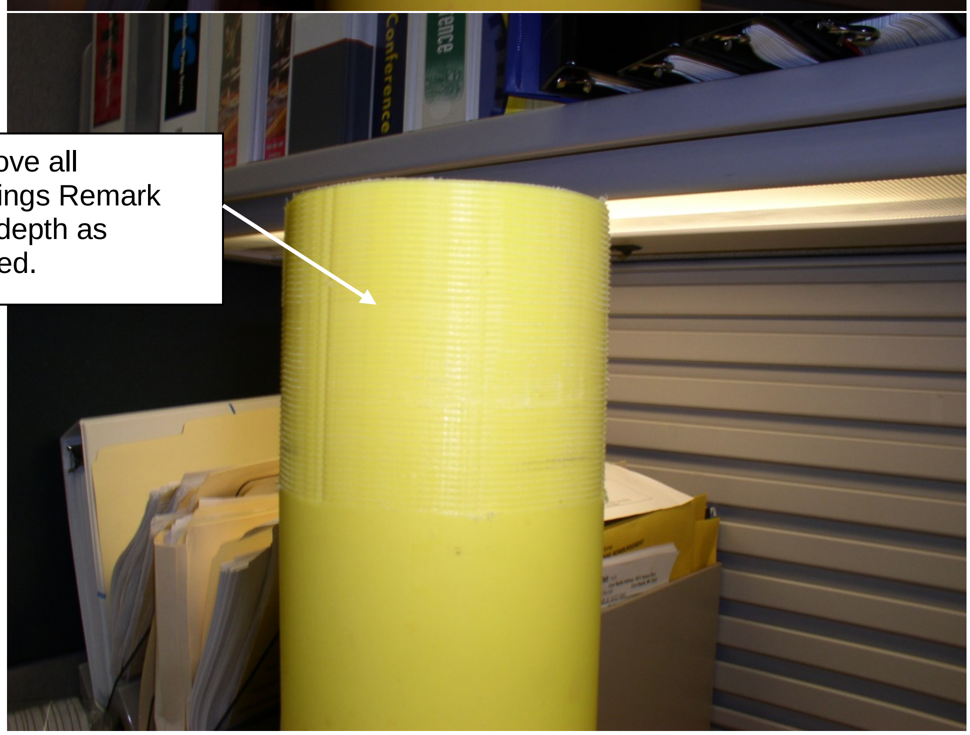
15) Remove leads, clamps and any temporary blocking used to support joint during fusion.

16) Soap-test fitting. Rinse soap off pipe surfaces with clean water and backfill.

Table 1 - 10% Allowable Scratch Depth by Size

Pipe Size	SDR	Diameter	Wall Thickness	10%
1/2" CTS		0.625	0.090	0.009
1" CTS		1.1250	0.099	0.010
1 1/4" CTS		1.375	0.090	0.009
1 1/4" IPS	10	1.6600	0.166	0.017
2"	11	2.3750	0.216	0.022
3"	11.5	3.5000	0.304	0.030
4"	11.5	4.5000	0.391	0.039
6"	11.5	6.625	0.576	0.058
8"	11.5	8.625	0.750	0.075
10"	11.5	10.750	0.935	0.094
12"	13.5	12.750	0.944	0.094


Fusion zone, all markings <u>and</u> printline are to be removed.


Remove all markings Remark stab depth as needed.

Tool Inspection:

As an additional step each crew/area should inspect each tool to determine its type and condition. A test should be performed on a scrap of pipe using the marking technique to verify the tool's capability. Any tool which cannot uniformly and completely remove the markings and print line should not be used until it is serviced and corrected.

See DOT §192.273, 192.281, 192.756

Handling and Storage of Plastic Pipe and Components

Note: Refer to Construction Safety Precautions section.

Steps:

Loading and Unloading

1) When unloading or loading a shipment of pipe, extreme care should be taken not to damage the pipe.
2) Lift operators should be cautioned against damaging the pipe with the forks or tines of the lift truck. The use of padded fork lifts or the use of nylon slings is recommended.
3) When unloading or loading straight sticks of pipe allow for some bending in the middle of the lift. Position fork lift tines as far apart as possible to reduce the amount of bending.
4) Do not drop pipe from excessive heights or drop heavy objects upon it. This is particularly important when unloading pipe at temperatures of 40°F, or below.
5) When pipe will be unloaded from a truck bed it will be rolled down inclined planks if necessary to keep damage to a minimum.
6) When breaking down bulk packs or mini-bundles, caution should be taken while strapping is being cut.

Stringing

1) It is helpful when handling coiled pipe to string the pipe out on the ground upon arrival at the job site. This allows time for the coil set to relax, and will simplify handling and emplacement of the pipe.
2) Always inspect the pipe prior to installation for damage that has occurred. Any section of pipe which has been damaged should be cut out.
3) When un-coiling pipe by hand, cut only those straps on the coil which are necessary to uncoil outer rolls; cut internal bands whenever necessary as the coil is unrolled.

Dragging

1) When the pipe must be dragged over rocky terrain or hard pavement, take precautions to protect the pipe from abrasion. Sand bags, used tires, pipe rollers or other suitable material may be used to support the pipe and prevent contact with sharp rocks or hard pavement.

2) If pipe is damaged it should be cut out if the scratch depth is greater than 10% of the minimum pipe wall thickness.

Cutting

1) Plastic pipe will be cut with knife blade cutter or tubing cutters with special cutter wheels designed for plastic pipe.
2) When using the tubing cutter, adjust the cutting wheel and rotate around the pipe advancing the wheel ahead of the roller. Once a cut is made around the pipe *reverse* the wheel cutting direction and proceed to cut all the way through the pipe.
3) When cutting in service pipe, all cutters will be grounded.

Storage

1) Plastic pipe should be stored in a manner to minimize damage from crushing, piercing, or cutting.
2) Polyethylene pipe should be used on a first-in, first-out inventory system to minimize the ultra-violet (UV) exposure in storage.
3) Plastic pipe should not be stored outside in direct sunlight for more than 3 years for yellow MDPE pipe or 10 years for black HDPE. When necessary to store pipe outside for extended periods, cover it with colored plastic to minimize deterioration.
4) Store plastic pipe with end caps in place to prevent trash from accumulating in pipe interior.

Component Storage and Handling

Plastic heat and electrofusion components should be kept boxed and bagged in their original manufactures packaging whenever possible, and be protected from damage and defects. Larger fittings such as risers and transition fittings must be handled as not to damage or impose defects to exposed plastic or to corrosion coatings.

See DOT §192.321

Insertion Renewal

Note: Refer to Construction Safety Precautions section.

Particular care must be taken when inserting plastic to avoid damage to the pipe during installation and from shear forces caused by earth loading after the system is installed.

Steps:

1) Abandon line to be inserted. If already abandoned go to step 2.
Refer to Abandoning Mains and Services Procedure.

2) If necessary a starter ditch of sufficient length must be opened to allow the pipe to be inserted without buckling or excessive bending. Required length is dependent upon casing depth and inserted pipe diameter. A table of starting ditch length is provided as a guide. See Table I.

TABLE I
STARTING DITCH LENGTHS
Suggested Lengths of Ditches for Inserting
Various Sizes of Plastic Pipe at Various Depths

STARTING DITCH LENGTHS Suggested Lengths of Ditches for Inserting Various Sizes of Plastic Pipe at Various Depths					
Pipe Size	Depth of Old Main				
	2 ft	3 ft	4 ft	5 ft	6 ft
1 ¼”	4’	5’	7’	8’	9’
2”	6’	7’	10’	12’	14’
3”	8’	10’	12’	14’	16’
4”	10’	12’	14’	16’	20’
6”	12’	14’	17’	20’	24’

3) The sleeve pipe will be prepared by reaming ends to remove any sharp edges, projections or abrasive materials from damaging the plastic pipe during or after insertion.

4) The ends of the sleeve openings should be protected to prevent shaving or gouging of pipe being inserted.

5) If inserting a service line, make appropriate welds and fusions at this time. For mains make necessary Tie-ins when appropriate.

Note: When holes in the sleeve must be cut for installation of service taps it is desirable to remove only the top part of the sleeve to insure continuous support for the inserted plastic main.

6) Generally the pipe will be pushed through the sleeve. When plastic pipe is to be pulled through the sleeve pipe, Weak links, made from smaller sizes of pipe or by drilling a series of holes in the lead section, can be fabricated to protect the inserted pipe from damage due to excessive pulling stress. Adequate time must be allowed prior to final tie-in for the newly inserted pipe to contract or recover from any stretching which may have occurred

7) Attach tracer wire to lead end pipe that will be inserted.

8) The leading end of the plastic will be closed before insertion. Plastic end caps can be used for this purpose. A straight length on the lead end of the coiled pipe will aid insertion, especially in cold weather.

9) Insert the pipe. Be sure weak link emerges through the sleeve before tie ins are made. Inspect the lead pipe for any damage.

10) Make appropriate tie-ins of the pipe.
Refer to appropriate procedures.

11) Pressure Test Line
Refer to Pressure Testing Procedure

12) Tap out tee or fittings.

13) Purge Line.
Refer to Purging Procedure

14) The inserted pipe must be padded where it emerges from the sleeve to prevent pipe from bearing down on the end of the sleeve. Cold shrink gas pipe insertion seal, split rings of plastic pipe or other appropriate padding devices will serve this purpose.

15) Attach tracer wire.
Refer to Tracer Wire Procedures.

16) Soap test fitting and if necessary, apply pipe coat protection. If plastic, rinse soap off pipe surfaces with clean water.

Refer to Field Joint Coating Procedure.

17) Any portion of exposed plastic piping that spans disturbed earth should be protected by adequate compaction of backfill beneath and around the exposed section or bridging between the sleeve ends.

18) The same care in backfilling and compaction around service connections that applies for direct burial applications also applies for insertion of service connections.

Cold Climate Considerations for Insertions

Inserted PE tubing can become partially or completely restricted by ground water freezing within the annulus of the old service pipe. The recommended maximum existing service pipe size for PE insertions where ground water could be present or trapped in the annular space is shown below:

Liner Size	Maximum Existing Service Pipe Size
5/8" OD	1" IPS
7/8" OD	1 ¼" IPS
1 1/8" OD	2" IPS
1 3/8" OD	3" IPS
1 ¼" IPS	3" IPS

However, the following options or alternatives should be considered:
- There is limited probability that water is present or trapped in the annular space during the winter months;
- The burial depth of the service to be inserted is below the normal expected frost line;
- Direct burial replacement of the service at an alternate location;
- Oversizing the liner to minimize the annular space; or
- Double insertion – insert a PE tubing filler, properly sized for the annular space, along with the normal liner, when the existing service pipe size exceeds those listed for the tubing sizes.

See DOT §192.321

Heat Fusion Joining

General Notes:

Polyethylene (PE), Polyamide PA 11 and Polyamide PA 12 materials are all different plastic materials and are not compatible. None of these can be cross fused with one of the others.

Heating Iron and Faces - The heating iron must remain in the insulated bags at all times when not in use.

Be sure to rinse soap off pipe surfaces with clean water after soap tests.

All persons making plastic joints must make a legible, permanent mark of their assigned identification number at each production joint. In the case of pressure test failure refer to Section CS-B-4.180.

The following fusion procedures are based on manufacturers recommended fusion procedures. These procedures have been qualified according to DOT 192.283.

Heat Fusion Equipment Maintenance

Heating Irons and Heater Faces (Butt fusion, socket fusion and side wall fusion):

Check heating irons and fusion faces for overall condition each day before they are used. Fusion face temperature must be checked: each day before a fusion tool is used for the first time, and each time fusion faces are attached and/or replaced. If the heating iron or heater faces are not in good condition report it to your supervisor/manager for replacement. Fusion tools should be checked by the following method:

1) Inspect heating irons and fusion faces. Heater faces should be in good working condition and free from dirt and debris and free of plastic build-up. Fusion faces should fit flat to the iron face without visible warpage or gaps. Inspect nonstick coatings on faces for dirt, scratches, or other foreign matter. Replace faces if they are not in a good, clean condition.

2) After visual inspection plug in the iron with fusion faces installed and allow sufficient time to come to a stabilized temperature.

3) Using an approved surface temperature indicator, measure the surface temperature of each fusion face using care not to scratch or contaminate the fusion face coating. The surface temperature of each face must fall in the allowable temperature range for the type of fusion to be made. To ensure a uniform temperature range, readings should be taken across the entire fusion surface which is in contact with the pipe or fitting.

4) Adjust the iron as necessary and allow the temperature to stabilize. Re-check the temperature of each fusion face.

5) Repeat steps 3 and 4 until the temperature of each face is stabilized to the required temperature.

6) If both fusion surfaces cannot be adjusted within the required temperature range, do not use the fusion tool and report it to your supervisor/manager.

Saddle Tee Application Tool (Sidewinder):

Application tool must be kept clean and well maintained. It is recommended that the machine be kept inside and out of the weather whenever possible. Maintain the machine by the following practices periodically or as often as necessary to keep machine in good working order:

1) Machine should be cleaned as needed with soap and water; do not pressure wash.

2) Remove dirt and debris from guide rods, lubricate with WD-40 or equivalent and wipe clean.

3) Lubricate guide rod wipers, seals and bearings 30W or lighter oil.

4) Remove dirt from jaw and insert serrations, drive screws and clamp knob eyebolt.

5) Clean and lubricate clamp knob bearings with 30W or lighter oil.

6) Keep clamp knob eye bolt threads brushed clean.

7) Check all nuts, bolts and snap rings to make sure they are secure and in place.

8) Clean and lubricate the threaded surface of the split nut with WD-40 or equivalent daily or before each use to maintain smooth action of the drive screw.

9) Clean the chain with a stiff bristled brush and oil and be sure to wipe off excess oil.

10) Check the hydraulic fluid level by removing the gauge following manufacturer's procedures.

11) If gauge pointer is below the zero box area when no pressure is applied, use the external adjustment screw to move the pointer to the center of the box area.

12) If gauge is in the need of calibration, follow the manufacturer's calibration procedures or have gauge calibrated by a local representative and maintain record with the application tool.

Butt Fusion-Manual:

Butt fusion machine must be kept clean and well maintained. It is recommended that the machine be kept inside and out of the weather whenever possible. Maintain the machine by the following practices periodically or as often as necessary to keep machine in good working order:

1) Machine should be cleaned as needed with soap and water; do not pressure wash.

2) Remove oily dirt buildup from guide rods, using WD-40 or equivalent and wipe clean.

3) Lubricate guide rod bushings with 10W-40 motor oil.

4) Lightly oil pivot pins and shafts; this will only take a drop of oil.

5) Remove dirt from jaw and insert serrations and clamp knob eyebolt.

6) Clean and lubricate clamp knob thrust bearings with light oil. If bearings become inoperative, they must be replaced. Report to your supervisor/manager for their replacement.

7) Keep clamp knob eye bolt threads brushed clean.

8) Check all nuts, bolts and snap rings to make sure they are secure and in place.

9) Check cam locks and springs for any ware or damage, they must be replaced. Report to your supervisor/manager for their replacement.

10) Inspect facer blades for damage or sharpness. If a blade is found to be dull or damaged replace the blade. Report to your supervisor/manager for their replacement.

11) Clean surface of facer guides and lubricate with a dry film lubricant.

Butt Fusion Machine-Hydraulic:

1) Machine should be cleaned as needed with soap and water; do not pressure wash.

2) Daily or before each use remove oily dirt buildup from guide rods, using WD-40 or equivalent and wipe clean.

3) Lubricate guide rod bushings with 10W-40 motor oil.

4) Daily or before each use check Hydraulic fluid level. Change Hydraulic fluid following manufacturer's recommendations and procedures: McElroy, every 2 years.

5) Daily or before each use check gauge, it should read zero when unit is not under pressure. If gauge is damaged or inoperable notify your supervisor/manager for replacement.

6) Remove dirt from jaw and insert serrations and clamp knob eyebolt.

7) Clean and lubricate clamp knob thrust bearings with light oil. If bearings become inoperative, they must be replaced. Report to your supervisor/manager for their replacement.

8) Keep clamp knob eye bolt threads brushed clean.

9) Check all nuts, bolts and snap rings to make sure they are secure and in place.

10) Facer should be lubricated as required by manufacturer: McElroy, annually.

12) Inspect facer blades for damage or sharpness. If a blade is found to be dull or damaged replace the blade. Report to your supervisor/manager for their replacement.

13) Clean surface of facer guides and lubricate with a dry film lubricant.

Cold Ring:

Check cold ring for overall condition each day before it is used for any visible signs of damage or defects. Cold ring should be cleaned regularly and kept in good working condition. Report any damage or defects to your supervisor/manager for repair or replacement.

Chamfering Tools:

Check chamfering tool for overall condition each day before it is used for any visible signs of damage or dulling of the blades. Chamfering tool should be cleaned regularly and kept in good working condition. Report any damage or dulled blades to your supervisor/manager for blade replacement or tool replacement.

Calibration of Temperature Indicators:

Digital temperature indicators that use a contact thermocouple type probe must be checked for accuracy once a month using a thermocouple simulator unit or calibration block. The following procedure should be used:

1) Set the thermocouple simulator to 500°F and note the indicated reading on the digital readout. If the reading is 500°F±2°F the setting of the temperature is acceptable and needs no adjustment. If it is not within that specified range, the calibration must be adjusted using the manufacture's recommendations. If the digital temperature indicator cannot be adjusted using the above method, the unit should be returned to the manufacturer or other authorized persons for adjustment and/or repairs.

2) IR temperature indicators calibration must be checked on a black-body temperature source. If the temperature is 500°F ± 10°F, the IR indicator is acceptable. Contact Gas Standards for proper procedure and method.

3) Record results of calibrations on appropriate format.

Cold Weather Fusion

The pipe and fittings contract in cold weather, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2”, 3” and 4” pipe) the pipe may barely contact the heating surface. Longer heating cycles are therefore used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develop complete melt. See attached tables for fusion at various ambient temperatures

Carefully remove (by light tapping and scraping) any ice, snow, or frost from inside and outside the pipe ends, fusion area and the areas to be clamped in the joiner. This may cause incomplete fusion. Also, frost and ice on the clamping surface of the pipe may cause slippage during fusion.

Socket Fusion Procedure

Steps:

1) Attach the proper size heater faces and heat the tool to the fusion temperature, 500°±10°F. The temperature is taken on the fusion face of the heating iron (with an approved surface contact pyrometer, infrared, or 490°F, 500°F and 510°F temp sticks.

2) Verify Heater Face Temperature is 500°F ± 10°F (see previous section on fusion tool checking).

3) Clean each pipe end both inside and outside by wiping with a clean lint-free 100% cotton cloth or paper towel. Alcohol wipes may be used for additional cleaning if surface contamination is suspected followed by wiping with a clean paper wipe.

4) Square the end of the pipe with a pipe cutter.

5) Chamfer the end of the pipe with chamfering tool.

6) Install Depth Gauge.

7) Install Cold Ring immediately behind depth gauge to insure proper socket penetration and pipe roundness.

8) A fitting puller is recommended for 2” or larger fittings.

9) For Cross fusion
   - Firmly seat the fitting heater adapter into the part of the joint that requires lead time and heat for the lead time cycle. See appropriate chart.
   - After the lead time, immediately insert the pipe or fitting fully into/onto the socket iron.

10) Begin time cycle when Cold Ring and Heater are in firm contact with the pipe.

11) At the end of the time cycle, snap the coupling from the heater and then heater from the pipe.
12) Quickly inspect melt pattern on pipe and fitting. If melt pattern is uniform around the circumference, immediately (within 3 seconds) insert the pipe squarely and fully into the socket of the fitting. Hold the joint in place, without twisting or bending, until the melts of the mating surface have solidified. Hold time is shown in the following tables.

    Note: If melt pattern is unacceptable cut out melt area, discard fitting and go back to step 4

13) Release cold ring and fitting puller.

14) Allow joint to cool an additional 3 minutes before handling and 10-30 minutes before pressure testing or plowing in.

See the following chart for proper heating times.

Socket Fusion
of
MDPE 2306/2406/2708 TR 418 Type

Heater Face Temperature: 500°±10°F

Pipe Size (inches)	**Heating Time** (seconds)	**Holding Time** (seconds)	**Cooling Time In Ring Clamp** (minutes)	**Cooling Time Before Handling** (minutes)
½"IPS/CTS	6-7	30	3	10
¾" IPS	8-10	30	3	10
1" CTS	9-10	30	3	10
1" IPS	10-12	30	3	10
1-1/4" IPS	12-14	45	3	10
2" IPS	16-19	45	3	10
3" IPS	20-24	60	3	10
4" IPS	24-28	60	3	10

Socket Fusion Various Ambient Temperatures
MDPE 2306/2406/2708 TR418 Type

Heater Face Temperature: 500° F ± 10°F

Pipe Size (inches)	**Atmospheric Temperature**								
	70°F	**60°F**	**50°F**	**40°F**	**30°F**	**20°F**	**10°F**	**0°F**	**-10°F**
½" IPS/CTS	6	6	6	6	7	7	8	8	9
1" CTS	9	9	9	9	10	10	11	11	13
1-1/4" CTS	10	10	10	10	11	11	12	12	14
1-1/4" IPS	12	14	15	17	18	20	21	22	23
2" IPS	16	18	19	21	22	24	25	26	27
3" IPS	20	22	23	25	26	27	29	30	31
4" IPS	24	26	27	29	30	31	33	34	35

Socket Fusion
of
Aldyl A

Heater Face Temperature: 500°F±10°F

Pipe Size (inches)	**Heating Time** (seconds)	**Cooling Time in Clamp** (minutes)	**Cooling Time Before Handling** (minutes)
½" CTS	4 – 6	3	10
½" IPS ¾" IPS 1" CTS 1" IPS 1- ¼" CTS	6 – 8	3	10
1-1/4" IPS 2" IPS	8 – 10	3	10
3" IPS 4" IPS	10 – 12	3	10

Socket Fusion Various Ambient Temperatures
Aldyl A

Heater Face Temperature: 500° F + 10°F

Pipe Size	**Atmospheric Temperature**								
	70°F	**60°F**	**50°F**	**40°F**	**30°F**	**20°F**	**10°F**	**0°F**	**-10°F**
½" IPS/CTS	4	4	4	4	5	5	6	6	7
1" CTS	6	6	6	6	7	7	8	8	9
1-1/4" CTS	8	8	8	8	9	9	10	10	12
1-1/4" IPS	9	11	12	14	15	17	18	19	20
2" IPS	9	11	12	14	15	17	18	19	20
3" IPS	11	13	14	16	17	18	20	21	22
4" IPS	11	13	14	16	17	18	20	21	22

Socket Cross Fusion of MDPE 2406/2708 to Aldyl A Pipe
Fusion Times

Heater Face Temperature: 500° F ± 10° F

Pipe Size (inches)	**Yellow Lead Time** (seconds)	**Combined Yellow/Aldyl Time** (seconds)	**Holding Time** (seconds)	**Cooling Time Clamp** (minutes)
½" CTS	2	4-6	60	3
½" IPS	0	6-8	60	3
¾" IPS	2	6-8	60	3
1" CTS	3	6-8	60	3
1" IPS	4	6-8	60	3
1 ¼" IPS	4	8-10	60	3
2" IPS	8-9	8-10	60	3
3" IPS	10-12	10-12	60	3
4" IPS	14-16	10-12	60	3

Note: 1) Cooling time before handling is an additional 10 minutes beyond the 3 minute ring clamp time.
2) Cold weather may require the heating times to be increased, in order to obtain the required melt.

Socket Cross Fusion MDPE 2406/2708 Coupling to Yellowstripe HDPE 3408/4710
Fusion Times

Note: When joining MDPE 2406/2708 to all HDPE 3408/4710 materials, electrofusion is the preferred joining method although socket fusion may be used to join yellowstriped piping to MDPE socket couplings 2" and smaller diameters. Socket fusion may not be used on Phillips Driscopipe M7000 or M8000 PE3408 materials. Electrofusion must be used to join Phillips Driscopipe HDPE 3408 materials to MDPE 2406/2708 materials.

Heater face Temperature: 500°F ±10°F

Pipe Size (inches)	**HDPE 3408/4710 Lead Time** (seconds)	**Combined MDPE 2708/PE 3408/4710 Time** (seconds)	**Cooling Time in Ring Clamp** (seconds)	**Cooling Time Before Handling** (minutes)
½"CTS/IPS	3	6-7	30	10
¾ IPS	4	8-10	30	10
1" CTS	5-6	9-10	30	10
1" IPS	5	10-12	40	10
1-1/4" IPS	6-7	12-14	45	10
2" IPS	8-9	16-19	45	10

Saddle Fusion Procedure

Steps:

1) Attach the proper size heater faces and heat the tool to the fusion temperature, 500°±10°F. The temperature is taken on the fusion face of the heating iron (with an approved surface contact pyrometer, infrared, or 490°F , 500°F and 510°F temp sticks

2) Verify Heater Face Temperature is 500°F ± 10°F.

3) Clean pipe area that is to be fused with a clean lint free 100% cloth or paper towel. Alcohol wipes are an effective way to remove surface contaminants. Utilize two alcohol wipes followed by a paper wipe prior to the surface roughening if surface contamination is a possibility.

4) Remove the surface skin from the melt areas of the clean, dry pipe and saddle fitting by roughening with 50-60 grit emery cloth. Brush away any residue with a clean lint free 100% cotton cloth or paper towel. Do not use alcohol wipes after roughening as there is a risk of dragging contaminants into fusion area. If an alcohol wipe is used moved to a new location.

5) The use of an Application Tool is required when making saddle fusions.

6) Place the heater tool in position on the pipe and place the fitting against the heater face and apply force (see table). During heating, the heating iron may be rocked about 2° to assure full contact with the main surface. It should not be allowed to slide between the fitting and the main. After 3-5 seconds, snap the fitting and heater from the pipe. Check the melt pattern on the pipe and fitting. If you do not have a 100% melt pattern, start over with step 1 in a new location on the pipe.

7) Heat pipe and fitting for times shown in the following tables.

8) For cross fusion
   - Place a heat shield between the Aldyl main and the iron face; apply appropriate fusion force onto the top of the tee for the required additional heating time on the tee.
   - After the appropriate pre-heat time on the tee is reached, relax the fusion force, remove the heating shield, re-apply the fusion force, and continue heating for the total required time

9) Begin timing the heating cycle after the full force has been applied. Cold weather may require the times to be increased.

   Note: When saddle fittings are fused to pipe that is under pressure, too much heat penetration may rupture the pipe from the internal pressure.

10) After proper melt time, snap the fitting and heater from pipe. DO NOT displace melt on pipe and fitting surfaces.

11) Check melt pattern on pipe and fitting. Heated surfaces on fitting and pipe should be 100% melted with no cold spots.

12) Press the fitting on the pipe immediately (within 3 seconds) with steady force (pressure) until melt bead of sizes listed in the following tables appear around the entire base of the fitting. Apply the force listed in the following tables.

13) Allow the fusion joint to cool while applying force (holding time) for the times shown in the following tables.

14) Let the joint cool for 3 minutes as shown in the following tables.

15) Visually check fitting for fusion melt bead around the entire base. See photos next page for examples of correct appearance.

16) If the melt pattern or bead on the fitting or pipe is unsatisfactory after heating, apply fitting to pipe and let cool. Remove cutter from tapping tee and cut off fitting top to avoid misuse later. Repeat procedure from Step 1.

17) For standard tapping tees and service saddles, let fusion cool an additional 10 minutes prior to applying stress pulling, pressure testing and tapping main. For high volume tapping tees and branch saddles, allow an additional 30 minutes prior to applying any stress, pulling, tapping or pressure testing.

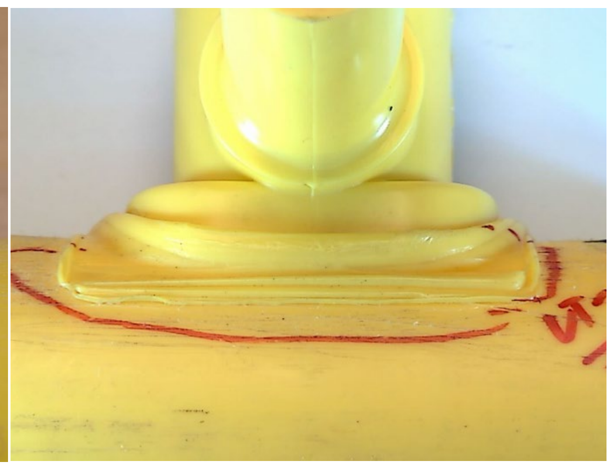
18) With the tee closure cap (with “O”-ring) in place, pressure test the service line prior to tapping the main according to pressure testing procedure. Joints and closure caps can be checked by soaping. If a Service Tee leak occurs, cut off the top of fitting to prevent future use. Repeat the saddle and service fusions with a new tee.

    Refer to Pressure Testing Procedure

Correct Appearance (serrated faces)

Incorrect Appearance (serrated faces)

Correct Appearance (smooth faces)



Incorrect Appearance (smooth faces)

Saddle Fusion
of
MDPE 2306/2406/2708 TR 418 Type(Orange, Yellow)
Fusion Times

Heater Face Temperature: 500°F±10°F

Pipe Size (inches)	**Heating Time With Force** (seconds)	**Holding Time With Force** (seconds)	**Cooling Time Before Tapping** (minutes)	**Bead Thickness** (inches)	**Force** (psi)
Service Punch Tee					
1-1/4”	*40-saddle	60	10	1/16”	60-80
	25-pipe				
2”	40	60	10	1/8”	60-80
3” – 8”	40	60	10	>1/8”	60-80
High Volume Tapping Tee and Branch Saddle					
2”	50-60	120	30	1/8”	70-90
3”	70-80	180	30	>1/8”	85-110
4”	70-80	180	30	>1/8”	85-110
6”	80-90	180	30	>1/8”	85-110
8”	80-100	180	30	>1/8”	120-140

Saddle Fusion of HDPE 3408/4710 Tees and HDPE 3408/4710 Mains
Fusion Times

Heater Face Temperature: 500°F±10°F

Pipe Size (inches)	**Heating Time With Force** (seconds)	**Holding Time with Force** (seconds)	**Cooling Time Before Tapping** (minutes)	**Bead Thickness** (inches)	**Heating Force** (psi)	**Fusion and Cooling Force** (psi)
2”	50	70	10	1/8”	60-80	40-80
3”	50	70	10	>1/8”	60-80	40-80
4”	50	70	10	>1/8”	60-80	40-80
6”	50	70	10	>1/8”	60-80	40-80
High Volume Tapping Tee and Branch Saddle						
2	55-65	150	30	-	120-140	60-80
3	75-90	180	30	-	120-140	80-100
4	75-90	180	30	-	120-140	90-120
6	85-100	180	30	-	120-140	90-120

Saddle Fusion of MDPE 2406/2708 (Yellow) and Aldyl A (Pink) Pipe
Fusion Times

Heater Face Temperature: 500° F ± 10° F

Pipe Size (inches)	**Yellow Lead With Force Time** (seconds)	**Combined Yellow/Aldyl Time With Force** (seconds)	**Holding Time With Force** (seconds)	**Cooling Time Clamp** (minutes)	**Force** (psi)
1 ¼”	20	20	60	3	60-80
2”	20	20	60	3	60-80
4”	20	20	60	3	60-80
6”	20	20	60	3	60-80
High Volume Service Punch Tee					
2”	15-25	35-45	60	3	70-90
4”	15-25	35-45	60	3	85-110
6”	15-25	35-45	60	3	85-110
Branch Saddle					
2”	20-30	30	70	3	70-90
4”	0-10	40-70	70	3	70-90
6”	10	50-70	70	3	70-90

Pipe Butt Fusion Procedure

The following procedure is used to butt fuse plastic pipe. The specific parameters of time, temperature and pressure are those generally accepted, but may vary depending on the specific resin or manufacturer. The tables which follow this procedure must be consulted to determine if parameters other than those given in the procedure must be used. Where different parameters are specified by a particular manufacturer, engineering should be consulted to determine which parameters to use.

Procedure

1. Securely fasten the components to be joined

   Clean the inside and outside of the pipe to be joined with a clean lint-free 100% cotton cloth or untreated paper towel. Place components ends into fusion machine approximately 1" through the jaws. Bring ends together to check alignment. In the case of stick pipe, align the print lines if possible. In the case of coiled pipe, print lines should be 180° apart to form an "S" configuration in the pipe. If the pipe is out of round, wait two minutes for pipe relaxation and retighten the shells.

2. Face the pipe ends

   Insert facing unit between pipe ends and lock onto guide rods. Using lever handle, bring pipe ends against facer and face pipe ends till facer stops bottom out. This is evident by the speed up of the motor. Turn facer off and wait till rotation has stopped before releasing pressure against facer. Remove shavings. DO NOT TOUCH FACED ENDS. Remove any loose material with a clean lint free cloth.

3. Align the pipe profile

   Bring pipe ends together to check alignment. (High / Low). When adjustments are needed tighten the high side, never loosen. If adjustment is made, reinsert facing unit and reface to the stops.

4. Melt the pipe surfaces

   Check heater plate temperature. The preferred Heater Face Temperature for PE pipe is 440°F±10°F. 500°±10°F may be used as an alternative for PE and is the recommended temperature for PA-11. Wipe surface clean with 100% cotton cloth or untreated paper towel. The temperature is taken on the fusion face of the heating iron with a surface pyrometer.

   For cross fusion:

   - Place a heating shield between the end of the Aldyl component and the heater face.
   - Push the ends to be joined against the heater plate with sufficient force to provide circumferential contact on that component which is against the heater face.
   - The component may be held against the heater plate using 40-200 inch pounds of force for a brief period of time to insure that proper contact with the plate has been made. <u>Release the force and hold in place for the specified period of time.</u>
   - Reverse the direction of the force to allow removal of the heat shield,

   Insert heater plate between aligned ends and bring ends firmly in contact with heater plate, but DO NOT APPLY PRESSURE. Heating time starts when a complete, uniform bead of molten material is visible around the entire circumference of both pipe ends. See the tables for the recommended bead thickness. Heat pipe for times shown in following tables. Cold weather may require the times to be increased in order to obtain the required melt bead.

5. Join the two profiles together

   Remove heater plate after achieving proper melt bead. Quickly inspect the pipe ends to make sure the melt surface does not have a concave shape. Do not use this melt in this case. If the melt appears normal, bring melt ends together rapidly. DO NOT SLAM.

6. Hold under pressure

   Apply enough force to achieve a double roll back of each bead onto the pipe. Follow the manufacturer's pressure charts when using a hydraulic machine. Hold this force during cooling, for the time shown in following tables. DO NOT remove the fused joint from the equipment for an additional 3 minutes after the holding time.

7. Visually inspect the joint and compare it to manufacturers' appearance guidelines. Bubbles in the bead is normal for PA-11 pipe. See drawings next page for visually acceptable beads.

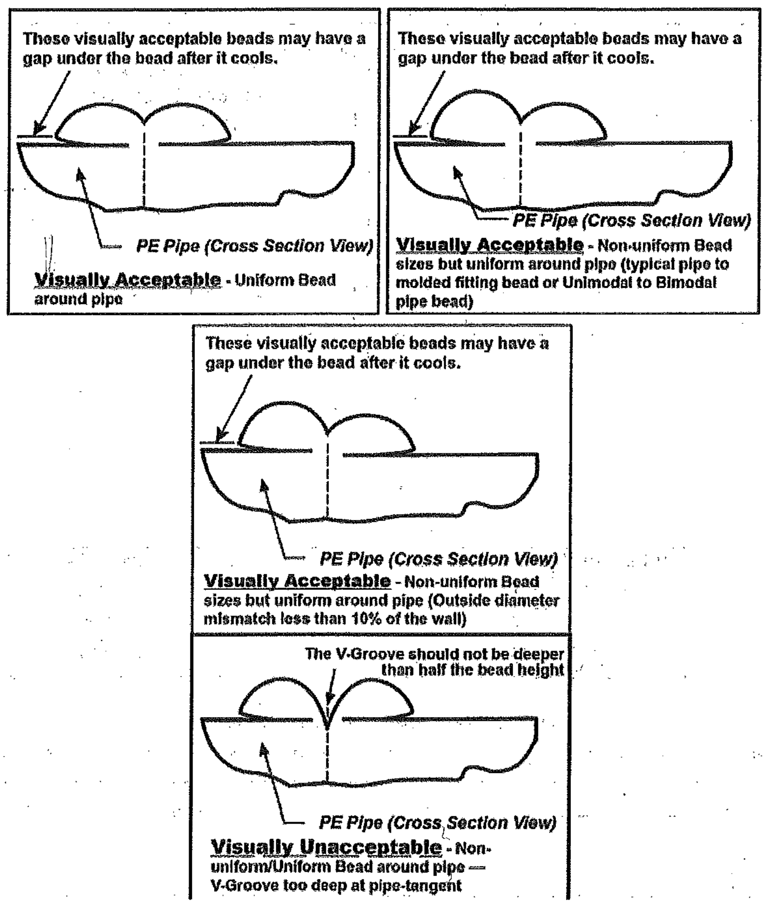


FIG. 4 Outside Diameter Butt Fusion Bead Guideline

After removal from the fusion machine, DO NOT test, stress, pull, bury in ground or otherwise “rough handle” for the time recommended by the pipe manufacturer. Use the times shown in the tables below or 30 minutes if the specific recommendations of the manufacturer are not known.

Butt Fusion of
MDPE 2306/2406/2708
TR418 Type Resins
(Yellow/Orange) Pipe
Fusion Times

Pipe Size (inches)	**Heating Times** 440°±10°F (seconds)	**Heating Times** 500°±10°F (seconds)	**Holding Time With Force** (seconds)	**Cooling Time In Machine Clamp** (minutes)	**Cooling Time Before Handling** (minutes)	**Bead Thickness** (inches)
½" CTS	12-14	6-7	40	3	10	
1" CTS	16-19	10-12	40	3	10	
1 ¼" CTS	18-22	12-14	40	3	10	1/16"
½" IPS	14-17	8-10	40	3	10	
¾" IPS	16-19	10-12	40	3	10	
1"	18 – 22	12-14	40	3	10	1/16"
1-1/4"	25- 30	14-17	60	3	10	1/16"
2"	40 – 48	16-19	60	3	20	1/16" - 1/8"
3"	50 – 60	20-24	75	3	20	1/8"
4"	55 – 66	24-29	90	3	30	1/8"
6"	90 – 108	40-48	180	3	30	3/16"
8"	90-108	55-65	210	3	30	3/16"
10"	110 - 125		225	3	30	¼"
12"	120 - 140		240	3	30	¼"

Butt Fusion of
Aldyl A Pipe (Pink Pipe)
Fusion Times
Heater Face Temperature: 340°±10°F

Pipe Size (inches)	**Heating Cycle** (seconds)	**Holding Time** (seconds)	**Cooling Time** (minutes)	**Cooling Time for Rough Handling** (minutes)
1-1/4"	30	30	1	15
2"	35	35	1-1/2	20
3"	60	60	2-1/2	20
4"	90	90	3	20
6" SDR 21	120	120	3	20
6" SDR 13.5	150	150	5	20
6" SDR 11.5	150	150	5	20
8" SDR 21	150	150	5	20
8" SDR 13.5	210	210	5	20
8" SDR 11	210	210	5	20
10" SDR 13.5	210	210	5	20
12" SDR 13.5	210	210	5	20
16" SDR 13.5	210	210	7-1/2	20

Note: Cold weather may require the heating times to be increased, in order to obtain the required melt.

Butt Fusion of MDPE 2306/2406/2708 (Yellow) and Aldyl A (Pink) Pipe
Fusion Times

Heater Face Temperature: 440°F ± 10°F

Pipe Size (inches)	**Yellow Lead Time** (seconds)	**Combined Yellow/Aldyl Time** (seconds)	**Holding Time w/ Force** (seconds)	**Cooling Time in Machine** (minutes)	**Bead Thickness** (inches)
1 ¼”	10-15	15-20	60	3	1/16”
2”	20-28	20	60	3	1/16”-1/8”
4”	30-39	25-30	90	3	1/8”
6”	55-63	35-45	180	3	3/16”

Approximate melt bead size, PA-11

Pipe Size	Approximate Melt Bead Size
1-1/4 and smaller	1/32” – 1/16”
1-1/4 through 3”	1/16”
Above 3” through 8”	1/8” to 3/16”
Above 8”	3/16” to 1/4"

Approximate melt bead size, PA-12

Pipe Size	Approximate Melt Bead Size
2”	1/16” – 1/8”
4”	1/8”
6”	1/8” - 3/16

Butt Fusion of HDPE 3408/4710 (Black) DriscoPlex Pipe
(From Performance Pipe Bulletin PP 750-TN-05)

See the attached copy of this Bulletin for specific procedures to use.

TECHNICAL NOTE PP 750-TN-05

BUTT FUSION JOINING PROCEDURES

For DriscoPlex® Municipal/Industrial/Energy Piping Products

This bulletin has been developed to assist those responsible for the butt fusion joining of Performance Pipe products in municipal, industrial, gas and energy applications. For more specific fusion information and safety requirements, saddle fusion procedures, socket fusion procedures and Federal regulations, please refer to Performance Pipe Bulletin PP 750 "Heat Fusion Joining Procedures and Qualification Guide." This procedure is in alignment with ASTM F2620.

OVERVIEW

In heat fusion joining, mating surfaces are prepared by cleaning and facing, and simultaneously melted with a hot-plate heater. The heater is removed and the melted surfaces are pressed together and held under pressure. As the molten materials cool, they mix and fuse into a permanent, monolithic joint.

SET-UP PARAMETERS

HEATING TOOL SURFACE TEMPERATURE — MINIMUM 400°F – MAXIMUM 450°F (204 – 232°C)

Heating tool surfaces must reach the specified temperature range before you begin. This includes any and all points that will come in contact with the pipe. Heating tool surfaces must be clean to allow proper fusion.

GAUGE PRESSURE

Gauge pressure is the pressure required for fusion. For hydraulic machines, the gauge pressure is a function of interfacial pressure, fusion surface area, machine's carriage cylinder size and drag pressure. When calculated, gauge pressure is what the operator will input into the fusion machine. The total effective piston area can be obtained from the machine manufacturer. The drag pressure is the pressure that is required to overcome movement in the carriage. ***Interfacial pressure and gauge pressure are not the same.*** Manually operated machines do not require a calculation for gauge pressure. Below is the equation used to calculate for Gauge Pressure in psi. A slide rule or a gauge pressure calculator obtained from the machine's manufacturer can be a substitute for this calculation.

$$\mathbf{P_G} = \frac{\left[\mathbf{OD^2} \times \boldsymbol{\pi} \times \left(\frac{\mathbf{1}}{\mathbf{DR}} - \frac{\mathbf{1}}{\mathbf{DR^2}}\right)\right] \times \mathbf{IFP}}{\mathbf{TEPA}} + \mathbf{P_D}$$

P_G = Gauge Pressure, psi
OD = Outside Diameter, in.
DR = Dimension Ratio
IFP = Interfacial Pressure, *60 – 90 psi (4.14 – 6.21 bar)*
P_D = Drag Pressure, psi
TEPA = Total Effective Piston Area, in^2

PROCEDURE

1. ***Secure.*** Clean the inside and outside of the component (pipe or fitting) ends by wiping with a clean, dry, lint-free cloth or paper towel. Align the component ends in the machine. ***Do not force pipes into alignment against open fusion machine clamps.*** Component ends should protrude past the clamps enough so that facing will be complete. Bring the ends together and check high-low alignment. Adjust alignment as necessary by tightening the high side down. Make sure clamps are properly secured to prevent slippage of the component ends.

Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7329

2. ***Face.*** Place the facing tool between the component ends and face them to establish smooth, clean, parallel mating surfaces. If stops are present, face down to the stops. Remove all shavings from pipe ends after facing. ***Do not touch the component ends after facing.***

3. ***Align.*** Bring the component ends together, check alignment and check for slippage against fusion pressure. Look for complete contact all around both ends with no detectable gaps and outside diameters in high-low alignment.

4. ***Melt.*** Verify that the heating tool is between 400°F- 450°F. Place the heating tool between the component ends and move the ends against the heating tool. The initial contact should be under fusion pressure to ensure full contact. Once full contact is made, hold the ends against the heating tool ***without force.*** For hydraulic machines, ensure that no pressure has been captured in the cylinder.

   Beads of melted polyethylene will form against the heating tool at the component ends. When the proper melt bead size is formed, quickly separate the ends and remove the heating tool.

Table 1. Melt Bead Size

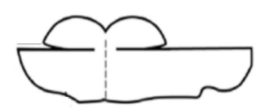
Pipe OD, in (mm)	Approximate Melt Bead Size, in (mm)
< 2.37 (60)	1/32 (1)
≥ 2.37 (60) < 3.5 (89)	1/16 (1.5)
> 3.5 (89) < 8.62 (219)	3/16 (5)
> 8.62 (219) to < 12.75 (324)	1/4 (6)
> 12.75 (324) to ≤ 24 (610)	3/8 (10)
> 24 (610) to < 36 (900)	7/16 (11)
> 36 (900) to ≤ 65 (1625)	9/16 (14)

*****Please note that for 14" and larger pipes, a minimum heat soak time of 4.5 minutes per inch of pipe wall thickness and the minimum melt bead size must be achieved.***

5. ***Join.*** Immediately after removing the heating tool, ***QUICKLY*** inspect the melted ends and then bring them together, applying the correct joining force and using the calculated Gauge Pressure. ***Do not slam the ends together.*** The correct joining force will form a double bead that is rolled over to the surface on both ends.

6. ***Hold.*** Hold joining force against the ends until the joint is cool. Maintain fusion pressure against the pipe ends at a minimum cool time rate of 11 minutes per inch of pipe wall thickness. Avoid pulling, installing, pressure testing and rough handing for at least an additional 30 minutes. Heavier wall thickness pipes may require longer cooling times.

7. ***Inspect.*** On both sides, the double bead should be rolled over to the surface and be uniformly rounded and consistent in size all around the joint. If equipped, verify joint via a Data Logger.



It is a common practice and accepted industry "Rule of Thumb" when fusing pipes of unlike Dimension Ratio (DR) to fuse a maximum mismatch of **one** SDR. For example, this would allow fusion of DR 11 pipe to DR 9 or DR 11 to DR 13.5. A successful fusion may be accomplished without the need of any change in the actual fusion procedure. When fusing unlike DR values, the fusion pressure is calculated to the higher DR number.

Per ASTM, Standard Dimension Ratio (SDR) value is when the outside diameter divided by the minimum wall thickness equals one of the following values:

5.0	6.0	7.3	9.0	11.0	13.5	17.0	21.0	26.0	32.5

The terms DR and SDR are often used interchangeably.

Pre-Testing Plastic Pipe

Note: Refer to Construction Safety Precautions section.

Coils and straight sections of pipe used for short replacements segments such as leak repairs, will be pre-tested. Such pipe will be marked or tagged to show the test date and pressure and should be used for repair purposes only.

Steps:

1) Test pipe according to the Pressure Testing Procedure.
2) When pressure testing is complete, the pipe will be marked or tagged to show test date and pressure.
3) Make sure that Test date and Pressure are transferred to the remaining end of the pipe after portions of the pipe are used.
4) Document on construction orders the roll number and the date tested.
   Example: roll #1001 date: 9-12-99.

See DOT 192.513

Repair of Other Plastics (PVC, Perfex, Orangeburg, 2306)

Policies for Addressing PVC

Be sure to rinse soap off pipe surfaces with clean water after all soap tests.

PVC Repair General Information

Note: PVC line will be supported when long lengths of line are exposed.

PVC presents many unique situations because of the few options available for making repairs without special procedures. PVC pipe is difficult to squeeze and it should only be done in cases where there is no other method available to stop the flow of gas. PVC also does not have a fusion procedure, comes in many odd sizes and because of it's brittleness can present safety hazards when working around it. Current available methods of joining include mechanical fittings or solvent and adhesive cement (glue).

The major problem faced when repairing PVC is shutting off the flow of gas. To successfully operate a PVC system, shut off devices **must** be built into the system. If no shut off devices are in place, follow the Hazard Tree in Leak Investigation section of this manual.

Recommended Implementation plan for PVC systems:

Only approved PVC fittings will be used.

Install squeeze points at key locations using mechanical compression couplings and a section of PE pipe. (Stiffeners may need to be used on compression couplings) This section should be long enough to allow for multiple squeezes at the same location. The last place to be squeezed on this section should be nearest the upstream side, at that time the section should be replaced. Refer to squeezing plastic pipe procedure

Install PE valves at key locations using mechanical compression couplings. The valve must be stacked.

It is recommended to install special locating devices at key points on PVC systems without tracing wire.

Maps of the PVC systems should be on file in each office

Clamping PVC Procedure

1) Locate PVC line.

2) Excavate and expose pipe.

3) Clean pipe thoroughly and install leak clamp. It is recommended to only use Full Seal clamps on PVC.
   Refer to Installing Leak Clamp procedure

4) Soap test for leaks

Tapping PVC Procedure

1) Locate PVC line.

2) Excavate and expose pipe.

3) Clean pipe and install appropriate fitting.

4) Install tapping machine and tap out line.

   Note: Follow manufacturers written procedure for tapping lines.

Plugging PVC Procedure

1) After tapping out the pipe install stopper unit.

2) Stop off line according to manufacturers written procedure.

Joining PVC Procedure

No one is authorized to join PVC pipe unless properly qualified using the following qualified procedure.

Whenever performing repairs or replacing PVC piping, only that piping which meets or exceeds ASTM D2513 shall be used. In addition, adhesive or bonding material shall meet or exceed ASTM D2564.

1) Cut pipe ends square.

2) Remove all burrs from inside and outside of the pipe.

3) Remove all dirt, grease, and moisture and wipe with a clean dry cloth.

4) Before applying adhesive, install pipe into fitting to ensure a proper fit.
   Note: Ambient temperature use of the adhesive should be between 40º F and 110º F.

5) Apply the primer using Keatone and paint brush, and allow to dry.

6) Apply adhesive evenly around the pipe end and equal to the stab depth of the fitting. Avoid puddling. Adhesive layers must be without voids and sufficient to fill any gap in the joint.

7) Assemble without delay, while adhesive is still wet, using enough force to bottom out in the fitting. Twist 1/8” to ¼” and hold together for approximately 30 seconds to make sure pipe does not travel out. Wipe off excess adhesive. (Do not use a cleaner)

8) Allow 15-20 minutes drying time before handling. Pressure test in accordance with Pressure Testing Procedure.

Policies for Addressing Other Plastics

Use the table on the following page to aid in determining the appropriate method for repair of plastic pipe.

Plastic Repair Matrix

PE Type	Heat Fusable	Repair or Replace	Repair Permanent or Temporary
PE 2306 Aldyl All tubing sizes	YES	Repair	1. Fuse 2. Metfit, 5/8" OD or LycoFit 3. Constab 5/8", 1 1/8" OD 4. Chicago Fitting Sealastic
PE 2306 TR418, Orange, black, all tubing sizes	YES	Repair	1. Fuse 2. Metfit 5/8" or LycoFit 3. Constab 5/8", 1 1/8" OD 4. Chicago Fitting Sealastic
PE 2306 Perfex , Sinclair Coppers 4002, Orange/Red 5/8" and 1 3/8" OD, 090" wall	NO	Replace – temporary repairs only.	1. Metfit 5/8" OD or LycoFit 2. Chicago Fittings Sealstic 3. Constab 5/8" OD
PE 2406 Yellow and Orange all tubing sizes	YES	Repair	1. Fuse 2. Metfit 5/8" or LycoFit 3. Constab 5/8", 1 1/8" OD 4. Chicago Fitting Sealastic
PE 3306 Black 5/8", 7/8", 1 1/8", 1 3/8" and 1 ¼" OD, .062", .070". .090" wall	NO	Replace – temporary repairs only	1. Chicago Fitting Sealastic 2. Metfit .090" wall <u>ONLY</u>
PE 3306 Orangeburg Black (Midwest Area) ½", ¾", and 1" IPS, Sch 40 wall	NO	Replace	1. Contact Engineering
PE 3408 Plexco Yellowstripe Eagle TriStripe all tubing sizes	Yes, Socket, Butt	Repair	1. Fuse 2. Metfit 5/8" OD or LycoFit 3. Constab 5/8, 1 1/8" OD 4. Chicago Fitting Sealastic
PE 3408 Drisco 7000 (Midwest Area) Sizes greater than 5/8" OD	NO	Replace	1. Contact Engineering
PE 3408 OD Drisco 7000, 8000 5/8" OD, .090" Wall	Yes, Butt only	Repair	1. Metfit 5/8" OD or LycoFit 1. Constab 5/8", 1 1/8" OD 2. Butt Fuse 3. Chicago Fitting

See DOT §192.281

Qualification of Plastic Pipe Joiners

Qualification of Plastic Pipe Joiners

All persons making fusion joints in plastic pipe shall be qualified by performing a qualification test that consists of making a specimen joint similar to that shown in Drawing A-ES-3 and in accordance with the proper procedure. The specimen shall be visually examined during and after assembly and found to have the same appearance as a joint or photographs of a joint that is acceptable under the procedure. In addition, the specimen shall be tested as described under step 3 below.

Training will require the making and testing of representative types of joints pertinent to the qualification. In addition, initial operator training shall include:

a. Fusion Equipment and Techniques
b. Different Plastic Materials (Compounds)
c. Test Procedure
d. Maintenance of Equipment.

Steps:

1) Prepare a test specimen similar to that shown in Drawing A-ES-3 using appropriate fusion procedure.
2) Each person being tested shall make of at least one socket, saddle and butt fusion joint using the types of joining they will be expected to perform.
3) Evaluation of fusion joints. No person may carry out the inspection of joints in plastic pipes unless that person has been qualified by appropriate training or experience in evaluating the acceptability of plastic pipe joints made under the applicable joining procedure. The following is the procedure in the evaluation of a socket, saddle, butt, electrofusion, mechanical fitting joint, and PVC joining.

Requalification of Plastic Pipe Joiners

A person must be requalified under an applicable procedure once each calendar year at intervals not exceeding 15 months.

A person will also have to be requalified under an applicable procedure after any production joint is found unacceptable by failing the post construction pressure test.

Note: A person will not have to be requalified if it is determined that the fusion is not acceptable and it is removed and replaced prior to the pressure test.

Qualification Records

For plastic transmissions lines installed after July 1, 2020, individual joiner qualification records shall be retained for a minimum of 5 years following construction.

Socket Fusion

1) Visual inspection outside of joints
   a) Face of fitting should not be defaced or melted into more than 1/16”.
   b) No excess melted plastic should be rolled up around face of joint.
   c) No holidays should be visible around joint between pipe and fitting.
   d) There should be no evidence of overheating and excessive melting of plastic.
   e) There should be no misalignment in joint of more than 5°.
2) Visual Inspection inside of joints
   a) Cut specimen into three longitudinal straps. One strap should be a half-section of pipe (see Drawing A-ES-4).
   b) End of pipe must stop approximately ¼” from collar inside fitting.
   c) No excess melted plastic should extend inside the I.D. of the pipe more than 1/16”.
   d) There should be no evidence of overheating and excess melting of plastic.
3) Destructive Test
   a) The half-section of pipe may be tested by being squeezed in a vise as shown in Drawing A-ES-5.
   b) Using the other two straps, bend each one at least 180°.

   There should be no evidence of separation or cracking at the joint. If separation or cracking in the joint area in either of the straps is present, the person being tested shall make a new test sample.

Saddle Fusion

1) Visual Inspection outside of joint
   a) Service saddle fitting base should cover melt pattern on main.
   b) Roll of melted plastic around outside of saddle base should not be excessive.
   c) There should be no melted plastic up inside service outlet.
   d) There should be no evidence of overheating and excessive melting of plastic.
   e) Socket fusion part of saddle should conform to conditions as stated previously under **Testing of Socket Fusion Joint.**
2) Visual Inspection inside of joint
   a) Cut specimen longitudinally as per Drawing A-ES-7.
   b) There should be no gaps or voids in joint area.
   c) There should be no evidence of overheating and excess melting of plastic.

3) Destructive Test
   a) A knock-off or a bend test will be performed on the saddle fitting. Refer to Drawing A-ES 6 & 7 for the bend test. During the knock - off test care should be taken to avoid injury.

Butt Fusion (Manual and Hydraulic)

Note: Using a hydraulic machine to produce butt fusions requires a separate qualification. The fuser must produce a sample with a hydraulic machine that is visually inspected and destructively tested in accordance with this section.

1) Visual Inspection outside of joint
   a) No excess melted plastic should be rolled up around joint.
   b) Bead should be a uniform thickness around circumference.
   c) No holidays should be visible around joint.
   d) There should be no evidence of overheating and excessive melting of plastic.
   e) There should be no misalignment in the joint.
2) Visual Inspection inside of joint
   a) Cut specimen longitudinally into three straps as per Drawing A-ES-8.
   b) No excess melted plastic should extend inside the I.D. of the pipe.
   c) There should be no evidence of overheating and excess melting of plastic.
3) Destructive Test
   a) Using the three straps, bend each one at least 180°. There should be no evidence of separation or cracking at the joint. If separation or cracking in the joint area in any one of the straps is present, the person being tested shall make a new test sample.

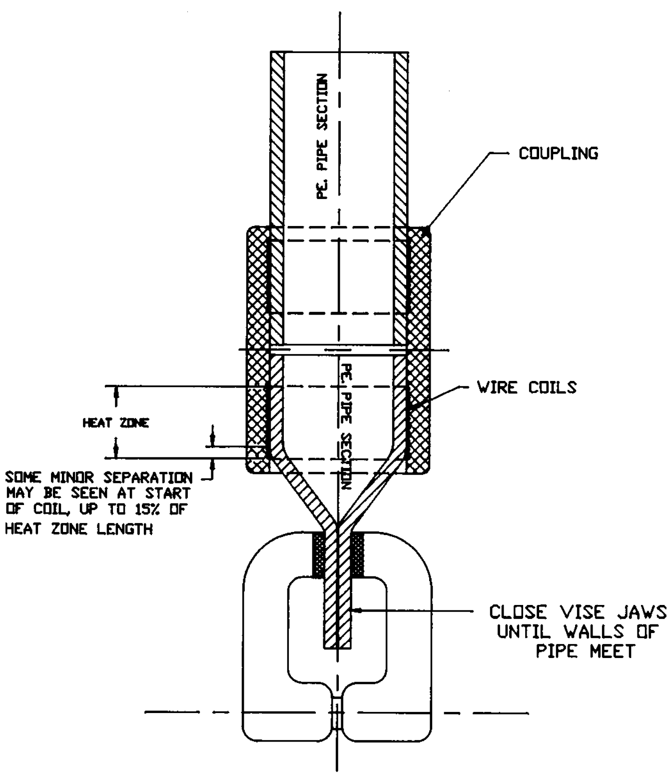
Electrofusion

Follow the manufacturers recommended procedure for all electrofusions.

1) Is pipe scraped properly.
2) Is fitting protected from contamination.
3) Make sure pipe ends are square.
4) Are marks made on the pipe so that centering of the fitting can be achieved.
5) Are proper gaps achieved.
6) Make sure leads are connected properly.
7) Verify that proper fitting has been identified.
8) Perform the appropriate destructive test for the type of fitting tested.

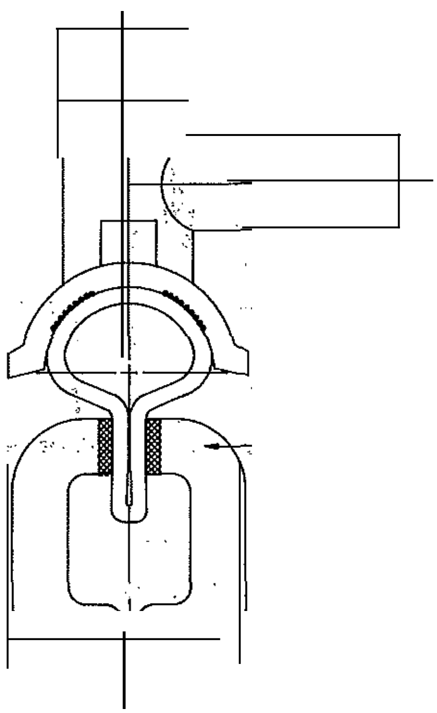
Joint Crush Test

Slit the joint as close to the centerline as practical. Pipe length extending from the socket can be cut to a minimum of 3 inches. Place the specimen in the vise so that the outermost coil is within 1.25 inches (+ or - .125 inches) of the vice jaws. Tighten the jaws until the inner walls of the pipe meet. Repeat test on each end of each half. Separation of the fitting from the pipe at the fusion interface constitutes failure. Some minor separation at the outer limits of the fusion heat source up to 15% of the fusion length may be seen. This does not constitute a failure.



Saddle Type Joint Crush Test

The length of pipe extending from either side of the saddle is not critical. Place the specimen in the vice so the bottom of the saddle is within ½ inch of the vice jaws. Tighten the vice until the inner walls of the pipe meet. Separation of the fitting from the pipe at the fusion interface constitutes failure. Some minor separation at the outer limits of the fusion heat source may be seen or there may be voids between the wires. This does not constitute a failure if round or elliptical in shape with no sharp corners .



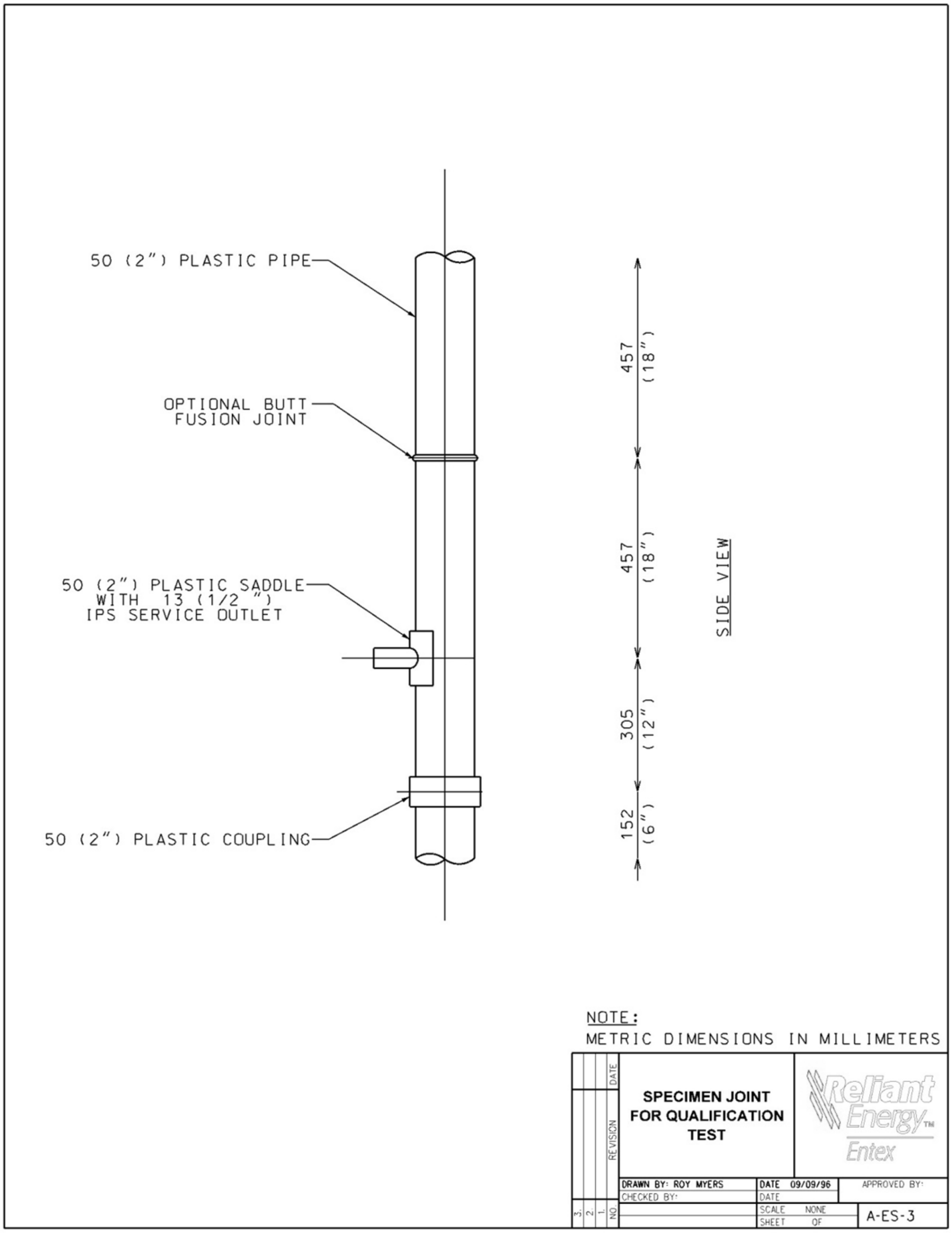
Mechanical Fittings

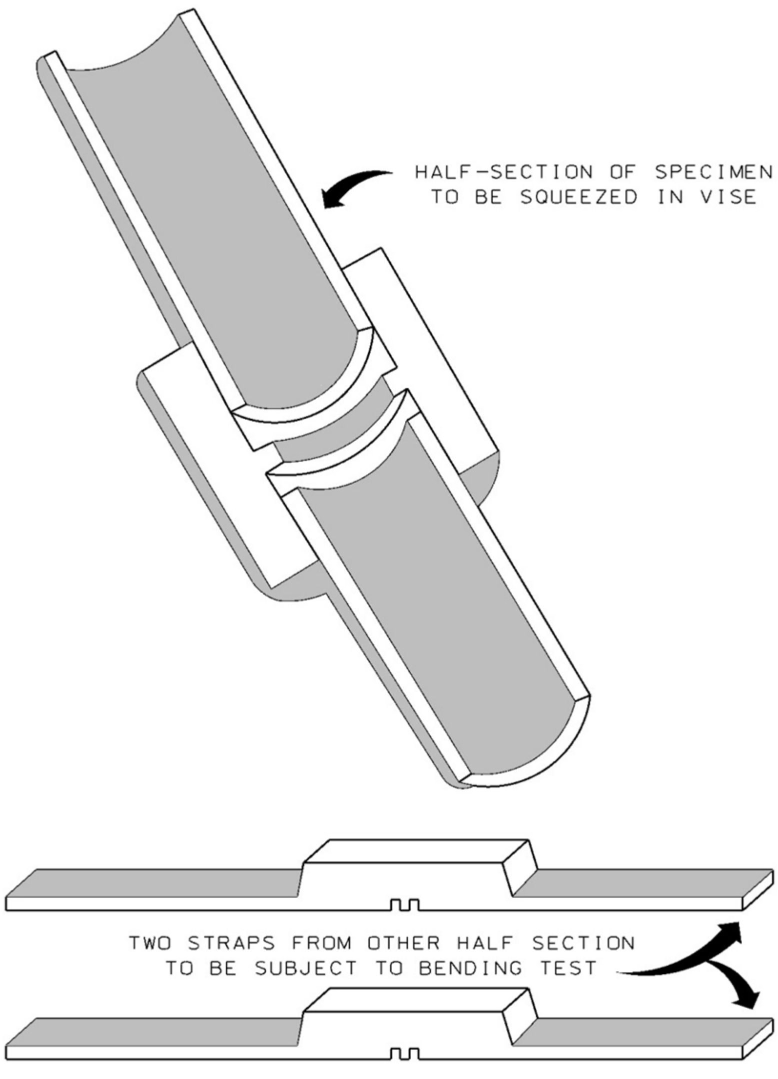
Install each type of mechanical fitting according to manufacturers recommended procedure.

1) Refer to installation procedures for mechanical fittings.
2) Pipe should not be kinked during the process.
3) Pipe ends should completely cover last spigot barb.
4) Sleeves should be compressed until they touch the coupling flanges.

PVC Joining Qualification

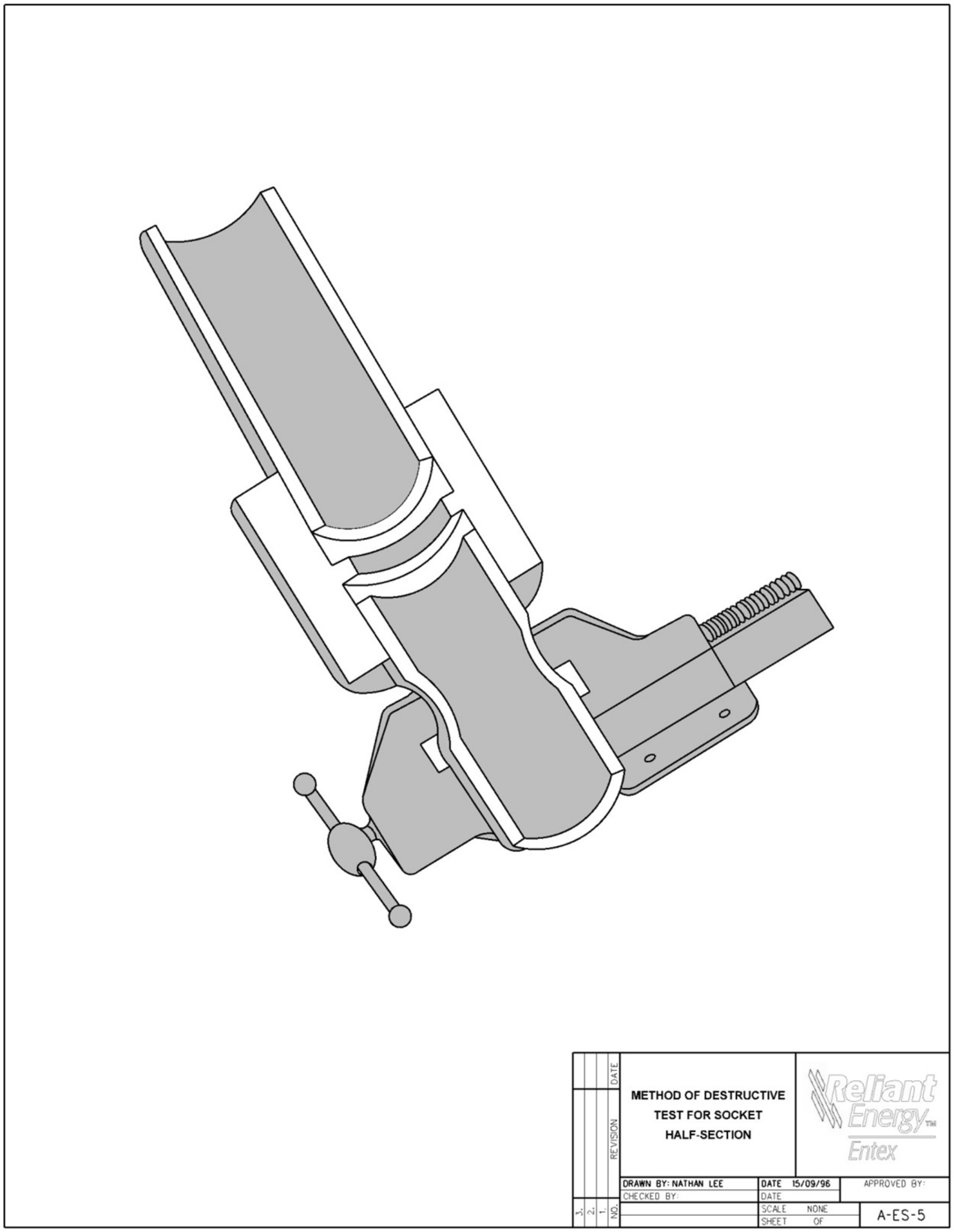
1) Written or oral tests will be administered for certifying that personnel have appropriate training or experience to perform the functions required to properly maintain a gas system containing PVC piping. This test will include, but is not limited to the following:
   a) Identifying PVC allowed for gas service.
   b) Identifying proper adhesive for joining PVC pipe.
   c) Identifying proper procedures for joining PVC pipe.
2) Manual test for certifying that personnel can properly join PVC pipe will be administered. This test will ascertain the examinee possesses knowledge and skill in joining PVC and fittings. Each joint must pass the following criteria:
   a) Visual inspection by the examiner for proper joining procedures.
   b) Coupons will be cut from each joint after allowing time for it to set properly. A coupon consists of a 1" wide strip of the joint and approximately 8" of pipe on either site of the joint.
      i) Visually examine the joint for voids or discontinuities on the cut surface of the joint area.
      ii) Bend the ends of the strip until approximately parallel. If cracks appear in the joint, the joint will be rejected.
      iii) Deform the strip by continuing the bend, by tensile pull, by torsion or by impact. Any failures must be at a point other than the joint area.


50 (2") PLASTIC PIPE
OPTIONAL BUTT FUSION JOINT
50 (2") PLASTIC SADDLE WITH 13 (1/2 ") IPS SERVICE OUTLET
50 (2") PLASTIC COUPLING
457 (18")
457 (18")
305 (12")
152 (6")
SIDE VIEW
NOTE:
METRIC DIMENSIONS IN MILLIMETERS
SPECIMEN JOINT FOR QUALIFICATION TEST
Reliant Energy
Entex
DRAWN BY: ROY MYERS
CHECKED BY:
DATE 09/09/96
DATE
SCALE NONE
SHEET OF
APPROVED BY:
A-ES-3
REVISION
DATE
NO



SUGGESTED METHOD OF PREPARING SOCKET JOINT TEST SPECIMENS	Reliant Energy Entex
DRAWN BY: NATHAN LEE	DATE 06/09/96
CHECKED BY:	DATE
SCALE NONE	A-ES-4
SHEET OF	APPROVED BY:

REVISION / DATE / NO. 1 2 3


METHOD OF DESTRUCTIVE
TEST FOR SOCKET
HALF-SECTION
Reliant Energy
Entex
DRAWN BY: NATHAN LEE
CHECKED BY:
DATE 15/09/96
DATE
SCALE NONE
SHEET OF
APPROVED BY:
A-ES-5
DATE
REVISION
NO.
3.
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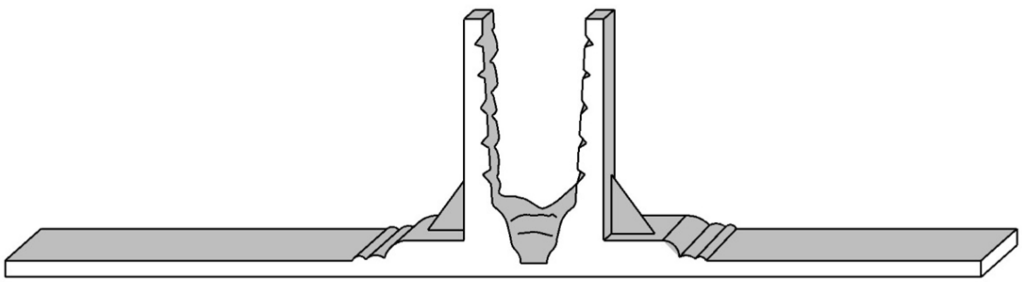
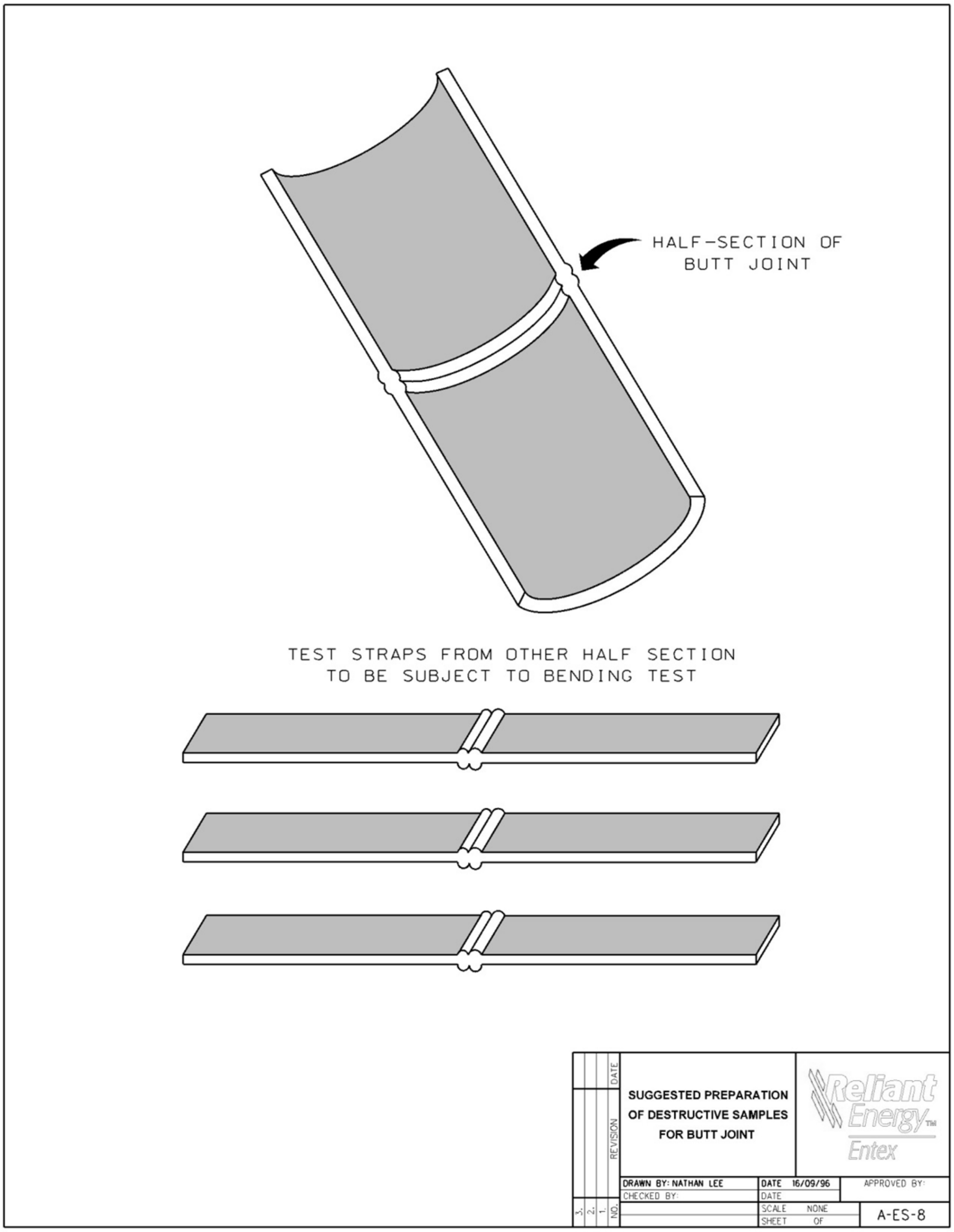


ONE STRAP FROM OTHER HALF SECTION
OF SADDLE JOINT TO BE SUBJECT TO BENDING TEST

REVISION / DATE / NO. 1. 2. 3.	METHOD OF DESTRUCTIVE TEST FOR SADDLE JOINT (OTHER) HALF-SECTION	Reliant Energy Entex
DRAWN BY: NATHAN LEE	DATE 15/09/96	APPROVED BY:
CHECKED BY:	DATE	
	SCALE NONE	A-ES-7
	SHEET OF	


HALF-SECTION OF
BUTT JOINT
TEST STRAPS FROM OTHER HALF SECTION
TO BE SUBJECT TO BENDING TEST
SUGGESTED PREPARATION
OF DESTRUCTIVE SAMPLES
FOR BUTT JOINT
Reliant Energy
Entex
DRAWN BY: NATHAN LEE
DATE 16/09/96
APPROVED BY:
CHECKED BY:
DATE
SCALE NONE
SHEET OF
A-ES-8
REVISION
DATE
NO.

Squeezing Polyethylene Pipe

General Information

Effective pressure control is a basic requirement in gas distribution systems. Squeezing plastic pipe provides pressure control for installation, system extensions and emergency situations. Laboratory and field tests have confirmed that when plastic pipe is squeezed closed and then reopened, using recommended procedures and equipment, the pressure rating of the pipe is not reduced. If proper tooling and procedures are not used, the pipe can be damaged.

If gaseous atmosphere is present the squeeze off operation will be performed, if possible, in a separate bellhole away from the repair point (see attached drawing), also follow the Hazard Tree (Section D-1.120) for working in a Gaseous Environment.

Squeeze-Off Tools

Squeeze tools must meet ASTM standards. Most squeeze units consist of round steel bars to prevent pipe damage and a mechanical means of forcing the bars together. The units are designed to squeeze plastic pipe until the inside surfaces meet. This adequately controls gas flow, although a bubble tight seal is not always obtained. To assure pressure control, yet prevent damage to the pipe, tools should have mechanical stops to limit the minimum gap between squeeze bars.

Because large forces are required for squeeze-off, particularly for main sizes, precautions should be taken to prevent damage to the squeeze tool and pipe while achieving adequate pressure control.

Steps:

1) The proper squeeze tool and gap stops must be used for the pipe size to be squeezed. Squeeze tools without gap stops must not be used. Squeeze tools must be grounded.

2) The point of squeeze should be located at least three pipe diameters or 12 ", whichever is greater, away from the nearest fitting or butt-fused joint, prior squeeze point or other squeeze tool.

3) The pipe must be centered and squared in the squeeze tool. This will help to prevent structural damage to the tool and also aid in achieving complete squeeze-off.

4) Position the squeeze tool so the pipe flattens freely without jamming against tool frame.
5) While squeezing pipe, pauses in the operation will allow pipe relaxation to work in favor of closure. This is particularly helpful when the pipe becomes stiffer in cold weather. The general guideline for the squeeze-off is 2.0 inches per minute or less. If pipe must be squeezed more quickly due to emergencies, the squeezed section must be replaced. If it is not practical to replace it immediately, it can be scheduled for replacement within a reasonable period of time. See Table 1 for minimum squeeze times.

Table 1
Minimum Squeeze Times

Minimum squeeze times	
½" Pipe	15 Seconds
¾" Pipe	25 Seconds
1" Pipe	35 Seconds
1 ¼" Pipe	45 Seconds
2" Pipe	1 Minute
3" Pipe	1 Minute 30 Seconds
4" Pipe	2 Minutes
6" Pipe	3 Minutes
8" Pipe	4 Minutes
10" Pipe	5 Minutes
12" Pipe	6 minutes

6) If the gas flow is not completely shut off, use an additional squeezer in the same bellhole at least eight pipe diameters or 24", whichever is greater, away from the first squeezers. When 2 squeezers are used, install a vent hole (e.g. punch tee) between the squeezers so that any trapped gas can be released, making sure that it is at least 3 pipe diameters or 12", whichever is greater, away from either of the squeezers.

7) Measures should be taken to limit the rate of opening of hydraulic tools. Hydraulic squeezes should be released at a rate no faster than originally used to perform the squeeze-off. The general guideline for the release rate is 0.5 inches per minute or less. Refer to Table 2 for minimum release times.

Table 2
Minimum Release Times

Minimum release times	
½" Pipe	1 Minute
¾" Pipe	1 Minute 45 Seconds
1" Pipe	2 Minutes 30 Seconds
1 ¼" Pipe	3 Minutes 15 Seconds
2" Pipe	4 Minutes
3" Pipe	6 Minutes
4" Pipe	8 Minutes
6" Pipe	12 Minutes
8" Pipe	16 Minutes
10" Pipe	20 Minutes
12" Pipe	24 Minutes

8) Plastic pipe should not be squeezed at the same location twice. Therefore electrical tape will be wrapped around the pipe after the squeeze tool is removed. The tape would indicate the pipe had been squeezed, should it be exposed in the future.

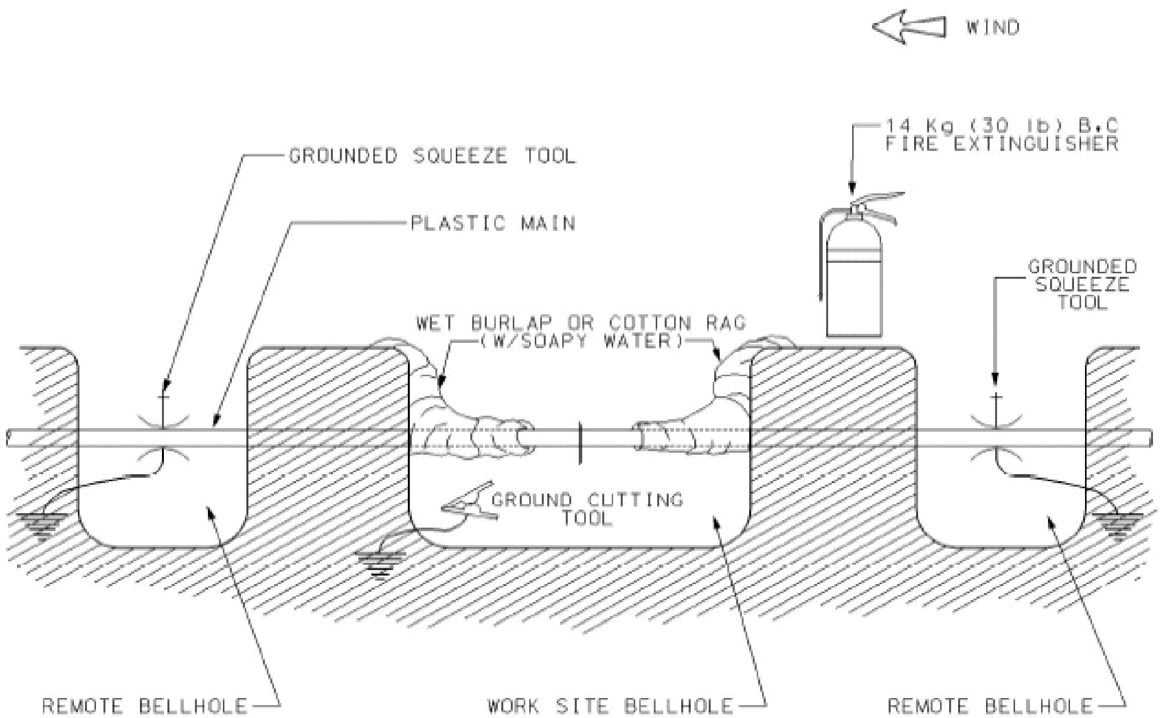
9) Excessive squeeze-off closure time may damage the pipe. From the installation of the squeeze-off tool to its removal, the total time should not exceed 8 hours. If squeeze off exceeds 8 hours, squeeze point(s) must be replaced.

10) Soap test the squeeze point for leaks after the squeeze tool is removed. Completely rinse all of the soap off of the pipe with clean water.

Additional Reinforcement For Squeeze Points On Certain Plastic Pipes

If the pipe being squeezed is Aldyl A (all sizes), additional reinforcing must be added when the squeezing is completed. If not sure about the type of pipe, add the additional reinforcing.

For pipe sizes 2" and larger, a stainless steel full encirclement clamp or sleeve should be used. Plastic support clamps or sleeves are used on the smaller sizes. Additional reinforcement methods may be acceptable upon approval by the Operations Compliance Department.



APPROVED BY:		DATE:
SQUEEZE OFF OF PLASTIC MAINS		
CenterPoint Energy Houston Gas Engineering	DRAWN BY: ROY MEYERS	
	DATE: 10/09/96	
	SCALE: NONE	
	SHEET:	
	DWG No: A-ES-10	

Squeezing Off PE Inserted in Steel Service Line – Ring Method

Scope: This method provides a method to remove a small section of an old steel service, which contains an inserted PE service, exposing the plastic service for squeeze off.

Tools and Equipment:

1. 4-Wheel pipe cutter
2. 24”-36” bolt cutters
3. Squeeze tool with ground cable

Procedure:

1. Expose inserted steel service at a point where squeeze off will be performed. Clean away dirt and debris from steel service.
2. Using the 4 wheel cutter, make 3-4 adjacent cuts through the steel service roughly ¼” to ½” apart. This will produce loose rings of the steel pipe on the PE service.
3. Using the bolt cutter, cut the loose rings with two cuts roughly 180° apart and remove the two halves exposing the PE service line.
4. Continue cutting the remaining rings providing enough space for the squeeze tool to operate.
5. Ground squeeze tool and perform the squeeze off according to C&S Section CS-B-4.190.
6. After completing work and removing squeeze tool , use a plastic insert in the open steel pipe to protect PE from sharp edge of the cut old steel service.

Static Electricity

Additional Safety Precautions: Static electricity is an electrical charge generated on plastic pipe by dirt, rust, or scale in the gas flow, and creates severe problems when gas surges through breaks in the pipe. Whenever a section of plastic pipe is uncovered and isolated from the earth, significant static charges can accumulate on both the interior and exterior walls of the pipe. These charges will be increased when cleaning the pipe surface with a vigorous rubbing action using a dry rag. Squeezing the pipe will increase gas flow velocities, which generates even higher levels of static electricity.

Gas flow through plastic pipe	**= 24,000 static volts**
Wiping Plastic Pipe	**= 14,000 static volts**
Handling Plastic Pipe	**= 9,000 static volts**

3,000 static volts = 1,200 degrees Fahrenheit which will ignite natural gas.

Plastic is a nonconductive material. Therefore, an exposed section of plastic pipe will not ground itself like a section of steel pipe will. If natural gas escapes from a plastic pipe and reaches the flammable range, a static charge may cause the gas to ignite

From an electrical standpoint, the worker is a potential generator/storage cell and can be isolated from the neutral ground by their footwear. A static electric charge on a person entering the bellhole poses the same hazard as a charge accumulated on the plastic pipe. Anyone entering the bellhole will clear themselves' and tools of static electricity by touching their bare hands to the ground prior to entering

A Combustible Gas Indicator (CGI) and oxygen monitor are to be used to test all excavations for gas and oxygen levels prior to personnel entering and while in the excavation. If no oxygen monitor is available, do not enter the work area without the appropriate equipment.

There are two methods to reduce surface static charges on plastic pipe, Anti Static Spray and the Wet Rag Technique.

Anti Static Spray

Since wet wrapping can be cumbersome, the use of commercially available anti-static sprays is recommended. This product is sprayed the entire length of the exposed pipe to the ends. Since it is colored, it is easy to ensure the entire surface is covered.

Follow the manufacturer's instructions.

Wet Rag Techniques

Precautions will be taken to dissipate static charges on the outside of a plastic pipe by saturating the soil near the work point and using the wet rag technique. This consists of burlap cloth strips, cotton or other non-synthetic material soaked in a soap solution and applied to the pipe in the bellhole where repairs are to be performed. Spiral wrap the pipe with the cloth strips starting from the bellhole wall, wrapping toward the area to be repaired while maintaining continuous contact between the saturated soil and wet rags. Initially after cutting the pipe, wet inside surfaces of each section of pipe before touching. When a Gaseous Atmosphere is present **the squeeze off operation will be performed, if possible, in a separate bellhole away from the repair point (see attached drawing), also** follow the Hazard Tree (Section D-2.120) for working in a Gaseous Environment.

Soap Solution: Use either a commercially available leak soap or a solution consisting of 6 oz of liquid dish-washing soap mixed into 5 gallons of water. This will provide for complete, even coverage for electrical continuity on plastic pipes. In freezing weather 3 ½ gallons of soapy water mixed with 1 ½ gallons of antifreeze may be used.

Eliminating Other Ignition Sources

When cutting in-service plastic pipe, approved cutting tools and squeezers will be properly grounded.

All other tools will be touched to ground a safe distance away before entering bellhole.

Do not wear rubber boots in a dry excavation.

Steps:

1) Follow squeezing procedure. **If gaseous atmosphere is present the squeeze off operation will be performed, if possible, in a separate bellhole away from the repair point (see attached drawing), also see potential** Hazard Decision Tree (Section D-2.120) **for appropriate action.**

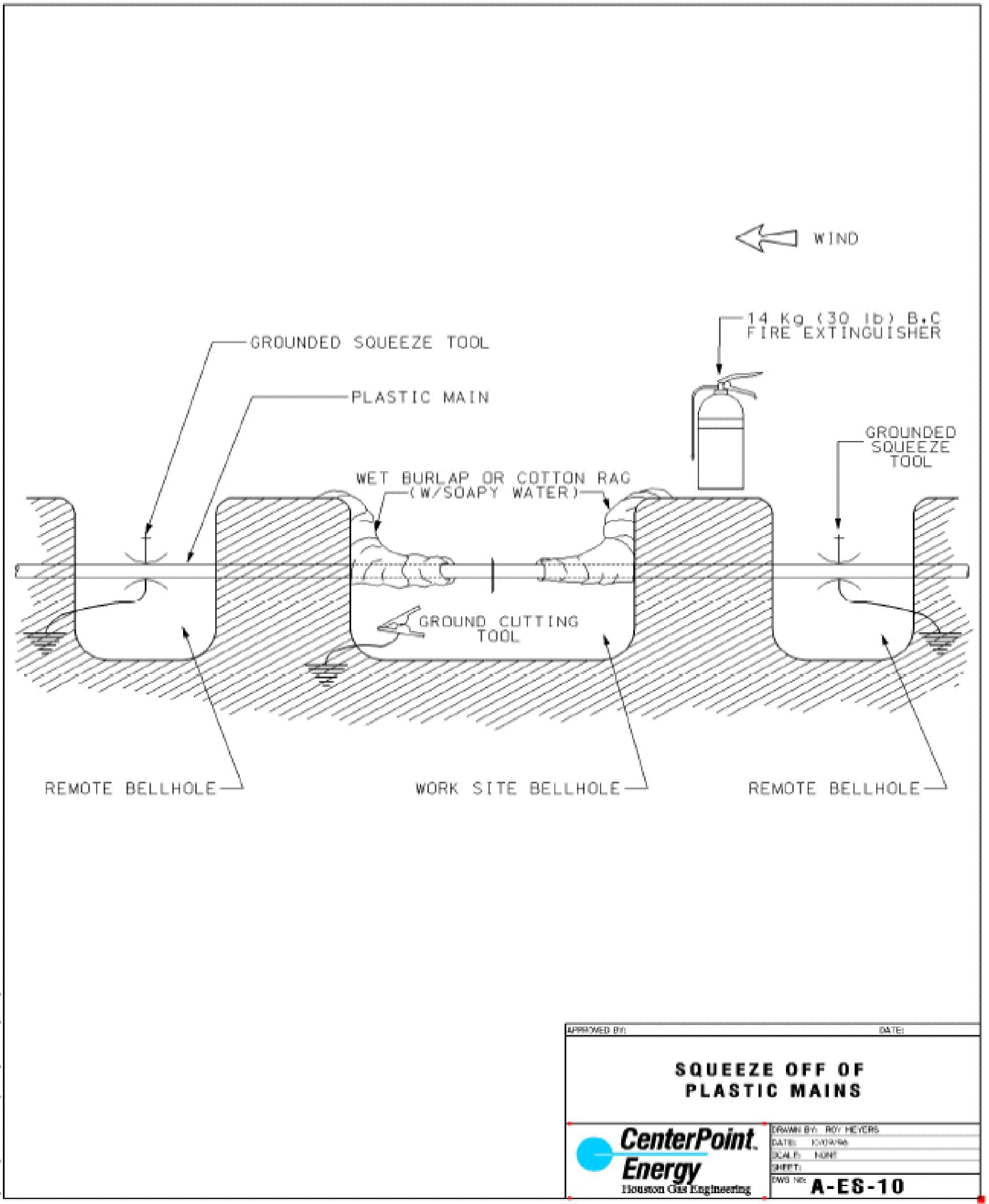
   Refer to Squeezing Plastic Pipe Procedure.

2) Ground self by touching bare hand to ground and tools before entering repair bellhole.

3) Apply wet rag technique or use anti-static spray

4) Cut the pipe.

5) After completion of repair, remove wet soapy rags, if used. Rinse soap or anti-static spray off pipe surfaces with clean water.


WIND
14 Kg (30 lb) B.C
FIRE EXTINGUISHER
GROUNDED SQUEEZE TOOL
PLASTIC MAIN
GROUNDED
SQUEEZE
TOOL
WET BURLAP OR COTTON RAG
(W/SOAPY WATER)
GROUND CUTTING
TOOL
REMOTE BELLHOLE
WORK SITE BELLHOLE
REMOTE BELLHOLE
APPROVED BY:
DATE:
SQUEEZE OFF OF
PLASTIC MAINS
CenterPoint Energy
Houston Gas Engineering
DRAWN BY: ROY MEYERS
DATE:
SCALE: NONE
SHEET:
DWG NO: A-ES-10

Tapping Service Punch Tees

The tee comes in a polyethylene bag. One reason is to keep the parts clean, particularly the internal threads of the tee and the “O”-ring which have been lubricated with a special grease. If field lubrication is necessary, use only approved lubricant

Steps:

1) After the service punch tee is fused to the main using normal saddle fusion procedures, prepare to add the service pipe.

2) Slip the appropriate protective sleeve over the service pipe. The sleeve can be properly positioned after making the service connection to give a snug fit over the service outlet. Protective sleeves shall be used with all saddle fittings to minimize the probability of failure due to excessive bending at the joint between the service line and the saddle fitting. Bending is normally caused by poor alignment of the service line and the saddle fitting during installation or by earth loading due to poor compaction.

3) Join the service line to the tee using the standard socket fusion procedure.

4) With the tee closure cap (with “O”-ring) in place, pressure test the service line prior to tapping the main according to pressure testing procedure. Joints and closure caps can be checked by soaping. Rinse soap off pipe surfaces with clean water. If a Service Tee leak occurs, cut off the top of fitting to prevent future use. Repeat the saddle and service fusions with a new tee.

   Refer to Pressure Testing Procedure

5) The main is now ready to be tapped. Remove the closure cap and place it back in the plastic bag. Insert the hex shank of punch tool all the way into the hex socket portion of the punch. Turn the tool steadily clockwise. Resistance will be felt as the cutter is forced through the main. Continue turning until the groove on the tool reaches the top of the tee body to indicate complete penetration.

   Note: The turning resistance will decrease as small main sizes are tapped before the tool groove reaches the top of the body.

6) Turn the tool counterclockwise until the top of punch is flush with the top of the tee body. This positions the punch with proper space for closure cap seating.

7) Check the closure cap to be sure that the "O"-ring is in place. Wipe the top clean. Install the closure cap and hand tighten. The installation is now complete.

   Note: Never use a wrench to tighten the closure cap.

8) Soap fitting. Rinse soap off pipe surfaces with clean water.

9) If it becomes necessary to shut off the service at the main, the closure cap may be removed. Turn punch clockwise with the punch tool until the upper groove reaches the top of the tee body. Slowly continue turning until resistance is felt as the punch seats. An additional 1/8 to l/4 turn after bottoming completes the operation. Replace the closure cap. To restore service, turn the punch counterclockwise until the lower tool groove is again flush with the top of the body. The outlet is now back in service.

10) Running the punch back into the tap hole will provide effective temporary flow control, but not necessarily a bubble tight shutoff.

See DOT §192.367, 192.627

Tracer Wire

An electrical conductor (such as tracer wire or metallic tape) must be installed adjacent to buried plastic pipe to permit location with electronic detectors. Tracer wire must be at least a #14 coated copper wire per company material standards.

Excessive electrical energy carried on tracer wire as the result of a lightning strike or a short can cause the wire to get very hot. It is preferable, where practical, to separate the tracer wire from the plastic pipe to avoid melting the pipe if this were to occur, resulting in a leak or fire. Never wrap tracer wire around plastic pipe.

Tracer wires may also be used to carry cathodic protection current to protect miscellaneous steel segments, valves, services, etc.

Approved methods for joining tracer wire are, soldering, the DBR splice kit, or crimp sleeve installation.

- Use appropriate technique of soldering tracer wire, or:
- See 3M recommended installation procedure for use of the DBR splice kit, or
- Follow manufacturers instructions for installation of crimp sleeve.

To verify tracer wire continuity, after a tracer wire is installed, it must be located in the conductive mode with a maximum frequency of 8 kHz or the lowest frequency available on approved pipe locators whose minimum frequency is higher than 8 kHz. Repair wire as needed to ensure pipe locatability.

Tracer Wire Connections

At the meter set:

To protect the tracer wire at the point where it comes above ground at the riser, utilize approved tracer wire protective devices/materials, or install a piece of plastic pipe extending from at least 12” below the ground at the riser to at least 6” above the final grade. Thread the tracer wire through this piece of pipe. Extend the tracer wire at least 12” beyond the PE pipe, fold it and tuck it back into back into the pipe. Leave a loop folded over the edge of the pipe for access (see picture).

The PE pipe can be tied to the riser using tape, clamps or ties.

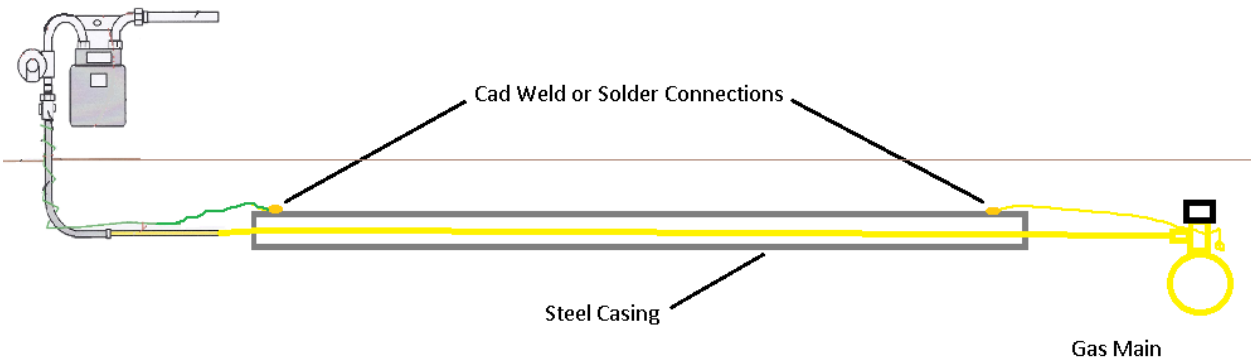
To reduce the effects of a lightning strike through the wire care should be taken to maintain a separation between the wire and the riser or the wire and the meter.

<u>If protective measures are not installed, wind the tracer wire around the riser and terminate it above ground, upstream of any insulators. This will prevent shorting to the meter set.</u>

When inserting PE pipe through casings:

A tracer wire must always be installed with PE pipe when inserted in a nonconductive casing. It is preferable that this wire be external to the nonconductive casing.

When a service tracer wire cannot be installed with PE pipe inserted in a steel casing, the tracer wire must be soldered to both ends of the casing. (NOTE: Make all soldered connections to casing pipe prior to PE pipe insertion).



At a PE main:

Connect the service tracer wire to the main tracer wire.

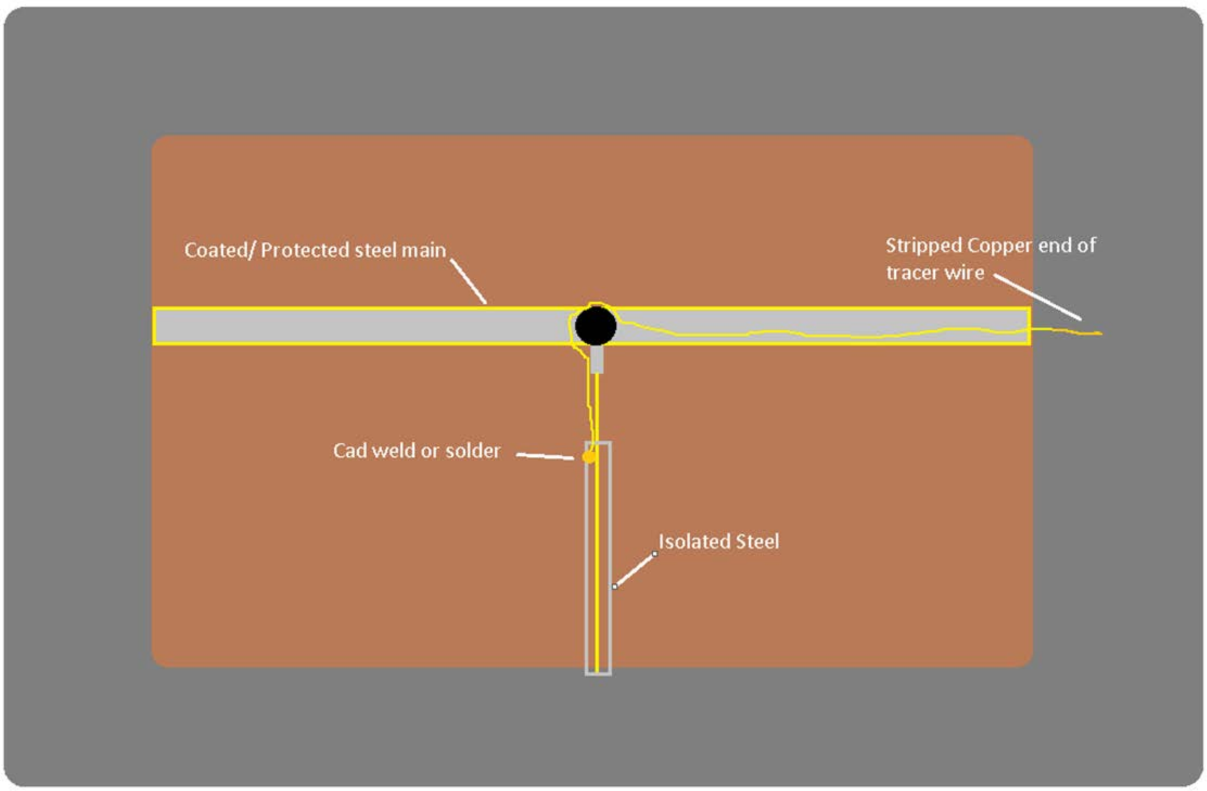
Note: Only persons trained in procedures to attach tracer wire to steel pipe may perform the following procedures.

At coated and/or cathodically protected main:

Solder service tracer wire to main unless the wire is connected to cathodically unprotected metal pipe. When service tracer wire is inserted or bonded to a metal casing, do not bond to the main. In situations, like this, where the tracer wire will short out protected steel, terminate the tracer wire in one of the following ways:

a) Create a locate point. Terminate a main tracer wire and a service tracer wire in a roadway or curb box. Wires should not be connected unless needed for a locate.

b) Install tracer wire with the PE service up to main. Above the tee, bend the tracer wire to follow main. Continue running the wire down length of main to the edge of the bell hole. Remove 6” of insulation from tracer wire and stab it into the soil of the excavation sidewall, directly above and in line with the main. Do not allow contact between tracer wire and coated main or tee.



At bare steel or cast iron mains:

Solder service tracer wire to the main. (NOTE: never bond main tracer wire to cast iron or bare steel main that could be connected to cathodically protected pipe).

See DOT §192.321

Glossary of Welding Terms

Backing:	Backing is where welding is performed against either existing weld metal or a fusible material.
Buttering Pass:	The addition of material, by welding, on one or both faces of a joint, prior to the preparation of the joint for final welding, for the purpose of providing a suitable transition weld deposit for the completion of the joint.
Retainer:	Retainers as used in Section IX are designed to hold metal they are not part of the weld nor fused with the weld deposit.
Trepanning:	To remove a disk or cylindrical core for testing.

Equipment and Materials

Welding shall be done by manual shielded metal arc welding (SMAW), semi-automatic gas metal arc welding (GMAW) or manual oxyacetylene welding (OFW), or a combination of these processes.

Welding equipment of any size and type is permitted as long as it is suitable for the work, properly maintained and safe for the welding personnel. Do not use any equipment which does not meet the requirements. Operate arc welding equipment within the amperage and voltage ranges given in the welding procedure. Operate gas welding equipment with the flame characteristics and tip sizes given in the welding procedure.

This manual applies to the welding of pipe and fittings conforming to:

- API Specification for Line Pipe (API Standard 5L);
- API Specification for High-Test Line Pipe (API Standard 5LX);
- Applicable ASTM Standards; and
- Material of similar physical and chemical properties.

Store and handle filler metals and fluxes carefully to avoid damage. Filler metals and fluxes shall be kept in their original sealed containers until required. When original containers are opened they shall be protected from deterioration and stored as specified by the product manufacture..

Low-hydrogen SMAW stick electrodes must be kept dry and electrodes from an open container shall be stored in a stick oven at a temperature of at least 250°F until required.

Do not use filler metals and fluxes which show signs of damage or deterioration.

GMAW and OFW require shielding gas which may consist of inert gases, active gases or mixtures of both. The purity and dryness of these atmospheres have great influences on welding and should be used as specified in the welding procedures.

Safety

Follow all safety rules referred to in this manual, Construction Safety Precautions, Section B-1.100, in addition to the following:

Shielding Gases for Welding and Cutting

Legibly mark all compressed gas cylinders to identify the gas content. Make sure the markings are permanent and located on the shoulder of the cylinder.

Store all empty cylinders in a well-protected, well ventilated, dry location at least 20 feet from highly combustible materials and away from sources of heat. Close the valves on all empty cylinders and replace the caps.

During welding, place cylinders far enough away so that sparks, hot slag and flame will not reach them or else protect cylinders with fire-resistant shields.

Do not place cylinders where they might become part of an electric circuit. Always stand to one side when opening a cylinder valve and be sure the regulator and other safety devices are properly attached to the cylinder.

Close cylinder valves before moving and when work is finished. Do not use slings or electromagnets to lift cylinders. Securely anchor cylinders to the vehicle during transport or when being operated on a vehicle.

Wear proper eye protection during welding or cutting operations.

When extinguishing the flame, turn off the fuel gas prior to the oxygen.

Cutting is allowed when the line contains 100% gas at atmospheric pressure or after it has been properly purged and vented. Make certain that all personnel are clear when cutting material. Where practical, block material so that it cannot fall after it is cut.

Arc Welding

When arc welding is suspended for a substantial period of time, turn off the power source.

Wear welding helmets or other proper eye protection during welding operations

Use screens or other protection during welding operations to protect passers-by from injury. Attach an approved sign to the screen warning passers-by of the potential eye hazards.

Prior to welding in or around a structure or area containing gas facilities, a thorough check shall be made to determine the possible presence of a combustible gas mixture. Welding shall begin only when safe conditions are indicated.

Air Movers

Air Movers are not required for cutting and welding. Cutting is permitted when the air movers are turned on, air is flowing equally upstream and downstream from a large access hole, the air movers have been in operation for a minimum of 15 minutes regardless of the length of pipeline; and a CGI check at each access hole reads zero percent.

To install air movers:

Move personnel not directly involved with the welders away from open pipe ends before cutting or welding on a pipeline.

If a weld repair requires removal beyond the last 1/8 inch of the defective weld, shut down the air movers and purge the pipeline with gas to prevent an explosive mixture.

1. Perform maintenance on valves involved in the shut-out.

2. Blow down the pipeline to atmospheric pressure and cut the test holes and access holes.

    a. At each point where cutting or welding will occur, cut a small test hole for the purpose of inserting a CGI test hose. Close these holes with tape until the air movers are in use.

    b. Hot cut an elliptically-shaped access hole where cutting and welding will occur. Purged air will be drawn through this hole by the air mover. The width of the access coupon should be approximately 70 percent of the pipe diameter. Pipe sizes 26" through 36" = 24" access coupon. Pipe sizes 2" through 24" = 16" access coupon.

3. Install air movers.

4. Do not allow air to enter a pipeline through blow-offs or access holes until air movers are in use and positive control of air movement is established.

5. Turn on the air movers and equalize the airflow to the upstream and downstream blow-offs.

    a. Attach ribbons at each end of access holes to determine if air is flowing equally in both directions.

    b. Do not do any additional cutting or welding until the line has been purged for 15 minutes.

6. Conduct CGI tests through each test hole after the 15 minute purge and before work begins.

To operate air movers:

1. Ground the air movers to prevent a buildup of static electricity.

2. Control volume of air through air movers by regulating gas or air pressure supply and by observing supply pressure gauge.

3. Operate air movers continually until work is completed on the affected section of pipeline.

4. Adjust pressure settings on air movers to reduce the vacuum on the pipeline to eliminate blow-in of welds as the pipeline is closed to the atmosphere by welding.

5. Monitor air movers constantly while staying in contact with those working on the pipe.

Welder Qualifications

No welder may weld with a particular welding process unless, within the preceding 6 months, that welder has engaged in welding with that process.

No welder whose qualification is based on nondestructive testing may weld compressor station pipe and components.

A separate qualification is required for each process. The three processes are:

-Shielded metal arc welding
-Gas metal arc welding
-Oxyacetylene welding

Qualification of Welders for High Stress Level Pipe

When welding lines designed to operate at a hoop stress of 20% or more of the Specified Minimum Yield Strength (SMYS) or pipe diameters greater than 12” requires welders shall be qualified in accordance with the American Petroleum Institute (API) Standard 1104 (as incorporated by reference in 49 CFR 192.7) or welders qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code (as incorporated by reference in 49 CFR 192.7). It is preferred when qualifying welder according to API 1104 that the welders be qualified with the multiple qualification.

Contact Engineering if there is any question whether the pipe is designed to operate under or over 20% of SMYS.

Qualification of Welders for Low Stress Level Pipe and Service Line Connections to Mains

When welding lines designed to operate at a hoop stress less than 20 % of SMYS a welder shall be qualified by making two qualification welds, as described below, in accordance with 49 CFR 192 Appendix C regulations.

Contact Engineering if there is any question whether the pipe is designed to operate under or over 20% of SMYS.

1. The test is made on pipe 12” or less in diameter. The test weld must be made with the pipe in a horizontal fixed position so that the test weld includes at least one section of overhead position welding. The beveling, root opening, and other details must conform to the specifications of the procedure under which the welder is being qualified. Upon completion, the test weld is cut into four coupons and subjected to a root bend test. If, as a result of this test, two or more of the four coupons develop a crack in the weld material, or between the weld material and base metal, that is more than1/8-inch (3.2 millimeters) long in any direction, the weld is unacceptable. Cracks that occur on the corner of the specimen during testing are not considered. A welder who successfully passes a butt-weld qualification test under this section shall be qualified to weld on all pipe diameters less than or equal to 12 inches..
2. A service line connection fitting is welded to a pipe section with the same diameter as a typical main. The weld is made in the same position as it is made in the field. The weld is unacceptable if it shows a serious undercutting or if it has rolled edges. The weld is tested by attempting to break the fitting off the run pipe. The weld is unacceptable if it breaks and shows incomplete fusion, overlap, or poor penetration at the junction of the fitting and run pipe.

Requalification of Welders

Welders for High Stress Level Pipe

Following the initial welders' qualification test a welder may not weld on pipe to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS unless within the preceding 6 calendar months the welder has had one weld tested and found acceptable under the sections 6, section 9, section 12 or Appendix A of API Std 1104 (incorporated by reference, see Sec. 192.7). Alternatively, welders or welding operators may maintain an ongoing qualification status by performing welds tested and found acceptable under the above acceptance criteria at least twice each calendar year, but at intervals not exceeding 7\1/2\ months.

However, a welder may not weld with a particular process if they have not produced a weld of that particular welding process within the past 6 calendar months. Records must be kept by or accessible to the manager responsible for that welder.

Welders for Low Stress Level Pipe and Service Line Connections to Mains

A welder may not weld with a particular process if they have not produced a weld of that particular welding process within the past 6 calendar months. Records must be kept by or accessible to the manager responsible for that welder. If a welder has performed a particular welding process within a 6 calendar month period, they may requalify annually.

ASME Section IX Welder Qualification

49 CFR 192.227 allows the use of Section IX of the ASME Boiler and Pressure Vessel Code as an alternative to qualification under API 1104. A welder who qualifies in accordance with Section IX of the ASME Boiler and Pressure Vessel Code is qualified to weld on pipe that operates at a hoop stress of 20% or more of SMYS for all pipe diameters: and weld on all sizes of pipe that operates at less than 20% of SYMS.

Welding Qualifiers

1) Welding qualifiers have the ability to qualify a welder based on:

    a) Either becoming certified in welding inspection through a recognized welding institute.
        i) E.g. American Welding Institute Certified Welding Inspector Program

    b) Or by their experience in welding inspection and teaching of welding practices.
        i) Welding qualifiers shall be qualified by experience and Company provided classroom training for the specific inspection task they perform.
        ii) Their qualifications shall be acceptable to the company.
        iii) Documentation of these qualifications shall be retained by the company and should include but are not limited to the following:
            (1) Welding education and inspection experience.
            (2) Classroom training.
            (3) Results of any qualification examinations.

    c) Or by welding test coupons as described in “Welder Qualifications” in the beginning of this section and by maintaining certification every six months in accordance with “Requalification of Welders”.
    Welding qualifiers designated to qualify welders using this method must be experienced personnel who have demonstrated proficiency and are currently qualified to perform the welding procedure they are using to test welders.

As a minimum welding qualifiers must:

Be familiar with CenterPoint Energy welding procedures.
Be familiar with federal and state record keeping requirements.
Be reviewed/designated by the District Operations Manager semiannually.

Welding qualifiers that do not perform installation or maintenance on company owned facilities will not be required to take the welder qualification tests described in “Welder Qualifications” at the beginning of this section, in this case they shall comply with either paragraph a or b above.

Welders are authorized to perform required installation and maintenance of CenterPoint Energy facilities when they have been qualified by a company designated welding qualifier as defined by paragraphs a, b or c above, and after successful completion of the appropriate welding test as prescribed in “Welder Qualifications”.

These elements are considered sufficient to perform installation and maintenance of company owned facilities.

Qualification Records

For steel transmissions lines installed after July 1, 2020, individual welder qualification records shall be retained for a minimum of 5 years following construction.

Inspection Procedures

The company has the right to inspect all welds by nondestructive means or by removing welds and subjecting them to mechanical tests. The inspection may be made during the welding or after the weld has been completed. The company may reject any weld, which does not appear to meet these standards.

All welds should be visually inspected. Visual inspection of welding must be conducted by an individual qualified by appropriate training and experience. The inspection shall insure that the welding is performed in accordance with the welding procedures and is acceptable according to Section 9 of API 1104 (20^{th} Edition October 2005 errata/addendum July 2007 and errata 2 2008).

Nondestructive testing is required on pipe that will operate at 20% or more of SMYS unless; the pipe size is less than 6” or the pipe will be operated less than 40% SMYS and the welds are limited in number that nondestructive testing is impractical. Trepanning is not permitted. Perform nondestructive testing by using radiographic or equivalent means by qualified personnel following written procedures and with the equipment employed in the inspection. Acceptance standards for non-destructive tests can be found in API 1104.

When nondestructive testing is required, the following percentages of each day’s field butt welds will be randomly selected:

- At least 10% of all Class 1 locations
- At least 15% of all Class 2 locations,
- 100 % unless impracticable, in which case 90% of all Class 3 and 4 locations, at crossings of major or navigable rivers, offshore, and within railroad or public highway rights-of-way, including tunnels, bridges, and overhead road crossings; Inspection must be impractical for each girth weld not tested.
- 100% of all pipeline tie-ins and replacement tie-ins,.

When more than one welder is used on a job, each welder must be represented in the random selection even if that welder’s work is isolated from the principal welding activity. Keep records of weld stationing and non-destructive test documentation for the life of the pipeline. Records of nondestructive tests will be filed with the construction documentation and should include milepost, engineering station, or by geographic feature, the number of girth welds made, the number nondestructively tested, the number rejected, and the disposition of the reject.

Remove or repair each weld that is unacceptable including cracks. When repairing a defective weld the defect shall be removed down to sound metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. After repair, the segment of the weld that was repaired must be inspected to ensure its acceptability. When repairing cracks or any defect in a previously repaired area, a weld repair procedure must be used. Remove the weld if the repair is not acceptable.

Defects such as laminations, split ends, arc burns and other defects that are found during the welding process shall be repaired and may be removed by grinding providing the pipe's minimum wall thickness is not violated. The repaired segment must be inspected to insure its acceptability. Remove the weld if the repair is not acceptable.

Detecting Arc Burns

Use a solution of 10 gms of ammonium persulfate in 90 ml of distilled water to detect the effects/depths of arch burns. Etchant should be swabbed on a suspect area at room temperature, noting any visible discoloration or staining.

General Procedures

Weld Joint

Field bevel pipe ends by machine tool, machine oxygen cutting or manual oxygen cutting. The beveled ends shall be reasonably smooth and uniform and free from laminations, tears, scale, slag, grease, paint and any other deleterious material that might adversely affect the welding. (Dimensions shall be in accordance with the welding procedure to be used. See below Examples of Joint Design.) Provide sufficient clearance around the pipe at the weld to provide access to the joint. Make sure the surfaces to be welded are smooth, and clean before welding.

Align the abutting ends so as to minimize the offset between surfaces. For pipe of the same nominal wall thickness, do not exceed an offset of 1/16-inch (1.6 mm). Any greater offset, if caused by dimensional variation, must be equally distributed around the circumference of the pipe. Maintain alignment while welding the root bead. Keep hammering of the pipe to obtain proper line-up to a minimum.

The foreperson and/or inspector and/or welder will review the job design, including pipe type, size, and wall thickness prior to welding for the purpose of selecting the appropriate welding procedure. Unless there is reason to believe that the pipe is of a non-standard wall thickness review construction records or if it is necessary, use an appropriate measurement device such as an Ultrasonic Thickness Tester. Detailed welding procedures can be found later in this section.

Electrode Selection

Electrode class must be selected from the electrode classes outlined in the appropriate welding procedure specifications. The electrode class selected should match or exceed the tensile strength of the pipe grade which is being welded. When multiple pipe grades are to be joined by welding, the selected electrode class should be based on higher tensile strength material to be joined. The below table outlines the typical materials (base metals) used for line pipe, fittings, and flanges and their relevant attributes to allow the proper electrode class selection.

Component	Size Rage	Spec	Grade	Yield (min.)	Tensile (min.)	P-No. (S-No.)	Group No.
Line Pipe	1/8" - 1-1/2"	SA-53	Type F	30,000	48,000	1	1
Line Pipe	2" - 6"	SA-53	Type E, Gr. B	35,000	60,000	1	1
Nipples (Thrd.)	1/8" - 1-1/2"	SA-53	Type F	30,000	48,000	1	1
Nipples (Thrd.)	2" - 4"	SA-53	Type E, Gr. B	35,000	60,000	1	1
Line Pipe	≥ 2"	API 5L	A25	25,000	45,000	1	1
Line Pipe	≥ 2"	API 5L	A	30,000	48,000	1	1
Line Pipe	≥ 2"	API 5L	B	35,000	60,000	1	1
Line Pipe	≥ 2"	API 5L	X42	42,000	60,000	1	1
Line Pipe	≥ 2"	API 5L	X46	46,000	63,000	1	1
Line Pipe	≥ 2"	API 5L	X52	52,000	66,000	1	1
Line Pipe	≥ 2"	API 5L	X56	56,000	71,000	1	2
Line Pipe	≥ 2"	API 5L	X60	60,000	75,000	1	2
Line Pipe	≥ 2"	API 5L	X65	65,000	77,000	1	2
Fittings (Weld)	All	SA-105	n/a *(WPB)*	36,000	70,000	1	2
Fittings (Weld)	All	SA-106	B *(WPB)*	35,000	60,000	1	1
Fittings (Weld)	All	SA-181	Cl. 70 *(WPB)*	36,000	70,000	1	2
Fittings (Weld)	All	SA-234	WPB	35,000	60,000	1	1
Fittings (Weld)	All	MSS SP-75	WPHY-42	42,000	60,000	1	1
Fittings (Weld)	All	MSS SP-75	WPHY-46	46,000	63,000	1	1
Fittings (Weld)	All	MSS SP-75	WPHY-52	52,000	66,000	1	1
Fittings (Weld)	All	MSS SP-75	WPHY-56	56,000	71,000	1	2
Fittings (Weld)	All	MSS SP-75	WPHY-60	60,000	75,000	1	2
Fittings (Weld)	All	MSS SP-75	WPHY-65	65,000	77,000	1	2
Flanges (Weld)	All	SA-105	n/a *(WPB)*	36,000	70,000	1	2
Flanges (Weld)	All	SA-106	B *(WPB)*	35,000	60,000	1	1
Flanges (Weld)	All	SA-181	Cl. 70 *(WPB)*	36,000	70,000	1	2
Flanges (Weld)	All	SA-234	WPB	35,000	60,000	1	1
Flanges (Weld)	All	SA-694	F42	42,000	60,000	1	1
Flanges (Weld)	All	SA-694	F46	46,000	60,000	1	1
Flanges (Weld)	All	SA-694	F52	52,000	66,000	1	1
Flanges (Weld)	All	SA-694	F56	56,000	68,000	1	2
Flanges (Weld)	All	SA-694	F60	60,000	75,000	1	2
Flanges (Weld)	All	SA-694	F65	65,000	77,000	1	2

Protection from Weather

Do not weld when the quality of the completed weld would be impaired by the weather, such as falling moisture, blowing sand or high winds. Wind / moisture shields may be used when practical.

Cleaning

Remove scale and slag from each bead and groove. Use either hand or power tools except that all root beads, when arc-welded, should be ground out with a power tool. If a power tool is not available, the root bead may be cleaned thoroughly using hand tools. Interpass cleaning should be performed to assure no slag is present in the weld area and all surface porosity, high spots and bead starts are ground. All completed welds shall be thoroughly brushed and cleaned using hand or power tools.

Position Welding

Secure the parts to be joined during fixed-position welds.

The number of beads shall be such that the completed weld will have a uniform cross section around the pipe. At no point shall the crown surface be below the outside surface of the pipe, nor should it be raised above the pipe by more than 1/16 inch (1.6 mm).

After the root bead has been completed, complete the remaining beads within the time required. Finish the weld before the end of the day. Do not start two beads at the same location.

The face of the completed weld should be approximately 1/8 inch (3.2 mm) greater than the width of the original groove

When required line-up clamps should be used to assist with the joint fit-up for butt welds. When using internal line-up clamps the root pass should be completed prior to removing the clamp. When using external clamps the root pass should be completed prior to removing the clamp but if not possible the root beads should be of equally length and equally spaced segments around the circumference of the pipe with a minimum of 50% of the entire circumference completed.

Roll Welding

Use an approved positioner rotating the pipe on all roll welding. Use line-up clamps to securely hold the parts to be joined. Deposit the filler metal at or near the top center while the parts to be joined are rotated past the rod or electrode.

Determine the proper preheat temperature by using a Thermomelt, or equivalent, temperature indicator.

Allow welds to air cool. Do not cool by using water or similar liquids. Leak test with soap solutions only after the weld has properly cooled.

Securely attach work leads to the pipe by mechanical means. Does not tack or weld work leads to the pipe. Do not arc between the work lead and the pipe.

Install the pipe so the seam or longitudinal welds are in the upper quadrant and within 45° of the vertical centerline. Stagger the pipe seams or longitudinal welds at least 20° between abutting pipe joints.

Arc burns are not permitted.

The number of beads shall be such that the completed weld will have a uniform cross section around the pipe. At no point shall the crown surface be below the outside surface of the pipe, nor should it be raised above the pipe by more than 1/16 inch (1.6 mm).

After the root bead has been completed, complete the remaining beads within the time required. Finish the weld before the end of the day. Do not start two beads at the same location.

The face of the completed weld should be approximately 1/8 inch (3.2 mm) greater than the width of the original groove. Thoroughly brush and clean the completed weld.

Internal Diameters Unequal

For piping designed to operate at less than 20% SMYS the nominal wall thickness of the adjoining ends should not vary more than 1/8 inch (3.2 mm). If the offset is greater than 1/8 inch (3.2 mm), check with engineering.

For piping designed to operate greater than 20% SMYS the nominal wall thickness of the adjoining ends should not vary more than 3/32 inch (2.4 mm), If the offset is greater than 3/32 inch (2.4 mm), check with engineering.

External Diameters Unequal

When the external offset is less than one-half of the thinner section, the transition may be made by welding, provided the angle of rise of the weld surface does not exceed 30°.

When the external offset exceeds one-half of the thinner section, the portion of the offset that is over one-half of the thickness should be taper welded.

See Acceptable Design for Unequal Wall Thickness chart

Internal and External Diameters Unequal

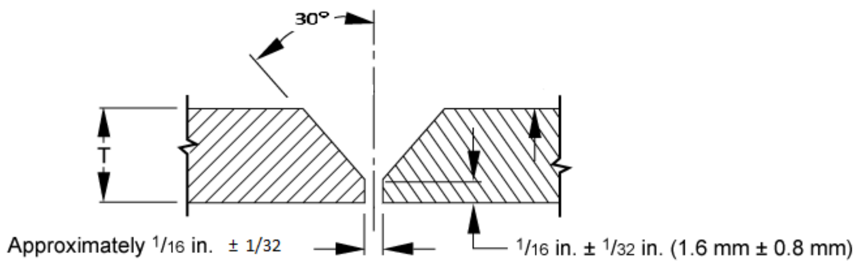
Where there is both an internal and an external offset, the joint design will be a combination of both the Internal and External Diameters Unequal weld requirements. Particular attention must be paid to proper alignment under these conditions.

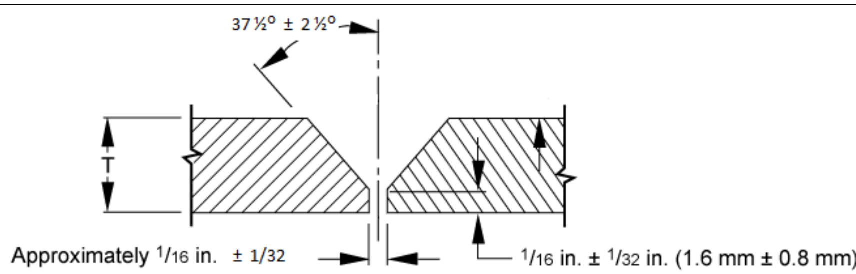
Examples of Joint Design

Below are examples of acceptable weld joint designs. Example Joint designs are based on the Written Weld Procedures.

Examples are based on equal wall thicknesses; see Acceptable Design for Unequal Wall Thickness chart

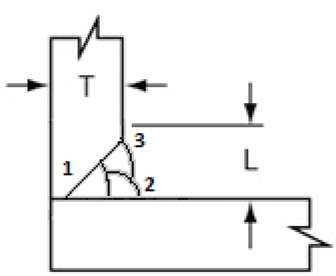
Butt Weld

<table>
<tr><th colspan="2">(Example Joint Design)</th></tr>
<tr><td>

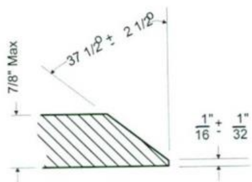
(Example) Pipe End Preparations V-Groove</td><td>Standard V-Grove Joint Design</td></tr>
<tr><td>

(Example) Pipe End Preparations V-Groove</td><td>Optional V-Grove Joint Design</td></tr>
</table>

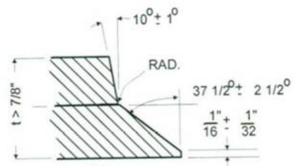
Service Tee

<table>
<tr><th colspan="3">(Example Joint Design and Bead Construction)</th></tr>
<tr><td>

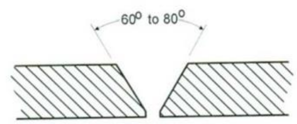
Example Filet Weld
(Service Tee)</td><td></td><td></td></tr>
</table>



(2)
Standard End Preparation of
Pipe and Bull Welding Fittings
7/8" and Thinner.

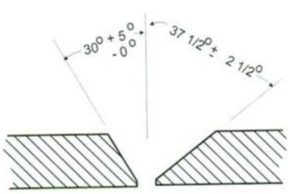


(3)
Suggested End Preparation.
Pipe and Fittings
Over 7/8" Thickness

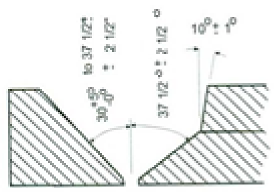


(4)

Acceptable Combinations of Pipe End Preparations

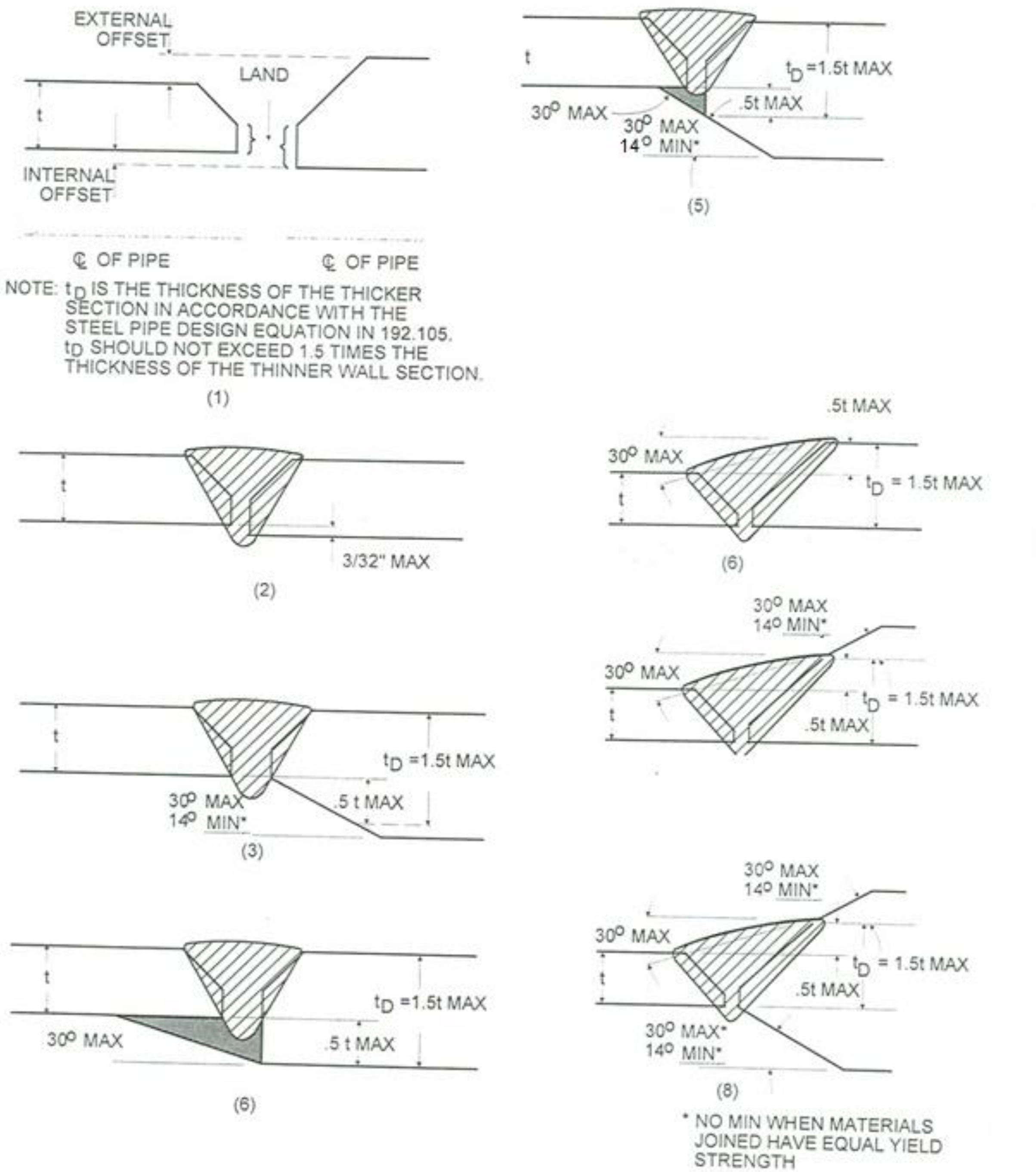


(5)



(6)

Acceptable Design for Unequal Wall Thickness



Prevention of Hydrogen cracking in welds

Hydrogen cracking requires that three conditions be fulfilled simultaneously; hydrogen in the weld, a crack-susceptible weld microstructure (the product of accelerated cooling), and tensile stress acting on the weld. To prevent hydrogen cracking, at least one of the three conditions necessary for its occurrence must be eliminated.

There are very limited situations in our daily operations that would warrant consideration of cracking. We will train our welders, who are subject to welding under these conditions, during qualification (and re-qualification) to recognize conditions that make possible a situation for cracking. The conditions are as follows:

1) Operating pressure greater than 20% of SMYS.
2) Pipe size larger than 4” in diameter.
3) Extreme flow rates produced by a complete line separation

If all of the above conditions exist, use the Low Hydrogen welding procedure, SMA-LH, or, prior to making the weld we will perform a Heat Sink Capacity Measurement to determine if measures should be taken to prevent possible cracking. The Heat Sink Capacity Measurement test involves heating a 2-inch diameter area on the pipeline with a torch to a temperature between 572° F (300° C) and 617° F (325° C). If the time required for the temperature of the area to cool from 482° F (250° C) to 212° F (100° C), is less than the minimum allowable time on the attached chart, we will attempt mitigation of the conditions by:

1) Lowering the pressure or,
2) Lowering the flow rate.

Post mitigation and prior to welding we will repeat the Heat Sink Capacity Measurement test, as described above, to determine if any additional measures should be taken to prevent possible cracking. If the time required for the temperature of the area to cool from 482° F (250° C) to 212° F (100° C) is less than the minimum allowable time on the attached chart, then preheating of the metal to be welded should be done.

If the time required for the temperature of the area to cool from 482° F (250° C) to 212° F (100° C) is more than the minimum allowable time on the attached chart, the use of Low Hydrogen welding procedure, SMA-LH is not required and SMA-P1or GMA-P1 should be used.

Heat Sink Capacity Measurement Chart

Pipe OD	Pipe Wall Thickness or less	Min. Allowable Heat Sink Time
4.500”	0.312	26 seconds
6.625"	0.312	26 seconds
8.625"	0.322	30 seconds
10.75"	0.281	20 seconds
12.75"	0.312	26 seconds
16"	0.312	26 seconds
18"	0.344	35 seconds
20"	0.344	35 seconds
22"	0.344	35 seconds
24"	0.344	35 seconds

Preheat Requirements

Preheating reduces the cooling rate, promotes the escape of hydrogen and reduces hardness so preventing crack-susceptible weld microstructure from being formed. If required, prior to welding the pipe shall be preheated to a minimum of 200° F for a distance of approximately three inches from the weld area. This temperature shall be maintained during the welding operation. If a weld is made under marginal conditions in an emergency, then it is to be removed after the emergency passes.

Preheat Applications

The following conditions require preheating of the pipe and fittings as part of the welding process:

- Pipe or fitting temperature less than 32°F;
- Pipe or fitting wall thickness greater than 0.5 inches;
- Pipe pressurized higher than 100 psig; or
- Wet pipe requiring drying.

Preheat temperatures will be monitored with temperature indicating crayons, thermocouples, or infrared temperature indicators. Temperatures are measured approximately 1-3 inches from the weld. Wherever possible, measure temperatures at the backside of the component (i.e. inside of flange) to ensure adequate heat supply

Preheat will be applied with an oxy-acetylene torch (rosebud), propane torch, or heating cables in a uniform manner. Parts to be welded will be heated for a minimum of 3 inches on both sides of the weld. Preheat will be maintained during welding and for an additional 15 minutes after the weld is completed.

Preheat will be maintained between 200°F and 400°F, unless otherwise directed by Engineering.

Weld Cover

1. Clean the pipe out past the end of the weld cover to ensure a proper fit.

2. Assemble and tack-weld the cover in place.

   Note: For sleeves, remove the plug in the sleeve's vent hole to prevent pressure from building up in the annular space between the pipe and the sleeve as needed.

3. For sleeves use the appropriate Company butt-welding procedure, to weld the halves together as needed.

4. Using the appropriate Company fillet-welding procedure, weld cover ends/edges to the pipe.

5. Install the plug into the vent hole as needed.

6. Coat the cover and affected areas of existing pipe using an approved field-applied coating.

Miter Joints

The following requirements pertain to miter joints:

1. A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS (transmission lines) may not deflect the pipe more than 3 degrees.

2. A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of less than 20 percent, but more than 10 percent, of SMYS may not deflect the pipe more than 12.5 degrees and must be a distance equal to one pipe diameter or more away from any other joint, as measured from the crotch of each joint.

3. A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of 10 percent or less of SMYS may not deflect the pipe more than 90 degrees.

Contact Engineering to determine the maximum potential hoop stress.

Qualification of Welding Procedures

A. Procedure Qualification

Prior to the start of production welding, establish and qualify a detailed welding procedure to demonstrate that a weld deposited using the welding procedure will have suitable mechanical properties and soundness. Procedures shall be qualified using the requirements of Section IX of the ASME Boiler and Pressure Vessel Code which include the requirements for destructive testing. These welding procedures shall be strictly adhered to by the welder during construction.

B. Records

Record the details of each welding procedure as a procedure qualification record (PQR). This record should show complete results of the welding procedure qualification testing and the actual conditions under which the weld was deposited. These records shall meet the requirements Section IX of the ASME Boiler and Pressure Vessel Code The records are on file at the Division Office and available for inspection upon request.

C. Changes to Welding Procedures

When any of the essential variables listed below are changed, a new welding procedure must be established and qualified. Changes may be made in a welding procedure without the necessity for requalification, provided the welding procedure is revised to show these changes. If changes are needed to a WPS, Engineering shall review the change and determine if it is essential or non-essential and specify the requirement for revising the welding procedure or re-qualifying the welding procedure.

Tables

A. Number of Beads and Electrode Sizes

Following is a table on the suggested number of beads and electrode sizes for a weld by wall thickness.

Table I
Suggested Number of Beads and Electrode Sizes by Wall Thickness
For SMAW

Wall Thick-ness (T) (inches)	Beads and Electrode Sizes (inches)							
	1	2	3	4	5	6	7	8
Up to .187	3/32	1/8	1/8					
.188 - .250	1/8	1/8	1/8					
.251 - .343	1/8	5/32	3/16	3/16				
.344 - .436	1/8	5/32	3/16	3/16	3/16			
.437 - .561	1/8	5/32	3/16	3/16	3/16	3/16		
.562 - .687	1/8	5/32	3/16	3/16	3/16	3/16	3/16	
.688 - .750	1/8	5/32	3/16	3/16	3/16	3/16	3/16	3/16

General Welding Procedures Index

Welding Procedure	Groove Thickness	Fillet Thickness	Pipe Strength Group	Type of Weld	Direction
SMA-P1(stick)	0.063" to 0.75"	Unlimited	P1/ S1, groups 1 and 2/ 1	Fillet/Groove	Downhill
SMA-LH (stick) [1]	0.063" to 0.75"	Unlimited	P1/ S1, groups 1 and 2/ 1	Fillet/Groove	Uphill
GMA-P1(wire feed) [1]	0.063" to 1.0"	Unlimited	P1/ S1, groups 1 and 2/ 1	Fillet/Groove	Downhill
OF-P1(oxyfuel)	0.063" to 0.218"	Unlimited	P1/ S1, groups 1 and 2/ 1	Fillet/Groove	Uphill
SMA-LH-ISW (stick) [1]	0.063" to 0.75"	Unlimited	P1, groups 1 thru 4	Fillet/Groove	Uphill

[1] Low Hydrogen Procedure

Gas Storage Well Head Welding Procedures Index

Welding Procedure	Groove Thickness	Fillet Thickness	Pipe Strength Group	Type of Weld	Direction
GSWH 01 (stick)	0.0625" to 1.092"	Unlimited	API 5CT J55 to J55	Fillet/Groove	VUH
GSWH 02 (wire feed)	0.0625" to 1.092"	Unlimited	API 5CT J55 to J55	Fillet/Groove	VDH
GSWH 03 (stick)	0.0625" to 1.092"	Unlimited	API 5CT H40 to H40	Fillet/Groove	VUH
GSWH 04 (wire feed)	0.0625" to 1.092"	Unlimited	API 5CT H40 to H40	Fillet/Groove	VDH
GSWH 05 (stick)	0.0625" to 1.092"	Unlimited	API 5CT K55 to K55	Fillet/Groove	VUH
GSWH 06 (wire feed)	0.0625" to 1.092"	Unlimited	API 5CT K55 to K55	Fillet/Groove	VDH
GSWA F10 (stick)	n/a	Unlimited	API 5CT J55 to A105 P1 G2	Fillet	VUH
GSWA F11 (wire feed)	n/a	Unlimited	API 5CT J55 to A105 P1 G2	Fillet	VUH/VDH
GSWA F12 (stick)	n/a	Unlimited	API 5CT K55 to A105 P1 G2	Fillet	VUH
GSWA F13 (wire feed)	n/a	Unlimited	API 5CT K55 to A105 P1 G2	Fillet	VUH/VDH
GSWA F14 (stick)	n/a	Unlimited	API 5CT H40 to A105 P1 G2	Fillet	VUH
GSWA F15 (wire feed)	n/a	Unlimited	API 5CT H40 to A105 P1 G2	Fillet	VUH/VDH
GSWH F01 (stick)	n/a	Unlimited	4130 to J55 Tubing	Fillet	VUH
GSWH F02 (wire feed)	0.0625" to 1.092"	Unlimited	API 5CT J55 to 4130	Fillet/Groove	VUH/VDH
GSWH F03 (stick)	n/a	Unlimited	4130 to H40 Tubing	Fillet	VUH
GSWH F04 (wire feed)	n/a	Unlimited	API 5CT H40 to 4130	Fillet	VUH/VDH
GSWH F05 (stick)	n/a	Unlimited	4130 to K55 Tubing	Fillet	VUH
GSWH F06 (wire feed)	0.0625" to 1.092"	Unlimited	API 5CT K55 to 4130	Fillet/Groove	VUH/VDH

VUH = Vertical Uphill
VDH = Vertical Downhill

ASME WELDING PROCEDURE SPECIFICATIONS (WPS)

Company Name CenterPoint Energy **By** Chris Shoaf

Welding Procedure Specification No. SMA-P1 **Date** August 29, 2003 **Supporting PQR No.(s)** SMA-P1-G1; SMA-S1-G2

Revision No. 1 **Date** March 14, 2012 — SMA P1_G1-P1_G2 Groove 3; SMA P1_G1-P1_G2 Groove 4; 2020 08 04 SMAW X70-X52 PQR2r1 ASME API Combined

2 — January 15, 2020 — SMA P1_G1 - P1_G1 Groove 5; SMA P1_G1 - P1_G1 Groove 6;

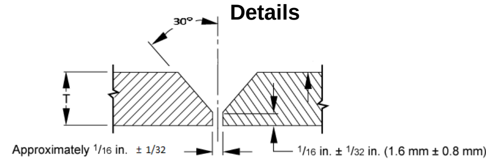
3 — July 5, 2023 — SMA P1_G2 - P1_G2 Groove 7; SMAP1_PQR X65-X52; 2020 07 22 SMAP1_PQR X70-X65 ASME and API Combined Procedure

Welding Process(es) Shielded Metal Arc Welding (SMAW) **Type(s)** Manual

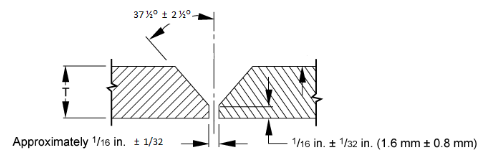
(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)

Details



(Example) Pipe End Preparations V-Groove



(Example) Pipe End Preparations V-Groove

Joint Design V-Grooves and fillets per attachment

Backing **Yes** X **No** X

Backing Material (Type) Backing may be used but not required.

(Refer to both backing and retainers)

☒ **Metal** ☐ **Nonfusing Metal**

☐ **Nonmetallic** ☐ **Other**

Joint Designs shown are the most common; Refer to SECTION: CS-B-5.140 of this manual for alternate joint designs.

Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified. (At the option of the Mfgr. sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403, QW-420.2)

P-No. P1 (S1) **Group No.** 1 and 2 (S1 G1&2) **to P-No.** P1 (S1) **Group No.** 1 and 2 & (S1/G 1, 2, & 3)

AND

Specification Type and Grade (Example) (SA-53 Gr.B P1/G1); (SA-516 Gr.70 P1/G2) Any S1 G 1,2 or 3 materials to same in any combination

to Specification Type and Grade SA-106 Gr.B (P1/G1);(SA-516 Gr.70 P1/G2) in any combination

OR

Chem. Analysis and Mech. Prop.

to Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: **Groove** 0.063” to 1.50” **Fillet** Unlimited (QW-452.6)

Other Qualification using a P-Number material; qualifies corresponding S-Number materials Qualification using an S-Number material qualifies corresponding S-Number materials but not corresponding P-Number Materials. Combinations of Base Metal Grades are proven in PQRs referenced above.

FILLER METALS (QW-404)

Spec. No. (SFA)	SFA 5.1 and SFA 5.5	(QW-432)
AWS No. (Class)	E6010 (5P+, 6P+), E7010 (7P+), or E8010 (8P+, ARC 80)	(QW-430)
F-No.	3	(QW-432)
A-No.	1 and 2	(QW404.5)
Size of Filler Metals	3/32”, 1/8”, 5/32”, 3/16” Note: Only increase one rod diameter per layer (e.g. 3/32” up to 1/8”)	
Weld Metal Thickness Range		
Groove	0.125" single pass limit with 1.75" total thickness	(QW-452.1(b))
Fillet	Unlimited	(QW-452.6)
Electrode-Flux (Class)	N/A	
Flux Trade Name	N/A	
Consumable Insert	N/A	
Other	All root beads shall be E6010; Regardless of pipe SMYS. Electrode class to be chosen based on higher tensile strength material to be joined.	

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. SMA-P1 **Rev.** 3

POSITIONS (QW-405)

Position(s) of Groove All

Welding Progression **Up** ____ **Down** X

Position(s) of Fillet All

PREHEAT (QW-406)

Preheat Temperature **Min.** 32ºF

Interpass Temperature **Max.** 500ºF

Preheat Maintenance When utilized; Preheat will be maintained between 200 Deg. and 400 Deg. F during welding and for an additional 15 minutes after the weld is completed.

(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range None

Time Range N/A

GAS (QW-408)

	Percent Composition		
	Gases	**Mixture**	**Flow Rate**
GTAW Shielding	None	N/A	N/A
Trailing	None	N/A	N/A
Backing	None	N/A	N/A

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC Direct (DC) **Polarity** Electrode Positive (EP)

Amps (Range) See table below **Volts (Range)** See table below

(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type N/A

(Pure tungsten, 2% thoriated, etc.)

Mode of Metal Transfer N/A

(Spray arc, short circuiting arc, etc.)

Electrode Wire Feed Speed Range N/A

Maximum Heat Input N/A

TECHNIQUE (QW-410)

Sting or Weave Bead Both stringer and weave beads are permitted

Orifice or Gas Cup Size N/A

Initial and Interpass Cleaning (brushing, grinding, etc.) Both power and hand tools may be utilized for Grinding, filing, chipping and bushing

Method of Back Gouging Grinding and air carbon arc gouging

Oscillation N/A

Contact Tube to Work Distance N/A

Multiple or Single Pass (per side) Single or multiple depending on thickness

Multiple or Single Electrodes Single

Travel Speed (range) See table below

Peening Not Required

Other Thermal Processing is N/A

Weld Layer(s)	**Process**	**Filler Metal**		**Current**		**Volt Range**	**Travel Speed Range**	**Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)**
		Class	**Diameter**	**Type Polar.**	**Amp Range**			
Root	SMAW	E6010	3/32”	DCEP	40 **(50 – 80)** 130	18**(20 – 25)**35	2 – 15	3/32" diameter electrodes may be used in any weld layer on wall thickness equal to or less than .280
Root	SMAW	E6010	1/8”	DCEP	60 **(90 – 115)** 130	18**(20 – 25)**35	2 – 15	
Balance	SMAW	EXX10	1/8”	DCEP	60 **(90 – 115)** 130	18**(20 – 25)**35	2 – 15	
Balance	SMAW	EXX10	5/32”	DCEP	90**(115 – 140)**175	18**(20 – 25)**35	2 – 15	
Balance	SMAW	EXX10	3/16”	DCEP	95**(120 – 200)**225	18**(20 – 25)**35	2 – 15	

( ) indicates preferred range

Electrodes covered by procedure include the following:

Electrode Designation	**Minimum Tensile Strength**
E6010	60,000 psi
E7010	70,000 psi
E8010	80,000 psi

Back to Index

ASME WELDING PROCEDURE SPECIFICATIONS (WPS)

Company Name CenterPoint Energy **By** Chris Shoaf

Welding Procedure Specification No. SMA-LH **Date** August 29, 2003 **Supporting PQR No.(s)** SMA LH P1_G1 - P1_G1_Groove 1

Revision No. 1 **Date** March 14, 2012 SMA-LH P1 G1 - P1 G1 Groove 2; SMA-LH P1 G1 - P1 G2 Groove 3;

2 January 15, 2020 SMA-LH P1 G1 - P1 G2 Groove 4; SMA-LH P1 G2 - P1 G2 Groove 6;

3 June 30, 2023

Welding Process(es) Shielded Metal Arc Welding (SMAW) **Type(s)** Manual

(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)

Details

Joint Design V-Grooves and fillets per attachment

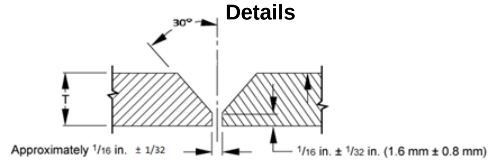
Backing **Yes** X **No** X

Backing Material (Type) Backing may be used but not required.

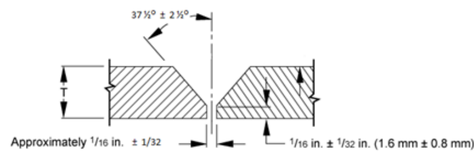
(Refer to both backing and retainers)

☒ **Metal** ☐ **Nonfusing Metal**

☐ **Nonmetallic** ☐ **Other**



(Example) Pipe End Preparations V-Groove



(Example) Pipe End Preparations V-Groove

Joint Designs shown are the most common; Refer to SECTION: CS-B-5.140 of this manual for alternate joint designs.

Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified. (At the option of the Mfgr. sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. P1 (S1 included) **Group No.** 1 & 2 (S1 Gr. 1 & 2) **to P-No.** P1 (S1 included) **Group No.** 1 & 2 (S1 Gr. 1 & 2)

AND

Specification Type and Grade Includes but not limited to SA-53 Gr.B (P1/G1); (SA-516 Gr.70 P1/G2) in any combination

to Specification Type and Grade Includes but not limited to SA-106 Gr.B (P1/G1);(SA-516 Gr.70 P1/G2) in any combination

OR

Chem. Analysis and Mech. Prop.

to Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: **Groove** 0.063” to 1.50” **Fillet** Unlimited

Other Qualification using a P-Number material; qualifies corresponding S-Number materials Qualification using an S-Number material qualifies corresponding S-Number materials but not corresponding P-Number Materials. Combinations of Base Metal Grades were established in the PQRs referenced above.

FILLER METALS (QW-404)

Spec. No. (SFA)	SFA 5.1 and SFA 5.5	(QW-432)
AWS No. (Class)	E6010 (5P+, 6P+), E7018 4HR, E8018-C3 4HR	(QW-430)
F-No.	3 and 4	(QW-432)
A-No.	See AWS Classification	(QW-404.5)
Size of Filler Metals	3/32”,1/8”	
Weld Metal Thickness Range		
Groove	0.125" Single pass limit with 1.75” total thickness	(QW-451.1)
Fillet	Unlimited	(QW-451.4)
Electrode-Flux (Class)	N/A	
Flux Trade Name	N/A	
Consumable Insert	N/A	
Other	The root pass of any V-groove may be E6010 or E7018, the balance of the weld and fillet welds will be EXX18. Electrode class to be chosen based on higher tensile strength material to be joined.	

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. SMA-LH **Rev.** 3

POSITIONS (QW-405)
Position(s) of Groove All
Welding Progression **Up** X **Down** X
Position(s) of Fillet All

PREHEAT (QW-406)

Preheat Temperature **Min.** 32ºF
Interpass Temperature **Max.** 500ºF
Preheat Maintenance When utilized; Preheat to be maintained between 200 Deg. and 400 Deg. F during welding and for an additional 15 minutes after the weld is completed.
(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range None
Time Range N/A

GAS (QW-408)

	Percent Composition		
	Gases	**Mixture**	**Flow Rate**
GTAW Shielding	NONE	N/A	N/A
Trailing	NONE	N/A	N/A
Backing	NONE	N/A	N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC Direct Current (DC) **Polarity** Electrode Positive (EP)
Amps (Range) See table below **Volts (Range)** See table below
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type N/A
(Pure tungsten, 2% thoriated, etc.)
Mode of Metal Transfer N/A
(Spray arc, short circuiting arc, etc.)
Electrode Wire Feed Speed Range N/A
Maximum Heat Input N/A

TECHNIQUE (QW-410)
Sting or Weave Bead Both stringer and weave beads are permitted
Orifice or Gas Cup Size N/A
Initial and Interpass Cleaning (brushing, grinding, etc.) Both power and hand tools may be utilized for grinding, filing, chipping and brushing
Method of Back Gouging Grinding and air carbon arc gouging
Oscillation N/A
Contact Tube to Work Distance N/A
Multiple or Single Pass (per side) Single or multiple depending on thickness
Multiple or Single Electrodes Single
Travel Speed (range) See table below
Peening Not Required
Other Thermal Processing is N/A

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Diameter	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
Root	SMAW	E6010	3/32”	DCEP	40 **(50-80)** 100	18 **(20-25)** 32	2 – 15	E6010 stick electrodes may be used in the open root of a V-Groove only. they may not be used for fillet welds
Root	SMAW	E6010	1/8”	DCEP	50 **(90-120)** 150	18 **(20-25)** 32	2 – 15	
Root/Bal.	SMAW	EXX18	3/32”	DCEP	60 **(90-105)** 150	18 **(20-22)** 26	2 – 10	25 kj/in minimum for fillet
Balance	SMAW	EXX18	1/8”	DCEP	95 **(115-125)** 160	18 **(20-22)** 26	2 – 10	25 kj/in minimum for fillet

( ) indicates preferred range

Electrodes covered by procedure include the following:

Electrode Designation	Minimum Tensile Strength
E6010	60,000 psi
E7018	74,000 psi
E8018	90,000 psi

Back to Index

ASME WELDING PROCEDURE SPECIFICATIONS (WPS)

Company Name CenterPoint Energy **By** Chris Shoaf

Welding Procedure Specification No. GMA-P1 **Date** September 18, 2003 **Supporting PQR No.(s)** GMA-P1-G1a; GMA-P1-G1b; GMA-S1-G2; GMA-P1-Groove 3 GMA-P1-Groove 4; GMA-P1-Groove 5 GMA-P1-Groove 6; GMA-P1-Groove 7

Revision No.	**Date**
1	March 14, 2012
2	January 15, 2020
3	June 30, 2023

Welding Process(es) Gas Metal Arc Welding (GMAW) **Type(s)** Semi-automatic
(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)

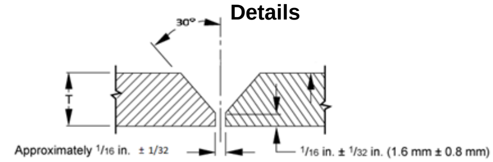
Details

Joint Design V-Groove and fillet

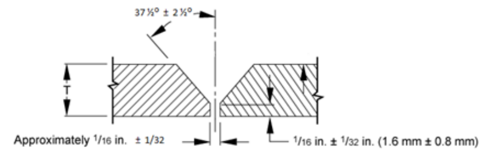
Backing **Yes** X **No** X

Backing Material (Type) Backing may be used but not required.
(Refer to both backing and retainers)

☒ **Metal** ☐ **Nonfusing Metal**
☐ **Nonmetallic** ☐ **Other**



(Example) Pipe End Preparations V-Groove



(Example) Pipe End Preparations V-Groove

Joint Designs shown are the most common; Refer to SECTION: CS-B-5.140 of this manual for alternate joint designs.

Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified. (At the option of the Mfgr. sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. 1 (S1) **Group No.** 1 & 2 **to P-No.** 1 (S1) **Group No.** 1 & 2

AND

Specification Type and Grade SA-36 - APL 5L X65 (or equivalent subject to P-No. and Group No. indicated above)

to Specification Type and Grade SA-36 - APL 5L X65 (or equivalent subject to P-No. and Group No. indicated above) in any combination

OR

Chem. Analysis and Mech. Prop.

to Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: **Groove** 0.063” to 1.50” **Fillet** Unlimited

Other

FILLER METALS (QW-404)

Spec. No. (SFA)	SFA 5.18 A5.28/SFA 5.28		
AWS No. (Class)	ER70S-6 and ER80S-D2		
F-No.	6		
A-No.	See AWS Classification		
Size of Filler Metals	0.035”		
Weld Metal Thickness Range			
Groove	0.125" single pass limit with 1.75" total thickness		
Fillet	Unlimited		
Electrode-Flux (Class)	N/A		
Flux Trade Name	N/A		
Consumable Insert	N/A		
Other	Electrode class to be chosen based on higher tensile strength material to be joined.		
	X70 and Stronger Material Is Not Qualified		

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. GMA-P1 **Rev.** 3

POSITIONS (QW-405)

Position(s) of Groove All

Welding Progression **Up** ______ **Down** X

Position(s) of Fillet All

PREHEAT (QW-406)

Preheat Temperature **Min.** 32ºF

Interpass Temperature **Max.** 500ºF

Preheat Maintenance When utilized, preheat to be maintained between 250 Deg. and 400 Deg. F during welding and for an additional 15 minutes after the weld is completed.

(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range N/A

Time Range N/A

GAS (QW-408)

	Percent Composition		
	Gases	**Mixture**	**Flow Rate**
GTAW Shielding	CO_2	100%	20 – 30 cfm
Trailing	N/A		
Backing	N/A		

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC Direct (DC) **Polarity** Electrode Positive (EP)

Amps (Range) See table below **Volts (Range)** See table below

(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type N/A

(Pure tungsten, 2% thoriated, etc.)

Mode of Metal Transfer Short circuiting

(Spray arc, short circuiting arc, etc.)

Electrode Wire Feed Speed Range 100 **(150-210)** 260 IPM

Maximum Heat Input N/A

TECHNIQUE (QW-410)

Sting or Weave Bead Both stringer and weave beads are permitted

Orifice or Gas Cup Size 3/8" – 5/8"

Initial and Interpass Cleaning (brushing, grinding, etc.) Both power and hand tools may be utilized for Grinding, filing, chipping and bushing

Method of Back Gouging Grinding and air carbon arc gouging

Oscillation N/A

Contact Tube to Work Distance 3/8" – 5/8"

Multiple or Single Pass (per side) Multiple

Multiple or Single Electrodes Single

Travel Speed (range) See table below

Peening Not used

Other

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Diameter	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
Any	GMAW-S	ER70S-6	0.035"	DCEP	60 **(90-100)** 160	14 **(18-20)** 26	2.5 – 18 IPM	Stringer or Weave Technique
Any	GMAW-S	ER80S-D2	0.035"	DCEP	60 **(90-100)** 160	14 **(18-20)** 26	2.5 – 18 IPM	Stringer of Weave Technique

( ) indicates preferred range

Electrodes covered by procedure include the following:

Electrode Designation	Minimum Tensile Strength
ER70S-6	70,000 psi
ER80S-D2	80,000 psi

Back to Index

ASME WELDING PROCEDURE SPECIFICATIONS (WPS)

Company Name CenterPoint Energy **By** ______

Welding Procedure Specification No. OF-P1 **Date** August 29, 2003 **Supporting PQR No.(s)** OF-P1-G1

Revision No. 1 **Date** March 14, 2012

Welding Process(es) Oxyfuel (Acetylene) Gas Welding (OFW) **Type(s)** Manual

(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)

Details

Joint Design Grooves and fillets per attachment

Backing **Yes** X **No** X

Backing Material (Type) When require use a backing ring with matching composition of the base material

(Refer to both backing and retainers)

☒ **Metal** ☐ **Nonfusing Metal**

☐ **Nonmetallic** ☐ **Other**

Details of acceptable joint designs shown on attached sheet

Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified. (At the option of the Mfgr. sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. 1 **Group No.** 1 and 2 **to P-No.** 1 **Group No.** 1 and 2

OR

Specification Type and Grade ______

to Specification Type and Grade ______

OR

Chem. Analysis and Mech. Prop. ______

to Chem. Analysis and Mech. Prop. ______

Thickness Range:

Base Metal: **Groove** 0.063” to 0.218” **Fillet** Unlimited

Other ______

FILLER METALS (QW-404)

	(P-1/S-1, Gr 1&2 /1)		
Spec. No. (SFA)	SFA 5.2		
AWS No. (Class)	R-60		
F-No.	6		
A-No.	1		
Size of Filler Metals	1/8”		
Weld Metal Thickness Range			
Groove	0.218” Maximum		
Fillet	Unlimited		
Electrode-Flux (Class)	N/A		
Flux Trade Name	N/A		
Consumable Insert	N/A		
Other			

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. OF-P1 **Rev.** 1

POSITIONS (QW-405)
Position(s) of Groove All
Welding Progression **Up** X **Down**
Position(s) of Fillet All

PREHEAT (QW-406)
Preheat Temperature **Min.** 32ºF
Interpass Temperature **Max.** 500ºF
Preheat Maintenance Within min. and max. values
(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range N/A
Time Range N/A

GAS (QW-408)

	Gases	Percent Composition Mixture	Flow Rate
Fuel	Acetylene	100%	6 – 8 psi
Trailing	N/A		
Backing	N/A		

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC N/A **Polarity** N/A
Amps (Range) N/A **Volts (Range)** N/A
(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type N/A
(Pure tungsten, 2% thoriated, etc.)
Mode of Metal Transfer N/A
(Spray arc, short circuiting arc, etc.)
Electrode Wire Feed Speed Range N/A

TECHNIQUE (QW-410)
Sting or Weave Bead Stringer and weave beads are permitted
Orifice or Gas Cup Size N/A
Initial and Interpass Cleaning (brushing, grinding, etc.) Grinding and power wire brushing
Method of Back Gouging Grinding and air carbon gouging
Oscillation N/A
Contact Tube to Work Distance N/A
Multiple or Single Pass (per side) Multiple
Multiple or Single Electrodes N/A
Travel Speed (range) See table below
Peening Not Required
Other Thermal Processing is N/A
Flame Characteristics: Neutral
Travel Direction (Forehand, Backhand): Forehand
O_2 pressure 8 – 12 psi; Acetylene 6 – 8 psi

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Diameter	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
All	OFW	R-60	1/8"	N/A	N/A	N/A	1 – 4	Neutral flame; forehand technique; O_2 pressure 8 – 12 psi; Acetylene 6 – 8 psi

Back to Index

ASME WELDING PROCEDURE SPECIFICATIONS (WPS)

Company Name CenterPoint Energy **By**

Welding Procedure Specification No. SMA-LH-ISW **Date** August 29, 2003 **Supporting PQR No.(s)** EWI 41905CPQ – 1A

Revision No. 1 **Date** March 14, 2012

Welding Process(es) Shielded Metal Arc Welding (SMAW) **Type(s)** Manual

(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402) **Details**

Joint Design Sleeve fillets and branch grooves per attachment

Backing **Yes** X **No** X

Backing Material (Type) No backing or retainers

(Refer to both backing and retainers)

Details of acceptable joint designs shown on attached sheet

☐ **Metal** ☐ **Nonfusing Metal**

☐ **Nonmetallic** ☐ **Other**

Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified. (At the option of the Mfgr. sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

BASE METALS (QW-403)

P-No. 1 **Group No.** 1 – 4 **to P-No.** 1 **Group No.** 1 – 4

OR

Specification Type and Grade

to Specification Type and Grade

OR

Chem. Analysis and Mech. Prop. CE limits exist with respect to flow conditions and minimum required heat input – See Procedural Applicability information provided in PQR 1A

to Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: **Groove** 0.063” to 0.75”* **Fillet** Unlimited*

Other * Wall thickness limits exist with respect to flow conditions and minimum required heat input – See Procedural Applicability information provided in PQR 1A

FILLER METALS (QW-404)			
Spec. No. (SFA)	SFA 5.1		
AWS No. (Class)	E7018		
F-No.	4		
A-No.	1		
Size of Filler Metals	3/32”, 1/8”		
Weld Metal Thickness Range			
Groove	0.75” Maximum*		
Fillet	Unlimited*		
Electrode-Flux (Class)	N/A		
Flux Trade Name	N/A		
Consumable Insert	N/A		
Other	No Single Pass is ½” Thick		

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. SMA-LH-ISW **Rev.** 1

POSITIONS (QW-405)

Position(s) of Groove All

Welding Progression **Up** X **Down** ____

Position(s) of Fillet All

PREHEAT (QW-406)

Preheat Temperature **Min.** 32ºF (150ºF minimum if required for moisture removal only)

Interpass Temperature **Max.** 500ºF

Preheat Maintenance Within minimum and maximum values

(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range N/A

Time Range N/A

GAS (QW-408)

	Percent Composition		
	Gases	**Mixture**	**Flow Rate**
GTAW Shielding	N/A		
Trailing	N/A		
Backing	N/A		

ELECTRICAL CHARACTERISTICS (QW-409)

Current AC or DC Direct (DC) **Polarity** Electrode Positive (EP)

Amps (Range) See table below **Volts (Range)** See table below

(Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.)

Tungsten Electrode Size and Type N/A

(Pure tungsten, 2% thoriated, etc.)

Mode of Metal Transfer N/A

(Spray arc, short circuiting arc, etc.)

Electrode Wire Feed Speed Range N/A

Maximum Heat Input See table below

TECHNIQUE (QW-410)

Sting or Weave Bead Both stringer and weave beads are permitted

Orifice or Gas Cup Size N/A

Initial and Interpass Cleaning (brushing, grinding, etc.) Grinding and power wire brushing

Method of Back Gouging Grinding and air carbon gouging

Oscillation N/A

Contact Tube to Work Distance N/A

Multiple or Single Pass (per side) Single or multiple depending on thickness

Multiple or Single Electrodes Single

Travel Speed (range) See table below

Peening Not Required

Other No Thermal Processing is Permitted

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Diameter	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
All	SMAW	E7018	3/32"	DCEP	80 – 100	22 – 24	3 – 5	Minimum required heat input for sleeve fillets and branch grooves + 25 kJ/in., or a run-out ratio of 0.6 maximum
All	SMAW	E7018	1/8"	DCEP	120 – 140	24 – 24	4 – 8	

Back to Index

CenterPoint Energy

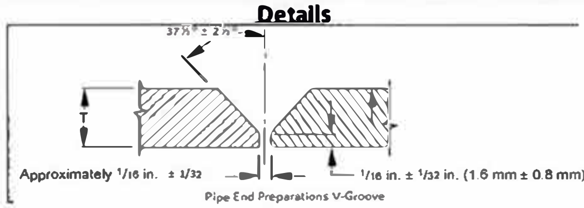
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 01

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH 01 **Date:** 9/1/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH 01 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT J55 to J55
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	SFA-5.5
AWS Classification No.:	E 7016 / E 7018 H4R root bead	E 8018-C3 H4R
F-No.:	4	4
A-No.:	5	5
Size of Filler Metal:	3/32"	3/32" / 1/8"
Groove Weld Metal Thickness Range Qualified:		
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	All thickness fillet welds

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	SMAW	E7016/E7018	3/32"	DCEP	55-100		NA	18-26	2.5-6 IPM	
Fill & Cap	SMAW	E8018 C3	3/32"/1/8"	DCEP	55-105	95-125	NA	19-28	2.5-12 IPM	

Back to Index

CenterPoint Energy

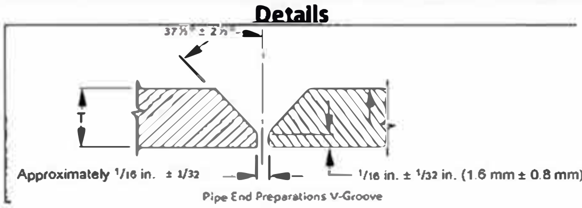
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 02

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH 02 **Date:** 9/1/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH 02 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT J55 to J55
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	0.0625"- 1.092"	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: VDH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: Wrap with ceramic blankets to slow cooling rates

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
		AWS Class.	Dia.							
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

CenterPoint Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 03

Company Name: CenterPoint Energy **By:** Christopher Shoaf

Welding Procedure Specification No.: GSWH 03 **Date:** 11/5/21

Revision No. Original **Date:**

Supporting Procedure Qualification No.(s): GSWH 03 PQR

Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail

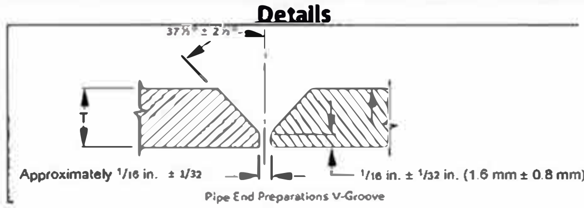
Root Spacing: 1/16 inch +/- 1/32 inch

Backing Material: NA, but if used the material should be carbon steel

Retainers: NA

Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT H40 to H40

Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"

Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals

Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	SFA-5.5
AWS Classification No.:	E 7016 / E 7018 H4R root bead	E 8018-C3 H4R
F-No.:	4	4
A-No.:	5	5
Size of Filler Metal:	3/32"	3/32" / 1/8"
Groove Weld Metal Thickness Range Qualified:	?	?
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	All thickness fillet welds

POSITION (QW-405)

Position(s) of Groove: All positions

Position(s) of Fillet: All positions

Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None

Time Range: None

Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F

Maximum Interpass Temperature: 400 degrees F

Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either

Cleaning: hand or power tools

Multiple/Single Pass: multiple pass

Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
		AWS Class.	Dia.							
1 root	SMAW	E7016/E7018	3/32"	DCEP	55-100		NA	18-26	2.5-6 IPM	
Fill & Cap	SMAW	E8018 C3	3/32"/1/8"	DCEP	55-105	95-125	NA	19-28	2.5-12 IPM	

Back to Index

CenterPoint Energy

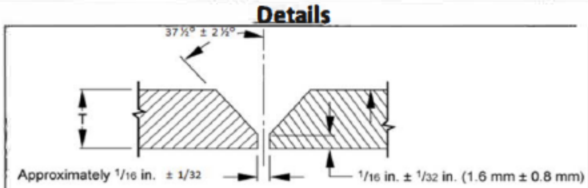
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 04

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH 04 **Date:** 11/29/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH 04 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



Pipe End Preparations V-Groove

BASE METALS (QW-403)

Base Metal Qualified: API 5CT H40 to H40
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	0.0625"- 1.092"	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: VDH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: Wrap with ceramic blankets to slow cooling rates

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

CenterPoint Energy

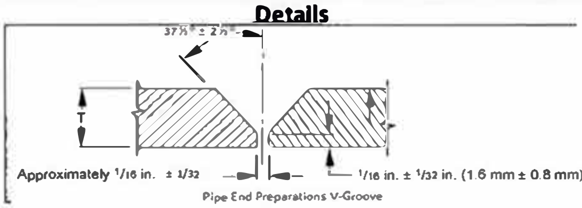
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 05

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH 05 **Date:** 11/29/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH 05 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT K55 to K55
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	SFA-5.5
AWS Classification No.:	E 7016 / E 7018 H4R root bead	E 8018-C3 H4R
F-No.:	4	4
A-No.:	5	5
Size of Filler Metal:	3/32"	3/32" / 1/8"
Groove Weld Metal Thickness Range Qualified:	0.0625" to 1.092"	0.0625" to 1.092"
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	All thickness fillet welds

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other: Weldment Insulated and cooled slowly after welding

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
		AWS Class.	Dia.							
1 root	SMAW	E7016/E7018	3/32"	DCEP	55-100		NA	18-26	2.5-6 IPM	
Fill & Cap	SMAW	E8018 C3	3/32"/1/8"	DCEP	55-105	95-125	NA	19-28	2.5-12 IPM	

Back to Index

CenterPoint Energy

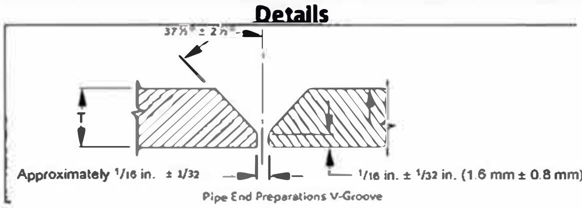
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH 06

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH 06 **Date:** 11/29/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH 06 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT K55 to K55
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	0.0625"- 1.092"	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: VDH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other: Weldment Insulated and cooled slowly after welding

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: Wrap with ceramic blankets to slow cooling rates

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

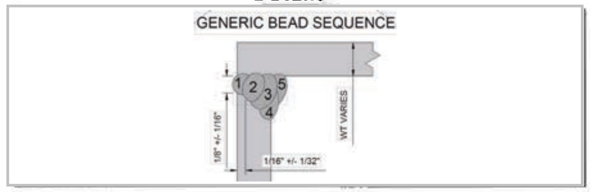
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWA F10

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWA F10 **Date:** 5/31/22
Revision No. original **Date:**
Supporting Procedure Qualification No.(s): GSWA F10 POR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Fillet Joint designs
Root Spacing: 1/16" +/- 1/32"
Backing Material: NA
Retainers: NA-optional
Other:

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT J55 to A105 P.1 Gr. 2
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials
Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	See AWS Classification	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degree F.
Maximum Interpass Temperature: 400 degree F
Other:

TECHNIQUE (QW-410)

Stringer or Weave: Either
Cleaning: Hand or power tools
Multiple/Single Pass: Multiple
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

CenterPoint Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWA F11

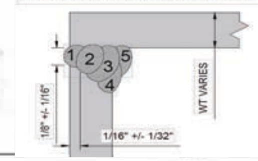
Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWA F11 **Date:** 6/17/22
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWA F11 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Fillet joint design including the figure shown in detail
Root Spacing: 1/8 inch +/- 1/32 inch
Backing Material: NA
Retainers: NA
Other:

Details

GENERIC BEAD SEQUENCE



BASE METALS (QW-403)

Base Metal Qualified: API 5CT J55 to A105 P.1 Gr. 2
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	See AWS Classification	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All positions
Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other:

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

CenterPoint Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWA F12

Company Name: CenterPoint Energy **By:** Christopher Shoaf

Welding Procedure Specification No.: GSWA F12 **Date:** 5/31/22

Revision No. original **Date:**

Supporting Procedure Qualification No.(s): GSWA F12 POR

Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Fillet Joint designs

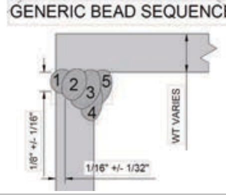
Root Spacing: 1/16" +/- 1/32"

Backing Material: NA

Retainers: NA

Other:

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT K55 to A105 P.1 Gr. 2

Groove Base Metal Thickness Range Qualified: NA

Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials

Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	See AWS Classification	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)

Position(s) of Groove: NA

Position(s) of Fillet: All

Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None

Time Range: None

Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degree F.

Maximum Interpass Temperature: 400 degree F

Other:

TECHNIQUE (QW-410)

Stringer or Weave: Either

Cleaning: Hand or power tools

Multiple/Single Pass: Multiple

Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

CenterPoint Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWA F13

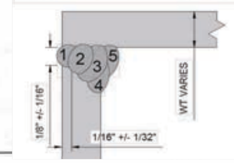
Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWA F13 **Date:** 6/17/22
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWA F13 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/8 inch +/- 1/32 inch
Backing Material: NA,
Retainers: NA
Other:

Details

GENERIC BEAD SEQUENCE



BASE METALS (QW-403)

Base Metal Qualified: API 5CT K55 to A105 P.1 Gr. 2
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	See AWS Classification	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All positions
Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other: Insulate weldment and cool slowly after welding

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other:

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

CenterPoint Energy

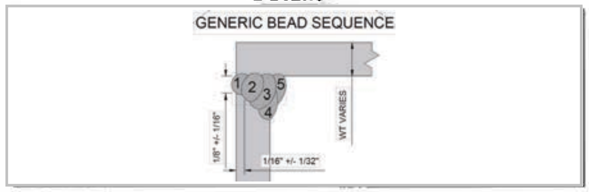
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWA F14

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWA F14 **Date:** 5/27/22
Revision No. original **Date:**
Supporting Procedure Qualification No.(s): GSWA F14 POR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Fillet Joint designs
Root Spacing: 1/16" +/- 1/32"
Backing Material: NA
Retainers: NA
Other:

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT H40 to A105 P.1 Gr. 2
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials
Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	See AWS Classification	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degree F.
Maximum Interpass Temperature: 400 degree F
Other:

TECHNIQUE (QW-410)

Stringer or Weave: Either
Cleaning: Hand or power tools
Multiple/Single Pass: Multiple
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

CenterPoint Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWA F15

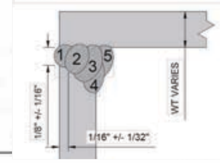
Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWA F15 **Date:** 5/31/22
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWA F15 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine)**:** GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/8 inch +/- 1/32 inch
Backing Material: NA
Retainers: NA
Other:

Details

GENERIC BEAD SEQUENCE



BASE METALS (QW-403)

Base Metal Qualified: API 5CT H40 to A105 P.1 Gr. 2
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	See AWS Classification	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All positions
Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other:

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	3-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

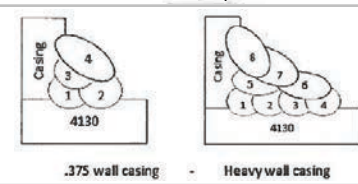
Back to Index

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWH F01

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH F01 **Date:** 9/1/21
Revision No. original **Date:**
Supporting Procedure Qualification No.(s): GSWH F01 POR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)
Joint Design: Fillet Joint designs
Root Spacing: 1/16" +/- 1/32"
Backing Material: NA- if used should be Carbon Steel
Retainers: NA-optional
Other:

Details



BASE METALS (QW-403)
Base Metal Qualified: 4130 materials to J-55 Mechanical tubing
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials
Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	5	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)
Position(s) of Groove: NA
Position(s) of Fillet: All
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)
Minimum Preheat Temperature: 350 degree F.
Maximum Interpass Temperature: 400 degree F
Other: O-ring damage possible above 450 degree F.

TECHNIQUE (QW-410)
Stringer or Weave: Either
Cleaning: Hand or power tools
Multiple/Single Pass: Multiple
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

CenterPoint Energy

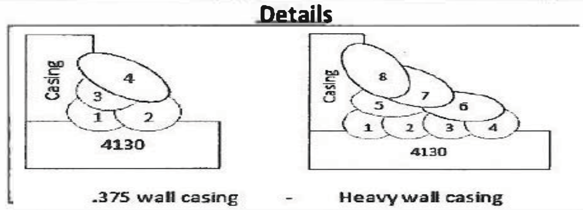
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH F02

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH F02 **Date:** 9/1/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH F02 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



BASE METALS (QW-403)

Base Metal Qualified: API 5CT J55 to 4130
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	0.0625"- 1.092"	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
		AWS Class.	Dia.							
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

CenterPoint. Energy

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWH F03

Company Name: CenterPoint Energy **By:** Christopher Shoaf

Welding Procedure Specification No.: GSWH F03 **Date:** 11/5/21

Revision No. original **Date:**

Supporting Procedure Qualification No.(s): GSWH F03 POR

Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Fillet Joint designs

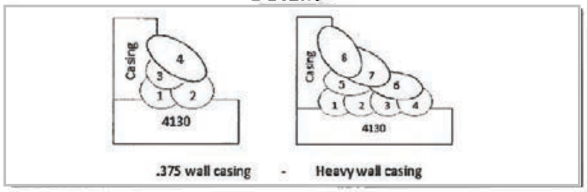
Root Spacing: 1/16" +/- 1/32"

Backing Material: NA- if used should be Carbon Steel

Retainers: NA-optional

Other:

Details



BASE METALS (QW-403)

Base Metal Qualified: 4130 materials to H-40 Mechanical tubing

Groove Base Metal Thickness Range Qualified: NA

Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials

Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	5	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)

Position(s) of Groove: NA

Position(s) of Fillet: All

Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None

Time Range: None

Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degree F.

Maximum Interpass Temperature: 400 degree F

Other: O-ring damage possible above 450 degree F.

TECHNIQUE (QW-410)

Stringer or Weave: Either

Cleaning: Hand or power tools

Multiple/Single Pass: Multiple

Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH F04

Company Name: CenterPoint Energy **By:** Christopher Shoaf

Welding Procedure Specification No.: GSWH F04 **Date:** 11/5/21

Revision No. Original **Date:**

Supporting Procedure Qualification No.(s): GSWH F04 PQR

Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any fillet joint design including the figure shown in detail

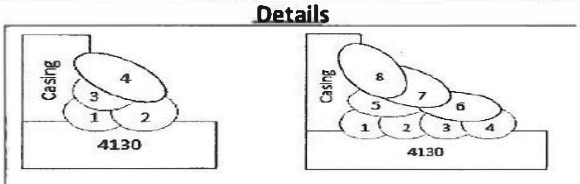
Root Spacing: 1/16 inch +/- 1/32 inch

Backing Material: NA, but if used the material should be carbon steel

Retainers: NA

Other: ~~Fillets should be space off of internal step approx. 1/16 inch~~

Details



.375 wall casing - Heavy wall casing

BASE METALS (QW-403)

Base Metal Qualified: API 5CT H40 to 4130

Groove Base Metal Thickness Range Qualified: NA

Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals

Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions

Position(s) of Fillet: All positions

Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None

Time Range: None

Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F

Maximum Interpass Temperature: 400 degrees F

Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either

Cleaning: hand or power tools

Multiple/Single Pass: multiple pass

Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
		AWS Class.	Dia.							
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO_2	100%	20-30 CFH

Back to Index

CenterPoint. Energy

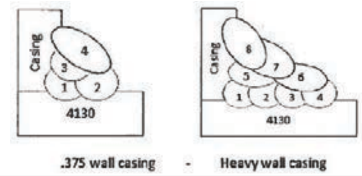
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head - GSWH F05

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH F05 **Date:** 11/29/21
Revision No. original **Date:**
Supporting Procedure Qualification No.(s): GSWH F05 POR
Welding Process and Type (manual, automatic, semi-automatic, machine): Manual SMAW

JOINTS (QW-402)

Joint Design: Fillet Joint designs
Root Spacing: 1/16" +/- 1/32"
Backing Material: NA- if used should be Carbon Steel
Retainers: NA-optional
Other:

Details



BASE METALS (QW-403)

Base Metal Qualified: 4130 materials to K-55 Mechanical tubing
Groove Base Metal Thickness Range Qualified: NA
Fillet Base Metal Thickness Range Qualified: Fillet welds on a thicknesses of base materials
Maximum Pass Thickness ≤ 0.156" or 4 mm: Yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.5	
AWS Classification No.:	E-8018 C3	
F-No.:	4	
A-No.:	5	
Size of Filler Metal:	3/32" or 1/8"	
Groove Weld Metal Thickness Range Qualified:	NA	
Fillet Weld Metal Thickness Range Qualified:	All	

POSITION (QW-405)

Position(s) of Groove: NA
Position(s) of Fillet: All
Welding Progression: VUH

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other:

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degree F.
Maximum Interpass Temperature: 400 degree F
Other: O-ring damage possible above 450 degree F.

TECHNIQUE (QW-410)

Stringer or Weave: Either
Cleaning: Hand or power tools
Multiple/Single Pass: Multiple
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 Root	SMAW	E8018 C3	3/32"	DCEP	70-100		NA	19-26	3-6	
Fill & Cap	SMAW	E8018 C3	3/32 or 1/8	DCEP	70-125		NA	19-26	3-12	

Back to Index

CenterPoint Energy

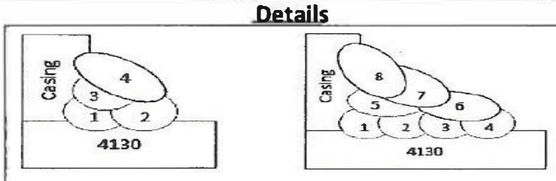
ASME SECTION IX WELDING PROCEDURE SPECIFICATION Gas Storage Well Head GSWH F06

Company Name: CenterPoint Energy **By:** Christopher Shoaf
Welding Procedure Specification No.: GSWH F06 **Date:** 11/29/21
Revision No. Original **Date:**
Supporting Procedure Qualification No.(s): GSWH F06 PQR
Welding Process and Type (manual, automatic, semi-automatic, machine): GMAW / Semi-automatic

JOINTS (QW-402)

Joint Design: Any joint design including the figure shown in detail
Root Spacing: 1/16 inch +/- 1/32 inch
Backing Material: NA, but if used the material should be carbon steel
Retainers: NA
Other: Fillets should be space off of internal step approx. 1/16 inch

Details



.375 wall casing - Heavy wall casing

BASE METALS (QW-403)

Base Metal Qualified: API 5CT K55 to 4130
Groove Base Metal Thickness Range Qualified: 0.0625" to 1.092"
Fillet Base Metal Thickness Range Qualified: Fillet welds on all thicknesses of base metals
Maximum Pass Thickness ≤ 0.156" or 4 mm: yes

FILLER METALS (QW-404)

	1	2
Specification NO. (SFA):	SFA-5.28	
AWS Classification No.:	ER-80S-D2	
F-No.:	6	
A-No.:	2	
Size of Filler Metal:	0.035"	
Groove Weld Metal Thickness Range Qualified:	0.0625"- 1.092"	
Fillet Weld Metal Thickness Range Qualified:	All thickness fillet welds	

POSITION (QW-405)

Position(s) of Groove: All positions
Position(s) of Fillet: All positions
Welding Progression: Either VUH or VDH see PQR

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: None
Time Range: None
Other: Insulate weldment and cool slowly after welding

PREHEAT (QW-406)

Minimum Preheat Temperature: 350 degrees F
Maximum Interpass Temperature: 400 degrees F
Other: O-ring damage possible above 450 degrees

TECHNIQUE (QW-410)

Stringer or Weave: either
Cleaning: hand or power tools
Multiple/Single Pass: multiple pass
Peening: NA

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal AWS Class.	Filler Metal Dia.	Current/ Polarity	Amps (Range)	Amps (Range)	Heat Input	Volts (Range)	Travel Speed (Range)	Other
1 root	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-8 IPM	
Fill & Cap	GMAW	ER-80S-D2	0.035"	DCEP	85-130		NA	16-21	4-12 IPM	

GAS (QW-408)			
	Percent Composition		
	Gas(es)	Mixture	Flow Rate
Shielding	CO2	100%	20-30 CFH

Back to Index

Work on Customer Premises

All work performed on the Customer's premises must be done in a safe and professional manner. This is usually the only contact many customers will ever have with CenterPoint Energy. Extreme care must be taken not to damage or unnecessarily alter their property. The work area should be kept as neat and organized as possible.

Smoking on a customer premises is PROHIBITED.

Entry into Customer's House

Entry into a customer's house will be made only if an adult over 18 years of age is present who is a member of the household or an authorized representative of the household, or if the house is vacated and the customer's permission to enter has been obtained and it is so noted on the order. If entry cannot be made under these conditions, routine work shall be deferred and an explanation made on the Service order or computer.

Appliance Tagging Procedures

See Turn-on Procedures Supplement Section 8.0 for procedures.

Gas Appliances Located in Garages and Utility Rooms

See Turn-on Procedures Supplement Section 7.3 for procedures.

Investigating "No Gas"

1) Check all appliances for gas supply.

   If no gas is found at any appliance proceed to step 2.

   If gas is found at all appliances and all pilots are out the meter and regulator must be checked to make sure they are operating properly. Proceed to step 2.

   If gas is found at all appliances and only some of the pilots are out, re-light the pilots according to CS-C-3.900.

   Note: If sufficient gas pressure is found at all appliances but the pilots will not light, use a CGI to test the gas at the meter. If the percent gas is less than normal, notify supervisory personnel.

2) Remove "test tee" plug on outlet of meter, or loosen the downstream swivel if no test tee plug is available or usable, to determine if gas is flowing.

   If gas is flowing and the portion of the house line found to be the problem can be isolated follow the notification tagging procedure. If it cannot be isolated, pull the meter and apply a notification tag to the house piping. For large meter installations, the house line may be isolated by closing and locking the service valve and inserting a blind plate.

   If no gas is flowing proceed to step 3.

3) Loosen inlet swivel on meter to determine if gas is flowing.

   If gas is flowing replace the meter. Refer to Change/Remove Meter & Regulator Procedures.

   If gas is not flowing proceed to step 4.

4) Close the service valve, remove the regulator and open the service valve just enough to determine if gas is flowing.

   If gas is found replace the regulator. Refer to Change/Remove Meter & Regulator Procedures.

If no gas is found determine if an excess flow valve (EFV) has been installed in the service. If an (EFV) is present in the service, refer to Procedure for Resetting An Excess Flow Valve (EFV*).* If a bypass style EFV is installed, verify that the pressure has equalized across the device and has reset.
If it is determined there is no (EFV) in the service check another service in area for gas. Notify area supervisor with results.

Note: On installations over 60 psig, check pressure limiting valve (PLV) or other pressure regulating devices, if present, for a broken disk. See CS-C-2.600.

Carbon Monoxide Investigation

Preparing for the investigation

1) The CO monitor should be calibrated according to manufacturer's recommendation.

2) Turn off the audible alarm, if possible.

3) Sample the outside air away from the structure or any vehicle.

4) Record the instrument reading. This is the background reading.

5) Making contact with the customer:

   If the customer is not available to grant access, request dispatching to contact them using the call back number provided. If the customer cannot be reached, and there is a possibility that they are in the building, turn off the gas to eliminate sources of CO, call 911, or emergency, and your supervisor.

   Explain to the customer why you are there. Immediately enter the structure and test the air for CO.

6) Immediately evacuate the structure under any of the following conditions:

   a) If the CO Monitor reading is 200 PPM or greater

   b) If the customer displays symptoms of CO poisoning; i.e., severe headaches, nausea or vomiting, unable to communicate thoughts or appears disoriented.

   Note: If in your judgment the customer needs immediate medical attention, call 911.

Investigation

The CO level must be below 200 PPM before the investigation can continue. The building may be ventilated and/or the gas service turned off if needed to reduce the CO level below 200 PPM.

The production of carbon monoxide is not limited to just gas-burning appliances. The burning of ANY hydrocarbon fuel under certain conditions may create carbon monoxide; therefore, during an investigation, it is important to keep this in mind. The following is a list of some of the most common sources of carbon monoxide:

- Automobile or other internal combustion engine running in attached garages.
- The operation of kerosene or LP gas heaters indoors.
- The operation of wood heaters indoors.
- The operation of charcoal grills indoors or in an area where the carbon monoxide from the burning of the charcoal can enter into the home.
- The burning of tobacco products such as cigarettes and cigars.
- The operation of wood fireplaces without adequate ventilation.

1) Ask what prompted the customer to report a CO problem. Explain the investigation procedure. Ask about possible sources of CO, such as smoking, auto engine exhaust, wood or charcoal grills, etc.

2) Test the inside of the structure using the appropriate company testing procedures.

   a. Carbon Monoxide Monitoring Results.

      - Residential Structures: If all CO readings are at or below 10 PPM above the background readings, then go to Step 5.
      - Commercial and Industrial Structures: If all CO readings are at or below 35 PPM above the background reading, then go to Step 5.

- If any readings are above these levels, attempt to locate the source of CO.

3) If the CO source is found to be a gas-burning appliance (ie. Leaking Combustion Gases).

    - If the appliance is operating improperly and is creating a hazardous condition, it should be adjusted if possible and retested.

    - If the appliance cannot be adjusted properly, follow the appliance tagging procedure. The customer will be advised to contact a qualified service agent.

4) If the source of CO cannot be found, contact your supervisor for assistance in determining what action will be taken.

5) Questions about CO should be referred to the Poison Control Center (1-800-POISON1), (1-800-764-7661).

6) Document all readings taken, adjustments made, and advice given to the customer.

Testing for Carbon Monoxide

1) Carbon monoxide monitors should be at room temperature, and test samples should not be taken if the temperature is over 115 degrees F. This will ensure accurate carbon monoxide readings, as well as to protect the carbon monoxide monitor from damage.

2) Test for carbon monoxide in the following locations.

    a) In the atmosphere: at the floor, head, and ceiling level of each room.

    b) Near all gas appliances.

    c) Near discharge registers for each central heating unit.

    d) Near appliance diverters and fire doors on appliances in basement or utility room.

3) When a carbon monoxide investigation is being conducted, tests should be made in the following order:

   a) Just after the appliance has been restarted.

   b) After the appliance has been in operation for a few minutes.

   Note: An oven must be in operation for at least 15 minutes before testing.

Handling and Transporting Meters and Regulators

Meters

Meters are quite accurate when properly handled, installed and maintained. However, like other mechanical devices, they are likely to be inaccurate when damaged. The guidelines listed below should be followed to avoid damaging the meter.

1) Caps should be installed on the inlet and outlet swivel connections of all meters as soon as they are removed from the setting. Meters received from the storeroom or Meter Shop should normally have caps on the inlet and outlet swivel connections. Plastic caps should be on the meter at all times while in transit from meter installation to the Meter Shop as well as from the Meter Shop to the customer's meter installation, to prevent dirt and water from entering the meter and damaging the mechanism.
2) Perhaps it is not so obvious why a meter should be treated with care even though it has been disconnected and is to be returned to the Meter Shop. The reason being, a customer's billing may have to be adjusted on the basis of the proof of their meter as it is returned. This test is made prior to any repair and should reflect the operation of the meter prior to its being disconnected, so the meter must be carefully handled while transporting it between the point of operation and the Meter Shop.
3) All meters are to be carried on trucks in an upright position and strapped on a padded shelf or in special meter boxes. Never carry meters lying loose in the bed of a truck. If it becomes necessary to carry meters on a truck not fitted for meter transportation, they must be padded with rags or newspaper and tied so that they will not roll around, or fall from the truck.
4) Every effort should be made to minimize the time meters are carried on trucks.
5) Do not install a meter that has been dropped or jarred excessively. Customer goodwill and the Company's revenue depend on an accurate meter.
6) Meters must be accurately accounted for. Service people must always use meter tags and enter readings and meter numbers on the Service order or computer.

Regulators

1) As soon as the regulator is removed from the setting, remove all fittings and insert plastic plugs in the inlet and outlet connections. Regulators received from the storeroom or Meter Shop will normally have plastic plugs in the inlet and outlet connections. Plastic plugs should remain in the regulator at all times while in transit or storage, to prevent dirt and water from entering the regulator and damaging the mechanism. Never store a regulator with the vent opening upward as water and dirt can cause internal damage through the vent opening.
2) All regulators must be handled with care while in transit.
   Note: Regulators carried in an open truck bed in random positions are subject to entry of dirt and moisture through their vents. For this reason, regulators should be stored and transported in covered truck bins.

Meter and Regulator Installations

Safety Precautions

1) Always get assistance when lifting, loading, unloading, or setting larger meters for industrial and commercial customers.
2) Use mechanical equipment, when available, to lift and set larger meters.
3) Watch hand placement on meter sets; avoid pinch points.
4) Use the proper tools to tighten fittings.
5) Protect your feet; wear footguards when there is a possibility of having a large meter or piping fall on your feet.
6) Do not smoke or introduce other sources of ignition around meter sets when gas is, or has been, run to the installation.
7) Protect yourself, wear the personal protective equipment required to do the job safely.
8) Good housekeeping reflects careful job planning and safe work practices. It eliminates many of the hazards that might otherwise cause accidents. A clean job is a safer job.

General Information

1) Each meter and regulator should be installed outside buildings in an accessible location and be protected from corrosion and other damage.
2) When practical, meters and regulators previously installed inside of buildings should be relocated to outside of buildings when regulator or meter is removed for any reason.
3) Each customer regulator and meter must be provided with reasonable protection from physical damage due to vehicles or other causes by being placed in a suitable location or by the installation of barricades.
4) Regulator vents must terminate outdoors a minimum of three (3) foot radius (or as close to three (3) feet as practical) from an ignition source, and the outlet should be oriented in the downward position in order to prevent the accumulation of rain, moisture, and debris from obstructing the vent.

Building Meter Installations

1) Install meters in a plumb and level position with the piping aligned and plumb.
2) A meter installed on a service line where the maximum operating pressure exceeds 60 psig shall be protected by two or more stages of pressure regulation, or a service regulator with internal relief valve or a pressure limiting device (192.197). Refer to

typical drawings of meter installations for over these pressures in the Standard Drawings manual.

3) The service valve on the service riser and all exposed downstream metal pipe and metal fittings shall be of properly coated material.
4) Service risers should be located so that new meter/regulator installations will be a minimum of a three (3) foot radius or as near to three (3) feet away from an ignition source as practical.
5) Customers piping downstream of the meter loop shall be in conformance to meet or exceed local and/or building codes.
   Note: No type of plastic pipe is allowed above ground.

Service Regulator

1) The term "Service Regulator" as used in this section shall mean a regulator having the following characteristics:
   a) A regulator capable of reducing distribution line pressure to pressure recommended for household appliances.
   b) A single port valve with orifice for the maximum gas pressure at the regulator inlet.
   c) A valve seat made of resilient material designed to withstand abrasion of the gas, impurities in the gas, cutting by the valve, and to resist permanent deformation when it is pressed against the valve port.
   d) Pipe connections to the regulator not exceeding 2 inches in diameter.
   e) A regulator that, under normal operating conditions, is able to regulate the down-stream pressure within the necessary limits of accuracy and to limit the build-up of pressure under no-flow conditions to prevent a pressure that would cause the unsafe operation of any connected and properly adjusted gas utilization equipment.
   f) A self-contained service regulator with no external static or control lines.
2) The service regulator vent and relief must:
   a) Be rain and insect resistant.
   b) Be located at a place where gas can escape freely away from any opening into the building.
   c) Be protected from damage caused in areas where flooding may occur.
3) When a High Pressure Regulator and a Service Type (Ounces) Regulator are used in the customer's meter installation, provide over pressure protection upstream of the service regulator if required.
4) When a regulator other than a Service Regulator is used in a customer's meter installation, over pressure protection must be provided to limit the pressure of the gas delivered to the customer to no more than a pressure less than that which could cause unsafe operation of any device or appliance connected to the source of gas pressure without additional pressure control.

   a) Suitable types of protective devices to prevent over pressuring of customer's appliances include:
      i) A monitoring regulator
      ii) A relief valve
      iii) An automatic shut-off device which must be reset manually
5) Insulate the meter installation according to approved standards for cathodic protection. Each time the installation is rebuilt, if the previous insulator was plastic, replace it. Otherwise inspect the insulator and replace as necessary. Refer to Standard Methods for Insulating Small Meter Installations in this section.
6) When the meter is ready to be placed in service, the meter and installation should be pressurized and soap tested for leaks, and after any leaks are repaired, follow the Turn-On Procedures, if applicable.
7) Thoroughly clean the installation of pipe thread compound rust, scale, grease, and dirt, using a solvent if necessary, and apply an approved Company paint. Touch up all scratches or other breaks in the painted surfaces of the meter, regulator and installation.

Rebuilding Meter Installations

1) A meter installation shall be reconstructed if at least one of the following conditions exists:
   a) The meter and/or regulator(s) is to be exchanged or the installation is to be altered, or is damaged in some way, and presently does not conform to applicable codes or Company standards.
   b) Meter or service valve is partially buried.
   c) Meter is misaligned; not hanging in a reasonably level position, or piping is either in a strain or not plumb.
   d) Leaking connections, service valves, piping or fittings.
   e) Fittings, service valves, or piping severely corroded.
2) Regulators should be included in the same installation as the meter. However, regulator installations which are separate from meter installations need not be relocated unless:
   a) The meter and/or regulator is to be changed or the installation is to be altered in some way and presently does not conform to Company standards.
   b) The regulator location is adjacent to a sidewalk or adjacent to a curb or driveway.
   c) The regulator installation must be completely dismantled to repair leaks, or repair/replace fittings or risers.
      i) If the regulator is relocated to the meter loop, the yard line shall be pressure tested to 1.5 times maximum operating pressure of the system or 100 psig, whichever is greater, and either all leaks shall be repaired, or the line replaced.

3) All service risers at meter installations found in an unacceptable condition should be reported to construction and maintenance or their supervisor for a decision regarding repair or replacement.
4) Follow the procedures outlined in Building Meter Installations.

Insulation of Meter Sets

Only one insulation method is required for each meter installation. Examples include: insulating bushing, insulating flange, insulating union.

1) If an insulating bushing is used, it should be located in a vertical leg of the installation if possible and preferable downstream of the regulator.
2) An insulating bushing may not be used at a pressure greater than 60 psig.
3) The standard insulating bushing size is 1”x1-¼”. A bushing size larger than 1-1/2” may not be used.
4) Insulating flanges or insulating unions must be used for sizes larger than 1-1/2”, although they may be used on small sizes. Only insulating flanges are to be used for insulation of all meter installations larger than 2”. For smaller sizes, an insulating union may be used if preferred.
5) For 2” and larger installations, if a flanged valve is used on the inlet riser, then the downstream side of the valve should be an insulated flange.
6) Or as specified by our Engineering Department.

Meter Set Shielding

If one or multiple conditions listed below are evident at a residence or commercial meter set location, protection or shielding the meter set should be considered:

- Snow or ice formations visible above the meter set
- Downspouts or water scuppers above the meter set
- Overhang or eave which does not fully extend over the meter set
- Meter sets located directly below roof valleys that have no gutters
- Exterior water spigots above meter sets.

Meter and Regulator Removal

Domestic Meters

Meters are removed because they are no longer needed, or they need testing and /or repair. Meters are returned to the local office and forwarded to the Meter Shop for one or more of the following reasons:

1) Meters are due for Sample Testing. (Meter Device Status Code "S")
2) Meters are part of a group demonstrating poor performance. (Meter Device Status Code "X")
3) Special test request.
4) If there is gas usage on a locked meter:
   a) Remove the regulator and meter
   b) Or, if local office dictates, disconnect the service at the main connection. The service person shall ask their supervisor if they are unsure of the local office procedures.
5) Meters with obvious damage such as:
   b) Meter case is broken, dented, badly rusted, or leaking.
   c) Index box is broken, index glass is broken, or if the index is unreadable.
   d) Meter is binding, locked-up, non-registering, or excessively noisy.
   e) Liquids in the meter case or index box.
6) Meters operated in excess of its rated capacity or rated pressure.
7) Meters not properly badged.
8) Meter is of a combination type. These meters are not to be Reset (Combination meters are meters with integral regulators).
9) Any Meter removed from the installation that has not been recertified within the past 20 years, should not be reset regardless of the Meter Status code. Return these meters to the local office and forward to the Meter Shop.

Meter Device CCS "User" Status Codes

CNP-Gas Distribution Operations	
"N" or "R"	Normal Operations and may Remain in Service or be Reset locally (Except as noted in item 9 above)
"S"	Sample Meter, send to meter shop
"X"	Exchange and send to meter shop
"L/S"	Code indicating that the meter was reported as Lost or Stolen
"RET"	The meter has been retired and written of the books
"UN/D"	Reported as Unusable or damaged.

Service Regulators

1) All service regulators with internal relief valves (IRV) are to remain in service unless otherwise listed in the following table. Change out the regulator if it:
   a) Fails the flowing or lock-up pressure tests.
   b) Is damaged or malfunctioning.
   c) Is no longer needed at the customer site.
   d) Is not full relief
2) If the installation has NON-IRV service regulator, it is to be removed if it:
   a) Fails the flowing or lock-up pressure tests.
   b) Is damaged or malfunctioning.
   c) Is no longer needed at the customer site.
   d) Is included in a change in the meter loop (i.e. Meter removed) that dictates a turn-on procedure.
3) If there is gas usage on a locked meter:
   a) Remove the regulator and meter
   b) Or, if local office dictates, disconnect the service at the main connection. The service person shall ask their supervisor if they are unsure of the local office procedures.
4) Replace any ½" or smaller vent lines where a Full Relief Regulator is to be used.
5) Remove any ¾" or ½" bushings that may be found in some full relief regulators.
6) Full relief regulators, located inside, that are not in the drained position do not have to be modified.
7) Disposition of service regulators removed from services:
   a) Non-IRV Service Regulators will be retired, destroyed, and disposed of locally. On a monthly basis, report the total number of service regulators destroyed. This report will enable the Meter Shop to purchase replacement inventory.
   b) Service Regulators with IRVs should be re-installed. If unsuitable for continued service (per above) return to local office or Meter Shop for further handling.

Special Note:

All metering and pressure control equipment is to be removed per the following special circumstances:

- Fires and issues of potential liability – Remove as a single unit, tag for special handling, and store for investigative purposes with chain of custody letter. The retention period will be determined by the legal department of the business unit.

The following table may serve as a general guide when determining if a regulator should be removed as described in the above procedures. This table is not all-inclusive.

Regulators to Remain in Service/Remove

To Remain in Service	To Be Replaced
Sprague	*Sprague*
B31R B-39 B-42-R	B31N B33N , B33R, B33 B33NMB, B33RMB B39**R** (1)(5)
Reliance	*Reliance*
1813B 1813C 1413B	1803B 1403B
Mueller	*Mueller*
None	All
Fisher	*Fisher*
S102 S252(4)(5) S253 S254	730 733 S100 S201 S252(4) (5)
National	*National*
NATIONAL-61R	None
Rockwell	*Rockwell*
043(2)(4)(5) 143-2 143-22 143(2)	043(4) (5) 143-1 143-21 143 (3)

(1) Having a 1/4" orifice on 60# MAOP system. (2) Leave in service if “IRV” is stamped on the diaphragm casing.

(3) Remove if “IRV” is not stamped on the diaphragm casing.

(4) Remove if larger than an 1/8” orifice exists on a 20 # (Class 5 or 6) MAOP or greater system.

(5) If orifice size can not be verified, remove the regulator

Change and Remove Meter Procedure

Safety Precautions

1) Use the proper tools to tighten fittings.
2) Do not smoke or introduce other sources of ignition around meter sets when gas is, or has been, run to the installation.
3) Protect yourself, wear the personal protective equipment required to do the job safely.
4) Good housekeeping reflects careful job planning and safe work practices. It eliminates many of the hazards that might otherwise cause accidents. A clean job is a safer job. Good housekeeping is necessary in every job at The Company.

Meter Removal

To determine if a meter is to be removed, see Section 2.160: Meter and Regulator Removal Policy.

If a meter is to be removed, use the following procedure:

1) Arrival and Contacting the customer.
   a) Verify the correct address.
   b) Verify the meter serial number.
   c) Verify the customer's name.
   d) Explain the nature of the work and obtain permission to do work. If the customer cannot be reached and it is necessary to turn the gas off and make the change-out, consult supervisor for specific instructions.
2) Examine the meter and regulator installation.
3) Determine if meter installation should be rebuilt. Refer to Rebuilding Meter Installations.
4) Prior to turning the meter off, check the house piping for gas leakage as outlined in Shut-In Test Procedure. **Note**: This step is not required if the meter is being removed and a new meter will not be installed at this time. This step also applies to all Regions except CNP-Minnesota. If no leakage is indicated; proceed as follows:
   a) Turn off the gas at the meter installation.
   b) Remove the meter. If the regulator is of a Non-IRV (Internal Relief Valve) type, then remove it also. Service Regulators with IRV may remain in service. High Pressure Regulators are to be exchanged and returned to the Meter Shop. If the installation contains a (PLV) pressure limiting valve, test it in accordance with the Pressure Limiting Valve Test (PLV), and either reuse or replace the valve as

indicated by the test result. PLV'S ARE NEVER EXCHANGED FOR AGE, only for repair or failure.

c) Install a new or reconditioned meter, and IRV service regulator if needed, including any high pressure regulators. Also install a new insulator for cathodic protection, unless a pre-bent inlet fitting is utilized.

5) Follow the Turn-On Procedure, if applicable.
6) When the meter and regulator are removed and another meter and regulator are not installed, the customer's piping must be sealed with a cap or plug, and plug and lock the service valve.
7) Complete and attach a meter repair tag to the meter.
8) Complete Service order or enter data on computer.

Meter Change Procedure for Uninterrupted Service
Grunsky Method

The Grunsky method is a procedure for providing uninterrupted gas service during meter changes. When residential customers are not at home or when commercial businesses, such as small restaurants, must remain in operation, this method may be used. It may also be used for restoring gas service utilizing compressed natural gas when normal gas service is prevented by an installation of ERT meters, etc.

To use the Grunsky method, the meter loop must have a 1”x1”x1” tee connection to the house line. This permits the use of a pressurized gas bottle to supply house load during the few moments necessary to change meters.

Steps:

1) Serviceman carries Grunsky equipment and replacement meter to meter location.
2) With wrench, back out plug at the meter outlet tee to finger tight and also loosen meter nuts.
3) Snap mouth of bag over end of tee.
4) Turn on auxiliary gas valve.
5) Purge air from the bag with purge valve at bag.

6) Remove the plug by manipulating it through the rubber bag. When the plug drops into the bag, auxiliary gas will mingle with metered gas.
7) Force the probe into the house line through the tee, using a twisting motion. This places the house load entirely on the auxiliary supply.
8) Shut off the lock wing service valve and install a regulator with an internal relief (if applicable), install an insulated swivel and a new meter. At this time, with the inlet side of the meter connected to the inlet riser, turn on the service valve, purge air from the meter, test for odorant in the gas, and make the flow and lock up pressure tests. See Regulator Testing Procedure.
9) Turn off the service valve, connect the outlet side of the meter to the customer’s house piping. Turn the service valve on and purge air from bag with the purge valve on the bag.
10) Manipulate the plug through the bag and screw it in the tee one or two turns.
11) Shut off the auxiliary gas valve and remove the bag.
12) Apply thread lubricant to the remaining threads on the plug and tighten with a wrench.
13) Make a soapsuds test, paint the meter loop as needed and return equipment to the truck.

Continuous Service Restoration and Meter Change-Out System

The Meter bag was developed to provide a means to change out meters without having to interrupt service to the customer. This procedure should only be used for ounce delivery meter installations.

Prior to beginning the procedure, the valve upstream of the meter should be inspected to verify that it could be operated if needed.

1. Ground meter set piping using grounding cable and grounding rod.
2. Install alignment meter plate on the meter inlet and outlet swivels approximately ½"-5/8" above the meter nuts.
3. Place a single layer of gasket tape around the meter inlet and outlet swivels above the alignment meter plate.
4. Connect the top plate onto the meter inlet and outlet swivels over the gasket tape and latch the two plates together. The top plate should be resting on the alignment meter plate.
5. Prepare the vinyl bag for use. Place the bypass fitting, gasket removal tool and spanner wrench into the bottom of the bag and open the ¼ turn purge valve inside the bag.
6. Apply a fine mist of IGT ™ anti-static spray to the bag's interior surface, gloves, and on the bag opening ring.
7. Loosen the existing meter nuts with a pipe wrench. They should be loosened just enough so that they can be turned by hand.
8. Install the bag over the meter and up to the top plate. The latch studs on the bag ring will pass through the top plate. Secure the latch studs with the six cam locks and tighten evenly around the top plate hand tight. Do not over-tighten.
9. Using the glove ports, loosen the meter nuts (primarily the inlet) until an audible flow of gas can be heard. Purge slowly. Do not loosen this nut excessively and release a great amount of gas. This could disrupt the customer's service.
10. Squeeze air/gas out of the bag and continue purging through the bag bulkhead fitting for about 1 ½ minutes. Use the included 10' length of hose to vent the purged gas away from the work area.
11. From within the bag, close the ¼ turn purge valve and allow the bag to fully inflate.
12. Carefully remove the old meter and lower to the bottom of the bag.

13. Lift the bypass fitting from the bottom of the bag and install on the meter inlet and outlet connections and tighten by hand.
14. Open the ¼ turn purge valve and purge the gas from the bag with the 10' hose away from the work area.
15. Unlock the cam locks and lower the bag with the old meter. Remove old meter from bag.
16. If meter set sits high off the ground, use lifting strap to hang the new meter from the alignment meter plate and secure. Otherwise, the new meter may be simply loaded into the bag. Re-install bag over the bypass fitting and again re-attach ring to the top plate with the six cam locks.
17. Using the glove ports, loosen the meter nuts holding the bypass fitting (primarily the inlet) until an audible flow of gas can be heard. Purge slowly. Do not loosen this nut excessively and release a great amount of gas. This could disrupt the customer's service.
18. Squeeze air/gas out of the bag and continue purging through the bag bulkhead fitting for about 1 ½ minutes. Use the included 10' length of hose to vent the purged gas away from the work area.
19. Position new meter within the bag for purging. Insert the rubber stopper at the purge hose into the outlet of the new meter.
20. Purge the new meter by opening the ¼ turn purge valve. Flow 1 cubic foot of gas though the meter outlet. This will allow the gas in the bag to enter the meter inlet and the air to be purged from the meter outlet through the bulkhead fitting to atmosphere.
21. After passing 1 cubic foot of gas through the meter outlet or five seconds of purging, close the purge valve. The new meter is ready to hang.
22. Remove the bypass fitting and lower carefully to the bottom of the bag.
23. Replace meter gaskets and raise new meter to the meter nuts and tighten them by hand.
24. Open ¼ turn purge valve and squeeze excess gas from the bag and vent purged gas away from work area through 10' hose..
25. Remove the bag assembly and fully tighten the meter nuts with a pipe wrench.
26. Remove the remaining components from the meter set. Soap the meter connections for leak tightness. Tighten as needed. The change out is complete.

StayLit Meter Exchange Bag Compressed Natural Gas (CNG) Alternate Feed Tank Procedure

1. Inspect the CNG tank and its components and ensure they are in proper working condition.
2. Slightly turn the stopcock at the riser to confirm it will operate. Do not shut off gas flow all the way.
3. Connect three-cut pressure regulation unit to CNG tank. Ensure connection is tight to avoid leaks.
4. Mount the bypass across the meter set. Using the union connection, attach the CNG tank and regulation configuration to the existing three-way valve on the bypass. Hand-tighten the union connection. NOTE: The residence is STILL FEEDING VIA BYPASS at this point.
5. Slowly open the valve at the CNG tank and monitor pressure.
6. Slowly loosen CNG tank union connection and purge air out of the tank's hose for 30 seconds. Once purging is complete, hand-tighten this connection again.
7. Slowly open the three-way valve at bypass to begin feeding the residence via the portable CNG tank. Monitor pressure at CNG tank.
8. Once the residence is feeding via the CNG tank, turn off gas flow at the riser stopcock.
9. Slowly loosen the meter set inlet swivel from the bypass to purge any gas from the line and then completely disconnect. Once fully disconnected, perform any necessary meter loop rebuilding, riser stopcock and/or regulator work needed upstream of the meter set inlet swivel. Keep in mind the residence is feeding via the CNG tank. When replacing the existing regulator, the new regulator must be tested for flow and lock up. Use test fitting and 7" water column manometer to conduct this testing.
10. Once all upstream work is complete, reconnect the meter set inlet swivel to the bypass. Hand-tighten this connection.
11. Loosen the inlet swivel connection and slowly open the stopcock at the riser to purge the line. Wait for 30 seconds. Once purge is complete, hand-tighten the inlet swivel connection
12. Slowly turn the three-way valve to discontinue feed from the CNG tank and shut off the valve at the CNG tank. Disconnect the Bypass/CNG tank connection and set the CNG tank aside.

13. Install new meter set per Continuous Service Restoration and Meter Change-Out System instructions.

Turn On Procedure

See Turn-on Procedure Supplement Section 1.0 for procedures.

Turn-On Procedure for Elevated Pressure

See Turn-on Procedures Supplement Section 1.0 for procedures.

Regulator Testing Procedures

See Turn-on Procedures Supplement Section 2.0 for procedures.

Setting Monitor and Control Regulator

See Turn-on Procedures Supplement Section 3.0 for procedures.

Two Pound Single Regulator Testing Procedures

See Turn-on Procedures Supplement Section 2.0 for procedures.

Pressure Limiting Valve Test (PLV)

See Turn-on Procedures Supplement Section 4.0 for procedures.

Shut-In Test

See Turn-on Procedures Supplement Section 5.1 for procedures.

Purging House Lines

See Turn-on Procedures Supplement Section 6.0 for procedures.

Lighting and Checking Appliances

See Turn-on Procedures Supplement Section 7.0 for procedures.

Turn-Off Procedure

Safety Precautions:

1) Use the proper tools to tighten fittings.
2) Do not smoke or introduce other sources of ignition around meter sets when gas is, or has been, run to the installation.
3) Protect yourself, wear the personal protective equipment required to do the job safely.
4) Good housekeeping reflects careful job planning and safe work practices. It eliminates many of the hazards that might otherwise cause accidents. A clean job is a safer job. Good housekeeping is necessary in every job at The Company.

Steps:

1) Arrival and Contacting the Customer:
   a) Verify the address.
   b) Verify that the customer is moving or has moved out.
   c) Verify the meter serial number.
2) Close and lock the service inlet valve. If a locking plate is available and compatible with the lock wing valve, it should also be installed with the appropriate locking device.

   ALTERNATIVE: If equipped, close the internal meter valve[1][2][3] and proceed to Step 9.
3) From the service order, determine the meter status code. Refer to Change/Remove Meter & Regulator Procedures.
4) Determine if the meter installation should be removed. Refer to Change/Remove Meter & Regulator Procedures.
5) If the meter is not due for repairs and appears to be in good condition, the disposition of the meter in the absence of other specific instructions depends on its possible reuse at the same location
6) If it appears the meter will not be used again at its present location within six months (or other period of time designated by management), remove the meter and regulator(s) and return to meter stock. Refer to Change/Remove Meter & Regulator Procedures.
7) Depending on the meter status, the meter will be used or returned to the Meter Shop.

8) If the meter is not removed, an approved secondary shut-off shall be utilized to restrict flow into the house line (such as a blind disc and gasket installed in the outlet of the meter, point-of-service valve closed and locked, or, if equipped, close the internal meter valve[(1)(2)]).
9) Read the meter and complete the service order.

NOTES:

(1) Meters equipped with an internal shut-off valve may only be actuated by authorized and trained personnel with the proper equipment.

(2) The internal meter shut-off valve may be used for up to 30 days. After 30 days, an alternative approved secondary shut-off must be utilized.

(3) After 30 days, the meter must be removed or the service inlet valve must be closed and locked and an approved secondary shut-off must be utilized.

A. Removing Pipeline Liquids

A. 1. *Rotary Meters*

Prior to transporting rotary meters, as much liquids as possible must be drained. Only a 3% liquid remainder is allowed.

Procedure:

Rotary meters have three locations where liquid needs to be removed; in the index or T.C. end and in both ends of the meter body. Caution: The meter end cover is pressurized. Relieve pressure before removing the liquid or fill or drain plug from the meter.

1. Shut off gas to meter and relieve line pressure.
2. Remove liquid fill plug at top of index (T.C. end).
3. Place a liquid capture container under drain plug.
4. Remove drain plug.
5. Allow liquid to drain into container.
6. When liquid stops flowing, including large drips; reinstall drain plug and fill plug.
7. Repeat steps with remaining chambers at both ends of meter body. Plugs are hex head.
8. Transport and dispose of liquids following approved procedures.

A. 2. *Diaphragm Meters*

Tin or iron case diaphragm meters removed from the field must be drained of liquids.

Procedure:

1. Take meter out of service, keeping meter in an upright position.
2. Place liquid capture container in such a position as will collect drained liquid when meter is tipped.
3. Tip meter to allow liquid to drain. Meters are slow to drain. The amount of liquid which will drain depends on where the meter was installed.
4. Allow liquid to drain into the container.
5. When liquid stops flowing, including large drips; set meter upright.
6. Cap the inlet and outlet of meter.
7. Transport and dispose of liquids following approved procedures.

A. 3. *Regulators*

Some regulators, including the Fisher model 733, may contain liquids. A good indication that the regulator may contain liquids is that it will emit a bad odor. When these regulators are removed from the field, they must be drained of liquids

Procedure:
For draining liquids from regulators, follow the same procedure as for draining a diaphragm meter.

A. 4. *Main Line Drips*

Main line drips are located in low spots in the distribution system for the purpose of collecting pipeline liquids. When pumping pipeline liquids from drips during normal maintenance follow the approved procedure for liquid removal. If the drip is to be removed from the system, any liquids must first be removed.

Procedure :

- Containers for collection can be 5-gal steel pails, 30-gal steel drums or 55-gal steel drums depending on the size needed. Depending on the material a “Used Oil” or “Material for Recycle” label must be attached to the pail or drum. The container must be DOT UN-specification.

- PPE – Due to the potential for polychlorinated biphenyls (PCB), Modified Level D Protection is recommended. Modified Level D Protection includes single-use disposable vinyl or nitrile gloves, disposable Tyvek coveralls, chemical splash goggles, disposal boot covers or waterproof boots.

Mains with MAOP 11” w.c.:

Procedure:

Refer to the Corporate Purge Procedures for draining Pipeline Liquids

1. Connect a hose to the drip stem and pump the pipeline liquid from the drip.
2. Close the valve and disconnect hose from the drip and drain hose into approved capture container.

3. Apply thread sealant compound to plug threads and reinstall into drip stem valve.
4. Soap test the valve and plug for leaks.
5. Transport and dispose of liquid following approved procedures.

Mains with MAOP of 15 psig or higher:

<u>Procedure:</u>

1. Slowly open the valve on the drip stem enough to allow system pressure to force pipeline liquid from the drip into an approved capture container.
2. Once liquids have been removed, close the valve.
3. Apply thread sealant compound to plug threads and reinstall into drip stem valve.
4. Soap test the valve and plug for leaks.
5. Transport and dispose of liquids following approved procedures.

A. 5. *SEPARATOR, ACCUMULATOR, OR FREE LIQUID VESSELS*

Sources of gas that do not provide “pipeline quality” gas supply may require a separator, accumulator, or a free liquid vessel to be placed in-line to capture liquids that precipitate out of the gas stream due to various factors. This equipment must be inspected periodically and emptied to ensure that liquids do not enter the distribution system. Some installations may have automated controls to evacuate any accumulated liquid or to shut-in the supply at predetermined liquid levels.

For installations that have manual controls, refer to existing main line drip liquid removal and disposal procedures.

For installations that have automatic controls to evacuate liquids to an onsite storage container, follow the below periodic inspections to ensure reliable equipment operation. To evacuate liquid contents from a pressurized onsite storage container, follow existing main line drip liquid removal and disposal procedures. If onsite storage container is not pressurized, contact Environmental.

The liquids disposal procedure below addresses installations where the supply will be shut-in when the liquid level reaches the predetermined level with a manual reset actuator.

Periodic Inspection

- Monthly:
  - Read site glass for liquid level
  - Test Pressure and Level Switches per manufacturers procedure
- Annually:
  - Inspect stick pilot and actuator or dump valve per manufacturers procedure
  - Evaluate and Maintain Pressure and Level Switches per manufacturers procedure

Procedure

1. Read site glass for liquid level
2. If liquid is present, evacuate contents of vessel to approved container. Follow existing main line drip liquid removal and disposal procedures.
3. If appropriate, contact Gas supply operator to collect and dispose of liquid (coordinate with Environmental Department if necessary). CenterPoint Energy shall have an authorized representative on site during liquid collection.
4. Once liquids have been evacuated from the vessel, if actuator has closed, shutting in the source of gas, confirm proper operation of the pressure switch and level switch utilizing monthly manufacturers procedures.
5. Once pressure and level switches are confirmed operational, verify the distribution system is operating normally and ready to resume gas flow by confirming system pressure downstream of isolated vessel.
6. If system is operating normally or ready to resume gas flow, slowly reset actuator to the open position.

7. Monitor downstream pressure to insure source of gas is feeding normally and within expected pressure range.
8. If placing the actuator in the open state causes abnormal operation, return actuator to closed state and contact your Supervisor.
9. Document results of inspection, repair, and/or disposal in work order completion.

A. 6. *Pipeline Liquid found elsewhere in our distribution system*

Procedure:

A crew may also come across liquids unexpectedly in the distribution system. Generally in these cases, a spill has occurred, and the *Procedures for a Hazardous Material Spill* must be followed.

B. Transporting Pipeline Liquids

In compliance with the Department of Transportation (DOT) rules, 49 CFR 173, hazardous materials must legally be transported in a securely closed container. Use only the approved containers to transport liquids drained from the distribution system to a collection point.

B.I. Transportation and handling of odorant and/or distillate in quantities of **119 gallons or less**.

1. Drivers must have completed HazMat Training
2. Drivers and handlers must have completed Emergency Response Training
3. Drivers must have a copy of the Emergency Response Guide Booklet or Emergency Response Guide documentation available on the vehicle.
4. Tank and / or Drum must be properly labeled:
    a. Identification Number
    b. Hazard Class
    c. Substance / Health Identity Label
    (Contact safety department for labels containing the above info)
5. SDS for distillate / condensate
6. Handlers must adorn the proper PPE:
    a. Goggles or face shield
    b. Nitrile or Neoprene Gloves
    c. Rubber boots for spills

B.II. Transportation and handling of odorant and/or distillate in quantities of **119 gallons or more**.

1. Vehicles must be Placarded
2. Vehicle must carry Proper Shipping Papers
3. Drivers must have completed HazMat Training
4. Drivers and Handlers must have completed Emergency Response Training
5. Driver must be a CDL Licensed Driver
6. Driver must have a HazMat Endorsement
7. Driver must have a Tanker Endorsement
8. Vehicle must be registered as a HazMat Carrier
9. Hazardous Materials Security Plan Document

10. SDS for distillate / condensate
11. Handlers must adorn the proper PPE
    a. Goggles and Face Shield
    b. Nitrile or Neoprene Gloves
    c. Rubber boots for spills

C. Storage

- Waste liquids must be stored on a spill control pallet or some form of approved secondary containment. See Environmental Programs for additional guidance.

- Soaked rags, spill kit material, dirt, PPE, pump tubing, clothing or gloves that come into contact with pipeline liquids will be stored at designated collection sites. Place into drums marked "Used Rags and Sorbents" – See Environmental Programs for “region specific” labeling requirements.

D. Disposal
See Environmental Programs.

Pipeline Liquids Spill Procedures

1. Evaluate the situation. If there is any potential for danger, evacuate all people at risk. Extinguish all sources of ignition such as sparks from equipment, open flames or lit cigarettes. Pipeline liquids may have an odor similar to that of natural gas and could cause an extreme number of “outside” leak complaints.

2. Stop the source of the spill and contain it. If the area around the spill is safe, find and stop the source of the spill if possible. Personal safety should be the main concern at all times. Wear a full face safety shield, safety goggles, or safety glasses with side shields, nitrile or neoprene gloves, a long-sleeved shirt and approved respirator. In certain situations, pipeline liquids vapors may be neutralized using fire fighting foam or a water spray. Control flow of spill by diking, and use of absorbents and absorbent booms. Absorb the spill in a dry, inert material (sand, kitty litter, etc) or with absorbents from the Vehicle Emergency Spill Kit.

3. Notify the supervisor. Contact your supervisor during normal working hours or the duty supervisor during off hours. Be prepared to supply the information on the spill checklist (see page 5).

4. Notify Environmental Programs. Call this number (available 24 hours a day, 7 days a week) and, if necessary, leave your call-back number after the tone:

Arkansas & Oklahoma	Louisiana, & Mississippi	Minnesota	Texas
(501) 258 1358	**(318) 510-5119**	**(612) 916-9213**	**(832) 470-3098**

Your Regional Environmental Specialist will call you back immediately. When Environmental Programs calls, be prepared to supply the information on the spill checklist. Environmental Programs will provide guidance to the crew on containment, cleanup and storage of the spill material. Environmental Programs may also decide to inspect the spill site.

SPILL CHECKLIST

Crew contact person

Date/time/weather conditions when spill occurred

What spilled/how much?

Where was it spilled (water, sewer, road, grass, etc)?

Address of the spill (including city and county)

Is the spill contained?

Are any additional supplies/equipment needed to control/contain the spill?

How did this spill occur?

Were any emergency precautions taken (evacuation, etc)?

Were any authorities (police, fire department, ambulance) notified?

Are there any injuries? If so, to what extent?

Is there any other information you wish to add?

Hazard Tree

See Gaseous Atmosphere Supplement Section 2.1 – Hazard Tree

Hazard Tree Definitions

See Gaseous Atmosphere Supplement Section 2.1.1 – Hazard Tree Definitions

Special Precautions for Gaseous Atmospheres

See Gaseous Atmosphere Supplement Section 1.4 – Special Precautions for Hazardous Atmosphere

Survey Procedures

Leak Surveys

The type of surveys used must be one or more of the following, employed singly or in combination, or some other effective procedure for locating leaks:

- Gas Detector Surveys
- Bar Test Surveys
- Vegetation Surveys
- Pressure Drop Surveys
- Soapsuds Testing on Exposed Facilities

Note: Leaks found in the vicinity of transmission lines

Transmission lines are typically high pressure lines that transport significant volumes of natural gas and therefore any leak must be rigorously evaluated to determine the source of the leak. Transmission lines and distribution lines run parallel to and cross each other throughout the operating systems and pose a challenge to making a determination as to the source of any detected leak.

Whenever a transmission line is in close proximity to a suspected leak, reasonable steps must be taken to pinpoint the leak on the transmission line or eliminate the possibility that the transmission line is the source of the leak.

A transmission line is considered in close proximity if the possibility of gas migrating from the line to the site being investigated cannot be reasonably ruled out.

Qualifications of Leak Survey Personnel

- Only trained personnel will execute leak surveys.
- Leak survey training will be "on-the-job" and/or "formal" training that will enable the surveyor(s) to recognize a hazardous leak situation, and whether or not they require additional assistance to locate or make safe the leaking facility.
- Anyone who makes this type of survey should be both trained and experienced in the use of the instrument. The employee should know and understand its basic operating principles and know how to check its sensitivity. The employee should also have a working knowledge of the vegetation survey method and be experienced in the use of combustible gas indicators.

Gas Detector Survey

Mobile leak detector surveys and walking leak detector surveys employ instruments such as Flame Ionization Units, Infra-Red Detectors, Continuous Sampling Combustible Gas Indicators, and Optical Methane Detectors (OMD) Laser and Cavity Ring-Down Spectroscopy. These are extremely sensitive devices that test the air at the ground surface above the mains and services for indications of gas. They can often pinpoint leaks in areas where gas can readily escape to the atmosphere. Although less efficient in areas where the streets are paved from building to building so that gas can escape to the atmosphere only through breaks and cracks in the paving, mobile detectors are still very effective in picking up evidence of leakage. When leakage is indicated, bar testing and sampling with a combustible gas indicator must be done to establish the repair priority. Weather also limits the use of these devices since wind and rain make it difficult to accurately sample the atmosphere. The employee shall refer to the manufacturer’s guidelines for the device being used to determine the appropriate limits. If these guidelines are not available, surveys should neither be conducted during rain nor when the wind velocity is determined to be above 15 miles per hour.

The instrument used should be checked daily and periodically calibrated. The manufacturer's recommendations should be followed.

Vegetation Survey

The vegetation survey is a visual examination of a distribution system searching for areas of dead grass, other dead vegetation, or bare discolored soil over or adjacent to gas mains. All such surface indications should be investigated since they may indicate gas leakage. The size of the surface indication has no direct relation to either the size of the leak or the quantity of gas escaping.

The vegetation survey method of detecting leaks is used in conjunction with all other methods. The proper method of investigating possible leakage spots indicated by dead vegetation is to systematically bar-test the individual area.

Bar-Testing Survey

1) Systematic bar-testing of mains and services in a limited area is the most effective method of furthering the investigation of surface indications of leakage found by any of the survey methods. Usually only a few bar holes will be necessary in these cases. The extent of the bar-testing in such an area will depend largely on the surface indications of leakage.
2) An air compressor and drill are necessary for drilling through concrete pavement. Pipe locator, combustible gas indicator, miscellaneous small hand tools, and proper safety equipment are also necessary items of equipment.
3) Before bar-testing mains located under gravel, asphalt topping, or concrete pavement, one should first accurately locate the main with a pipe locator and determine its depth, also using a pipe locator. Then use a probe bar to penetrate the soil at the side of the main to a point near the bottom of the pipe.
4) Efforts to pinpoint a leak under paving or crusted soil may occasionally be impeded by pockets of accumulated gas which mask the direction of the leak. To facilitate the search, it may be necessary to leave the bar holes open for an extended period to allow the gas to dissipate. The time required for ventilation may be greatly reduced, however, by vacuuming each affected bar hole with an aspirator powered by an air compressor.
5) The nature and condition of the soil are the big factors in the results that can be obtained by bar-testing. Wet black gumbo soil will sometimes seal leaks on utilization pressure and intermediate pressure mains. When black gumbo dries out, it usually shrinks and cracks allowing an almost unrestricted flow of gas from some leaks. Some clay soils show the same reaction to changes in moisture content. Sand, sandy loam, or a sandy clay will usually dry out around the leak and the gas will permeate the soils above the dry area.

Rooftop and Sidewall Piping Survey

Leak surveying rooftop and sidewall (vertical) mains, service lines, and meter sets may require extra consideration to ensure the safety of the employee, the public and to prevent damage to private property. Areas that may be exposed to falling hazards from the leak survey should be barricaded and marked with cones, signs, tape, or other means. If you have questions concerning these safety considerations, contact your supervisor before performing this survey.

Consideration should be given to environmental conditions, such as wind, when performing these surveys. Reschedule the survey for another day if conditions are not conducive for an effective survey.

An atmospheric corrosion inspection will be conducted as part of this leak survey.

Survey procedure:

1. At ground level, survey around the riser (or vertical main), from the riser to the building and along the building, immediately behind the riser.

2. Standing at the riser, survey up the riser as high as can be reached, including all fittings.

3. Above your reach, visually inspect the riser along its length, to the roof. Look for deteriorated coating, corrosion, damaged fittings, connections or pipe that might result in a leak. Inform your supervisor of any of these conditions so a more detailed inspection/survey will be scheduled.

4. With safety in mind, access the roof and proceed to the edge of the roof. Survey the air around the upper end of the vertical pipe run.

5. Continue surveying rooftop piping up to and including all meter sets.

6. Follow additional company policy upon discovery of any leaks or corrosion.

Waterway Crossing Piping Surveys

Leak surveying mains and services crossing waterways or bodies of water may require extra consideration to ensure the safety of the employee and the public. In addition to the types of surveys stated above that may be used, the survey may also include visual detection of bubbles. Optical assistance, such as binoculars, may be used to detect bubbles, erosion along the river banks and accumulation of debris in the vicinity of the pipeline crossing.

Depending on the water depth, length of the crossing and range of detection tools, special transportation may be necessary to survey the crossing. The technician should contact their supervisor for scheduling, determining type of special transportation necessary, and reviewing safety considerations prior to conducting a survey. Consult with the safety department as needed.

Picarro Survey

Leak Surveys performed with the Picarro Surveyor™ require a minimum of at least two nighttime runs of the survey area. Its preferable to run each survey on a different night. However, in Survey areas with long travel time, low mileage or other factors that make surveying two separate nights impractical the two runs may occur on the same night. Runs shall include both sides of the street as well as accessible areas relative to CNP distribution or transmission assets. These runs must occur within allowable condition limits as detailed in the Picarro Surveyor Users Guide. The Picarro Surveyor™ can be utilized as a leak detection tool with either daytime or night time runs and with less than 2 runs.

Each Region shall review the Surveyor™ run results to ensure they are complete. When the coverage is deemed complete the “Compliance Report” for the leak survey area shall be run in Picarro PCubed™. An area requiring investigation is referred to as a Leak Investigation Search Area or LISA. A LISA investigation WO for each LISA generated by the Picarro Compliance report, will be created in SAP and dispatched via Mobile Data to a Leak Survey Technician for investigation. Each LISA is to be fully investigated by a qualified Leak Survey Technician. Results of each LISA Investigation are to be entered in the corresponding LISA Investigation WO in Mobile Data. Areas that are outside of the Surveyor™ Field of View (FOV) are referred to as GAP Surveys. There will be GAP Survey Work Order or Work Orders created and GAP’s will be surveyed by a qualified Leak Survey Technician utilizing traditional Gas Detector Survey Methods. Results of GAP Surveys will be entered in the GAP Survey WO in Mobile Data. Records of Picarro Surveys will be kept in SAP and GIS.

Leak Investigation – Guidance for Difficult Conditions

Only trained and Operator Qualified personnel will conduct leak investigations.

Personnel should contact their Supervisor for additional guidance if, in their judgement, factors exist which prevent performing a leak investigation protecting life and property.

First…Protect Life and Property. Ensure that the area is made safe. Institute evacuations as necessary. Contact Supervisor.

Potential factors that can negatively affect leak investigations include, but are not limited to:

- inability to gain access
- weather conditions – heavy rain, snow, high wind, ground freeze, etc.
- ground saturation – high water table which prevents effective bar holing
- inability to bar hole – concrete or other hard surface
- conditions which are outside the usage recommendation of the leak survey instrument(s) manufacturer.
- other as determined by investigating personnel

A supervisor or above may incorporate additional resources and technology if personnel have contacted them and indicated that, in their judgement, conditions exist (including weather) that prevents them from performing a leak investigation that reasonably protects life and property. This may include, but is not limited to:

- incorporating company approved infrared walking ppm technology such as Heath DPI
- incorporating company approved laser leak detection technology such as Heath RMLD
- request TFO Leak Survey
- use Picarro Surveyor™- if available
- use leak detecting canine - if available
- expand survey area – conditions may increase distance of migration
- inside leak investigations of all structures in the area relative to the leak call

- survey potential other migration paths, even those away from company gas facilities – i.e. sewer lines, phone conduit, etc.
- vapor extraction units (VEU)
- map review
- potential leak point digs – service taps, etc.
- vent with excavation equipment.

If in the judgement of the next level supervisor or above that an adequate leak investigation cannot be executed, they should:

- notify the appropriate operations manager
- consider evacuation of a larger area of potentially effected structures until an adequate leak investigation can be performed
- consider isolating and pressure testing main and services that could be contributing to the potential leak
- Coordinate with Gas Control and/or Engineering to pressure test isolated sections when the test section system is monitored by Gas Control or the test section warrants engineering review per Regional practices.

Survey Schedule

Leak surveys in Texas will be scheduled according to the risk based leak survey plan (The Plan) approved by the Railroad Commission of Texas. The Distribution Integrity Group will determine any proposed revisions to the base leak survey frequencies in the Plan and modifications to the initial risk based leak survey schedule frequencies. The revisions to the Plan will be filed with the Railroad Commission for approval and once approved will become a part of the Plan. The acceleration or resetting of leak survey frequencies will be completed according to the criteria established in the Plan, documented and made available during field audits.

All other states will use the following schedule.

1) Leak survey distribution system mains and services every five years, except for those facilities that have operational considerations.
   a) Operational consideration facilities are surveyed on a more frequent basis. The frequency of survey must be determined by the severity of the conditions that could cause failure or leakage, and the consequent hazards to the public safety. Included, but not limited to:
      i) Cast Iron Mains
      ii) Compression coupled mains
      iii) Bare steel mains
      iv) Special maintenance mains
      v) Special high pressure (transmission) pipelines that have a MAOP of more than 20% SMYS
2) Leak survey high-pressure distribution system mains (pressure greater than 60 psig and a SMYS of less than 20%) every five years.
3) Customer owned service lines downstream of the meter will not be surveyed unless state regulations require that customer owned service lines be surveyed. Written notice will be sent to customers having customer owned service lines.
4) Business districts will be surveyed every calendar year not to exceed 15 months.

Chain of Custody Guidelines for the Removal, Handling, and Storage of CenterPoint Energy Equipment Following an Incident

The Chain of Custody Procedure and the forms to be used are available in PowerForms, forms numbered CNP 1178, CNP 1178A, CNP 1178B and CNP 1178C.

Form CNP 1178D is the tag to be used to mark the equipment removed. The tag must be ordered from the warehouse.

Copies of the Forms are attached for reference only. Working copies should be printed from PowerForms.

Chain of Custody Guidelines for the Removal, Handling, and Storage of CenterPoint Energy Equipment Following an Incident

"Chain of Custody" is an important legal consideration that must be observed. When a piece of equipment is removed from an incident scene, a record must be kept to show who handled the equipment and where it is stored following removal from the incident scene. It is extremely important that equipment possibly involved in an incident and removed from the incident scene be properly handled and preserved, as it may become evidence in a legal proceeding.

If the incident results in third-party property damage, bodily injury, or if in the judgment of the responsible Operations management the situation warrants it, the Claims Department should be contacted as soon as practical. In that event, a claim number will be issued and will be placed on the Physical Evidence and Chain of Custody Form and Photo/Video/Data Collection Verification Log. Once a SAP Work Order number is generated, it will be entered on these documents as well.

IMPORTANT - Do not remove equipment from an incident scene until the Fire Marshal or other applicable authority has released the scene or otherwise authorized the removal of CenterPoint Energy's equipment from the scene.

1. Before removing any CenterPoint Energy equipment, document the scene appropriately, which should include taking pictures and/or video from various angles of the equipment in its original location as it was found immediately after the incident, as well as the surrounding area. Time and date stamp whenever possible. Return pictures and completed Photo Verification Log to the appropriate local office or designated location.

2. After the incident scene has been released or authorization granted by the Fire Marshal or other applicable authority, remove CenterPoint Energy's affected equipment and all associated piping and fittings in their existing condition as much as possible, taking care to avoid damaging the equipment during the removal. Protect damaged areas of equipment with best method and appropriate material (plastic, rags, etc.) during the removal and transportation. All shipping documents will be kept with the original documents.

3. Tag removed equipment with description, date, address, and investigator's initials and employee number, and complete and attach Physical Evidence and Chain of Custody form. (For retained investigators or consultants, their signatures are required in lieu of initials and employee number.) Photos/videos should be taken of the marked equipment to document its condition at the time of removal from the field. Any such photos/videos should be logged on the PhotoVideo/Data Collection Verification Log. If the Claims Department is involved, any pictures/videos must be sent to the Claims Department. Otherwise, the local office or designated location should keep the photos/videos. If the equipment removed includes a gas meter, email the Meter Reading Department at MeterReadingDepartment@CenterPoint Energy.com with the incident address, meter number and current location of meter. Meter reading will determine if the meter has an ERT with internal data storage and if so, will download the data, save it to a secure site and document transactions on the Photo/Video/Data Collection Verification Log.

4. Deliver removed and marked equipment to the appropriate local office or designated location. Update/complete the Physical Evidence and Chain of Custody form at this time.

5. The local office or designated location will store the marked equipment in a secure, locked location. Keys for this area will be assigned only to the appropriate individuals.

6. Testing or inspection of equipment subject to these guidelines will be coordinated by the appropriate Operations group (in consultation with the Claims Department, if necessary).

7. Any time a piece of equipment subject to these guidelines is inspected or transferred to a different person or location, the appropriate log entries must be made to document the action.

8. Written approval from the Claims Department is required before disposing of equipment subject to these guidelines.

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PHOTO / VIDEO / DATA COLLECTION VERIFICATION LOG

Fill in all boxes. For those that are not applicable, use NA.

DATE OF INCIDENT	SAP WORK ORDER NUMBER	CENTERPOINT ENERGY CLAIM NUMBER	
INCIDENT LOCATION ADDRESS		CITY	ZIP

METER READING NOTIFIED (Date)	IS IT AN ERT METER? ☐ Yes ☐ No	DOES THE ERT HAVE INTERNAL DATA STORAGE? ☐ Yes ☐ No	ERT ID#
DATA FIELD COLLECTED BY (Employee name)		DATE	EMPLOYEE NUMBER
DATA TRANSFERRED TO SHARE POINT FOLDER By (Employee name)		DATE	EMPLOYEE NUMBER

PHOTOGRAPHER (Employee name)	EMPLOYEE NUMBER
DATE PHOTOS / VIDEO TAKEN	NUMBER OF PHOTOS / VIDEO TAKEN

DESCRIPTION OF PHOTOS / VIDEO

#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
#11

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PHYSICAL EVIDENCE AND CHAIN OF CUSTODY

Fill in all boxes. For those that are not applicable, use NA.

SAP WORK ORDER NUMBER	CENTERPOINT ENERGY CLAIM NUMBER

PHYSICAL EVIDENCE

1. Description

EQUIPMENT/METER TYPE/SIZE	MFG	SERIAL NUMBER/PRINTLINE	READING

REGULATOR TYPE / SIZE	MFG

IF METER WAS REMOVED, WAS METER READING DEPARTMENT NOTIFIED BY EMAIL AT MeterReadingDepartment@CenterPointEnergy.com WITH INCIDENT LOCATION, METER NUMBER AND CURRENT METER LOCATION? ☐ Yes ☐ No

IF YES, DATE NOTIFIED	IF NO, WHY?

OTHER

2. Removed From

NUMBER & STREET NAME

CITY, COUNTY, STATE, ZIP CODE

REASON REMOVED	REMOVED BY (Employee signature)	EMPLOYEE NUMBER

REMOVE DATE	REMOVED TIME

3. Transported By

NAME (Signature required)	TITLE
LOCATION	PHONE NUMBER
RECEIVE DATE	RECEIVED TIME

4. Received By

NAME (Signature required)	TITLE
LOCATION	PHONE NUMBER
RECEIVE DATE	RECEIVED TIME

CHAIN OF CUSTODY

DATE	TIME	TRANSFEROR	RECIPIENT	REASON FOR TRANSFER	SIGNATURE OF RECIPIENT

NOTE: This form is to remain with the evidence and/or the custodian. Use this form to record any transfer of evidence to another location and/or person.

CNP 1178B (3-2016)

CenterPoint. Energy

NON-DESTRUCTIVE EVIDENCE INSPECTION LOG

DATE

PARTY'S NAME	ADDRESS	CNP CLAIM NUMBER

NAME	COMPANY	REPRESENTING	EMAIL ADDRESS	COMMENTS

Return to Specifications

SAMPLE ONLY

INCIDENT EQUIPMENT PHYSICAL EVIDENCE

CNP 1178D (12-2011)

CNP CLAIM #		SAP WORK ORDER #
EQUIPMENT SIZE	MFG	SERIAL NUMBER/PRINTLINE
OTHER		

ADDRESS REMOVED FROM (NUMBER & STREET NAME)	
CITY, COUNTY, STATE, ZIP CODE	
REASON REMOVED	REMOVED BY
DATE REMOVED	TIME REMOVED

Leak Classification Procedures

GRADE	DEFINITION	ACTION CRITERIA	EXAMPLES
'A'	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.	Requires *prompt action** to protect life and property, and continuous action until the conditions are no longer hazardous. Identify the extent of gas migration by locating the 0% perimeter of the migration area and document appropriately. *The *prompt action* in some instances may require one or more of the following: a. Implementation of the company emergency plan. including checking buildings for conditions that could threaten the safety of occupants b. Evacuating premises. c. Blocking off an area. d. Rerouting traffic. e. Eliminating sources of ignition. f. Venting the area. g. Stopping the flow of gas by closing valves or other means. Notifying police and fire departments.	1. Any leak which, in the judgement of operating personnel at the scene, is regarded as an immediate hazard. 2. Escaping gas that has ignited. 3. Any indication of gas which has migrated into or under a building, or into a tunnel. 4. Any reading at the outside wall of a building, or where gas would likely migrate to an outside wall of a building. 5. Any reading of 4% gas (80% LEL), or greater, in a confined space. 6. Any reading of 4% gas (80% LEL), or greater, in a small substructure (other than gas associated substructures) from which gas would likely migrate to the outside wall of a building. 7. Any leak that can be seen, heard, or felt, and which is in a location that may endanger the general public.

GRADE	DEFINITION	ACTION CRITERIA	EXAMPLES
'B'	A leak that is recognized as being non-hazardous at the time of detection, but justifies scheduled repair based on probable future hazard.	Leaks should be repaired or cleared within 12 months from the date the leak was reported. Identify the extent of gas migration by locating the 0% perimeter of the migration area and document appropriately. In determining the 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. Soil type, and soil conditions (such as hardened cap, moisture and natural venting).	A. *Leaks Requiring Action Ahead of Adverse Changes in Venting Conditions:* Any leak which, under adverse soil conditions, would likely migrate to the outside wall of a building. B. *Leaks Requiring Action Within Twelve Months:* 1. Any reading of 2% gas (40% LEL), or greater, under a sidewalk in a wall-to-wall paved area that does not qualify as a Grade A leak. 2. Any reading of 5% gas (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 A leak. 3. Any reading less than 4% gas (80% LEL) in small substructures (other than gas associated substructures) from which gas would likely migrate creating a probable future hazard, except in sewers and storm sewers. (Continued on next page)

GRADE	DEFINITION	ACTION CRITERIA	EXAMPLES
'B' (Continued)			4. (Continued) Any reading between 1% gas (20% LEL) and 4% gas (80% LEL) in a confined space 5. Any reading of 4% gas (80% LEL) or greater, in gas associated substructures. 6. Any leak which, in the judgement of operating personnel at the scene, is of sufficient magnitude to justify scheduled repair as a Grade B leak.
'C'	A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous.	Leaks should be repaired within 15 months or reevaluated every 15 months from the date the leak was reported. This reevaluation schedule should be repeated until the leak is either regraded, no longer results in a reading, or is repaired. Identify the extent of gas migration by locating the 0% perimeter of the migration area and document appropriately.	1. Any reading of less than 4% gas (80% LEL) in small gas associated substructures. 2. Any reading in areas without wall-to-wall paving where it is unlikely the gas could migrate to the outside wall of a building. 3. Any reading of less than 1% gas (20% LEL) in a confined space, except sewers and storm sewers.

Arkansas Leak Classification Procedures

In addition to the requirements described above, Arkansas requires the following leak classification and action criteria.

GRADE	DEFINITION	ACTION CRITERIA
Class 1 (A)	Leaks that represent an existing or probable hazard to persons or property and requires immediate repair or continuous action until the hazardous condition no longer exists.	
Class 2 (B)	Leaks that are considered non-hazardous at the time of detection, but could become hazardous if repair is not accomplished in a reasonable length of time.	Repair as soon as possible, but within a period not to exceed five (5) months.
Class 3 (C)	Leaks that are non-hazardous at the time of detection and can be expected to remain non-hazardous. These leaks should be re-evaluated during the next scheduled survey. Repair as time and expenditures permit.	

Texas Leak Classification Procedures

Leak classification and repair schedules for Texas are revised to comply with 16 TAC 8.207. See Figure 16 TAC §8.207 below for a summary of the Texas requirements. The Texas rules are patterned after the GPTC leak grading system. Where the rule refers to Grade 1 leaks, CenterPoint Energy will classify them as Grade “A” leaks. Grade 2 leaks will be classified as Grade “B”, and Grade 3 leaks will be classified as Grade “C”.

A Leaks

The basic definition and action criteria for “A” leaks is the same. The Texas rules do require immediate repair of “A” leaks in addition to requiring prompt action to eliminate the hazard.

Any leak that the Texas rules classify as Grade 2 but that require expedited repair scheduling will be classified as Grade “A” and repaired immediately.

B Leaks

The basic definition for “B” leaks is the same, but the Texas rules require repair within 6 months.

“B” leaks must be reevaluated once every 30 days until cleared.

Leaks that are classified as Grade “B” but require expedited repair scheduling before the full 6 month term are to be classified as Grade “A” leaks and repaired immediately.

C Leaks

The Texas rules require Grade “C” leaks to be repaired within 36 months. “C” leaks must be reevaluated during the next scheduled survey or within 15 months of the date reported, whichever is sooner.

Post Repair Inspections

For post repair inspection procedures, refer to Pipeline Repair Procedures/Safety Considerations (B-1.185).

These inspections are not necessary if the leak was repaired by remedial measures such as lubricating valves, tightening packing nuts on valves or similar actions which are considered routine maintenance.

Upgrading Leaks

If a leak is upgraded, the time until repair must be the shorter of the time remaining under the initial classification or the time allowed under the new classification.

Figure: 16 TAC §8.207(g)

GRADE	DEFINITION	ACTION CRITERIA	EXAMPLES
1	A leak that represents an existing or probable hazard to persons or property, and requires immediate repair.	Requires immediate repair. Requires prompt action to eliminate the hazardous conditions. The prompt action in some instances may require one or more of the following: ▪ Implementation an emergency plan (§192.615). ▪ Evacuating premises. ▪ Blocking off an area. ▪ Rerouting traffic. ▪ Eliminating sources of ignition. ▪ Venting the area by removing manhole covers, barholing, installing vent holes, or other means. ▪ Stopping the flow of gas by closing valves or other means. ▪ Notifying emergency responders.	▪ Any leak which, in the judgment of operating personnel at the scene, is regarded as an immediate hazard. ▪ Escaping gas that has ignited. ▪ Any indication of gas, which has migrated into or under a building, or into a tunnel. ▪ Any reading at the outside wall of a building, or where gas would likely migrate to an outside wall of a building. ▪ Any reading of 80% LEL, or greater, in a confined space. ▪ Any reading of 80% LEL, or greater in small substructures (other than gas associated substructures) from which gas would likely migrate to the outside wall of a building. ▪ Any leak that can be seen, heard, or felt, and which is in a location that may endanger the general public or property.
2	A leak that is recognized as being non-hazardous at the time of detection, but requires scheduled repair based on probable future hazard	Leaks shall be repaired or cleared within six months from the date the leak was reported. In determining the repair priority, criteria such as the following should be considered: ▪ Amount and migration of gas. ▪ Proximity of gas to buildings and subsurface structures. ▪ Extent of pavement. ▪ Soil type, and soil conditions (such as frost cap, moisture and natural venting). Grade 2 leaks should be reevaluated at least once every 30 days until cleared. Grade 2 leaks vary greatly in degree of potential hazard. Some Grade 2 leaks, when evaluated by the above criteria, may require a scheduled repair within the next five working days. Others will require repair within 30 days. During the working day on which the leak is discovered, these situations should be brought to the attention of the individual responsible for scheduling leak repair. On the other hand, many Grade 2 leaks, because of their location and magnitude, can be scheduled for repair on a normal	Leaks Requiring Action Ahead of Ground Freezing or Other Adverse Changes in Venting Conditions. Any leak which, under frozen or other adverse soil conditions, would likely migrate to the outside wall of a building. Leaks Requiring Action Within Six Months ▪ 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. ▪ 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. ▪ 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. ▪ Any reading between 20% LEL and 80% LEL in a confined space. ▪ Any reading on a pipeline operating at 30 percent SMYS, or greater, in a class 3 or 4 location, which does not qualify as a Grade 1 leak. ▪ Any reading of 80% LEL, or greater, in gas associated substructures. ▪ Any leak which, in the judgment of operating personnel at the scene, is of sufficient magnitude to justify scheduled

GRADE	DEFINITION	ACTION CRITERIA	EXAMPLES
		routine basis with periodic reinspection as necessary.	repair.
3	A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous.	These leaks should be reevaluated during the next scheduled survey, or within 15 months of date reported, whichever occurs first, until the leak is cleared, re-graded, or repaired within 36 months.	Leaks Requiring Reevaluation at Periodic Intervals ▪ Any reading of less than 80% LEL in small gas associated substructures ▪ Any reading under a street in areas without wall-to-wall paving where it is unlikely the gas could migrate to the outside wall of a building. ▪ Any reading of less than 20% LEL in a confined space.

MAXIMUM RECOMMENDED RATE OF FLOW (CAPACITY) THROUGH POSITIVE METERS AT HIGH PRESSURES

Inlet Gauge Pressure	Maximum **UNCORRECTED** Dial Rate (Flow Rate)						Maximum **CORRECTED** Dial Rate (Flow Rate) (Cubic Feet per hour @ Base Pressure 4 oz/Sq. In.)					
	Emco Meters						**Emco Meters**					
	800	**2-1/2**	**3**	**4**	**4-1/2**	**5**	**800**	**2-1/2**	**3**	**4**	**4-1/2**	**5**
4 oz.	1,600	1,800	2,500	5,000	6,000	10,000	1,600	1,800	2,500	5,000	6,000	10,000
5 psig	1,517	1,725	2,402	4,759	5,726	9,593	2,040	2,320	3,230	6,400	7,700	12,900
10 psig	1,471	1,661	2,301	4,626	5,516	9,193	2,480	2,800	3,880	7,800	9,300	15,500
15 psig	1,421	1,593	2,220	4,439	5,327	8,879	2,880	3,230	4,500	9,000	10,800	18,000
20 psig	1,368	1,537	2,111	4,264	5,109	8,528	3,240	3,640	5,000	10,100	12,100	20,200
30 psig	1,274	1,429	1,999	3,966	4,752	7,931	3,888	4,360	6,100	12,100	14,500	24,200
40 psig	1,178	1,339	1,848	3,723	4,473	7,472	4,400	5,000	6,900	13,900	16,700	27,900
50 psig	1,087	1,245	1,721	3,464	4,144	6,906	4,800	5,500	7,600	15,300	18,300	30,500
75 psig	1,013	1,143	1,584	3,152	3,805		6,200	7,000	9,700	19,300	23,300	
100 psig	920	1,035	1,443	2,887			7,200	8,100	11,300	22,600		
200 psig		798	1,105	2,218				11,700	16,200	32,500		
300 psig		670	931	1,857				14,400	20,000	39,900		
400 psig		593	823	1,650				16,800	23,300	46,700		
500 psig		549	732	1,523				19,300	25,700	53,500		
							Reference: EMCO Bulletins 1003, pg8 & 1033, pg6					

Inlet Gauge Pressure	**Metric Meters**						**Metric Meters**					
	25B	**35B**	**60B**	**80B**	**250B**	**500B**	**25B**	**35B**	**60B**	**80B**	**250B**	**500B**
4 oz.	900	1,500	2,000	2,500	6,000	10,000	900	1,500	2,000	2,500	6,000	10,000
5 psig	818	1,413	1,859	2,305	5,577	9,296	1,100	1,900	2,500	3,100	7,500	12,500
10 psig	771	1,305	1,779	2,195	5,279	8,897	1,300	2,200	3,000	3,700	8,900	15,000
15 psig	740	1,282	1,677	2,121	4,933	8,386	1,500	2,600	3,400	4,300	10,000	17,000
20 psig	718	1,224	1,604	2,027	5,066	8,022	1,700	2,900	3,800	4,800	12,000	19,000
30 psig	688	1,147	1,540	1,901	4,588	7,538	2,100	3,500	4,700	5,800	14,000	23,000
50 psig	634	1,042	1,381	1,744	4,076	7,019	2,800	4,600	6,100	7,700	18,000	31,000
75 psig	572	474	1,290	1,617	3,920	6,370	3,500	2,900	7,900	9,900	24,000	39,000
100 psig	549	907	1,213	1,533	3,576	6,003	4,300	7,100	9,500	12,000	28,000	47,000
150 psig	498			1,334	3,291	5,515	5,600			15,000	37,000	62,000
200 psig	464			1,296	3,139	5,186	6,800			19,000	46,000	76,000
250 psig	437			1,218	2,933	4,870	7,900			22,000	53,000	88,000
							Reference: American Meter Bulletin 320.2 1966					

Values listed in Tables are per the manufacturer's Maximum Allowable Capacity and are in excess of the 2" w.c. differential capacities.

MAXIMUM RECOMMENDED RATE OF FLOW (CAPACITY) THROUGH POSITIVE METERS AT HIGH PRESSURES

Inlet Gauge Pressure	Maximum **UNCORRECTED** Dial Rate (Flow Rate)						Maximum **CORRECTED** Dial Rate (Flow Rate) (Cubic Feet per hour @ Base Pressure 4 oz/Sq. In.)					
	Equimeter (Rockwell) Meters						**Equimeter (Rockwell) Meters**					
	750	**1600**	**1000**	**3000**	**5000**	**10,000**	**750**	**1600**	**1000**	**3000**	**5000**	**10,000**
4 oz.	1,600	1,600	2,200	3,000	5,000	10,000	1,600	1,600	2,200	3,000	5,000	10,000
5 psig	1,539	1,539	2,112	2,885	4,797	9,593	2,070	2,070	2,840	3,880	6,450	12,900
10 psig	1,471	1,471	2,028	2,764	4,603	9,223	2,480	2,480	3,420	4,660	7,760	15,550
15 psig	1,401	1,401	1,953	2,664	4,439	8,879	2,840	2,840	3,960	5,400	9,000	18,000
20 psig	1,364	1,364	1,875	2,457	4,264	8,528	3,230	3,230	4,440	5,820	10,100	20,200
25 psig		1,317	1,808	2,472	4,096	8,229		3,570	4,900	6,700	11,100	22,300
40 psig		1,192		2,330	3,723	7,446		4,450		8,700	13,900	27,800
50 psig		1,132		2,122	3,532	7,065		5,000		9,370	15,600	31,200
70 psig		1,034		1,937	3,234	6,469		5,980		11,200	18,700	37,400
100 psig		916		1,712	2,861	5,722		7,170		13,400	22,400	44,800

Reference:Equimeter Bulletin M-1021 Rev. 6, Page 6

Inlet Gauge Pressure	**American Meters**						**American Meters**					
	AL-425	**AL-800**	**AL-1000**	**AL-1400**	**AL-2300**	**AL-5000**	**AL-425**	**AL-800**	**AL-1000**	**AL-1400**	**AL-2300**	**AL-5000**
4 oz.	900	1,700	2,200	3,000	5,000	11,000	900	1,700	2,200	3,000	5,000	11,000
5 psig	818	1,562	2,045	2,789	4,611	10,039	1,100	2,100	2,750	3,750	6,200	13,500
10 psig	801	1,483	1,928	2,610	4,359	9,490	1,350	2,500	3,250	4,400	7,350	16,000
15 psig	740	1,430	1,825	2,516	4,168	9,125	1,500	2,900	3,700	5,100	8,450	18,500
20 psig	718	1,372	1,773	2,406	4,011	8,866	1,700	3,250	4,200	5,700	9,500	21,000
30 psig		1,278	1,655	2,261	3,769	8,357		3,900	5,050	6,900	11,500	25,500
50 psig		1,166	1,506	2,061	3,396	7,585		5,150	6,650	9,100	15,000	33,500
75 psig		1,078	1,388	1,878	3,185	6,860		6,600	8,500	11,500	19,500	42,000
100 psig		1,015	1,341	1,788	3,002	6,578		7,950	10,500	14,000	23,500	51,500

Reference: American Meter Catalog 2000D, page 5

Values listed in Tables are per the manufacturer's Maximum Allowable Capacity and are in excess of the 2" w.c. differential capacities.

VOLUME RATE OF FLOW (CAPACITY) THROUGH SERVICE REGULATORS

Capacities are in Cubic Feet per Hour - Orifice Sizes are in inches

REGULATOR, Make & Model	1" IRV Service Regulator		1" Non-IRV Service Regulator		1-1/4" Non-IRV Service Regulator		1-1/2" Non-IRV Service Regulator		2" Non-IRV Service Regulator	
	Orifice Size	Capcacity	Orifice Size	Capcacity	Orifice Size	Capcacity	Orifice Size	Capcacity	Orifice Size	Capcacity
American, 1400 series			1/4	830						
American, 1800 series	3/16	500	1/4	765						
American, " "	3/16 (10#)	750								
Fisher, S-100	3/16	450	1/4	775						
Fisher, "	3/16 (10#)	790								
Fisher, 730C & 733C			5/16	580	5/16	580				
Fisher, " "					5/16 (25#)	1,800				
Fisher, " "			3/8	1,425	3/8	1,770				
Fisher, " "					3/8 (25#)	1,800				
Fisher, S-201									3/4	7,700
Fisher, "									3/4 (25#)	10,000
Rockwell, Model 143	3/16	580	1/4	780						
Rockwell, " "	3/16 (10#)	840								
Rockwell, Model 173			3/8	1,150						
Rockwell, Model 243-8					1/4	770				
Rockwell, " "					1/4 (25#)	2,400				
Rockwell, " "					3/8	1,600				
Rockwell, " "					3/8 (25#)	3,300				
Rockwell, Model 243-12									1/2	3,700
Rockwell, " "									1/2 (25#)	9,500
Rockwell, " "									3/4	6,000
Rockwell, " "									3/4 (25#)	11,500
Sprague, Model B-31-N	3/16	470	1/4	830						
Sprague, " "	3/16 (10#)	870								
Sprague, Model B-39-N			1/4	650						
Sprague, Model B-34-SN							1/2	3,400		
Sprague, " "							1/2 (25#)	10,000		
Sprague, Model B-38-N									1	5,600
Sprague, " "									1 (25#)	15,500
Universal, Model 47			3/8	1,300						
Universal, Model 61	3/16	460	1/4	625						
Universal, " "	3/16 (10#)	630								

Note: All capacities are based on an **Outlet Pressure of 4.0 oz./sq.in** (7"w.c.) and an **Inlet Pressure of 5.0 psig** (unless otherwise noted.)

MAXIMUM RECOMMENDED RATE OF FLOW (CAPACITY) THROUGH Dresser Roots ROTARY METERS AT HIGH PRESSURES

Capacities are in 1,000 cubic feet per hour (MCF)

PSIG	Line Mounted (LM)							Foot Mounted (FM)			
	8C175	1.5M175	3M175	5M175	7M175	11M175	16M175	23M125	38M125	56M125	102M125
4 oz	800	1,500	3,000	5,000	7,000	11,000	16,000	23,000	38,000	56,000	102,000
1	0.84	1.6	3.1	5.2	7.3	11.5	16.7	24.0	39.7	58.5	106.6
3	0.95	1.8	3.5	5.9	8.3	13.0	18.9	27.2	44.9	66.2	120.5
5	1.1	2.0	4.0	6.6	9.2	14.5	21.1	30.3	50.0	73.8	134.3
10	1.3	2.5	5.0	8.3	11.6	18.2	26.5	38.1	63.9	92.7	168.9
15	1.6	3.0	6.0	10.0	14.0	22.0	31.9	45.9	75.8	111.8	230.6
20	1.9	3.5	7.0	11.7	16.3	25.7	37.4	53.7	88.7	130.8	238.2
25	2.1	4.0	8.0	13.4	18.7	29.4	42.8	61.5	101.7	149.8	272.9
30	2.4	4.5	9.0	15.1	21.1	33.2	48.2	69.3	114.5	168.8	307.4
40	3.0	5.5	1.1	18.5	25.9	40.6	49.1	84.9	140.3	206.8	376.7
50	3.5	6.6	13.1	21.9	30.6	48.1	70.0	100.6	166.1	244.8	445.9
60	4.0	7.6	15.2	25.3	35.4	55.6	80.8	116.2	191.9	282.9	515.2
70	4.6	8.6	17.2	28.7	40.1	63.0	91.7	131.8	217.7	320.9	584.5
80	5.3	9.6	19.2	32.0	44.9	70.5	102.5	147.4	243.5	358.9	653.7
90	5.7	10.6	21.3	35.4	49.6	78.0	113.4	163.0	269.3	396.9	723.0
100	6.2	11.7	23.3	38.8	54.4	85.4	124.3	178.6	295.1	434.9	792.1
125	7.6	14.2	28.4	47.3	66.2	104.1	151.4	217.7	359.6	530.0	965.3
150	8.9	17.0	33.0	56.0	78.0	123.0	179.0				
175	10.3	19.0	39.0	64.0	90.0	141.0	206.0				

PSIG	Line Mounted (LM)							Foot Mounted (FM)			
	1M600	1M900	2M900	3M1440	3.6M600	4.6M900	7M1440	8M400	11.5M400	19M400	102M300
4 oz	1,000	1,000	3,000	3,000	3,600	7,000	7,000	16,000	23,000	38,000	102,000
125	9.4	9.4	28.0	28.0	34.0	66.0	66.0	151.0	218.0	360.0	965.0
150	11.1	11.1	33.0	33.0	40.0	78.0	78.0	179.0	257.0	424.0	1,138.0
200	14.5	14.5	44.0	44.0	52.0	102.0	102.0	233.0	335.0	553.0	1,485.0
300	21.3	21.3	64.0	64.0	76.0	149.0	149.0	171.0	245.0	405.0	1,089.0
400	28.1	28.1	84.0	84.0	101.0	197.0	197.0	225.0	324.0	535.0	
500	34.9	34.9	70.0	105.0	125.0	163.0	244.0	223.0	321.0	531.0	
600	41.7	41.7	83.0	125.0	150.0	194.0	292.0	267.0	384.0	634.0	
900		62.0	124.0	186.0		289.0	435.0				
1200			124.0	247.0		289.0	577.0				
1440				296.0			691.0				

Reference: Dresser - Roots Bulletin IB-588

VOLUME RATE OF FLOW (CAPACITY) THROUGH IRON/ALUMINUM CASE METERS ON LOW PRESSURES (serving less than 2.0 psig)

1. On utilization pressure systems (UP), size meters using the 1/2" w.c. differential capacities.
2. On intermediate pressure systems (IP), the maximum demand should not exceed the 1" w.c. differential capacity when the meter is located on the low pressure side of the service regulator (serving less than 2 psig.)
3. Meters operating at the 2" w.c. differential capacity rate are subject to increased wear and will be tested more frequently. For meters needed at 2" w.c. differential capacity consult with your division measurement supervisor.

IRON AND ALUMINUM GAS METERS					
			CAPACITIES (Cu. Ft. per Hr.)		
MAKE	MODEL	TYPE SIZE CODE	1/2" w.c. Differential	1" w.c. Differential	2" w.c. Differential
American (Metric)	5B	232	175	245	---
	AL-175	378	175	260	---
	5B-225	380	225	325	---
	AL-250	383	250	375	---
	AC-250	379	250	375	---
	10B	236	250	375	---
	AL-310	381	310	460	---
	20B	240	350	490	---
	25B	242	400	600	900
	AL-425	383	425	635	900
	30B	244	550	775	1,100
	35B	246	650	985	1,500
	AL-800	384	800	1,200	1,700
	60B	943	950	1,380	2,000
	AL-1000	385	1,000	1,500	2,200
	80B	944	1,200	1,730	2,500
	AL-1400	931	1,400	2,100	3,000
	AL-2300	932	2,300	3,450	5,000
	250B	946	3,000	4,240	6,000
	500B	947	4,800	6,930	10,000
	AL-5000	933	5,000	7,500	11,000
Arkla	V-175	510	230	345	---
	V-250	520	280	420	---
Equimeter (Rockwell) (Emco)	#00	268	150	225	---
	150	300	150	225	---
	#0	270	175	280	---
	175	302	175	280	---
	175S	305	175	250	---
	R-175	303	175	250	---
	R-200	304	200	300	---
	250	306	250	375	---
	#1	274	275	420	---
	275	307	275	420	---
	310	308	310	465	---
	315	309	315	470	---
	#2	278	415	610	---
	415	310	415	610	---

MAXIMUM RECOMMENDED RATE OF FLOW (CAPACITY)
THROUGH Rockwell/Equimeter TURBINE METERS AT HIGH PRESSURES
Capacities are in 1,000 cubic feet per hour (MCF)

PSIG	Angle Body	Between Flange	Mark II Turbo Meter				Auto-Adjust Turbo Meters			
	TPL-9	T-10	T-18	T-30	T-60	T-140	AAT-18	AAT-35	AAT-60	AAT-140
4 oz	9.0	10.0	18.0	30.0	60.0	140.0	18.0	35.0	60.0	140.0
5	12.0	13.0	24.0	40.0	79.0	185.0	24.0	46.0	79.0	185.0
10	15.0	16.0	30.0	50.0	100.0	233.0	30.0	58.0	100.0	233.0
15	18.0	19.0	36.0	60.0	120.0	281.0	36.0	70.0	120.0	281.0
20	21.0	22.0	42.0	70.0	141.0	329.0	42.0	82.0	141.0	329.0
25	24.0	25.0	48.0	81.0	161.0	377.0	48.0	94.0	161.0	377.0
50	39.0	43.7	79.0	132.0	265.0	618.0	79.0	154.0	265.0	618.0
75	55.0	60.7	111.0	184.0	369.0	861.0	111.0	215.0	369.0	861.0
100	70.0	77.7	142.0	237.0	474.0	1,106.0	142.0	276.0	474.0	1,106.0
125	85.2	94.6	174.0	290.0	580.0	1,353.0	174.0	338.0	580.0	1,353.0
200	132.0	145.6	271.0	451.0	902.0	2,106.0	271.0	526.0	902.0	2,106.0
300	193.0	213.4	404.0	673.0	1,345.0	3,139.0	404.0	785.0	1,345.0	3,139.0
400	255.0	281.3	541.0	902.0	1,803.0	4,207.0	541.0	1,052.0	1,803.0	4,207.0
500	316.0	349.2	683.0	1,138.0	2,276.0	5,312.0	683.0	1,328.0	2,276.0	5,312.0
600	377.0	417.1	830.0	1,383.0	2,766.0	6,454.0	830.0	1,613.0	2,766.0	6,454.0
700	439.0	485.0	981.0	1,636.0	3,271.0	7,633.0	981.0	1,908.0	3,271.0	7,633.0
800	500.0	552.9	1,138.0	1,897.0	3,794.0	8,852.0	1,138.0	2,213.0	3,794.0	8,852.0
900	562.0	620.8	1,300.0	2,166.0	4,332.0	10,108.0	1,300.0	2,527.0	4,332.0	10,108.0
1,000	623.0	688.7	1,466.0	2,443.0	4,887.0	11,403.0	1,466.0	2,851.0	4,887.0	11,403.0
1,100	685.0	756.6	1,637.0	2,729.0	5,457.0	12,733.0	1,637.0	3,183.0	5,457.0	12,733.0
1,200	746.0	824.4	1,812.0	3,012.0	6,041.0	14,096.0	1,812.0	3,524.0	6,041.0	14,096.0
1,300	807.0	892.3	1,991.0	3,319.0	6,638.0	15,488.0	1,991.0	3,872.0	6,638.0	15,488.0
1,440	869.0	987.4	2,247.0	3,745.0	7,489.0	17,475.0	2,247.0	4,369.0	7,489.0	17,475.0

Reference: Equimeter Bulletins M1070, M1073 Rev. 2, M1080

Nominal Size	Class 150 (285 psig maximum working pressure -20 to 100 F)				Class 300 (740 psig maximum working pressure -20 to 100 F)		
	Number of Alloy A193 Grade 7 Bolts per Flange	Bolt Diameter and Length	Gasket (OD) Ring	Gasket (OD) Full Face	Number of Bolts per Flange	Bolt Diameter and Length	Gasket (OD) Ring
1”	4	½’ x 2-1/2”	2”		4	5/8” x 3”	2-7/8”
1-1/4”	4	½” x 2-3/4”	2-13/16”		4	5/8” x 3-1/4”	3-3/4”
1-1/2”	4	½” x 2-3/4”	3-5/16”		4	¾” x 3-1/2”	4-3/8”
2”	4	5/8” x 3-1/4”	4-1/16”	6-1/8”	8	5/8” x 3-1/2”	5-7/8”
3”	4	5/8” x 3-1/2”	5-5/16”	7-1/2”	8	¾” x 4-1/4”	
4”	8	5/8” x 3-1/2”	6-7/8”	9”	8	¾” x 4-1/2”	
6”	8	¾” x 4”	8-5/8”	11	12	¾” x 5”	9-13/16”
8”	8	¾” x 4-1/4”	10-15/16”	13-1/2”	12	7/8” x 5-1/2”	12-1/8”
10”	12	7/8” x 4-1/4”	13-1/4”		16	1” x 6-1/4”	
12”	12	7/8” x 4-3/4”	16”	18-15/16”	16	1-1/8” x 6-3/4”	16-5/8”
16”	16	1” x 5-1/2”	20-3/16”		20	1-1/4” x 7-1/2”	21-1/4”
20”	20	1-1/8” x 6-1/4”	23-3/4”		24	1-1/4” x 8-1/4”	
24”	20	1-1/4” x 7”			24	1-1/2” x 9-1/4”	

Flange Assembly Classifications

	ASME/ANSI Class	Pressure Max. psig[1]	Material	Standard [6]
ANSI B 16.1	25	25	Grey Cast Iron	Casting, marked A126, Cl. A
	125	175[2]	Grey Cast Iron	Casting, marked A126, Cl. A or B
ANSI B 16.42	150	250[1]	Ductile Cast Iron	Casting, marked A395 Ductile or DI
	300	640[1]	Ductile Cast Iron	Casting, marked A395 Ductile or DI
ANSI B 16.5	150	285[1]	Steel	Wrought, marked A105, A515, Gr. 65
			Steel	Forged, marked A105
			Steel	Casting, markedA216, Gr. WCB
	300	740[1]	Steel	Wrought, marked A106, A515, Gr. 65
			Steel	Forged, marked A105
			Steel	Casting, marked A216, Gr. WCB
	600	1480[1]	Steel	Wrought, marked A105, A515, Gr. 65
				Forged, marked A105
				Casting, markedA216, Gr. WCB
Bolt[3]			Carbon Steel	A307 gr B, marked "307B" [5]
Bolt[4]			Alloy Steel ,Heat Treated	A193, Gr. B7, marked "B7" [85]
Heavy Hex Nut[3]			Carbon Steel	A563 Gr A, marked "A" [5]
Heavy Hex Nut[4]			Alloy Steel Heat Treated	A194, Gr. 2H, marked "2H" [5]

1 Pressure rating at -20 to 100 F operating temperature
2 Pressure rating at -20 to 150 F operating temperature 1 " to 12" NPS3
3/ ANSI B16.1 and B16.2 cast iIron flanges should be assembled with A307 Gr B stud bolts and A563 Gr A Heavy nuts
4/ ANSI B16.5 steel flanges should be assembled with A193 Gr B7 stud bolts and A194 Gr 2H Heavy nuts
5/ DO NOT USE Stud Bolts or Nuts that are not correctly marked.
6/ Refer to CNP Material Standards for more information; Flanges 34-01, Gaskets 34-02, Studs Bolts and Nuts 70-01 and 70-02

Flange Classifications, Configurations, and Assembly Recommendations Assuming the Same Mating Flanges

Nominal Pipe Size	ANSI Class	Material	Max. Flange Pressure (for -20F to 100F)	# of Bolts	Bolt Size-Dia./Length (in)	Non Lubed Bolt Torque [1]	Lubricated Bolt Torque-Oil [1]	Bolt Material [2,3]	Preferred Gasket
2	125	Grey Cast	175	4	5/8” – 2 ½”	70-90		Carbon 307B	Full Face
	150	Ductile Cast	250	4	5/8” – 3 ¼”	80-100		Carbon 307B	Full Face
	150	Steel	285	4	5/8” – 3 ¼”	90-120	80	Alloy A193 B7	Ring
	300	Steel	740	8	5/8” – 3 ½”	90-140	110	Alloy A193 B7	Ring
	600	Steel	1480	8	5/8” – 4 ¼”	100-150	110	Alloy A193 B7	Ring
3	125	Grey Cast	175	4	5/8” – 2 ½”	70-90		Carbon 307B	Full Face
	150	Ductile Cast	250	4	5/8” – 3 3/4”	80-100		Carbon 307B	Full Face
	150	Steel	285	4	5/8” – 3 ½”	90-120	110	Alloy A193 B7	Ring
	300	Steel	740	8	3/4” – 4 ¼”	150-210	150	Alloy A193 B7	Ring
	600	Steel	1480	8	3/4” – 5”	150-210	150	Alloy A193 B7	Ring
4	125	Grey Cast	175	8	5/8” – 3”	70-90		Carbon 307B	Full Face
	150	Ductile Cast	250	8	5/8” – 3 3/4”	80-100		Carbon 307B	Full Face
	150	Steel	285	8	5/8” – 3 ½”	90-120	100	Alloy A193 B7	Ring
	300	Steel	740	8	3/4” – 4 ½”	150-210	180	Alloy A193 B7	Ring
	600	Steel	1480	8	7/8” – 5 3/4”	240-300	225	Alloy A193 B7	Ring
6	125	Grey Cast	175	8	3/4” – 3 ½”	100-130		Carbon 307B	Full Face
	150	Ductile Cast	250	8	3/4” – 4”	115-140		Carbon 307B	Full Face
	150	Steel	285	8	3/4” – 4”	150-210	130	Alloy A193 B7	Ring
	300	Steel	740	12	3/4” –5”	150-210	170	Alloy A193 B7	Ring
	600	Steel	1480	12	1” – 6 3/4”	400-510	320	Alloy A193 B7	Ring
8	25	Grey Cast	25	8	5/8” – 2 ½”	70-90		Carbon 307B	Full Face
	125	Grey Cast	175	8	3/4” – 3 ½”	100-130		Carbon 307B	Full Face
	150	Ductile Cast	250	8	3/4” – 4 ½”	100-130		Carbon 307B	Full Face
	150	Steel	285	8	3/4” – 4 ½”	150-210	130	Alloy A193 B7	Ring
	300	Steel	740	12	7/8” – 5 ½”	240-310	265	Alloy A193 B7	Ring
	600	Steel	1480	12	1 1/8” –7 3/4	550-750	450	Alloy A193 B7	Ring

Nominal Pipe Size	ANSI Class	Material	Max. Flange Pressure	# of Bolts	Bolt Size-Dia./Length (in)	Non Lubed Bolt Torque [1]	Lubricated Bolt Torque-Oil [1]	Bolt Material [2,3]	Preferred Gasket
10	125	Grey Cast	175	12	7/8" – 4"	110-150		Carbon 307B	Full Face
	150	Ductile Cast	250	12	7/8" – 4 3/4"	110-150		Carbon 307B	Full Face
	150	Steel	285	12	7/8" – 4 ½"	240-300	215	Alloy B7	Ring
	300	Steel	740	16	1" – 6 1/4"	400-510	320	Alloy B7	Ring
	600	Steel	1480	16	1 1/4" – 8 ½"	750-1000	650	Alloy B7	Ring
12	125	Grey Cast	175	12	7/8" – 4"	110-150		Carbon 307B	Full Face
	150	Ductile Cast	250	12	7/8" – 4 3/4"	110-150		Carbon 307B	Ring
	150	Steel	285	12	7/8" – 4 3/4"	240-300	220	Alloy B7	Ring
	300	Steel	740	16	1 1/8" – 6 3/4"	550-750	450	Alloy B7	Ring
	600	Steel	1480	16	1 1/4" – 8 3/4"	750-1000	675	Alloy B7	Ring
16	150	Steel	250	16	1" – 5 1/4"	400-510	320	Alloy B7	Ring
	300	Steel	740	20	1 1/4" – 7 1/2"	750-1000	650	Alloy B7	Ring
	600	Steel	1480	20	1 1/2" – 10"		1125	Alloy B7	Ring
20	150	Steel	250	20	1 1/8" – 6 1/4"	550-750	450	Alloy B7	Ring
	300	Steel	740	24	1 1/4" – 8 1/4	750-1000	650	Alloy B7	Ring
	600	Steel	1480	24	1 5/8" – 11 1/4"		1400	Alloy B7	Ring
24	150	Steel	250	20	1 1/4" – 6 3/4"	750-1000	650	Alloy B7	Ring
	300	Steel	740	24	1 1/2" –9 1/4	662-1552	1200	Alloy B7	Ring
	600	Steel	1480	24	1 7/8" – 13"		2230	Alloy B7	Ring

1. Torque values are approximate and assume uniform sheet gasket facing material. Lubricated bolt torque is represented with well oiled stud and nut face contacting flanges (30W oil with a coefficient of friction of approximately 0.15). Use of other lubricants can significantly lower torque values for the same bolt loading and should not be used with this table. If anti-seize compounds are used verify torque values base on specific anti-seize compound. If gaskets using elastomeric elements are used consult manufacturer's recommended tightening torque.

2. Alloy bolts must be used with alloy nuts, carbon bolts must be used with carbon nuts. Do not mix material types. See bolt/nut matchup table in Section CS-E-1.160.

3. Some flanged piping components (valves, strainers, regulators etc.) may have flanges of varying thicknesses. Choose the appropriate stud bolt length to ensure the chamfered end extends beyond the nut face when the final tightening torque is reached to ensure full thread engagement through the nut. (If additional clearance is required, the stud length may stop or be cut flush with the nut face when the final tightening torque is reached. **NOTE:** All portions of the stud's chamfered end must be beyond the nut face.)

Insulating flange connections: When insulating flange joints the following items should be observed: full faced gaskets should be selected, use 1/8" undersized alloy stud bolt, and select bolt length sufficient to extend the chamfered end beyond the nut face when the final tightening torque is reached to ensure full thread engagement through the nut. If additional clearance is required, the stud length may stop or be cut flush with the nut face when the final tightening torque is reached. **NOTE:** All portions of the stud's chamfered end must be beyond the nut face.

Flange Classifications and Configurations when mating a Single Full Face Class 25 or Class 125 Grey Cast Iron Flange

Nominal Pipe Size	ASME/ANSI Class	# of Bolts	Bolt Size Dia./Length	Bolt Torque, ft-lb[1]	Bolt Material	Gasket Type[4]
2	125	4	.5/8”/2.50”	30-60	Carbon 307B	Full Face or Ring
	150	4	5/8”/3.25”	30-60	Carbon 307B	
3	125	4	5/8”/2.50”	30-60	Carbon 307B	
	150	4	5/8”/3.75”	30-60	Carbon 307B	
4	25	8	5/8”/2.50”	30-60	Carbon 307B	
	125	8	5/8”/3.00”	30-60	Carbon 307B	
	150	8	5/8”/3.75”	30-60	Carbon 307B	
6	25	8	5/8”/2.50”	30-60	Carbon 307B	
	125	8	3/4”/3.50”	50-100	Carbon 307B	
	150	8	5/8”/4.00”	30-60	Carbon 307B	
8	25	8	5/8”/2.50”	30-60	Carbon 307B	
	125	8	3/4”/3.50”	50-100	Carbon 307B	
	150	8	3/4”/4.25”	50-100	Carbon 307B	
10	25	12	5/8”/3.00”	30-60	Carbon 307B	
	125	12	7/8”/4.00”	80-120	Alloy B7	
	150	12	.7/8”/4.75”	80-120	Alloy B7	
12	25	12	5/8”/3.00”	30-60	Carbon 307B	
	125	12	7/8”/4.00”	80-120	Alloy B7	
	150	12	7/8”/4.75”	80-120	Alloy B7	

1. Non lubricated bolt torque. Stud bolts with a film of oil - bolt torques should be reduced 20-40%. Anti seize compounds should never be used on stud bolts prior to torquing. Alloy bolts must be used with alloy nuts, carbon bolts must be used with carbon nuts (See CS-E-1.160). Do not mix material types.

Insulating flange connections: When insulating flange joints the following items should be observed: full face gaskets should be selected, use 1/8” undersized alloy stud bolt, and select bolt length sufficient to extend the chamfered end beyond the nut face when the final tightening torque is reached to ensure full thread engagement through the nut. If additional clearance is required, the stud length may stop or be cut flush with the nut face when the final tightening torque is reached. **NOTE:** All portions of the stud’s chamfered end must be beyond the nut face.

Chicago Fittings Sealastic®

Cleavenger

Continental®

Dresser®

T.D. Williamson

Uponor

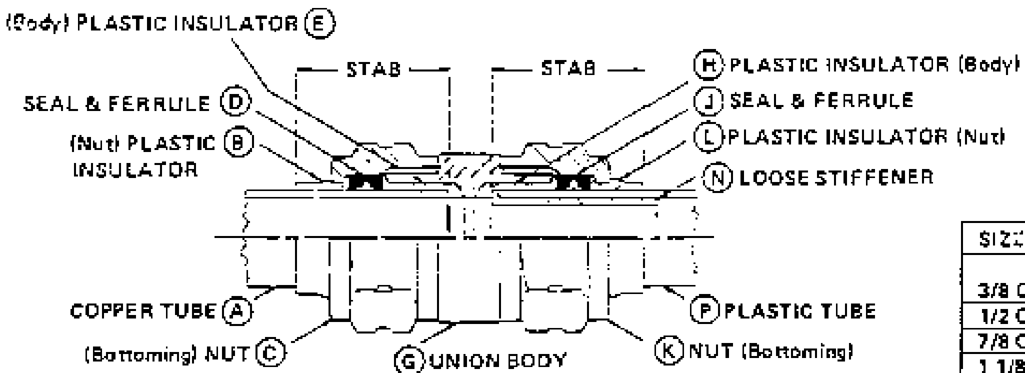
Manufacturer's Recommended Procedures

Chicago Fittings - Sealastic® Insulated Coupling With Loose Stiffener

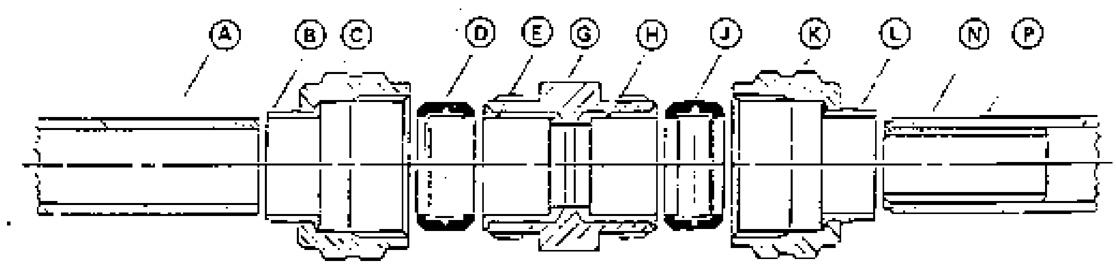
SEALASTIC ® GAS PRODUCTS INSTALLATION INSTRUCTIONS

SERIES 769
Coupling, Insulated, Loose Stiffener

1. Cut plastic square and deburr O.D. and I.D. Clean surface minimum of 4", with a clean, dry grease free cloth.
2. Mark tubing to stab depth as indicated on chart with felt pen or suitable marker. Make sure not to scratch surface of plastic with marker.
3. Insert proper stiffener into plastic tubing until shoulder or stiffener is butted against end of plastic.
4. Loosen nut 1 to 2 turns. Make sure gasket is free.
5. Insert plastic tubing with stiffener thru nut and seal assembly until mark is flush to 1/8" from end of nut.
6. Tighten nut with appropriate wrench holding body with another wrench until nut becomes iron bound, that is, "metal to metal."



SIZE	STAB DEPTH
3/8 O.D.	1
1/2 O.D.	1 3/16
7/8 O.D.	1 1/2
1 1/8 O.D.	1 13/16
1 3/8 O.D.	1 5/8



Note: Follow installation instructions on page 7 for joining copper tubing.

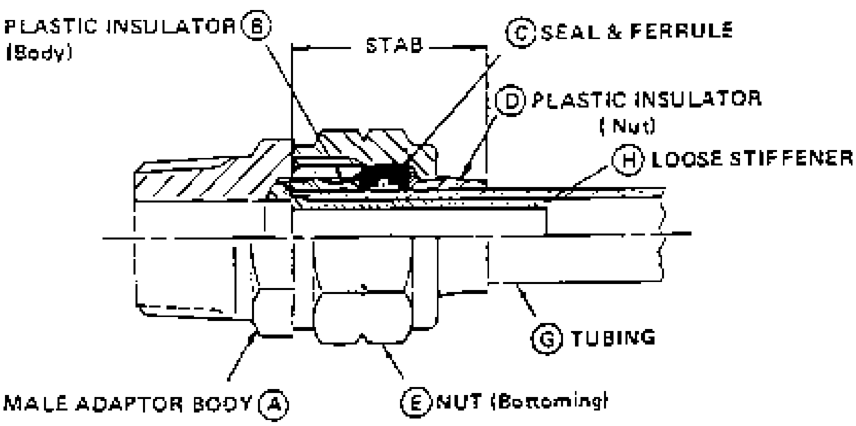
Manufacturer's Recommended Procedures

Chicago Fittings - Sealastic® Insulated Male Adapter With Loose Stiffener

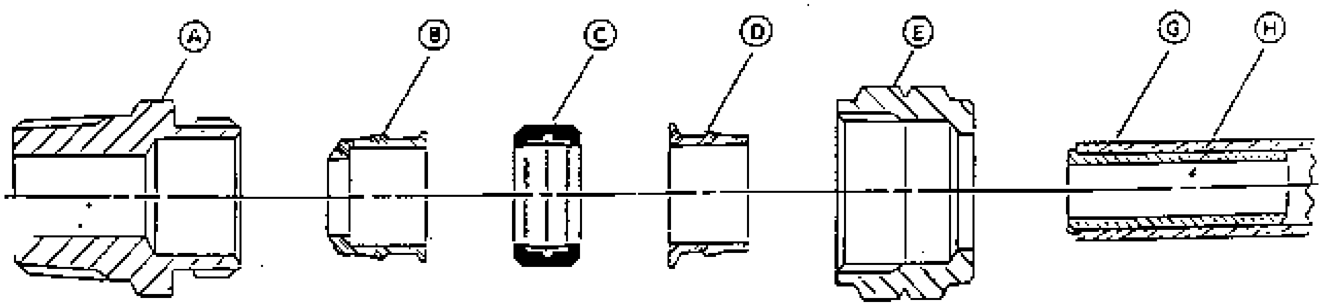
SEALASTIC ® GAS PRODUCTS INSTALLATION INSTRUCTIONS

SERIES 569
Adaptor, Male Insulated, Loose Stiffener

1. Cut plastic square and deburr O.D. and I.D. Clean surface minimum of 4" with a clean, dry, grease free cloth.
2. Mark tubing to stab depth as indicated on chart with felt pen or suitable marker. Make sure not to scratch surface of plastic with marker.
3. Insert proper stifferner into plastic tubing until shoulder of stiffener is butted against end of plastic.
4. Loosen nut 1 to 2 turns. Make sure gasket is free.
5. Insert plastic tubing with stiffener thru nut and seal assembly until mark is flush to 1/8" from end of plastic insert in nut.
6. Tighten nut with appropriate wrench holding body with another wrench until nut becomes iron bound, that is, " metal to metal ".



TUBE SIZE	STAB DEPTH
3/8 O.D.	1 1/8
5/8 O.D.	1 3/8
7/8 O.D.	1 1/2
1 1/8 O.D.	1 13/16
1 3/8 O.D.	1 5/8



TITLE OF SECTION

Chicago Fittings - Sealastic® Steel Coupling With Loose Stiffener

SEALASTIC® GAS PRODUCTS INSTALLATION INSTRUCTIONS

SERIES 750
Coupling, Steel, Loose Stiffeners

1. Cut plastic square and deburr O.D. and I.D. Clean surface minimum of 4", with a clean, dry grease free cloth.

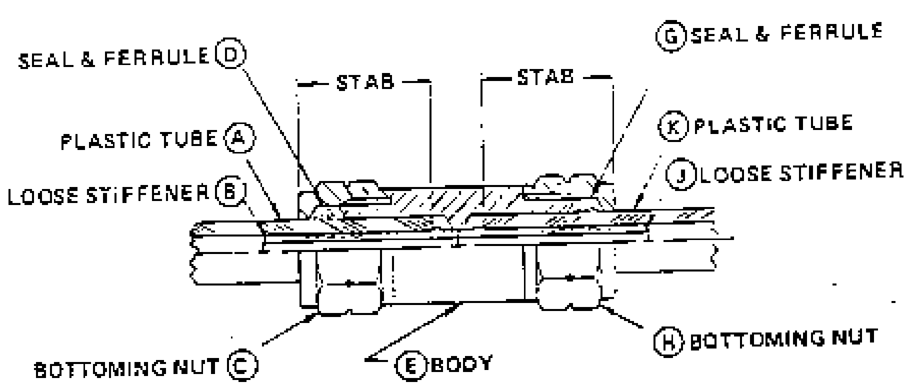
2. Mark tubing to stab depth as indicated on chart with felt pen or suitable marker. Make sure not to scratch surface of plastic with marker.

3. Insert proper stiffener into plastic tubing until shoulder of stiffener is butted against end of plastic.

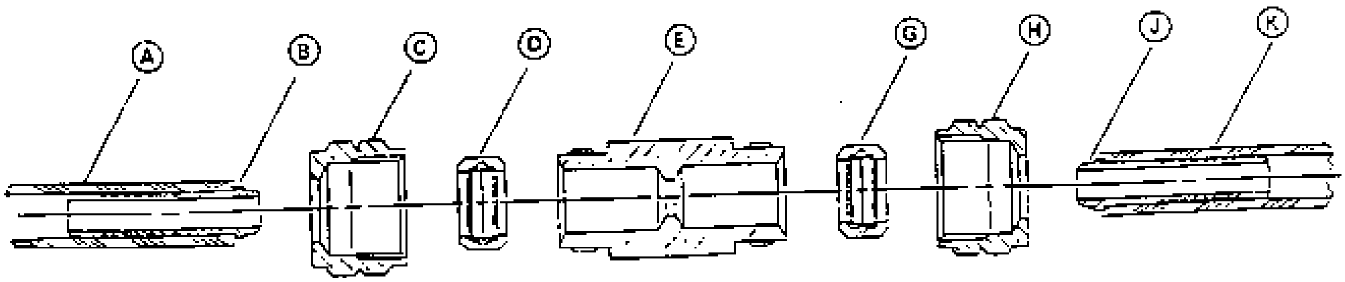
4. Loosen nut 1 to 2 turns. Make sure gasket is free.

5. Insert plastic tubing with stiffener thru nut and seal assembly until mark is flush to 1/8" from end of nut.

6. Tighten nut with appropriate wrench holding body with another wrench until nut becomes iron bound, that is, " metal to metal ".



SIZE	STAB DEPTH
3/8 O.D.	11/16
1/2 O.D.	3/4
5/8 O.D	1 1/4
7/8 O.D.	1 7/16
1 1/8 O.D.	1 1/2
1 3/8 O.D.	1 5/8
1/2 IPS	1 7/16
3/4 IPS	1 9/16
1 IPS	1 5/8
1 1/4 IPS	1 3/4
1 1/2 IPS	1 9/16
2 IPS	1 13/16



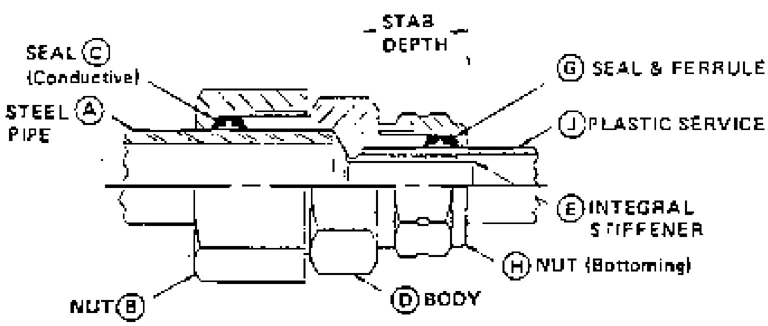
Manufacturer's Recommended Procedures

Chicago Fittings – Sealastic® Transition Coupling With Intregral Stiffener

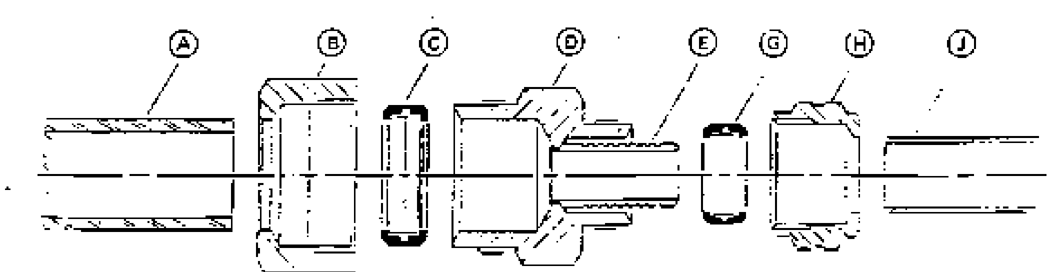
SEALASTIC® GAS PRODUCTS INSTALLATION INSTRUCTIONS

SERIES 750
Couplings, Transition, Integral Stiffener

1. Cut plastic tubing square and deburr O.D. and I.D. Clean surface minimum of 4" with a clean, dry, grease free cloth.
2. Mark tubing to stab depth as indicated on chart with felt pen or suitable marker. Make sure not to scratch surface of plastic tubing with marker.
3. Loosen nut 1 to 2 turns. Make sure gasket is free.
4. Insert plastic tubing thru nut and seal assembly over stiffener until mark is flush to 1/8" from end of nut.
5. Tighten nut with appropriate wrench, holding body with another wrench until nut becomes iron bound, that is, " metal to metal ".



TUBE SIZE	STAB DEPTH
3/8 O.D.	1 3/8
5/8 O.D.	1 3/8
7/8 O.D.	1 1/2
1 1/8 O.D.	1 5/8
1 3/8 O.D.	1 5/8
1/2 IPS	1 7/16
3/4 IPS	1 1/2
1 IPS	1 11/16
1 1/4 IPS	1 15/16
1 1/2 IPS	1 3/4
2 IPS	2 1/16



Chicago Fittings - Sealastic® Installation On Copper Tubing

A. Cut the ends of the copper tubing square and remove any burrs.

B. Ream the ends of the copper tubing, using a small reamer.

C. Remove the compression nut and gasket from the fitting and slide them onto the tubing, placing the bottom of the nut flush with the end of the tubing. Mark the tubing next to the end of the insulator with a marker.

D. Slide the compression nut and gasket up the tubing and drive a stiffener into the end of the copper tubing.

E. Push the tubing into the fitting as far as it will go.

F. Slide the compression nut and gasket up to the fitting and engage the threads of the nut onto the fitting.

G. Tighten the compression nut until it becomes iron bound, that is, "metal to metal".

H. Check to ensure the mark on the tubing shows next or no greater than 1/8" to the end of the insulator.

I. Apply a protective coating to the fitting when it is installed below grade.

Chicago Fittings - Sealastic® Stiffener Selection Chart

MCC CODE	PLASTIC DATA			STIFFENER DATA					
	Size	Wall	Type	O.D. (A)	Min Wall (B)	Max Wall (B)	Lgth ± 1/8" (C)	STOP ±.025 (D)	Color
44-5338	3/8" OD	.062	PE	.248±.003	.020	.040	1-3/8"	.330	Yellow
44-8506	1/2" OD	.062	PE	.356±.003	.023	.043	2-3/8"	.450	Yellow
44-5700	5/8" OD	.062	CAB-PE-PVC	.491±.003	.025	.045	2-3/8"	.562	Yellow
44-2210	5/8" OD	.070	PE	.475±.003	.025	.045	2-3/8"	.562	None
44-5767	5/8" OD	.070	PE	.465±.003	.025	.045	2-3/8"	.562	Green
44-5619	5/8" OD	.090	PE-PVC	.435±.003	.025	.045	2-3/8"	.562	White
44-6260	5/8" OD	.090	PE-PVC	.425±.003	.025	.045	2-3/8"	.562	Orange
44-7227	7/8" OD	.090	PE	.685±.003	.040	.070	2-3/8"	.825	White
44-7888	7/8" OD	.090	PE	.675±.003	.040	.070	2-3/8"	.825	Orange
44-5726	1-1/8" OD	.062	CAB-PVC	.989±.003	.050	.080	2-3/8"	1.050	Yellow
44-1881	1-1/8" OD	.090	CAB-PE	.933±.003	.050	.080	2-3/8"	1.050	None
44-7896	1-1/8" OD	.090	PE-CAB	.920±.003	.050	.080	2-3/8"	1.050	Green
44-6518	1-1/8" OD	.099	PE	.915±.003	.050	.080	2-3/8"	1.050	White
44-7904	1-1/8" OD	.099	PE	.902±.003	.050	.080	2-3/8"	1.050	Orange
44-0024	1/2" IPS	.109	PE (3406)	.600±.003	.040	.070	2-3/8"	.790	White
44-0032	1/2" IPS	.109	PE (3406)	.575±.003	.040	.070	2-3/8"	.790	Orange
44-9736	3/4" IPS	*.095	PE	.835±.003	.050	.080	2-3/8"	1.000	White
44-9744	3/4" IPS	*.095	PE	.810±.005	.050	.080	2-3/8"	1.000	Orange
44-4828	1" IPS	.090	PVC	1.109±.005	.060	.110	3-5/8"	1.215	None
44-5775	1" IPS	.090	PVC	1.084±.005	.060	.110	3-5/8"	1.215	Green
44-4877	1-1/4" IPS	.090	PVC	1.454±.005	.080	.130	3-5/8"	1.560	None
44-5783	1-1/4" IPS	.090	PVC	1.429±.005	.080	.130	3-5/8"	1.560	Green
44-3937	1-1/2" IPS	.090	CAB	1.696±.005	.095	.145	3-5/8"	1.800	Yellow
44-3853	2" IPS	.110	CAB-PVC	2.141±.005	.120	.170	3-5/8"	2.287	Yellow

Cleavenger: Minnegasco Service Head Adapter

Install the service head adaptor in the old steel service at the inside wall of the basement using the following procedure:

1. Locate all pilot lights that are to be relit after the job has been completed.

2. Shut off the gas at the main and remove the service riser and associated fittings to expose the threads of the service pipe at the wall.

3. Ream the end of the service pipe and clean the inside with a wire brush. File or sandpaper any rough spots or ridges inside the service pipe and clean the debris out before inserting the liner.

4. Insert the liner (leading end plugged) into the old service from the street until it reaches the basement.

5. Remove the expansion plug, cut the end of the tubing square and insert the service head adaptor wedge into it. Turn the wedge until the first thread engages the tubing. Insert the wedge and the tubing into the service head adaptor as far as it will go.

6. Secure the tubing in the service head adaptor as follows:

   a. Grip the tubing and the service head adaptor firmly with the modified vice-grip tool.

   b. Mark the tubing next to the service head adaptor.

   c. Screw the tapered wedge into the tubing with a tee wrench until the washer on the tee wrench bottoms against the service head adaptor or until it is difficult to turn any further. Use the wrench by hand only. Do not use any tools for additional leverage.

   d. Remove the tool from the tubing and adaptor and check the mark on the tubing to make sure it did not slip out of the service head adaptor during tightening. If there was any tubing pullout at all, remake the fitting starting at step 5 above.

Cleavenger: Minnegasco Service Head Adapter (continued)

7. Apply tap water (do not use soap) to the service head adaptor neoprene gasket and push the assembly into the old steel service until the assembly is even with the end of the service at the wall.

8. Expand the gasket seal on the service head adaptor using the special adaptor wrench snugly against the wall of the old steel service.

Reconnect the piping inside the house, close the service valve, make the street connection and air test the service. If the service is from a PE main, wait at least 10 minutes after the last fusion before doing the air test. If no leakage occurs, purge the air out of the service, turn on the gas at the main and inside the house and relight all pilots.

Continental® PVC "Eliminator" Tee

Thermoplastic and PVC Saddle

1. Clean pipe area before mounting saddle.

2. Place top half of saddle on main. Place bottom half of saddle under main. Insert bolts and tighten until flanges of saddle come together. Approximately 5 foot pounds torque are required.

3. Insert service line in outlet. IMPORTANT -Tighten compression nut per instructions for PVC compression outlets shown below.

4. Remove o-ring cap and insert drive key in punch.

5. Screw punch down until stop on drive contacts the top of the tee. The tap is now complete.

6. To allow flow thru the service, back punch up until the top of punch is flush with top of tee. It is important that punch does not protrude above tee.

7. Replace o-ring cap. Screw down hand tight. Do not use wrenches on o-ring cap.

Thermoplastic and PVC Compression Outlets

1. Cut tubing end square and clean thoroughly to assure there is no dirt, grease, oil, etc., on O.D. or I.D. of tubing.

2. Remove compression nut with seal ring and slip plastic tubing through nut and seal ring approximately 3". Insert tubing in outlet until it bottoms, slip nut with seal ring up in position to engage threads hand tight.

3. Then with a strap wrench or padding in jaws of a pipe wrench, tighten until nut bottoms on shoulder of outlet.

Punch Valve Service Tee

CONTINENTAL INDUSTRIES, INC.

4102 SOUTH 74TH EAST AVE / TULSA, OKLAHOMA 74145

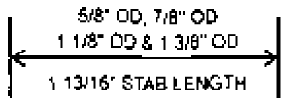
PUNCH VALVE SERVICE TEE INSTALLATION INSTRUCTIONS

Follow the appropriate instructions for required inlet on the service tee.

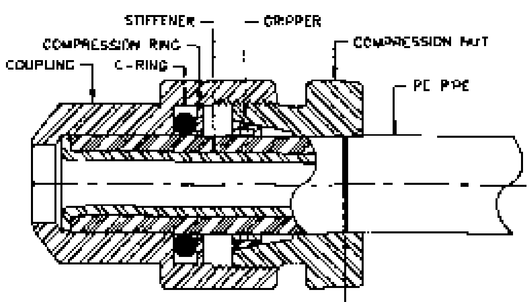
1. WELD INLET
   A. Remove the pipe cap, the punch, outlet o-ring, stiffener, compression ring, gripper and compression nut from the service tee and place in the plastic bag in which the service tee was shipped. Do not remove the steel dirt and splatter shield from the inlet.
   B. Clean the main of all coatings, rust, dirt, etc., in the area where the service tee is to be welded onto the main.
   C. Weld service tee to main per your companies instructions.
   D. Goto step 4.
2. THREADED INLET
   A. After affixing a suitable coupling device to the main, coat the threads of the tee with a good grade of thread sealant or lubricant.
   B. Screw the tee into the coupling device until it is leak tight and positioned.
   C. Goto step 4.
3. SADDLE TEE
   A. Clean the main of all coatings, rust, dirt, etc., in the area where the saddle is to be mounted. Pay particular attention to the area where the O-ring will make its seal.
   B. Remove saddle bolt and place in the desired position.
   C. Replace saddle bolt and tighten leak tight, taking care not to rotate saddle on main.
4. Make the service connection. Refer to outlet assembly instructions.
5. Pressure test after affixing tee to the main and making service connection.
6. Insert punch and screw down at least two turns by hand to avoid cross threading.
7. Use ratchet wrench with Continental adapter key and bushing to make the tap. (It is recommended, a liberal amount of lubricant be applied to the internal threads of the service tee to greatly increase the tapping efficiency of the punch.)
   IMPORTANT: To insure retention of the coupon - coupon retaining punch valves should be run all the way down until the punch valve seats on the main.
8. Back punch valve up until it is flush with the top of the tee.
9. Apply thread sealant or a good grade of lubricant and screw down on cap until it is leak tight.
10. If desirable at a later date, the service may be interrupted by running the punch valve down until it seats on the main.

OUTLET ASSEMBLY INSTRUCTIONS

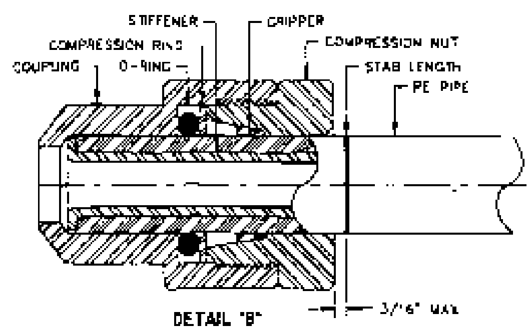
1. Cut pipe ends square, deburr outside and inside, clean thoroughly to assure there is no dirt, grease, oil, etc. on assembly area of pipe.
2. Mark stab length on pipe (see example for correct pipe or tubing size and corresponding stab length).



3. Loosen compression nut and insert pipe until it bottoms in outlet. (See detail "A")
4. Tighten compression nut until it shoulders against the outlet. (See detail "B") Line marked for stab length should be no more than 3/16" from face of nut, if not, reassemble.



DETAIL "A"



DETAIL "B"

34 4834-71

CON STAB I.D. SEAL® FITTINGS

ASSEMBLY INSTRUCTIONS

1 Verify the pipe or tubing being assembled is the correct size.

2 Cut pipe ends square.

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

4 Chamfer end of pipe using the Continental O.D./I.D. chamfering tool.

5 Mark the stab depth using any of the methods listed below.
- Holding the piping against the collar on the fitting, mark the pipe at the entrance as shown (see figure 1).
- O.D./I.D. chamfer tool / depth gauge (see figure 2).
- Measure stab length, which is 1 7/8" from chamfered end of piping.

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

NOTE: Repeat steps 1 thru 6 for all Con-Stab joints.

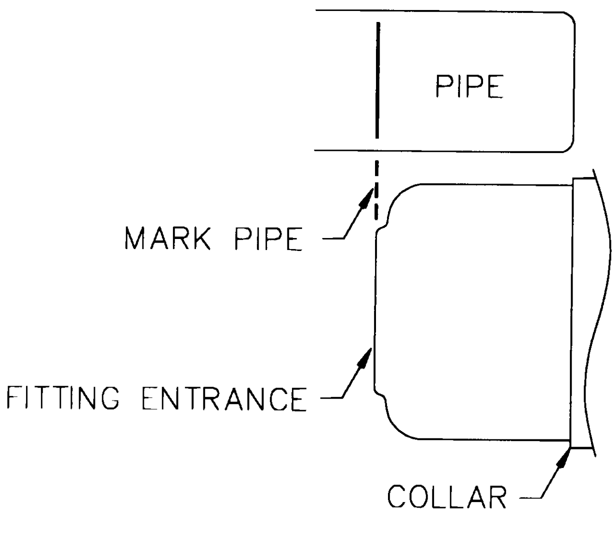


FIGURE #1

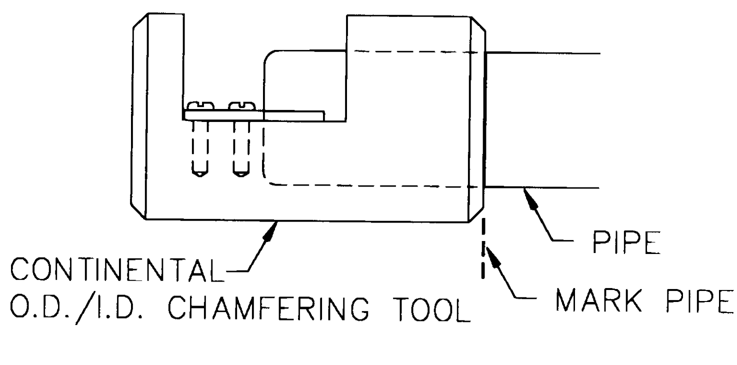


FIGURE #2

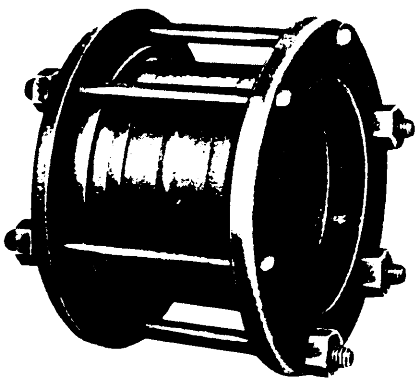
PATENT #5,366,260

For Assistance Call 1-800-558-1373 or FAX 1-800-788-1668

04/10/97

DRESSER
GAS PRODUCT INSTALLATION MANUAL

STAB-38® Coupling



This is a factory-assembled coupling. You do not have to take apart.

1. Clean pipe ends, removing oil, dirt, loose scale and rust; gasket should seat on bare metal.
2. For the purpose of centering coupling, each pipe shall be marked an equal distance from pipe end. This should be a minimum of one-half the middle ring (body) length plus two inches.
3. Lubricate gaskets and pipe ends with soap-water (ethylene glycol should be added in freezing weather).
4. Slip coupling over one pipe end—stab other pipe into coupling.
5. Center coupling between marks (See step 2).
6. Tighten bolts, applying one or two turns to a nut at a time only, and proceeding from bolt to bolt around the pipe until all bolts have a minimum torque of 80 ft. lbs.

Maximum Recommended Laying Deflection

2" I.D.	6°
3" thru 12" I.D. coupling	4°

Note: Where pipe movement out of the coupling might occur, proper anchorage must be provided.

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GAS PRODUCT INSTALLATION MANUAL

Style 38 Coupling

1. Clean pipe ends, removing oil, dirt, loose scale, and rust; gasket should seat on bare metal.
2. For the purpose of centering coupling, each pipe shall be marked an equal distance from pipe end. This should be a minimum of one-half the middle ring (body) length plus two inches.
3. Slip one follower over each pipe end.
4. Wipe gasket clean, immerse in soap-water (ethylene glycol should be added in freezing weather) and slide gasket over each pipe end with tapered (thin) edge toward pipe end.
5. Make sure middle ring is clean, especially flares where gasket will seat. Slip middle ring over one pipe end.
6. Stab other pipe end into middle ring (body). Center middle ring between marks (See step 2).
7. Lubricate pipe ends and flare of middle ring with soap-water (ethylene glycol should be added in freezing weather); slide gaskets and followers into place.
8. Insert bolts (bolts may be inserted in opposite directions from right to left to facilitate downward wrenching). Assemble nuts and tighten uniformly until all bolts have a uniform tightness to the torque recommendations indicated below.

Torque Recommendations

Coupling Size	Bolt Dia.	Torque
⅜″ thru 1½″	⅝″ and ½″	35 ft. lbs. minimum
2″ thru 30″	⅝″	75 ft. lbs. minimum

Maximum Laying Deflection

From ⅜″ I.D. to 2″ I.D. inclusive	6°
Above 2″ I.D. to 14″ O.D. inclusive	4°

Middle Ring Length	5″	7″	10″ and Longer
Above 14″ O.D. to 20″ O.D. incl.	2½°	4°	4°
Above 20″ O.D. to 30″ O.D. incl.	2°	4°	4°

Note: Where pipe movement out of coupling might occur, proper anchorage must be provided.

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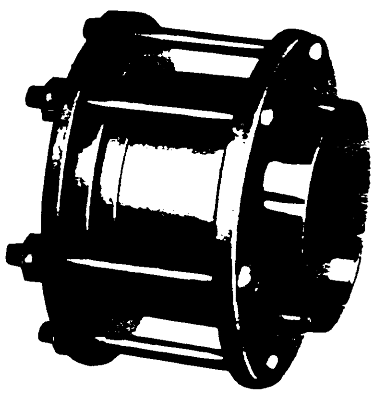
GAS PRODUCT INSTALLATION MANUAL

Style 39 Insulating Coupling (with #1 Insulating Gasket)



1. Clean pipe ends, removing oil, dirt, loose scale, and rust; gasket should seat on bare metal.
2. For the purpose of centering coupling, each pipe shall be marked and equal distance from pipe end. This should be a minimum of one-half of middle ring (body) length plus two inches.
3. Place follower with larger bore over pipe end to be insulated, and other follower over adjoining pipe end.
4. Clean rubber gaskets and insulator sleeve. Place insulating gasket (gasket with skirt) and insulator on end of pipe to be insulated. Push insulator on until small lip contacts pipe end. Place regular gasket on adjoining pipe end.
5. Make sure middle ring is clean, especially flares where gasket will seat. Place the larger end of the middle ring over the insulator.
6. Stab other pipe end into middle ring (body). Center middle ring between marks (See step 2).
7. Lubricate rubber gaskets, pipe and flares of middle ring with soap-water (ethylene glycol should be added in freezing weather). Slide gaskets and followers into place.

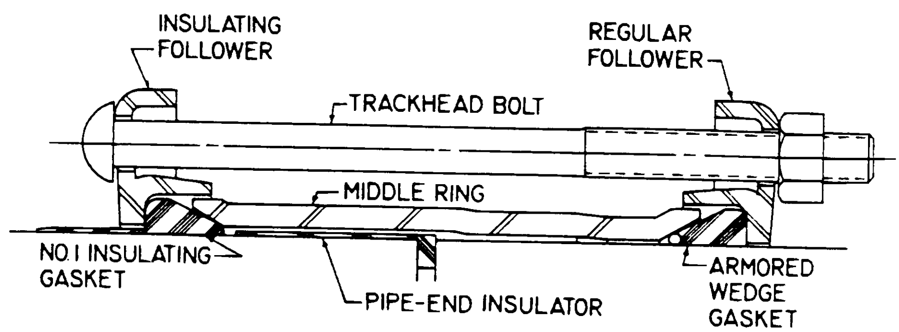
Torque Recommendations

Coupling Size	Bolt Dia.	Torque
¾" thru 1½"	½"	35 ft. lbs. minimum
2" thru 30"	⅝"	75 ft. lbs. minimum

Maximum Recommended Deflection

From ¾" I.D. to 2" I.D. inclusive	3°
Above 2" I.D. to 30" inclusive	2°

Note: Where pipe movement out of coupling might occur, proper anchorage must be provided.



FORM NO. 776

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DRESSER MANUFACTURING DIVISION
DRESSER INDUSTRIES INC.
Bradford, Pennsylvania 16701

REVISED 10/76

INSTALLATION INSTRUCTIONS

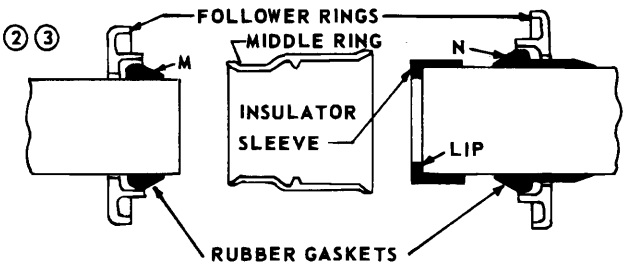
for

STYLE 39 - 62 DRESSER INSULATING REDUCING COUPLINGS

(With No. 1 Insulating Gasket)

1. Clean pipe ends.

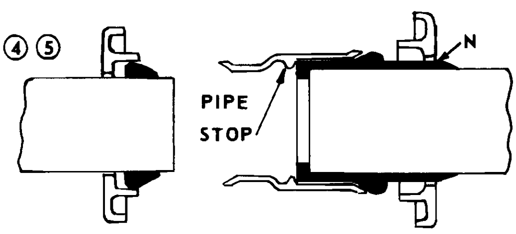
②③



2. Place follower rings over pipe ends. Chalk mark "X" half middle ring length from pipe ends to use as gage for centering middle ring.

3. Clean rubber gaskets and insulator sleeve and place on pipe. Push insulator on the big pipe as far as it will go.

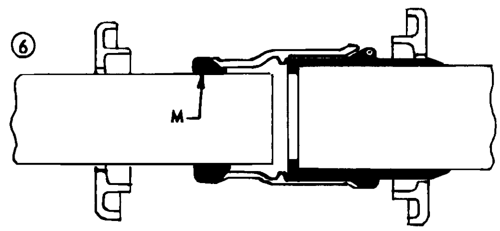
④⑤



4. Brush soapy water (Alcohol and soapy water in freezing weather) to outside of gaskets and inside of middle ring at each end.

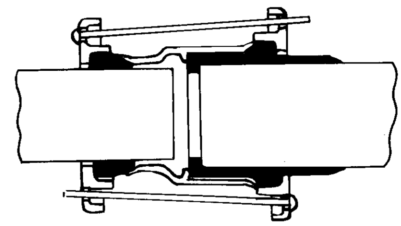
5. Place the big end of the middle ring over the insulator until the end of the middle ring meets the chalk mark. Slide gasket "N" into final position.

⑥



6. Stab the other pipe end into the middle ring until the end of middle ring meets the chalk mark. Pull out pipe ½" to allow for expansion. Slide gasket "M" into final position.

⑦⑧



7. Move follower rings into position over the gasket and line up the bolt holes.

8. Insert bolts and run on nuts with the flat face toward the end of the bolt.

9. Two (2) men wrench tighten (about 25lbs. pull) one (1) bolt at top of pipe and one bolt at bottom, making sure that nuts are about the same distance from ends of bolt.

10. Wrench tighten (about 25 lbs. pull) the remaining bolts in the same manner.

11. Continue to tighten all bolts evenly until proper tightness is reached (see torque recommendations).

⑪ TORQUE RECOMMENDATIONS

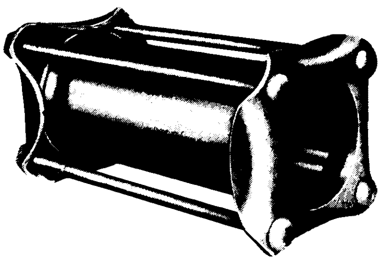
Coupling Size	Bolt Dia.	Torque
2"-24"	5/8"	75
30" thru 48" (1/4" & 5/16" thick middle rings)	5/8"	65
30" thru 72" (3/8" and heavier middle rings)	5/8"	70
30" to 48"	3/4"	80
48" to 72"	3/4"	80

On special installations, obtain torque from Dresser Engineering.

NOTE: Where pipe movement out of the coupling might occur, proper anchorage must be provided.

DRESSER
GAS PRODUCT INSTALLATION MANUAL

STAB-40® Long Coupling



This is a factory-assembled coupling. You do not have to take apart.

1. Clean pipe ends, removing oil, dirt, loose scale and rust; gasket should seat on bare metal.
2. For the purpose of centering coupling, each pipe shall be marked an equal distance from pipe end. This should be a minimum of one-half the middle ring (body) length plus two inches.
3. Lubricate gaskets and pipe ends with soap-water (ethylene glycol should be added in freezing weather).
4. Slip coupling over one pipe end—stab other pipe into coupling.
5. Center coupling between marks (See step 2).
6. Tighten bolts, applying one or two turns to a nut at a time only, and proceeding from bolt to bolt around the pipe until all bolts have a minimum torque of 80 ft. lbs.

Maximum Recommended Laying Deflection

2" I.D.	6°
3" thru 12" I.D. coupling	4°

Note: Where pipe movement out of the coupling might occur, proper anchorage must be provided.

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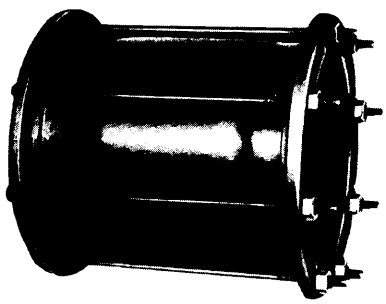
GAS PRODUCT INSTALLATION MANUAL

Style 40 Long coupling



1. Clean pipe ends, removing oil, dirt, loose scale, and rust; gasket should seat on bare metal.
2. For the purpose of centering coupling, each pipe shall be marked an equal distance from pipe end. This should be a minimum of one-half the middle ring (body) length plus two inches.
3. Slip one follower over each pipe end.
4. Wipe gasket clean, immerse in soap-water (ethylene glycol should be added in freezing weather) and slide gasket over each pipe end with tapered (thin) edge toward pipe end.
5. Make sure middle ring is clean, especially flares where gasket will seat. Slip middle ring over one pipe end.
6. Stab other pipe end into middle ring (body). Center middle ring between marks (See step 2).
7. Lubricate pipe ends and flare of middle ring with soap-water (ethylene glycol should be added in freezing weather); slide gaskets and followers into place.
8. Insert bolts (bolts may be inserted in opposite directions from right to left to facilitate downward wrenching). Assemble nuts and tighten uniformly until all bolts have a uniform tightness to the torque recommendations indicated below.

Torque Recommendations

Coupling Size	Bolt Dia.	Torque
⅜" thru 1½"	⅜" and ½"	35 ft. lbs. minimum
2" thru 30"	⅝"	75 ft. lbs. minimum

Maximum Laying Deflection

From ⅜" I.D. to 2" I.D. inclusive	6°
Above 2" I.D. to 30" O.D. inclusive	4°

Note: Where pipe movement out of coupling might occur, proper anchorage must be provided.

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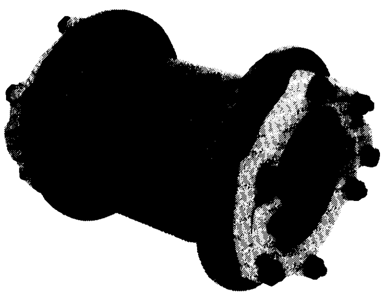
GAS PRODUCT INSTALLATION MANUAL

Style 50 Split Repair Sleeve (Insulating)



1. Clean dirt and scale from the pipe, especially where the end gaskets fit around the pipe. This is important. A clean metallic surface under the gasket will help to insure a tight repair.
2. Make sure side gaskets are located in lower half of the sleeve and ends are flush with the end-gasket recess. Lubricate gaskets with soap-water (ethylene glycol should be added in freezing weather.)
3. Remove vent plug from upper half of sleeve to relieve internal pressure during installation. (A valve with a nipple screwed into the vent is sometimes used to take the contents of the line above the ground level, and to facilitate closing off the vent after installation if internal pressure is high.)
4. Measure distance between end-gasket recesses of sleeve. Wrap this distance on pipe with an electrical tape to prevent contact of chips that may bridge pipe O.D. and sleeve belly I.D. Tape to be furnished by customer. If sleeve is coated with AL-CLAD™, wrapping of pipe with electrical tape is not required.
5. Place the top and bottom halves of the sleeve body in position, centering over taped area. Insert and draw up side bolts to final tightness. (Do not trim off ends of side gaskets that may be squeezed out after this tightening, since a slight protrusion of rubber will help to give a better pack where end and side gaskets meet.)
6. Assemble the followers on the pipe adjacent to each end of the sleeve body, bolting the sections together.
7. Place end gaskets around pipe with beveled face toward the sleeve. (If necessary, trim the gaskets parallel with the original cut to a length that will fit snugly around the pipe.) Lubricate gaskets, pipe and gasket recess of sleeve with soap-water (ethylene glycol should be added in freezing weather). Move gaskets into end-gasket recesses of sleeve, slide followers into place, insert follower bolts and tighten uniformly all around.
8. Screw plug into vent or on high-pressure lines, close valve previously installed on the vent.

NOTE: Where pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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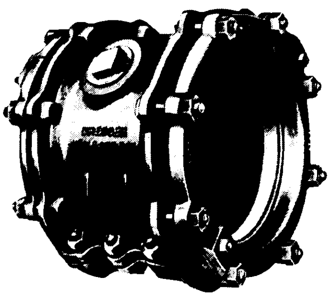
GAS PRODUCT INSTALLATION MANUAL

Style 57 Split Repair Sleeve



1. Clean dirt and scale from the pipe, especially where the end gaskets fit around the pipe. This is important. A clean metallic surface under the gasket will help to insure a tight repair.
2. Make sure side gaskets are located in lower half of the sleeve and ends are flush with the end gasket recess. Lubricate gaskets with soap-water (ethylene glycol should be added in freezing weather).
3. Remove vent plug from upper half of sleeve to relieve internal pressure during installation. (A valve with a nipple screwed into the vent is sometimes used to take the contents of the line above the ground level, and to facilitate closing off the vent after installation if internal pressure is high.)
4. Place the top and bottom halves of the sleeve body in position around the break. Insert and draw up side bolts to final tightness. (Do not trim off ends of side gaskets that may be squeezed out after this tightening, since a slight protrusion of rubber will help to give a better pack where end and side gaskets meet.)
5. Assemble the followers on the pipe adjacent to each end of the sleeve body, bolting the sections together.
6. Place end gaskets around pipe with beveled face toward the sleeve. (If necessary, trim the gaskets parallel with the original cut to a length that will fit snugly around the pipe.) Lubricate gaskets, pipe and gasket recess of sleeve with soap-water (ethylene glycol should be added in freezing weather). Move gaskets into end gasket recesses of sleeve, slide followers into place, insert follower bolts and tighten uniformly all around.
7. Screw plug into vent or on high-pressure lines, close valve previously installed on the vent.

NOTE: Where pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

FORM NO. 776

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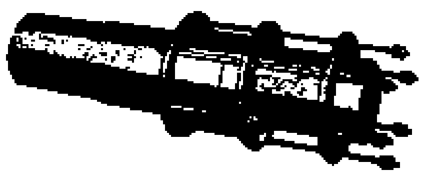
Style 63 Expansion Joint, Type 3



1. Clean joint body and slip pipe. Type 3 requires prepared pipe ends 24 inches long. Slip pipe must be smooth; round and the outside diameter tolerance must be no greater than plus .030 of an inch (1/32 of an inch) or less than minus .010 of an inch from the nominal size. (Above 36 inches in diameter, tolerance is plus or minus .030 of an inch.) Lubricate slip pipe the entire surface with a thin film of a non-petroleum base lubricant. When asbestos packings are used lubrication is not required.

2. Place followers over slip pipe and stab slip pipe, with square end first, to full entry into joint body. Then withdraw to the position correct for present temperature of the line. Determine amount to withdraw slip pipe by the following formula.

$$\frac{\text{Max. Operating Temp.} - \text{Installation Temp}}{\text{Total Temperature Range}} \times \text{*max. Recommended Movement for joint} = \text{Amount slip pipe should be withdrawn}$$

*Indicated on body & slip pipe of expansion joint

Example:

Minimum Temperature = -25^{0} F
Max. Operating Temperature = 100°F
Installation Temperature = 75°F
Total Temperature Range = 125°F
*Maximum Recommended Movement = 10"

$$\frac{100 - 75}{125} \times 10 = \frac{250}{125} \text{ or } 2"$$

In this case slip pipe should be withdrawn two inches.

SKETCH 1

3. Place a rubber packing around the slip pipe in area "A" Sketch 1. Alternate jute and rubber packing rings as in Sketch 2. Then slip packing along slip pipe into recess between sleeve "B" and the slip pipe. Stagger the joints of the packing rings through the upper 180° of the stuffing box for joints installed on the horizontal position. See Sketch 3. The packing, furnished extra long, should be cut at the same angle and trimmed to length in the field. When asbestos packings are furnished all packings are the same. The method of packing the joint varies somewhat but in general it is advisable to insert a few packing rings at a time, compressing them into position by temporarily drawing up the followers, before adding more packing.

4. Align bolt holes. Place bolts with track head at ring on joint body. Place nuts on bolts with camfer side against follower.

(Continued)

Dresser® Style 63 Expansion Joint, Type 3 (continued)

5. Bolt up - Start tightening two bolts, one on each side of the joint and then work around the joint. Keep the follower advancing evenly until sufficient torque is reached on all bolts to avoid leakage. Excessive tightening should be avoided to prevent excessive packing wear. If the joints are inspected and the followers adjusted periodically for a few days thereafter, a little each time, the packing mass will become so adjusted that a minimum of maintenance will be required thereafter. Install these joints only where they can be reached for future adjustment.

6. It is important that exposed slip pipe be lubricated at regular intervals to avoid corrosion of the slip pipe surface
The pipe adjacent to the expansion joint should be properly supported and guided to prevent deflection and misalignment between the slip pipe and body cylinder.

NOTE When joints are furnished with asbestos packings a bottle tight seal may not be provided and leakage must be tolerated.

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<u>Maintenance of Dresser Style 63</u>
<u>Slip-Type Expansion Joints</u>

For Seasonal Cycling

If pipe movement occurs due to seasonal temperature changes or other than daily cycling, we recommend that inspection and maintenance be done on a yearly basis. Actual experience may dictate more frequent inspection. During inspection, bolts used to compress the packing should be checked to make sure the nuts are tight. In the event leakage is evident, tighten bolts on the packing gland until leakage stops. It is recommended that the slip pipe be cleaned and then coated with General Electric DC-111 grease or an equivalent grease at each inspection preferably when the expansion joint is in the open position.

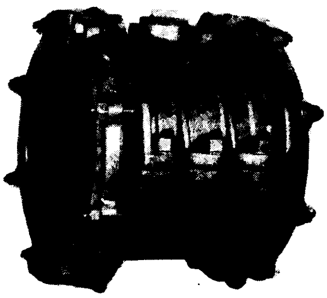
For Daily Cycling

When pipe movement occurs daily due to differential temperatures caused by something other than seasonal temperature changes, the inspection should be done on a monthly basis. Follow the same procedure as outlined above for maintenance of the Expansion Joints.

4-4-90

DRESSER
GAS PRODUCT INSTALLATION MANUAL

Style 73 Split Repair Sleeve



1. Clean dirt and scale from the pipe, especially where the end gaskets fit around the pipe. This is important. A clean metallic surface under the gasket will help to insure a tight repair.
2. Make sure side gaskets are located in lower half of the sleeve and ends are flush with the end gasket recess. Lubricate gaskets with soap-water (ethylene glycol should be added in freezing weather).
3. Remove vent plug from upper half of sleeve to relieve internal pressure during installation. (A valve with a nipple screwed into the vent is sometimes used to take the contents of the line above the ground level, and to facilitate closing off the vent after installation if internal pressure is high.
4. Place the top and bottom halves of the sleeve body in position around the break. Insert and draw up side bolts to final tightness. (Do not trim off ends of side gaskets that may be squeezed out after this tightening, since a slight protrusion of rubber will help to give a better pack where end and side gaskets meet.)
5. Assemble the followers on the pipe adjacent to each end of the sleeve body, bolting the sections together.
6. Place end gaskets around pipe with beveled face toward the sleeve. (If necessary, trim the gaskets parallel with the original cut to a length that will fit snugly around the pipe.) Lubricate gaskets, pipe and gasket recess of sleeve with soap-water (ethylene glycol should be added in freezing weather). Move gaskets into end gasket recesses of sleeve, slide followers into place, insert follower bolts and tighten uniformly all around.
7. Screw plug into vent or on high-pressure lines, close valve previously installed on the vent.

Note: When pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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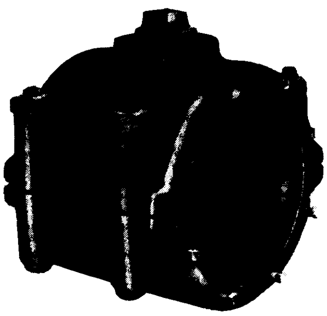
DRESSER
GAS PRODUCT INSTALLATION MANUAL

Style 80 Ready-Pack Sleeve



1. Clean all dirt and rust from the pipe where the sleeve gaskets contact the surface. These surfaces must be clean all around the pipe.

2. Separate the sleeve into halves by removing the nuts from the side bolts. Do not remove side bolts, gaskets, follower rings or setscrews. After lubricating the gaskets with soap-water (ethylene glycol may be added in freezing weather) place halves of sleeve around the pipe.

3. Run on side bolt nuts. Tighten these one by one, a few pulls of the wrench, to get uniform tightness. Recommended torque for ½ inch bolts (2" sleeve) is 50 pound minimum pull on 12" wrench; for 3" thru 8" sleeves, the ⅝ inch bolts should receive a 100 pound minimum pull on a 12" wrench.
4. Next tighten the hex-head setscrews a little at a time to 20-25 ft. lbs. torque. Make several passes around each end of the sleeve to get all setscrews uniformly tightened. The setscrews and body castings can easily withstand 30-40 ft. lbs. torque so be sure to get the setscrews tight. Do not use an open-end wrench; use a socket type having at least a 7" handle.

Size	Range
2½"	2.290" O.D. to 2.540" O.D. incl.
2¾"	2.540" O.D. to 2.790" O.D. incl.
3"	3.750" O.D. to 4.000" O.D. incl.
4"	4.740" O.D. to 4.990" O.D. incl.
6"	6.840" O.D. to 7.090" O.D. incl.
8"	8.990" O.D. to 9.240" O.D. incl.

Note: When pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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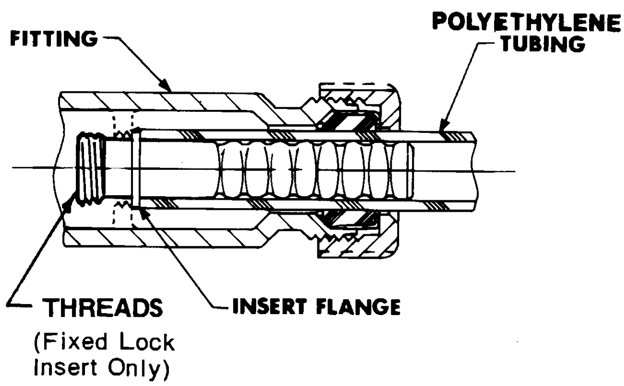
GAS PRODUCT INSTALLATION MANUAL

Style 88 Couplings and Fittings for Polyethylene Tubing with Fixed or Loose Ripple Design Lock Insert when used with or without pipe stops



Style 88 tubing sizes 5/8" O.D. thru 1-3/8" O.D. having tubing wall thickness range of .062 thru .101.

1. Remove all burrs from end of plastic tubing I.D. and O.D. Cle the surface for a distance of four inches from pipe end with a clean, dry, grease-free cloth.

2. Loosen nut about one-quarter turn and make sure gasket is free. DO NOT LUBRICATE GASKET.

3. *For Dresser Fixed Lock Insert –*
Stab tubing until tubing comes in contact with flange on insert, and tighten nut to recommended torque. In each case a pull of about 75 lbs. should be applied to the end of the wrench. See table for recommended wrench size.

   Note: Dresser fixed lock insert may be changed to accommodate various tubing wall thicknesses. To remove insert, unscrew counterclockwise and replace with the proper size (O.D. size and wall thickness is marked on insert).

4. *For Dresser Loose Lock Insert without pipe stops–*
Push insert into tubing until tubing end is in contact with the flange on the insert, mark tubing with a crayon at the end of insert opposite the flange then stab into the coupling or fitting until mark is flush to 1/8" with nut in loose position and tighten to the recommended torque. In each case a pull of about 75 lbs. should be applied to the end of the wrench. See table for recommended wrench size.

5. *For Dresser Loose Lock Insert with pipe stops–*
Push insert into tubing until tubing is in contact with the flange on the insert, then stab into the fitting until insert flange is against stop in fitting, and tighten to the recommended torque. In each case, a pull of about 75 lbs. should be applied to the end of the wrench. See table for recommended wrench size.

Note: Use proper wall thickness Dresser insert. Wall thickness is marked on insert.

Note: in the event of welding, coupling or fitting SHOULD NOT be made up prior to welding.

RECOMMENDED WRENCH SIZE	
Tubing Size (O.D.)	Recommended Wrench Size
5/8"	14"
7/8"	14"
1-1/8"	18"
1-3/8"	18"

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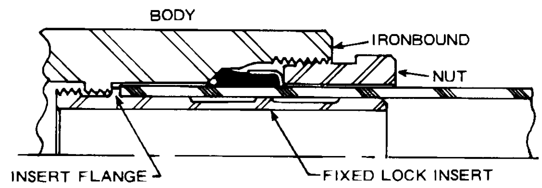
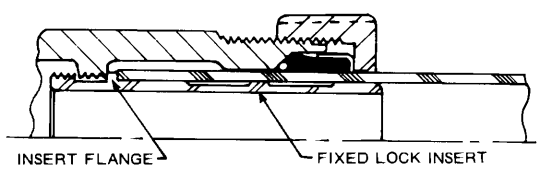
GAS PRODUCT INSTALLATION MANUAL

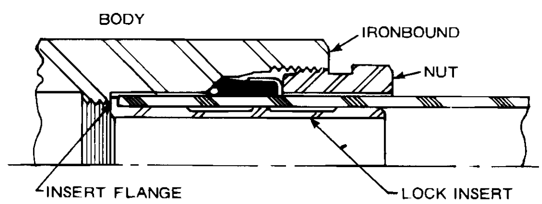
Style 88 compression ends for polyethylene tubing



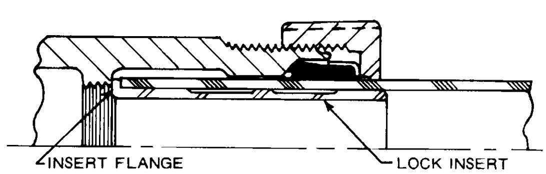
INTERNAL NUT - FIXED LOCK INSERT



EXTERNAL NUT - FIXED LOCK INSERT



INTERNAL NUT - LOOSE LOCK INSERT



EXTERNAL NUT - LOOSE LOCK INSERT

The style 88 Fittings for Plastic Tubing are recommended for a maximum operating pressure of 100 PSIG and a maximum temperature of 100 degrees F.

Size range 5/8" O.D., 1-1/8" O.D. and 1-3/8" O.D. with tubing wall thickness from .062 thru .101.

1. Remove all burrs from end of plastic tubing I.D. and O.D. and clean tubing surface for a distance of four inches from the tubing ends with a clean, dry, grease-free cloth.

2. Loosen nut about one-quarter turn and make sure gasket is free.

3. DO NOT LUBRICATE GASKET.

4. *For Dresser Fixed Lock Insert* – Start plastic tubing over end of insert and stab tubing until it comes in contact with the flange on the insert.

   For Dresser Loose Lock Insert – Push insert into tubing until tubing end is in contact with the flange on the insert, then stab in the fitting until insert flange is against stop in fitting. Use the proper wall thickness insert for the plastic p tubing. Wall thickness is marked on the insert.

5. Tighten internal nut until ironbound against body – see sketch. Tighten external nut to torques given in table below.

   NOTE: Fixed lock insert may be changed to accomodate various tubing wall thicknesses. To remove insert, unscrew counterclockwise and replace with proper size (O.D. size and wall thickness are marked on insert). Dresser fittings, when used with Dresser Lock Inserts, will provide a joint stronger in tension than the plastic tubing itself.

External Nut Torques:

Tubing Size (O.D.)	Torque Ft. Lbs.
5/8"	40
1-1/8"	65
1-3/8"	65

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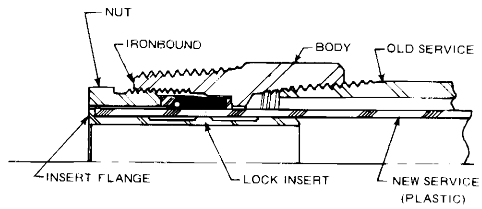
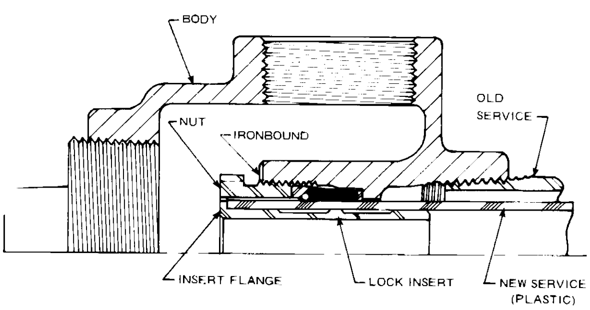
GAS PRODUCT INSTALLATION MANUAL

Style 88 Service Head Adaptors and Basement Tees for polyethylene tubing



SERVICE HEAD ADAPTOR



BASEMENT TEE

The style 88 Service Head Adaptors and Basement Tees for plastic pipe are recommended for a maximum operating pressure of 100 PSIG and a maximum temperature of 100 degrees F.

Size range 5/8" O.D., 1-1/8" O.D. and 1-3/8" O.D. with tubing wall thickness from .062 thru .101.

1. Remove all burrs from end of tubing I.D. and O.D. and clean tubing surface for a distance of four inches from tubing ends with a clean, dry, grease-free cloth.
2. Loosen nut about one-quarter turn and make sure gasket is free.
3. DO NOT LUBRICATE GASKET.
4. Push lock insert into plastic tubing until tubing end is firmly in contact with insert flange. Use proper wall thickness insert for the plastic tubing. Wall thickness is marked on insert.
5. Stab plastic tubing with insert in position until the flange face of insert is flush with the face of the loosened nut.
6. Tighten nut until it is ironbound with body.

NOTE: Dresser fittings, when used with Dresser Lock Inserts will provide a joint stronger in tension than the plastic tubing itself.

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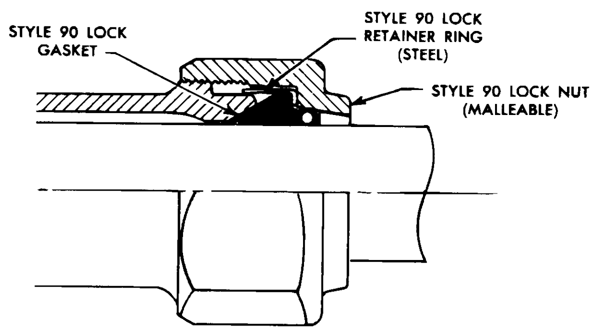
GAS PRODUCT INSTALLATION MANUAL

Style 90 Couplings and Fittings (with Lock Nuts)



1. Clean pipe surface to bare metal for a distance from pipe ends of four inches for 5" bodies and seven inches for 10" bodies.
2. Loosen nuts approximately one-quarter turn (do not disassemble).
3. Apply soap-water to gasket (ethylene glycol may be added in freezing weather).
4. Stab pipe ends into coupling or fitting. Center coupling over joint. Leave approximately ½" gap between pipe ends.
5. Tighten each nut independently while holding coupling body from rotating, with a 100 lb. minimum pull on the recommended wrench size.

Nominal Pipe Size (I.D.)	Wrench Size
¾"	14"
1"	18"
1¼"	18"
1½"	24"
2"	24"

NOTE: When pipe movement out of the coupling might occur as a result of forces other than that caused by internal line pressure of 150 PSI maximum, proper anchorage of the pipe must be provided.

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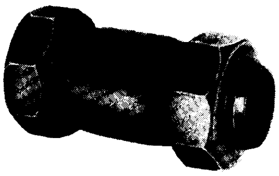
GAS PRODUCT INSTALLATION MANUAL

Style 90 Insulating Coupling



1. Clean pipe ends to bare metal and remove any metal burrs. Apply soap-water to gaskets (ethylene glycol should be added in freezing weather).
2. Loosen nut on noninsulating end to relieve gasket pressure and stab pipe end into coupling body, contacting the insulator and pushing it to contact with the insulating gasket. Tighten Style 90 Nut with a 75 lb. pull on the Recommended Wrench Size.
3. At the insulating-gasket end of coupling, loosen nut to relieve gasket pressure and stab the pipe end to full entry. Tighten each nut independently while holding coupling body from rotating, with a 75 lb. minimum and 100 lb. maximum pull on the recommended wrench size.

Steel Pipe Size (I.D.)	Recommended Wrench Size
¾″	14″
1″	18″
1¼″	18″
1½″	24″
2″	24″

Note: When it becomes necessary to remove the pipe-end insulator, remove the nut, follower insulator, gasket and retainer cup from the insulating end. Loosen nut on opposite end and push middle ring over pipe ring to force insulator out of the middle ring. WHEN REASSEMBLING, FOLLOWER INSULATOR MUST BE LOCATED BETWEEN GASKET AND RETAINER CUP.

Maximum pipe movement per coupling ⅛″.

When pipe movement out of coupling might occur, proper anchorage of the pipe must be provided.

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GAS PRODUCT INSTALLATION MANUAL

Style 91 Service Saddle

1. Remove stirrups from saddle. Gasket is cemented in place and should not be disturbed.
2. Clean pipe where the gasket is to seat.
3. Lubricate saddle gasket and cleaned area of pipe with soap-water (ethylene glycol may be added in freezing weather).
4. Assemble saddle on pipe and tighten stirrups to 75 foot pounds torque. If torque wrench is not available, tighten stirrups until gasket starts to extrude from under saddle.

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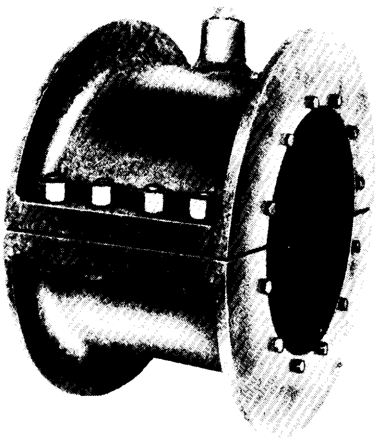
GAS PRODUCT INSTALLATION MANUAL

Style 93 Split Repair Sleeve



1. Clean all dirt and rust from pipe where the sleeve gaskets contact the surface. These surfaces must be clean all around the pipe.
2. Remove nuts from large side bolts and separate sleeve halves. DO NOT REMOVE CAP SCREWS OR FOLLOWER RINGS. All gaskets are in place and do not need trimming or fitting.

Note: If leak is so large that assembly is difficult, because of internal pressure developing, the vent plug in repair sleeve should be replaced with a nipple and open valve before sleeve is attached, in order to relieve pressure and control leakage during installation.
If leak is small, removal of vent plug is not necessary.

3. After placing sleeve halves in position over the leak, tighten side bolts evenly by screwing down large nuts to final tightness. ALWAYS TIGHTEN SIDE BOLTS COMPLETELY AT THIS STAGE. (A 3-foot bar with a 125-lb. pull gives the correct tightness.
4. Tighten each cap screw (starting with top ones) a few turns at a time, until uniform and final tightness is reached.

Note: Gaskets should always be lubricated with water (soap-water if available). Ethylene glycol should be added in freezing weather.

5. Upon completing installation, IF VENT PLUG HAS BEEN REPLACED BY NIPPLE AND VALVE FOR LARGE LEAK, the valve should be closed and vent plug screwed into valve opening. The vent plug in valve will act as protection against possible leakage through valve.
Should sleeve leak after being installed, check all bolts for maximum uniform tightness and check lubrication of gaskets. If all bolts are at maximum tightness, gaskets properly lubricated, and the repair sleeve still leaks, it is practically certain that there is dirt or scale between the gaskets and the pipe. Careful cleaning of pipe before sleeve is attached is imperative to assure a good installation.

Important: If, when this repair sleeve is taken off, it is returned to storage for future use, care should be taken that cap screws are **well loosened**. This relieves pressure on end gaskets and returns them to correct position and contour, which is necessary for proper reuse. It is also advisable to put shims between the two sleeve halves to prevent pressure against the side gaskets and resultant distortion while in storage. Gaskets, cap screws and bolts should be replaced if not in first-class condition.

CAUTION: Where pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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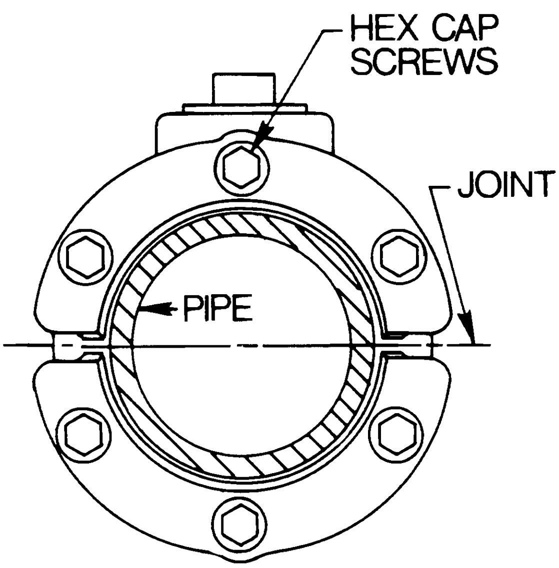
GAS PRODUCT INSTALLATION MANUAL

Style 94 Repair Sleeve for Steel Pipe



This is a preassembled sleeve ready for installation. DO NOT cut any gaskets, or remove any parts (except the side bolt hex nuts). Loosen the end capscrews 1 TURN only to remove the wooden blocks.

PIPE DIAMETER FOR INSULATING SLEEVES

4" IPS - 4.50" O.D.
6" IPS - 6.625" O.D.
8" IPS - 8.625" O.D.

1. Clean all dirt and rust from the pipe where the sleeve gaskets contact the surface. These surfaces must be clean all around the pipe.

2. Separate the sleeves into halves by removing the hex nuts from side bolts. DO NOT REMOVE ANY OTHER PARTS. After lubricating the gaskets with soapwater (glycerin should be added to the solution in freezing weather), place halves of sleeve around the pipe.

3. Run on side bolt nuts. Tighten these one by one a few pulls of the wrench to get uniform tightness. Recommended torque is 75 to 100 ft. lbs. This is a minimum of 75 lbs. pull on a 12" wrench.

4. Tighten end pack by starting at the top hex capscrew. Tighten each capscrew a little at a time working opposite (180°) of the previous capscrew tightened. Make several passes around each end of the sleeve to get all capscrews tightened uniformly until 40 ft. lbs. torque is obtained. This is 40 lbs. pull on a 12" wrench.

CAUTION: Where pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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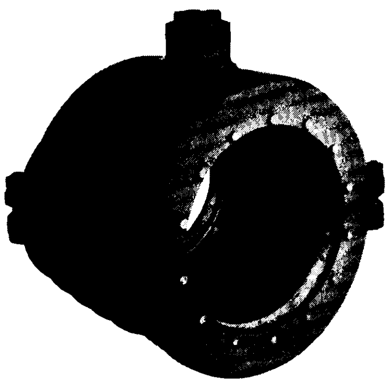
GAS PRODUCT INSTALLATION MANUAL

Style 96 Split Repair Sleeve



1. Clean all dirt and rust from pipe where the sleeve gaskets contact the surface. These surfaces must be clean all around the pipe.

2. Remove nuts from large side bolts and separate sleeve halves. **Do not remove cap screws or follower rings.** All gaskets are in place and do not need trimming or fitting.

Note: If leak is so large that assembly is difficult, because of internal pressure developing, the vent plug in repair sleeve should be replaced with a nipple and open valve before sleeve is attached, in order to relieve pressure and control leakage during installation.

If leak is small, removal of vent plug is not necessary.

3. After placing sleeve halves in position over the leak, tighten side bolts evenly by screwing down large nuts to final tightness. **Always tighten side bolts completely at this stage.** (A 3-foot bar with a 125-lb. pull gives the correct tightness.

4. Tighten each cap screw (starting with top ones) a few turns at a time, until uniform and final tightness is reached.

Note: Gaskets should always be lubricated with water (soap-water if available). Ethylene glycol should be added in freezing weather.

5. Upon completing installation, **if vent plug has been replaced by nipple and valve for large leak**, the valve should be closed and vent plug screwed into valve opening. The vent plug in valve will act as protection against possible leakage through valve.
   Should sleeve leak after being installed, check all bolts for maximum uniform tightness and check lubrication of gaskets. If all bolts are at maximum tightness, gaskets properly lubricated, and the repair sleeve still leaks, it is practically certain that there is dirt or scale between the gaskets and the pipe. Careful cleaning of pipe before sleeve is attached is imperative to assure a good installation.

Important: If, when this repair sleeve is taken off, it is returned to storage for future use, care should be taken that cap screws are **well loosened**. This relieves pressure on end gaskets and returns them to correct position and contour, which is necessary for proper reuse. It is also advisable to put shims between the two sleeve halves to prevent pressure against the side gaskets and resultant distortion while in storage. Gaskets, cap screws and bolts should be replaced if not in first-class condition.

Note: When pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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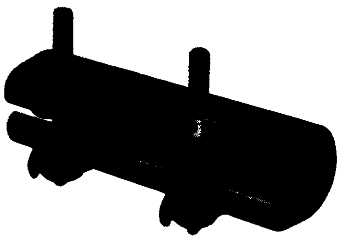
GAS PRODUCT INSTALLATION MANUAL

Style 118 HANDIBAND® Repair Clamp



1. Clean pipe thoroughly where gasket is to seat.
2. Lubricate gasket and cleaned area of pipe with soap-water (ethylene glycol should be added in freezing weather).
3. Place clamp around pipe with gasket centered over leak. Hook bolt head in slotted lug and tighten the nut.

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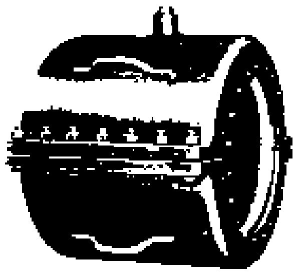
Style 126-A BELL-PACK® Repair Sleeve



1. Clean all dirt and rust from pipe where the sleeve gaskets contact the surface. These surfaces must be clean all around the pipe.
2. Remove nuts from large side bolts and separate sleeve halves. DO NOT REMOVE CAP SCREWS OR FOLLOWER RINGS. All gaskets are in place and do not need trimming or fitting.)

Note: If leak is so large that assembly is difficult, because of internal pressure developing, the vent plug in repair sleeve should be replaced with a nipple and open valve before sleeve is attached, in order to relieve pressure and control leakage during installation.

If leak is small, removal of vent plug is not necessary.

3. After placing sleeve halves in position over the leak, tighten side bolts evenly by screwing down large nuts to final tightness. ALWAYS TIGHTEN SIDE BOLTS COMPLETELY AT THIS STAGE. (A 3-ft. bar with a 125-lb. pull gives the correct tightness.
4. Tighten each cap screw (starting with top ones) a few turns at a time, until uniform and final tightness is reached.

Note: Gaskets should always be lubricated with water (soap-water if available). Ethylene glycol should be added in freezing weather.

5. Upon completing installation, IF VENT PLUG HAS BEEN REPLACED BY NIPPLE AND VALVE FOR LARGE LEAK, the valve should be closed and vent plug screwed into valve opening. The vent plug in valve will act as protection against possible leakage through valve.

Should sleeve leak after being installed, check all bolts for maximum uniform tightness and check lubrication of gaskets. If all bolts are at maximum tightness, gaskets properly lubricated, and the repair sleeve still leaks, it is practically certain that there is dirt or scale between the gaskets and the pipe. Careful cleaning of pipe before sleeve is attached is imperative to assure a good installation.

Important: If, when this repair sleeve is taken off, it is returned to storage for future use, care should be taken that cap screws are WELL LOOSENED. This relieves pressure on end gaskets and returns them to correct position and contour, which is necessary for proper reuse. It is also advisable to put shims between the two sleeve halves to prevent pressure against the side gaskets and resultant distortion while in storage. Gaskets, cap screws and bolts should be replaced if not in first-class condition.

Note: When pipe movement out of the sleeve might occur, proper anchorage of the pipe must be provided.

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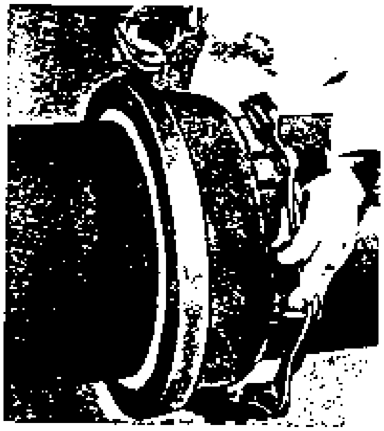
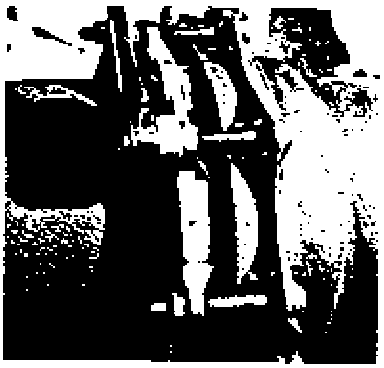
Style 160 Bell-Joint Clamp



1. Clean the joint thoroughly on the back of the bell, on the face of the bell, and along the spigot beyond where the gasket will seat. Dirt, loose rust and scale must be removed so that the gasket will seat on virtually bare metal.
2. Caulking should be flush with the face of the bell as far as practical to assure a flat seating surface. It should not extend beyond the face of the bell. If recessed more than ⅛", the caulking should be faced up with lead wool, plaster of Paris or other material. Keep excess material off the spigot and the face of the bell.
3. Assemble the bell ring on the bell, adjusting it to a good fit. Tighten the section bolts. Note that either the bell ring or spigot ring may be handled by removing the bolt and hinging the other joints.
4. Fit the split Dresser gasket around the spigot, letting the ends pass. Mark one end for cutting parallel to the original cut. Cut the gasket ¼" short for clamps 12" and above, and ⅛" short for smaller clamps.
5. Lubricate the gasket and the gasket seating area of the pipe with soap-water (to which ethylene glycol should be added in freezing weather).
6. Position the gasket against the face of the bell with the splice at the top. Use Dresser Gasket Tongs and pull ends slightly past each other so that ends overlap.
7. Assemble the spigot ring on the pipe, adjusting it so that it will barely slide on the pipe. Distribute the filler as evenly as possible. Insert fillers in all the openings.
8. Soap the outer face of the gasket and slide the spigot ring into position on the gasket. Tighten the section bolts
9. Insert the track-head bolts with the head against the bell ring. The chamfered face of the nut must be against the spigot ring.
10. Tighten diametrically opposite bolts uniformly and progressively. Take up each bolt a little at a time to 50 ft. lbs. torque. Strike all the long bolt heads sharply and then retighten to 50 ft. lbs. Do not strike the short bolts joining sections together.



DRESSER
GAS PRODUCT INSTALLATION MANUAL

Style 201 Wall Seal

1. Measure wall thickness and add sufficient length for nut make-up.
2. Cut pipe and thread both ends, using standard pipe threads.
3. Place gaskets in nuts with wedge-shaped tip to enter sleeve pipe, and install on sleeve pipe. Do not tighten until service line is run through sleeve.

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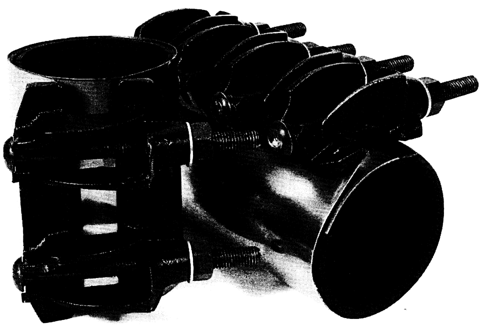
Style 360® Repair Clamp



1. DO NOT CUT GASKET-IT IS CORRECT LENGTH AND WIDTH.
2. Clean pipe thoroughly where gasket is to seat. Smooth any rough spots.
3. Lubricate pipe with soap-water to help gasket slide into correct position.
4. Open the clamp and place it around the pipe, making sure the spanner at split of clamp is located under the band. Do not remove the bolts, since bolt heads drop into the slots in lugs without being removed.
5. After installing bolts finger tight rotate clamp in direction of arrow on body until gasket end is flat against pipe.
6. Center the clamp over the leak and tighten the bolts to 50 ft. lbs. torque.

Rating: **CIP:** 2" thru 8" 100 PSI Gas
10" thru 24" 60 PSI Gas

Steel: 2" thru 8" 100 PSI Gas
14" thru 24" 60 PSI Gas

Caution: (Circumferential Break) When pipe movement out of the clamp might occur, proper anchorage of the pipe must be provided.

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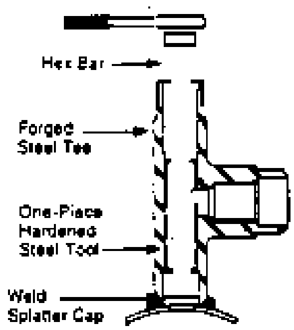
INSTALLATION INSTRUCTIONS

TAP-N-VALVE® TEE



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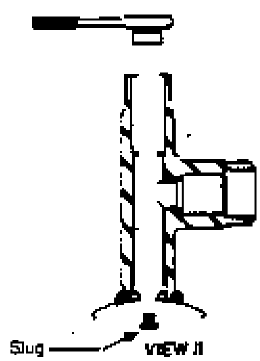
VIEW I

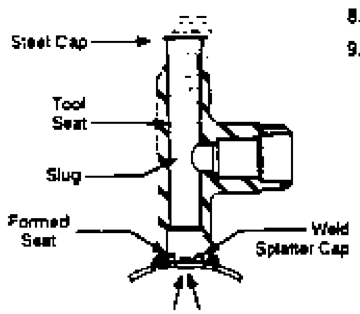
1. Tapping tee is assembled in saddle or welded to main. Tee is supplied with splatter cap to prevent splatter from entering the internal threads. Do not remove weld splatter cap from tee inlet. Splatter cap can be pushed further into tee if required. Tapping tool must be removed from inside the tee while welding. *IMPORTANT: Place tool in plastic bag while welding.* (After welding, tee must be cool to touch before reinserting tool.
2. Hollow, cutting end of tapping tool is then inserted in top of tee and threads are engaged. Leave weld splatter cap in place to prevent slag from entering threads.
3. A hex bar and 14" ratchet wrench are used to rotate the tapping tool in a clockwise direction. Turn down until cutting edge touches the main.



VIEW II

VIEW II

4. To make the tap, continue clockwise wrenching. Once tap has been started in pipe, tool should not be retracted until tap is completed and tool is seated. As tip of tool penetrates through the pipe wall, the required wrench pull or torque will decrease. The operator will feel the seating of the tool on the pipe because the pull will again increase sharply.
5. Tap is now completed. The tool is seated and the slug is retained in the tool.



VIEW III

VIEW III

6. To admit gas to branch, the wrench is rotated in counter-clockwise direction until top of the tool is flush with top of tee body.
7. Apply thread sealing compound to both the cap and tee thread.
8. Cap is tightened on tee body and service connection is complete.
9. Compression branches – *refer to Style 65B, 88 or 90 coupling installation instructions.*

⚠ WARNING

On Weld Point Tees, remove tapping tool and all compression seals components before welding. [illegible] damage the tapping tool and destroy the [illegible] could ignite [illegible] serious injury or death.

DMD DRESSER

DMD DIVISION, DRESSER INDUSTRIES, INC.
41 FISHER AVENUE
BRADFORD PENNSYLVANIA 16701

0001-0543-999
Revised 2-97

INSTALLATION INSTRUCTIONS

DRESSER® Style 501 TAP-N-VALVE® Tee

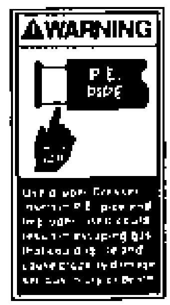
With SEAL-PLUS™ Restraining End

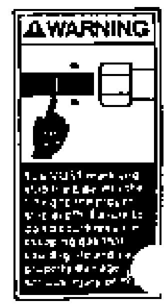
GENERAL: FOR WELDED INLET AND THREADED INLET X 501 POLYETHYLENE TUBING COMPRESSION OUTLET TAP-N-VALVE TEES

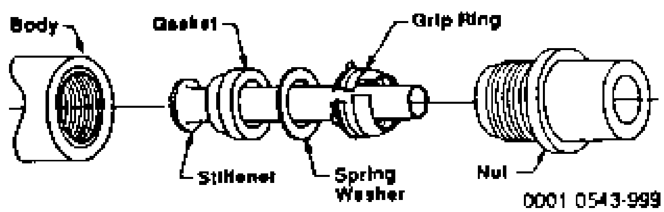
1. On weld inlet tees, remove tapping tool and all compression end components. Do not remove weld splatter cap from tee inlet.
2. For threaded inlet tees, apply pipe thread compound to threads and attach to the main. For weld inlet tees, weld to main and allow to cool to hand touch prior to reassembly of tapping tool & compression end components. (Reassemble parts in the sequence and orientation shown.)
3. Cut tubing square and deburr. Tubing must be clean and free of longitudinal scratches. At lower temperature a slight chamfer approximately 1/16" x 45° on the end of tubing will facilitate insertion into the fitting.
4. Make sure nut flange is 1/4" to 5/16" from body contact.
5. Mark tubing for stab depth; 2-3/4" for 5/8" O.D. thru 1-1/8" O.D., 3" for larger sizes.
6. Check stiffener to assure it is for wall thickness of tubing used (see color code).
7. Stab tubing into fitting until it bottoms. If properly stabbed, the tube markings will be inside or not over 1/8" from the UNTIGHTENED nut. STABBING NOTE. This fitting does not grip when the tubing is stabbed. If difficulty is encountered in stabbing, withdraw the tubing and try reinserting again. (Be sure nut flange is at least 1/4" from body.) After proper stabbing is determined, THE NUT MUST BE HAND TIGHTENED TO ACTUATE THE GRIP RING FOR HOLDING THE TUBING IN PLACE DURING FINAL TIGHTENING.
8. Tighten nut until flange contacts body. (Do not overtighten.)
9. Check stabbing marks on tubing. If mark is over 9/16" from the tightened nut on 5/8" O.D. thru 1-1/8" O.D. sizes and over 5/8" on larger sizes, the end must be disassembled. After disassembly, check if stab mark length is correct. In reassembling an improperly stabbed end, cut off the tubing to eliminate the gripper teeth marks, reassemble parts in proper order, remark tubing, and then repeat the connection procedure.
10. See other side for tapping instructions.
11. Rotate tool counterclockwise until flush with top of tee.
12. Apply thread compound on pipe threads and tighten cap.

COLOR CODE

Tubing Wall (Any Dia.)	Color
.062	Red
.077	Blue
.090	Steel (plain)
.099/.101/.103	Gold
.121	Black







0001 0543-999
Rev. 3/97

DMD DRESSER
DRESSER MANUFACTURING DIVISION
DRESSER INDUSTRIES, INC.
Bradford, Pennsylvania 16701

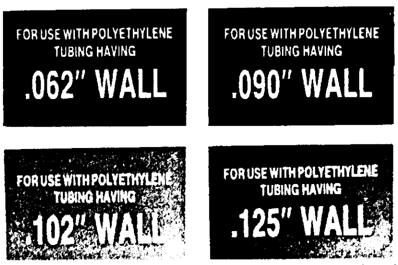
INNER-TITE®

INSTALLATION INSTRUCTIONS

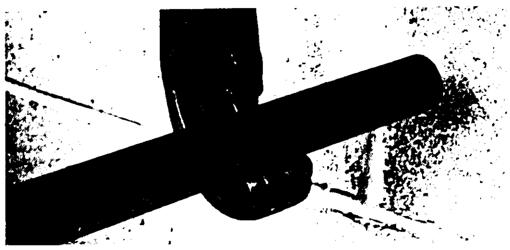
POSILOCK® STRAIGHT ADAPTERS
For Polyethylene Gas Tubing

- The Posilock Straight Adapter is factory assembled and quality control inspected prior to shipment. DO NOT DISASSEMBLE.
- Do not apply pipe dope to internal machine threads of the Posilock Straight Adapter.
- The Posilock Straight Adapter can be used as a Service Head Adapter.
- Soapy water (leak test solution) and a pipe wrench are required for proper installation.

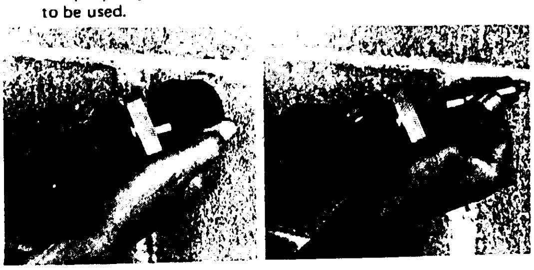
GREEN BLUE YELLOW RED



1 Each box of Posilock Adapters contains installation instructions. A color coded label is affixed to each box, denoting the polyethylene wall thickness with which the fittings are to be used.

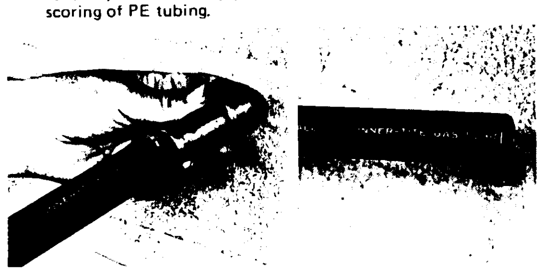


2 Cut the polyethylene tubing square. Tubing should be free of scratches, burrs and cuts. If installation is a service renewal, old steel pipe should be cleaned to prevent scoring of PE tubing.

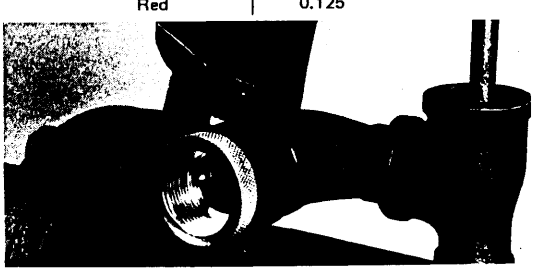


3 Remove plastic end cap and discard. Withdraw color coded insert stiffener.

COLOR	USE WITH
Green	0.062" Wall Tubing
Plain	0.090"
Yellow	0.102"
Red	0.125"



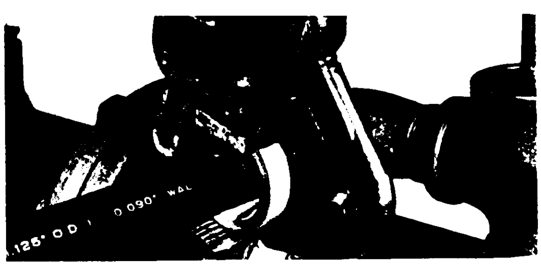
4 Push insert stiffener all the way into polyethylene tubing.



5 Connect Posilock body (MPT threads) to desired fitting and tighten. Place wrench on body only. Do not tighten nut.

6 Apply soap solution or leak test solution to inside of Posilock and outside of polyethylene tubing. This lubricates gasket and permits full insertion of tubing into fitting. This is important!

7 Stab plastic into Posilock until it bottoms out. Be sure plastic is bottomed...you can hear it and feel it.



8 Tighten fitting nut until body and nut meet while holding Adapter body secure with locking wrench. Tighten to mechanical stop. You cannot overtighten the Posilock Straight Adapter.

Patent Number 3,375,025

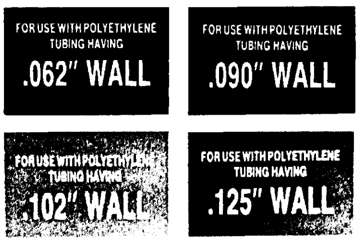
POSILOCK® SERVICE HEAD ADAPTERS
For Polyethylene Gas Tubing

- The Posilock Service Head Adapter is factory assembled and quality control inspected prior to shipment.

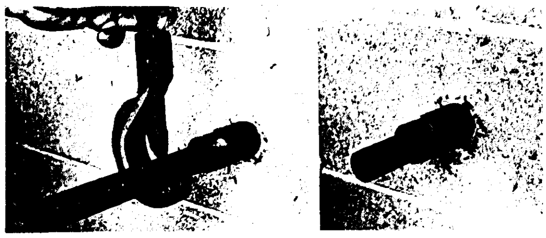
DO NOT DISASSEMBLE

- Do not apply pipe dope to internal machine threads of the Posilock Service Head Adapter.
- The Posilock Service Head Adapter can be used as a Straight Adapter.
- Soapy water (leak test solution) and a pipe wrench are required for proper installation.

GREEN BLUE YELLOW RED



1 Each box of Posilock Adapters contains installation instructions. A color coded label is affixed to each box, denoting the polyethylene wall thickness with which the fittings are to be used.



2 Cut the polyethylene tubing square. Tubing should be free of scratches, burrs and cuts. If installation is a service renewal, old steel pipe should be cleaned to prevent scoring of PE tubing.

3 Remove plastic end cap and discard. Withdraw color coded insert stiffener.

COLOR	USE WITH
Green	0.062" Wall Tubing
Plain	0.090"
Yellow	0.102"
Red	0.125"

4 Push stiffener all the way into polyethylene tubing.

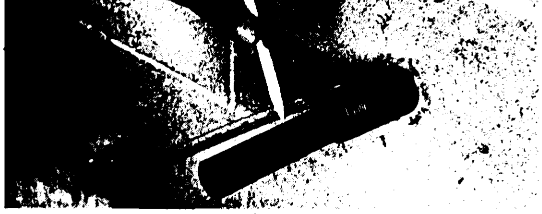
5 Apply soap solution or leak test solution to inside of Posilock and outside of polyethylene tubing. This lubricates gasket and permits full insertion of tubing into fitting. This is important!

6 Stab plastic into Posilock until it bottoms out. Be sure plastic is bottomed out...you can hear it and feel it. Visually check by looking into open end of fitting.

7 Push fitting and tubing onto old steel service line. Thread Adapter nut onto steel service line. Tighten firmly. Be careful to only tighten Adapter nut with wrench, allowing fitting body to rotate freely.

8 Tighten Posilock body until nut and body meet while holding Adapter nut secure with locking wrench. Tighten to mechanical stop. You cannot overtighten the Posilock Service Head Adapter.

If the street end of the service is installed first, it will be necessary to measure the required length of PE tubing extending beyond the old steel service for proper installation of the Service Head Adapter. Measure and cut the PE tubing in accordance with the following chart. After cutting, proceed with the recommended installation steps 4 thru 8 listed above.



Street end of service installed first.

9

TUBING LENGTH

Steel Service IPS	Plastic Tubing CTS	Approx. Length of Plastic Extended From Steel Service
3/4"	1/2"	1-5/8"
1"	1/2"	2"
1-1/4"	1/2"	2-1/4"
1-1/2"	1/2"	2-1/2"
1"	3/4"	1-1/2"
1-1/4"	3/4"	2-1/8"
1-1/4"	1"	1-3/4"
1-1/2"	1"	2-1/8"
1-1/2"	1-1/4"	1-3/4"
2"	1-1/4"	2-1/2"

Manufacturer's Recommended Procedures

Mueller® - Mechanical Joint Stoppers: H-17165, H-17265 & H-17266

Step 1 Thoroughly clean the pipe on which the fitting is to be attached.

Step 2 Remove completion cap. (For protection during shipment, the end screws and pipe gripping screws* are placed under completion cap of 3" and larger fittings.) Separate top and bottom halves of fitting by removing the side bolt nuts only. Do not remove end gasket followers, side bolts, or side gaskets.

Step 3 Lubricate rubber gaskets with soap suds (add glycerin in freezing weather). Place the two halves of fitting on the pipe, locate the fitting in the desired position then tighten side bolts evenly by pulling up each one a small amount at a time until all are tightened to 900 in-lbs.

Step 4 Insert and tighten end screws with a small wrench. Start at the top and work around the fitting, tightening each one a little at a time until all are tightened to 200 in-lbs.

Step 5 Insert and tighten pipe gripping set screws to 200 in-lbs. to hold fitting firmly in place.

Step 6 Remove completion plug. Bolt completion cap to fitting, being sure gasket is in good condition and in place. Remove test plug from completion cap and fit up for test pressure application.

Step 7 Apply air pressure and test for leaks at all joints with leak detection fluid (add glycerin in freezing weather).

Step 8 Remove completion cap and replace test plug in completion cap.

* The longest screws are pipe gripping screws.

Mueller® - Repair Clamps

Step 1 Clean the main as thoroughly as conditions will permit making sure all burs and debris are removed. In the case of Asbestos-Cement, follow the pipe manufacturer's instruction for cleaning pipe.

Step 2 Slip bolt head out of lug and fit clamp on pipe, centering the clamp over the damaged area.

Step 3 Slip bolt head back in lug.

Step 4 Rotate Clamp in direction as indicated by arrow on clamp band to "smooth" out gasket lap.

Step 5 Tighten 5/8" bolts evenly to 840 inch pounds (70 pound pull on a 12" wrench) - altering between bolts. Tighten 1/2" bolts evenly to 480 inch pounds (40 pound pull on a 12" wrench) - altering between bolts.

Note: Band type clamps are NOT to be used to bring pipe ends into alignment and are not intended to take pipe line stresses. On SERVISEAL® Clamps, use thread sealant on external threads to be screwed into tapping boss.

PLASTIC PIPE and TUBING

For Lock-Stiffener Configurations with Polyethylene

Properly installed fittings with the patented NORMAC® Lock Stiffener resist pull-out forces greater than the tensile strength of the polyethylene pipe on which they are installed.

INSTALLATION

1. Apply a straight cut to the end to be joined. Mark the pipe 3″ from the same end.
2. Disassemble the appropriate end of the NORMAC fitting; slide the nut, retainer, gasket, and lock ring over the pipe end.
3. Insert the stiffener into the pipe or tubing all the way to the end of the flange.
4. Push lock ring back to engage the stiffener flange.
5. Stab the end into the fitting center coupling. Using appropriate wrench *(see table below)*, tighten the nut to the recommended torque in table below.

NOTE: In repair situations, use ASG (Arcless Static Ground) as instructed in Catalog Section D, page D22 to reduce the chance of sparking caused by static electricity in plastic piping systems.

Recommended working pressures for NORMAC fittings are:

25 psig on unrestrained gas line

125 psig for a restrained gas line in an underground application.

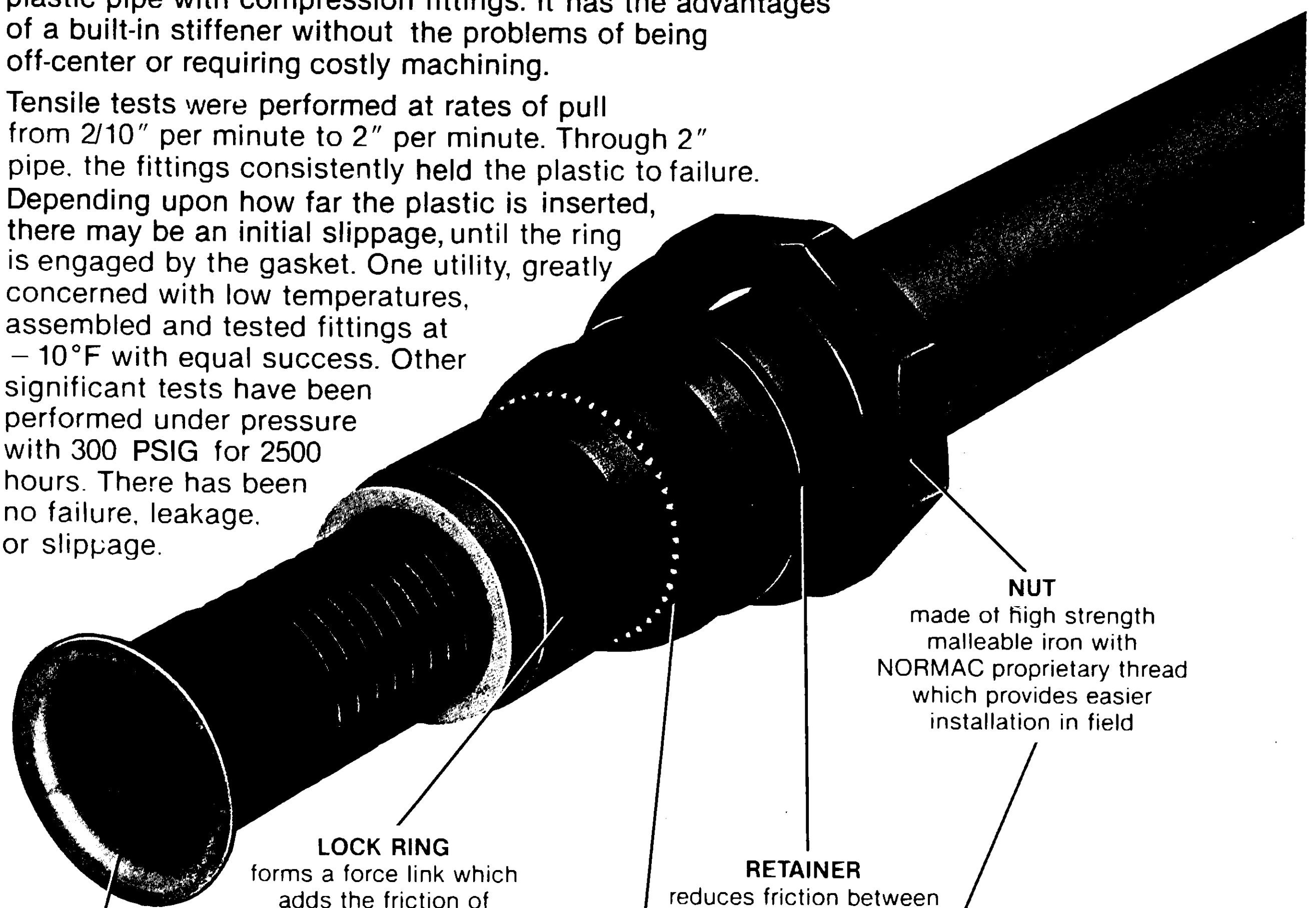
For higher pressures consult our Engineering Department.

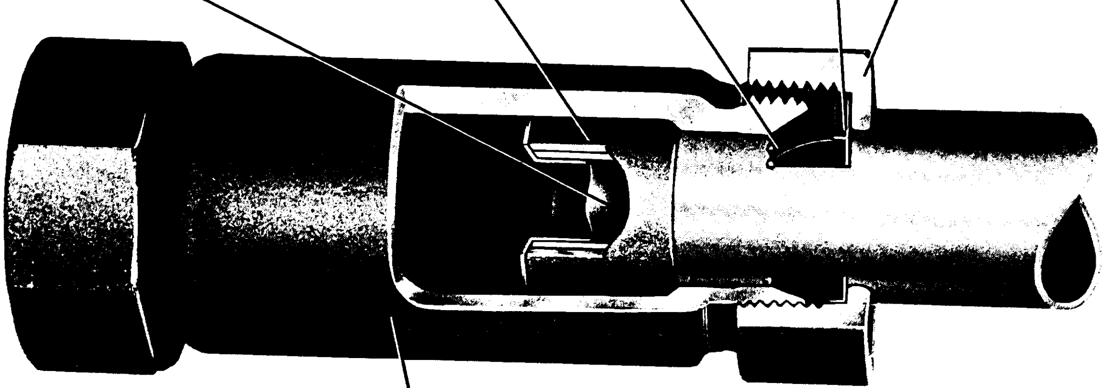
PIPE OR TUBING SIZE (Inches)	RECOMMENDED WRENCH SIZE (Inches)	TORQUE (Ft. Lbs.)
½ IPS	14	95
¾ IPS	14	100
1 IPS	18	100
1¼ IPS	18	110
1½ IPS	24	115
2 IPS	24	160
½ or ⅝OD	14	55
⅞ OD	14	85
1⅛ OD	14	100
1⅜ OD	18	110

NORMAC Lock-Stiffener

NORMAC developed the Lock Stiffener in response to the problem of the pull-out experienced by many gas utilities using plastic pipe with compression fittings. It has the advantages of a built-in stiffener without the problems of being off-center or requiring costly machining.

Tensile tests were performed at rates of pull from 2/10″ per minute to 2″ per minute. Through 2″ pipe, the fittings consistently held the plastic to failure. Depending upon how far the plastic is inserted, there may be an initial slippage, until the ring is engaged by the gasket. One utility, greatly concerned with low temperatures, assembled and tested fittings at −10°F with equal success. Other significant tests have been performed under pressure with 300 PSIG for 2500 hours. There has been no failure, leakage, or slippage.





STEEL PIPE and COPPER TUBING

For Bead-Tipped Gasket Configurations

NORMAC gaskets have an exceptional record of service. The gaskets retain their resiliency. The exclusive design of NORMAC gaskets incorporates a curved face which assures faster conformation and seating. The exposed beads on NORMAC bead-tipped gaskets provide greatly improved bonding efficiency, creating the maximum area for metal to metal contact. Brass beads, a NORMAC exclusive, bite with maximum efficiency into both the pipe and the fitting under compression. This results in a joint of low resistance eliminating the need for standard bonding.

INSTALLATION

1. **Steel.** Remove all coatings, tar and mill scale from the pipe ends that are to be joined (4″ on each end for fittings with the standard body, 7″ on each end for fittings with 10″ sleeves). Deburr pipe.
   Copper. Apply straight cut and deburr both ends to be joined. Clean ends for conductivity.
2. Loosen compression nuts on both ends of the fitting so that the gaskets are free to move.
3. Stab the end into the fitting. Using appropriate wrench *(see table below)*, tighten the nut to the recommended torque in table below.

Recommended working pressures for NORMAC fittings are:

25 psig on unrestrained gas line

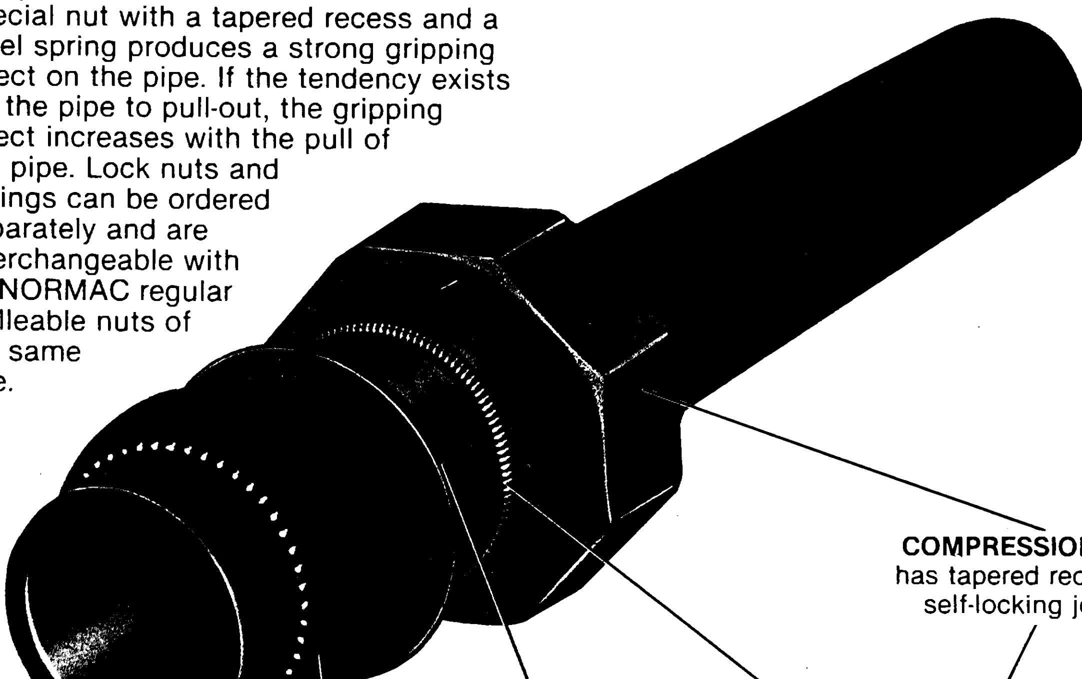
125 psig for a restrained gas line in an underground application.

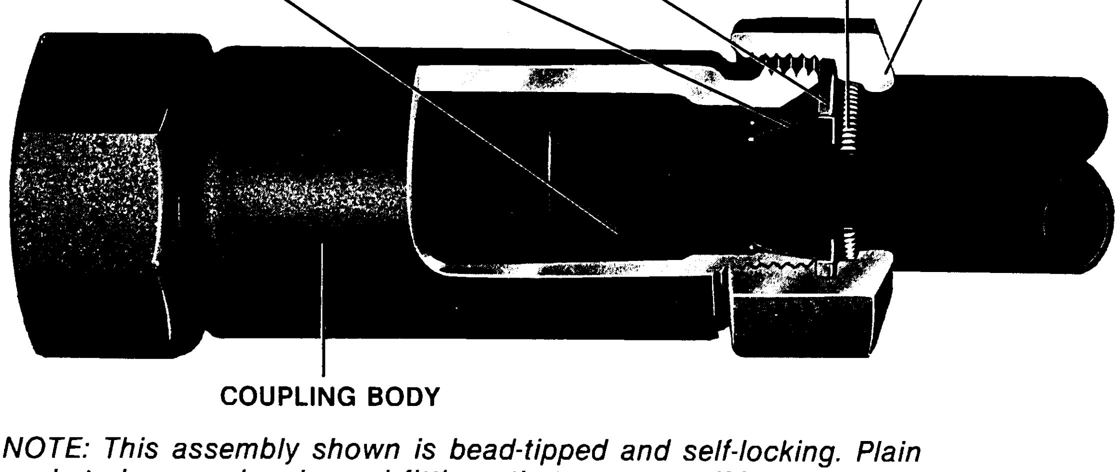
For higher pressures consult our Engineering Department.

	GASKET SIZE (Inches)	RECOMMENDED WRENCH SIZE (Inches)	TORQUE (Ft. Lbs.)
STEEL	½ IPS	14	95
	¾ IPS	14	100
	1 IPS	18	100
	1 ¼ IPS	18	110
	1 ½ IPS	24	115
	2 IPS	24	160
COPPER	½ or ⅝ OD	10	30
	⅞ OD	14	85
	1⅛ OD	14	90
	1⅜ OD	18	100

NORMAC Self-Locking Joints

The NORMAC self-locking joint is available on all NORMAC malleable and steel fittings with ¾" through 2" IPS dimensions on the compression ends. The combination of a special nut with a tapered recess and a steel spring produces a strong gripping effect on the pipe. If the tendency exists for the pipe to pull-out, the gripping effect increases with the pull of the pipe. Lock nuts and springs can be ordered separately and are interchangeable with all NORMAC regular malleable nuts of the same size.





NOTE: This assembly shown is bead-tipped and self-locking. Plain gaskets have no beads, and fittings that are not self-locking use a regular compression nut and have no steel spring.

STEEL PIPE and COPPER TUBING

For Insulating Gasket Configurations

NORMAC Insulating Gaskets. NORMAC insulated couplings and fittings combine the use of a rubber insulating gasket and a nylon insulator. Nylon has very high dielectric properties and the rubber gaskets have low carbon content for maximum insulation. Insulating couplings and fittings are sized and assembled for use with insulating gaskets.

INSTALLATION

1. **Steel.** Remove all coatings, tar and mill scale from the pipe ends that are to be joined (4″ on each end for fittings with the standard body, 7″ on each end for fittings with 10″ sleeves). Deburr pipe.
   Copper. Apply straight cut and deburr both ends to be joined. Clean both ends.
2. Loosen compression nuts on both ends of the fitting so that the gaskets are free to move.
3. Stab the end into the fitting. Using appropriate wrench *(see table below)*, tighten the nut to the recommended torque in table below.

Recommended working pressures for NORMAC fittings are:

25 psig on unrestrained gas line

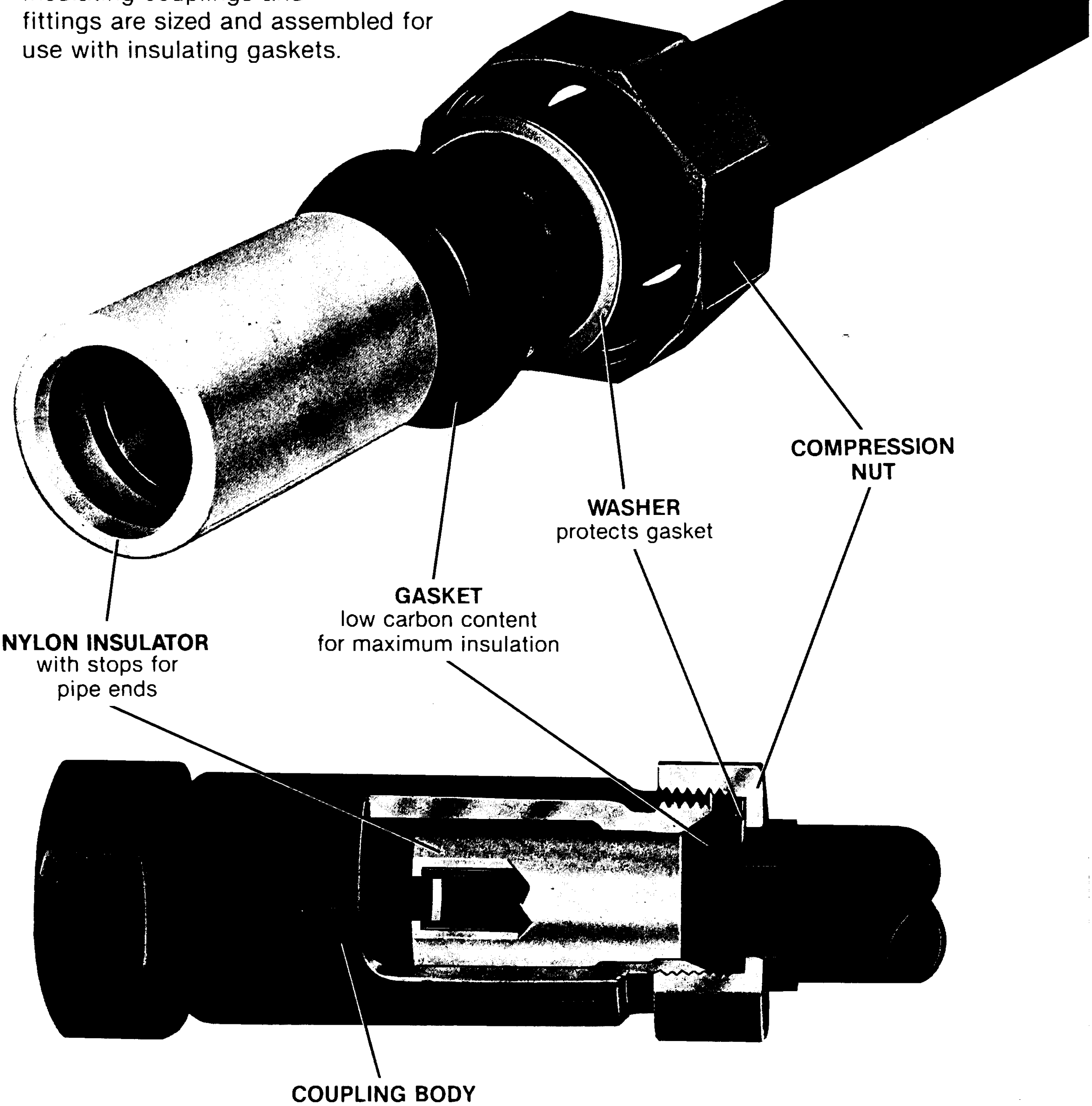
125 psig for a restrained gas line in an underground application.

For higher pressures consult our Engineering Department.

	GASKET SIZE (Inches)	RECOMMENDED WRENCH SIZE (Inches)	TORQUE (Ft. Lbs.)
STEEL	½ IPS	14	75
	¾ IPS	14	65
	1 IPS	18	75
	1¼ IPS	18	90
	1½ IPS	24	115
	2 IPS	24	150
COPPER	⅞ OD	10	30
	1⅛ OD	14	55

NORMAC Insulating Gaskets

NORMAC insulated couplings and fittings combine the use of a rubber insulating gasket and a nylon insulator. Nylon has very high dielectric properties and the rubber gaskets have low carbon content for maximum insulation. Insulating couplings and fittings are sized and assembled for use with insulating gaskets.



PLIDCO® SPLIT+SLEEVE INSTALLATION INSTRUCTIONS

READ CAREFULLY FIRST!

Maintenance personnel should be supplied with these instructions so they can study them before proceeding with installation.

Plidco Split+Sleeves will achieve high pressure seals over moderately pitted pipe surface areas. Also, some surface irregularities can be tolerated by the elastomer seal.

Standard Split+Sleeves are rated at 1000 psig.

They are shop tested to 1½ times working pressure.

STORAGE INSTRUCTIONS

Plidco Split+Sleeves should be stored in a cool, dark, dry environment at temperatures not to exceed 120°F (49°C.). We suggest putting a heavy grease over the studs and nuts to keep them from rusting. Cover with a dark polyethylene to keep the direct sunlight from the packing. It is best to exclude air, contamination, light, ozones and radiation.

WHEN IN DOUBT, CONTACT PLIDCO SALES OR ENGINEERING

PLIDCO® THE PIPE LINE DEVELOPMENT COMPANY
PLIDCO INTERNATIONAL, INC.
870 Canterbury Road ● Westlake, Ohio 44145 ● Phone: (216) 871-5700
CABLE ADDRESS: WELDENDS CLEVELAND, OHIO ● TELEX 980-670
CALL TOLL FREE: 1-800-848-3333 In Ohio, Call Collect

PLIDCO SPLIT+SLEEVE TORQUE CHART

Nominal Diameter of Stud (Inches)	Wrench Opening Across Flats	25,000 PSI STRESS LEVEL 0.08 (C.O.F.)* Torque (Ft. Lbs.)	0.15 (C.O.F.)* Torque (Ft. Lbs.)
5/8—11	1-1/16	33	56
3/4—10	1-1/4	57	98
7/8— 9	1-7/16	91	156
1 — 8	1-5/8	135	233
1-1/8— 8	1-13/16	197	342
1-1/4— 8	2	274	480
1-3/8— 8	2-3/16	370	651
1-1/2— 8	2-3/8	485	857
1-5/8— 8	2-1/2	617	1096
1-3/4— 8	2-3/4	782	1394
1-7/8— 8	2-15/16	968	1730
2 — 8	3-1/8	1180	2116
2-1/4— 8	3-1/2	1695	3053
2-1/2— 8	3-7/8	2340	4231
2-3/4— 8	4-1/4	3130	5678
3 — 8	4-5/8	4114	7484
3-1/4— 8	5	5246	9564
3-1/2— 8	5-3/8	6568	11997

Studs: ASTM A 193 Grade B7. Nuts: ASTM A 194 Grade 2H.

Torque values shown in the table represent two different coefficients of friction (C.O.F.), .08 and .15. When the C.O.F. is .08, it is assumed that the studs and nuts are clean, free running, free of obvious surface flaws and lubricated with a high grade graphite-oil thread lubricant. When the C.O.F. is .15 it is assumed that the studs and nuts are clean, free running, free of obvious surface flaws and lubricated with a light weight machine oil. The torque values are safe minimums and represent approximately 25,000 psi bolt pre-stress.

PIPE PREPARATION

1. Remove all coatings, rust and scale from the pipe surface where the Plidco Split+Sleeve is to be assembled, especially where the seals are to be placed.
2. The smoother and cleaner the surface under the seal, the more positive it will be. Also, the bolt stress required to seal will be lower and the installation will proceed faster.

INSTALLATION

1. Coat all exposed surfaces of the gasketing with a lubricant that is compatible with the seal and product.
2. Clean and lubricate all studs and nuts, and prove free and easy nut running prior to installation.
3. Assemble the sleeve loosely around the pipeline to one side of the leak, matching the yellow painted ends. Slide sleeve over the leak, being careful not to damage girdering and packing. Center it over the leak and damaged area as much as possible. Hand tighten studs and nuts.
4. All studs and nuts should be uniformly torqued as indicated by the chart on page 2. The best results are obtained by maintaining an equal gap all around between side bars while tightening the bolts.
5. To complete assembly, ALL studs should be rechecked at the recommended torque. Keep in mind, the slightest increase in torque on one stud can cause a decrease in torque on neighboring studs.
6. The side bars are gapped approximately ⅛″ when the sleeve is fully tightened.

WELDING SEQUENCE

PIPELINE SHOULD BE FULL AND UNDER FLOW.

If pipeline has been shut down, pressure up pipeline to test seals. Repressuring should be accomplished slowly and steadily without surges or slugging which could vibrate and shake lines and fitting.

Do not exceed safe maximum pressure.

READ NOTE BELOW BEFORE WELDING*

Welding should proceed slowly as not to overheat the packing.

1. Caution should be observed so that welding does not overheat the seals. Sequence the welding so that the heat is not concentrated in one area.
2. Fillet-weld ends to pipe (Fig. 1).
3. Seal-weld side openings (Fig. 2).
4. Re-torque studs and nuts.
5. Seal-weld around bottoms of nuts to side bar (Fig. 2).
6. Seal-weld nuts to studs (Fig. 2).

Studs: ASTM A 193 Grade B7. Nuts: ASTM A 194 Grade 2H.

***NOTE:** Use **absolutely dry** basic low hydrogen electrodes and carefully control the size and shape of the circumferential fillet welds. The leg of the fillet weld should equal 1.4 times the wall thickness of the pipe. Strive for a concave faced fillet weld, with streamlined blending into both members; avoid notches and undercuts. The smoother and more streamlined the weld, the greater the resistance to fatigue failure. **The worst possible shape would be a heavy reinforced convex weld with an undercut.**

Welders should be qualified in accordance with the requirements of API Standard RP 1107, Latest Edition.

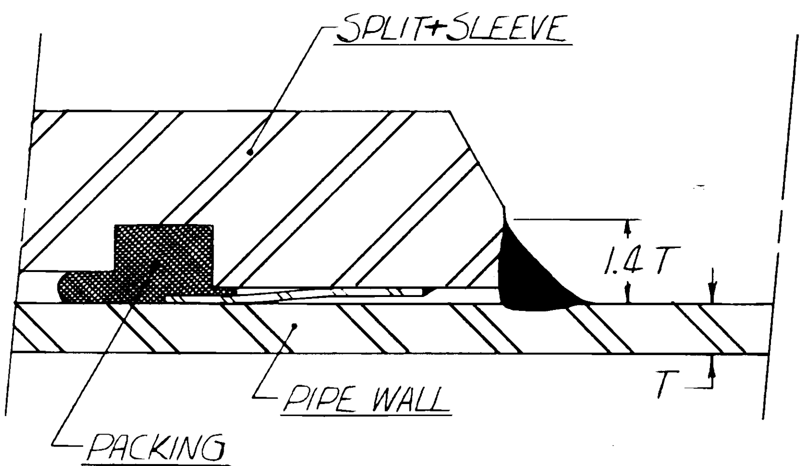


Fig. 1

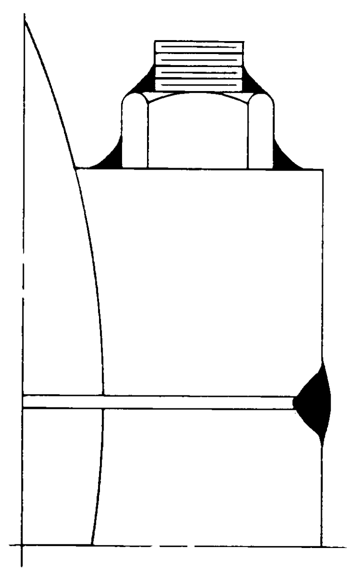
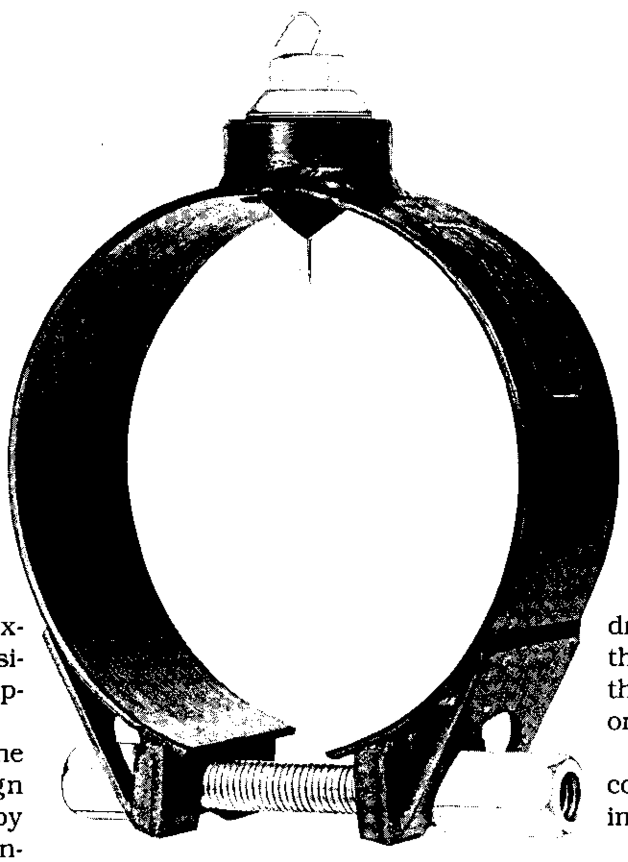


Fig. 2

PLIDCO® SMITH+CLAMP™



Patented

The Plidco Smith+Clamp's exclusive pilot pin makes it possible to locate pit-hole leaks in piping, even if they can't be seen.

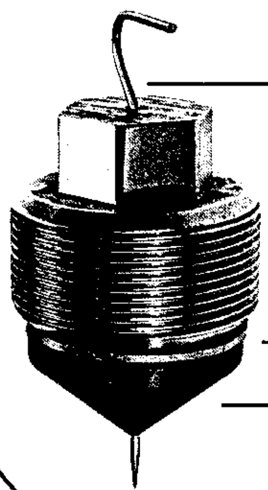
So simple and sensible is the Plidco Smith+Clamp design that it could be installed even by a blindfolded person . . . certainly in darkness or on a pipeline submerged in water or oil.

The pilot pin guides the cone point into the leaking pit-hole (see panel at bottom of page).

Pressure is then applied behind the cone—not by drawing bolts on opposite side of the pipe. The drawbolt shown at the bottom of this cutaway view only holds clamps in place.

Exerting pressure directly on cone eliminates danger of caving in badly corroded pipe.

Line pressure need not be reduced during installation of light-weight, easily-handled Plidco Smith+Clamp, which is designed to shut off high pressure leaks. Available in sizes ½″ through 48″ or larger. Special sizes on application.

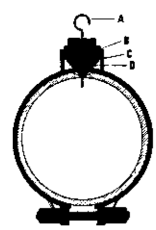


A. Pilot pin (1/16″ diam. stainless steel wire) goes down through center of force screw and cone, locates hole, guides cone point (D) to trouble spot.

B. Steel packing force-screw. Turned with wrench, it forces point of cone in leaking hole. Additional wrenching pressure flattens cone into flat disc shape.

C. Thrust washer. Permits force-screw (B) to turn without rotating (D).

D. Pointed cone of Buna-N (or silicone, fluorocarbon or other specified material) serves as leak packing.



Pressure rating up to 2000 psig working pressure, depending upon leak area.

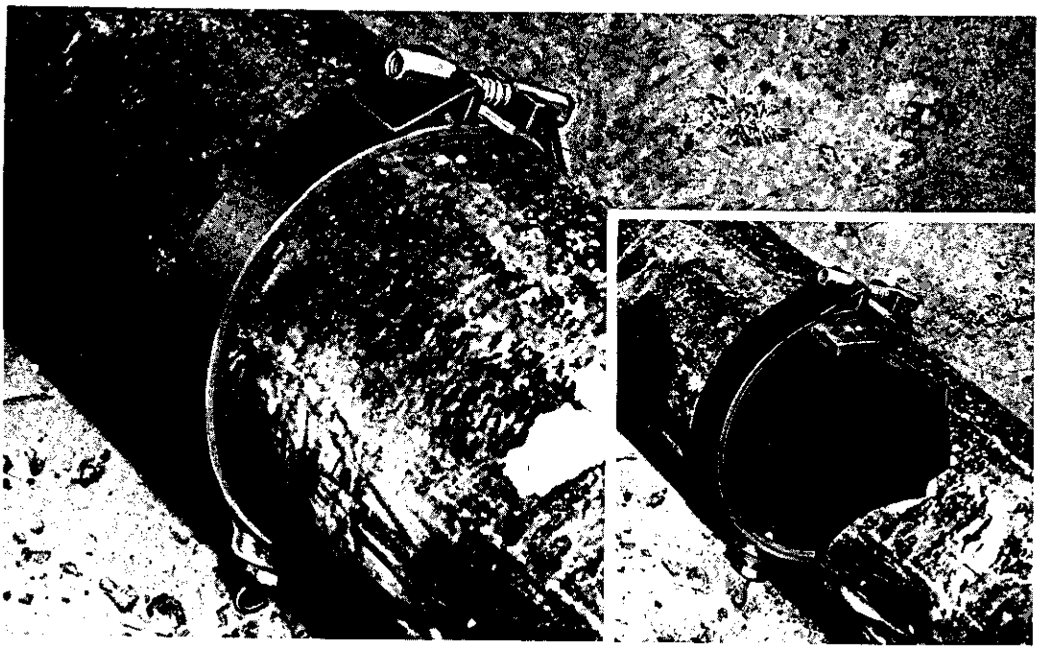
PLIDCO® SMITH+CLAMP
Requires much lower bolting pressure

Since the point of the cone is centered exactly on the leak, a minimum of force is required to shut-off the leak.

For example—a 1/8" diameter hole is 0.012 square inches in area. At a pipeline pressure of 1000 psig only 12 pounds of force is needed to push the cone into the leaking hole.

The pipe wall is roughly corroded over an area of 3 square inches surrounding the hole. This is by no means an unusual condition but very difficult for the ordinary clamp because it will require over 3000 pounds of force to shut off this same hole.

In other words the old-fashioned "blunder-buss clamp" requires 250 times as much force to shut off the same leak.



A 12¾" O.D. pipeline in west Texas, carrying sour gas to a plant of a major oil company, developed a ¼" diam. hole, the result of internal corrosion.

This gas (sulfur-bearing) is so toxic that men working around it must wear gas masks.

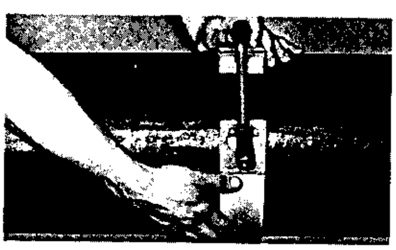
The larger photo shows installation of Plidco Smith+Clamp which stopped leak in 3 minutes.

The cutaway view shows Smith+Clamp features—drawbolt at top; pilot pin, force-screw and pointed cone at bottom stopping rust hole leak.

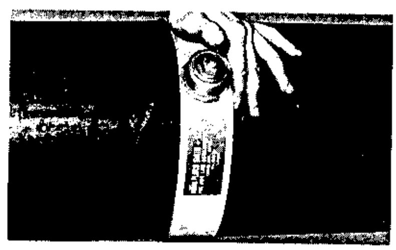
How to install

1. Spring Plidco Smith+Clamp apart; push it over the pipe.

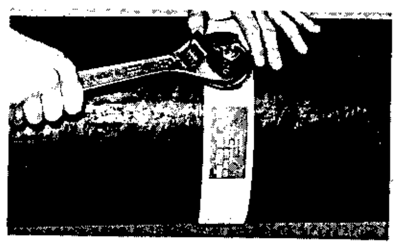
2. Pull ends back together, reposition drawbolt and pull up on it until clamp fits loosely on pipe. (Drawbolt nuts are tapered at ends. This locks them into drawband ears so they cannot come out after being tightened.)



3. Move clamp about until pilot pin "finds" leak hole. Push pilot pin into hole as far as it will go. Turn force-screw until tip of cone touches pipe. Pilot pin may be withdrawn if desired.



4. Tighten drawbolt securely and draw up tightly on force-screw. Leak is repaired.



PLIDCO® THE PIPE LINE DEVELOPMENT COMPANY
PLIDCO INTERNATIONAL, INC.
870 Canterbury Road • Cleveland, Ohio 44145 • Phone: 216-871-5700
CABLE ADDRESS: WELDENDS CLEVELAND, OHIO • TELEX 980-670

Rockwell

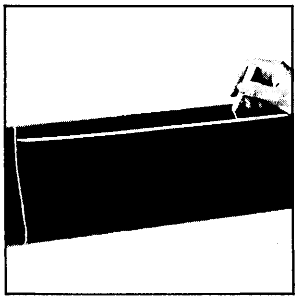
Clamp and Coupling products

For Gas Service

Installation Instructions Rockwell FULL CIRCLE® CLAMP COUPLINGS for gas service 225, 234 and 258 single band clamps

1 Thoroughly clean the pipe where the clamp will be installed.

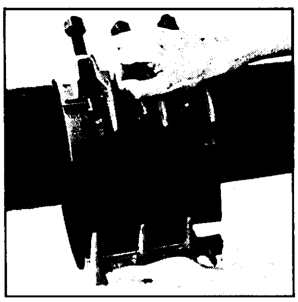
2



If conditions permit, place a reference mark on the pipe a measured distance from the center of the break or damaged area.

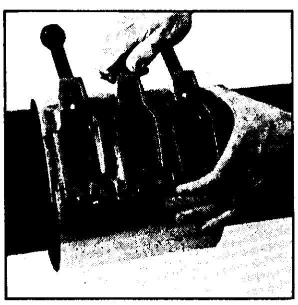
Thoroughly lubricate the pipe with soap solution or other suitable lubricant.

3



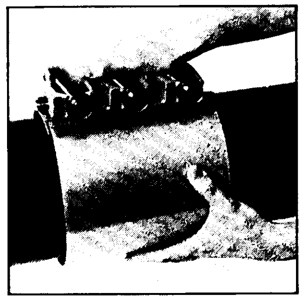
Place the clamp around the pipe centered over the break or damaged area with the gasket flap at the top.

4



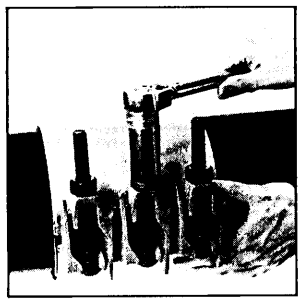
Tuck the gasket flap in place and mesh the lug fingers. Engage the center most bolt(s) in the drop-in lugs, and tighten finger tight.
(NOTE: The clamp may be assembled beside the break or damaged area and slid into position, if the pipe surface is wet or has been lubricated.)

5



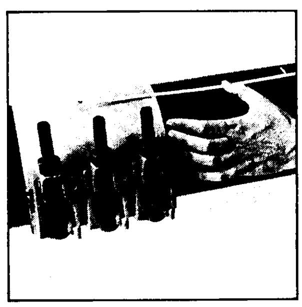
Rotate the clamp in the direction indicated by the arrow to insure proper seating of the gasket, and position the bolts and nuts for convenient tightening.

6



Tighten the bolts working from the center outward. Completely tightening the center bolt will usually stop or sufficiently retard the leakage to simplify completion of the installation.

7



When bolts have been tightened sufficiently to stop the leakage, measure from the reference mark (Instruction 2) to the center of the clamp to see if the clamp is properly positioned over the break or damaged area. Loosen the bolts and reposition the clamp if necessary.

8 Recheck the bolt tightness, and torque the bolts as evenly as possible.

Maximum torque recommendation: 50 ft. lbs.

Sufficient tightening to seal off the leak is all that is required.

Rockwell

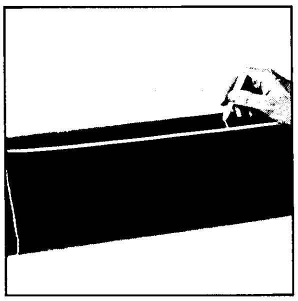
Clamp and Coupling products

For Gas Service

Installation Instructions Rockwell FULL CIRCLE® CLAMP COUPLINGS 225, 235 and 259 multiple band clamps

1 Thoroughly clean the pipe where the clamp will be installed.

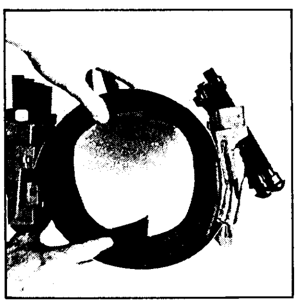
2



If conditions permit, place a reference mark on the pipe a measured distance from the center of the break or damaged area.

Thoroughly lubricate the pipe with soap solution or other suitable lubricant.

3

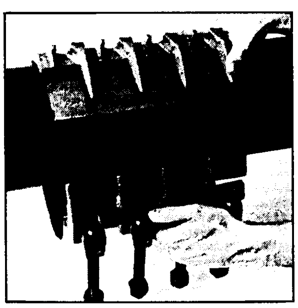


Check the clamp to insure that the gasket flaps are properly positioned, and that the closed lugs (lugs without drop-in bolt feature) are properly spaced:

Approximately ⅜ inch for pipe diameter near the bottom of the clamp O.D. range.

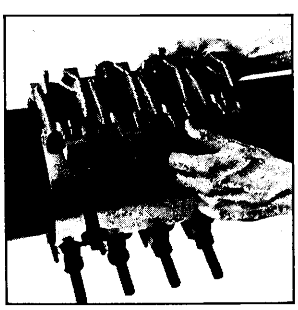
Approximately 1¼ inch for pipe diameter near the top of the clamp O.D. range.

4



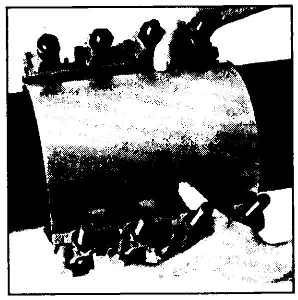
Place the clamp around the pipe centered over the break or damaged area with the gasket flap at the top.

5



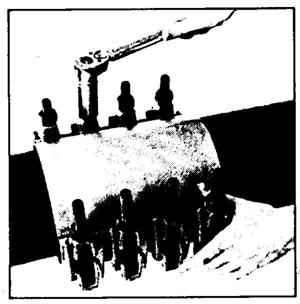
Tuck the gasket flap in place and mesh the lug fingers. Engage the center most bolt(s) in the drop-in lugs, and tighten finger tight.
(NOTE: The clamp may be assembled beside the break or damaged area and slid into position, if the pipe surface is wet or has been lubricated.)

6



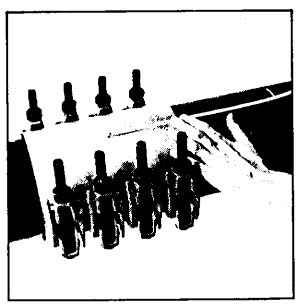
Rotate the clamp in the direction indicated by the arrow to insure proper seating of the gasket, and position the bolts and nuts for convenient tightening.

7



Tighten the bolts working from the center outward. Completely tightening the center bolt will usually stop or sufficiently retard the leakage to simplify completion of the installation.

8



When bolts have been tightened sufficiently to stop the leakage, measure from the reference mark (Instruction 2) to the center of the clamp to see if the clamp is properly positioned over the break or damaged area. Loosen the bolts and reposition the clamp if necessary.

9 Recheck the bolt tightness, and torque the bolts as evenly as possible.

Maximum torque recommendation: 50 ft. lbs.

Sufficient tightening to seal off the leak is all that is required.

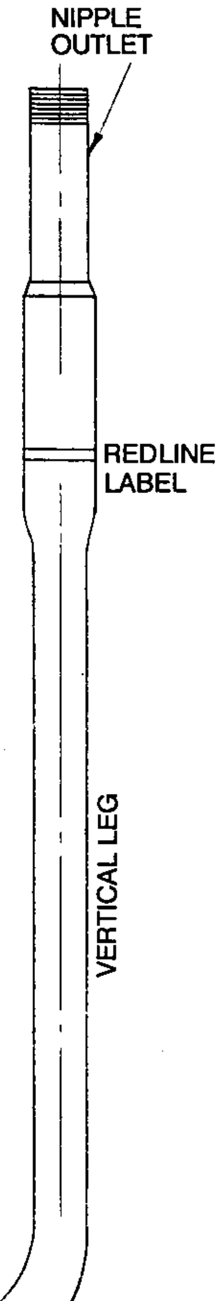
IMPROVISING LARGE O.D. CLAMPS

To fill an emergency need for a large O.D. clamp when none are available, smaller clamps can be joined together to make a multiple band large clamp.

1. Determine exact O.D. of the pipe to be repaired.
2. Select two or three smaller clamps of sizes whose combined O.D. ranges equals the correct O.D. range to fit the damaged pipe.
   A. Example:
      Pipe to be repaired to 20″ cast iron 21.60″ O.D.
      Use 3 ea. 6″ clamps 6.84-7.24 O.D. range
      6.84—7.24
      6.84—7.24
      6.84—7.24
      20.52-21.72 Improvised Clamp O.D. Range
3. It is not necessary to use clamps of the same size, but they should be as close in size as possible.
4. The bridge plate molded into the gasket has a preformed curvature for each size range to facilitate installation. To insure proper sealing the bridge plates must be straightened before installation.

R.W. Lyall and Company, Inc.
Gas Distribution Products

LYCO® ANODELESS METER RISER INSTALLATION INSTRUCTIONS



FACTS

The anodeless meter riser was first designed by R.W. Lyall & Company, Inc. 1973. The anodeless meter riser design eliminates gas carrying steel pipe below ground. This results in the elimination of the need for cathodic protection on the meter riser.

The Lyco riser is designed to safely transition gas from O.D. controlled polyethylene gas pipe below ground to steel pipe above ground. Lyco risers are also manufactured to support normally constructed gas utility meter sets. The anodeless meter riser is the only place in a gas distribution system that polyethylene gas carrying pipe is allowed to be used above ground. This is accomplished by housing the polyethylene gas pipe within a soundly constructed steel casing which is protected externally with a long-life epoxy coating.

If you have any questions concerning the following instructions, please call R.W. Lyall & Company, Inc. at the phone number listed below.

INSTALLATION INSTRUCTIONS

1. Thread gas shut off valve on riser nipple outlet per gas shut off valve manufacturer's instructions. Pipe wrench marks on riser nipple outlet should be painted to prevent corrosion.
2. Dig and prepare service line ditch per current local, state or federal requirements.
3. Connect incoming polyethylene gas service line to inlet of riser polyethylene pipe per gas utility specifications.
4. Install riser in service trench with threaded nipple outlet positioned vertically above ground level.
5. Make sure that the *DO NOT BURY ABOVE RED LINE* indicator label on riser is located above ground level.
6. Pressure test each fitting after installation to comply with the minimum pipeline test requirements as specified in Department of Transportation Title 49, Part 192, Sub Part J-Test Requirements.
7. Back-fill riser trench per gas utility back-fill instructions with riser outlet in vertical position and *DO NOT BURY ABOVE RED LINE* indicator label above ground level.

IMPORTANT NOTES

DO *NOT* lay riser on heat source.*

DO *NOT* weld on riser.*

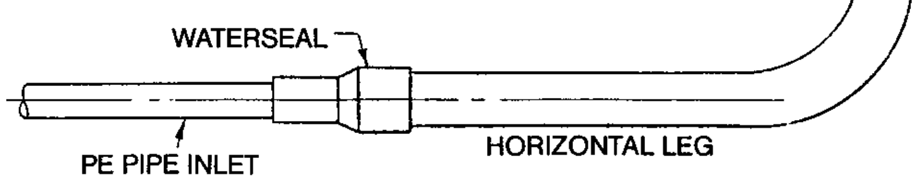
DO *NOT* stick sharp objects into riser.*

*INTERIOR POLYETHYLENE PIPE MAY BECOME DAMAGED.

DO NOT damage coating during installation. If coating is damaged, proper pipe primer and tape wrap should be applied to damaged area.

DO NOT loosen or unthread riser waterseal.

If outlet threads are damaged, riser may be rethreaded with field threading equipment. Make sure thread shavings DO NOT fall into riser nipple outlet opening. Repaint riser nipple after threading to prevent corrosion.



MANUFACTURED BY:

R.W. LYALL AND COMPANY, INC.
P.O. BOX 3528
10455 SLUSHER DRIVE
SANTA FE SPRINGS, CALIFORNIA 90670-3528
(213) 946-8880 FAX (213) 946-4377

RWL

Manufactured By:

R.W. Lyall & Company, Inc.
10455 Slusher Drive
Santa Fe Springs, CA 90670
Phone: (213) 946-8880

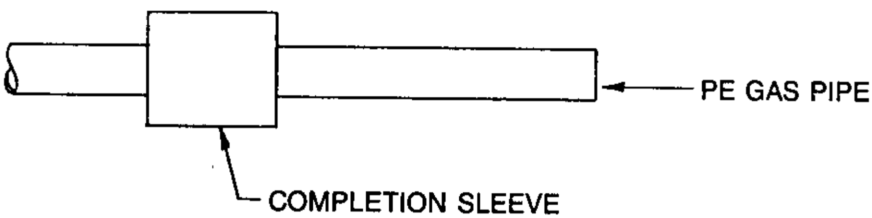
QUICK RACHET PRESS (QRP100) INSTALLATION PROCEDURE FOR

1/2" CTS THROUGH 1" IPS LYCOFIT® POLYETHYLENE GAS PIPE COUPLINGS

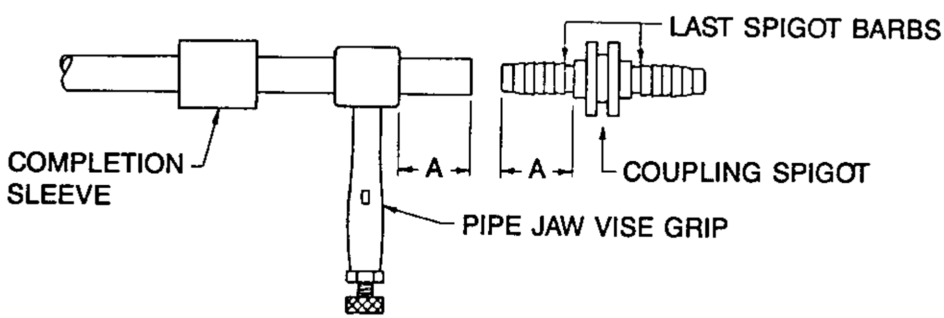
IMPORTANT:
Do NOT apply lubricants to Lycofit® spigot or sleeves.

NOTE: Lycofit® couplings to be installed on O.D. controlled PE natural gas pipe only. Examine pipe and coupling labels and install coupling only to pipe with correct size and wall thickness/SDR dimensions.

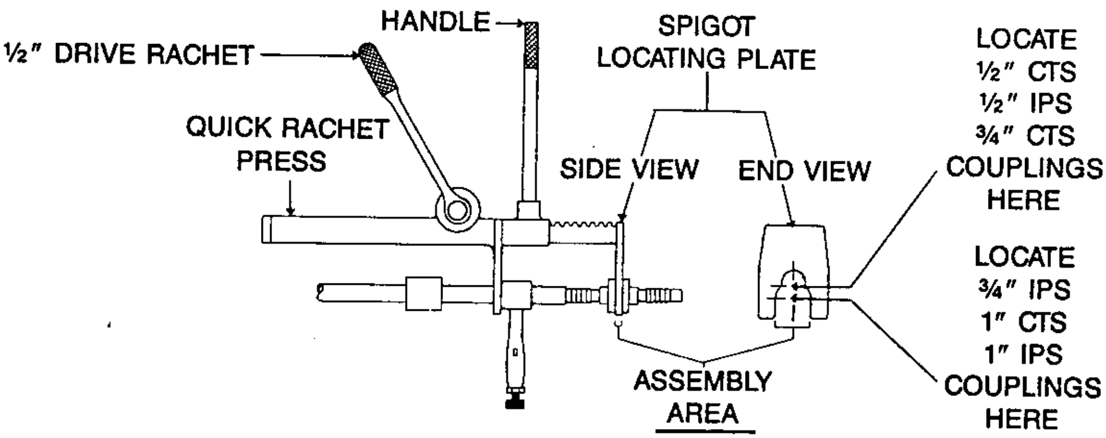
STEP 1 • SLIDE COMPLETION SLEEVE ONTO PIPE.



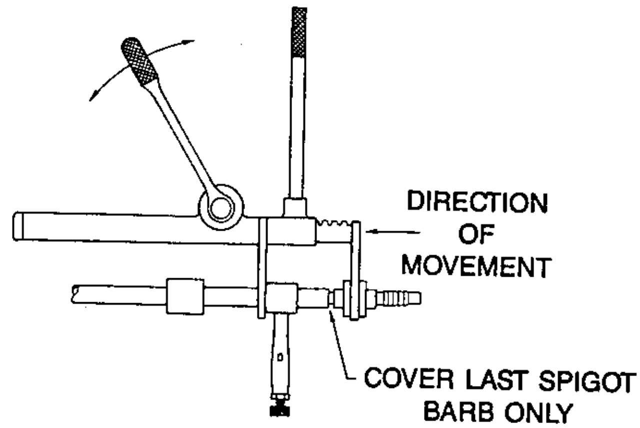
STEP 2 • CLAMP PIPE JAW VISE GRIP ONTO PIPE WITH A LENGTH OF PIPE EXTENDING BEHIND THE PIPE JAW EQUAL TO THE COUPLING SPIGOT LENGTH. (Dimensions A)



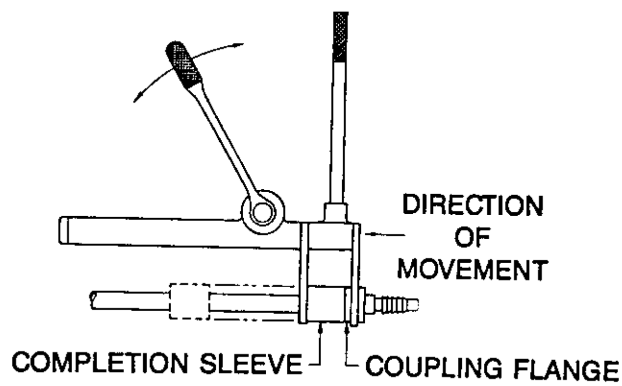
STEP 3 • INSERT LINE UP NOSE OF SPIGOT INTO POLYETHYLENE PIPE.
• POSITION PIPE AND SPIGOT IN TOOL LOCATING PLATES AS SHOWN BELOW.



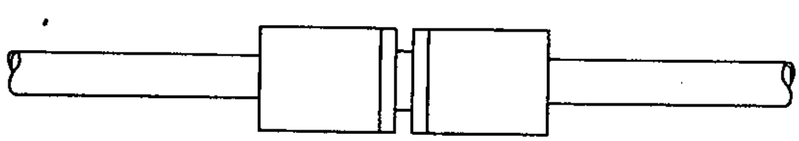
STEP 4 • OPERATE RACHET UNTIL PIPE COMPLETELY COVERS LAST SPIGOT BARB AS ILLUSTRATED IN STEP 2.



STEP 5
- REMOVE PIPE JAW VISE GRIP FROM PIPE.
- SLIDE COMPLETION SLEEVE BY HAND TOWARD SPIGOT UNTIL IT STOPS.
- POSITION PIPE, COMPLETION SLEEVE AND SPIGOT IN TOOL LOCATING PLATES.
- CONTINUE OPERATING RACHET UNTIL COMPLETION SLEEVE MEETS COUPLING FLANGE AS SHOWN.



STEP 6 • REMOVE TOOL FROM PIPE AND REPEAT STEPS 1 THROUGH 5 ON SECOND SPIGOT OF THE COUPLING TO COMPLETE THE PIPE JOINT AS SHOWN.



STEP 7 • PRESSURE TEST EACH FITTING AFTER INSTALLATION TO COMPLY WITH THE MINIMUM PIPELINE TEST REQUIREMENTS AS SPECIFIED IN DEPARTMENT OF TRANSPORTATION TITLE 49, PART 192, SUB PART J - TEST REQUIREMENTS.

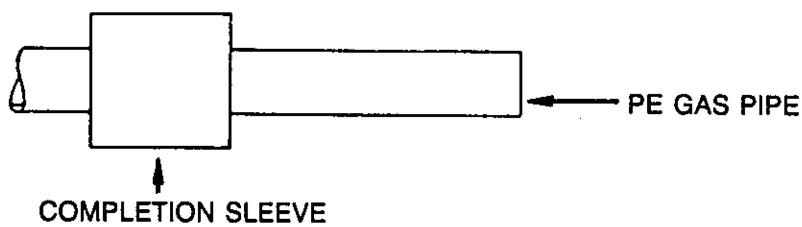
Manufactured By:
R.W. Lyall & Company, Inc.
9637 Pioneer Blvd. Santa Fe Springs, CA 90670
Phone: (213) 949-8341

SMALL HYDRAULIC PRESS (SAP100) INSTALLATION PROCEDURE FOR 1/2" CTS THROUGH 1" IPS LYCOFIT POLYETHYLENE GAS PIPE COUPLINGS

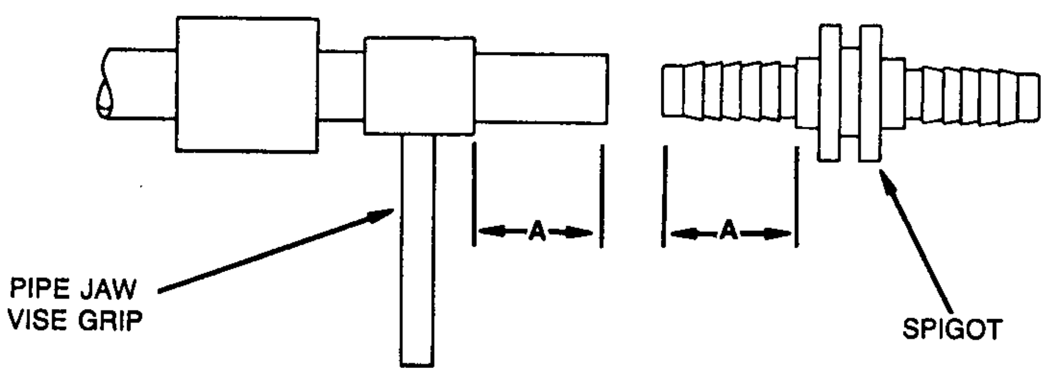
IMPORTANT:
Do NOT apply lubricants to LycoFit® spigot or sleeves.

NOTE: LycoFit® couplings to be installed on O.D. controlled PE natural gas pipe only. Examine pipe and coupling labels and install coupling only to pipe with correct size and wall thickness/SDR dimensions.

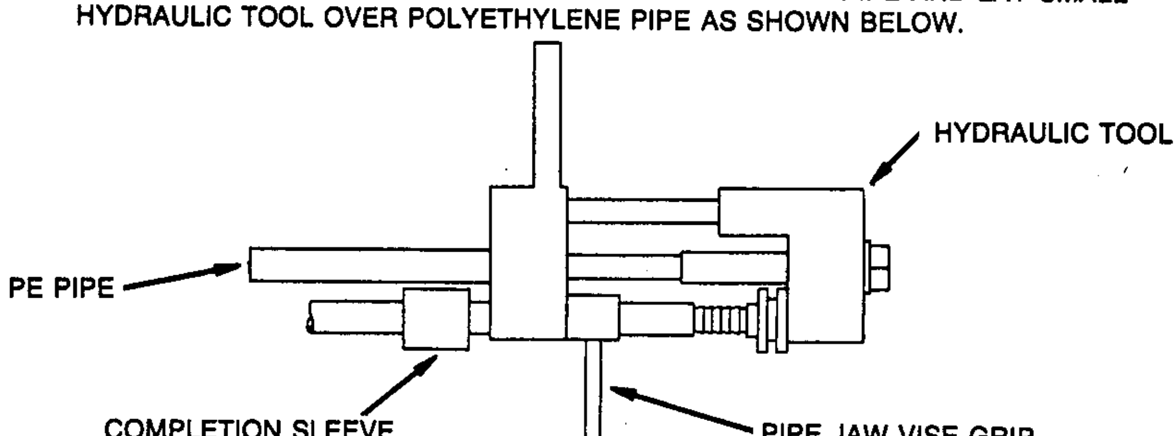
STEP 1 SLIDE COMPLETION SLEEVE ONTO PIPE.



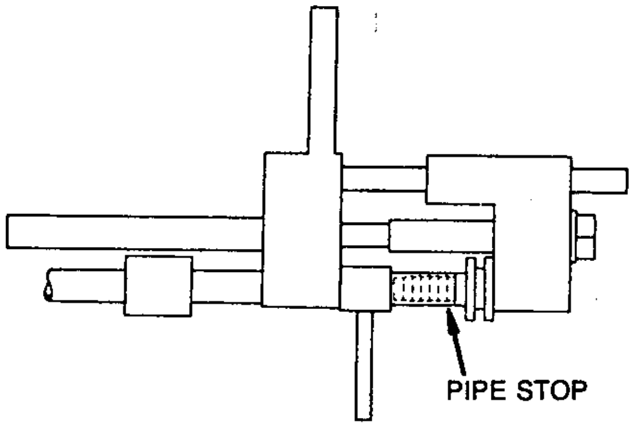
STEP 2 CLAMP PIPE JAW VISE GRIP ONTO PIPE WITH A LENGTH OF PIPE EXTENDING BEHIND THE PIPE JAW EQUAL TO THE COUPLING SPIGOT LENGTH. (Dimensions A)



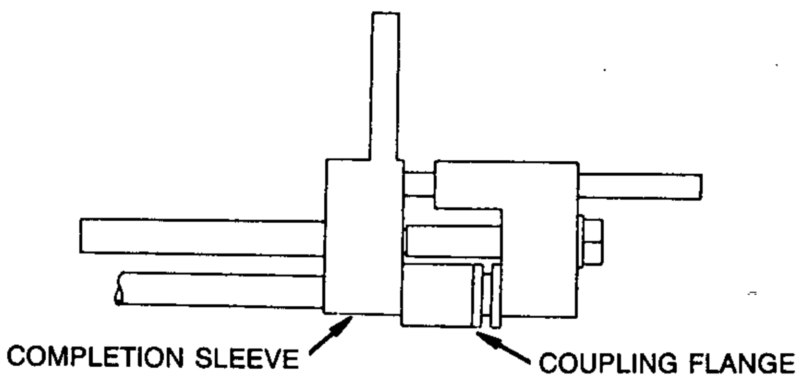
STEP 3 INSERT LINE UP NOSE OF SPIGOT INTO POLYETHYLENE PIPE AND LAY SMALL HYDRAULIC TOOL OVER POLYETHYLENE PIPE AS SHOWN BELOW.



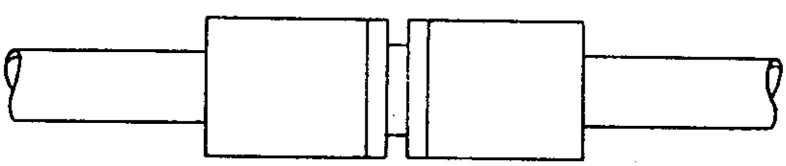
STEP 4 OPERATE HYDRAULIC HAND PUMP UNTIL PIPE MEETS PIPE STOP.



STEP 5 REMOVE PIPE JAW VISE GRIP FROM PIPE. CONTINUE OPERATING HAND PUMP UNTIL COMPLETION SLEEVE MEETS COUPLING FLANGE AS SHOWN.



STEP 6 REMOVE TOOL FROM PIPE AND REPEAT STEPS 1 THROUGH 5 ON SECOND SPIGOT OF THE COUPLING TO COMPLETE THE PIPE JOINT AS SHOWN.



STEP 7 PRESSURIZE PIPE AND SOAP TEST FITTING BEFORE BACKFILLING DITCH.

T. D. WILLIAMSON, INC.

MECHANICAL SHORTSLEEVE

INSTRUCTION SHEET

1. Smooth and thoroughly clean area of pipe surface which will be covered by the installed Shortsleeve Fitting. The fitting may not be pressure tight if the pipe has not been cleaned.

2. Remove pipe cap and Shortplug Completion Plug from fitting.

3. Remove bolts which hold the two halves of the fitting together. Inspect the seals to insure they are in place and undamaged. Seals and bore through fitting must be clean.

4. Place fitting on pipe. Attach with side bolts and nuts. Tighten bolts uniformly.

CAUTION

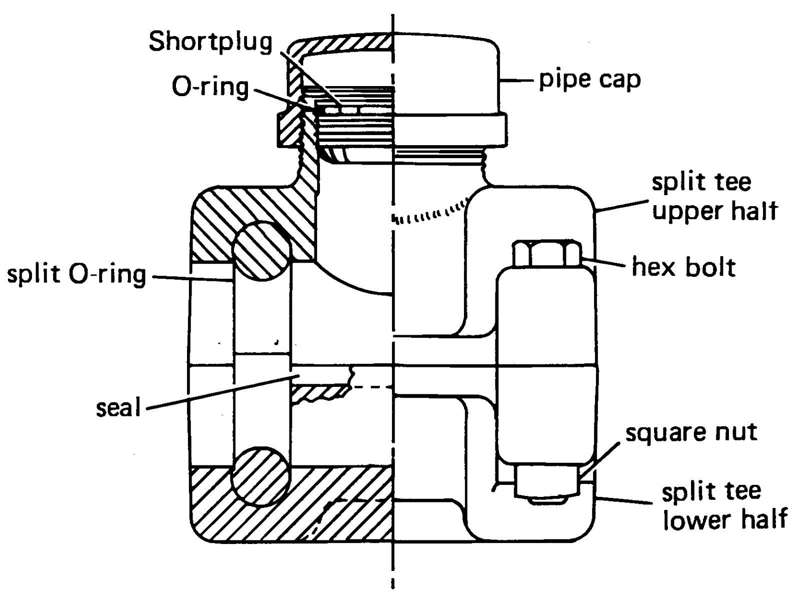
Overtightening bolts can cause damage to casting.

NOTE:

Do not overtighten bolts. Faces of upper and lower halves of fitting should be approximately 1/32" apart (both sides) when bolt torque is a **maximum** 40 ft. lbs.

If side gap exceeds 1/32", slightly shorten the four circumferential O-ring seals equally. Always trim O-ring by cutting 90° to its length. Remove approximately 1/16" per circumference, then reinstall to test fit. Cut again if, and as, found necessary. Excess O-ring material may exist as a result of castings ID and pipe OD tolerances.

5. Pressure test the Shortsleeve Fitting up to operating line pressure for leaks, before beginning tapping operations.



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Mechanical SHORTSLEEVE™

For Steel Pipe, Size: 2”

T. D. Williamson, Inc.

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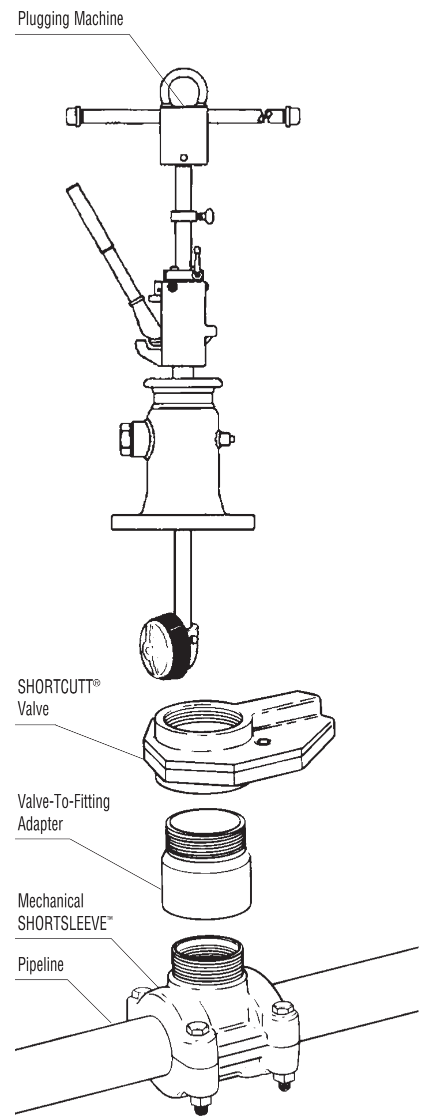
■ **Mechanical SHORTSLEEVE™**

■ Typical Setup



Description

Mechanical SHORTSLEEVE™ Fittings eliminate welding. They are designed for use on 2-3/8” (60 mm) OD steel pipe with the TDW SHORTSTOPP® Plugging Machine system.

Features

Circumferential and longitudinal sealing elements provide a continuous seal around the pipe. Mechanical SHORTSLEEVE™ Fittings can also be used without plugging machines to install branch connections.The maximum recommended operating pressure is 175 psi (12 bar) @ 150°F (66°C). The maximum recommended operating temperature is 180°F (82°C) @ 165 psi (11 bar). When used with the SHORTSTOPP® 60 Plugging Machine, the maximum recommended plugging pressure is 60 psi (4 bar).

ISO 9001 Certified

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T. D. Williamson, Inc.

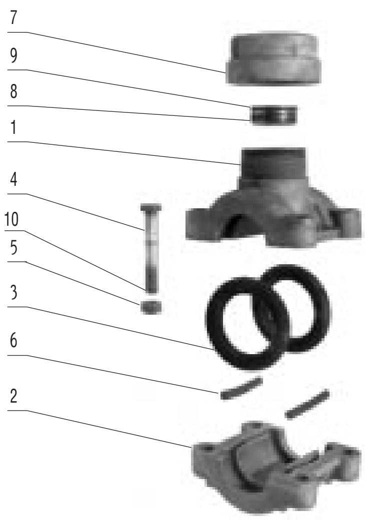
Mechanical SHORTSLEEVE™ For 2” Steel Pipe

2” Mechanical SHORTSLEEVE™

	Part Number	Lbs.	Kg.
Complete with cap, O-ring, steel plug and cast-iron fitting	26-0228-0000	18-3/4	9
Items 1-10 below			

Spare SHORTPLUG™ O-ring
00-0117-0010

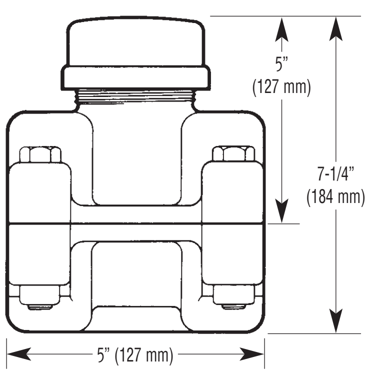
Valve-To-Fitting Adapter (required)
06-1384-0001



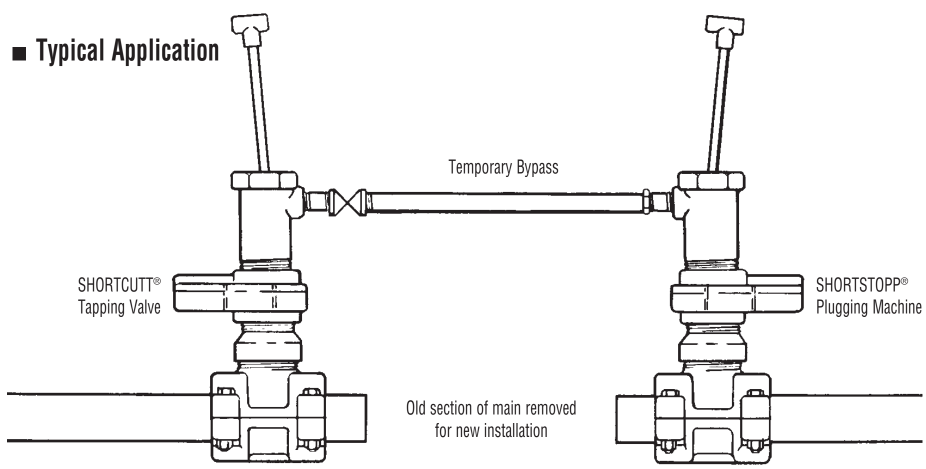
Parts and Descriptions

Item	Description	Quantity	Part Number
1	Split tee, upper half	1	26-0228-0001
2	Split tee, lower half	1	06-1288-0002
3	Split O-ring seal	4	00-1458-0011
4	Hex bolt	4	00-0681-0800-28
5	Square nut	4	00-1544-0005
6	Seal	2	00-1459-0008
7	Pipe cap	1	00-1054-0010
8	Shortplug	1	07-1745-0001
9	O-ring	1	00-0117-0010
10	Washer	4	00-0435-0006

■ Dimensions



■ Typical Application



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MET-FIT™

MECHANICAL FITTINGS

Installation Instructions

Warning: Before beginning procedure, confirm that the pipe is ½" CTS×.090" (⅝" O.D.).

A. Preparation and Assembly

To prepare the plastic tubing and assemble the fitting prior to crimping, use the following procedure:

a. Cut end of tubing square.
b. Remove burrs (formed by cutting) from tubing.
c. Mark the insertion depth on the tubing using a marking pen (insertion depth is ⅞" for ⅝" fittings).
d. Slide ring over end of tubing. Push tubing into fitting until end of tubing butts against shoulder inside fitting. (See Figure 1.) The mark should line up with the edge of the fitting.
e. Fitting is now ready to be crimped.

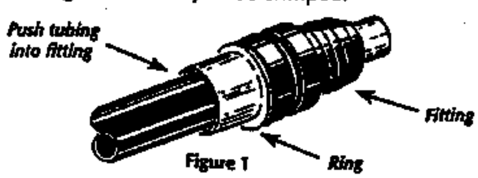
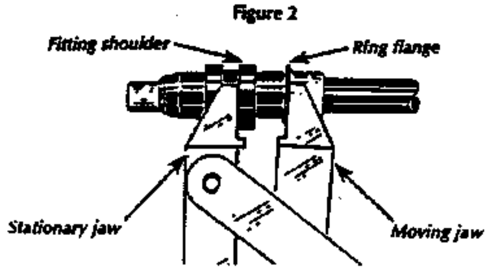


Figure 1

B. Crimping Procedure

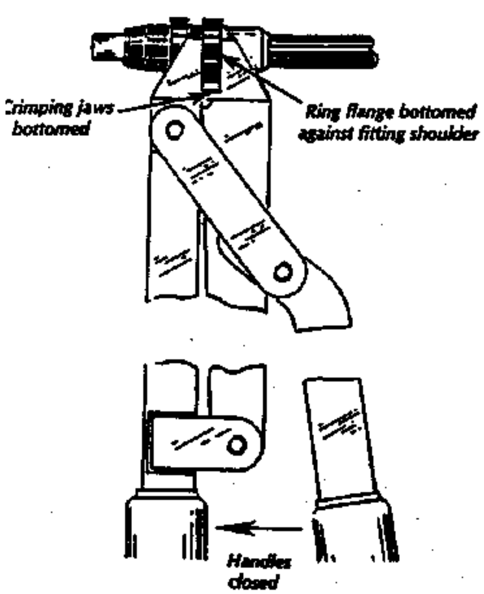
a. Open handles of hand tool and place fitting in crimping jaws of tool with stationary jaw back of fitting shoulder and moving jaw back of ring flange. (See Figure 2.)
b. Close handles until crimping jaws bottom and ring flange is against fitting shoulder. (See Figure 3.)
c. Pull handles open and remove tool.
d. Inspect fitting to ensure rings are bottomed out, and are past locking rib.

Figure 2



OPEN

Figure 3



CLOSED

C. Cold Weather Crimping Procedure
(Below freezing)

a. Prepare tubing as noted previously.
b. Coat crimp ends of fitting with same soap solution used for leak detection.
c. Crimp per Section B.

D. Tool Inspection

a. Metcal recommends frequent tool inspection. Refer to General Instructions for inspection procedure.

Any questions or comments can be directed to Metcal Customer Service.

P/N MF-9001 REV 1

METCAL

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METFIT™ MECHANICAL FITTINGS

METFIT 1/2"CTS (5/8" O.D.) HAND TOOL INSTRUCTIONS

INTRODUCTION

This instruction sheet is intended to provide you with Instructions on product applications and a Maintenance and Inspection Procedure for the MetFit Hand Tool 1/2" CTS (5/8" O.D.) [Metcal part number MF-7001].

This tool is used to apply MetFit Mechanical Fittings to 1/2" CTS (5/8" O.D.) polyethylene gas tubing. Tube preparation and fitting installation procedures are described in the Instructions section.

The Maintenance section contains a Maintenance and Inspection Procedure which will enable you to establish and maintain a tool certification program.

INSTRUCTIONS

PREPARATION AND ASSEMBLY

To prepare the plastic tubing and assemble the fitting prior to crimping, use the following procedure:

a. Cut end of tubing square.

b. Remove burrs (formed by cutting) from the tubing.

c. Mark the insertion depth on the tubing using a marking pen (insertion depth is 7/8").

d. Slide compression ring over end of tubing. Push tubing into fitting until end of tubing butts against shoulder inside the fitting (fig. 1). The mark should line up with the edge of the fitting.

e. Fitting is now ready to be crimped.

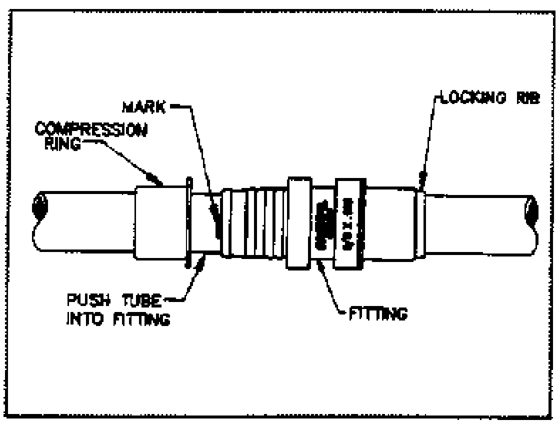

FIGURE 1.

CRIMPING PROCEDURE

a. Open the handles of the hand tool and place fitting in crimping jaws of tool, with stationary jaw in back of the fitting shoulder and moving jaw in back of the ring flange (fig. 2).

b. Close handles until the ring flange is against the fitting shoulder (fig. 3).

c. Pull handles open and remove tool.

d. Inspect to ensure rings are bottomed out and are past locking rib (fig. 3).

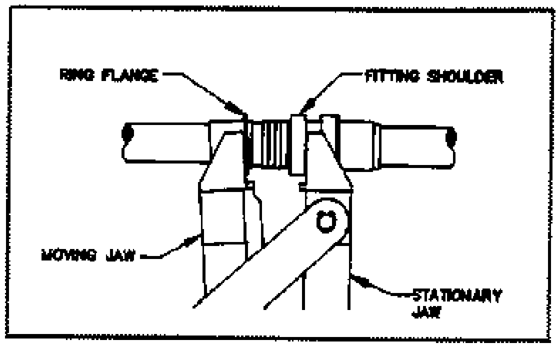

FIGURE 2.

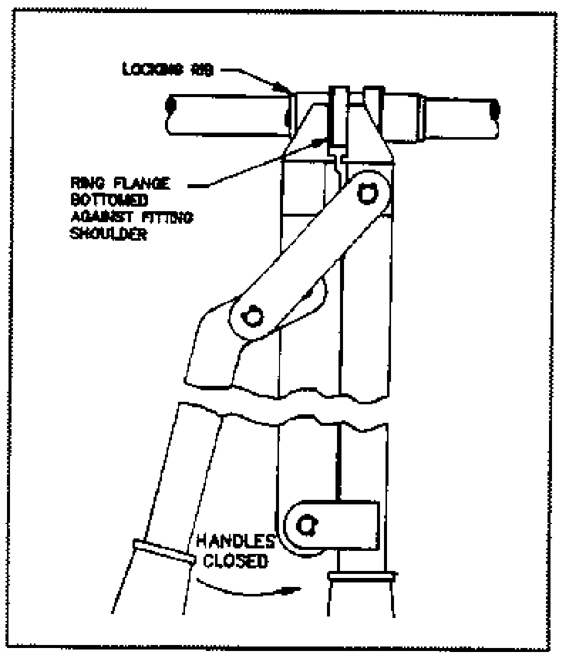

FIGURE 3.

MAINTENANCE

MAINTENANCE/INSPECTION PROCEDURE

Metcal recommends that a maintenance/inspection program be performed periodically. This will assure that continued use of the tools will result in the same dependable and uniform connections for which the tools were designed.

We recommend an initial inspection frequency of once a month. This frequency may be adjusted to suit your requirements through experience. The frequency of an inspection is dependent upon:

- The care, amount of use, and handling of the tool.
- The presence of abnormal amounts of dust and dirt.
- Your own established standards.

With proper maintenance and inspection, these tools will provide years of satisfactory service.

All Metcal tools are thoroughly inspected before being shipped from the factory. However, since there is a possibility of tool damage in shipment, Metcal recommends that new tools be inspected when received in your plant (see Visual Inspection).

CLEANING

The tool should be immersed in a reliable commercial degreasing compound to remove accumulated dirt, grease and foreign matter. Make certain the degreasing compound does not attack plastic materials. Remove remaining degreasing compound with a cloth. When degreasing compounds are not available, the tool may be wiped clean with a cloth. Relubricate tool as instructed before placing it back in service (see Lubrication).

LUBRICATION

Lubricate all pins, pivot points and bearing surfaces with a good grade S.A.E. No. 20 motor oil as follows:

Tools used in daily production - Lubricate daily
Tools used daily (occasional) - Lubricate weekly
Tools used weekly - Lubricate monthly

Wipe excess oil from tool.

VISUAL INSPECTION

Visually inspect the tool for worn or missing pins or retaining rings.

Every Metcal hand tool is inspected and tested for proper jaw closure and alignment before being shipped from the factory. However, a visual inspection should be performed periodically to observe jaw alignment. Misalignment of jaws indicates bent or worn parts.

Figures 4 and 5 show both good and worn tools. A tool resembling the worn tool in Figure 4 can adversely affect fitting installation. If you suspect your tool is worn, please contact Metcal Customer Service.

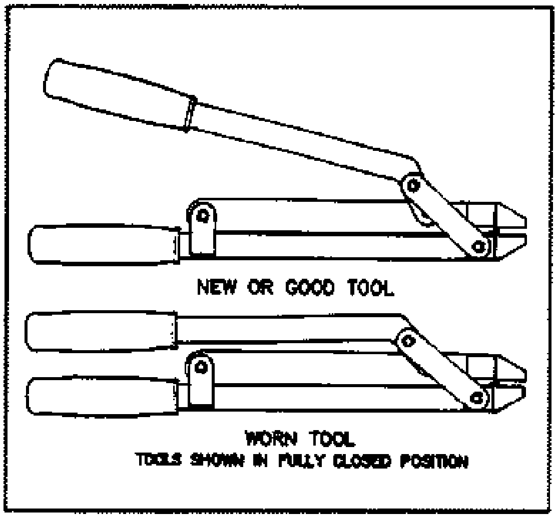

FIGURE 4.

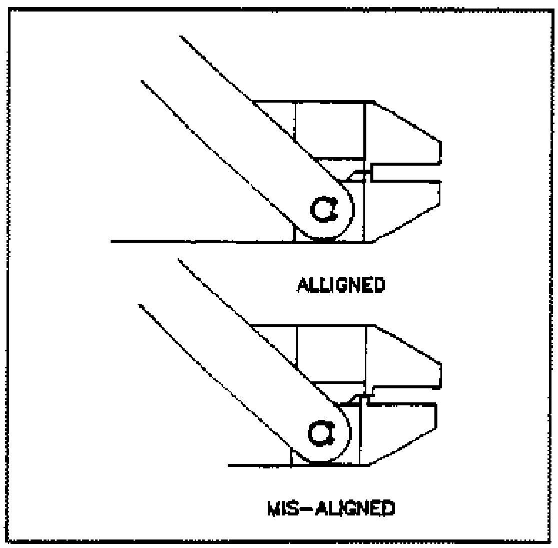

FIGURE 5.

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