Exhibit RH-3(2)
Documents Produced with Data Request Responses

Contains 3 documents (LIUNA 1.3a, 1.3b, and 1.3c)

Attachment LIUNA 1.3a

NorthWestern Gas Distribution Construction Standards

NorthWestern Energy
Delivering a Bright Future

GAS DISTRIBUTION

CONSTRUCTION STANDARDS

2026

NorthWestern Energy

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Supersedes Standard: 50	REV # 17	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

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50 General 50-A General		Original Date 06/01/2006	Standard Number 50-A
Supersedes 51	Revision 8	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

This field guide has been developed to provide guidelines and procedures for the construction of all NorthWestern Energy (NWE) distribution systems, natural gas and propane. The intent of this guide is to meet the safetyrequirements as set forth in the Department of Transportation's 49 CFR Part 192.301, 192.303, and 192.305 and NorthWestern's O&M manual.

2.0 General

2.1 All Gas distribution components shall be constructed in accordance with NorthWestern Energy's construction standards and other operation standards as they apply. Any deviation from the standard(s) must be designed by an engineer.

2.2 All pipelines constructed shall be inspected to ensure that they are built to NorthWestern Energy's standard(s). Inspection and disposition of pipe and components shall be completed in accordance with the Inspection Standards of this manual.

2.3 It is not intended that these standards cover unusual conditions. The need for special instructions is infrequent, the requirements of unusual conditions vary widely, and detailed specifications covering all conditions do not appear to be necessary or practical. In the event that any exception is needed the proposed deviation from the standard shall be handled as follows:

2.3.1 Be reviewed by a professional engineer who will stamp a sketch of the proposed installation before installation.

(and/or)

2.3.2 Be approved by an Area/Division/District Construction or Operations Manager before installation.

2.4 All work shall be done in accordance with the laws, ordinances and codes adopted by the various political subdivisions in which NWE operates. Should any of the provisions of these standards be at variance with the above, the more stringent shall be followed.

2.5 NWE's gas distribution system shall not have copper piping, tubing, or cast iron piping installed from the acceptance date of this standard forward; therefore, this guide is not intended to address copper piping or cast iron piping. Additionally, there should be no new installations of threaded pipe below ground on the NorthWestern Energy distribution system.

2.6 It is not intended that existing construction be brought into conformity with these standards, but all reconstruction where feasible, and new construction shall be in accordance with these specifications.

3.0 Revisions

The construction guideline committee must approve all additions, deletions, revisions, or changes of any kind to this manual before they become effective. The construction guideline committee consists of the following members:

Committee Member		Location
Johnson	Aimee	Missoula
Baruth	Melissa	Huron
Barker	Brent	North Platte
DeJonge	Kelly	Kearney
Hanson	Robert	Havre
Kuchtyn	Duane	Helena
Poppen	Keith	Brookings
Smith	Eric	Kalispell
Swanson	Jason	Mitchell

NorthWestern Energy

50 General Information 50-B Definitions		Original Date 06/01/2006	Standard Number 50-B
Supersedes 51	Revision 8	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Definitions

For the purpose of these standards the following definitions will apply for the terms as stated:

Abandoned – permanently removed from service.

American Petroleum Institute (API) – Organization that develops standards based on all aspects of the petroleum and natural gas industry.

American Society for Testing Materials (ASTM) – Organization that specifies testing materials and is an open forum that develops standards for high quality, market-relevant standards.

Anode – For the purpose of this standard an anode is defined as: a sacrificial material that is connected to another metal object, such as an underground tank or pipe, to inhibit the object's corrosion. The anode is decomposed while the object remains free of damage.

Base Pressure Index (BPI) – Corrects for pressure only.

Base Volume Index (BVI) – Corrects for pressure and temperature.

British Thermal Unit (BTU) - A Btu is defined as the amount of heat required to raise the temperature of one pound water from 63 to 64 degrees Fahrenheit. There is approximately 1000 BTU's in 1 Scfh of Natural Gas.

Cadweld (Thermit) – A joining process that uses thermit to join materials in a localized area.

Code of Federal Regulations (CFR) – Code which governs utilities that store, transport, and distribute gas.

Customer Meter – the meter that measures the transfer of gas from an operator to a consumer.

Customer Shut off Valve – Lockwing or a key valve. It located at the end of the riser and is the main shut off for the gas supply to a customer's meter.

Department of Transportation (DOT) – States governing body on transportation. Each state has varied differences so specific states codes and regulations should be consulted for more specific details.

Distribution line - a gas pipeline (other than a gathering or transmission line), which operated at less than 20%, SMYS as defined by NorthWestern Energy standards steel pipelines and meets the pressure requirements as defined by NorthWestern Energy standard for plastic pipelines.

Diversity factor – A varied factor that is determined by experience that is a percentage of the expected units that can be on at one time and is used in determining meter sizing.

Excess Flow Valve (EFV) – A residential customer optional device on systems over 10 psig that protects the customer from a problem with the service line; specifically if the line is hit. NOTE: Most EFV's will not work unless the line is severed or there is enough differential to cause the device to close.

Exposed pipeline - Any pipeline where any part of the pipeline is exposed to air.

Gas – Natural gas, propane gas, flammable gas, or gas which is toxic or corrosive.

High-pressure distribution system - a distribution system in which the gas pressure in the main is higher than the pressure provided to the customer.

Low-pressure distribution system - a distribution system in which the gas pressure in the main is substantially the same as the pressure provided to the customer and less than 1 psig.

Main - a distribution line that serves as a common source of supply for more than one service line.

Maximum actual operating pressure - the maximum pressure that occurs during normal operations over a period of 1 year.

Maximum allowable operating pressure (MAOP) - the maximum pressure at which a pipeline or segment of a pipeline may be operated under this part.

Municipality - a city, county, or any other political subdivision of a State.

Operator - a person who engages in the transportation of gas.

Person - any individual, firm, joint venture, partnership, corporation, association, state, municipality, cooperative association, or joint stock association, and including any trustee, receiver, assignee, or personal representative thereof.

Pigging – The act of inserting a poly pig and using compressed air to push the pig through the line.

Pipe - any pipe or tubing used in the transportation of gas, including pipe-type holder.

Pipeline - All parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Pipeline Facility – new and existing pipeline, rights-of-way, and any equipment, facility, or building used in the transportation of gas or in the treatment of gas during the course of transmportation.

Purging – The act of using air, natural, or inert gas at sufficient pressure or pigging a line to remove gas or air from the line.

Secretary - the Secretary of Transportation or any person to whom he has delegated authority in the matter concerned.

Service line - a distribution line that transports gas from a common source of supply to:

1. An individual customer

   Or

2. Two adjacent or adjoining residential or small commercial customers

   Or

3. Multiple residential or small commercial customers served through a meter header or manifold.

A service line ends at the outlet of the customer meter or at the connection to a customer's piping, whichever is further downstream, or at the connection to customer piping if there is no meter.

Service regulator – the device on a service line that controls the pressure of gas delivered from higher pressure to the pressure provided to the customer. A service regulator may serve one customer or multiple customers through a meter header or manifold.

Separately Protected – a main or service that is electrically isolated from the main corrosion system or is protected separately by other methods. I.e. A steel section of main protected by anodes in a plastic system.

SMYS - Specified minimum yield strength is:

1. For steel pipe manufactured in accordance with a listed specification, the yield strength specified as a minimum in that specification

   Or

2. For steel pipe manufactured in accordance with an unknown or unlisted specification, the yield strength determined in accordance with 192.107(b) of the DOT code.

Standard Dimension Ratio (SDR) – The ratio of the average specified outside diameter to the minimum specified wall thickness.

State - the state of Montana, Nebraska or South Dakota depending upon respective location.

Transmission line - a pipeline, other than a gathering line, that:

1. Transports gas from a gathering line, storage facility, or another transmission line to a distribution center, storage facility, or large volume customer that is not downstream from a distribution center;
2. Operates at a hoop stress of 20 percent or more of SMYS; or
3. Transports gas within a storage field.

Transportation of Gas - the gathering, transmission, or distribution of gas by pipeline or the storage of gas, in or affecting interstate or foreign commerce.

Units – Units used in this standard are US customary units (i.e. ft, in, lbs, etc.). Stated here are some of the unit's abbreviations utilized in this standard.

- Hundreds of cubic feet – ccf
- Thousands of cubic feet – mcf
- Standard cubic foot – scf
- British thermal unit – BTU
- Therm – 100,000 BTU
- International Piping Standard – IPS
- Copper Tubing Standard – CTS
- Corrugated Stainless Steel Tubing – CSST

Weak Link – a device used when pulling polyethylene pipe, typically through methods such as horizontal directional drillin, to ensure tha t damage will not ocdcur to the pipeline by exceeding the maximum tensile stresses allowed.

NorthWestern Energy

51 Pre-Construction 51-D Transportation, Handling, and Storage		Original Date 06/01/2006	Standard Number 51-D
Supersedes 52-W, O&M 4020	REV # 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general procedures and policies concerning the transportation, handling, and storage of pipe and pipe components.

This standard is intended to comply with the requirements as set by the DOT 49 CFR part 192.69.

2.0 Transportation

2.1 Pipe should be properly secured to the truck or trailer during transportation and should be properly supported to avoid any potential damage during transport.

3.0 Receiving Inspection

3.1 Visually inspect an incoming shipment to verify that the paperwork accurately describes the load. Products are identified by markings on each individual product. These markings should be checked. The number of packages and their descriptions should be checked.

3.2 Any damage, missing packages, etc., should be noted at that time and reported to the Manufacturer immediately.

4.0 Unloading

4.1 Make sure the truck is parked on level ground. If not, have the driver move the truck to a level area. Engage hand brakes and chock wheels.

4.2 People not involved in the unloading of the trailer and the truck driver should remain clear of the unloading area.

4.3 The trucker's chains and straps should be removed from the load only after checking that the load has not shifted and will remain stable. Use caution straightening shifted loads.

4.4 Equipment must be appropriate for lifting and handling and have adequate rated capacity to lift and move components from the truck to temporary storage. Safe handling and operating procedures must be followed.

4.5 Chains should not be applied directly to the pipe unless special precautions are used to prevent damage. Chains should be properly rated for the loads being lifted.

4.6 It is suggested that silo packs and other palletized packages be unloaded from the side of the trailer with a forklift having a capacity rating sufficient to handle the load. The equipment should be inspected for condition prior to use.

4.7 Non-palletized pipe, fittings, and other components should be unloaded from above with lifting equipment that will ensure pipe is not damaged, such as wide web slings, padded tongs, and/or pipe hooks, etc.

4.8 Plastic pipe should be handled by hand or with appropriate power equipment. Forklift forks should only be used with pallets and should not come in contact with plastic material.

4.9 DO NOT USE backhoes, end loaders, or other material handling equipment to push or pull the trailer. This is dangerous to unloading personnel and may damage the pipe.

4.10 DO NOT ROLL OR DROP REELS OR COILS OFF TRUCKS. This is dangerous to unloading personnel and may damage the pipe or nearby equipment. Pipe must not be rolled or pushed off the truck. Pipe, fittings, and other components must not be pushed or dumped off the truck.

5.0 Handling

5.1 Pipe, valves, fittings, and other materials integral to the distribution pipeline should be handled in a manner to prevent damage to coating, walls, and ends of the respective materials.

5.2 Occasionally, it is necessary to drag the pipe to where it will be installed. When the pipe must be dragged over rocky terrain or hard pavement, take precautions to protect the pipe from abrasion. Sand bags and/or used tires maybe used to support the pipe and prevent hard contact with sharp rocks or hard pavement.

5.3 Dragging pipe strings along the ground at speeds above a walking pace can damage the pipe, especially in cold weather.

5.4 The pipe should be strung in such a manner so as to avoid excess or deficient quantities of pipe for the line, and in such a manner as to cause the least interference with the normal use of the property(ies).

5.5 Gaps should be left at intervals in the pipe as strung to permit the regular use of the land, roadways, streets, alleys, driveways, and the passage of farm stock and/or property owners' equipment across the right-of-way.

5.6 Storage and stringing of materials on or near right-of-way may be subject to approval by local authorities.

5.7 Pipe ends should remain closed to prevent foreign materials or objects from entering. Pipe ends should remain closed until being joined to another pipe, valve, or fitting. The open end(s) of pipe should be securely closed at the close of each workday.

5.8 Plastic

5.8.1 Continuous pipe should have an appropriate reel to support the coil.

5.8.2 The pipe must be adequately secured to the reel to prevent the pipe from dragging or uncoiling during transport.

5.8.3 In the instances where the pipe must be uncoiled (unrolled) by hand, care should be taken to avoid damage from stones or other debris that may be in the path of the pipe coil.

5.8.4 A mechanical pipe-straightening device may be used to aid stringing of plastic pipe.

5.8.5 Coiled plastic pipe can cause serious injury as it uncoils. Great care must be taken to stay clear of the coil when binding straps are cut. The memory of the coil may be taken out of the plastic through the use of a mechanical pipe straightening device, which will greatly reduce this hazard. All proper Personal Protective Equipment (PPE) pertaining to the task, should be worn by all NorthWestern Energy employees.

5.9 Steel

5.9.1 Enamel, primer, and other coating materials should be handled in such a manner as to prevent damage to coating materials.

5.9.2 Pipe should be placed on skids so that pipe is raised above the ground a sufficient height to accommodate welding, cleaning, and coating machines. Pipe should be laid to allow for "slack" when lowering.

6.0 Storage

6.1 Valves, fittings, and other materials should be stored in a manner to preserve their initial condition, prevent material misplacement or loss, and to provide easy access for inventory purposes.

6.2 The storage area should provide protection against physical damage to components, be of sufficient size to accommodate piping components, to allow room for handling equipment to get around, and have relatively smooth, level surface free of stones, debris, or other material that could damage pipe or components, or interfere with handling.

6.3 Where necessary to store in stacks, pipe should be stacked not to exceed three rows high and blocked in a manner that will prevent damage to the pipe and/or coating by shifting of the pile, or by vehicular, equipment, or pedestrian traffic through the right-of-way.

6.4 Pipe ends should be properly closed at storage facilities, as well as on construction sites, to prevent small animals and foreign material from entering the pipe. The ends should remain closed until work is to be conducted on the pipe. Pipe ends should be reclosed at the conclusion of each workday.

6.5 Plastic

6.5.1 All plastic pipe coils should be stored on pallets.

6.5.2 Sticks of plastic pipe should be stored off the ground and be properly supported.

6.5.3 MDPE 2406/2708 (yellow) plastic pipe exposure to direct sunlight shall be limited to 3 years. The date of manufacture, date of pressure test (if applicable), date of inside storage, and date out of storage will be tracked on form 3776.

6.5.4 HDPE 3408/3608/4710 (black) plastic pipe exposure to direct sunlight shall be limited to 10 years. The date of manufacture, date of pressure test (if applicable), date of inside storage, and date out of storage will be tracked on form 3776.

7.0 Cold Weather Handling

7.1 Temperatures near or below freezing will affect polyethylene (PE) pipe by increasing stiffness, vulnerability to impact damage and sensitivity to suddenly applied stress especially when cutting. PE pipe will be more difficult to uncoil or field bend in cold weather.

7.2 Significant impact or shock loads against a PE pipe that is at freezing or lower temperatures can fracture the pipe.

7.2.1 Do not drop pipe. Do not allow pipe to fall off the truck or into the trench.

7.2.2 Do not strike the pipe with handling equipment, tools or other objects.

7.2.3 Do not drag pipe lengths at speeds where bouncing against the surface may cause impact damage.

7.3 Pipe should be firmly supported on both sides when cutting with a handsaw. Low temperature can cause the pipe to fracture at the cut if bending stress is applied.

7.4 Ice, snow, and rain are not harmful to the material, but may make storage areas more troublesome for handling equipment and personnel. Unsure footing and traction require greater care and caution to prevent damage or injury.

NorthWestern Energy

51 Pre-Construction 51-F Inspection of Materials		Original Date 06/01/2006	Standard Number 51-F
Supersedes Standard: 52-W, O&M 4020	REV # 6	Revision Date 01/01/2026	Prepared / Approved By AJ DP / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general procedures and policies concerning the inspection of pipe and pipe components.

The intent of this guide is to meet the requirements as set forth in the Department of Transportation's 49 CFR Part 192.307.

2.0 General

2.1 Inspection shall be done to any distribution main or service line prior to commissioning the line.

2.2 Inspection shall be done to the company's applicable federal, state, and local requirements.

2.3 Inspector has the right to order repair, removal, and/or replacement of any component that, in the inspector's judgement, does not meet the requirements stated in these standards.

3.0 Inspection of Materials

3.1 *Procedure*

Each length of pipe and each component shall be visually inspected at the site of installation to ensure that it is free from damage. Inspection of materials should include:

3.1.1 Material general condition shall be determined during layout.

- Is the component fit for the purpose?

3.1.2 Presence of material markings shall be determined during layout and during installation.

- Are the markings present?
- Is the material specification correct?
- Is the pipe wall thickness or SDR correct?

3.1.3 Material wall condition shall be determined during layout, during installation, and prior to backfill.

- Are any visible scratches, dents, gouges present in pipe wall or coating (plastic or steel)?
- Is pitting or corrosion evident (steel)?
- Is the pipe distorted from a true cylindrical shape?

3.1.4 Material end condition shall be determined during layout and fit up of joints.

- Are any visible scratches, dents, gouges present?
- Can the material be prepared for joining if imperfections are present?

3.1.5 Each condition found during inspection shall be remedied by repair or removal of the component. If damage is rectified, the repair work must be inspected as well.

3.2 Types of Damage

The following types of damage can result from improper transportation, handling, and storing. Proper care should be taken when working with pipe to avoid any of these circumstances.

3.2.1 Impact Damage (Dents) – Pipe may become dented if dropped, or struck against sharp objects. When loading and unloading, use proper machinery to lower pipe to its desired position.

3.2.2 Gouge and/or Scrape Damage – Pipe can be gouged and/or scraped during handling, stringing, or dragging operations.

3.2.3 Dents, gouges, and scrapes shall be removed or repaired. They weaken steel pipe in two ways:

- Changes in the roundness of the pipe create internal force at these locations and increase the stress concentrations at the gouge or dent.
- Change the metallurgy of the pipe and cause a loss of important material property toughness. The area of interest gets “work hardened” and becomes hard and brittle; thus it will fracture at a lower force than the surrounding ductile material.

3.2.4 Scratched Pipe – Typically a scratch is light on the surface, dragging a fingernail across the location can sense scratches.

3.2.5 Kink Damage – Plastic pipe may become kinked if proper bending procedures are not followed. Please refer to the bending guidelines found in this handbook.

3.2.6 Fitting Damage - Broken or damaged fittings cannot be repaired. They must be removed and replaced.

3.2.7 Squeeze-Off Damage - Pipe damaged during an *improper* emergency squeeze-off cannot be repaired. Squeeze-off damaged pipe must be removed and replaced.

3.2.8 Coating Damage – Coating can be chipped, if pipe is dropped or struck against sharp objects.

3.2.9 Coating Holiday - A defect such as an area of insufficient coating film thickness.

3.2.10 Weld Damage – Each weld that does not meet the acceptance requirements shall be removed or repaired.

3.2.11 Arc Burns – Arc strikes/burns are strictly prohibited. Arc burns rapidly heat and cool the material causing a chance in the metallurgy and create a hardened brittle area that will fracture at a lower force than the rest of the material surrounding the arc strike.

3.3 Plastic

Inspection of plastic pipe should be done whenever it is handled and prior to its installation. The following is guidance on when to repair and/or replace plastic pipe.

3.3.1 All defects, gouges, or kinks found in plastic pipe resulting in a loss of 10% or more of the wall thickness require immediate removal of the section of pipe affected, and shall not be put into service initially. Please refer to Table for pipe wall thickness increments.

Plastic Pipe Dimensions				
Pipe Size	**SDR**	**Pipe OD**	**Minimum Wall Thickness**	**10% of Wall Thickness**
½” CTS	7.0	0.625”	0.090”	0.01”
½” IPS	9.3	0.840”	0.090”	0.01”
¾” IPS	11.0	1.050”	0.095”	0.01”
1” IPS	11.0	1.315”	0.120”	0.01”
1 ¼” IPS	11.0	1.660”	0.151”	0.02”
1 ¼” IPS	10.0	1.660”	0.166”	0.02”
1 ½” IPS	11.0	1.900”	0.173”	0.02”
2" IPS	11.0	2.375"	0.216"	0.02"
3" IPS	11.5	3.500"	0.304"	0.03"
3” IPS	11.0	3.500”	0.318”	0.03”
4" IPS	11.5	4.500"	0.391"	0.04"
4” IPS	11.0	4.500”	0.409”	0.04”
6" IPS	11.5	6.625"	0.576"	0.06"
6” IPS	11.0	6.625”	0.602”	0.06”
8" IPS	11.5	8.625"	0.750"	0.08"
8” IPS	11.0	8.625”	0.784”	0.08”
12” IPS	11.0	12.750”	1.159”	0.12”
12” IPS	9.0	12.750”	1.417”	0.14”

3.4 Steel

Inspection of steel pipe should be done whenever it is handled and prior to its installation. The following is guidance on when to repair and/or replace steel pipe and coating.

3.4.1 Coating

3.4.1.1 When installing large diameter steel main (8" and larger), a coating inspection with the use of holiday detection equipment (jeeping) is encouraged on large capital installations.

3.4.1.2 When installing steel main with an MAOP exceeding 60psig, a coating inspection with the use of holiday detection equipment (jeeping) is strongly encouraged.

3.4.1.3 When using holiday detection equipment (jeeping), refer to NACE SPO490-2007 Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 10 to 30 mil for techniques in the operation of the equipment and recommended voltages for various coating thicknesses. A copy can be found on the Gas Distribution SharePoint.

3.4.1.4 All visible defects, gouges, or holidays found in steel pipe coating shall be repaired.

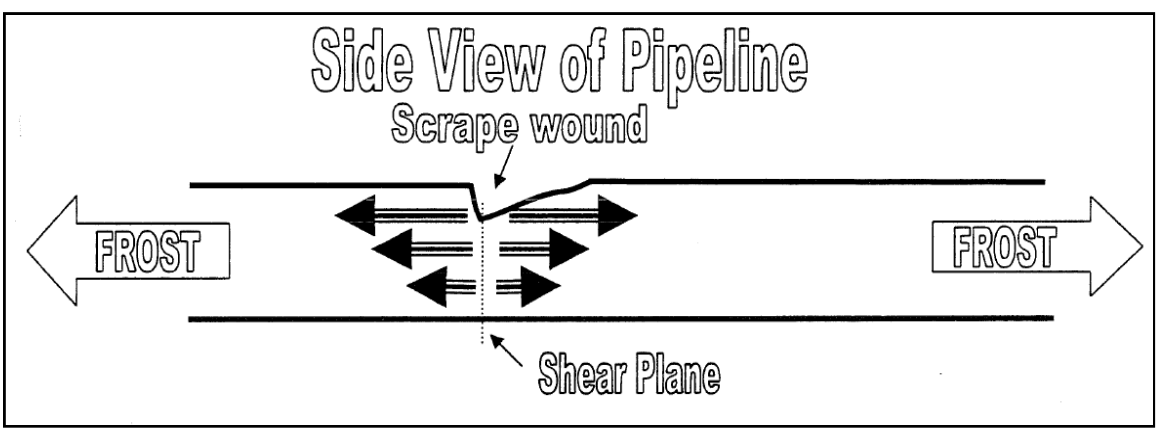
3.4.1.5 If a pipe has coating damage, the pipe should be checked for scratches prior to rewrapping. Dragging a fingernail across the location can sense scratches.

3.4.2 Pipe

3.4.2.1 When a dent or gouge is found, the pipe shall be examined for roundness of the pipe. If the pipe is not a true cylinder, then it shall be removed, and a new piece inserted.

3.4.2.2 For gouges, dents, scrapes, and scratches that have kept the roundness of the pipe:

- Typically a scratch is light on the surface, filing should be attempted prior to repair or removal.
- Filing or grinding is not allowed if it requires the removal of more than 8% of wall thickness. Repair or removal will be required in that situation.
- Any defect and/or damage that impairs the serviceability of the pipe by more than 50% of the wall thickness shall be repaired or removed.



NorthWestern *Energy*

52 Plastic 52-A General		Original Date 06/01/2006	Standard Number 52-A
Supersedes Standard: 52-A	REV# 5	Revision Date 08/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's (NWE) general policies concerning plastic materials and fittings found on its natural gas distribution system.

2.0 General

2.1 NorthWestern Energy gas distribution systems primarily consists of MDPE 2406/2708 (yellow). HDPE 3408/3608/4710 (black) is installed in some areas. Consult maps and or local management/supervision for details and guidance.

2.2 Please be aware that plastic pipe industry designations have changed. The print line identification on polyethylene pipe has been changed to reflect both the new and old designations. New print line markings will be as follows:

2.2.1.1 Previous Designation - PE 2406
2.2.1.2 Previous Designation - PE 2406/2708
2.2.1.3 Current Designation – PE2708

2.2.1.4 Previous Designation - PE 3408
2.2.1.5 Previous Designation - PE 3408/3608/4710
2.2.1.6 Current Designation – PE4710

2.3 Plastic pipe sizes found on NorthWestern Energy's gas distribution system range from:

2.3.1 ½" CTS, ½" IPS, ¾" IPS, 1" IPS, 1 ¼" IPS, 2" IPS, 3" IPS, 4" IPS, 6" IPS, 8" IPS, 12" IPS.

2.3.2 1 ¼" IPS is existing on NorthWestern Energy's system and can be installed for maintenance purposes, but not new construction.

2.3.3 3" IPS is existing on NorthWestern Energy's system and can be installed for maintenance purposes, but not new construction.

2.3.4 ½" CTS is being phased out as of 2017.

3.0 Plastic Pipe and Fittings

3.1 *Polyethylene pipe and fittings must be in compliance with ASTM D2513 - Standard Specification for Polyethylene Gas Pressure Pipe, Tubing, and Fittings.*

3.2 *Polyethylene pipe and fittings must be in compliance with ASTM F2897 - Standard Specification for Tracking and Traceability.*

3.3 *Socket fusion fittings must be in compliance with ASTM D2683.*

3.4 *Electrofusion fittings must be in compliance with ASTM F1055.*

3.5 *Butt fusion fittings must be in compliance with ASTM D3261.*

3.6 *Transition fittings must be in compliance with ASTM F1973*

3.7 *Factory Assembled Anodeless Risers must be in compliance with ASTM F1973.*

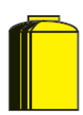
3.8 *Mechanical fittings must be in compliance with ASTM F1924.*

3.9 *Mechanical couplings must be ASTM D2513 Category 1.*

3.10 *All electrically isolated, metal alloy fittings in plastic pipelines must be designed to prevent leakage caused by localized corrosion pitting (192.455(f)).*

NorthWestern Energy

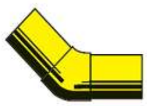
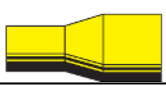
Gas Standards Subject: Plastic Plastic Materials/Fittings		Original Date 06/01/2006	Standard Number 52-B
Supersedes Standard: 52-B	REV# 8	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Materials/Fittings	Size	Material Code
Pipe (Polyethylene 2406)		
	1/2" CTS	7504420
	1/2" IPS	7504421
	3/4" IPS	10002540
	1" IPS	7504422
	1-1/4" IPS	7504423
	2" IPS	7504424
	*3" IPS	7504425
	4" IPS	7504426
	6" IPS	7504427
	8" IPS	7504428
Coupling (Socket Fusion)		
	1/2" CTS	7790920
	1/2" IPS	7790921
	3/4" IPS	10002351
	1" IPS	7790922
	1-1/4" IPS	7790923
	2" IPS	7790924
Coupling – (Electrofusion)		
	1" IPS	7790861
	1-1/4" IPS	7790862
	2" IPS	7790863
	*3" IPS	7790864
	4" IPS	7790865
	6" IPS	7790866
	8" IPS	7790867
Cap (Butt Fusion)		
	2" IPS	7790234
	*3" IPS	7790235
	4" IPS	7790236
	6" IPS	7790237
	8" IPS	7790238
Cap (Socket Fusion)		
	1/2" CTS	7790220
	1/2" IPS	7790221
	3/4" IPS	10002298
	1" IPS	7790222
	1-1/4" IPS	7790223
	2" IPS	7790224

*3" pipe may not be a suitable choice due to economics and availability.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Materials/Fittings		Original Date 06/01/2006	Standard Number 52-B
Supersedes Standard: 52-B	REV# 8	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Materials/Fittings	Size	Material Code
Elbow (Butt Fusion) - 45 Degree		
	4" IPS	7791486
	6" IPS	7791487
	8" IPS	7791488
Elbow (Butt Fusion) - 90 Degree		
	2" IPS	10000502
	*3" IPS	7791573
	4" IPS	7791586
	6" IPS	7791587
	8" IPS	7791588
Elbow (Socket Fusion) - 90 Degree		
	1/2" CTS	7791520
	1/2" IPS	7791521
	1" IPS	7791522
	2” IPS	7791524
Reducer (Butt Fusion)		
	2" IPS x 1" IPS	10006961
	*3" IPS x 2" IPS	7794665
	4" IPS x 2" IPS	7794685
	4" IPS x *3" IPS	7794691
	6" IPS x 4" IPS	7794693
	8" IPS x 6" IPS	7794697
Reducer (Socket Fusion)		
	1/2" IPS x 1/2" CTS	7794768
	1" IPS x 1/2" IPS	7794775
	1-1/4" IPS x 1" IPS	7794777
	2" IPS x 1" IPS	7794800
	2” IPS x 1-1/4” IPS	7794801

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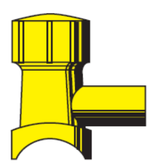
Gas Standards Subject: Plastic Plastic Materials/Fittings		Original Date 06/01/2006	Standard Number 52-B
Supersedes Standard: 52-B	REV# 8	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Materials/Fittings	Size	Material Code
Service Tee (Tapping Tee) - Socket Fused Outlet		
	2" IPS x 1/2" CTS	10002641
	2" IPS x 1/2" IPS	7795942
	2" IPS x 3/4" IPS	10002642
	2" IPS x 1" IPS	7795943
	*3" IPS x 1/2" CTS	10002643
	*3" IPS x 1/2" IPS	7795945
	*3" IPS x 3/4" IPS	10002644
	*3" IPS x 1" IPS	7795946
	4" IPS x 1/2" CTS	7795949
	4" IPS x 1/2" IPS	7795947
	4" IPS x 3/4" IPS	10002645
	4" IPS x 1" IPS	7795948
	6" IPS x 1/2" CTS	10002647
	6" IPS x 1/2" IPS	7795950
	6" IPS x 3/4" IPS	10002648
	6" IPS x 1" IPS	7795951
	8" IPS x 1/2" IPS	7795962
	8" IPS x 1" IPS	7795961
Service Tee (Tapping Tee)–(Electrofusion)		
	1 ¼ IPS x 1/2" CTS	10017431
	1 ¼ IPS x 1/2" IPS	10017432
	1 ¼ IPS x 3/4" IPS	10017433
	1 ¼ IPS x 1" IPS	7795995
	2" IPS x 1/2" CTS	10007702
	2" IPS x 1/2" IPS	10015527
	2" IPS x 3/4" IPS	10007756
	2" IPS x 1" IPS	7795996
	*3" IPS x 1/2" CTS	10007703
	*3" IPS x 1/2" IPS	10011844
	*3" IPS x 3/4" IPS	10017434
	*3" IPS x 1" IPS	10000844
	4" IPS x 1/2" CTS	10007704
	4" IPS x 1/2" IPS	10011801
	4" IPS x 3/4" IPS	10007757
	4" IPS x 1" IPS	10000845
	6" IPS x 1/2" CTS	10017435
	6" IPS x 1/2" IPS	10009073
	6" IPS x 3/4" IPS	10017436
	6" IPS x 1" IPS	10000601
	8" IPS x 1/2" IPS	10017437
	8" IPS x 1" IPS	10004213

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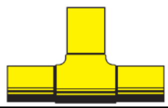
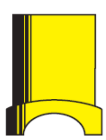
Materials/Fittings	Size	Material Code
Tee (Butt Fusion)		
	2" IPS	10000501
	*3" IPS	7796029
	4" IPS	7796030
	6" IPS	7796031
	8" IPS	7796032
Tee (Socket Fusion)		
	1/2" IPS	7795903
	1/2" CTS	10002706
	3/4" IPS	10002707
	1" IPS	7795905
	1-1/4" IPS	7795908
	1" x 1" x 1/2" IPS	7795986
	2" x 2" x 2" IPS	7795910
Branch Saddle (Butt Fusion)		
	2" IPS x 2" IPS	7794928
	*3" IPS x 2" IPS	7794929
	4" IPS x 2" IPS	7794930
	4" IPS x 3" IPS*	7794933
	6" IPS x 2" IPS	7794931
	6" IPS x 4" IPS	7794932
	8" IPS x 2" IPS	7794938
	8" IPS x 4" IPS	10015513
Electrofusion Branch Saddle (Butt Fusion Outlet)		
	2" IPS x 2" IPS	7794940
	*3" IPS x 2" IPS	10015512
	4" IPS x 2" IPS	7794944
	4" IPS x 4" IPS	7794948
	6” IPS x 2” IPS	10017413
	6” IPS x 4” IPS	10017414
	8” IPS x 2” IPS	10017415
	8” IPS x 4” IPS** **Must** be used with 4” EF coupling	10017416 7790865
	8” IPS x 6” IPS** **Must** be used with 6” EF coupling	10017417 7790866

*3” pipe may not be a suitable choice due to economics and availability.
** HDPE (black) Fitting that can be used on MDPE (yellow) system. Pin Type is 4.7 S – Solid Pin.

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Materials/Fittings	Size	Material Code
High Volume Tapping Tee – (Electrofusion)		
	2" IPS x 2" IPS	7796050
	*3" IPS x 2" IPS	7796054
	4" IPS x 2" IPS	7796055
	6" IPS x 2" IPS	7796056
	8" IPS x 2" IPS	10007264
Autoperf/Service Tees – With Transition Outlet (PE/)		
	3/4"x 3/4" Tee (1/2" CTS PE Trans)	10002636
	3/4"x 3/4" Tee (3/4" IPS PE Trans)	10002637
	3/4"x 3/4" Tee (1/2" IPS PE Trans)	7796767
	3/4"x 3/4" Tee (1" IPS PE Trans)	10005044
Transition Fitting – Steel to Plastic		
	1/2" CTS x 3/4" NOM	10002730
	1/2" IPS x 3/4" NOM	7792119
	1" IPS x 1" NOM	7792120
	1 1/4" IPS x 1 1/4" NOM	7792121
	2" IPS x 2" NOM	7792122
	*3" IPS x 3" NOM	7792123
	4" IPS x 4" NOM	7792124
	6" IPS x 6" NOM	7792180
	8" IPS x 8" NOM	7792182
NOTE: In Montana, all Steel Main to Plastic Main Transitions (and Plastic Main to Steel Main Transitions) must have a test station. Please refer to 55-F (Line Markers, Locate Stations, and Test Stations), and 53-J (Installation of Anodes).		

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Gas Standards Subject: Plastic Plastic Materials/Fittings		Original Date 06/01/2006	Standard Number 52-B
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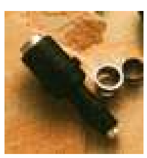
Materials/Fittings	Size	Material Code
METFIT - Mechanical Fitting – (Coupling)		
	1/2" CTS	10002364
	1/2" IPS	10007888
	3/4" IPS	10002365
	1" CTS	10002366
	1" IPS	10007889
	1-1/4" IPS	10002367
	2" IPS	10002368
METFIT - Mechanical Fitting – (Cap)		
	1/2" CTS	10002297
	1/2" IPS	10007886
	3/4" IPS	10006572
	1" IPS	10007887
	2" IPS	10004711
METFIT - Mechanical Fitting – (Reducer)		
	1/2" IPS x 1/2" CTS	10007904
	3/4" IPS x 1/2" CTS	10022402
	1" IPS x 1/2" IPS	10007905
	2" IPS x 1-1/4" IPS	10007906
METFIT - Mechanical Fitting – (Elbow)		
	2" IPS	10007890
METFIT - Mechanical Fitting – (Tee)		
	1/2" CTS	10002724
	1/2" IPS	10007901
	3/4" IPS	10002725
	1" IPS	10007902
	2" IPS	10007011

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Materials/Fittings	Size	Material Code
Electrofusion Repair Sleeves		
5' piece of pre-tested pipe with one loose EF coupling and one EF coupling (dual fusion) fused to one side of the pipe.	1 ¼" x 5'	10017593
	2" x 5'	10009681
	*3" x 5'	10009682
	4" x 5'	10009683
	6" x 5'	10009684
	8" x 5'	10009685
	10" x 5'	10009686
	12" x 5'	Call Engineering
Aldyl A Repair/Replacement Caps		
	Central Plastics	Manufacturer's Number 10001385
	JM Eagle / US Poly	Manufacturer's Number EFRK - 02
Polyethylene Valves (Butt Fusion)		
	2" IPS Full Port	10008626
	*3" IPS Std Port	7904023
	4" IPS Full Port	10008628
	6" IPS Full Port	10008630
	8" IPS Full Port	10008631

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Materials/Fittings	Size	Material Code
Excess Flow Valves (EFV)		
	½” CTS – METFIT (360scfh, 140ft)	10002765
	½” IPS (705scfh, 296ft)	7900280
	¾” IPS (630scfh, 1,483ft)	10008231
	¾” IPS (990scfh, 721ft)	10008151
	1" IPS (residential) (777scfh, 2,515ft)	7900282
	1" IPS (1200scfh, 869ft)	10008232
	1" IPS (commercial) (2,364scfh, 374ft)	10018152
	1 ¼” IPS (2,340scfh, 779ft)	10008298
	2” IPS (5,500scfh, 1,332ft)	10018153
	2” IPS (9,000scfh, 667ft)	10018153
	½” CTS – No Dig Tool (495scfh, 69ft)	10017655
	½” IPS – No Dig Tool (495scfh, 408ft)	10017582
	1” IPS – No Dig Tool (495scfh, 4340ft)	10017656

Materials/Fittings	Size	Material Code

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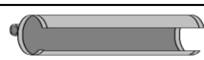
Warning Tape		
	3" x 1000' – 8 rolls/box	10007754
	6" x 1000' – 4 rolls/box	10007755

Tracer/Locate Wire		
	#14 AWG	10006491
	Copperhead – EHS Tracer – 500 ft (Extra High Strength) – #12 AWG	10007758

Direct Bury Splice Kit (DBY)		
	Size N/A: DBY Includes – Scotchlok Electrical Spring Connector; and Gel-Filled Insulator Tube	5211230

Tracer Wire Snap		
	3/4" x 12"	10007882
	1" x 12"	10007881

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Materials/Fittings	Size	Material Code
Line Marker		
	Line Marker (Triangle)	10009732
	Anchor for Triangle Markers and Stations	10009733
	Line Marker (Direct Bury) 5' Range, 83khz	10006251

Materials/Fittings	Size	Material Code

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Cathodic Protection		
  	Cathodic Test Station (Triangle)	10009695
	Cathodic Test Station (Ground Level)	10010614
	17lb Anode (MT)	6720310
	17lb Anode (SDNE)	10002291
	5lb Anode (SDNE)	10002290
	1lb Anode (SDNE)	10002289

	White #2 Cathodic Cable (preferred)	2570680
	Black #2 Cathodic Cable (alternate)	2520920

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Materials/Fittings	Size	Material Code
Pipe (Polyethylene 3408/3608/4710)		
	1/2" CTS	10002548
	3/4" IPS	10002549
	1 ¼“ IPS	10002550
	2" IPS	10002551
	*3" IPS	10002552
	4" IPS	10002553
	6" IPS	10002554
Reducer (Polyethylene 3408/3608/4710)		
	1” IPS x 1/2" CTS	10002356
	1” IPS x ¾” IPS	10002357
	1 ¼” IPS x 1” IPS	10002358
	*3” IPS x 2” IPS	10002359
	4” IPS x 2” IPS	10002360
	4” IPS x *3” IPS	10002361
Cap (Polyethylene 3408/3608/4710)		
	1/2" CTS	10002304
	3/4" IPS	10002305
	1" IPS	10002306
	1-1/4" IPS	10002307
	2” IPS	10002308
	*3” IPS	10002309
	4" IPS	10002310
Elbow 90 Degree (Polyethylene 3408/3608/4710)		
	1 ¼” IPS	10002405
	2" IPS	10002406
	*3" IPS	10002407
	4" IPS	10002408
	6" IPS	10002409
Service Tee (Polyethylene 3408/3608/4710)		
	1 ¼” IPS x 1" IPS	10002655
	2" IPS x 1/2" CTS	10002656
	2" IPS x 1/2" IPS	10002657
	*3" IPS x 1" IPS	10002659
	4" IPS x ½” IPS	10002660
	4" IPS x 1" IPS	10002661

*3” pipe may not be a suitable choice due to economics and availability.

Materials/Fittings	Size	Material Code

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Gas Standards Subject: Plastic Plastic Materials/Fittings		Original Date 06/01/2006	Standard Number 52-B
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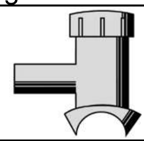
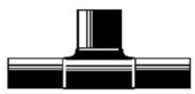
High Volume Tapping Tee (Polyethylene 3408/3608/4710)		
	2" IPS x 2" IPS	10002674
	*3" IPS x 2" IPS	10002675
	4" IPS x 2" IPS	10002680

Tee (Polyethylene 3408/3608/4710)		
	¾” IPS	10002711
	1 ¼” IPS	10002712
	2” IPS	10002713
	*3” IPS	10002714
	4” IPS	10002715

Transition (Polyethylene 3408/3608/4710)		
	½” x ½” CTS	10002733
	¾” x ¾” IPS	10002734
	1” x 1” IPS	10002735
	1 ¼” x 1 ¼” IPS	10002736
	2” x 2” IPS	10002737
	*3” x 3” IPS	10002738
	4” x 4” IPS	10002739
	6” x 6” IPS	10002740
NOTE: In Montana, all Steel Main to Plastic Main Transitions (and Plastic Main to Steel Main Transitions) must have a test station. Please refer to 55-F (Line Markers, Locate Stations, and Test Stations), and 53-J (Installation of Anodes).		

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NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
Supersedes Standard: 52-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

1.0 Scope – Plastic Pipe Capacity Tables

The purpose of this standard is to illustrate in table form, general **guidelines** pertaining to plastic PE2406 pipe and its capacity (scfh), relative to the size and length of the pipe in question. These tables are intended as system design guidelines and may not accommodate all possibilities found on NorthWestern Energy's gas distribution system. The tables were generated from NorthWestern Energy's (formally Montana Power Company) Gas Distribution Construction Standards (Revision 1991), WinFlow-Gas Modeling Software, and GASCalc 4.0-Gas Calculation Software.

NOTE: Design for a 5 psig drop or less.

Table 1.0a – Service Line Capacity (scfh)

Inlet Pressure = 25 (psig)				
Outlet Pressure = 20 (psig)				
Pipe Length (ft)	**1/2" CTS**	**1/2" IPS**	**3/4" IPS**	**1" IPS**
100	616	1,804	4,152	6,851
150	488	1,429	3,314	5,426
200	414	1,211	2,824	4,599
250	364	1,065	2,495	4,045
300	328	959	2,254	3,643
350	300	878	2,069	3,334
400	278	813	1,921	3,087
450	260	760	1,799	2,885
500	244	715	1,697	2,715
550	231	677	1,609	2,571
600	220	644	1,533	2,445
650	210	615	1,467	2,335
700	201	589	1,407	2,238
750	193	566	1,354	2,151
800	186	546	1,307	2,072
850	180	527	1,263	2,001
900	174	510	1,224	1,937
950	169	494	1,188	1,877
1,000	164	480	1,154	1,823

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Table 1.0b – Service Line Capacity (scfh)

Inlet Pressure = 20 (psig)				
Outlet Pressure = 15 (psig)				
Pipe Length (ft)	**1/2" CTS**	**1/2" IPS**	**3/4" IPS**	**1" IPS**
100	533	1,561	3,808	5,929
150	422	1,237	3,040	4,696
200	358	1,048	2,590	3,980
250	315	922	2,288	3,501
300	284	830	2,067	3,152
350	260	760	1,898	2,885
400	240	704	1,762	2,672
450	225	657	1,650	2,497
500	211	619	1,556	2,350
550	200	586	1,476	2,225
600	190	557	1,406	2,116
650	182	532	1,345	2,021
700	174	510	1,291	1,937
750	167	490	1,242	1,861
800	161	472	1,198	1,794
850	156	456	1,159	1,732
900	151	441	1,122	1,676
950	146	428	1,089	1,625
1,000	142	415	1,059	1,578

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Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0c – Service Line Capacity (scfh)

Inlet Pressure = 10 (psig)				
Outlet Pressure = 5 (psig)				
Pipe Length (ft)	**1/2" CTS**	**1/2" IPS**	**3/4" IPS**	**1" IPS**
100	518	1,482	3,031	5,459
150	415	1,195	2,419	4,398
200	354	1,021	2,061	3,771
250	313	904	1,821	3,345
300	283	818	1,645	3,031
350	260	751	1,510	2,789
400	241	698	1,402	2,594
450	226	655	1,313	2,433
500	213	617	1,239	2,298
550	202	585	1,175	2,181
600	192	558	1,119	2,080
650	184	533	1,071	1,991
700	176	512	1,027	1,912
750	170	493	989	1,841
800	164	475	954	1,777
850	158	459	922	1,719
900	153	445	893	1,665
950	149	432	867	1,617
1,000	144	420	843	1,574

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Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0d – Service Line Capacity (scfh)

Inlet Pressure = 40 (psig)				
Outlet Pressure = 35 (psig)				
Pipe Length (ft)	**1/2" CTS**	**1/2" IPS**	**3/4" IPS**	**1" IPS**
100	844	2,475	5,070	9,264
150	674	1,975	4,047	7,394
200	574	1,683	3,449	6,301
250	507	1,487	3,046	5,566
300	458	1,343	2,753	5,029
350	421	1,233	2,527	4,616
400	391	1,145	2,346	4,286
450	366	1,072	2,197	4,014
500	345	1011	2,072	3,786
550	327	959	1,965	3,590
600	312	914	1,872	3,421
650	298	874	1,791	3,272
700	286	839	1,719	3,140
750	275	807	1,654	3,022
800	266	779	1,596	2,915
850	257	753	1,543	2,819
900	249	729	1,494	2,730
950	242	708	1,450	2,650
1,000	235	688	1,409	2,575

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0e – Service Line Capacity (scfh)

Inlet Pressure = 30 (psig)				
Outlet Pressure = 25 (psig)				
Pipe Length (ft)	1/2" CTS	1/2" IPS	3/4" IPS	1" IPS
100	745	2,184	4,475	8,176
150	595	1,743	3,572	6,526
200	507	1,485	3,044	5,561
250	448	1,312	2,689	4,912
300	405	1,186	2,430	4,439
350	371	1,088	2,230	4,074
400	345	1,010	2,070	3,783
450	323	946	1,939	3,543
500	305	893	1,829	3,341
550	289	846	1,734	3,169
600	275	806	1,653	3,019
650	263	771	1,581	2,888
700	253	740	1,517	2,771
750	243	712	1,460	2,667
800	235	687	1,408	2,573
850	227	664	1,362	2,488
900	220	643	1,319	2,410
950	213	624	1,280	2,338
1,000	207	607	1,244	2,273

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Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0f – Service Line Capacity (scfh)

Use for North Platte low pressure system 10” w.c.

(<u>NOTE:</u> Use for Troubleshooting Purposes Only – Not for Design)

Inlet Pressure = 10” w.c.			
Outlet Pressure =7” w.c.			
Pipe Length (ft)	**¾” IPS**	**1 ¼” IPS**	**2" IPS**
10	1,037	3,293	15,196
20	706	2,240	10,340
30	563	1,789	8,256
40	480	1,524	7,035
50	424	1,347	6,215
60	385	1,217	5,616
70	353	1,117	5,155
80	327	1,037	4,787
90	306	973	4,483
100	289	918	4,228
110	274	870	4,010
120	261	829	3,821
130	250	793	3,655
140	239	761	3,510
150	230	732	3,378

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0g – Service Line Capacity (scfh)

(NOTE: Use for Troubleshooting Purposes Only – Not for Design)

Inlet Pressure = 25 (psig)				
Outlet Pressure = 15 (psig)				
Pipe Length (ft)	**1/2" CTS**	**1/2" IPS**	**3/4" IPS**	**1" IPS**
100	858	2,511	5,856	9,537
150	679	1,989	4,674	7,554
200	576	1,686	3,983	6,402
250	507	1,483	3,518	5,631
300	456	1,335	3,179	5,071
350	417	1,222	2,918	4,641
400	387	1,132	2,709	4,298
450	361	1,058	2,538	4,016
500	340	995	2,393	3,780
550	322	942	2,270	3,579
600	306	896	2,162	3,404
650	292	856	2,068	3,251
700	280	820	1,985	3,115
750	269	788	1,910	2,994
800	260	760	1,843	2,885
850	251	734	1,782	2,786
900	243	710	1,726	2,696
950	235	688	1,675	2,614
1,000	228	668	1,628	2,538

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Table 1.0h – Main Line Capacity (scfh)

Inlet Pressure = 25 (psig)					
Outlet Pressure = 20 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
100	34,202	100,524	199,300	572,088	1,148,464
150	27,089	79,619	157,854	453,117	909,630
200	22,959	67,480	133,787	384,035	770,948
250	20,195	59,355	117,677	337,790	678,112
300	18,185	53,447	105,965	304,171	610,622
350	16,642	48,914	96,977	278,371	558,828
400	15,412	45,299	89,809	257,797	517,527
450	14,403	42,332	83,929	240,916	483,638
500	13,556	39,844	78,995	226,754	455,208
550	12,833	37,719	74,782	214,662	430,932
600	12,207	35,878	71,133	204,186	409,902
650	11,658	34,265	67,933	195,001	391,464
700	11,172	32,835	65,099	186,867	375,133
750	10,737	31,558	62,567	179,598	360,543
800	10,346	30,408	60,288	173,056	347,409
850	9,992	29,367	58,222	167,127	335,507
900	9,669	28,417	56,340	161,724	324,659
950	9,373	27,547	54,615	156,773	314,721
1,000	9,100	26,747	53,028	152,217	305,575
1,050	8,848	26,007	51,561	148,006	297,121
1,100	8,615	25,320	50,200	144,099	289,279
1,150	8,397	24,681	48,933	140,463	281,978
1,200	8,194	24,085	47,750	137,067	275,162
1,250	8,004	23,526	46,643	133,887	268,778
1,300	7,826	23,001	45,603	130,902	262,785
1,350	7,658	22,508	44,624	128,092	257,143
1,400	7,499	22,042	43,700	125,441	251,822
1,450	7,350	21,601	42,827	122,935	246,792
1,500	7,208	21,184	42,000	120,562	242,028
1,550	7,073	20,789	41,216	118,310	237,507
1,600	6,945	20,413	40,470	116,170	233,211
1,650	6,823	20,055	39,761	114,133	229,120
1,700	6,707	19,713	39,084	112,190	225,221

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
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Table 1.0h (continued) – Main Line Capacity (scfh)

Inlet Pressure = 25 (psig)					
Outlet Pressure = 20 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
1,800	6,490	19,076	37,820	108,563	217,939
1,900	6,292	18,492	36,663	105,240	211,268
2,000	6,109	17,955	35,597	102,181	205,128
2,100	5,940	17,458	34,612	99,354	199,453
2,200	5,783	16,997	33,699	96,732	194,189
2,300	5,637	16,568	32,848	94,291	189,288
2,400	5,501	16,168	32,054	92,011	184,712
2,500	5,373	15,793	31,311	89,877	180,427
2,600	5,253	15,440	30,612	87,873	176,404
2,700	5,141	15,109	29,955	85,986	172,617
2,800	5,034	14,796	29,335	84,207	169,045
2,900	4,934	14,501	28,749	82,525	165,668
3,000	4,838	14,221	28,194	80,932	162,470
3,100	4,748	13,955	27,668	79,420	159,435
3,200	4,662	13,703	27,167	77,983	156,551
3,300	4,580	13,462	26,691	76,616	153,805
3,400	4,502	13,233	26,237	75,312	151,188
3,500	4,428	13,015	25,803	74,067	148,689
3,600	4,357	12,805	25,388	72,877	146,300
3,700	4,289	12,605	24,991	71,738	144,013
3,800	4,224	12,414	24,611	70,646	141,821
3,900	4,161	12,229	24,246	69,599	139,719
4,000	4,101	12,053	23,896	68,593	137,700
4,100	4,043	11,883	23,559	67,626	135,758
4,200	3,987	11,719	23,235	66,695	133,890
4,300	3,934	11,562	22,923	65,799	132,091
4,400	3,882	11,410	22,622	64,935	130,356
4,500	3,832	11,263	22,331	64,101	128,683
4,600	3,784	11,122	22,051	63,296	127,067
4,700	3,738	10,985	21,780	62,518	125,505
4,800	3,693	10,853	21,518	61,766	123,995
4,900	3,570	10,338	20,179	56,607	114,441
5,000	3,530	10,223	19,954	55,974	113,163

NorthWestern Energy

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Table 1.0i – Main Line Capacity (scfh)

Inlet Pressure = 20 (psig)					
Outlet Pressure = 15 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
100	29,600	86,999	172,484	495,114	993,938
150	23,444	68,906	136,614	392,150	887,239
200	19,870	58,401	115,786	332,363	667,217
250	17,477	51,368	101,843	292,341	586,872
300	15,738	46,256	91,707	263,245	528,463
350	14,403	42,332	83,929	240,916	483,638
400	13,339	39,204	77,726	223,111	447,893
450	12,465	36,637	72,636	208,501	418,564
500	11,732	34,483	68,366	196,244	393,959
550	11,107	32,644	64,720	185,779	372,950
600	10,565	31,051	61,562	176,713	354,750
650	10,089	29,654	58,793	168,764	338,793
700	9,669	28,417	56,340	161,724	324,659
750	9,293	27,312	54,149	155,433	312,032
800	8,954	26,317	52,176	149,771	300,665
850	8,647	25,415	50,389	144,640	290,364
900	8,368	24,594	48,759	139,964	280,976
950	8,112	23,841	47,267	135,679	272,376
1,000	7,876	23,148	45,893	131,736	264,459
1,050	7,658	22,508	44,624	128,092	257,143
1,100	7,456	21,913	43,446	124,711	250,356
1,150	7,268	21,360	42,349	121,564	244,038
1,200	7,092	20,844	41,326	118,625	238,139
1,250	6,927	20,361	40,367	115,873	232,614
1,300	6,773	19,906	39,467	113,289	227,427
1,350	6,628	19,479	38,620	110,857	222,545
1,400	6,490	19,076	37,820	108,563	217,939
1,450	6,361	18,695	37,065	106,394	213,586
1,500	6,238	18,334	36,349	104,340	209,463
1,550	6,121	17,992	35,670	102,392	205,550
1,600	6,011	17,666	35,025	100,539	201,832
1,650	5,905	17,356	34,411	98,776	198,292
1,700	5,805	17,061	33,825	97,095	194,918

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Table 1.0i (continued) – Main Line Capacity (scfh)

Inlet Pressure = 20 (psig)					
Outlet Pressure = 15 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
1,800	5,617	16,509	32,732	93,956	188,616
1,900	5,445	16,004	31,730	91,080	182,842
2,000	5,287	15,539	30,807	88,433	177,528
2,100	5,141	15,109	29,955	85,986	172,617
2,200	5,005	14,710	29,165	83,717	168,061
2,300	4,879	14,339	28,429	81,604	163,820
2,400	4,761	13,992	27,741	79,631	159,859
2,500	4,650	13,668	27,098	77,784	156,151
2,600	4,547	13,363	26,493	76,049	152,669
2,700	4,449	13,076	25,925	74,417	149,391
2,800	4,357	12,805	25,388	72,877	146,300
2,900	4,270	12,550	24,881	71,421	143,377
3,000	4,187	12,307	24,401	70,042	140,609
3,100	4,109	12,078	23,945	68,734	137,983
3,200	4,035	11,859	23,512	67,491	135,487
3,300	3,964	11,651	23,100	66,307	133,111
3,400	3,897	11,453	22,706	65,179	130,845
3,500	3,832	11,263	22,331	64,101	128,683
3,600	3,771	11,083	21,972	63,071	126,615
3,700	3,712	10,909	21,629	62,085	124,636
3,800	3,655	10,743	21,300	61,141	122,739
3,900	3,601	10,584	20,984	60,234	120,920
4,000	3,549	10,431	20,681	59,364	119,172
4,100	3,499	10,284	20,389	58,527	117,492
4,200	3,451	10,142	20,109	57,721	115,875
4,300	3,404	10,006	19,838	56,946	114,318
4,400	3,360	9,875	19,578	56,198	112,817
4,500	3,317	9,748	19,326	55,476	111,368
4,600	3,275	9,626	19,084	54,780	109,970
4,700	3,235	9,507	18,849	54,106	108,618
4,800	3,196	9,393	18,622	53,455	107,311
4,900	3,081	8,923	17,417	48,860	98,782
5,000	3,047	8,824	17,223	48,315	97,679

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Table 1.0j – Main Line Capacity (scfh)

Inlet Pressure = 40 (psig)					
Outlet Pressure = 35 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
100	44,645	129,278	252,338	707,873	1,431,104
150	35,634	103,185	201,407	565,000	1,142,259
200	30,367	87,933	171,636	481,485	973,416
250	26,824	77,673	151,610	425,305	859,837
300	24,238	70,185	136,994	384,305	776,948
350	22,247	64,420	125,742	352,739	713,131
400	20,655	59,811	116,745	327,499	662,103
450	19,346	56,019	109,344	306,739	620,133
500	18,245	52,832	103,123	289,286	584,849
550	17,303	50,105	97,800	274,355	554,663
600	16,486	47,739	93,182	261,399	528,469
650	15,769	45,661	89,126	250,020	505,465
700	15,132	43,818	85,528	239,928	485,061
750	14,562	42,169	82,309	230,899	466,807
800	14,049	40,682	79,408	222,760	450,353
850	13,584	39,334	76,776	215,377	435,426
900	13,159	38,104	74,374	208,639	421,806
950	12,769	36,975	72,172	202,461	409,314
1,000	12,410	35,936	70,142	196,768	397,806
1,050	12,078	34,974	68,265	191,502	387,160
1,100	11,769	34,081	66,522	186,613	377,274
1,150	11,482	33,249	64,898	182,057	368,064
1,200	11,214	32,471	63,381	177,799	359,457
1,250	10,962	31,743	61,958	173,809	351,390
1,300	10,726	31,058	60,622	170,060	343,810
1,350	10,502	30,413	59,363	166,529	336,671
1,400	10,293	29,804	58,175	163,195	329,932
1,450	10,093	29,228	57,051	160,042	323,557
1,500	9,905	28,683	55,985	157,054	317,515
1,550	9,726	28,164	54,974	154,217	311,779
1,600	9,556	27,672	54,012	151,518	306,324
1,650	9,394	27,202	53,096	148,948	301,127
1,700	9,239	26,754	52,222	146,496	296,170

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Table 1.0j (continued) – Main Line Capacity (scfh)

Inlet Pressure = 40 (psig)					
Outlet Pressure = 35 (psig)					
Pipe Length (ft)	2" IPS	3" IPS	4" IPS	6" IPS	8" IPS
1,800	8,950	25,918	50,588	141,914	286,906
1,900	8,685	25,150	49,090	137,711	278,410
2,000	8,441	24,443	47,710	133,839	270,582
2,100	8,215	23,789	46,433	130,257	263,340
2,200	8,005	23,181	45,248	126,931	256,616
2,300	7,810	22,615	44,143	123,832	250,352
2,400	7,627	22,087	43,111	120,937	244,497
2,500	7,456	21,591	42,143	118,223	239,010
2,600	7,295	21,125	41,234	115,673	233,855
2,700	7,144	20,686	40,378	113,271	228,999
2,800	7,001	20,272	39,570	111,003	224,415
2,900	6,866	19,881	38,805	108,858	220,079
3,000	6,737	19,509	38,081	106,826	215,969
3,100	6,616	19,157	37,393	104,896	212,067
3,200	6,500	18,822	36,738	103,060	208,357
3,300	6,390	18,503	36,115	101,312	204,822
3,400	6,284	18,198	35,521	99,644	201,451
3,500	6,184	17,907	34,953	98,051	198,230
3,600	6,088	17,629	34,409	96,528	195,149
3,700	5,996	17,362	33,889	95,068	192,199
3,800	5,908	17,107	33,390	93,669	189,370
3,900	5,823	16,861	32,912	92,326	186,655
4,000	5,742	16,626	32,452	91,035	184,046
4,100	5,663	16,399	32,009	89,794	181,536
4,200	5,588	16,181	31,583	88,599	179,120
4,300	5,515	15,970	31,173	87,447	176,792
4,400	5,445	15,768	30,777	86,337	174,547
4,500	5,378	15,572	30,395	85,265	172,379
4,600	5,312	15,383	30,025	84,229	170,286
4,700	5,249	15,200	29,669	83,228	168,262
4,800	5,188	15,023	29,323	82,259	166,303
4,900	5,129	14,852	28,989	81,322	164,408
5,000	5,072	14,686	28,665	80,413	162,571

NorthWestern Energy

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Table 1.0k – Main Line Capacity (scfh)

Inlet Pressure = 30 (psig)					
Outlet Pressure = 25 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
100	39,402	114,097	222,706	624,748	1,263,050
150	31,449	91,068	177,756	498,652	1,008,123
200	26,801	77,607	151,481	424,944	859,108
250	23,674	68,552	133,806	375,362	758,867
300	21,391	61,943	120,907	339,176	685,711
350	19,634	56,855	110,976	311,317	629,388
400	18,230	52,787	103,035	289,041	584,353
450	17,074	49,441	96,504	270,719	547,311
500	16,102	46,628	91,013	255,316	516,170
550	15,271	44,221	86,316	242,138	489,529
600	14,550	42,133	82,239	230,703	466,411
650	13,917	40,299	78,660	220,661	446,109
700	13,355	38,672	75,484	211,753	428,101
750	12,852	37,217	72,644	203,784	411,990
800	12,399	35,905	70,083	196,601	397,468
850	11,988	34,715	67,760	190,085	384,294
900	11,613	33,629	65,641	184,139	372,273
950	11,270	32,633	63,697	178,686	361,249
1,000	10,953	31,716	61,906	173,662	351,092
1,050	10,660	30,867	60,249	169,014	341,695
1,100	10,387	30,079	58,711	164,699	332,971
1,150	10,134	29,344	57,277	160,678	324,842
1,200	9,897	28,658	55,938	156,921	317,246
1,250	9,675	28,015	54,683	153,399	310,126
1,300	9,466	27,411	53,503	150,090	303,437
1,350	9,269	26,842	52,392	146,973	297,136
1,400	9,084	26,304	51,343	144,031	291,188
1,450	8,908	25,796	50,351	141,249	285,562
1,500	8,742	25,314	49,411	138,611	280,229
1,550	8,584	24,857	48,518	136,107	275,167
1,600	8,434	24,422	47,670	133,725	270,352
1,650	8,291	24,008	46,861	131,457	265,765
1,700	8,154	23,613	46,089	129,293	261,391

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
Supersedes Standard: 52-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

Table 1.0k (continued) – Main Line Capacity (scfh)

Inlet Pressure = 30 (psig)					
Outlet Pressure = 25 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
1,800	7,899	22,874	44,648	125,249	253,215
1,900	7,665	22,197	43,326	121,540	245,716
2,000	7,450	21,573	42,107	118,122	238,807
2,100	7,250	20,995	40,981	114,961	232,416
2,200	7,065	20,459	39,934	112,026	226,482
2,300	6,893	19,960	38,959	109,291	220,953
2,400	6,732	19,493	38,048	106,735	215,786
2,500	6,581	19,055	37,194	104,340	210,943
2,600	6,439	18,644	36,392	102,089	206,393
2,700	6,305	18,257	35,636	99,969	202,107
2,800	6,179	17,892	34,923	97,968	198,062
2,900	6,059	17,546	34,248	96,075	194,235
3,000	5,946	17,218	33,609	94,281	190,608
3,100	5,839	16,907	33,002	92,578	187,164
3,200	5,737	16,612	32,424	90,958	183,890
3,300	5,639	16,330	31,874	89,415	180,770
3,400	5,546	16,061	31,349	87,943	177,794
3,500	5,458	15,804	30,848	86,537	174,952
3,600	5,373	15,559	30,369	85,192	172,233
3,700	5,292	15,323	29,910	83,904	169,629
3,800	5,214	15,098	29,469	82,669	167,132
3,900	5,139	14,881	29,047	81,484	164,736
4,000	5,067	14,673	28,641	80,345	162,433
4,100	4,998	14,473	28,250	79,250	160,218
4,200	4,932	14,281	27,874	78,195	158,086
4,300	4,868	14,095	27,512	77,178	156,031
4,400	4,806	13,916	27,163	76,198	154,050
4,500	4,746	13,743	26,825	75,252	152,137
4,600	4,688	13,576	26,500	74,338	150,289
4,700	4,633	13,415	26,185	73,454	148,503
4,800	4,579	13,259	25,880	72,600	146,774
4,900	4,527	13,108	25,585	71,772	145,101
5,000	4,476	12,961	25,299	70,970	143,481

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
Supersedes Standard: 52-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

Table 1.0l – Main Line Capacity (scfh)

(NOTE: Use for Troubleshooting Purposes Only – Not for Design)

Inlet Pressure = 25 (psig)					
Outlet Pressure = 15 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
100	47,614	139,943	277,451	796,420	1,598,810
150	37,712	110,840	219,752	630,797	1,266,322
200	31,962	93,942	186,249	534,626	1,073,259
250	28,114	82,629	163,821	470,248	944,020
300	25,315	74,406	147,517	423,446	850,065
350	23,168	68,094	135,004	387,528	777,961
400	21,456	63,062	125,026	358,887	720,464
450	20,051	58,932	116,839	335,386	673,286
500	18,872	55,468	109,971	315,671	633,708
550	17,866	52,510	104,106	298,837	599,913
600	16,994	49,947	99,026	284,253	570,637
650	16,230	47,701	94,572	271,467	544,969
700	15,552	45,711	90,626	260,142	522,234
750	14,948	43,933	87,102	250,024	501,922
800	14,403	42,332	83,929	240,916	483,638
850	13,910	40,882	81,053	232,663	467,069
900	13,460	39,560	78,433	225,140	451,968
950	13,048	38,349	76,032	218,249	438,133
1,000	12,669	37,235	73,822	211,906	425,399
1,050	12,318	36,205	71,780	206,043	413,631
1,100	11,993	35,249	69,885	200,605	402,713
1,150	11,690	34,360	68,122	195,542	392,550
1,200	11,408	33,529	66,475	190,815	383,061
1,250	11,143	32,751	64,933	186,389	374,174
1,300	10,895	32,021	63,485	182,232	365,830
1,350	10,661	31,333	62,122	178,320	357,977
1,400	10,440	30,685	60,836	174,630	350,569
1,450	10,232	30,072	59,621	171,142	343,566
1,500	10,034	29,492	58,470	167,838	336,934
1,550	9,847	28,941	57,378	164,703	330,640
1,600	9,669	28,417	56,340	161,724	324,659
1,650	9,499	27,919	55,352	158,887	318,965
1,700	9,337	27,444	54,410	156,183	313,537

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Pipe Capacity Tables		Original Date 06/01/2006	Standard Number 52-C
Supersedes Standard: 52-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

Table 1.0l (continued) – Main Line Capacity (scfh)

(NOTE: Use for Troubleshooting Purposes Only – Not for Design)

Inlet Pressure = 25 (psig)					
Outlet Pressure = 15 (psig)					
Pipe Length (ft)	**2" IPS**	**3" IPS**	**4" IPS**	**6" IPS**	**8" IPS**
1,800	9,035	26,556	52,651	151,133	303,400
1,900	8,759	25,743	51,039	146,507	294,112
2,000	8,504	24,995	49,556	142,249	285,565
2,100	8,269	24,304	48,185	138,314	277,665
2,200	8,051	23,662	46,913	134,663	270,336
2,300	7,848	23,065	45,729	131,265	263,514
2,400	7,658	22,508	44,624	128,092	257,143
2,500	7,480	21,985	43,588	125,120	251,178
2,600	7,313	21,495	42,616	122,330	245,577
2,700	7,156	21,034	41,702	119,704	240,305
2,800	7,008	20,598	40,839	117,227	235,332
2,900	6,868	20,187	40,023	114,885	230,631
3,000	6,736	19,797	39,250	112,667	226,179
3,100	6,610	19,427	38,517	110,563	221,954
3,200	6,490	19,076	37,820	108,563	217,939
3,300	6,377	18,741	37,157	106,659	214,117
3,400	6,268	18,423	36,525	104,844	210,473
3,500	6,164	18,118	35,921	103,111	206,994
3,600	6,065	17,827	35,344	101,454	203,668
3,700	5,971	17,548	34,791	99,868	200,484
3,800	5,880	17,281	34,262	98,348	197,434
3,900	5,793	17,025	33,754	96,890	194,507
4,000	5,709	16,779	33,266	95,490	191,696
4,100	5,628	16,542	32,797	94,144	188,993
4,200	5,551	16,315	32,346	92,848	186,392
4,300	5,476	16,096	31,911	91,601	183,888
4,400	5,404	15,884	31,492	90,398	181,473
4,500	5,335	15,680	31,088	89,237	179,143
4,600	5,268	15,483	30,697	88,116	176,893
4,700	5,203	15,293	30,320	87,033	174,719
4,800	5,141	15,109	29,955	85,986	172,617
4,900	5,035	14,580	28,458	79,833	161,398
5,000	4,978	14,416	28,140	78,941	159,595

NorthWestern Energy

52 Plastic 52-F Plastic Main Installation		Original Date 06/01/2006	Standard Number 52-F
Supersedes Standard: 52-F	REV# 5	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope – Plastic Main Installation

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning plastic pipe and the construction of plastic mains. These procedures are intended to accommodate the minimum requirements as set by NorthWestern's O&M standards 4100 & 4155. For more information concerning general plastic construction practices, please refer to the Gas Operations and Maintenance Handbook corresponding to this subject.

NOTE: Main line sizes are considered as 2-inch polyethylene pipe and greater.

2.0 Trench Installation

2.1 Plastic pipe must be installed below ground.

2.2 Plastic pipe must be installed so as to minimize shear or tensile stresses. Pipe should be allowed to "snake" along the bottom of a trench to reduce stress caused by temperature changes of the backfill.

2.3 NOTE: Please refer to the Excavation Standard for more information concerning general trench requirements and safety obligations specified by NorthWestern Energy prior to installation.

2.4 Tracer wire shall be present on all plastic main installations for location purposes.

NOTE: Please refer to standard 52-L (Contact Wire and Tracer Wire) found in this handbook for more information pertaining to this subject.

2.5 To warn of potential digging hazards, warning tape is optional and may be installed on 2-inch or larger mains, approximately 12 inches above the plastic main on plowed or trenched construction areas.

3.0 Underground Clearance

3.1 All distribution lines (mains and services) should be installed with at least 12 inches of clearance from any other underground utility such as electric, telephone, and cable television.

NOTE: Please refer to the Excavation Standard, for more information pertaining to this subject.

3.2 All lines must be installed with enough clearance from any other underground structure to allow proper maintenance and to protect against damage that might result from the proximity of the other structure.

3.3 In anticipation of services, proper top vertical clearance must be maintained to accommodate the use of a saddle fusion apparatus.

4.0 Montana Department Of Transportation (MDOT) Right Of Way (ROW)

4.1 Longitudinal main lines in the MDOT ROW must have a minimum depth of cover of 30 inches to the top of the main.

4.2 Crossing a state highway, a main line must have a minimum of 42 inches of cover from the bottom of the ditch line.

4.3 In areas of curb and gutter, the minimum depth of the main line must be 42 inches from the drain line, and the minimum from centerline of the asphalt is also 42 inches.

NOTE: See also the MDOT Utility Guidelines Booklet.

5.0 South Dakota Department Of Transportation (SDDOT) Right Of Way (ROW)

5.1 The minimum depth of cover over for rural roadway sections is 4 feet (48 inches) over pipeline installation to the ground surface.

5.2 The minimum depth of cover under curb and gutter roadway sections is 2 feet (24 inches) over pipeline installation to the ground surface.

5.3 The minimum depth of cover for other areas within the right-of-way is 3 feet (36 inches) over pipeline installation to the ground surface.

5.4 SD DOT Form DOT-200 needs to be completed by land & permitting dept. and approved prior to construction and all of its requirements shall be met during construction.

6.0 Nebraska Department Of Roads (NDOR) Right Of Way (ROW)

7.1 Installations within villages and cities may require the use of shoulders for pipelines; however, attempts should be made to anticipate future construction and place the pipeline in such a position that it does not conflict with future construction. The preferred location is near the highway right-of-way line.

7.2 Installations of pipelines in parallel occupancies where the right-of-way width is insufficient or topography features prohibit a feasible route at or near the right-of-way line may, with the specific approval of the NDOR or authority having jurisdiction over the highway, occupy a position at the toe of the back slope. The NDOR or authority having jurisdiction over the highway shall designate the specific location of such facilities and any additional specific conditions concerning the occupancy.

7.3 Parallel pipelines shall not be located in the ditch under any circumstances.

7.4 The minimum depth of earth cover over pipelines shall be 36”.

7.5 Any underground utility facility that crosses a drainage course within the highway right-of-way must be installed a minimum of 4’ below the flow line of the drainage course or 1’ below the bottom of the drainage structure. If there is a difference in elevation between the flow line of the drainage structure and the drainage course, the lowest elevation shall be used.

7.6 Additional cover may be required if considered necessary to protect the traveling public or the pipeline.

7.7 Pipelines that cannot be installed with minimum cover due to natural conditions or conflict with other utilities may require protection by bridging, concrete slab, casing, or other appropriate means.

7.8 Installation of pipelines under the traveled portion of existing highways must be accomplished by directional boring from the toe of the fill slope to the toe of the opposite fill slope. Casings will be required unless waived through a request to the NDOT. Generally a casing will be waived unless PE pipe is greater than 2" and has an MAOP greater than 75 psig.

7.9 Casings and pipeline installations should be accomplished by dry boring.

7.10 All voids or abandoned holes caused by boring or jacking are to be filled by pressure grouting when deemed necessary by the NDOR or appropriate governing subdivision representative.

7.11 The size of an encasement pipe shall have a minimum 0.188" wall thickness.

NOTE: Backfill of pipeline trenches within highway construction projects shall conform to the appropriate state's current Standard Specifications for Highway Construction and the special provisions included with the contract.

Backfill of pipeline trenches on the existing highway shall conform to the applicable sections of the appropriate state's current Standard Specifications for Highway Construction.

A pipeline may not occupy Interstate highways longitudinally. Perpendicular crossings are acceptable.

A storm pollution permit and plan may be required by the state Dept. of Natural Resources depending on the scope of the project. Verify the need with the land/permitting dept.

7.0 Main Line Identification

7.1 Approved line markers should be placed at increments along gas main line installations to allow for more accurate recognition and identification as to where the pipeline is located.

NOTE: It is recommended that for substantially long main line installations, main line markers be placed in areas where needed and most practical.

7.2 Please refer to the standard on Located Stations, Line Markers, and Test Stations for required locations and more information pertaining to this subject.

8.0 Locate Stations & Test Stations

8.1 Please refer to the standard on Locate Stations, Line Markers, and Test Stations for detailed drawings and more information pertaining to this subject.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
Supersedes Standard: 52-G	REV# 11	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope – Service Lines

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning service line installation. These procedures are intended to accommodate the requirements as set by NorthWestern's O&M section 4100.

NOTE: Service line sizes used for new construction purposes on NWE's gas distribution system are specified as: ½" CTS; ½" IPS; ¾" IPS, 1" IPS and 2" IPS.

NOTE: Service line sizes may consist of larger diameter pipe for commercial service installations (i.e. large consumption customers).

2.0 Service Line Installation - General

2.1 Please refer to Standard-55 for excavation and burial requirements.

2.2 Please refer to Standard-57-B for pressure testing requirements.

2.3 Please refer to Standard 55 for backfilling, compacting and bedding requirements.

2.4 Please refer to Standard 57-C for soaping requirements.

2.5 Tracer wire shall be installed with all new plastic service installations for location purposes.

NOTE: Please refer to standard 52-L (Contact Wire and Tracer Wire) found in this handbook for more information pertaining to this subject.

2.6 Service lines shall extend from the main line as perpendicular as possible to the main line for a minimum of 3 feet. If then running parallel with the main a minimum of 3 feet of separation shall be maintained.

2.7 The intent of the installation crew should be to leave the service premises in as much of the same condition as was originally found.

3.0 Service Line Installation - Piggyback Services

3.1 Piggybacked services shall not be installed unless designed and approved by local area engineering/supervision and only serve two adjacent customers.

3.2 All new service lines shall conform to requirements for Excess Flow Valves, Standard 61-E.

3.3 Piggybacked services (if approved) must be clearly tagged/marked on the meter riser, noting the service and design deviation. Tags have been stores coded for piggybacked services (stores #10008331).

3.4 All piggybacked services installed must be mapped and recorded accordingly.

3.5 Piggybacked services (if approved) are NO LONGER considered to be main line installations therefore service line installation procedures may be followed.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
Supersedes Standard: 52-G	REV# 11	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

4.0 Service Line Installation – Into Buildings

4.1 Entry below grade (NOT RECOMMENDED - avoid whenever possible) – Service line (not customer piping) entry below grade into a building must include proper sealing to prevent water, etc., from entering the building.

NOTE: Service line installation into buildings is not recommended; however, if deemed necessary, installation must be designed and approved by local area engineering/supervision. A record of this approval, such as a diagram which has been signed by the engineer/supervisor or stamped by a PE, shall be kept in a permanent file.

4.1.1 When inserting plastic pipe through the wall, an appropriate length of steel pipe shall be placed through the wall seal portion, with the plastic pipe inserted through the steel, terminating with a service head adapter. The steel should be protected against any possible corrosion which may occur.

4.2 Entry above grade – Above grade entry is the preferred method when a meter must be located inside a building. The use of above grade entry greatly reduces the possibility of water or gas leakage into the building and eliminates hidden or buried service pipe within the building.

4.3 Extension inside building – When an outside meter location is not possible, every effort should be made to terminate the service line as soon as possible after the point of building entry.

NOTE: Extension inside buildings is discouraged and is not allowed without local area engineering/supervisor approval.

4.3.1 Below grade extension of the service pipe within the building is not permissible.

4.3.2 Service pipe concealed in any manner, has entry through more than one wall, or is an extension through areas of difficult access is not permissible.

4.3.3 Extension of service within a building, which allows the service pipe to be exposed in an area of access, shall be limited to a maximum of 5 feet as measured along the pipe from the point of entry to the meter stop.

4.3.4 Extension beyond 5 feet within a building, which allows the service pipe to be exposed in an area of access, must be approved by the area supervisor.

5.0 Service Line Installation – Under Buildings

5.1 Service line installation under buildings is discouraged. However, if a line is installed under a building there shall be a diagram of the installation which has been approved and signed by engineering/supervision or stamped by a PE. This record shall be kept in a permanent file. The following installation guidelines must be followed:

5.1.1 All service lines installed under a building must be encased in gas-tight conduit.

5.1.2 If the line supplies the building it is placed under, the conduit and service line must extend into a readily accessible area of the building.

5.1.3 The space between the conduit and the service line must be sealed to prevent gas leakage into the building, as well as being properly vented and terminated to an area where the gas would not be a hazard.

6.0 Service Lines Installation - Obstructions

6.1 Service lines should not be installed in the same trench as other utilities without proper clearance. A minimum clearance of 12 inches should be maintained throughout installation across communication lines, power lines or any other utility or structure. If 12 inches of clearance cannot be maintained, protection may be required. Approval of the clearance alteration must be granted by local area supervisor/engineering after adequate review of the situation.

If minimum clearance cannot be maintained from any other foreign structure (water, sewer, footings, etc.), protection (i.e. supervisor approved insulation/padding) must be installed allowing 6 inches of clearance in each direction from the service line away from the structure.

6.2 Service lines shall not be installed through obstructions such as large live tree roots, catch basins, sewers, ducts, tanks, or any other type of reservoir or manhole. Future settlement shall be considered at all times while installing service lines.

6.3 A service line should not be located in an area where its connection to the main is under driveways, trees, walls, or any other hard object, which will obstruct future access.

NOTE: Be aware of transformer and communication pedestal placements.

6.4 No gas line taps of any type will be made under transformer, television, or phone pedestals. A minimum of 3 feet of clearance should be maintained to allow for tapping and maintenance purposes.

7.0 Service Line - Insertion

7.1 Plastic pipe insertion SHOULD BE AVOIDED, but may be used when straight-line insertion can be accomplished. Always be aware of other possible factors to be considered, such as shallow depth and pipe offsets.

7.2 Excavation shall be sized large enough to properly insert the new service line into the old service line without excessive bending or force against the pipe end.

7.3 Old service pipe ends must be reamed. Ensure the reamer does not leave a rough or sharp edge.

7.4 Inspect the plastic pipe for cuts, scratches, gouges, or any other imperfections before insertion. The plastic pipe wall should be uniform at exposed ends. Install plastic insert protectors at each of the casing ends.

7.5 The end of the plastic pipe shall be plugged during insertion. DO NOT FORCE through the old service line. Care must also be taken not to stretch the plastic during insertion. Carefully inspect the plastic pipe exposed for any possible imperfections that may have occurred throughout the insertion process.

7.6 Inserted lines must be mapped.

7.7 Tracer wire must be located on all inserted lines.

7.8 After the insertion process, newly created casing pipe ends shall be a minimum length of 6 feet from customer service risers on all inserted lines, and there must be a permanent tag located on all risers indicating an inserted service.

7.9 Proper backfill and compaction techniques must be applied in order to reduce any undue stresses that may occur during and after installation.

8.0 Service Line – Valve Requirements

8.1 All service lines shall have a shutoff valve installed above ground in an accessible area. NOTE: This valve must be able to shut off the entire gas flow to the building in the event of an emergency.

8.2 A valve incorporated in a meter bar that allows the meter to be bypassed, shall not be used as a service line valve.

8.3 Soft seat service line valves may not be used if the valves ability to control the flow of gas could be adversely affected by exposure to a high heat environment.

8.4 Service line valves on a high-pressure service line installed above ground or in an area where the blowing of gas would be hazardous must be designed and constructed to minimize the possibility of removing the core of the valve with anything other than specialized tools.

8.5 Excess Flow Valves (EFV) are required on NorthWestern Energy's system, please see standard 61-E for more information.

9.0 Service Line – Location Of Valves

9.1 All service line valves must be installed upstream of the regulator, or if no regulator exists, upstream of the meter.

9.2 All service lines must have a shut-off valve in an accessible area that is, if possible, outside of the building.

9.3 Lock-wing meter stops with dielectric unions must be installed on all risers, and must be pin locked upon installation. The pin lock is not to be removed until the meter is turned on and the customer is put into service.

9.4 Non-insulating valves are acceptable on existing risers and may be used as long as the inlet swivel on the meter set is insulated or if the meter set includes an insulating union. NOTE: Insulation should be installed at or as near as practical to the shut off valve.

10.0 Service Line – Connections To Main

10.1 All service line connections to a main must be connected at the top of the main whenever practical, or at the side of the main when not. Otherwise a suitable protective device must be installed to minimize the possibility of moisture and dust being carried from the main into the service line.

10.2 Large plastic services connecting to steel main may incorporate a bottom out (or side out) fitting. Please refer to the Steel Standards – Section 53-K for more information pertaining to this subject.

11.0 Service Line – Plastic

11.1 All plastic service lines must be installed below ground level with the transition to above ground level made through a manufactured anodeless riser.

11.2 Service risers should be secured to the foundation of the residence they are serving using a riser bracket bolted in place, the bracket may be installed above or below grade.

NOTE: Service riser secure connections to residences may also involve an angle post and meter bracket (used on homes with cinder block foundations or trailer home meter sets/fits). The primary objective is to obtain a solid anchor for the meter (adjust as necessary in each construction situation).

11.3 All service risers must be anodeless types, with the plastic to steel transition point clearly marked. This “ground level” mark indicates the maximum allowable depth of cover.

NOTE: Final grade needs to be considered when installing a riser. Plastic portions of the service riser are not to be visible above ground level, and steel portions of the riser will be unprotected from potential corrosion, if buried.

11.4 All new risers located in concrete or asphalt, or any hard surface, must be sleeved at the ground line to prevent damage.

NOTE: If hard surfacing can be expected in the foreseeable future, incorporate a sleeve on the riser.

11.5 To warn of potential digging hazards, warning tape is optional and may be installed on service lines, approximately 12 inches above the plastic service on plowed or trenched construction areas.

11.6 Multiple service lines may be run to multiple unit residential and commercial buildings providing only ONE service feeds a unit or units separated by two-hour firewalls.

11.7 Multiple services to a single structure should be avoided whenever possible. When multiple services to a single building are installed, each riser must be tagged with a “Multiple Service” tag.

12.0 New Service Lines – Not In Use

If a service line installation is completed and the line is not placed into service immediately, one of the following specifications must be used until the customer is supplied with gas.

12.1 The closed valve used to prevent the flow of gas to the customer must be locked by means only accessible to authorized personnel.

12.2 A mechanical fitting or device must be placed in the service line or the meter assembly to prevent gas flow to the customer.

12.3 The customer’s piping must be physically disconnected from the gas supply and all open ends sealed to prevent contamination from outside sources.

12.4 NOTE: New service lines shall be covered according to proper trenching and excavation procedures. Please refer to Excavation Standards (Section 55) found in this handbook for further information pertaining to this subject.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
Supersedes Standard: 52-G	REV# 11	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

TABLE 01	**PLUG, BLACK MALL IRON**
7711050	PLUG, PIPE, BLACK MALL IRON, SIZE 3/4" - used for ½” CTS, ½” IPS, and ¾” services
7711060	PLUG, PIPE, BLACK MALL IRON, SIZE 1"
7711070	PLUG, BMI, 1-1/4" (Maintenance only)
7711090	PLUG, BMI, 2"

TABLE 02	**RISER/METER BRACKET**
7790105	BRACKET, 7" RISER SUPPORT - most common option
10008153	BRACKET, 11" RISER SUPPORT - used when more space is needed, façade on foundation
10002465	POST, 5' ANGLE & METER BRACKET - used when there is no permanent foundation, trailer
10017822	BRACKET, HEAVY DUTY, 11” RISER SUPPORT – used for 2” services

TABLE 03	**RISER, ANODELESS**
10002628	RISER, 3/4" NPT x 1/2" CTS – SD/NE
7794864	RISER WITH LOCKWING, 3/4" NPT x 1/2" IPS – MT
10002629	RISER, 3/4" NPT x 3/4" IPS – SD/NE
7794861	RISER WITH LOCKWING, 1" NPT x 1”IPS – MT
10002631	RISER, 1-1/4" NPT x 1-1/4" IPS – MT/SD/NE (Maintenance only)
10002632	RISER WITH STAKE, 2" NPT x 2" IPS – SD/NE
10008064	RISER, 2” NPT x 2” IPS – MT

TABLE 04	**PLASTIC PIPE**
7504420	PIPE, PE 2406/2708, 1/2" CTS - SD/NE
7504421	PIPE, PE 2406/2708, 1/2" IPS - MT
10002540	PIPE, PE 2406/2708, 3/4" IPS - SD/NE
7504422	PIPE, PE 2406/2708, 1" IPS - MT
7504423	PIPE, PE 2406/2708, 1-1/4" IPS - MT/SD/NE (Maintenance only)
7504424	PIPE, PE 2406/2708, 2" IPS - MT/SD/NE

TABLE 05	**TRACER WIRE**
10004259	TRACER, #14 SOL, PE COATED, YELLOW - SD/NE
10006491	TRACER, #14 SOL, PE COATED, YELLOW - MT

TABLE 06	**COUPLING**
7790920	COUPLING, SOCKET, 1/2" CTS - SD/NE
7790921	COUPLING, SOCKET, 1/2" IPS - MT (MT prefer)
10002351	COUPLING, SOCKET, 3/4" IPS - SD/NE
7790922	COUPLING, SOCKET, 1" IPS - MT (MT prefer)
7790923	COUPLING, SOCKET, 1 ¼” IPS - MT/SD/NE (MT prefer)
7790924	COUPLING, SOCKET, 2" IPS - MT/SD/NE (MT prefer)
10002364	COUPLING, METFIT, 1/2" CTS - SD/NE (SD/NE prefer)
10007888	COUPLING, METFIT, 1/2" IPS - MT
10002365	COUPLING, METFIT, 3/4" IPS - SD/NE (SD/NE prefer)
10007889	COUPLING, METFIT, 1" IPS - MT
10002367	COUPLING, METFIT, 1 ¼” IPS - MT/SD/NE (SD/NE prefer)
10002368	COUPLING, METFIT, 2" IPS - MT/SD/NE (SD/NE prefer)

NorthWestern Energy

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TABLE 07	**EXCESS FLOW VALVE (EFV)**
10002765	VALVE, EXCESS FLOW, UMAC 350, 1/2" CTS - SDNE
7900280	VALVE, EXCESS FLOW, LYALL 775, 1/2" IPS - MT
10018151	VALVE, EXCESS FLOW, UMAC 1100, 3/4" IPS - SDNE
7900282	VALVE, EXCESS FLOW, LYALL 855, 1" IPS - MT (Residential Services)
10018152	VALVE, EXCESS FLOW, LYALL 2600, 1" IPS - MT (Commercial Services)
10008298	VALVE, EXCESS FLOW, UMAC 2600, 1-1/4" IPS - MT/SD/NE (maintenance only)
10018153	VALVE, EXCESS FLOW, UMAC 10,000, 2" IPS - MT/SD/NE

TABLE 08	**SERVICE LOCKWING VALVE**
10002788	VALVE, LOCKWING, INSULATED, ¾” IPS - SD/NE (used with ½” CTS and ¾” IPS)
7900272	VALVE, LOCKWING, INSULATED, ¾” IPS - MT (used on ½” IPS, comes w/ riser)
7900273	VALVE, LOCKWING, INSULATED, 1” IPS - MT (comes w/ riser)
7900274	VALVE, LOCKWING, INSULATED, 1-1/4" IPS - MT/SD/NE (maintenance only)
10002787	VALVE, LOCKWING, NON-INSULATED, 2" IPS - SD
7900269	VALVE, LOCKWING, NON-INSULATED, 2” IPS - MT

TABLE 09	**TAPPING TEE FOR PLASTIC (Montana)**
7795942	TEE, TAP, SADDLE FUSION, 2" IPS x 1/2" IPS
7795943	TEE, TAP, SADDLE FUSION, 2" IPS x 1" IPS
7795945	TEE, TAP, SADDLE FUSION, 3" IPS x 1/2" IPS
7795946	TEE, TAP, SADDLE FUSION, 3" IPS x 1" IPS
7795947	TEE, TAP, SADDLE FUSION, 4" IPS x 1/2" IPS
7795948	TEE, TAP, SADDLE FUSION, 4" IPS x 1" IPS
7795950	TEE, TAP, SADDLE FUSION, 6" IPS x 1/2" IPS
7795951	TEE, TAP, SADDLE FUSION, 6" IPS x 1" IPS
7795962	TEE, TAP, SADDLE FUSION, 8" IPS x 1/2" IPS
7795961	TEE, TAP, SADDLE FUSION, 8" IPS x 1" IPS
10017432	TEE, TAP, ELECTRO FUSION, 1 1/4" IPS x 1/2" IPS
7795995	TEE, TAP, ELECTRO FUSION, 1 1/4" IPS x 1” IPS
10015527	TEE, TAP, ELECTRO FUSION, 2" IPS x 1/2" IPS
7795996	TEE, TAP, ELECTRO FUSION, 2" IPS x 1” IPS
10011844	TEE, TAP, ELECTRO FUSION, 3" IPS x 1/2" IPS
10000844	TEE, TAP, ELECTRO FUSION, 3" IPS x 1” IPS
10011801	TEE, TAP, ELECTRO FUSION, 4" IPS x 1/2" IPS
10000845	TEE, TAP, ELECTRO FUSION, 4" IPS x 1” IPS
10009073	TEE, TAP, ELECTRO FUSION, 6" IPS x 1/2" IPS
10000601	TEE, TAP, ELECTRO FUSION, 6" IPS x 1” IPS
10017437	TEE, TAP, ELECTRO FUSION, 8" IPS x 1/2" IPS
10004213	TEE, TAP, ELECTRO FUSION, 8" IPS x 1” IPS
7796050	TEE, HV TAP, ELECTRO FUSION, 2” IPS x 2” IPS
7796054	TEE, HV TAP, ELECTRO FUSION, 3” IPS x 2” IPS
7796055	TEE, HV TAP, ELECTRO FUSION, 4” IPS x 2” IPS
7796056	TEE, HV TAP, ELECTRO FUSION, 6” IPS x 2” IPS
10007264	TEE, HV TAP, ELECTRO FUSION, 8” IPS x 2” IPS

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TABLE 09	TAPPING TEE FOR PLASTIC (South Dakota / Nebraska)
10002642	TEE, TAP, SADDLE FUSION, 2" IPS x 3/4" IPS
7795943	TEE, TAP, SADDLE FUSION, 2" IPS x 1" IPS
10002644	TEE, TAP, SADDLE FUSION, 3" IPS x 3/4" IPS
7795946	TEE, TAP, SADDLE FUSION, 3" IPS x 1" IPS
10002645	TEE, TAP, SADDLE FUSION, 4" IPS x 3/4" IPS
7795948	TEE, TAP, SADDLE FUSION, 4" IPS x 1" IPS
10002648	TEE, TAP, SADDLE FUSION, 6" IPS x 3/4" IPS
7795951	TEE, TAP, SADDLE FUSION, 6" IPS x 1" IPS
10017433	TEE, TAP, ELECTRO FUSION, 1 1/4" IPS x 3/4" IPS
7795995	TEE, TAP, ELECTRO FUSION, 1 1/4" IPS x 1" IPS
10007756	TEE, TAP, ELECTRO FUSION, 2" IPS x 3/4" IPS
7795996	TEE, TAP, ELECTRO FUSION, 2" IPS x 1" IPS
10017434	TEE, TAP, ELECTRO FUSION, 3" IPS x 3/4" IPS
10000844	TEE, TAP, ELECTRO FUSION, 3" IPS x 1" IPS
10007757	TEE, TAP, ELECTRO FUSION, 4" IPS x 3/4" IPS
10000845	TEE, TAP, ELECTRO FUSION, 4" IPS x 1" IPS
10017436	TEE, TAP, ELECTRO FUSION, 6" IPS x 3/4" IPS
10000601	TEE, TAP, ELECTRO FUSION, 6" IPS x 1" IPS
7796050	TEE, HV TAP, ELECTRO FUSION, 2" IPS x 2" IPS
7796054	TEE, HV TAP, ELECTRO FUSION, 3" IPS x 2" IPS
7796055	TEE, HV TAP, ELECTRO FUSION, 4" IPS x 2" IPS
7796056	TEE, HV TAP, ELECTRO FUSION, 6" IPS x 2" IPS

½" CTS is no longer used for New Construction, only for maintenance purposes in SD and NE. For part numbers for tapping tees with CTS outlets, refer to 52-B Plastic Materials/Fittings

TABLE 10	TAPPING TEE FOR STEEL
10002636	TEE, AUTOPERF, 3/4" X 1/2" CTS PE PIGTAIL - SD/NE
7796767	TEE, AUTOPERF, 3/4" X 1/2" IPS PE PIGTAIL - MT
10002637	TEE, AUTOPERF, 3/4" X 3/4" IPS PE PIGTAIL - SD/NE
10005044	TEE, AUTOPERF, 3/4" X 1" IPS PE PIGTAIL - MT
7796107	NO-BLOW SERVICE TEE, WELD X WELD, 1-1/4" X 1-1/4" - MT/SD/NE
7796109	NO-BLOW SERVICE TEE, WELD X WELD, 2" X 2" - MT/SD/NE
10002633	NO-BLO SERVICE STOP TEE, WELD X WELD, 1-1/4" X 1-1/4" - SD/NE (SD/NE prefer)
10002634	NO-BLO SERVICE STOP TEE, WELD X WELD, 2" X 2" - SD/NE (SD/NE prefer)

TABLE 11	TRANSITION FITTING
7792121	TRANSITION FITTING, 1-1/4" IPS X 1-1/4" IPS, PE2406 - MT/SD/NE
7792122	TRANSITION FITTING, 2" IPS X 2" IPS, PE2406 - MT/SD/NE
10002736	TRANSITION FITTING, 1-1/4" IPS X 1-1/4" IPS, PE3408 - SD/NE
10002737	TRANSITION FITTING, 2" IPS X 2" IPS, PE3408 - SD/NE

TABLE 12	PROTECTIVE SLEEVE (OUTLET OF TEE)
10004267	PROTECTIVE SLEEVE, USED ON 1/2" CTS
	PROTECTIVE SLEEVE, USED ON 1/2" IPS (comes w/ tee)
10018292	PROTECTIVE SLEEVE, USED ON 3/4" IPS
	PROTECTIVE SLEEVE, USED ON 1" IPS (comes w/ tee)

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Gas Service on Plastic Main

Typical Montana Gas Services on Plastic Main

Item	Table	Description	Residential		Commercial	
			1/2" IPS (705scfh, 296ft)	1" IPS (777scfh, 2,515ft)	1" IPS (2,364scfh, 374ft)	2" IPS (9,000scfh, 667ft)
1	NA	EFV Tag	10007305	10007305	10007305	10007305
2	01	Plug	7711050	7711060	7711060	7711090
3	02	Riser / Meter Bracket	Table 02	Table 02	Table 02	10017822
4	03	Riser	7794864	7794861	7794861	10008064
5	04	Plastic Pipe	7504421	7504422	7504422	7504424
6	05	Tracer Wire	10006491	10006491	10006491	10006491
7	06	Coupling	7790921 (3)	7790922 (3)	7790922 (3)	7790924 (3)
8	07	EFV	7900280	7900282	10018152	10018153
9	08	Lock Wing Valve	NA	NA	NA	7900269
10	09	Tapping Tee	Table 09	Table 09	Table 09	Table 09
11	11	Transition Fitting	NA	NA	NA	NA

* Residences may be large enough to require the Commercial Service. This table is typical installations, and a summary of OLC / DDS.

Typical South Dakota / Nebraska Gas Services on Plastic Main

Item	Table	Description	Residential	Commercial		
			3/4" IPS (990scfh, 721ft)	3/4" IPS (1800scfh, 182ft)	1" IPS (2,364scfh, 374ft)	2" IPS (9,000scfh, 667ft)
1	NA	EFV Tag	10007305	10007305	10007305	10007305
2	01	Plug	7711050	7711050	7711060	7711090
3	02	Riser / Meter Bracket	Table 02	Table 02	Table 02	10017822
4	03	Riser	10002629	10002629	7794861	10002632
5	04	Plastic Pipe	10002540	10002540	7504422	7504424
6	05	Tracer Wire	10004259	10004259	10004259	10004259
7	06	Coupling	10002365 (3)	10002365 (3)	10007889 (3)	10002368 (3)
8	07	EFV	10018151	10018282	10018152	10018153
9	08	Lock Wing Valve	10002788	10002788	NA	10002787
10	09	Tapping Tee	Table 09	Table 09	Table 09	Table 09
11	11	Transition Fitting	NA	NA	NA	NA
12	12	Sleeve*	10018292	10018292	NA	NA

* Residences may be large enough to require the Commercial Service. This table is typical installations, and a summary of OLC / DDS.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
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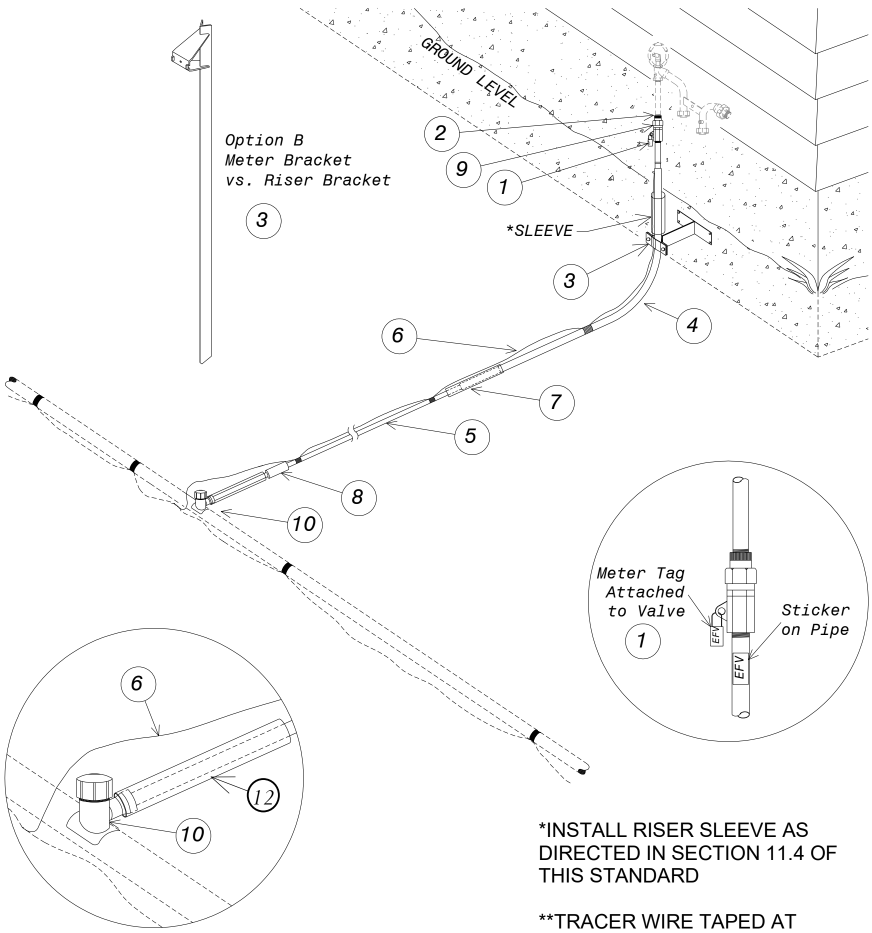
Gas Service on Plastic Main



*INSTALL RISER SLEEVE AS DIRECTED IN SECTION 11.4 OF THIS STANDARD

**TRACER WIRE TAPED AT INTERVALS TO PIPE

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
Supersedes Standard: 52-G	REV# 11	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Gas Service on Steel Main

Typical Montana Gas Services on Steel Main						
Item	Table	Description	Residential		Commercial	
			1/2" IPS (705scfh, 296ft)	1" IPS (777scfh, 2,515ft)	1" IPS (2,364scfh, 374ft)	2" IPS (9,000scfh, 667ft)
1	NA	EFV Tag	10007305	10007305	10007305	10007305
2	01	Plug	7711050	7711060	7711060	7711090
3	02	Riser / Meter Bracket	Table 02	Table 02	Table 02	10017822
4	03	Riser	7794864	7794861	7794861	10008064
5	04	Plastic Pipe	7504421	7504422	7504422	7504424
6	05	Tracer Wire	10006491	10006491	10006491	10006491
7	06	Coupling	7790921 (3)	7790922 (3)	7790922 (3)	7790924 (3)
8	07	EFV	7900280	7900282	10018152	10018153
9	08	Lock Wing Valve	NA	NA	NA	7900269
10	10	Tapping Tee	7796767	10005044	10005044	77796109
11	11	Transition Fitting	NA	NA	NA	7792122

* Residences may be large enough to require the Commercial Service. This table is typical installations, and a summary of OLC / DDS.

Typical South Dakota / Nebraska Gas Services on Steel Main						
Item	Table	Description	Residential	Commercial		
			3/4" IPS (990scfh, 721ft)	3/4" IPS (1800scfh, 182ft)	1" IPS (2,364scfh, 374ft)	2" IPS (9,000scfh, 667ft)
1	NA	EFV Tag	10007305	10007305	10007305	10007305
2	01	Plug	7711050	7711050	7711060	7711090
3	02	Riser / Meter Bracket	Table 02	Table 02	Table 02	10017822
4	03	Riser	10002629	10002629	7794861	10002632
5	04	Plastic Pipe	10002540	10002540	7504422	7504424
6	05	Tracer Wire	10004259	10004259	10004259	10004259
7	06	Coupling	10002365 (3)	10002365 (3)	10007889 (3)	10002368 (3)
8	07	EFV	10018151	10018282	10018152	10018153
9	08	Lock Wing Valve	10002788	10002788	NA	10002787
10	09	Tapping Tee	10002637	10002637	10005044	10002634
11	11	Transition Fitting	NA	NA	NA	7792122
12	12	Sleeve	10018292	10018292	NA	NA

* Residences may be large enough to require the Commercial Service. This table is typical installations, and a summary of OLC / DDS.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Service Installation		Original Date 06/01/2006	Standard Number 52-G
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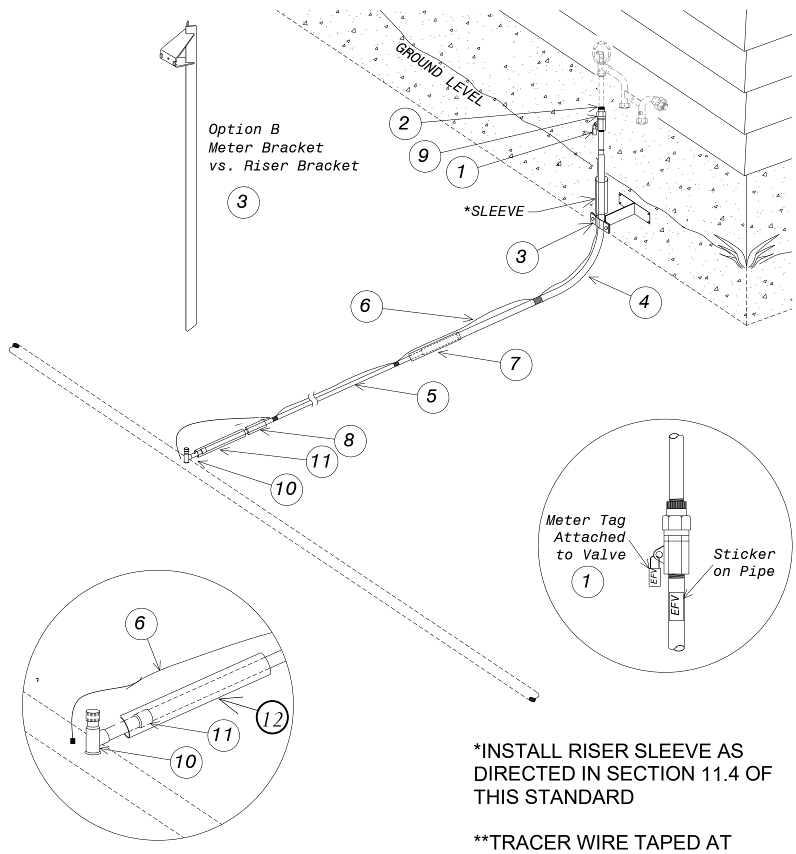
Gas Service on Steel Main



*INSTALL RISER SLEEVE AS DIRECTED IN SECTION 11.4 OF THIS STANDARD

**TRACER WIRE TAPED AT INTERVALS TO PIPE

***TRACER WIRE CAD WELDED TO MAIN

NorthWestern *Energy*

Gas Standards Subject: Plastic Plastic Location Planning		Original Date 04/01/2015	Standard Number 52-H
Supersedes Standard: 52-H	REV# 2	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to provide NorthWestern Energy employees, contractors, and customers with the appropriate guidance for the location, and design of gas utilities.

2.0 Roadways

2.1 Road crossings should be perpendicular to the roadway.

2.2 When crossing a road, culverts (ducts) can be used (see 55-B Section 5.0 Utility Culverts).

2.3 When facilities must be placed longitudinal along a roadway, they should be installed as far off of the traveled way as possible. When it is necessary to be under the traveled way, then facilities should be placed in the shoulder. If that is not possible, the facilities should be installed with the limits of one lane of traffic to the extent practical.

3.0 Joint Trench Considerations

3.1 In new developments it is often cost effective to coordinate installation efforts with other utilities and use joint trenches. When using joint trenches, the other utilities involved and historical construction practices, should be taken into consideration. It is ultimately the decision of the division/district/area.

3.2 See 55-B Open Excavation for specifics regarding joint trench.

4.0 Stubs

4.1 In new developments, it is often useful to provide stubs into lots. This prevents the need to dig up the main. This is especially practical in instances where a joint trench was used, and in digging up the main, the other utilities may be inadvertently disturbed and/or damaged.

4.2 Stubs shall be tracked on the appropriate form (Form 3620 Gas Service Record / Ditch Card).

4.3 Stubs shall be mapped.

4.4 Stubs shall be marked with an above ground and/or below ground marker with tracer wire.

NorthWestern Energy

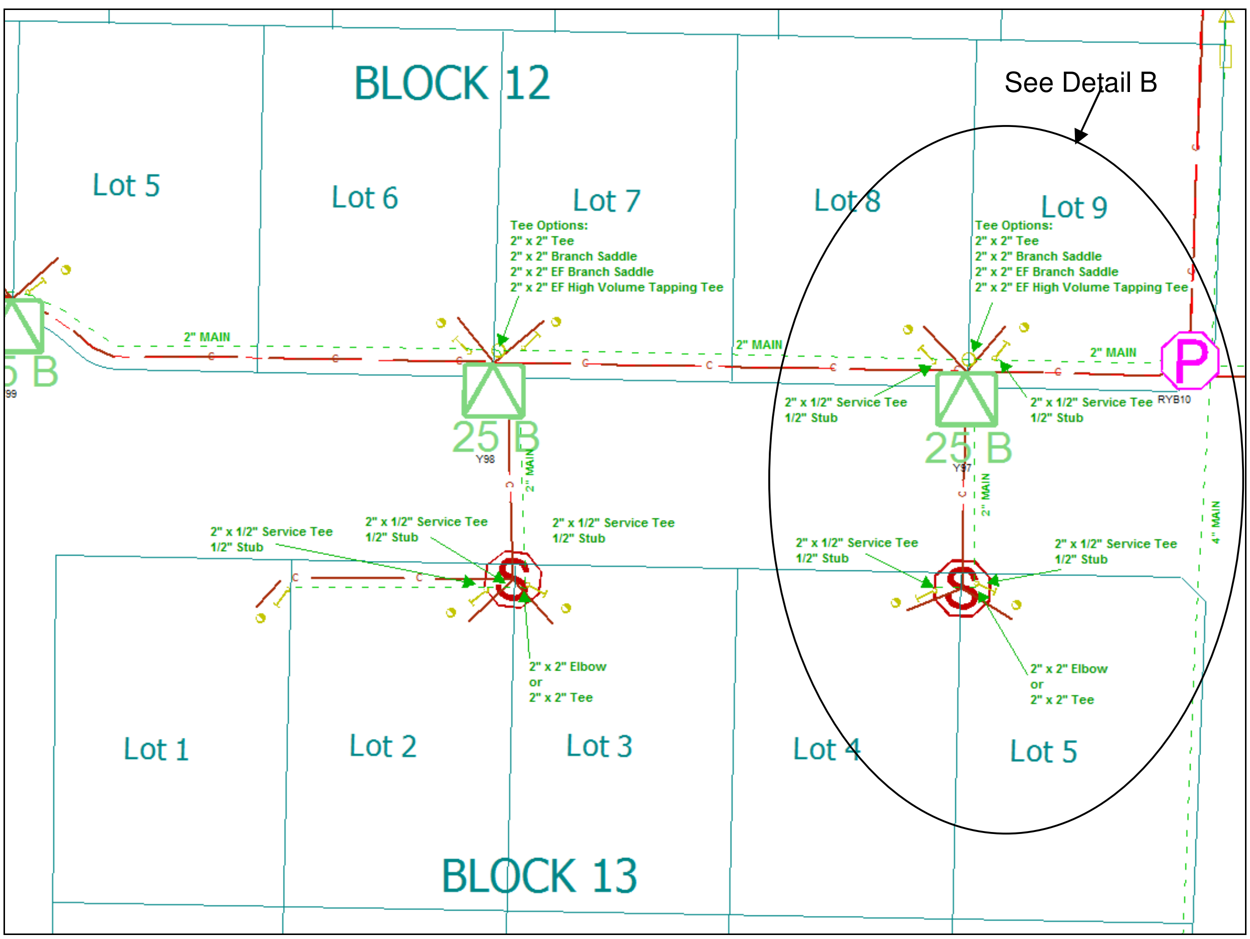
Gas Standards Subject: Plastic Plastic Location Planning		Original Date 04/01/2015	Standard Number 52-H
Supersedes Standard: 52-H	REV# 2	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

Examples of Development Layout

4.5 Example 1: Typical in town subdivision in Montana

Subdivision with joint trench, curb and gutter, and paved roads

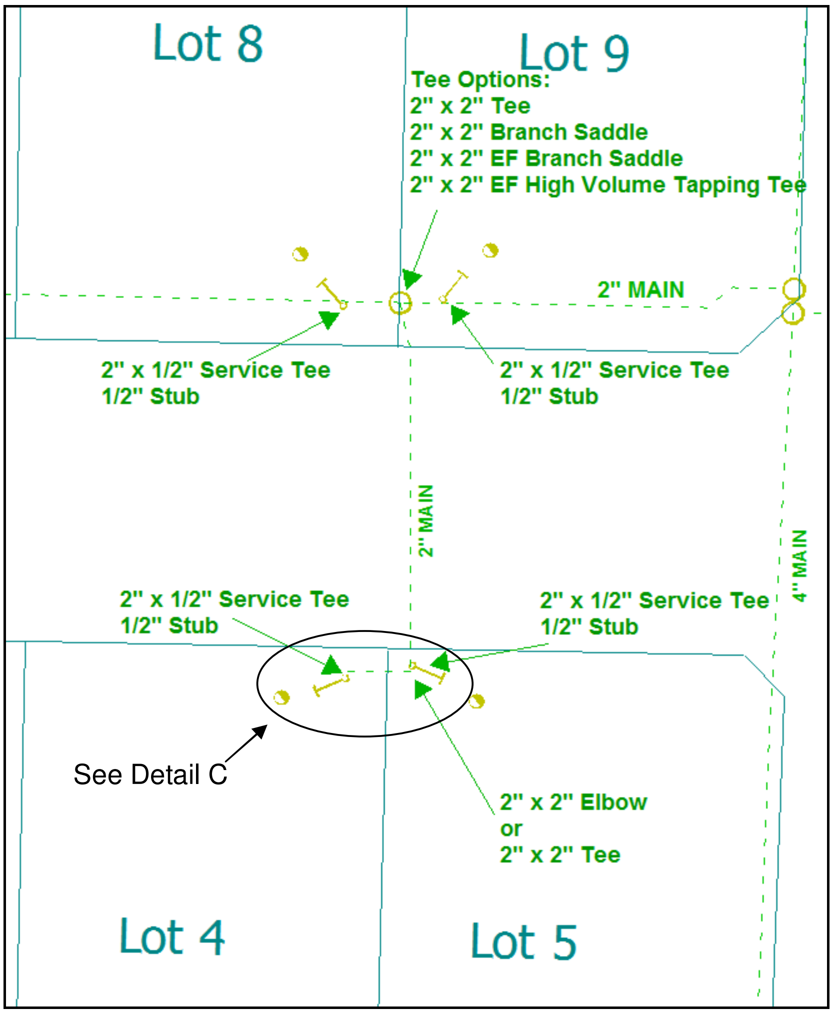
- Road crossings must be Main Pipe (at least 2”).
- Services are not allowed to cross roads.
- Stubs are encouraged.
- EFV will be placed on the lot it serves, when service is installed.
- Main stub past last service tee will be no longer than 12”.



Detail A

NorthWestern Energy

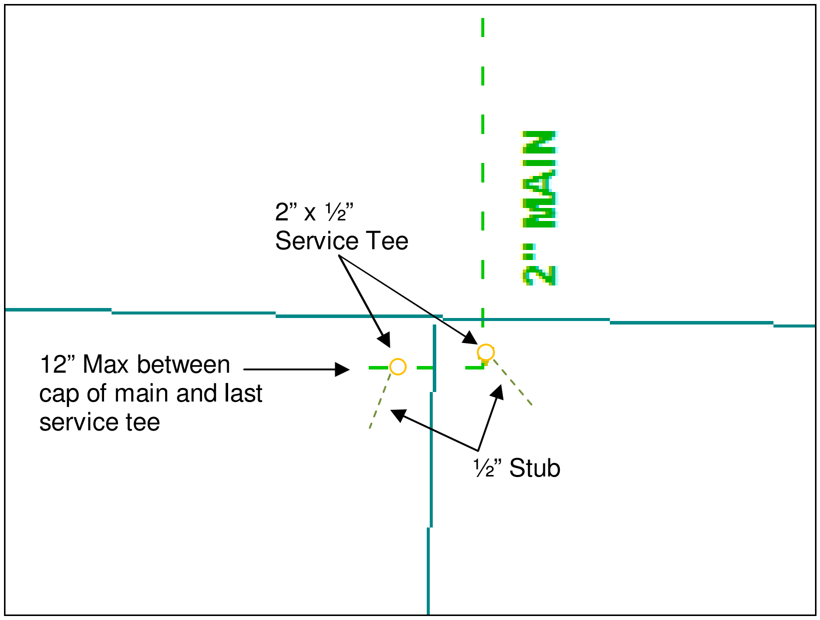
Gas Standards Subject: Plastic Plastic Location Planning		Original Date 04/01/2015	Standard Number 52-H
Supersedes Standard: 52-H	REV# 2	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee



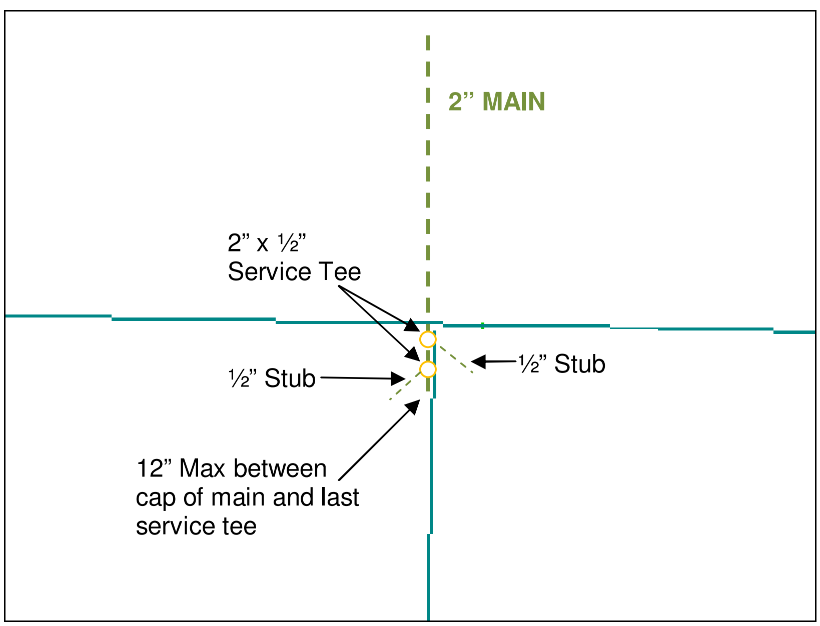
Detail B

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Location Planning		Original Date 04/01/2015	Standard Number 52-H
Supersedes Standard: 52-H	REV# 2	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee



Detail C Option 1



Detail C Option 2

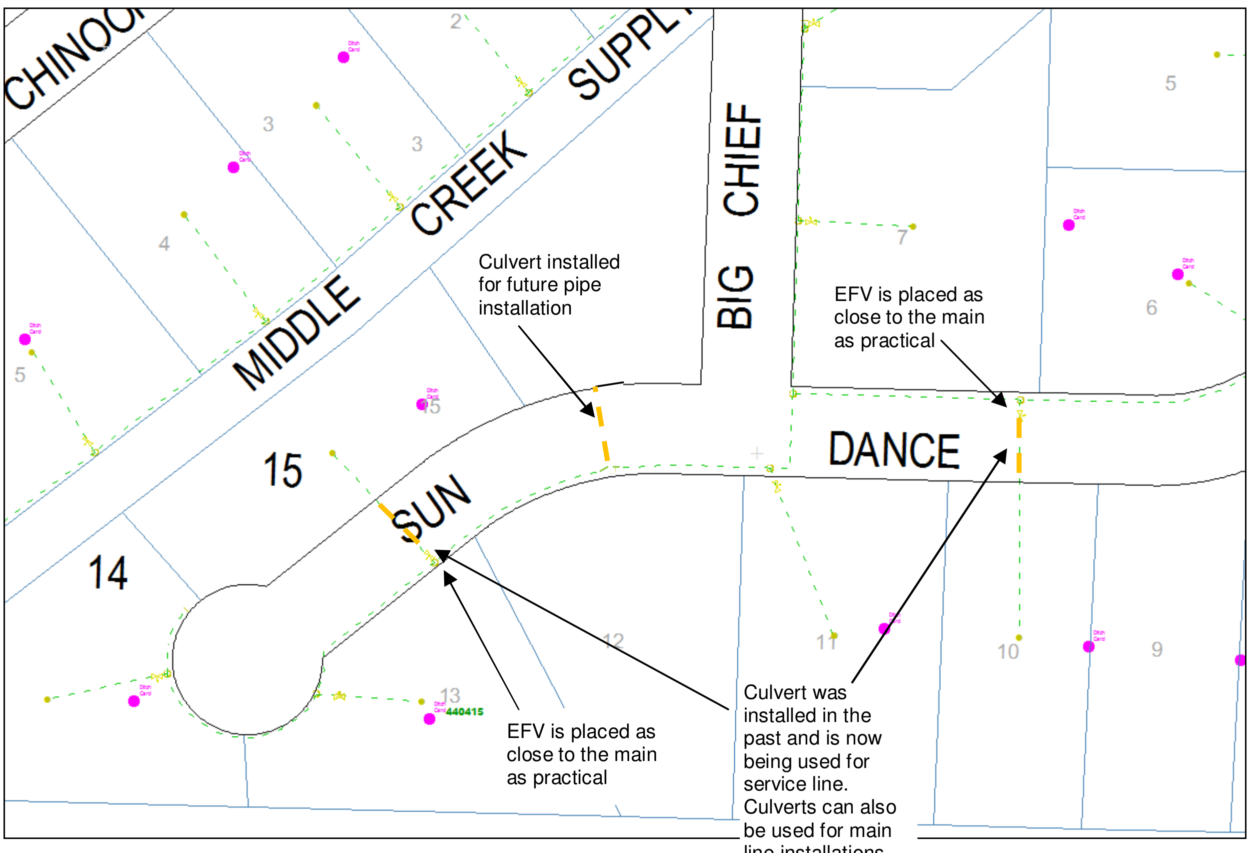
NorthWestern Energy

Gas Standards Subject: Plastic Plastic Location Planning		Original Date 04/01/2015	Standard Number 52-H
Supersedes Standard: 52-H	REV# 2	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

4.6 Example 2: Typical subdivision in South Dakota and Nebraska. Typical rural subdivision in Montana.

May have joint trench, may have paved roads.

- Services can cross roads
- Stubs are **not** encouraged
- Road crossing culverts (ducts) for future use may be used where appropriate
- EFV is allowed to be placed across the street from the lot it serves, when service is installed. EFV must be placed as close as practical to the main.



Detail D

NorthWestern Energy

52 Plastic 52-I Service Tee Tapping		Original Date 04/01/2017	Standard Number 52-I
Supersedes Standard: 52-I	Revision 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the NorthWestern Energy's procedure concerning service tee tapping on plastic pipelines. These procedures are intended to comply with the requirements as set by NorthWestern's O&M Standard 3130 and DOT 49 CFR 192.627.

2.0 General

2.1 This procedure will define the steps necessary for tapping a fused service tee to plastic main.

2.2 This procedures does not cover tapping a Permalock Mechanical Tapping Tee. Please refer to the specific installation standard on Permalock Mechanical Tapping Tees.

2.3 *The tapping of mains under pressure, referred to as "hot taps", shall only be performed by experienced and qualified employees.*

3.0 Prior to Tapping

3.1 Fuse the tapping tee to the main using the applicable fusion procedures. If applicable, slip the protective sleeve over the service line. Then connect the service/branch line to the outlet using the applicable fusion or mechanical fitting procedures. Tighten the cap.

3.2 If hot tapping, pressure test for leaks using the pressure testing procedure. If it passes the pressure test, release the pressure in preparation for tapping.

4.0 Tapping

4.1 If hot tapping, be aware of the pressure of the main.

4.2 Remove cap. It is important to keep both the cap and seal areas free of dirt.

4.3 Insert the hex shank of the tap tool all the way into the hex socket portion of the cutter. Using the tap tool, turn the cutter down until the appropriate tool mark (dependent on pipe size) is flush with the top of the stack.

CAUTION: Turning the cutter down appreciably beyond the above mentioned tool marks could result in dropping the cutter into the main.

4.4 Raise the cutter until the top of the cutter is flush with the top of the stack. It should never extend above the top of the stack. Gas leak-by may occur through the stack internal threads between the time of the tap and cap sealing.

4.5 Replace cap and tighten. Turn cap down by hand until base of cap just contacts shoulder on body. Some resistance to turning may be felt a couple turns prior to the cap reaching its final position. This is normal; the o-ring seal is being compressed. Excessive tightening does not improve sealing performance but may cause unnecessary stress on the fitting.

5.0 After Tapping

5.1 If hot tapping, soap the cap.

5.2 If cold tapping, pressure test the service line when the system is pressure tested.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Squeeze Off Procedures		Original Date 06/01/2006	Standard Number 52-J
Supersedes Standard: 52-J	REV# 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

1.0 Scope – Plastic Pipe Squeeze Off Procedure

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general operations and maintenance procedures and policies concerning plastic pipeline squeeze off procedures. These procedures are intended to comply with the minimum requirements as set by NorthWestern Energy's proper work practices and to follow general qualifications found in Part 192 of the CFR.

2.0 Squeeze Off Procedures

2.1 Polyethylene pipe may be squeezed for tie-in or emergency purposes. The squeezed portion of the pipe may be returned to service, but must be marked with visible tape, before backfilling takes place.

2.2 The following procedures must be used when performing a main/service squeeze on plastic pipe.

2.2.1 Ensure that the squeeze tool is properly grounded and that the pipe has been watered to dissipate any accumulated charges.

NOTE: All squeezed tools used must be approved. Be aware of the **CAUTION** note found in this standard.

2.2.2 Make certain that the squeeze tool has the proper stops in place and/or dialing, in order to avoid crushing the pipe wall during the squeezing operation.

2.2.3 Ensure that the pipe is centered and square in the tool, be aware that the pipe must be free to spread as it flattens.

2.2.4 Locate the squeeze point at least three pipe diameters away from fittings, fusion joints, or previous squeeze points (be aware of evidence of deteriorated marking tape).

2.2.5 Squeeze the pipe slowly using momentary pauses in the operation to allow for pipe relaxation and reduction. In general allow one-minute squeeze time per inch of pipe diameter. This minimizes potential structural damage to the pipe from the squeeze operation.

NOTE: Squeeze time may be double in cold weather conditions, be aware that PE pipe's resistance to damage greatly reduces in cold climates.

2.2.6 A bubble tight flow control will not always be obtained through squeeze off. If a more complete flow control is required, a valve should be used, or additional squeeze tools in series to supplement each other and contain the flow.

2.2.7 After the repair or tie-in has been made, slowly release the squeeze tool, allowing, once again, one-minute per inch of pipe diameter squeeze time. However, a release rate of 0.5 inches/minute or less is recommended.

2.2.8 All squeeze tools shall be removed and locations where squeeze-offs took place shall be soaped to check for leaks.

2.2.9 Plastic pipe shall NOT be squeezed twice in the same location. Indicate any squeeze point area with marking tape. Squeeze off areas must be marked with visible tape before backfilling may take place.

NOTE: Partial squeeze areas are considered as squeezed off, and cannot be squeezed again in that location. Indicate the squeeze area accordingly.

2.3 **CAUTION:** Squeeze off procedures will cause an increase in the velocity of the gas flowing past the squeeze off point. This increase will encourage the development of a dangerous static electrical charge, which may ignite the flowing gas. Squeeze off operations shall be performed outside the gas envelope, when this procedure is used to control escaping gas. Grounding of the squeeze tool is required and is a precaution taken to protect the operator from potential static discharge, which may occur through the pipe wall. Wetting the pipe reduces the possibility of ignition from static discharge on the outside wall of the pipe.

2.4 When performing a service line squeeze, follow the same procedures as for main. A quick squeeze clamp (ie. Timberline clamp) may be used when a quick squeeze off is desired. Follow manufacturer instructions for proper use and handling.

NOTE: Quick squeeze clamps may be used for service lines through 1” IPS, and the squeeze area DOES NOT need to be removed. Follow proper marking, squeeze tool removal, and backfill procedures.

NOTE: If a quick squeeze clamp is used on pipe sizes greater than 1” IPS, the operator must ensure the squeeze area is cut out and replaced before the pipe may be put back into service. The pipe should be re-squeezed a minimum of three pipe diameters upstream with a conventional slow squeeze tool to ensure that the pipe is not structurally damaged.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Bending Procedures		Original Date 06/01/2006	Standard Number 52-K
Supersedes Standard: 52-K	REV# 3	Revision Date 01/01/2026	Prepared / Approved By AJ

1.0 Scope

The purpose of this standard is to describe requirements and limitations when bending plastic pipe. These procedures are intended to accommodate the requirements of DOT CFR 49 Part 192.313(d).

2.0 Safety

2.1 Considerable force may be required to produce tighter field bends, and the pipe may spring back forcibly if the restraints slip or are inadvertently released while bending. Appropriate safety precautions should be used during field bending.

3.0 Installation

3.1 The minimum field bending radius is determined by pipe diameter and dimension ratio. Butt fusions can be present in the field bend. See table below.

3.2 If a fitting is either present or will be installed in the bend, the minimum field bending radius is 100 times the pipe OD. This is because fittings are rigid compared to the pipe. This includes, but is not limited to, tap tees, socket couplings, branch saddles, electrofusion couplings, electrofusion saddles, and mechanical fittings (MetFits). This does NOT include butt fusions.

3.3 If the bending radius is tighter than the minimum cold bending radius, or if appropriate equipment and restraints are not available, directional fittings (elbows) should be installed.

3.4 Directional fittings are recommended in urban areas or joint ditches. A more complete separation can be maintained with directional fittings.

3.5 No fittings may be installed within 5 times the pipe diameter on either side of the bend.

3.6 Be aware that polyethylene pipe's resistance to damage greatly reduces in cold climates.

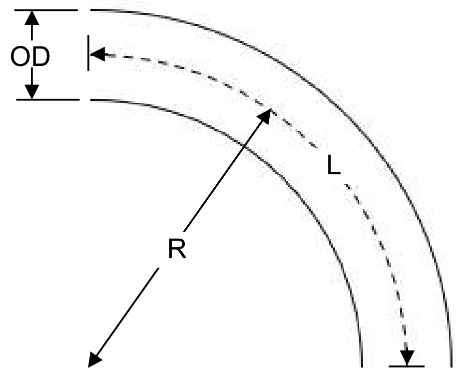
Minimum Cold (Field) Bending Radius (Long-Term)

Pipe DR	Minimum Cold Bending Radius[2], R
9	20 times pipe OD
11, 13.5	25 times pipe OD
17, 21	27 times pipe OD
Fitting (including tapping tee / service saddles) present or to be installed in bend[1]	100 times pipe OD

1. Observe the minimum cold bending radius for a distance of about 5 times the pipe diameter on either side of the fitting location.
2. Values include a safety factor again kinking of at least 2

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Bending Procedures		Original Date 06/01/2006	Standard Number 52-K
Supersedes Standard: 52-K	REV# 3	Revision Date 01/01/2026	Prepared / Approved By AJ



Minimum Bending Limits without a Fitting		
Pipe Size	Bend Radius (ft in)	Length of pipe required to make a 90deg bend (ft in)
1/2" CTS	1' 0.5"	1' 8"
1" CTS	2' 4.125"	3' 9"
1/2" IPS	1' 4.8"	2' 3"
3/4" IPS	2' 2.25"	3' 6"
1" IPS	2' 8.875"	4' 4"
1 1/4" IPS	3' 5.5"	5' 6"
2" IPS	4' 11.375"	7' 10"
3" IPS	7' 3.5"	11' 6"
4" IPS	9' 4.5"	14' 9"
6" IPS	11' 8.625"	18' 5"
8" IPS	17' 11.625"	28' 3"
12" IPS SDR 11	26' 6.75"	41' 9"
12" IPS SDR 9	21' 3.0"	33' 5"

Minimum Bending Limits with a Fitting		
Pipe Size	Bend Radius (ft in)	Length of pipe required to make a 90deg bend (ft in)
2" IPS	19' 9.5"	31' 1.0"
3" IPS	29' 2.0"	45' 9.8"
4" IPS	37' 6.0"	59' 10.8"
6" IPS	46' 10.5"	73' 7.5"
8" IPS	71' 10.5"	112' 10.8"
12" IPS SDR 11	106' 3.0"	166' 10.7"
12" IPS SDR 9	106' 3.0"	166' 10.7"

NorthWestern Energy

Gas Standards Subject: Plastic Plastic - Contact Wire and Tracer Wire		Original Date 06/01/2006	Standard Number 52-L
Supersedes Standard: 52-L	REV# 3	Revision Date 06/06/2013	Supersedes Standard: 52-L

1.0 <u>Scope – Tracer Wire</u>

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning plastic pipe and its attachment and placement with tracer wire. These procedures are intended to accommodate the requirements as set by best practices of NorthWestern Energy's O&M section 4100.

2.0 <u>Installation</u>

2.1 All plastic mains and services must be installed with tracer wire for locating purposes.

2.1.1 Plastic services from a steel main shall be installed with tracer wire.

2.2 Tracer wire should be kept as close as practical to main and service lines during installation. The wire may be attached to the top of the main or service line with electrical tape anchored at set intervals.

<u>NOTE</u>: Tracer wire shall not be coiled around the main or service pipe.

2.3 Tracer wire shall have an approved coating/insulation suitable for underground installation, be copper or copper clad steel, and have a minimum size of #14 AWG.

<u>NOTE:</u> For boring and plowing/pulling of mains and services, it is recommended that the tracer wire installed be stronger, either by having a higher tensile strength (EHS – Extra High Strength), or by having a larger diameter size. Installing these types of tracer wires will reduce potential damage in the continuity of the wire during construction.

2.4 Tracer wire shall be electrically continuous. If electrical test indicate a break in the coated wire exists at the time of installation, the break is to be repaired.

2.5 All wire terminations on service risers shall be made above ground. The wire shall be protected from 6 inches below grade to 6 inches above grade. This can be achieved in several ways, using a tracer wire snap (see Standard 52-B-8 for stores code number), tracer wire inside a sleeve used to protect the riser, or inside a separate conduit fastened to the side of the riser.

2.6 Tracer wire splices are to be made through the following **<u>soldering</u>** procedure.

2.7 Tracer wire used for plastic services from steel mains shall be electrically bonded to the steel main by approved CadWelding (Thermite) see standard 53PQ in this book.

3.0 <u>Tracer Wire – Soldering Procedure</u>

3.1 This process shall be completed using any of the following methods to heat the solder to a temperature that allows for an adequate joint.

3.1.1 Appropriate Methods of Heating include:

3.1.1.1 Butane Torch
3.1.1.2 Propane Torch

3.1.2 Inappropriate Methods of Heating include:

3.1.2.1 Oxyacetylene torch

NorthWestern Energy

Gas Standards Subject: Plastic Plastic - Contact Wire and Tracer Wire		Original Date 06/01/2006	Standard Number 52-L
Supersedes Standard: 52-L	REV# 3	Revision Date 06/06/2013	Supersedes Standard: 52-L

3.2 Materials used shall be the following:

3.2.1 Tracer wire that conforms to NorthWestern Energy procedures and standards.
3.2.2 Rosin Core Solder (plain solid with flux paste) NOTE: Acid Core is not allowed
3.2.3 DBY Connections, or
3.2.4 Stick Fusion Bonded Epoxy, or
3.2.5 3M Mastic Tape wrapped with 3M Electrical Tape

3.3 Cleaning of the bare tracer wire shall be completed prior to soldering. Removing oxidization from the wires will promote proper joining, easier soldering, and a sound joint. Cleaning shall not leave gouges in the wire and shall not affect the integrity of the main line.

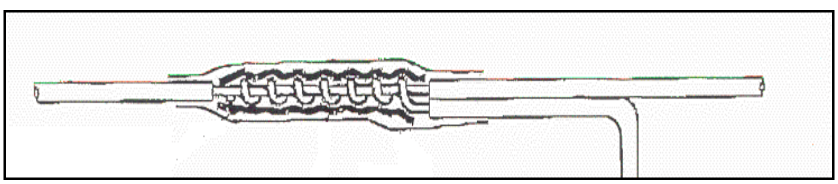
3.4 There are two approved methods for joining tracer wire on the distribution system.

3.4.1 Splicing the tracer wire without cutting the main tracer wire, and
3.4.2 Splicing by cutting the main tracer wire

3.5 The joint design for not cutting the main tracer shall be prepared in the following manner:

3.5.1 All sources of ignition shall be eliminated.
3.5.2 If the main tracer wire is tight against the Main line, give a slight pull, just enough to slack the wire (minimum 3 inches) and allow access to solder the joint.
3.5.3 An appropriate heat shield (i.e. leathers) shall be placed over the main line.
3.5.4 Strip the main tracer wire removing all shielding in no more than a 2-in. length.
3.5.5 Wrap the service tracer wire around the main tracer wire a minimum of 3 times. Making sure that the wraps are tight. See Figure 3.3a.

Figure 3.3a – Service Tracer Wire Connection To Main Tracer Wire



3.5.6 If this is a connection of one end to another, a splice as shown in Figure 3.3b shall be used.

Figure 3.3b – Western Union Splice – For End Connection Splices

3.5.7 Using one of the heating methods in 3.1.1, directly heat the joint while applying solder. Cover the entire joint with solder establishing a sound connection. The soldering process should not take longer than 20 seconds.

NOTE: Verify connection by pulling on the connection with one hand while holding the main wire in the other – the joint should not start to unwrap and solder should not crack or flake.

3.5.8 After allowing the wires to cool, apply one of the following covering methods on all sections of the exposed wire. Methods of covering are Fusion Bonded Epoxy, 3M Mastic wrapped with 3M Electrical tape.

3.5.8.1 If 3M Mastic is used it shall be formed to encase the joint and then electrical tape shall be used to cover the Mastic.

3.6 The joint design for cutting the main tracer shall be prepared in the following manner:

3.6.1 All sources of ignition shall be eliminated.

3.6.2 If the main tracer wire is tight against the main line, give a slight pull, just enough to slack the wire (minimum 3 inches) and allow access to solder the joint.

3.6.3 An appropriate heat shield (i.e. leathers) shall be placed over the main line.

3.6.4 Cut the tracer wire

3.6.5 Strip the main tracer wire removing all shielding with no more than 2 inches in length.

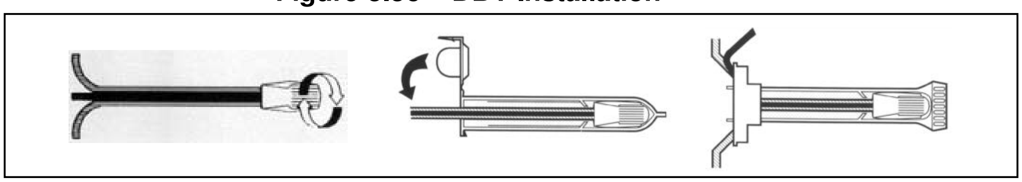
3.6.6 Splice shall be twisted together making a tight bundle. There should be a minimum of three twists.

3.6.7 The joint shall be soldered after twisting, using the method described in 3.5.7 above.

3.6.8 After allowing the joint to cool, a DBY splice kit shall be applied to the splice including: connecting the Scotchlok Electrical Spring Connector (wire nut) by twisting in a clockwise direction, and inserting the splice into the Gel-Filled Insulator Tube (grease ball/tube).

NOTE: Push past the locking fingers to hold the Scotchlok connector in place. Position the wires in wire channels and snap insulator tube cover closed.

Figure 3.3c – DBY Installation



NOTE: DBY Splice kits are only allowed in conjunction with a soldered tracer wire joint. DBY splice kits shall not be used to connect tracer wire on NWE's gas distribution system without the proper soldering procedures followed in this standard performed prior to installation (i.e. DBY splice kits are no longer an acceptable means of connection if used alone).

3.7 Relocate tracer wire next to main and cover according to NWE codes and standards.

3.8 Acceptable joints shall be verified by visually observing that soldering is completed in accordance with this procedure. Any joint not meeting the requirements of this procedure shall be removed and rework shall be done to this procedure.

3.9 Wire connections to steel components shall be made by CadWelding (Thermite) or other methods approved by engineering.

NOTE: Brazing wire to pipe is not allowed.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Abandonment, Retirement, & Temporary Disconnection		Original Date 06/01/2006	Standard Number 52-M
Supersedes Standard: 52-M	REV # 2	Revision Date 04/01/2007	Prepared / Approved By K. Meagor / Committee

1.0 Scope

The purpose of this guideline is for the abandonment and/or retirement, of plastic main and service gas lines in the NorthWestern Energy Distribution System. The purpose of this guideline is also for the temporary disconnection of plastic service gas lines in the NorthWestern Energy Distribution System. Deviation from these guidelines must be approved by local management and require engineering to be completed. This guide shall not be used in any manner for construction, retirement, or abandonment of steel services. These procedures are intended to accommodate the requirements as set by NorthWestern's O&M section 3190.

2.0 General

2.1 Procedures utilized to retire / abandon a plastic main or service shall be in accordance with the NorthWestern Gas Standards, are based on the Code of Federal Regulations (49CFR 192).

2.2 When abandoned, all facilities (main, service, and/or vaults) shall be physically disconnected from the system, purged, and sealed at both ends to avoid combustable accumulation.

2.2.1 Vaults shall be filled with acceptable compaction material.

2.2.2 If the volume of gas is minor, mains and services do not need to be purged.

2.3 Management shall be responsible to assure that only current qualified individuals, materials, and procedures are used to retire / abandon plastic mains / services in the Company's distribution system.

2.4 Two methods are available for the retirement / abandonment of main and service that NorthWestern utilizes in the distribution system.

2.4.1 It is preferred, where practical, to remove the abandoned / retired pipe.

2.4.2 For mains and services a cap shall be used to retire / abandon a plastic service.

Note: Local engineering may specify another method for retirements / abandonments based on location or engineering decision. Records of the decision must be kept in the job packet and ditch card.

3.0 Excavation

3.1 Please refer to Standard-55 for excavation and burial requirements.

4.0 Procedure for Retirement / Abandonment

4.1 Lines shall be stopped or bypassed using appropriate and acceptable means (i.e. line stopper/bypass fittings - mains or service tee - services).

4.2 After gas has been confirmed shut off to the retirement / abandonment area the line may be cut.

4.3 A line shall be cut in an area that is reasonable and will not create a hazard.

4.3.1 A main line should be cut as to leave enough room to join a cap on the end of the pipe.

4.3.2 A service line should be cut as close to the service tee as allowable and capped per approved joining process.

4.4 Cut an additional section from the pipe so as to create room and a spacer between a live line and an abandoned / retired line.

4.4.1 For a main line there shall be at a minimum 36 inches between the retired section of line and the live line. It is preferred that the line will be cut back to the right-of-way or the property line.

4.4.2 For services there shall be at a minimum 24 inches between the retired tee and service line. It is preferred that the line will be cut back to the right-of-way or the property line.

4.5 Burn Off/Purging & Pigging

4.5.1 For pipes less than an acceptable volume a controlled burn off may be used through a valve.

4.5.2 Purging of the retired / abandoned line is required for pipes with a volume greater than acceptable for neutral purging. Purging may be completed using a nitrogen atmosphere – See Purging Standard (57-E) for the Nitrogen Capacity Table. This table is only meant as a guideline and values are approximate. However, pigging of the line will accomplish the same results – See the Pigging Standard (57-D).

4.6 The following method shall be used depending on the size of the line retiring / abandoning. After the line has been cut, place an appropriate end cap over the pipe and completely join the pipe and end cap. This should be done for both the line side and the retired / abandoned side.

4.7 Tracer wire on the retired / abandoned line shall be disconnected from the main line and stored in a manner that will not give any indication during a locate.

4.8 Following the joining process, the live side should be soaped to ensure soundness and check for leaking.

5.0 <u>Temporary Disconnection of Services</u>

To discontinue service to a customer, the following procedures must be followed to ensure no potential flow beyond the disconnection point.

5.1 The valve closed to discontinue service must be sealed with proper locking devices to ensure that only authorized personnel may gain access.

5.2 When a valve has no positive shut off and cannot be replaced or repaired at the disconnection time, a mechanical device which prevents the flow of gas will be installed between the valve and customer meter until corrective action can take place.

5.3 Where outside conditions exist, preventing the use of a proper locking device on a valve, a mechanical device must be installed between the valve and the customer meter to prevent gas flow.

5.4 Please refer to Standard 3190 in the gas Operations and Maintenance Standards handbook for further information pertaining to proper abandonment, deactivation, or disconnection procedures.

NorthWestern Energy

Plastic Reinstating Plastic Service		Original Date 06/01/2006	Standard Number 52-N
Supersedes Standard: 52-N	REV# 3	Revision Date 01/01/2026	Prepared / Approved By Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's requirements for the reinstatement of plastic service linesThis standard is intended to comply with DOT 49 CFR part 192.725.

2.0 Facilities Reinstatement

2.1 All disconnected service lines must be tested in the same method as a new service line before they may be reinstated, except as described in section 2.2 of this Standard.

2.2 All service lines disconnected from the main line must be tested from the disconnection point to the service line valve by the same method as a new service line; however, if conditions are made to maintain a continuous service (installation of a bypass), any part of the original service line used to maintain the continuous service will not need to be tested.

2.3 If damage to the pipe is found in the vicinity of the service tee, an inspection is required at the service tee. The main and tee shall be closely examined for any damage.

NorthWestern Energy

52 Plastic 52-P Plastic Joining Methods		Original Date 06/01/2006	Standard Number 52-P
Supersedes Standard: 52-P	Revision 6	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning plastic pipe joining (joining material in pipelines other than by welding procedures). These procedures are intended to accommodate the requirements as set by NorthWestern's O&M section 5500.

2.0 Approved Joining Procedures

NorthWestern Energy approves the following procedures as appropriate joining methods for heat fusing and mechanically connecting plastic pipe. All NorthWestern Energy employees making heat fusions or mechanical connections on plastic pipe must be trained and tested according to the procedures found in subsequent areas of this handbook.

NOTE: Plastic fusion is the recognized method for joining plastic PE pipe, however, mechanical connections are also an approved method of joining plastic pipe (with approved fittings only).

NOTE: Heat may not be applied through the use of a torch or other flame. Only approved heating irons and faces may be used to perform heat fusion.

2.1 **Socket Fusion** - Approved as an appropriate joining method for plastic pipe in sizes ranging from ½" CTS through 2" IPS.

NOTE: Socket Fusion may be performed on 2" IPS plastic PE pipe, however, Butt Fusion is recommended.

2.2 **Butt Fusion** - Approved as an appropriate joining method for plastic pipe in sizes ranging from 2" IPS through 12" IPS. An approved application device must be used to perform the fusion.

NOTE: Butt Fusion is the recommended fusion for 2" IPS plastic PE pipe and above.

2.3 **Saddle Fusion** - Approved for plastic service tees and branch saddle installations in main sizes ranging from 2" IPS through 12" IPS. An approved application device must be used to perform the fusion.

NOTE: The use of serrated heating irons is mandatory.

2.4 **Electrofusion** - Approved for all plastic pipe and fittings, and is one of the two methods allowed for making mixed fusion joints. Recommended for tie-ins where butt fusion and socket fusion are less effective.

NOTE: The preferred method of fusing 2" x 2" High Volume Tapping Tees (HVTT's) is through Electrofusion methods.

NOTE: Be aware when tapping HVTT's on live distribution mains, that there is a possibility of a substantial amount of blowing gas to be released through the tapping procedure. A No-Blow Tap Tee Wrench shall always be used to prevent potential hazards caused by the unnecessary loss of natural gas.

2.5 **Mechanical Connections** - Approved as an appropriate joining method for plastic pipe in sizes ranging from 1/2" CTS through 2" IPS. Mechanical Connections are one of the two methods allowed for making mixed fusion joints.

2.6 **Steel to Plastic Transitions** – Only manufactured steel to plastic transition fittings are allowed. This includes transition fittings that are part of a fabricated assembly, such as risers and steel tapping tees with plastic outlets. Field installed mechanical joints shall not be used to connect steel to plastic.

2.7 Proper maintenance and safety rules shall always be followed, including keeping all heating irons/faces clean and ensuring all faces have adequate surfaces for proper fusion, shielding fusion equipment from inclement weather and winds, ALWAYS using proper safety precautions when fusing (ESPECIALLY WHEN FUSING IN A COMBUSTABLE ATMOSPHERE), and ALWAYS wearing proper Personal Protective Equipment (PPE).

2.8 Proper Personal Protective Equipment (PPE) and potential safety considerations may include the following:

NOTE: Proper PPE is dependant upon situation. Always be aware of potentially hazardous environments and prepare accordingly.

2.8.1 Fire Resistant Coveralls (Nomex)
2.8.2 Hard Hat
2.8.3 Eye Protection
2.8.4 Hearing Protection
2.8.5 Breathing Apparatus/Respirator
2.8.6 Gloves
2.8.7 Monitoring Device(s)
2.8.8 Seasonal Clothing
2.8.9 Wind Direction

NorthWestern Energy

52 Plastic 52-PA Butt Fusion		Original Date 06/01/2006	Standard Number 52-PA
Supersedes Standard: 52-PA	Revision 8	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for butt fusion procedures in accordance with NorthWestern's O&M section 5500.

2.0 Summary

The butt-fusion procedure in its simplest form consists of heating the squared ends of two pipes, a pipe and a fitting, or two fittings, by holding them against a heated plate, removing the heater plate when the proper melt is obtained, promptly bringing the ends together, and allowing the joint to cool while maintaining the appropriate applied force.

3.0 Reference Documents

3.1 ASTM F2620 Standard Practice for Heat Fusion Joining of PE Pipe and Fittings

4.0 Material

4.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

4.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

4.3 This procedure **CANNOT** be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

4.4 This procedure **CANNOT** be used to fuse Aldyl-A. Electrofusion or Mechanical Fittings must be used in these situations.

5.0 Pipe Size

5.1 This procedure will cover pipe diameter sizes ranging from 2" IPS to 12" IPS.

NOTE: Butt Fusion is recommended for pipe diameter sizes 2" IPS and greater, but Socket Fusion may be used on 2" plastic pipe according to the construction situation.

6.0 Equipment

6.1 Heating Tool
6.2 Butt Fusion Machine
6.3 Pipe Support Stands – Used for support on long pipe lengths.
6.4 Pipe cutter
6.5 Clean, dry, lint-free, non-synthetic cloth
6.6 Pyrometer (Contact pyrometers shall be used, no laser pyrometers are allowed.)
6.7 Isopropyl alcohol (Minimum 90% alcohol concentration.)

7.0 Setup

7.1 Butt fusion machine setup parameters are prescribed in the Table 7.1.

Table 7.1 Butt Fusion Machine Setup Parameters

Setup Parameter		**Required Condition**
Manual Butt Fusion Machine	**Hydraulic Butt Fusion Machine**	
Set heating tool temperature and heat to specified temperature		The surface temperature of heating tool faces must be 400° to 450° F. A pyrometer should be used periodically to insure proper surface temperature of the heating tool faces.
Install inserts	Install inserts	Install inserts for the pipe OD or the fitting being fused.
Electric power supply	Electric power supply	Check field generator for adequate power supply and fuel sufficient to complete the fusion joint.
Manual pressure	Set facing pressure	As required. Observe butt fusion machine manufacturer's instructions for setting facing pressure.
Manual pressure	Set heating pressure	Observe the pipe and butt fusion machine manufacturer's instructions for setting heating pressures.
Manual pressure	Set fusion joining pressure	Determine fusion joining pressure for the pipe OD and dimension ratio (DR) using 60 to 90 psi interface pressure. Observe pipe and butt fusion machine manufacturer's instructions to determine the theoretical fusion joining pressure.
	Determine drag pressure	Drag pressure is the amount of pressure required to get the carriage to move. This is determined in the field. Add this pressure to the theoretical fusion joining pressure to get the actual machine gage pressure to set.

7.2 An interfacial pressure (IFP) of 60 to 90 psi is used to determine the force required to butt fuse the pipe components. For manually operated fusion machines, enough force should be applied to roll the bead back to the pipe surface. A torque wrench may be used to apply the proper force. Manual fusion without a torque wrench has been used successfully by many gas utilities.

Table 7.2 – McElroy No. 28 Hydraulic Fusion Machine
with 4.71 in^2 Piston, High Force, Green Cylinders
Pressure Guidelines

Pipe Size	Target Theoretical Fusion (TFP) Pressure (psig)		Drag Pressure (DP)		Fusion (Gauge) Pressure (FP)
2" IPS SDR 11	23	+	Field Determined	=	MINIMUM **53**
3" IPS SDR 11.5	49	+	Field Determined	=	MINIMUM **79**
4" IPS SDR 11.5	80	+	Field Determined	=	MINIMUM **110**
6" IPS SDR 11.5	174	+	Field Determined	=	MINIMUM **204**
8" IPS SDR 11.5	295	+	Field Determined	=	MINIMUM **325**
8" IPS SDR 11	308	+	Field Determined	=	MINIMUM **338**
10" IPS SDR 11	478	+	Field Determined	=	MINIMUM **508**
12" IPS SDR 11	672	+	Field Determined	=	MINIMUM **702**
12” IPS SDR 9	803	+	Field Determined	=	MINIMUM **833**

7.3 For hydraulically operated fusion machines, the Fusion Pressure (FP) is the Theoretical Fusion Pressure (TFP) + Drag Pressure (DP).

7.3.1 The Theoretical Fusion Pressure (TFP) can be calculated using the fusion pressure calculator (slide rule device that is included with machine). Or Table 7.2 or 7.3. Or McElroy McCalc Application on smart phone or tablet.

7.3.2 Drag Pressure (DP) is the amount of pressure required to get the carriage to move. This is determined in the field. Drag Pressure (DP) is determined in the field by bringing the faced pipe ends within 2 in. of each other and increasing the pressure on the carriage until it just starts moving. Back off the pressure until the carriage is barely moving and record the drag pressure in psig. There must be material in the machine, not an empty machine. It is not uncommon to have a different drag pressure for each joint. The carriage may move with the heating pressure reducing valve backed all the way out. If so, this is your drag pressure. A minimum of 30 psi is still used for the following calculation.

7.3.3 The Fusion Pressure is calculated two ways.

- If the Drag Pressure (DP) is 30psig or less, TFP + 30 = **FP**
- If the Drag Pressure (DP) is above 30psig, TFP + DP = **FP**

Theoretical Fusion Pressure (from table above)	TFP
+ Drag Pressure (Determined in field, **MINIMUM 30psig**)	+ DP
= **Fusion Pressure**	= **FP**

Table 7.3 – McElroy No. 412 and 618 Hydraulic Fusion Machine with 11.78 in^2 Piston, High Force, Green Cylinders Pressure Guidelines

Pipe Size	Target Theoretical Fusion (TFP) Pressure (psig)		Drag Pressure (DP)		Fusion (Gauge) Pressure (FP)
2" IPS SDR 11	9	+	Field Determined	=	MINIMUM **39**
3" IPS SDR 11.5	19	+	Field Determined	=	MINIMUM **49**
4" IPS SDR 11.5	32	+	Field Determined	=	MINIMUM **62**
6" IPS SDR 11.5	70	+	Field Determined	=	MINIMUM **100**
8" IPS SDR 11.5	118	+	Field Determined	=	MINIMUM **148**
8" IPS SDR 11	123	+	Field Determined	=	MINIMUM **153**
10" IPS SDR 11	191	+	Field Determined	=	MINIMUM **221**
12" IPS SDR 11	269	+	Field Determined	=	MINIMUM **299**
12” IPS SDR 9	321	+	Field Determined	=	MINIMUM **351**

7.4 For hydraulically operated fusion machines, the Fusion Pressure (FP) is the Theoretical Fusion Pressure (TFP) + Drag Pressure (DP).

7.4.1 The Theoretical Fusion Pressure (TFP) can be calculated using the fusion pressure calculator (slide rule device that is included with machine). Or Table 7.2 or 7.3. Or McElroy McCalc Application on smart phone or tablet.

7.4.2 Drag Pressure (DP) is the amount of pressure required to get the carriage to move. This is determined in the field. Drag Pressure (DP) is determined in the field by bringing the faced pipe ends within 2 in. of each other and increasing the pressure on the carriage until it just starts moving. Back off the pressure until the carriage is barely moving and record the drag pressure in psig. There must be material in the machine, not an empty machine. It is not uncommon to have a different drag pressure for each joint. The carriage may move with the heating pressure reducing valve backed all the way out. If so, this is your drag pressure. A minimum of 30 psi is still used for the following calculation.

7.4.3 The Fusion Pressure is calculated two ways.

- If the Drag Pressure (DP) is 30psig or less, TFP + 30 = **FP**
- If the Drag Pressure (DP) is above 30psig, TFP + DP = **FP**

Theoretical Fusion Pressure (from table above)	TFP
+ Drag Pressure (Determined in field, **MINIMUM 30psig**)	+ DP
= **Fusion Pressure**	= **FP**

8.0 Procedure

8.1 Clean the inside and outside of the components (pipe or pipe and fitting) to be joined with a clean, dry, lint-free, non-synthetic cloth such as cotton. Remove all foreign matter from the piping component surfaces where they will be clamped in the butt fusion machine. If this does not remove the contamination, refer to 8.1.1.

8.1.1 *Before installing the pipe in the fusion machine, clean the OD, ID and ends with a clean, dry, lint-free, non-synthetic cloth such as cotton. If the contamination cannot be removed this way, wash the pipe with water and a clean cloth or paper towel to remove the contamination, rinse the pipe with water and dry thoroughly with a clean, dry, lint-free non-synthetic cloth such as cotton or paper towel. If contamination, such as bar oil, was transferred to the pipe ends after cutting, use 90% or greater isopropyl alcohol or acetone on a clean cloth or isopropyl alcohol wipes on the ends of the pipe to clean the contamination, then rinse with water and dry thoroughly on the pipe ends, ID and OD. It is important that pipe ends be clean before installing in the fusion machine to avoid contamination fusion machine parts that contact the pipe ends such as the facer and heater. If the facer or heater becomes contaminated, the contamination may be transferred back to the pipe ends, possibly compromising joint quality. Do not use the facer to remove contamination (Reference ASTM F2620 X1.7.1).*

8.2 If applicable, place pipe support stands at both ends of the butt fusion machine and adjust the support stands to align the pipe with the fusion machine centerline. Install the pipes or fittings being joined in the stationary and movable clamps of the butt fusion machine. Leave enough pipe protruding through the clamps to allow for facing and clamp the pipe or fitting in the machine.

8.2.1 Take care when placing pipe or fittings in the butt fusion machine. Pipes shall be aligned before the alignment clamp is closed. Do not force the pipe into alignment by pushing it against the side of an open butt fusion machine clamp. Pipes that are freshly cut and molded fittings general do not have toe-in, and when mated to old-cut pipe or fabricated fittings, removing toe-in can ease adjustment for high-low alignment.

8.3 Face the piping component ends until the facer bottoms out on the stops and is locked between the jaws to establish clean, parallel mating surfaces between the pipe/fitting ends (see note). Move the carriage to separate the pipe ends from the facer, remove the facer and all shavings and debris from the facing operation by brushing away with a clean, dry, lint-free, non-synthetic cloth such as cotton. Bring the pie/fitting ends together at facing pressure A visual inspection of this operation should verify a square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.

NOTE: A facer is a rotating cutting device used to square-off the pipe or fitting ends to obtain properly mating fusion surfaces. If so equipped, facing should continue until a positive mechanical stop on the butt fusion machine is reached.

8.4 Check the pipe ends for high-low alignment and out-of-roundness. If adjustment is needed, adjust the high side down by tightening the high side clamp. Do not loosen the low side clamp or slippage may occur during fusion. Re-face the pipe or fitting ends if excessive adjustment is required (more than 180^o rotation of the clamp knob) and remove any shavings from the re-facing operation with a clean, dry, lint-free, non-synthetic cloth such as cotton. The maximum OD high-low misalignment allowed in the butt fusion procedure is to be less than 10% of the pipe minimum wall thickness.

8.5 Butt Fusion of Coiled Pipe (Reference ASTM F2620 X1.5) – Coiled pipe is available in sizes up to 6in IPS. Coiling may leave a set in some pipe sizes that must be addressed in the preparation of the butt fusion process. There are several ways to address this situation:

8.5.1 *Straighten and re-round coiled pipe before the butt fusion process. (Specification D2513 requires field re-rounding of coiled pipe before joining pipe sizes larger than 3 in. IPS.)*

8.5.2 *If there is still a curvature present, install the pipe ends in the machine in an "S" configuration with the print lines approximately 180^o apart in order to help gain proper alignment and help produce a straight joint.*

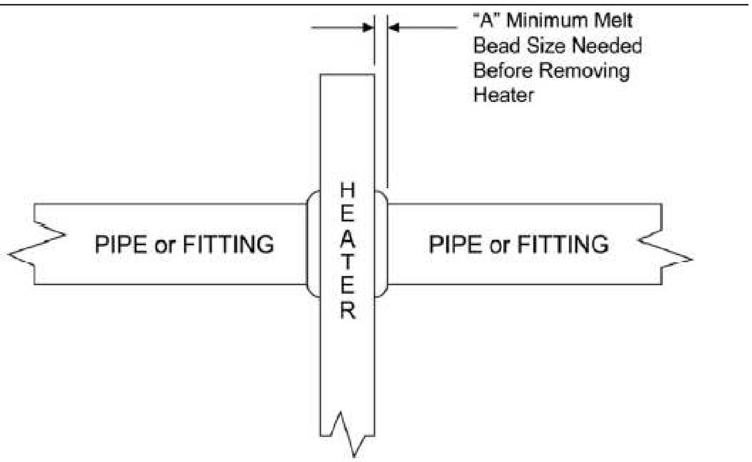
8.5.3 *If there is still a curvature present, another option would be to install a straight piece of pipe between the two coiled pipes.*

8.6 Verify that the heater surface temperatures are in the specified temperature range 400^{o}F to 450^{o}F. A pyrometer shall be used before the first joint of the day and periodically throughout the day to insure proper temperature of the heating tool face. All pyrometers are sensitive to usage techniques. Carefully follow the manufacturer's instructions for best results.

8.6.1 Ensure the contact surfaces of the heating tool are clean. If necessary, wipe the surfaces of the heating tool with a clean, dry, lint-free, non-synthetic cloth such as cotton. Place the heating tool in the butt fusion machine between the piping component ends and bring the pipe or fitting ends into full contact with the heating tool at fusion pressure. Briefly ensure full contact between piping component ends and the heating tool and then reduce the pressure to drag pressure but without breaking contact between the piping component ends and the heating tool.

8.6.2 Once the indication of melt is observed around the circumference of the pipe and pressure has been reduced from fusion pressure to contact pressure a bead of molten polyethylene will develop between the heater and the pipe or fitting. DO NOT USE EXCESSIVE PRESSURE – IT IS NOT NEEDED. Continue heat soak time until the melt bead size has developed against both heater faces per Table 8.1.

Table 8.1 Minimum Melt Bead Size



Pipe Size	"A" Minimum Melt Bead Size, Inches
2 IPS, 3 IPS	1/16
4 IPS, 6 IPS	3/16
8 IPS , 10 IPS, 12 IPS	1/4

8.7 When the proper bead size is observed, quickly move the piping component ends away from the heating tool, remove the heating tool and quickly inspect the pipe ends.

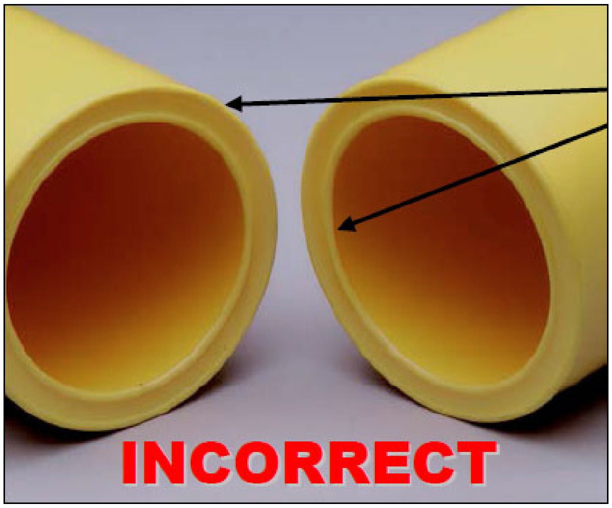
8.7.1 Acceptable melt appears flat and smooth with no unmelted areas. Unacceptable melt appearance is any combination of a concave surface, unmelted areas, a bubbly pockmarked sandpaper-like surface or melted material sticking to heating tool surfaces (see Fig 8.1). Low strength joints result from unacceptable melt appearance. Discontinue the joining procedure, allow the component ends to cool completely and restart from 8.1.

NOTE: A concave melt surface is caused by unacceptable pressure during heating.

Figure 8.1 – Unacceptable Melt Appearance *(Reference ASTM F2620 X2.7)*

Unacceptable concave melt appearance after heating.

Possible over-pressurization during the heating cycle.



8.7.2 Table 8.2 presents the maximum time allowed for opening the carriage, removing the heater, inspecting the acceptability of the melt, and bringing the pipe ends together. Do not slam the pipe ends.

NOTE: A concave melt surface is caused by unacceptable pressure during heating.

Table 8.2 Maximum Time to Open, Remove Heater Plate, Inspect Melt, and Close

NOTE: Fusion joints made in an enclosed and controlled factory fabrication environment will tolerate and may use longer maximum heater removal times.

Field Applications Pipe Size	Maximum Heater Plate Removal Time (Seconds)
2" IPS SDR 11	8
3" IPS SDR 11.5	8
4" IPS SDR 11.5	10
6" IPS SDR 11.5	15
8" IPS SDR 11.5	15
8” IPS SDR 11	15
10" IPS SDR 11	15
12" IPS SDR 11	15
12” IPS SDR 9	20

8.7.3 The correct fusion pressure rolls both melt beads over so that they touch the piping component OD surfaces. Do not use excessive or insufficient force (more than or less than the fusion interfacial pressure range). If the components are brought together with excessive force, molten material may be pushed out of the joint and cold material brought into contact forming a “cold” joint. If too little force is used, voids and weak bonded areas can develop in the joint as molten material cools and contracts.

8.8 Hold the molten joint immobile under fusion pressure until sufficiently cooled. Cooling under pressure before removal from the butt fusion machine is important in achieving joint integrity. Maintain fusion pressure against the piping component ends for a minimum of 11 minutes per inch of pipe wall (See Table 8.3). For ambient temperatures 100°F and higher, additional cooling time may be needed. Avoid high stress such as pulling, installation, or rough handling for an additional 30 min or more after removal from the fusion machine. Do not apply internal pressure until the joint and surrounding material have reached ambient air temperature.

NOTE: With the use of good handling equipment such as pipe lifts, pipe stands, rollers, and proper slings, the pipe can be removed from the machine and moved longitudinally down the pipeline with very minimal force.

Normal Pipe Handling would be considered:

- Elevating the pipe above the lower jaws of the machine with the pipe lifts fitted to the machine
- Pulling the pipe horizontally with support provided by pipe stands and/or rollers downs stream of the machine per industry practice.
- Lift the pipe on both sides of the joint so that the joint is supported but the machine is able to be removed.
- Using a pipe handling system that limits stresses to similar levels as the methods mentioned above.

<u>Rough Handling would be considered:</u>

- <u>Lifting the pipe directly at the butt fusion thereby inducing bending stress directly on the joint</u>
- <u>Pulling the pipe horizontally out of the machine without adequate support and allowing the fused section to fall</u>

<u>NOTE</u>: Pouring water or applying wet cloths to the joint to reduce cooling time is not acceptable. The use of a controlled cooling cycle procedure to reduce cooling time, such as applying conditioned air, is acceptable only where testing demonstrates that acceptable joints are produced using the controlled cooling cycle procedure.

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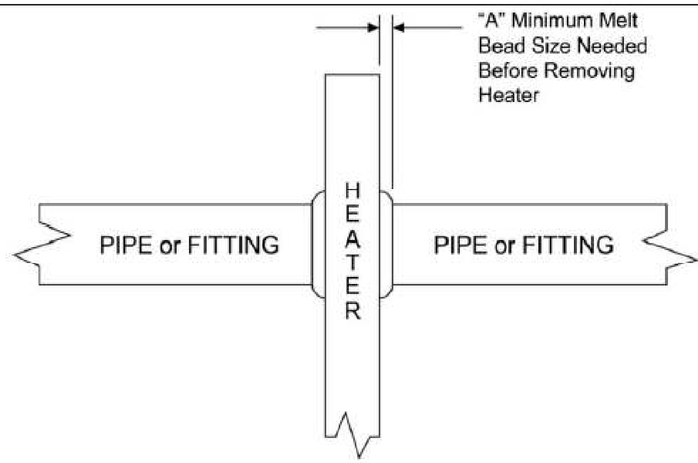


Table 8.3 - Butt Fusion Time Cycle Guidelines

Pipe Size	Minimum Melt Bead Size	*Approximate Heating Cycle Time 400°F to 450°F	**Minimum Fusion/Cool Pressure Time		Minimum Cooling Time Prior to pulling, installation, rough handling		Pipe Temperature Prior to Pressure Testing
2" IPS SDR 11	1/16 inches	**0 min, 58 s**	2 min, 30 s	+	30 min	+	ambient
3" IPS SDR 11.5	1/16 inches	**1 min, 22 s**	3 min, 30 s	+	30 min	+	ambient
4" IPS SDR 11.5	3/16 inches	**1 min, 45 s**	4 min, 30 s	+	30 min	+	ambient
6" IPS SDR 11.5	3/16 inches	**2 min, 35 s**	6 min, 30 s	+	30 min	+	ambient
8" IPS SDR 11.5	1/4 inches	**3 min, 22 s**	9 min	+	30 min	+	ambient
8” IPS SDR 11	1/4 inches	**3 min, 31 s**	9 min	+	30 min	+	ambient
10" IPS SDR 11	1/4 inches	**4 min, 23 s**	11 min	+	30 min	+	ambient
12" IPS SDR 11	1/4 inches	**5 min, 12 s**	13 min	+	30 min	+	ambient
12” IPS SDR 9	1/4 inches	**6 min, 22 s**	16 min	+	30 min	+	ambient

*Provided by McElroy McCalc. It should be emphasized that these approximate heating times are strictly guidelines. Certain conditions will almost always exist, which result in longer or shorter heating times. The most important guideline is to achieve a complete melt pattern with the proper bead size.

**Determined using equation in 8.8 to find the minimum. Then rounded up for simplification.

8.9 Strict adherence by a trained or qualified operator to the butt fusion procedures and adequate butt fusion process controls are the primary means to ensure a quality fusion. Visually inspect and compare the joint against the butt fusion bead visual inspection acceptance guideline in Figure 8.2.

NOTE: When butt fusing to molded fittings the fitting-side bead may display shape irregularities such as minor indentations, deflections, ripples, non-uniform bead rollover from molded part cooling and knit lines, and other surface effects. In such cases, visual evaluation is based mainly on the size and shape of the pipe-side bead.

Figure 8.2 – Outside Diameter Butt Fusion Bead Guideline

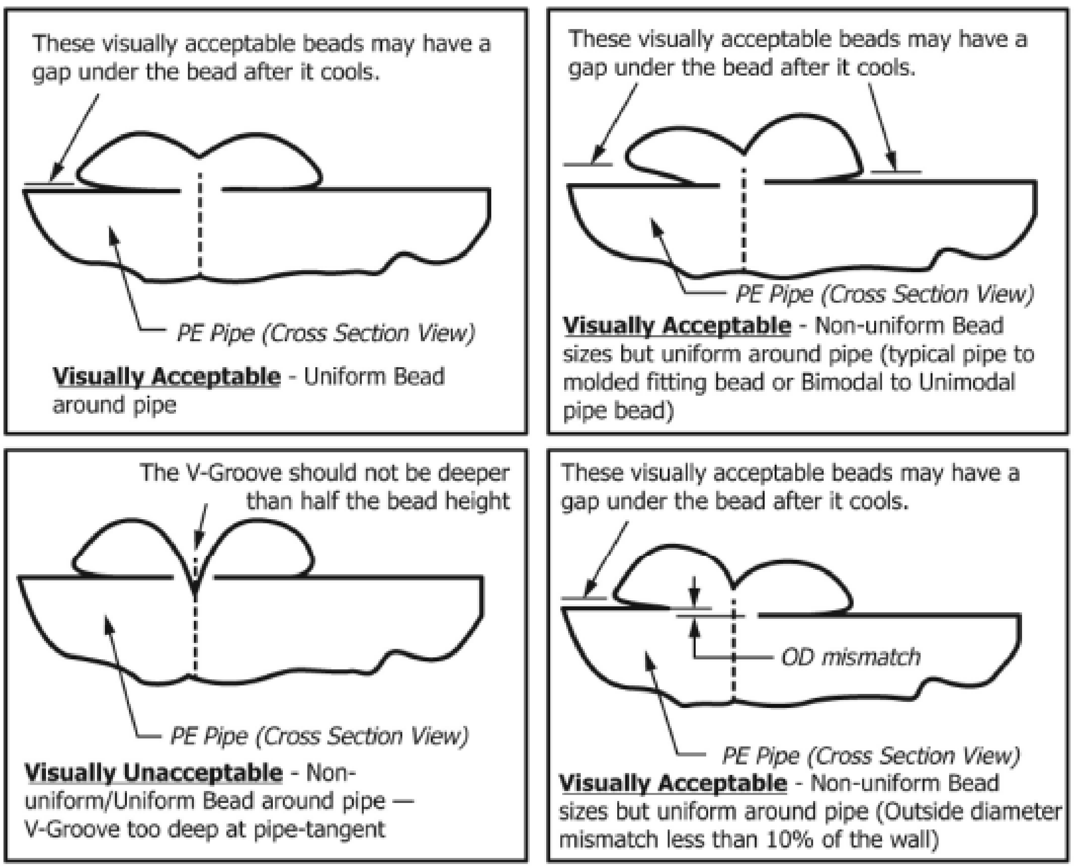
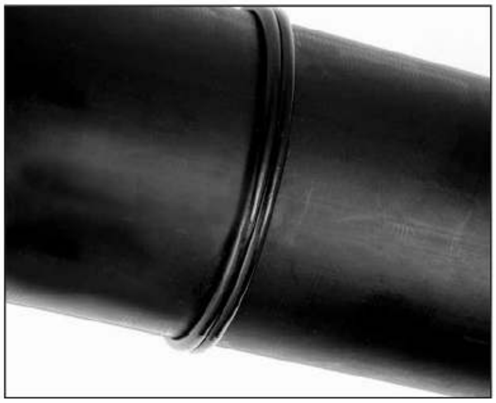
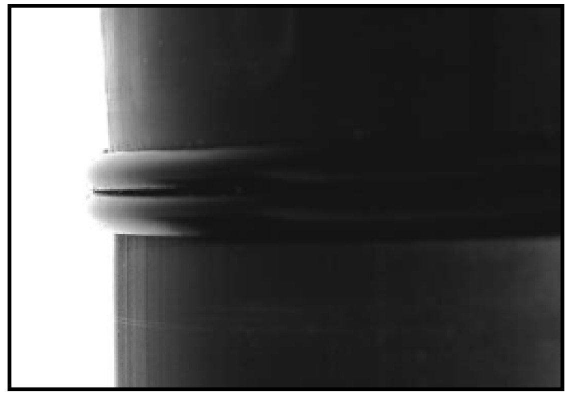
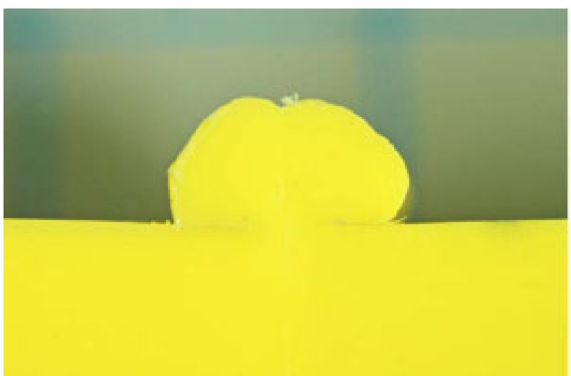


Figure 8.3 – Acceptable Visual Appearance *(Reference ASTM F2620 X2)*

Proper double roll-back bead. Proper alignment.







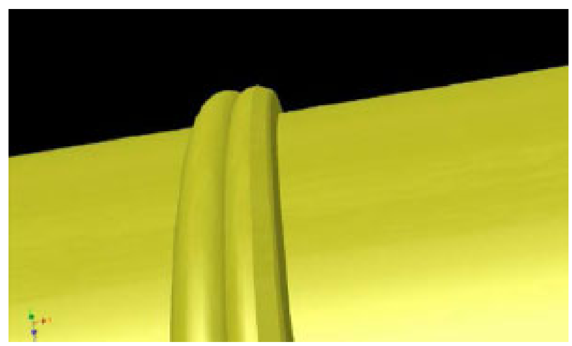


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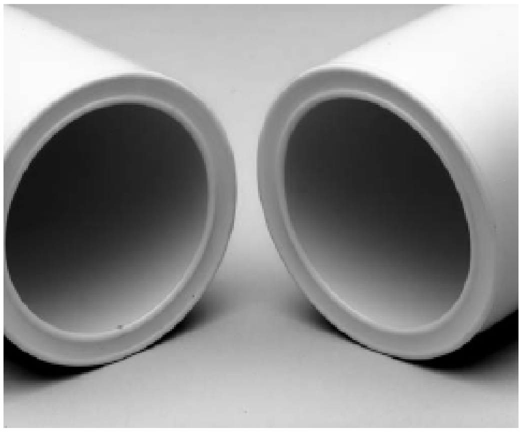
Figure 8.4 – Unacceptable Visual Appearance *(Reference ASTM F2620 X2)*

Unacceptable concave melt appearance after heating.
Possible over-pressurization during the heating cycle



Incomplete face-off.

Improper alignment in fusion machine-mitered joint.

Improper “high-low” pipe alignment.

9.0 Cold Weather Fusion Considerations *(Reference ASTM F2620 A1)*

9.1 Butt, Saddle, or Socket fusion joining is generally not recommended below -4 °F without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating.

9.2 Cold Weather Handling – Pipe shall be inspected for damage. Polyolefin Polyethylene pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

9.3 Wind and Precipitation – The heating tool shall be shielded in an insulated container to prevent excessive heat loss. Shield the pipe fusion area and fusion tools from wind, snow, blowing dust, and rain by using a canopy or similar device.

9.4 Pipe and Fitting Surface Preparation – The pipe and fitting surfaces to be "joined" or held in clamps shall be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion shall be emphasized. After preparation, the surfaces shall be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage, which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

9.4.1 Preparing Butt Fusion: When fusing coiled pipe at ambient temperatures below 32 °F removing an end section of pipe from the coil and butt fusing a straight section of pipe to achieve pipe alignment shall be acceptable. Completed joints shall be allowed to cool to ambient temperature before any stress is applied.

9.5 Heating – Work quickly once pipe and fitting have been separated from the heating tool; so that melt heat loss is minimized, but still take time (no more than 3s) to inspect both melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions. Do not increase heating tool temperature above the specified temperature setting. Gas-fired heating tools are used only in above freezing conditions.

9.6 Cold Weather Butt Fusion:

9.6.1 The fusion operator shall be aware of ambient weather conditions during the butt fusion of polyethylene pipe and fittings and be ready and capable to make adjustments to the fusion procedure if ambient weather conditions change significantly.

9.6.2 The qualified fusion procedure shall provide suitable measures for adjustment of fusion parameters, in particular the heating time, when the ambient temperature changes or during windy conditions. Colder temperatures require a longer heating time to develop an indication of melt and the final bead size. The pipe wall thickness and pipe diameter are primary factors to consider when determining the necessary heating cycle time.

9.6.3 The modifications to the fusion procedure require validation through the production of test fusions and their assessment by comparison to visual guidelines and bend testing.

9.6.4 When making butt fusion joints at ambient temperatures below 3 ^{o}F, the pipe ends shall be pre-heated. Pre-heating methods include using a heating blanket or warm air device to increase pipe end temperature, or clamping the pipe ends in the fusion machine, installing the heater plate between them, and moving the pipe ends to within 0.50 to 0.25 in of the heater plate. Pre-heating time vary depending on ambient temperature, pipe diameter and pipe wall thickness. The use of direct application open flame devices, such as torches, for heating polyethylene pipe is prohibited.

9.6.5 Exposure of the fusion heater plate and pipe to wind can result in unacceptable temperature variations during butt fusions and possible joint contamination. A suitable shelter shall be used to protect the pipe and fusion heater plate from extreme wind and to ensure a more consistent environment. Additionally plugs or covers shall be used for the ends of the pipe in order to alleviate temperature variations to the heating process caused by wind.

NOTE: Although wind conditions, during cold weather butt fusion, are the primary concern, wind conditions can affect butt fusion quality at all ambient temperatures by chilling the heated pipe surfaces during the heat soak. This increases the heat soak time to obtain the bead size against the heater surface.

9.6.6 The specified heating plate temperature range shall not be exceeded to accommodate cold weather conditions.

9.6.7 The fusion pressure must be maintained until a slight melt is observed around the circumference of the pipe or fitting before releasing pressure for the heat soak.

NOTE: Check for pipe slippage in the fusion machine in cold weather applications. The pipe is stiffer in cold temperatures and the OD of the pipe will shrink slightly, increasing the potential for slippage in the jaws.

9.6.8 Do not apply additional pressure during the heat soak to accommodate cold weather conditions.

9.6.9 Follow the minimum heat soak time for the wall thickness of pipe to be fused per 8.6.2. The melt beads formed against the heater surface during the heating soak shall be in accordance with Table 8.1. It is critical that the melt bead sizes specified in Table 8.1 be achieved.

9.6.10 When the specified heat soak time and melt bead size has been achieved, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined as soon as possible, within the maximum times allowed in Table 8.2, so as to minimize cooling of the melted pipe ends. Cool the joint per 8.7.

9.7 Cold Weather Butt Fusion Assessment

9.7.1 Assessment guidelines for fusion joints that are made under cold weather conditions are the same as for fusion joints made at warmer ambient temperatures. Key concerns affecting the quality of cold weather fusion joints are incorrect heating time, application of pressure during heating soak and moisture contamination that could generate a weak fusion joint. Therefore strict adherence by a trained or qualified operator to the butt fusion procedures and adequate butt fusion process controls are the primary means to ensure a quality fusion.

9.7.2 Visual assessment of the finished bead is the same as for fusion joints made at warmer ambient temperatures. Correct shape of the finished bead, degree of bead rollover to the pipe surface and depth of the v-groove are key indicators (see Fig. 8.1, 8.2, 8.3.)

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52 Plastic 52-PC Socket Fusion		Original Date 06/01/2006	Standard Number 52-PC
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1.0 Scope

This standard describes NorthWestern Energy's requirements for socket fusion procedures in accordance with NorthWestern's O&M section 5500.

2.0 Summary

The socket fusion procedure involves simultaneously heating the outside surface of a pipe end and the inside of a fitting socket, which is sized to be smaller than the smallest outside diameter of the pipe. After the proper melt has been generated at each face to be mated, the two components are joined by inserting one component into the other. The fusion bond is formed at the interface resulting from the interference fit. The melts from the two components flow together and fuse as the joint cools. Optional alignment devices are used to hold the pipe and socket fitting in longitudinal alignment during the joining process.

3.0 Reference Documents

3.1 ASTM F2620 Standard Practice for Heat Fusion Joining of PE Pipe and Fittings.

4.0 Material

4.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

4.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

4.3 This procedure **CANNOT** be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

4.4 This procedure **CANNOT** be used to fuse Aldyl-A. Electrofusion or Mechanical Fittings must be used in these situations.

5.0 Pipe Size

5.1 This procedure will cover pipe diameter sizes ranging from ½" CTS to 2" IPS.

NOTE: Butt Fusion is recommended for pipe diameter sizes 2" IPS and greater, but Socket Fusion may be used on 2" plastic pipe according to the construction situation.

6.0 Equipment

6.1 Heating Tool

6.2 Heating tool faces

6.3 Alignment jig

6.4 Rounding clamps (cold ring)

6.5 Depth gage

6.6 Chamfering tool (NOTE: For ½" IPS – 2" IPS pipe)

NOTE: The depth gage and chamfering tool may be combined into a single tool.

6.7 Tubing or pipe cutter

6.8 Fitting puller (NOTE: Recommended for 2" IPS fittings)

6.9 Clean, dry, lint-free, non-synthetic cloth

6.10 Pyrometer (Contact pyrometers shall be used, no laser pyrometers are allowed)

6.11 Isopropyl alcohol (Minimum 90% alcohol concentration)

7.0 Procedure

7.1 Attach the proper size heater faces to the heating tool, and bring the surface temperature of the tool faces to 490ºF to 510ºF. Use a pyrometer, on the first joint of the day and periodically during the day to verify the temperature of the tool face surfaces within the pipe or fitting contact area. Select multiple checkpoints to ensure uniform surface temperature. Heating tool thermometers measure the internal temperature of the heating tool, which is typically higher than the surface temperature of the heating tool faces.

7.2 Cut the pipe end squarely, and clean the pipe end and fitting, both inside and outside, by wiping with a clean, dry, lint-free, non-synthetic cloth such as cotton. If this does not remove the contamination, refer to 7.2.1.

7.2.1 Before installing the pipe in the fusion machine, clean the OD, ID and ends with a clean, dry, lint-free, non-synthetic cloth such as cotton. If the contamination cannot be removed this way, wash the pipe with water and a clean cloth or paper towel to remove the contamination, rinse the pipe with water and dry thoroughly with a clean, dry, lint-free non-synthetic cloth such as cotton or paper towel. If contamination, such as bar oil, was transferred to the pipe ends after cutting, use 90% or greater isopropyl alcohol or acetone on a clean cloth or isopropyl alcohol wipes on the ends of the pipe to clean the contamination, then rinse with water and dry thoroughly on the pipe ends, ID and OD. It is important that pipe ends be clean before installing in the fusion machine to avoid contamination fusion machine parts that contact the pipe ends such as the facer and heater. If the facer or heater becomes contaminated, the contamination may be transferred back to the pipe ends, possibly compromising joint quality. Do not use the facer to remove contamination. (Reference ASTM F2620 X1.7.1).

7.3 Chamfer to outside edge of the pipe end slightly and fix the rounding clamp about the pipe as determined from the depth gage. Completely seat the depth gauge on the end of the pipe, and install the cold ring clamp securely around the pipe and flush with the depth gauge (ensure secure fit between pipe and cold ring to avoid slippage). After the clamp is attached, remove the depth gauge - if necessary, clean fusion area again. Ensure pipe is sufficiently round once cold ring is installed.

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

7.3.2 It is recommended to install a fitting puller on couplings, caps, and reducers with a 2” IPS diameter.

<u>NOTE</u>: Some recommend using a 50-60 grit utility cloth to roughen the outside of the pipe and inside of the fitting as a means of minimizing any possible skin interface when making the fusion. Sandpaper is not recommended for this purpose, as it might disintegrate and contaminate the joint interface. If roughening is performed, first clean the surfaces before roughening with a clean cloth or water. Once the pipe or fitting surfaces have been roughened and clean material has been exposed, water cannot be used to clean the pipe surfaces. Clean dust and particles from the roughened surfaces afterwards by cleaning the pipe or fitting ends with a clean dry lint-free, non-synthetic cloth such as cotton.

7.4 Clean the heater adapters by wiping them with a clean, dry, lint-free, non-synthetic cloth such as cotton to remove any contamination from the surfaces. Push the socket fitting onto the preheated fitting tool face first, and then push the pipe into the pipe-side tool face until the rounding clamps make contact with the heating faces. Do not install the heating tool onto the pipe first. Inserting the pipe onto the heating tool first heats the pipe too long and will cause overmelt. Push the heating tool, the pipe, and the fitting together with even pressure. DO NOT TWIST OR ROTATE THE PIPE, FITTING, OR HEATING TOOL.

7.4.1 Molten PE material may be cleaned from heating tool faces with a wooden implement such as a tongue depressor.

7.4.2 To remove burned or charred material from heating tool faces, heat the faces, insert a short length of pipe into the female face and a socket fitting onto the male face, then unplug the heating tool and let it cool completely. When the pipe and fitting are removed from the cold heating tool, the burned or charred material will be released from the heating tool faces along with the pipe and fitting.

7.5 Heat the pipe end and the fitting socket for the time required in Table 7.1 or 7.2.

7.6 At the end of the heating time, simultaneously remove the pipe and fitting straight out from the tool, using a snap action. Do not displace the melt. Quickly inspect the melt pattern on the pipe and fitting. (If an incomplete pattern is seen, stop the fusion process, cut off the melted pipe end, discard the melted fitting, and repeat steps 7.2 – 7.6). Immediately insert the pipe straight into the socket of the fitting so the rounding clamp is flush against the end of the fitting socket. DO NOT TWIST OR ROTATE THE PIPE OR FITTING. Hold or block the joint in place to cool for the time specified in Table 7.1 or 7.2. For ambient temperatures 100°F and higher, additional cooling time may be needed.

7.6.1 If the pipe or fitting are removed at an angle or twisted, melt can be damaged and joint may leak or fail.

7.6.2 Grasp the pipe behind the cold ring clamp (Pulling on the cold ring clamp handle can cause slippage or displace the melt).

7.7 Remove the rounding clamp, and inspect the melt pattern at the end of the socket for a complete impression of the rounding clamp in the melt surface. There shall be no gaps, voids, or un-bonded areas. Visually inspect for the pipe and fitting to be correctly aligned. (See Figures 7.1 and 7.2). NEVER ALLOW A QUESTIONABLE JOINT TO BE PLACED IN SERVICE.

7.8 Allow the joint to cool an additional 5 minutes before exposing the joint to any type of stress (that is, burial, testing, or fusing the other end of the fitting.)

7.9 Allow for extremes in weather when making field joints. Heating times, dimensional changes, etc., are affected by extreme weather conditions.

NorthWestern Energy

52 Plastic 52-PC Socket Fusion		Original Date 06/01/2006	Standard Number 52-PC
Supersedes Standard: 52-PC	Revision 6	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Table 7.1 - Socket Fusion Time Cycles (PE 2406/2708) (Yellow)

Pipe Size	490° – 510° Heating Time Cycle (sec)	Fusing Time (Holding Time Under Pressure) (sec)	PLUS	Additional Minimum Cooling Time (Prior to Pressure Testing/Burial) (min)	TOTAL	Total Minimum Rough Handling Time (min - sec)
1/2" CTS	6 - 7	30s	+	5min	=	5min, 30 s
3/4" CTS	6 - 7	30s	+	5min	=	5min, 30 s
1" CTS	9 - 10	30s	+	5min	=	5min, 30 s
1-1/4" CTS	10 - 12	30s	+	5min	=	5min, 30 s
1/2" IPS	6 - 7	30s	+	5min	=	5min, 30 s
3/4" IPS	8 - 10	30s	+	5min	=	5min, 30 s
1" IPS	10 - 12	30s	+	5min	=	5min, 30 s
1-1/4" IPS	12 - 14	45s	+	5min	=	5min, 45 s
1-1/2" IPS	14 - 17	45s	+	5min	=	5min, 45 s
2" IPS	16 - 19	45s	+	5min	=	5min, 45 s

Table 7.2 - Socket Fusion Time Cycles (PE 3408/3608/4710) (Black)

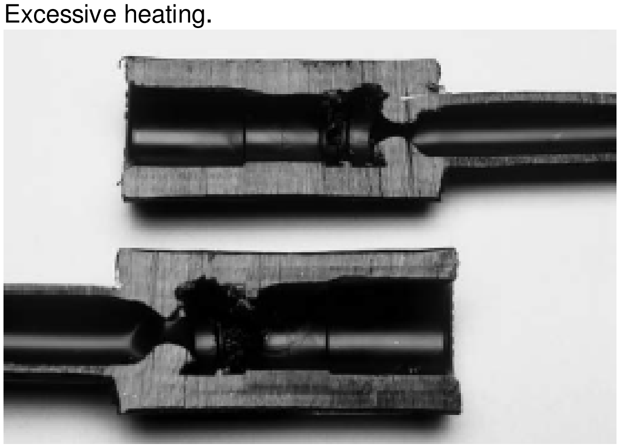
Pipe Size	490° – 510° Heating Time Cycle (sec)	Fusing Time (Holding Time Under Pressure) (sec)	PLUS	Additional Minimum Cooling Time (Prior to Pressure Testing/Burial) (min)	TOTAL	Total Minimum Rough Handling Time (min - sec)
1/2" CTS	6 - 10	30s	+	5min	=	5min, 30 s
3/4" CTS	6 – 10	30s	+	5min	=	5min, 30 s
1" CTS	9 – 16	30s	+	5min	=	5min, 30 s
1-1/4" CTS	10 – 12	30s	+	5min	=	5min, 30 s
1/2" IPS	6 – 10	30s	+	5min	=	5min, 30 s
3/4" IPS	8 – 14	30s	+	5min	=	5min, 30 s
1" IPS	15 – 17	30s	+	5min	=	5min, 30 s
1-1/4" IPS	18 – 21	60s	+	5min	=	6min
1-1/2" IPS	20 – 23	60s	+	5min	=	6min
2" IPS	24 – 28	60s	+	5min	=	6min

Figure 7.1 – Acceptable Visual Appearance *(Reference ASTM F2620 X2)*

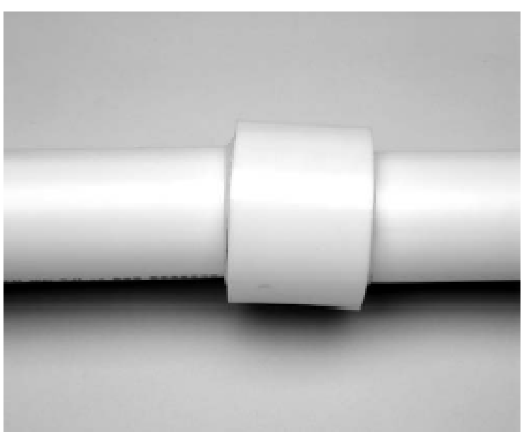
Melt bead flattened by cold ring. No gaps or voids. Good alignment between pipe and fitting.

Figure 7.2 – Unacceptable Visual Appearance *(Reference ASTM F2620 X2)*

Excessive heating.



Melt bead not flattened against the fitting/cold ring
Improper insertion depth; no cold ring.
Excessive heating.



Misalignment

8.0 <u>Cold Weather Fusion Considerations *(Reference ASTM F2620 A1)*</u>

8.1 Butt, Saddle, or Socket fusion joining is generally not recommended below -4 ºF without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating.

8.2 Cold Weather Handling – Pipe shall be inspected for damage. Polyolefin Polyethylene pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40ºF, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

8.3 Wind and Precipitation – The heating tool shall be shielded in an insulated container to prevent excessive heat loss. Shield the pipe fusion area and fusion tools from wind, snow, blowing dust, and rain by using a canopy or similar device.

8.4 Pipe and Fitting Surface Preparation – The pipe and fitting surfaces to be "joined" or held in clamps shall be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion shall be emphasized. After preparation, the surfaces shall be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage, which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

8.5 Heating – Work quickly once pipe and fitting have been separated from the heating tool; so that melt heat loss is minimized, but still take time (no more than 3s) to inspect both melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions. Do not increase heating tool temperature above the specified temperature setting. Gas-fired heating tools are used only in above freezing conditions.

8.5.1 Heating during Socket Fusion – At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with IPS 2, 3, and 4 in. pipe), the pipe may barely contact the heating surface. Longer heating times are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of time necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating time as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try 3s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

8.6 Pipe Outside Diameter – Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

8.7 Fitting Condition – If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

NorthWestern Energy

52 Plastic 52-PE Saddle Fusion		Original Date 06/01/2006	Standard Number 52-PE
Supersedes Standard: 52-PE	Revision 7	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for saddle fusion procedures in accordance with NorthWestern's O&M section 5500.

2.0 Summary

The saddle fusion procedure involves melting the concave surface of the base of a saddle fitting, while simultaneously melting a matching pattern on the surface of the pipe, bringing the two melted surfaces together and allowing the joint to cool whole maintaining the appropriate applied force. An appropriately sized saddle fusion machine is used to clamp the pipe main and the fitting, align the parts and apply the specified fusion force.

3.0 Reference Documents

3.1 ASTM F2620 Standard Practice for Heat Fusion Joining of PE Pipe and Fittings

4.0 Material

4.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

4.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

4.3 This procedure **CANNOT** be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

4.4 This procedure **CANNOT** be used to fuse Aldyl-A. Electrofusion or Mechanical Fittings must be used in these situations.

5.0 Pipe Size and Other Specifications

5.1 This procedure will cover pipe diameter sizes ranging from 2" IPS to 8" IPS.

5.2 In cases of 1-1/4" main involving saddle fusion, Electrofusion tees shall be used due to main wall thickness, and potential of burn through.

5.3 The preferred method of fusing High Volume Tapping Tees (HVTT's) is through Electrofusion methods.

5.4 The use of serrated heating iron faces is mandatory.

5.5 Saddle Fusion is allowed on live (pressurized) lines. However, Saddle Fusion is not allowed on lines under pressure test, pressure tests generally exceed the MAOP.

6.0 Equipment

6.1 Heating Tool and Faces

6.2 Saddle Fusion Tool w/Gauge

6.3 Optional Flexible Heat Shield

6.4 50-60 grit utility cloth (normally included in fitting package)

6.5 Clean, dry, lint-free, non-synthetic cloth

6.6 Pyrometer (Contact pyrometers shall be used, no laser pyrometers are allowed)

6.7 Isopropyl alcohol (Minimum 90% alcohol concentration)

7.0 Terminology

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

7.2 Initial Heat Force (Bead-up Force) – The force (lb) applied to establish an initial melt pattern on the main pipe. The Initial Heat Force is the first number on the fitting label (see figure 7.1 and 7.2).

7.2.1 Determining the saddle fusion force if label is not present – Initial Heat Force (IHF) is determined by multiplying the area of the saddle fitting base by 60 psi, the initial interface pressure. For rectangular base saddle fittings, the fusion area is the base length (L) times the base width (W) less the area of the outlet hole. Base curvature and corner radii are ignored. For round base saddle fittings, the fusion area is the area of the base outside diameter less the area of the outlet hole. Base curvature is ignored. (Reference ASTM F2620 X3).

Rectangular Base –

$$IHF = L \times W - (0.785 \times d^2) \times 60$$

Round Base –

$$IHF = 0.785 \times (D^2 - d^2) \times 60$$

Where:

IHF = initial heat force, lb.
L = rectangular base length, in.
W = rectangular base width, in.
d = outlet hole inside diameter, in.
D = round base outside diameter, in.

7.3 Heat Soak Force – The force (lb) applied after an initial melt pattern is established on the main pipe. The Heat Soak Force is the minimum force (essentially zero pounds) that ensures that the fitting, heater and main stay in contact with each other. The Heat Soak Force is the second number on the fitting label (See figure 7.1 and 7.2) and is usually zero.

7.4 Fusion Force – The force (lb) applied to establish the fusion bond between the fitting and the pipe. Fusion Force is usually half the Initial Heat Force. The Fusion Force is the third number on the fitting label (See figure 7.1 and 7.2).

7.4.1 Determining the Fusion Force if label is not present – Fusion Force (FF) is one-half of Initial Heat Force (IHF). (Reference ASTM F2620 X3).

$$FF = IHF / 2$$

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

7.6 Cool Time – The time required to cool the joint to approximately 120ºF (49ºC). The fusion force must be maintained for 10 min for all main sizes 2" IPS and above, after which the saddle fusion equipment can be removed. The joint must be allowed to cool undisturbed for an additional 30 min before tapping the main or joining to the branch saddle.

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52 Plastic 52-PE Saddle Fusion		Original Date 06/01/2006	Standard Number 52-PE
Supersedes Standard: 52-PE	Revision 7	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Figure 7.1 Fitting Label of a Performance Pipe 6 x 4 IPS Round Base Branch Saddle

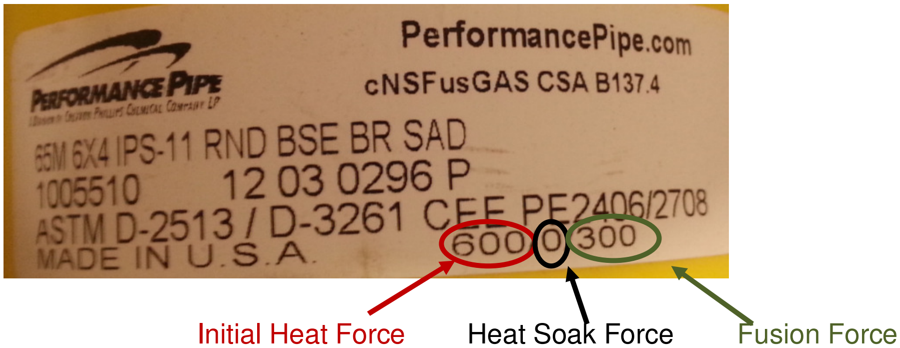
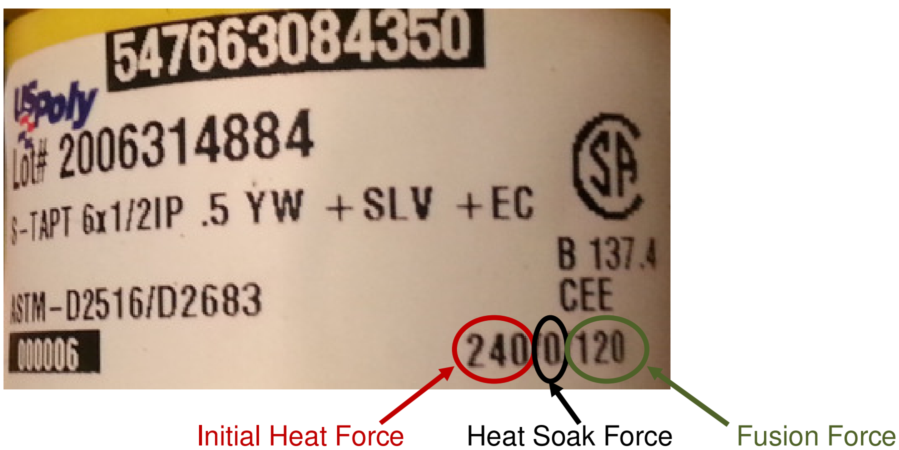


Figure 7.2 Fitting Label of a US Poly / JM Eagle 6 x ½ IPS Service Tee.



8.0 <u>Setup</u>

8.1 Select and install the proper heating tool faces to the heating tool based on the main size and fitting base size. Consult the pipe, fitting or equipment manufacturer's recommendations.

8.2 Plug in the heating tool and bring the heating tool face surfaces to 490°F to 510°F (see Table 12.1). A pyrometer is used to determine and periodically check the heating tool surface temperature. Heating tool thermometers measure the internal temperature of the heating tool which is typically higher than the surface temperature of the heating tool face.

8.3 Install the proper clamps in the Saddle Fusion Tool for the main size to be fused. Install the proper fitting clamp for the fitting to be joined. Consult the pipe, fitting, or equipment manufacturer's recommendations.

9.0 <u>Preparation</u>

9.1 Clean the inside and outside of the components (pipe or pipe and fitting) to be joined with a clean, dry, lint-free, non-synthetic cloth such as cotton. Remove all foreign matter from the piping component surfaces where they will be clamped in the Saddle Fusion Tool. If this does not remove the contamination, refer to 9.1.1. Install the Saddle Fusion Tool on the main according to the manufacturer's instructions. The tool should be centered over a clean, dry location where the fitting will be fused. Secure the tool to the main. A bolster plate is recommended for 6" IPS and smaller main sizes.

9.1.1 Before installing the pipe in the fusion machine, clean the OD, ID and ends with a clean, dry, lint-free, non-synthetic cloth such as cotton. If the contamination cannot be removed this way, wash the pipe with water and a clean cloth or paper towel to remove the contamination, rinse the pipe with water and dry thoroughly with a clean, dry, lint-free non-synthetic cloth such as cotton or paper towel. If contamination, such as bar oil, was transferred to the pipe ends after cutting, use 90% or greater isopropyl alcohol or acetone on a clean cloth or isopropyl alcohol wipes on the ends of the pipe to clean the contamination, then rinse with water and dry thoroughly on the pipe ends, ID and OD. It is important that pipe ends be clean before installing in the fusion machine to avoid contamination fusion machine parts that contact the pipe ends such as the facer and heater. If the facer or heater becomes contaminated, the contamination may be transferred back to the pipe ends, possibly compromising joint quality. Do not use the facer to remove contamination. (Reference ASTM F2620 X1.7.1).

9.2 Abrade or scrape the surface of the main, where the fitting will be joined, approximately 0.007 in deep to remove any oxidation or contamination. This can be done before or after the Tool is attached to the main. ENSURE ALL OF FUSION AREA IS ABRADED WITH 50-60 GRIT UTILITY CLOTH DOWN TO "FRESH PLASTIC." The abraded/scraped area must be larger than the area covered by the fitting base. It is important that the pipe surface be free from any type of contaminates that may be spread before the scraping or abrading process begins. Marks can be made on the outer surface of the pipe to aid in visual indication of abrading/scraping coverage, however the marks should be made with a non-petroleum based fast drying marker. After abrading/scraping, clean the pipe or fitting ends with a clean, dry, lint-free, non-synthetic cloth such as cotton. All markings on the pipe surface should be removed before beginning the heat cycle.

9.3 Abrade the fusion surface of the fitting with 50 to 60 grit utility cloth; remove all dust and residue with a clean, dry, lint-free, non-synthetic cloth such as cotton. If applicable, tighten the cap on the fitting. Insert the fitting in the Saddle Fusion Tool loosely. Using the Saddle Fusion Tool, move the fitting base against the main pipe and apply about 100 lbf to seat the fitting. Secure the fitting in the Saddle Fusion Tool.

10.0 Heating Procedure for Small Fittings (<2" IPS) (see Table 12.1)

10.1 Clean the heating tool faces with a clean, dry, lint-free, non-synthetic cloth such as cotton. Place the heating tool on the main centered beneath the fitting base. Immediately move the fitting against the heater faces, apply the Initial Heat Force (see fitting label), and start the heat time. Apply the Initial Heat Force until melt is first observed on the crown of the pipe main (usually is 3 to 5s) and then reduce the force to the Heat Soak Force (see fitting label, usually zero). Maintain the Heat Soak Force until the Total Heat Time is complete. Total Heat Time Ends:

10.1.1 When the Total Heating Time Expires for a IPS 2in pressurized main, or

10.1.2 When a melt bead of about 1/16 in is visible all around the fitting base for an IPS 2in. non-pressurized main, or a larger pressurized or non-pressurized main, (See Table 12.1).

10.2 At the end of the Total Heat Time, remove the fitting from the heater and the heater from the main with a quick snapping action. Quickly check for a complete and even melt pattern on the pipe main and fitting heated surfaces (no unheated areas).

11.0 Heating Procedure for Large Fittings (>3" IPS) and Large Mains (>6" IPS) (see Table 12.1)

11.1 Place the heating tool on the main centered beneath the fitting base, and then place the Flexible Heat Shield between the heating tool and the fitting base. This step usually required an assistant to handle the Flexible Heat Shield.

11.2 Move the fitting against the Flexible Heat Shield, apply Initial Heat Force, and observe melt bead formation on the main all around the heating tool faces. When a melt bead is first visible on the main all around the heating tool faces, in a quick continuous motion, release the Initial Heat Force, raise the fitting slightly, remove the Flexible Heat Shield, move the fitting against the heating tool face, apply Initial Heat Force and start the heat time. When a melt bead is first visible all around the fitting base (usually about 3 to 5 s) immediately reduce applied force to the Heat Soak Force (usually zero). Maintain the Heat Soak Force until the Table 12.1 Total Heat Time ends.

NOTE: During heating, hold the heating tool in position by lightly supporting the heating tool handle. If not supported, the heating tool can slip out of position or displace the main or fitting melt and result in a poor joint.

11.3 At the end of the Total Heat Time, remove the fitting from the heater and the heater from the main with a quick snapping action. Quickly check for a complete and even melt pattern on the pipe main and fitting heated surfaces (no unheated areas). A mirror may be needed to check the bottom of the fitting.

12.0 Fusion and Cooling (see Table 12.1)

12.1 Whether or not the melt patterns are satisfactory, press the fitting on to the main pipe very quickly (within 3 seconds) after removing the heater and apply the Fusion Force (see the fitting label). Maintain the Fusion Force on the assembly for 10 minutes, after which the saddle fusion equipment may be removed. Fusion Force adjustment may be required during Cool Time, but never reduce the Fusion Force during cooling.

12.2 Cool the assembly for an additional 30 minutes before rough handling, branch joining or tapping the main. If the melt pattern is not satisfactory or if the fusion bead is unacceptable, cut off the saddle fitting above the base to prevent use, relocate to a new section of main, and make a new saddle fusion using a new fitting.

NOTE: These procedures are based on tests conducted under controlled ambient temperature conditions. Environmental conditions on a job site could affect heating and cooling times. Regardless of job site conditions or ambient temperature, the prescribed heating tool temperature is required. Do not increase or decrease the heating tool temperature. When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration without exceeding the time guidelines in the Table 12.1. Excessive heat penetration could result in pipe rupture from internal pressure.

TABLE 12.1

	HEAT SHIELD TIME (490°F to 510°F)	**TOTAL HEAT TIME (490°F to 510°F)**		**COOL TIME**		
MAIN SIZE	**INITIAL HEAT FORCE** 1st Number on Fitting Label.	**INITIAL HEAT FORCE** 1st Number on Fitting Label.	**HEAT SOAK FORCE** 2nd Number on Fitting Label, usually zero.	**FUSION FORCE** 3rd Number on Fitting Label. Fitting in Saddle Fusion Tool.		**COOLING** Prior to rough handling, branch joining, or tapping.
2" Pressurized Main	NA	Melt is first observed on the **crown of the pipe main**. Usually 3 – 5 seconds	Look for a 1/16" bead around the **fitting** base 20 to 30 seconds MAX	10 Minutes	+	30 Minutes
2" Non-Pressurized Main	NA	Melt is first observed on the **crown of the pipe main**. Usually 3 – 5 seconds	Look for a 1/16" bead around the **fitting** base	10 Minutes	+	30 Minutes
3" and 4" Pressurized / Non Pressurized Main with 2" and smaller outlet on fitting	NA	Melt is first observed on the **crown of the pipe main**. Usually 3 – 5 seconds	Look for a 1/16" bead around the **fitting** base	10 Minutes	+	30 Minutes
3" and 4" Pressurized / Non Pressurized Main with 3" and larger outlet on fitting	Melt bead is first visible on the **main** all around the heating tool faces	Melt bead is first visible all around the **fitting base** Usually 3 – 5 seconds	Look for a 1/16" bead around the **fitting** base	10 Minutes	+	30 Minutes
Larger than 6" Pressurized / Non Pressurized Main	Melt bead is first visible on the **main** all around the heating tool faces	Melt bead is first visible all around the **fitting base** Usually 3 – 5 seconds	Look for a 1/16" bead around the **fitting** base	10 Minutes	+	30 Minutes

13.0 Visual Inspection

13.1 Visually inspect and compare the joint against visual inspection guidelines.

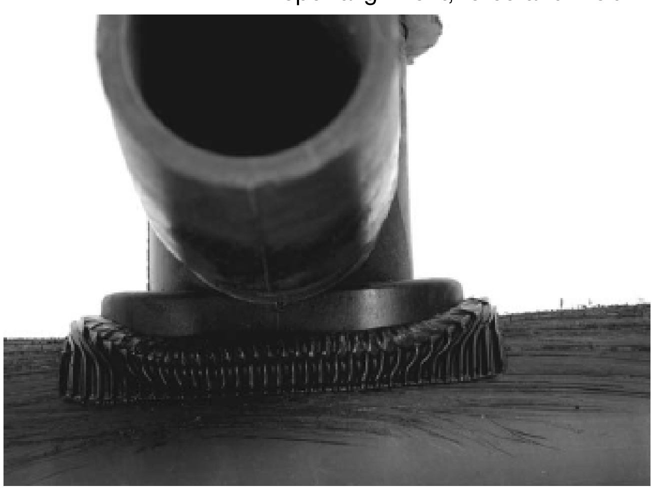
13.2 Visual Inspection Guidelines: There shall be three beads, a melt bead around the fitting base, a bead on the main from the edge of the heating tool, and a main pipe melt bead. The fitting and pipe melt beads are to be rounded and approximately 1/8" wide all around the fitting base. The heating tool edge bead shall be visible all around the fitting base, but it is acceptable for the heating tool edge bead to be separate from the main pipe melt bead.

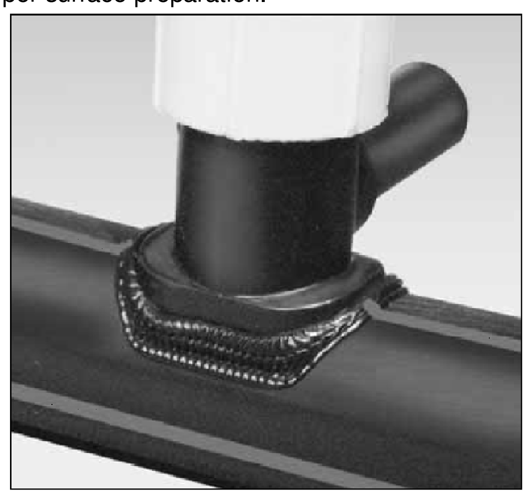
13.3 The saddle fusion joint is unacceptable for use if visual bead appearance is unacceptable or if the melted surfaces are unacceptable. To prevent use, cut the fitting off at or just above the base. (See Figure 13.1 and 13.2).

13.4 NEVER ALLOW A QUESTIONABLE JOINT TO BE PLACED IN SERVICE.

Figure 13.1 – Acceptable Visual Appearance *(Reference ASTM F2620 X2)*

Proper alignment, force and melt. Proper surface preparation.





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52 Plastic 52-PE Saddle Fusion		Original Date 06/01/2006	Standard Number 52-PE
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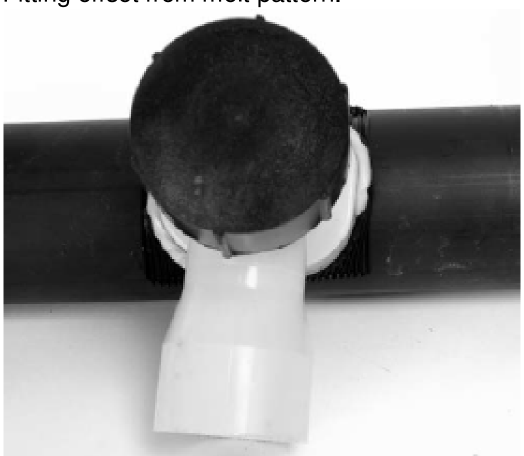
Figure 13.2 – Unacceptable Visual Appearance *(Reference ASTM F2620 X2)*

Improper alignment.
Fitting offset from melt pattern.



Over-melt of fitting and main.
Possible over-pressurization of fitting on main

Under-melt of fitting and main.
Fitting offset from melt pattern.
Possible under-pressurization of fitting on main.

14.0 Cold Weather Fusion Considerations *(Reference ASTM F2620 A1)*

14.1 Butt, Saddle, or Socket fusion joining is generally not recommended below -4 °F without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating.

14.2 Cold Weather Handling – Pipe shall be inspected for damage. Polyolefin Polyethylene pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

14.3 Wind and Precipitation – The heating tool shall be shielded in an insulated container to prevent excessive heat loss. Shield the pipe fusion area and fusion tools from wind, snow, blowing dust, and rain by using a canopy or similar device.

14.4 Pipe and Fitting Surface Preparation – The pipe and fitting surfaces to be “joined” or held in clamps shall be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion shall be emphasized. After preparation, the surfaces shall be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage, which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

14.5 Heating – Work quickly once pipe and fitting have been separated from the heating tool; so that melt heat loss is minimized, but still take time (no more than 3s) to inspect both melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions. Do not increase heating tool temperature above the specified temperature setting. Gas-fired heating tools are used only in above freezing conditions.

14.6 Surface Preparations – Regular procedures for roughening the surfaces to be fused on the pipe and the fitting shall be emphasized. After the surfaces have been prepared, particular care shall be taken to protect against contamination.

14.7 Heating Time – Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3s additions on a fresh section of cold pipe until a compete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it lean, straight, round, and well supported.

14.8 Fitting Condition – If possible, store fittings at a warm temperature, such as in a truck cab, prior to use.

NorthWestern Energy

Gas Standards Subject: Electrofusion Coupling		Original Date 06/01/2006	Standard Number 52-PJ
Supersedes Standard: 52-PJ	REV# 9	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for Electrofusion procedures (coupling) in accordance with NorthWestern's O&M section 5500.

2.0 Process

2.1 This procedure will define the steps necessary for the joining of polyethylene pipe and fittings by the method of Electrofusion.

3.0 Material

3.1 Medium Density Polyethylene MDPE 2406/2708 (yellow) pipe and fittings.

3.2 High Density Polyethylene HDPE 3408/3608/4710 (black) pipe and fittings.

3.3 Aldyl-A pipe

3.4 Electrofusion can be used to join the above dissimilar plastics.

3.5 In construction design, be aware of the pressure ratings for both the pipe and the Electrofusion fittings being installed. High density (HDPE, black) fittings are allowed on medium density (MDPE, yellow) pipe installations and will not limit design, however, medium density (MDPE, yellow) fittings will be a pressure limiting factor if used on high density (HDPE, black) pipe.

3.6 Electrofusion is NOT allowed on black Driscopipe 7000 or black Driscopipe 8000. This pipe will have 7000 or 8000 on the print line. Common in parts of Grand Island, NE.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from ½” CTS to 12” IPS.

5.0 Equipment

5.1 Electrofusion Processor

5.2 Pre-packaged 90% (or greater) isopropyl alcohol wipes are required (stores code #10015604).

5.3 Approved scraping tool

5.4 Non-petroleum based marker

5.4.1 Black Sharpie is recommended on yellow

5.4.2 Silver Sharpie is recommended on black

5.5 Appropriate fitting

5.6 Appropriate clamp(s)

5.7 Refer to Section 7.0 for Power Requirements

6.0 Jobsite Preparation and Weather Considerations

6.1 Tents / protection must be used when it is raining/snowing. Water cannot be present in the work area.

6.2 It is best practice, to lay down sheeting or tarp in the trench where fittings will be fused.

6.3 Cold weather reduces polyethylene pipe material properties and may increase possible risk of damage due to impact or bending stresses.

6.4 Remove all dew, frost, ice, or snow from the outside and inside diameters of areas to be fused. All surfaces must be clean, dry, and free of any foreign substances prior to fusion.

6.4.1 In inclement weather and especially in windy conditions, the fusion operation should be shielded to avoid precipitation or blowing snow and excessive heat loss from wind chill.

6.5 Electrofusion fittings may be installed in temperature ranges –10^{o}F to 120^{o}F.

7.0 Power Requirements

7.1 For the installation of Electrofusion fittings in field applications, it is necessary to have a reliable source of AC power for the Electrofusion Processor to operate properly in supplying the fitting with the right amount of energy. Generators used as an AC power source should conform to the following:

7.1.1 Be well maintained and subjected to a periodic maintenance schedule. Capacity of a generator can be reduced by the age and condition of the generator.

7.1.2 A generator is preferred, but a 5000W inverter is allowed on couplings up to 8" and all saddle fittings to power EF processors. A pigtail can be used to convert the processor to work off a 120v for 2" fittings during the OQ and training in the shop.

7.1.3 Provide an output voltage in the range that meets the specifications of the applicable processor model.

7.1.4 Operate within a frequency range of 45 Hertz (minimum) to 75 Hertz (maximum).

7.1.5 Generator has to be started and allowed to run at full throttle before connecting the control box to the generator.

7.1.6 A minimum Wattage capacity of the following table:

Minimum Wattage and Extension Cord Capacity

INPUT POWER REQUIREMENTS					
FITTING TYPE	FITTING SIZE	GENERATOR MINIMUM (WATT)	BREAKER MINIMUM 115v / 240v	EXTENSION CORD 25 ft.	EXTENSION CORD 50 ft.
COUPLING	1/2" to 8"	3500	15 / 15 AMP	#10/3	#8/3
COUPLING	10" to 12"	6000	30 / 20 AMP	#10/3*	#8/3*
SADDLE	ALL	3500	15 / 15 AMP	#10/3	#8/3

7.1.7 The ampacity of the electrical cord must be adequate for the fitting being fused. Due to the amperage draw of Electrofusion fittings, use of extension cords is not encouraged. In the event it becomes necessary to use extension cords refer to the table above.

NOTE: Extension cords should NOT be used on 14" IPS and larger couplings.

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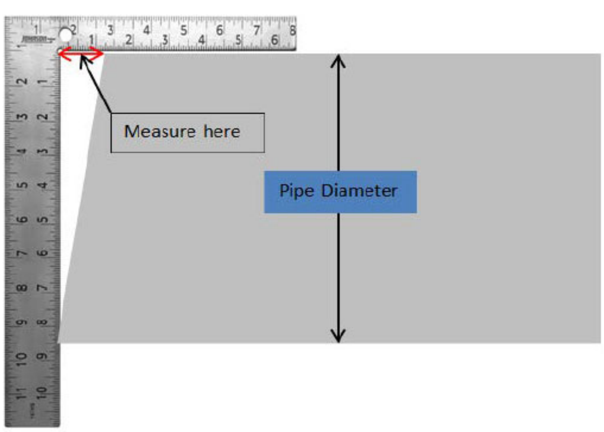
8.0 Pipe End Cutting

8.1 Cut the pipe ends as evenly and squarely as possible. For smaller pipe or tubing sizes, cutters made for this purpose work well. McElroy butt fusion facing equipment can be used to get a proper vertical cut.



For larger pipe sizes that are cut by hand, make a guide mark around the pipe that can be followed with the cutting tool. To accomplish this, a wrap-around strap can be used to ensure a straight mark. Chainsaws or reciprocating saws may be necessary for large diameter pipes. If using a chain saw, do not use chain oil.


8.2 If a square cut cannot be achieved, **it is required** that the resulting gap between the pipe and the square when measured with a square placed on the pipe end at its maximum width is equal to or less than what is shown in the following table.

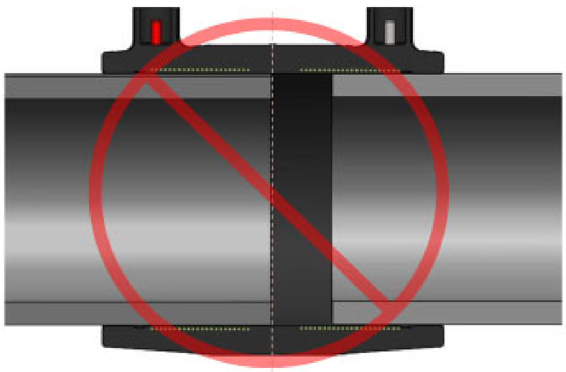


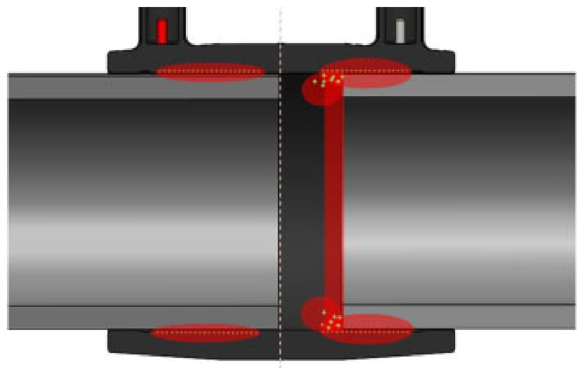
Pipe Size	Maximum gap
½ CTS to 1 ½ IPS	1/8"
2 IPS	3/16"
3 IPS	5/16"
4 IPS	5/16"
6 IPS	1/2"
8 IPS	3/4"
10 IPS	7/8"
12 IPS	1"

9.0 <u>Incorrect Assembly</u>

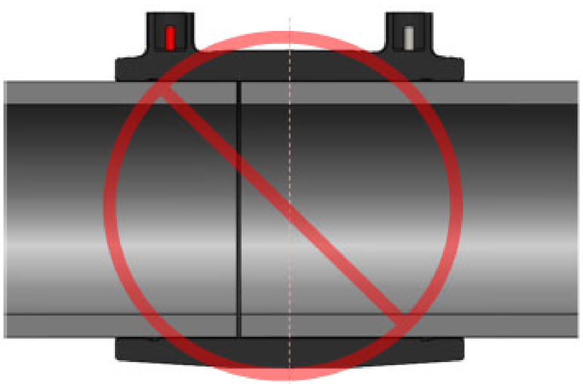
9.1 Proper insertion depth of a pipe end into an electrofusion coupling is required for a successful fusion. Failure to insert the pipe end correctly can result in a loss of melt containment during the fusion process.

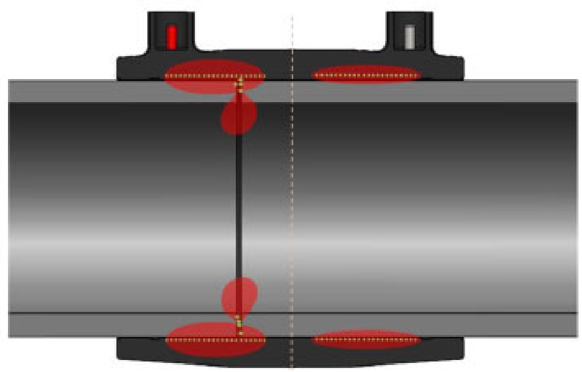
9.2 Short Stab – Where the one or both of the pipe ends are not centered in the coupling. This condition is avoidable by measuring and marking the stab depth on the pipe ends before inserting them into the coupling.



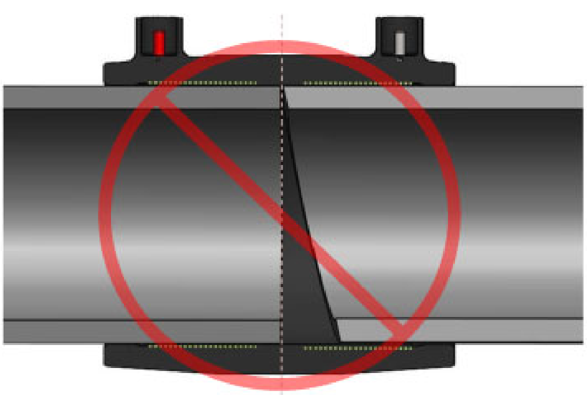


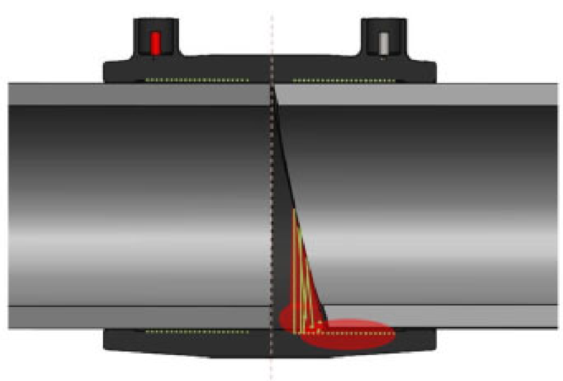
9.3 Mis-Stab – Where the pipes are not located in the center cold zone of the coupling. In this case, one pipe end is over-inserted into the coupling, while the other is under-inserted.





9.4 Mis-Cut – Lack of a square cut on the pipe ends. Care should be taken to keep the cut as square as possible.

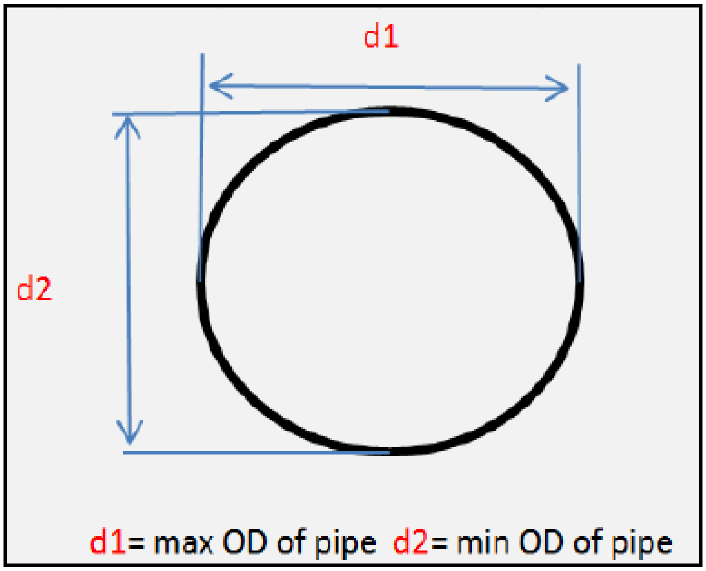




10.0 Pipe Roundness

10.1 Out-of-roundness is the difference in the maximum measured diameter minus the minimum measured diameter. The pipe can be measured with a tape measure or caliper to find the maximum (d1) and minimum (d2) diameter points. The out-of-roundness is calculated as d1-d2 as measured in the field.

10.2 Checking for out-of-roundness is required on pipe greater than 2".



10.3 For sizes equal to or larger than 3" IPS, re-rounding clamps may be needed on either side of an electrofusion fitting to ensure that the gap between the pipe and fitting is not too large. The following table can be used for guidance when measured pipe roundness conditions are approaching the condition where re-rounding clamps may be needed. Re-rounding of the pipe should bring the measured difference to less than the d1-d2 listed in the table below.

10.4 McElroy butt fusion clamps can be used as a re-rounding clamp.

Maximum Out-Of-Roundness	
PIPE SIZE	d1 - d2
3"	.125 or 1/8"
4"	.125 or 1/8"
6"	.187 or 3/16"
8"	.187 or 3/16"
10"	.250 or 1/4"
12"	.250 or 1/4"

11.0 Cleaning and Marking Pipe

11.1 Inspect the pipe surface to be scraped/peeled for embedded foreign objects such as rocks that might damage scraping tool blades. During the initial pipe inspection and prior to scraping the pipe can be cleaned of mud and debris with clean water.

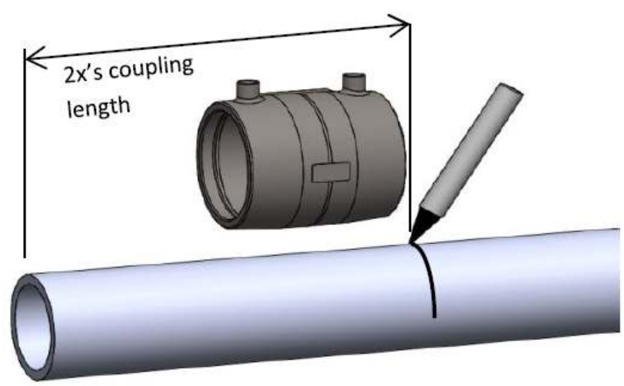
11.2 Pre-packaged 90% isopropyl alcohol wipes are required (stores code #10015604).

11.3 Do not use detergents to clean the pipe. Use no detergents as wetting agents and other substances contained in detergents can be difficult to remove from the pipe and will interfere with the fusion process later. If oils are suspected to be on the pipe surface at this point, additional cleaning with 90% isopropyl alcohol wipes may be necessary.

11.4 Pipe that has been installed by directional boring where drilling lubricants such as bentonite have been used require particular attention to pre-cleaning before scraping as well as any cleaning after scraping. Drilling lubricants, even when dried, can be difficult to see and are easily spread by wiping. Use extra caution to only wipe over areas that were previously cleaned with 90% isopropyl alcohol wipes to prevent spreading onto prepared surfaces.

11.5 **Mark the initially cleaned area**. DO NOT WIPE OUTSIDE THIS INITIALLY CLEANED AREA IN LATER STEPS. The marking of this initially cleaned area is to indicate the limits of the cleaned surface so that subsequent cleaning with wipes does not cross over onto un-cleaned pipe surfaces, thus picking up unintended contamination that could be redistributed over a previously cleaned surface.

11.6 Clean an area larger than the area to be scraped/peeled and fused. For couplings, **initially clean (with water or alcohol wipes)**, dry, and mark an area that is at least 2 times the full length of the coupling on each pipe end. This will remove loose particles and mud and will establish the area that should not be exceeded when cleaning in later steps.



11.7 **Clean this larger area with 90% isopropyl alcohol wipes**, wiping in only one direction, and not exceeding the boundary of the area that has been marked. Allow the pipe to dry. Discard the wipe and do not re-use.

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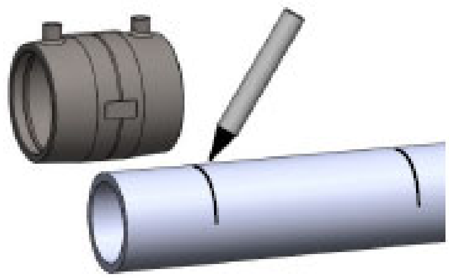
11.8 **Mark a second area** inside the initially cleaned area that is slightly longer than the area to be scraped/peeled (slightly longer than ½ the length of the coupling). **Clean the second marked area again** with 90% isopropyl alcohol wipes prior to scraping, being careful not to remove the marking. Discard the cloth/wipe after cleaning and do not re-use.



11.9 Scribe the pipe surface at regular intervals or mark in a crisscross pattern, so that any areas missed by the scraping tool will be visible by the marks that still remain.

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12.0 Scraping/Peeling Tools

12.1 Tools that are approved for scraping pipe for electrofusion joining are those that remove material cleanly. "Peeler" type tools that remove a continuous and measureable ribbon of pipe surface are the required scraping tools.

12.2 The Georg Fisher Central Plastics (GFCP) brand is preferred.

12.3 Pencil Scrapers are limited to 1" and smaller.

12.4 **The use of half-moon scrapers, dragon skin, paint scrapers, wood rasps, metal files, utility/emery cloth, or sandpaper are NOT ALLOWED.**

12.5 **Abrasives/grinders are NOT ALLOWED**

12.6 The following pictures show approved scrapers.

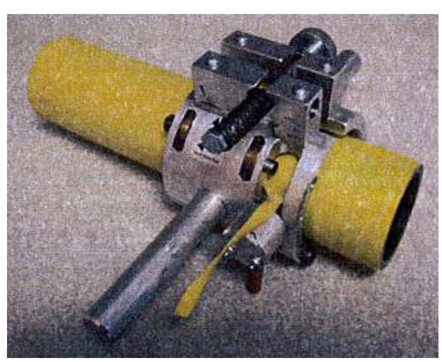
Older GFCP

Newer GFCP

Friatec

Pro-Scraper

Ritmo (Large Pipe)



Split Peeler

Pencil Scraper (Small Pipe)

13.0 Scraping/Peeling

13.1 Allow marks to dry before scraping/peeling the pipe and make sure that the scraping tool does not contact pipe that has not been cleaned previously.

13.2 Always check the condition of the tool before use:

13.2.1 Make sure the rollers are clean and move freely.

13.2.2 Make sure the blade is sharp and free of any oil or contaminates. Clean with alcohol if necessary.

13.2.3 Carefully make sure the spring loaded blade pendular operates freely side to side and up and down throughout its complete range of travel. Clean any debris or build up that prevents free movement.

13.3 When using the GFCP Rotary Peeler RS (preferred):

13.3.1 Open the rotary peeler by lifting the release handle.

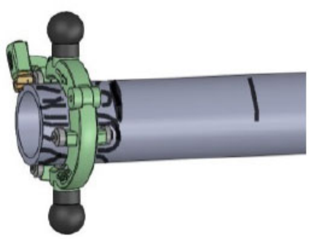
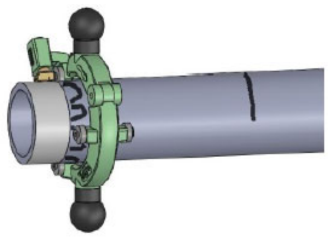
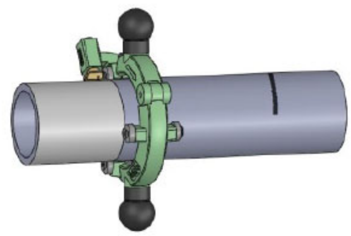
13.3.2 Put the rotary peeler around the pipe and lock by lowering the release handle (see illustration).

13.3.3 The blade of the rotary peeler should be located approximately 2/3 over the end of the pipe (see illustration).

13.3.4 Turn the rotary peeler by the handles around the pipe in shaft direction.

13.3.5 For more information on the GFCP Manual Rotary Peeler, refer to the Gas Distribution Construction Standards and Guidelines Sharepoint Site under Technical Documents.

13.4 Scrape/peel the pipe to remove the surface layer and expose clean virgin pipe beneath. Avoid allowing shavings/peeler tailings produced by the peeler from winding around pipe as this can re-distribute contaminates that may not have been removed by the initial cleaning. Break the tailings away frequently as-needed.

13.5 When using peeling type scraping tools the ribbon being peeled from the pipe can also be measured to gauge the scraper's effectiveness. **It is required to check the ribbon with a caliper, at least once a day. It is preferred to check the ribbon once per fitting.** Using an approved and qualified peeling tool, peel the pipe to remove at least .007" of the outer surface. This depth removes the oxidation layer from the pipe, along with surface contaminates that will prevent fusion.

Size	Min	Max
½" CTS & IPS	0.007	0.014
¾" IPS	0.007	0.014
1" IPS	0.007	0.014
1 ¼" IPS	0.007	0.017
2" IPS	0.007	0.017
3" IPS	0.007	0.022
4" IPS	0.007	0.022
6" IPS	0.007	0.027
8" IPS	0.007	0.027
12" IPS	0.007	0.027

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13.6 Witness/permanent marks should be completely removed by scraping.

13.7 Indented pipe print lines should be completely removed by scraping.

13.8 Inspect the scraped/peeled pipe surface thoroughly to ensure that all marks are removed and that only virgin pipe surface is exposed.

14.0 Clamping

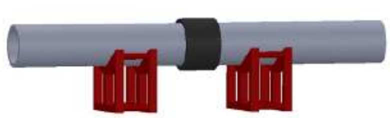
14.1 Remove the fitting from the bag, **clean the fusion surfaces of the fitting with a 90% alcohol wipe,** and place onto the scraped/peeled pipe surface.

14.2 Secure the pipe and fitting assembly by clamping to the pipe with the appropriate clamping device.

14.3 Clamping of Couplings:

14.3.1 Clamps for couplings and reducers are designed to align and restrain the pipe ends on either side of the coupling. The coupling itself is not clamped and is free between the clamps:

14.3.2 If the vice grip plyers style clamps are inadequate for stabilizing the fusion (2" coiled), then larger re-rounding clamps are needed.



Correct support placement

Incorrect support placement

15.0 Fusion

15.1 Review Section 7.0 on Power Requirements prior to connecting to the control box.

15.2 Connect the control box leads to the fitting, verify proper fusion time and voltage is displayed by the control box, and fuse the joint. Do not leave a fusion unattended.

15.3 Fusion Input Methods

15.3.1 Auto ID: When the processor is connected to the fitting red to red. GFCP control boxes read the resistor and automatically sets the fusion parameters for the fitting.

15.3.2 Barcode Scanner: When the processor is connected to the fitting white to red. The fusion barcode supplied with each fitting contains the fusion parameters needed to fuse the fitting. Scanning the barcode identifies the fitting to the control box and sets the fusion parameters for that fitting, including Temperature Compensated (TC).

15.3.3 Manual Barcode Entry: When the processor is connected to the fitting white to red. If the barcode cannot be scanned, the digits can be entered manually.

15.3.4 Manual Time and Voltage Entry – If known, fusion voltage and fusion time can be manually entered for the fitting.

15.4 Cooling time is typically expressed by two different terms in the following tables for fusion and cooling times:

15.4.1 **Clamped cooling time:** The minimum time the fitting must remain clamped after the fusion cycle is complete. This is the time displayed by the control box.

15.4.2 **Time before pressure test, tapping, and rough handling:** The minimum time before the joint can be pressurized to 150% of MAOP, the main can be tapped, and/or subjected to forces such as pulling, lifting, or back filling.

	Clamped Time	Rough Handling / Pressure Testing
Example 4” IPS coupling fusion cycle ends at 12:04	+15 = 12:19	+35 = 12:39

15.5 After the fusion cycle is complete, do not move or disturb the joint for the minimum cooling time displayed by the control box. The control box can be disconnected from the fitting at this time (carefully).

15.6 Pressure test and backfill only after the required minimum cooling time for the fitting used has been reached.

15.7 Inspect fitting to ensure no melt/wire extends beyond the coupling circumference. If melt/wire does extend beyond the coupling circumference, the fitting will need to be cut out and replaced. If this occurs on 12” Main, it may be acceptable if approved by both the local gas supervisor and a representative from the plastic qualification group. It will only be allowed if it meets the requirements of the Central Plastics Memo on Visible Melt and Wire. This memo can be found on the Gas Distribution Construction Standards and Guidelines SharePoint site under Technical Documents.

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Georg Fisher Central Plastics Cooling Times

Georg Fisher Central Plastics Electrofusion Table - Fusion and Cooling Times (NOTE: Table created by *Central Plastics* - May not correlate with all EF processors) (NOTE: Always confirm Fusion, Clamp, and Voltage information on fitting to EF processor – Table may not represent all fittings			
	Fusion Time (Seconds)	**Cooling Time in Clamped Position (minutes)**	**Total Cooling Time Before Rough Handling / Pressure Testing (minutes)**
¾" IPS x ½" CTS	See Fitting	See Fitting	30
1" IPS x ½" CTS	See Fitting	See Fitting	30
1" IPS x ½" IPS	See Fitting	See Fitting	30
1" IPS x ¾" IPS	See Fitting	See Fitting	30
1" IPS x 1 ¼" IPS	See Fitting	See Fitting	30
2" IPS x 1 ¼" IPS	See Fitting	See Fitting	30
½" CTS	See Fitting	See Fitting	30
½" IPS	See Fitting	See Fitting	30
¾" IPS	See Fitting	See Fitting	30
1" IPS	See Fitting	See Fitting	30
1 ¼" IPS	See Fitting	See Fitting	30
1 ½" IPS	See Fitting	See Fitting	30
2" IPS	See Fitting	See Fitting	30
3" IPS	See Fitting	See Fitting	35
4" IPS	See Fitting	See Fitting	35
6" IPS	See Fitting	See Fitting	45
8" IPS	See Fitting	See Fitting	45
10" IPS	See Fitting**	See Fitting	60
12" IPS	See Fitting**	See Fitting	60

**These fittings require temperature compensation – use barcode

	Clamped Time	Rough Handling / Pressure Testing
Example 4" IPS coupling fusion cycle ends at 12:04	+15 = 12:19	+35 = 12:39

16.0 Re-Fusion

16.1 NorthWestern Energy does not allow re-fusion on pipe smaller than 12". For 12" pipe and fittings, it may be allowed with the permission of both the local gas supervisor and a representative from the plastic qualification group. It will only be allowed if it meets the requirements of Georg Fisher Central Plastics Installation Manual (page 32). This manual can be found on the Gas Distribution Construction Standards and Guidelines SharePoint site under Technical Documents.

NorthWestern Energy

Gas Standards Subject: Electrofusion Saddle		Original Date 06/01/2006	Standard Number 52-PK
Supersedes Standard: 52-PK	REV# 9	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for Electrofusion procedures (saddle) in accordance with NorthWestern's O&M section 5500.

2.0 Summary

This procedure will define the steps necessary for the sidewall joining of polyethylene pipe and fittings by the method of Electrofusion.

3.0 Material

3.1 Medium Density Polyethylene MDPE 2406/2708 (yellow) pipe and fittings.

3.2 High Density Polyethylene HDPE 3408/3608/4710 (black) pipe and fittings.

3.3 Aldyl-A pipe

3.4 Electrofusion can be used to join the above dissimilar plastics.

3.5 In construction design, be aware of the pressure ratings for both the pipe and the Electrofusion fittings being installed. High density (HDPE, black) fittings are allowed on medium density (MDPE, yellow) pipe installations and will not limit design, however, medium density (MDPE, yellow) fittings will be a pressure limiting factor if used on high density (HDPE, black) pipe.

3.6 Electrofusion is NOT allowed on black Driscopipe 7000 or black Driscopipe 8000. This pipe will have 7000 or 8000 on the print line. Common in parts of Grand Island, NE.

4.0 Pipe Size and Other Specifications

4.1 This procedure will cover pipe diameter sizes ranging from 1 ¼" IPS to 12" IPS.

4.2 Saddle Electrofusion is allowed on live (pressurized) lines. However, Saddle Electrofusion is not allowed on lines under pressure test, pressure tests generally exceed the MAOP.

5.0 Equipment

5.1 Electrofusion Processor

5.2 Pre-packaged 90% (or greater) isopropyl alcohol wipes are required (stores code #10015604).

5.3 Approved scraping tool

5.4 Non-petroleum based marker

5.4.1 Black Sharpie is recommended on yellow

5.4.2 Silver Sharpie is recommended on black

5.5 Appropriate fitting

5.6 Appropriate clamp(s)

5.7 Refer to Section 7.0 for Power Requirements

6.0 Jobsite Preparation and Weather Considerations

6.1 Tents / protection must be used when it is raining/snowing. Water cannot be present in the work area.

6.2 It is best practice, to lay down sheeting or tarp in the trench where fittings will be fused.

6.3 Cold weather reduces polyethylene pipe material properties and may increase possible risk of damage due to impact or bending stresses.

6.4 Remove all dew, frost, ice, or snow from the outside and inside diameters of areas to be fused. All surfaces must be clean, dry, and free of any foreign substances prior to fusion.

6.4.1 In inclement weather and especially in windy conditions, the fusion operation should be shielded to avoid precipitation or blowing snow and excessive heat loss from wind chill.

6.5 Electrofusion fittings may be installed in temperature ranges –10°F to 120°F.

7.0 Power Requirements

7.1 For the installation of Electrofusion fittings in field applications, it is necessary to have a reliable source of AC power for the Electrofusion Processor to operate properly in supplying the fitting with the right amount of energy. Generators used as an AC power source should conform to the following:

7.1.1 Be well maintained and subjected to a periodic maintenance schedule. Capacity of a generator can be reduced by the age and condition of the generator.

7.1.2 A generator is preferred, but a 5000W inverter is allowed to power EF processors. A pigtail can be used to convert the processor to work off a 120v for 2” fittings during the OQ and training in the shop.

7.1.3 Provide an output voltage in the range that meets the specifications of the applicable processor model.

7.1.4 Operate within a frequency range of 45 Hertz (minimum) to 75 Hertz (maximum).

7.1.5 Generator has to be started and allowed to run at full throttle before connecting the control box to the generator.

7.1.6 A minimum Wattage capacity of the following table:

Minimum Wattage and Extension Cord Capacity

INPUT POWER REQUIREMENTS					
FITTING TYPE	FITTING SIZE	GENERATOR MINIMUM (WATT)	BREAKER MINIMUM 115v / 240v	EXTENSION CORD 25 ft.	EXTENSION CORD 50 ft.
COUPLING	1/2" to 8"	3500	15 / 15 AMP	#10/3	#8/3
COUPLING	10" to 12"	6000	30 / 20 AMP	#10/3*	#8/3*
SADDLE	ALL	3500	15 / 15 AMP	#10/3	#8/3

7.1.7 The ampacity of the electrical cord must be adequate for the fitting being fused. Due to the amperage draw of Electrofusion fittings, use of extension cords is not encouraged. In the event it becomes necessary to use extension cords refer to the table above.

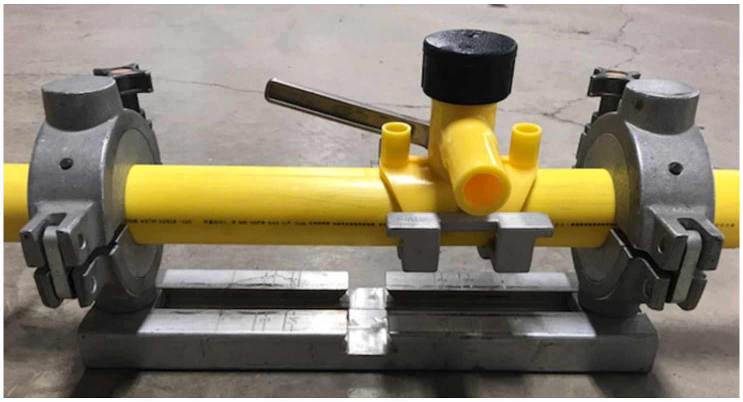
NOTE: Extension cords should NOT be used on 14” IPS and larger couplings.

8.0 Pipe Roundness

8.1 Check pipe for out-of-round condition by placing the fitting on the pipe. If there is a gap between the saddle inside diameter and the pipe outside diameter, then the pipe is out of round.

8.2 If fusion area is found to be out-of-round, take appropriate steps to bring fusion area back within required tolerances to allow for adequate contact between the fitting and the pipe.

8.3 The mechanical re-usable under saddle clamps should be adequate to make the pipe round. If a gap is still seen, then a bar clamp may be necessary to act as a re-rounding device.



8.4 McElroy butt fusion clamps can be used as a re-rounding device.

8.5 Out of round condition is not corrected by the permanent bolt-on underpart or understraps. If out-of-round conditions exist, appropriate re-rounding devices will need to be used on both sides of the fitting.

8.6 If out-of-round cannot be removed it may be necessary to incorporate a design change in the installation.

9.0 <u>Cleaning and Marking Pipe</u>

9.1 Inspect the pipe surface to be scraped/peeled for embedded foreign objects such as rocks that might damage scraping tool blades. During the initial pipe inspection and prior to scraping the pipe can be cleaned of mud and debris with clean water.

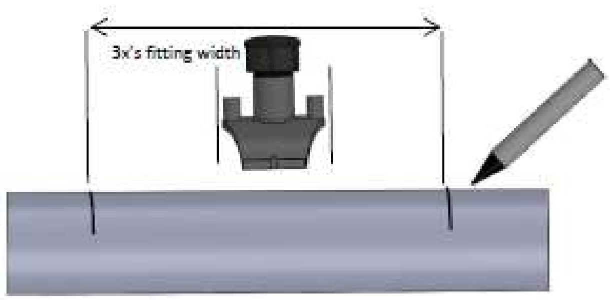
9.2 Pre-packaged 90% isopropyl alcohol wipes are required (stores code #10015604).

9.3 Do not use detergents to clean the pipe. Use no detergents as wetting agents and other substances contained in detergents can be difficult to remove from the pipe and will interfere with the fusion process later. If oils are suspected to be on the pipe surface at this point, additional cleaning with 90% isopropyl alcohol wipes may be necessary.

9.4 Pipe that has been installed by directional boring where drilling lubricants such as bentonite have been used require particular attention to pre-cleaning before scraping as well as any cleaning after scraping. Drilling lubricants, even when dried, can be difficult to see and are easily spread by wiping. Use extra caution to only wipe over areas that were previously cleaned with 90% isopropyl alcohol wipes to prevent spreading onto prepared surfaces.

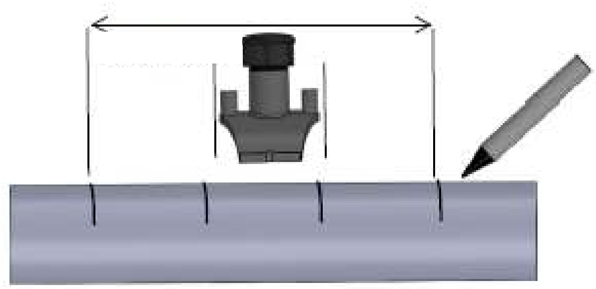
9.5 **Mark the initially cleaned area**. DO NOT WIPE OUTSIDE THIS INITIALLY CLEANED AREA IN LATER STEPS. The marking of this initially cleaned area is to indicate the limits of the cleaned surface so that subsequent cleaning with wipes does not cross over onto un-cleaned pipe surfaces, thus picking up unintended contamination that could be redistributed over a previously cleaned surface.

9.6 Clean an area larger than the area to be scraped/peeled and fused. For saddles, **initially clean (with water or alcohol wipes)**, dry, and mark an area that is at least 3 times the full length of the saddle. This will remove loose particles and mud and will establish the area that should not be exceeded when cleaning in later steps. Additional cleaning of this area with 90% isopropyl alcohol wipes is good practice to help remove other potential contaminates such as drilling fluids that may not be removed by cleaning with water.

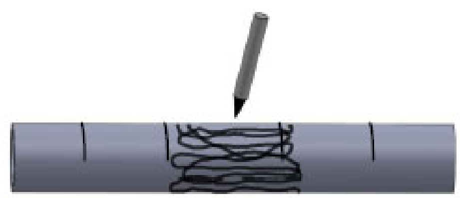


9.7 **Clean this larger area with 90% isopropyl alcohol wipes**, wiping in only one direction, and not exceeding the boundary of the area that has been marked. Allow the pipe to dry. Discard the wipe and do not re-use.

9.8 **Mark a second area** inside the initially cleaned area that is slightly longer than the area to be scraped/peeled. **Clean the second marked area again** with 90% isopropyl alcohol wipes prior to scraping, being careful not to remove the marking. Discard the cloth/wipe after cleaning and do not re-use.



9.9 Scribe the pipe surface at regular intervals or mark in a crisscross pattern, so that any areas missed by the scraping tool will be visible by the marks that still remain.



NorthWestern Energy

Gas Standards Subject: Electrofusion Saddle		Original Date 06/01/2006	Standard Number 52-PK
Supersedes Standard: 52-PK	REV# 9	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

10.0 Scraping/Peeling Tools

10.1 Tools that are approved for scraping pipe for electrofusion joining are those that remove material cleanly. "Peeler" type tools that remove a continuous and measureable ribbon of pipe surface are the required scraping tools.

10.2 The Georg Fisher Central Plastics (GFCP) brand is preferred.

10.3 Pencil Scrapers are limited to 1" and smaller.

10.4 **The use of half-moon scrapers, dragon skin, paint scrapers, wood rasps, metal files, utility/emery cloth, or sandpaper are NOT ALLOWED.**

10.5 **Abrasives/grinders are NOT ALLOWED**

10.6 The following pictures show approved scrapers.

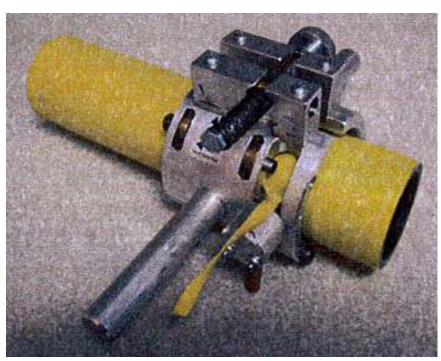
Older GFCP

Newer GFCP

Friatec

Pro-Scraper

Ritmo (Large Pipe)



Split Peeler

Pencil Scraper (Small Pipe)

Gas Standards Subject: Electrofusion Saddle		Original Date 06/01/2006	Standard Number 52-PK
Supersedes Standard: 52-PK	REV# 9	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

11.0 Scraping/Peeling

11.1 Allow marks to dry before scraping/peeling the pipe and make sure that the scraping tool does not contact pipe that has not been cleaned previously.

11.2 Always check the condition of the tool before use:

11.2.1 Make sure the rollers are clean and move freely.

11.2.2 Make sure the blade is sharp and free of any oil or contaminates. Clean with alcohol if necessary.

11.2.3 Carefully make sure the spring loaded blade pendular operates freely side to side and up and down throughout its complete range of travel. Clean any debris or build up that prevents free movement.

11.3 When using the GFCP Rotary Peeler RS (preferred):

11.3.1 Open the rotary peeler by lifting the release handle.

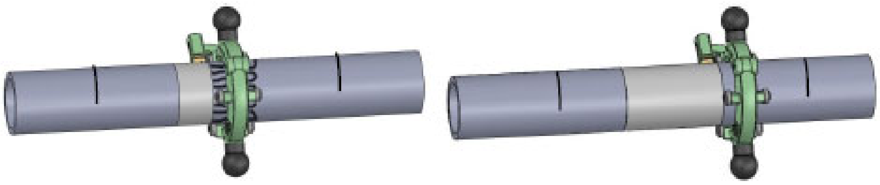
11.3.2 Put the rotary peeler around the pipe and lock by lowering the release handle (see illustration).

11.3.3 The blade of the rotary peeler should be located approximately 2/3 over the end of the pipe (see illustration).

11.3.4 Turn the rotary peeler by the handles around the pipe in shaft direction.

11.3.5 For more information on the GFCP Manual Rotary Peeler, refer to the Gas Distribution Construction Standards and Guidelines Sharepoint Site under Technical Documents.

11.4 Scrape/peel the pipe to remove the surface layer and expose clean virgin pipe beneath. Avoid allowing shavings/peeler tailings produced by the peeler from winding around pipe as this can re-distribute contaminates that may not have been removed by the initial cleaning. Break the tailings away frequently as-needed.



11.5 When using peeling type scraping tools the ribbon being peeled from the pipe can also be measured to gauge the scraper's effectiveness. **It is required to check the ribbon with a caliper, at least once a day. It is preferred to check the ribbon once per fitting.** Using an approved and qualified peeling tool, peel the pipe to remove at least .007" of the outer surface. This depth removes the oxidation layer from the pipe, along with surface contaminates that will prevent fusion.

Size	Min	Max
½" CTS & IPS	0.007	0.014
¾" IPS	0.007	0.014
1" IPS	0.007	0.014
1 ¼" IPS	0.007	0.017
2" IPS	0.007	0.017
3" IPS	0.007	0.022
4" IPS	0.007	0.022
6" IPS	0.007	0.027
8" IPS	0.007	0.027
12" IPS	0.007	0.027

NorthWestern Energy

Gas Standards Subject: Electrofusion Saddle		Original Date 06/01/2006	Standard Number 52-PK
Supersedes Standard: 52-PK	REV# 9	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

11.6 Witness/permanent marks should be completely removed by scraping.

11.7 Indented pipe print lines should be completely removed by scraping.

11.8 Inspect the scraped/peeled pipe surface thoroughly to ensure that all marks are removed and that only virgin pipe surface is exposed.

12.0 Clamping

12.1 Remove the fitting from the bag, **clean the fusion surfaces of the fitting with a 90% alcohol wipe,** and place onto the scraped/peeled pipe surface.

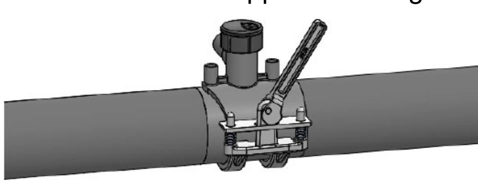
12.2 Secure the pipe and fitting assembly by clamping to the pipe with the appropriate clamping device.

12.3 Clamping of Saddles:

12.3.1 Clamps are always required when fusing saddles. The clamps provide the necessary attachment to the pipe and resist melt expansion forces to achieve the intended melt pressure on the pipe. Saddle clamps may be an external mechanical clamp that is re-usable or an integrated and permanent bolt-on clamp or strap. An underclamp (or strap) is a clamp that "pulls" the fitting base onto the pipe. A top loading clamp "pushes" the fitting downward onto the pipe. Each saddle fitting has a specific clamp(s) that has been designed and qualified for use. Substitutions are not acceptable and may result in failed fusion attempts.

12.3.2 Ensure that mechanical clamp placement is centered on the fitting and that underparts are bolted correctly to avoid uneven clamping.

12.3.3 External forces from service lines, valves, and or heavy appurtenances must be blocked or supported during fusion and cooling of saddle fittings.



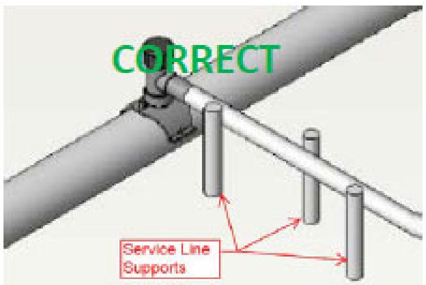
Mechanical re-usable clamp

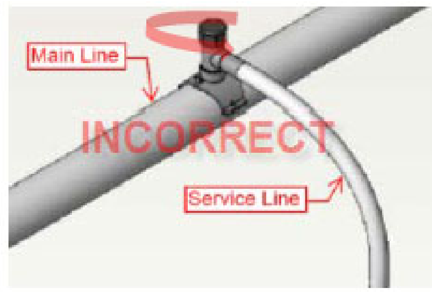
Permanent bolt-on underpart or understrap

13.0 Fusion

13.1 Review Section 7.0 on Power Requirements prior to connecting to the control box.

13.2 Avoid connecting the service line to the outlet before fusing the saddle to the main when possible. If the outlet/service connection is made to the saddle fitting before the saddle is fused to the main, always ensure that the pipe connected the tubing does not exert any pulling, twisting, or sideways forces on the main. Use shoring/supports as shown below to prevent external forces if necessary.





13.3 Connect the control box leads to the fitting, verify proper fusion time and voltage is displayed by the control box, and fuse the joint. Do not leave a fusion unattended.

13.4 Fusion Input Methods

13.4.1 Auto ID: When the processor is connected to the fitting red to red. GFCP control boxes read the resistor and automatically sets the fusion parameters for the fitting.

13.4.2 Barcode Scanner: When the processor is connected to the fitting white to red. The fusion barcode supplied with each fitting contains the fusion parameters needed to fuse the fitting. Scanning the barcode identifies the fitting to the control box and sets the fusion parameters for that fitting, including Temperature Compensated (TC).

13.4.3 Manual Barcode Entry: When the processor is connected to the fitting white to red. If the barcode cannot be scanned, the digits can be entered manually.

13.4.4 Manual Time and Voltage Entry – If known, fusion voltage and fusion time can be manually entered for the fitting.

13.5 Cooling time is typically expressed by two different terms in the following tables for fusion and cooling times:

13.5.1 **Clamped cooling time:** The minimum time the fitting must remain clamped after the fusion cycle is complete. This is the time displayed by the control box.

13.5.2 **Time before pressure test, tapping, and rough handling:** The minimum time before the joint can be pressurized to 150% of MAOP, the main can be tapped, and/or subjected to forces such as pulling, lifting, or back filling.

	Clamped Time	Rough Handling / Pressure Testing / Tapping
Example 4" IPS saddle fusion cycle ends at 12:04	+10 = 12:14	+30 = 12:34

13.6 Service outlet may be prepared after the Rough Handling Time.

13.7 After the fusion cycle is complete, do not move or disturb the joint for the minimum cooling time displayed by the control box. The control box can be disconnected from the fitting at this time (carefully).

13.8 Pressure test and backfill only after the required minimum cooling time for the fitting used has been reached.

13.9 Inspect fitting to ensure no melt/wire extends beyond the saddle fitting. If melt/wire does extend beyond the saddle fitting, the fitting will need to be retired.

Georg Fisher Central Plastics Cooling Times

Georg Fisher Central Plastics Electrofusion Table - Fusion and Cooling Times **(NOTE: Table created by *Central Plastics* - May not correlate with all EF processors)** **(NOTE: Always confirm Fusion, Clamp, and Voltage information on fitting to EF processor – Table may not represent all fittings**			
Tapping Tees are listed by saddle size. Times will apply to all outlet sizes	**Fusion Time (Seconds)**	**Cooling Time in Clamped Position (minutes)**	**Total Cooling Time Before Rough Handling / Pressure Testing / Tapping (minutes)**
Tapping Tees:			
1 ¼” IPS	See Fitting	See Fitting	30
1 ½” IPS	See Fitting	See Fitting	30
2” IPS	See Fitting	See Fitting	30
3” IPS	See Fitting	See Fitting	30
4” IPS	See Fitting	See Fitting	30
6” IPS	See Fitting	See Fitting	30
8” IPS	See Fitting	See Fitting	30
10” IPS	See Fitting	See Fitting	30
HV Tapping Tees, Branch Saddles with 2” and 1 ¼” Outlets:			
2” IPS	See Fitting	See Fitting	30
3” IPS	See Fitting	See Fitting	30
4” IPS	See Fitting	See Fitting	30
6” IPS	See Fitting	See Fitting	30
8” IPS PE2406	See Fitting	See Fitting	30
8” IPS PE3408	See Fitting	See Fitting	40
10” IPS	See Fitting	See Fitting	40
12” IPS	See Fitting	See Fitting	40
Branch Saddles:			
4” IPS x 4” IPS	See Fitting	See Fitting	30
6” IPS x 4” IPS	See Fitting	See Fitting	45
8” IPS x 4” IPS	See Fitting**	See Fitting	60
8” IPS x 6” IPS	See Fitting**	See Fitting	60
12” IPS x 4” IPS	See Fitting**	See Fitting	60
12” IPS x 6” IPS	See Fitting**	See Fitting	60
12” IPS x 8” IPS	See Fitting**	See Fitting	60

**These fittings require temperature compensation – use barcode

	Clamped Time	Rough Handling / Pressure Testing / Tapping
Example 4” IPS saddle fusion cycle ends at 12:04	+10 = 12:14	+30 = 12:34

14.0 Re-Fusion

14.1 NorthWestern Energy does not allow re-fusion on pipe smaller than 12”. For 12” pipe and fittings, it may be allowed with the permission of both the local gas supervisor and a representative from the plastic qualification group. It will only be allowed if it meets the requirements of Georg Fisher Central Plastics Installation Manual (page 32). This manual can be found on the Gas Distribution Construction Standards and Guidelines SharePoint site under Technical Documents.

NorthWestern Energy

Gas Standards Subject: Plastic MetFit Fittings ½" CTS – 1" IPS		Original Date 06/01/2006	Standard Number 52-PO
Supersedes Standard: 52-PO	REV # 6	Revision Date 08/01/2022	Prepared / Approved By AJ / Committee

1/2" CTS – 1" IPS Compression Coupling Installation – with use of Series 200 V-Tool

1.0 Scope – METFIT – FITTING

This standard describes NorthWestern Energy's requirements for mechanical joining procedures in accordance with NorthWestern's O&M section 5500.

1.0 Process

1.1 This procedure will define the steps necessary for the joining of polyethylene PE 2406 pipe through the use of METFIT mechanical fittings (However Aldyl-A pipe and different density plastic pipe (PE 3408, Drisco M8000) may also be joined).

1.2 NOTE: Mechanical joining is one of only two methods of joining dissimilar plastics (i.e. Aldyl-A to polyethylene PE 2406). The only other approved method of joining dissimilar plastics is through the use of Electrofusion.

2.0 Material

2.1 The materials joined according to this process will be PE 2406 medium density polyethylene pipe (However Aldyl-A pipe and different density plastic pipe (PE 3408, Drisco M8000) may also be joined).

3.0 Pipe Size

3.1 This procedure will cover pipe diameter sizes ranging from 1/2" CTS – 1" IPS.

4.0 Equipment

4.1 Appropriate METFIT fitting

4.2 Appropriate METFIT tool

NOTE: 1 ¼" IPS - 2" IPS pipe require different tooling – please refer to Standard 52-PP).

4.3 Appropriate Adapter Jaw

4.4 Pipe or tubing cutter

4.5 Clean cloth

4.6 Non-oil based marker

5.0 Procedures – READ COMPLETELY BEFORE JOINING

5.1 Ensure that the proper size METFIT fitting is being installed on the correct size pipe.

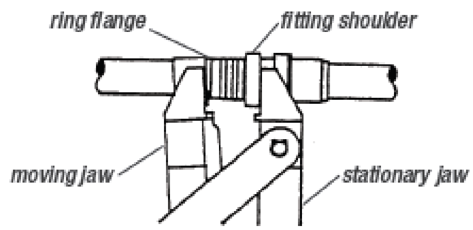
5.2 Use a pipe or tubing cutter to make certain that the pipe ends are cut square to allow for proper fit into fitting – Clean pipe ends with a clean cloth to remove any burrs that may have formed from cutting.

5.3 Mark the insertion depth on the tubing using a non-oil based maker.

5.4 Slide the METFIT compression ring (with flange closest to fitting) over the end of the pipe. Push the pipe into the fitting until the end of the pipe butts against the shoulder inside the fitting. The mark should line up with the edge of the fitting.

5.5 The fitting is now ready to be crimped by opening the jaws of the METFIT tool and inserting the fitting. The stationary jaw of the tool is to be placed in back of the fitting shoulder and the moving jaw of the tool is to be placed in back of the compression ring flange.

Figure 6.0a – METFIT Tool



5.6 Close the jaws until the ring is pulled past the locking rib (wax residue will issue out from seal).

5.7 Inspect the completed fitting to ensure a tight fit.

5.8 Soap and pressure test the fitting after installation to comply with minimum pipeline test requirements.

5.9 <u>NOTE:</u> Repair sleeve, METFIT Fittings, require a different insertion gap. Please refer to the information on the fitting packet or to the standard provided in this handbook.

Figure 6.0b – METFIT Fitting

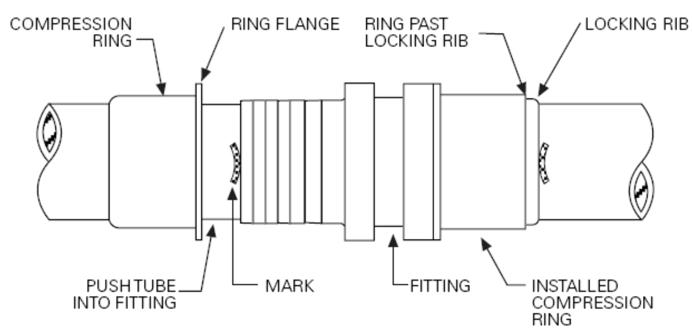
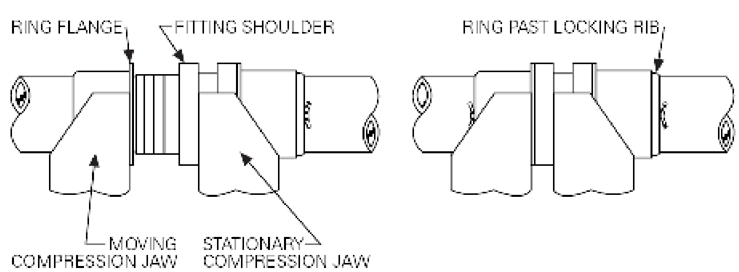


Figure 6.0c – METFIT Installation



NorthWestern Energy

Gas Standards Subject: Plastic MetFit Fittings 1 ¼" IPS – 2" IPS		Original Date 06/06/2013	Standard Number 52-PP
Supersedes Standard: 52-PP	REV # 3	Revision Date 08/01/2022	Prepared / Approved By AJ / Committee

1 ¼" - 2" IPS Compression Coupling Installation – with use of Series 200 Hydraulic Tool

1.0 Scope – METFIT – FITTING

This standard describes NorthWestern Energy's requirements for mechanical joining procedures in accordance with NorthWestern's O&M section 5500.

2.0 Process

2.1 This procedure will define the steps necessary for the joining of polyethylene PE 2406 pipe through the use of METFIT mechanical fittings (However Aldyl-A pipe and different density plastic pipe (PE 3408, Drisco M8000) may also be joined).

2.2 NOTE: Mechanical joining is one of only two methods of joining dissimilar plastics (i.e. Aldyl-A to polyethylene PE 2406). The only other approved method of joining dissimilar plastics is through the use of Electrofusion.

2.3 NOTE: METFIT repair couplings are not regarded as temporary fitting installations due to the higher cost associated with mechanical repair couplings – If the construction situation requires a temporary fitting installation, please consider using a polyethylene fitting.

3.0 Material

3.1 The materials joined according to this process will be PE 2406 medium density polyethylene pipe (However Aldyl-A pipe and different density plastic pipe (PE 3408, Drisco M8000) may also be joined).

4.0 Pipe Size

4.1 This procedure will cover pipe diameter size 1 ¼" - 2" IPS.

4.2 NOTE: For 1-1/4" IPS fittings please refer to package instructions for insertion depths. Also please note that 2" IPS full cut tee fittings and 2" IPS end cap fittings will have similar installation procedures as listed in this standard, however, certain fitting specific procedures may need to be followed – please refer to the package instructions prior to installation.

NOTE: 1-1/4" Drisco M8000 pipe is excluded from this procedure due to a conflict with the outside diameter of the METFIT fitting and the inside diameter of the pipe.

5.0 Equipment

5.1 Appropriate METFIT fitting

5.2 Appropriate METFIT tool – Series 200 Hydraulic Tool, Enerpac Pump and Hydraulic Hose

5.3 Appropriate METFIT Adapter Jaw

5.4 Pipe or tubing cutter

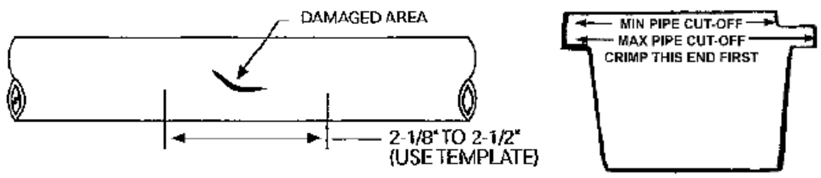
5.5 Clean cloth

5.6 Non-oil based marker

6.0 Procedures (Repair Coupling Installation) – READ COMPLETELY BEFORE JOINING

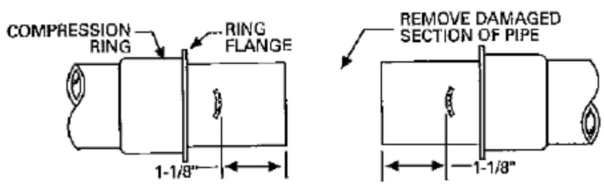
6.1 Ensure that the proper size METFIT fitting is being installed on the correct size pipe.

6.2 Using the paper template included with the fitting, cut the ends of the pipe square so that the gap between ends is 2-1/8" to 2-1/2" for proper fit into fitting – Clean pipe ends with a clean cloth to remove any burrs that may have formed from cutting.



6.3 Mark the insertion depth on the pipe with a non-oil based marker.

6.3.1 The insertion depth is 1-1/8" (Found on the repair coupling packaging).



6.4 Slide compression ring (with flange closest to fitting) over end of pipe.

NorthWestern Energy

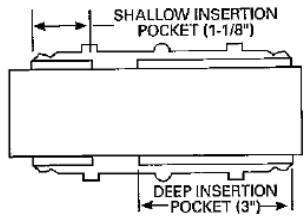
Gas Standards Subject: Plastic MetFit Fittings 1 ¼” IPS – 2” IPS		Original Date 06/06/2013	Standard Number 52-PP
Supersedes Standard: 52-PP	REV # 3	Revision Date 08/01/2022	Prepared / Approved By AJ / Committee

6.5 **PLEASE NOTE THAT THE INSERTION DISTANCES MAY NOT BE THE SAME FOR BOTH SIDES OF THE FITTING**. The coupling consists of two depths

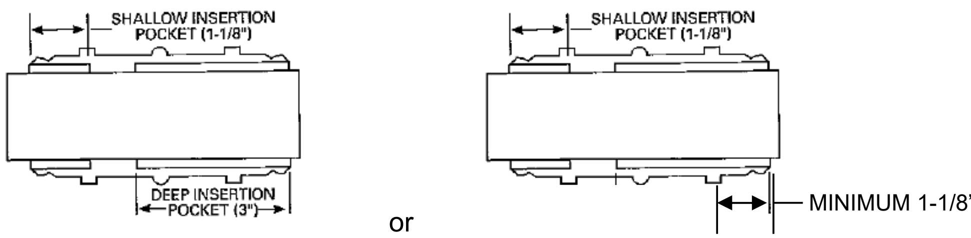
6.5.1 Shallow insertion pocket (1-1/8”)

6.5.2 Deep insertion pocket

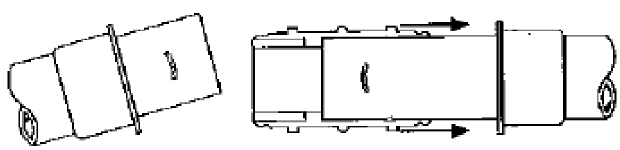
6.5.2.1 For Repair, the deep insertion pocket will be 3”



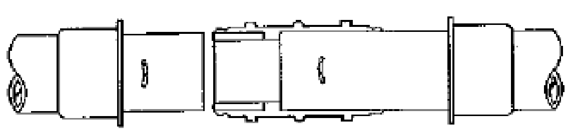
6.5.2.2 For New Construction, the deep insertion pocket maybe 1 1/8” minimum or fully bottomed against the internal shoulder (3”).



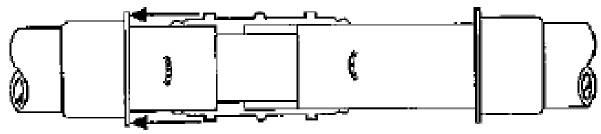
6.6 Pull up and over to deflect the pipe so that one pipe end can be inserted into the deep pocket side of the coupling.



6.7 Reposition the deflected pipe so it is back into horizontal (axial) alignment with the fitting.



6.8 Slide the fitting over the second end of the cut pipe so that the pipe bottoms out in the shallow pocket side of the coupling. Both pipe insertion depth markings (1-1/8") should line up with the edges of the fitting.



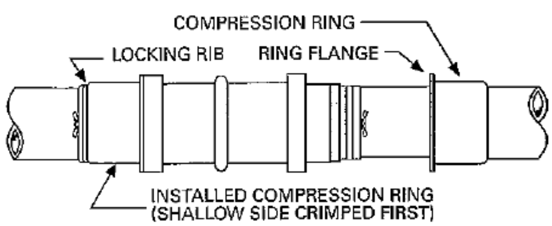
6.9 The fitting is now ready to be compressed (crimped). **CRIMP SHALLOW POCKET END FIRST**.

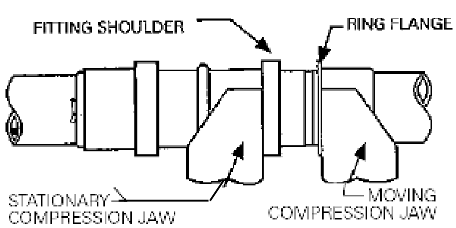
6.9.1 Open the jaws of the tool and insert the fitting with stationary jaw in back of the fitting shoulder and moving jaw in back of the compression ring flange.

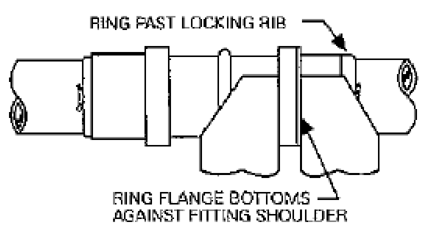
6.9.2 Close jaws until the ring is pulled past the locking rib. The figures below show the fitting and pipe throughout the first crimp.

6.9.3 Open jaws and remove tool.

6.9.4 Inspect to ensure that the rings are past the locking rib completely around the circumference of the pipe. NOTE: If locking is not complete you may rotate the fitting or the tool 90^{o} and repeat the crimping procedure.







NorthWestern Energy

Gas Standards Subject: Plastic Permasert XL Couplings – 3" IPS - 8" IPS		Original Date 04/01/2020	Standard Number 52-PR
Supersedes	REV # 1	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for mechanical joining procedures in accordance with NorthWestern's O&M section 5500.

2.0 Summary

2.1 This procedure will define the steps necessary for the joining of polyethylene pipe through the use of Permasert XL mechanical couplings.

3.0 Reference Documents

3.1 Perfection Installation Instructions - PE to PE Mechanical Coupling

3.2 Permasert XL Coupling PE to PE Mechanical Coupling Installation Instructions VIDEO. Video is available for all NWE employees, contact Gas Distribution Construction Standards Engineer.

4.0 Material

4.1 The materials joined will be dissimilar and/or similar polyethylene pipe, such as HDPE 3408/3608/4710 (black), MDPE 2406/2708 (yellow), and/or Performance Pipe DRISCOPIPE 7000 and 8000 (black with 7000 or 8000 on the print line).

4.2 This procedure should not be used to join Aldyl-A. Electrofusion or MetFit Couplings should be used in these situations.

5.0 Pipe Size

5.1 This procedure will cover pipe diameter size 3" IPS - 8" IPS.

6.0 Equipment

6.1 Permasert XL Coupling (New)

6.1.1 Permasert XL Couplings are not intended for re-installation, but may be re-used for training/testing purposes.

6.2 Leak Test Soap

6.3 ¾" Deep Well Socket

6.4 Socket Wrench

6.5 Torque Wrench

6.6 Pipe or tubing cutter

6.7 Clean cloth

6.8 Non-oil based marker (black and/or silver Sharpie on yellow pipe, silver Sharpie on black pipe)

7.0 Procedures

7.1 Cut pipe ends square. Remove any burrs from cut pipe prior to installing coupling. Pipe surfaces must be free of longitudinal scratches for at least 6" from pipe ends.

7.2 Gap between the pipe ends must not exceed 2". No minimum gap required.

7.3 Clean the surface of polyethylene (PE) main where the coupling is to be installed. Pipe surfaces must be clean for at least 6" from pipe ends.

7.4 Install properly identified Perfection insert stiffeners into polyethylene pipe ends. Polyethylene pipe with a thicker wall (SDR 11 is slightly thicker than SDR 11.5) or with out-of-round end condition may require the use of a wood block and a hammer to install the stiffener.

7.5 Mark pipe with a non-oil based marker:

7.5.1 3" IPS – 6" IPS pipe: Mark each pipe 6" from end.

7.5.2 8" IPS: Mark each pipe 7" from end.

7.6 Apply leak test soap solution to gaskets and pipe ends.

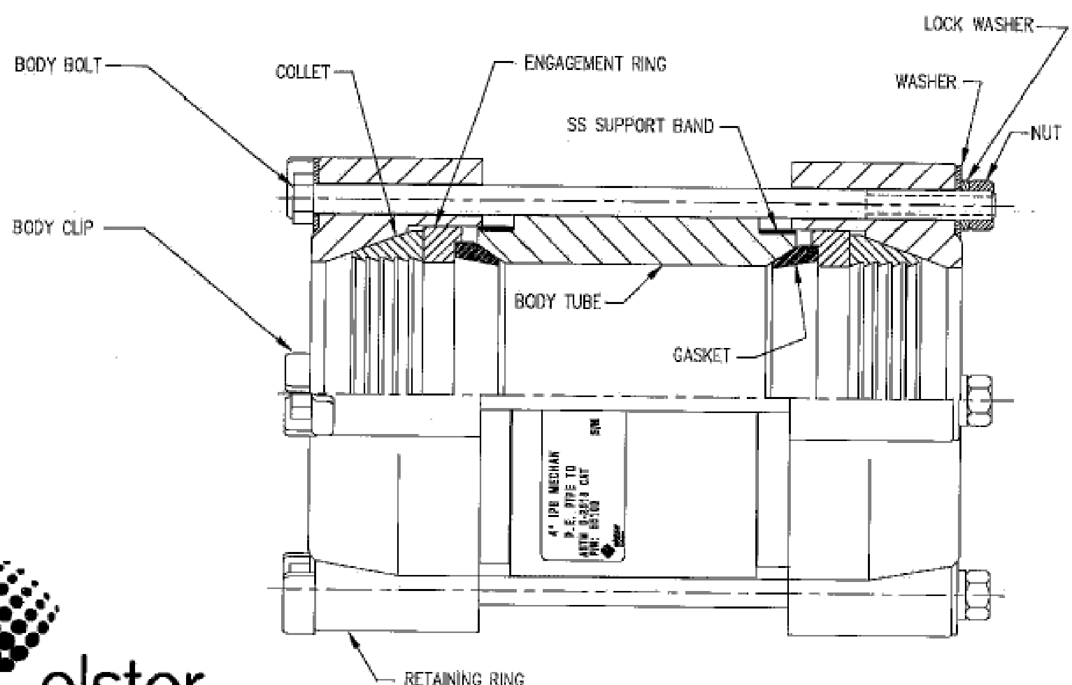
7.7 Without disassembling, pull coupling fully onto one pipe end.

7.8 Pull the coupling back onto the second pipe and center between marks.

7.9 Tighten the bolts, using a cross over tightening pattern. Specially designed clutch clips will open if the bolt is over torqued.

7.10 Uniformly torque nuts to 50-55 ft.lbs.

7.11 Leak test - soap test to verify seal.



elster
Perfection

NorthWestern Energy

Gas Standards Subject: Plastic Permalock Mechanical Tapping Tee 1 ¼" IPS – 4" IPS		Original Date 04/15/2020	Standard Number 52-PT
Supersedes	REV # 1	Revision Date 08/01/2020	Prepared / Approved By MB / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for joining a mechanical Permalock tapping tee and tapping it on plastic pipe in accordance with NorthWestern's O&M section 5500, 3130 and DOT 49 CFR 192.627.

2.0 Summary

2.1 This procedure will define the steps necessary for attaching (which includes tapping) a Permalock Mechanical Tapping Tee to plastic pipe.

2.2 *The tapping of mains under pressure, referred to as "hot taps", shall only be performed by experienced and qualified employees.*

2.3 NOTE: Permalock Mechanical Tapping Tee is the only acceptable method to attach a tapping tee to Drisco M7000 or Drisco M8000 plastic pipe.

3.0 Reference Documents

3.1 Rev R 37575 Installation Instructions Elster Perfection Permalock Tee

4.0 Material

4.1 The materials joined according to this process will be plastic pipe primarily Drisco M7000 or Drisco M8000 main with PE 4710 Permalock Tapping Tee Fitting.

5.0 Pipe Size

5.1 This procedure will cover pipe diameter size 1 ¼" - 4" IPS.

6.0 Equipment

6.1 Permalock Tapping Tee (PMTT) Assembly fitting – Tower, Saddle, O-rings and Bolts

6.2 Permalock Depth Tube (included)

6.2.1 1 ¼" IPS Requires a Blue Depth Tube

6.2.2 2- 4" IPS Requires a White Depth Tube

Fitting CANNOT BE INSTALLED without proper color Depth Tube.

6.3 Leak Test Soap

6.4 Silicone Grease (Leak Test Soap can be substituted)

6.5 5/16" T-Handle and/or Hex Socket Wrench (wrench handle should be no longer than 12')

NorthWestern *Energy*

Gas Standards Subject: Plastic Permalock Mechanical Tapping Tee 1 ¼" IPS – 4" IPS		Original Date 04/15/2020	Standard Number 52-PT
Supersedes	REV # 1	Revision Date 08/01/2020	Prepared / Approved By MB / Committee

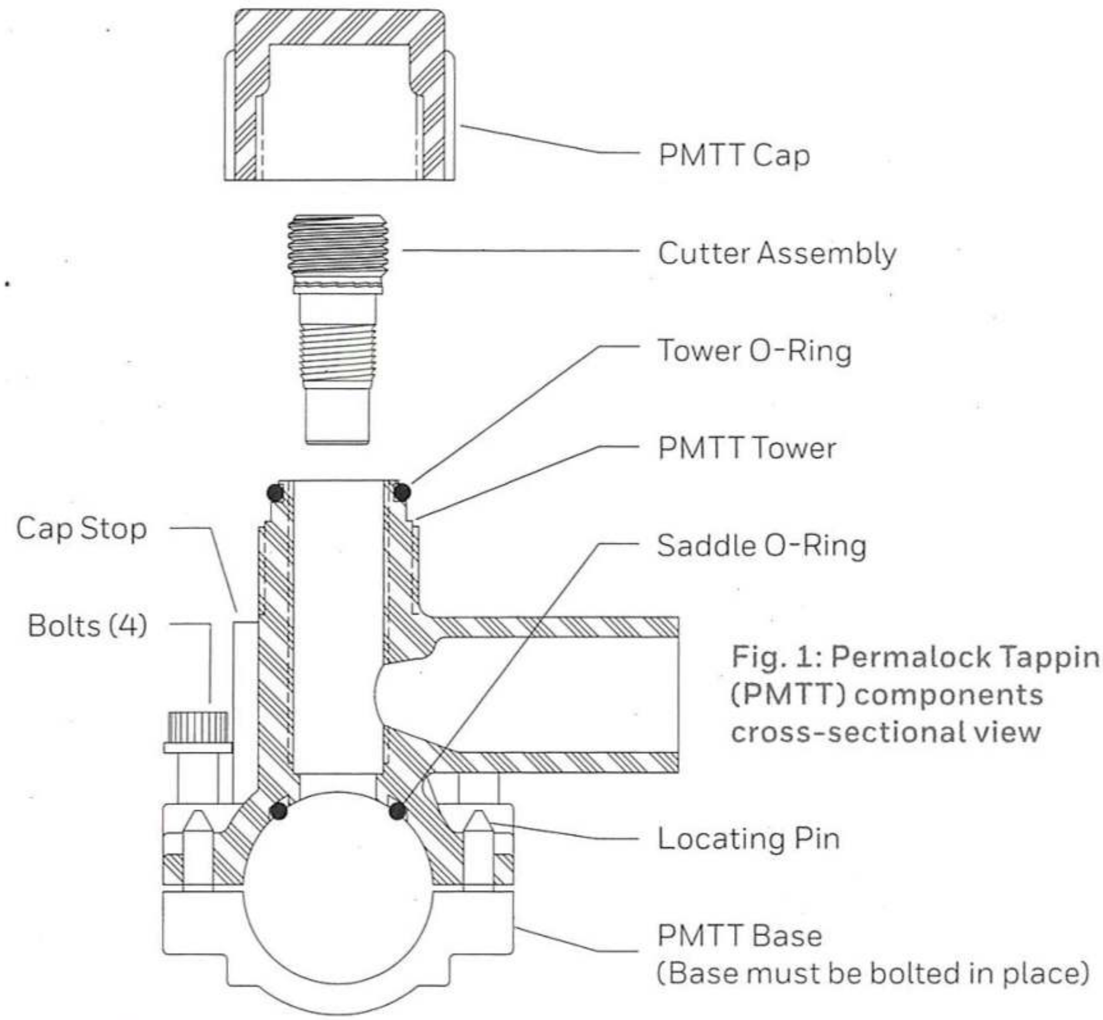


Fig. 1: Permalock Tapping Tee (PMTT) components cross-sectional view

NorthWestern Energy

Gas Standards Subject: Plastic Permalock Mechanical Tapping Tee 1 ¼” IPS – 4” IPS		Original Date 04/15/2020	Standard Number 52-PT
Supersedes	REV # 1	Revision Date 08/01/2020	Prepared / Approved By MB / Committee

7.0 Procedure

7.1 Assembly Preparation

Remove PMTT ASSEMBLY and DEPTH TUBE from the bag (check tee for TOWER and SADDLE O-RINGS).

NOTE: A blue colored depth tube is required for 1 1/4 IPS main installation, and a white colored depth tube is required for 2-4 IPS main installation. If you do not have the proper color depth tube, **DO NOT** install the fitting.

7.2 (PE) Main Preparation

Clean surface of Polyethylene (PE) Main where PMTT is to be installed. Avoid areas that are gouged or damaged. Gouge or damage cannot exceed those outlined in Construction Standard 52-W. This is critical in the area of O-ring.

LUBRICATE SADDLE O-RING AND MAIN SURFACE WITH LEAK TEST SOAP SOLUTION OR SILICONE GREASE.

7.3 Assemble onto (PE) Main

Bolt the PMTT onto PE main first by hand-threading. Tighten each bolt in a crossover pattern until the head of each bolt makes contact with the PMTT Tower (see figure below– Flush to PMTT Tower).

NOTE: It is important to tighten the bolt evenly to not strip the PMTT Base

When all 4 bolts have made contact with the PMTT tower, go back to the first bolt and tighten the bolts in the same crossover pattern with the 5/16” hex wrench in until the PMTT Tower and the PMTT Base are flush. The bolts should be flush with the bottom of the PMTT base (see figure below – Flush to PMTT Tower). Do not tighten further, a gap between the flanges in the locating pin area is acceptable (see figure below – Locating Pin and Gap).

Do not overtighten bolts. Overtightening will strip threads on the bolts. Torque values should not be utilized to install nylon bolts.

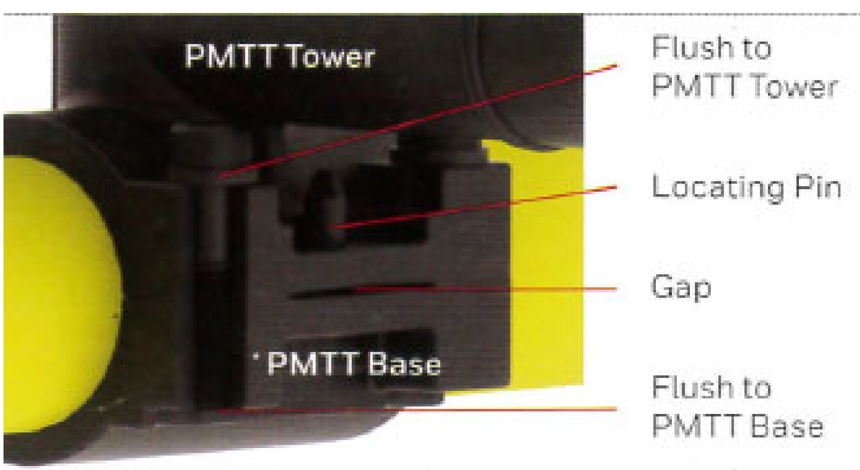


Fig. 2 - PMTT Assembly – Key areas during installation

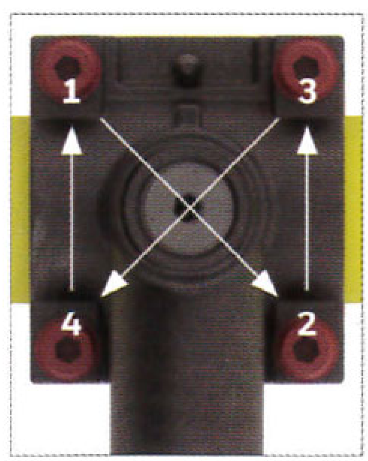


Fig. 3
Bolt tightening crossover pattern

NorthWestern Energy

Gas Standards Subject: Plastic Permalock Mechanical Tapping Tee 1 ¼" IPS – 4" IPS		Original Date 04/15/2020	Standard Number 52-PT
Supersedes	REV # 1	Revision Date 08/01/2020	Prepared / Approved By MB / Committee

7.4 Connect Outlet

Connect (PE) service line to the PMTT assembly outlet utilizing the appropriate Construction Standard.

7.5 Prior to tapping - Leak test

If hot tapping, test tapping tee/service line assembly in accordance with Construction Standard 57-B. If it passes the pressure test, release the pressure in preparation for tapping.

7.6 Tapping (PE) Main

Place DEPTH TUBE on the top of the CUTTER ASSEMBLY. Thread CUTTER ASSEMBLY downward using a 5/16" hex wrench. Continue threading the CUTTER ASSEMBLY downward until the DEPTH TUBE is flush with the PMTT tower (Fig below). The DEPTH TUBE is a visual guide and will be approximately flush with the top of the Tee Tower when the cutter is engaged.

Fig. 4 - Full installation of Cutter Assembly, Cutter Sleeve engaged in (PE) Main, Depth Tube is flush with top of PMTT Tower

7.7 Retract Cutter Punch and Remove Depth Tube

Thread CUTTER upward (counterclockwise) until top of CUTTER Punch is flush with the top of the PMTT Tower assembly (fig below). This will gasify the service. Remove and discard the DEPTH TUBE.

Utilization of the DEPTH TUBE is **REQUIRED**. The CUTTER ASSEMBLY steel locking sleeve is by design the primary anchor to the main, preventing radial, lateral and rotational movement. The DEPTH TUBE ensures the CUTTER ASSEMBLY is of sufficient depth to provide this anchor support. The O-Ring provides the seal between the tee and pipe.

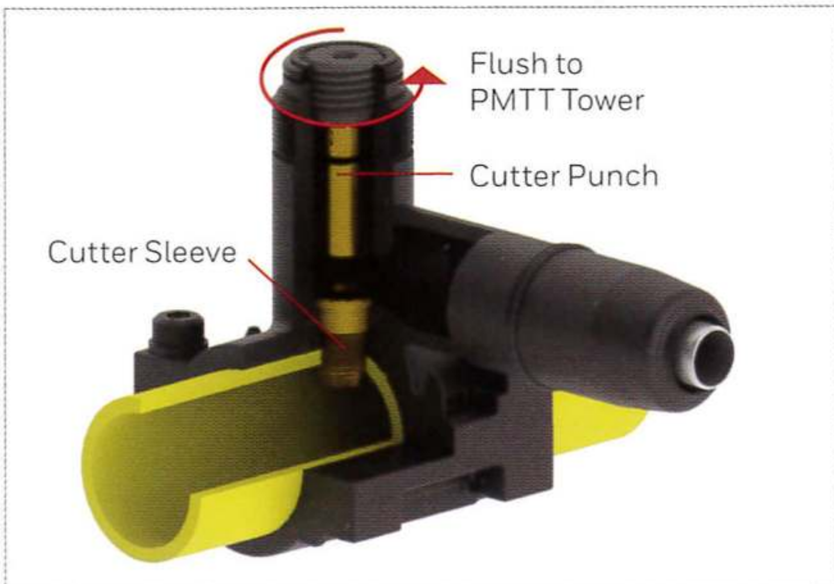


Fig.5 - Service Gasified – Cutter Punch retracted, Cutter Sleeve remains engaged with (PE) Main

7.8 Replace PMTT Cap

Install CAP on the PMTT Tower, hand tight to CAP STOP. Excessive tightening does not improve sealing performance but may cause unnecessary stress on the fitting.

7.9 After Tapping

If hot tapping, soap the cap and fitting to verify seal.

If cold tapping, pressure test the service line when the system is pressure tested.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RA
Supersedes Standard: 52-RA	REV # 2	Revision Date 09/30/09	Prepared / Approved By T. Wootton / Committee

1.0 Scope – Plastic Fusion Qualification

This standard is intended to be a general overview of proper qualification of NorthWestern Energy's personnel who join or inspect the joints of polyethylene plastic pipe and appropriate fittings on the Company's distribution system and to accommodate the minimum requirements as set by NorthWestern's O&M sections 5500 & 5510.

2.0 General

2.1 No NorthWestern Energy employee (or contracted personnel by NorthWestern Energy) shall be allowed to join plastic gas pipe on the NorthWestern Energy system without successfully completing an annual plastic fusion qualification.

3.0 Qualification Test

3.1 Qualified personnel must observe the joining process to determine proper procedures are being followed.

3.2 Qualified personnel performing inspection shall complete predetermined Operator Qualification forms and maintain records/documentation of all fusions and mechanical joints.

3.3 All test specimens must be visually inspected during and after the joining process and be acceptable to that of an approved photograph of a qualified joint.

3.4 The joint must be allowed to cool for an appropriate length of time and then be subjected to destruction testing (pertaining to the fusion) found in following areas of this handbook.

4.0 Certification

4.1 Annual certification records will be kept in a database provided by OQPlus, maintained by the proper resources, and joiners must be tested and re-certified each calendar year, not to exceed 15 months.

4.2 If the joiner being qualified does not obtain a qualification certificate, the joiner may re-qualify by retaking and passing the qualification test.

4.3 Qualification of heat fusion joiners will be revoked if one of the following occurs:

4.3.1 The qualified joiner fails to recertify each calendar year, not to exceed 15 months.

4.3.2 The qualified joiner has 1 joint under that procedure found unacceptable by testing identified in O&M standard 5500.

4.4 If qualification is revoked, the joiner may re-qualify immediately by retaking and passing the plastic fusion/joining covered tasks needed for certification on NorthWestern Energy's gas distribution system.

NorthWestern Energy

Gas Standards Subject: Plastic Plastic Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RA
Supersedes Standard: 52-RA	REV # 2	Revision Date 09/30/09	Prepared / Approved By T. Wootton / Committee

5.0 Quality Assurance

5.1 NorthWestern Energy area management and OQ qualification supervisors are responsible for assurance that only current qualified heat fusion joiners perform fusions on NorthWestern Energy's gas distribution system.

5.2 Unacceptable fusions will be documented and records maintained for all personnel qualified to join plastic pipe on NorthWestern Energy's gas distribution system.

5.3 Management may, at any time, require requalification testing if an operating individual's ability to perform certain tasks correctly is in question.

NorthWestern Energy

Gas Standards Subject: Plastic Socket Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RB
Supersedes Standard: 52-RB	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

1.0 Scope – Socket Fusion – Qualification

This standard describes NorthWestern Energy's minimum requirements for socket fusion qualification in accordance NorthWestern's O&M sections 5500 and 5510.

NOTE: Qualification procedures are performed in accordance to manufacturer recommendations.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of personnel with polyethylene pipe joined by socket fusion.

3.0 Material

3.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

3.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

3.3 This procedure CANNOT be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

3.4 NOTE: Visual and destructive qualification of the above listed fused material covers all acceptable different density pipe/fittings available for new construction installations (i.e. PE 3408/PE 3608 high density polyethylene pipe and fittings).

3.5 NOTE: Different density socket fusions (i.e. PE 3408/ PE 3608/ PE 4710) must follow the appropriate installation procedures provided in this Handbook. Please refer to installation guidelines and be aware that material densities for both pipe and fittings must be the same for correct heat fusion installations.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from ½" CTS to 2" IPS.

5.0 Equipment

5.1 Pipe or tubing cutter
5.2 Cold ring clamp
5.3 Depth gauge
5.4 Chamfering tool (NOTE: For ½" IPS – 2" IPS pipe)
5.5 Heating tool
5.6 Female and male heater adaptors
5.7 Fitting puller
5.8 Clean non-synthetic cloth
5.9 Pyrometer
5.10 Isopropyl alcohol

NorthWestern Energy

Gas Standards Subject: Plastic Socket Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RB
Supersedes Standard: 52-RB	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

6.0 Procedures – READ COMPLETELY BEFORE QUALIFICATION

6.1 Prepare the fusion joint, as described in the Socket Fusion procedures found in this handbook.

6.2 Visually inspect the fusion joint for the following:

6.2.1 Complete melt development

6.2.2 No gaps or voids present

6.2.3 External melt pressed against the coupling

6.2.4 Proper alignment

6.2.5 Proper depth

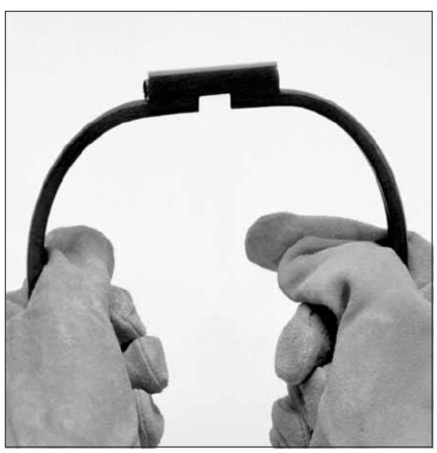
6.3 If the qualification is performed on a 2” pipe, section the joint into four quarters to expose the bond area (approximately (4) 1 inch wide strips), include all of the fitting and 8 inches of pipe on either side of the fitting.

NOTE: If the fusion is performed on pipe sizes smaller than 2”, section the joint in half.

6.4 Hold each strip at the ends, and bend the sample ends toward each other as shown in figure 6.0a.

6.5 Continue to hold each sample in the bent position and thoroughly examine the entire fusion area. If any separation, cracks, or voids are observed, the sample fusion is not satisfactory, and the joint shall be rejected.

Figure 6.0a - Socket Fusion Qualification



NorthWestern Energy

Gas Standards Subject: Plastic Butt Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RC
Supersedes Standard: 52-RC	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

1.0 Scope – Butt Fusion – Qualification

This standard describes NorthWestern Energy's minimum requirements for butt fusion qualification in accordance with NorthWestern's O&M sections 5500 and 5510.

NOTE: Qualification procedures are performed in accordance to manufacturer recommendations.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of personnel with polyethylene pipe joined by butt fusion.

3.0 Material

3.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

3.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

3.3 This procedure CANNOT be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

3.4 NOTE: Visual and destructive qualification of the above listed fused material covers all acceptable different density pipe/fittings available for new construction installations (i.e. PE 3408/3608/4710 high density polyethylene pipe and fittings).

3.5 NOTE: Different density butt fusions (i.e. PE 3408/3608/4710) must follow the appropriate installation procedures provided in this Handbook. Please refer to installation guidelines and be aware that material densities for both pipe and fittings must be the same for correct heat fusion installations.

3.6 NOTE: It is highly recommended prior to large diameter butt fusion installations (6" IPS – 12" IPS) all qualified personnel involved should review the different butt fusion machine setup, conduct test fuses, and feel completely comfortable with the machinery and material used. If additional review is needed please contact your local area supervisor/engineer. Never allow a questionable joint to be installed.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from 1/2" IPS to 12" IPS.

5.0 Equipment

5.1 Pipe cutter

5.2 Butt fusion machine

5.3 Clean non-synthetic cloth

5.4 Pyrometer

5.5 Isopropyl alcohol

NorthWestern Energy

Gas Standards Subject: Plastic Butt Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RC
Supersedes Standard: 52-RC	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

6.0 Procedures – READ COMPLETELY BEFORE QUALIFICATION

6.1 Prepare the fusion joint, as described in the Butt Fusion procedures found in this handbook.

6.2 Visually inspect the fusion for the following:

- 6.2.1 Complete and uniform melt beads
- 6.2.2 Melt beads rolled back to pipe
- 6.2.3 No gaps or voids
- 6.2.4 Proper alignment
- 6.2.5 Complete Facing
- 6.2.6 Correct fusion pressure

6.3 If the qualification is performed on 2" pipe, section the joint into four quarters to expose the bond area (approximately (4) 1 inch wide strips), include the melt area and 8 inches of pipe on either side of the fusion.

6.4 Hold each strip at the ends, and bend the sample ends toward each other as shown in figure 6.0a.

6.5 Continue to hold each sample in the bent position and thoroughly examine the entire fusion area. If any separation, cracks, or voids are observed, the sample fusion is not satisfactory, and the joint shall be rejected.

Figure 6.0a - Butt Fusion Qualification

NorthWestern Energy

Gas Standards Subject: Plastic Saddle Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RD
Supersedes Standard: 52-RD	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

1.0 Scope – Saddle Fusion – Qualification

This standard describes NorthWestern Energy's minimum requirements for saddle fusion qualification in accordance with NorthWestern's O&M sections 5500 and 5510.

NOTE: Qualification procedures are performed in accordance to manufacturer recommendations.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of personnel with polyethylene pipe joined by saddle fusion.

3.0 Material

3.1 The materials fused according to this process will be PE 2406/2708 medium density polyethylene (MDPE) pipe and fittings.

3.2 The materials fused according to this process will be PE 3408/3608/4710 high density polyethylene (HDPE) pipe and fittings.

3.3 This procedure CANNOT be used to fuse PE 2406/2708 MDPE to PE 3408/3608/4710 HDPE. Electrofusion or Mechanical Fittings must be used in these situations.

3.4 NOTE: Visual and destructive qualification of the above listed fused material covers all acceptable different density pipe/fittings available for new construction installations (i.e. PE 3408/PE 3608 high density polyethylene pipe and fittings).

3.5 NOTE: Different density saddle fusions (i.e. PE 3408/PE 3608) must follow the appropriate installation procedures provided in this Handbook. Please refer to installation guidelines and be aware that material densities for both pipe and fittings must be the same for correct heat fusion installations.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from 2" IPS to 12" IPS.

5.0 Equipment

5.1 Application tool
5.2 Heating tool
5.3 Appropriate size saddle heater adaptors
5.4 50-60 grit emery cloth (normally included in fitting package)
5.5 Clean non-synthetic cloth
5.6 Pyrometer
5.7 Isopropyl alcohol

NorthWestern Energy

Gas Standards Subject: Plastic Saddle Fusion Qualification		Original Date 06/01/2006	Standard Number 52-RD
Supersedes Standard: 52-RD	REV # 3	Revision Date 06/01/2009	Prepared / Approved By N. Hunt / Committee

6.0 Procedures – READ COMPLETELY BEFORE QUALIFICATION

6.1 Prepare the fusion joint, as described in the Saddle Fusion procedures found in this handbook, using 2" IPS PE pipe, and a 2" x ½" tapping tee.

6.2 Visually inspect the fusion for the following:

6.2.1 Properly prepared pipe surface

6.2.2 Complete pipe melt pattern

6.2.3 No gaps or voids

6.2.4 Complete melt development around base of fitting

6.2.5 Fitting placed in pipe melt pattern

6.2.6 Proper fitting alignment

6.2.7 Correct fusion/cooling pressures

6.2.8 Proper height and pattern of melt bead around saddle base.

NOTE: Melt bead shall not exceed height of fitting base (shoulder)

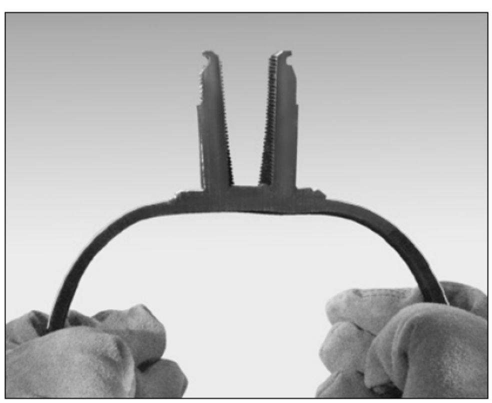
6.3 Allow the fusion to cool and place the fusion in a Porto-Power hydraulic pump (A vice may be used if a hydraulic press is unavailable). Position the fusion with the pressure point(s) just below the fusion melt bead.

6.4 Distribute pressure just below the fusion melt line until the pipe diameter is reduced to half its normal size.

6.5 If the fusion splits at the pipe to fitting melt line, the sample fusion is not satisfactory and the fusion shall be rejected.

6.6 Saddle fusion joints may also be inspected and qualified by cutting through a section of the tapping tee along with two eight inch (8") strips of plastic pipe along each side of the tee. The joint shall be inspected by bending the section and observing any incomplete melt patterns, gaps, and voids.

Figure 6.0a – Saddle Fusion Qualification



NorthWestern Energy

Gas Standards Subject: Plastic Electrofusion Coupling Qualification		Original Date 06/01/2006	Standard Number 52-RE
Supersedes Standard: 52-RE	REV # 4	Revision Date 04/01/2020	Prepared / Approved By A. Johnson / Committee

1.0 Scope

This standard describes NorthWestern Energy's minimum requirements for Electrofusion – Coupling Fusion qualification in accordance with NorthWestern's O&M sections 5500 and 5510.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of personnel with polyethylene pipe joined through an Electrofusion coupling. The inspector shall witness each individual perform a fusion; ensuring proper fusion procedures are followed.

3.0 Material

3.1 The materials fused according to this process will be polyethylene pipe/fittings.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from ½" CTS – 12" IPS.

5.0 Equipment

5.1 Electrofusion machine
5.2 Clean non-synthetic cloth
5.3 Isopropyl alcohol
5.4 Approved scraping tool
5.5 Non-oil based marker (Sharpie)
5.6 Appropriate coupling
5.7 Appropriate clamp
5.8 120 volt (AC) energy source

6.0 Procedures – READ COMPLETELY BEFORE QUALIFICATION

6.1 Prepare the fusion joint as described in the Electrofusion – Coupling procedures found in this handbook, using 2" IPS PE pipe, and a 2" Electrofusion coupling.

6.2 Visually inspect the fusion for the following:

6.2.1 Proper use of equipment
6.2.2 Correct cleaning procedures
6.2.3 Proper clamping
6.2.4 Proper alignment
6.2.5 Proper depth
6.2.6 Correct lead attachment

6.3 Ensure that correct fuse/clamp/cooling/rough handling times are identified on both the fitting and the Electrofusion machine.

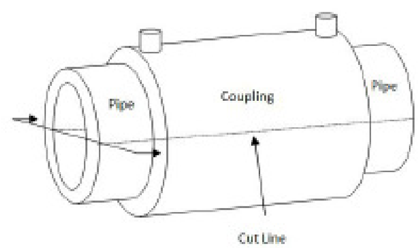
NorthWestern Energy

Gas Standards Subject: Plastic Electrofusion Coupling Qualification		Original Date 06/01/2006	Standard Number 52-RE
Supersedes Standard: 52-RE	REV # 4	Revision Date 04/01/2020	Prepared / Approved By A. Johnson / Committee

6.4 Allow the fusion to cool and perform the Destructive Tests:

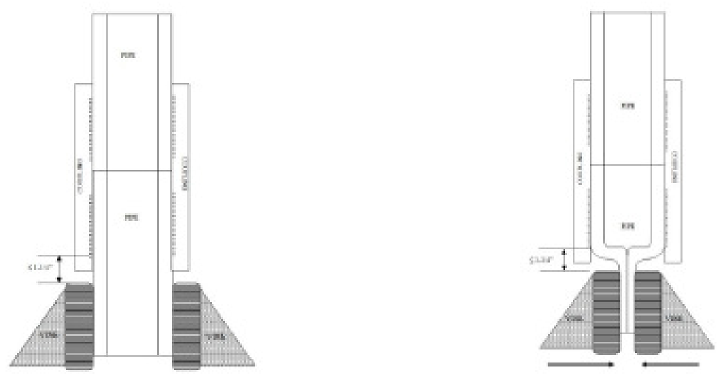
6.4.1 The pipe and fitting specimen should be cut and subjected to joint evaluation tests. Bend tests, peel tests, and crush tests are helpful in locating fusion weaknesses.

6.4.2 To prepare a specimen for crush testing, it is necessary to cut the pipe and coupling longitudinally in half as near to the centerline of the pipe and coupling as possible as shown in the image to the right. It is desirable to leave at least 3” of pipe length for 2” and smaller diameter pipes and 8” of pipe length for up to 12” diameter pipes at each end of the coupler for gripping by the vise/press.



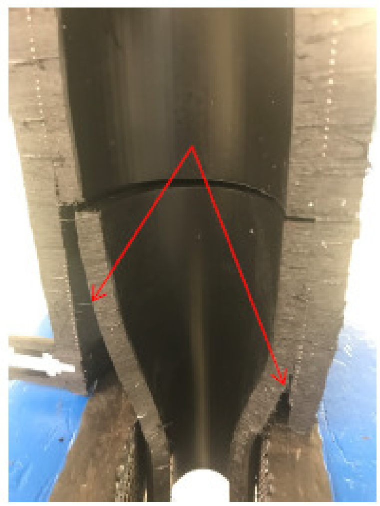
Crush Test Cut

6.4.3 Place a specimen half in a vise or press so that the outermost wire of the fusion zone is approximately 1 ¼” from the vise jaws. Close the vise jaws until the pipe walls meet. Repeat this process for each end of both halves of the coupling.



6.4.4 Inspect the crushed specimens for separation of the pipe and fitting in the fusion zone. Some minor separation (up to 15%) may be seen at the outermost region of the fusion zone, this does not constitute failure. Ductile failure of the pipe, fitting, or PE insulation around the wires is acceptable. There should be no separation at the fusion interface of the pipe and fitting beyond the 15% at the outer most edges. Refer to the following images for examples of passing and failing results.

Coupling Crush Test - Passing Result



Coupling Crush Test - Failing Result

NorthWestern Energy

Gas Standards Subject: Plastic Electrofusion Saddle Qualification		Original Date 06/01/2006	Standard Number 52-RF
Supersedes Standard: 52-RF	REV # 4	Revision Date 04/01/2020	Prepared / Approved By A. Johnson / Committee

1.0 Scope

This standard describes NorthWestern Energy's minimum requirements for Electrofusion – Saddle Fusion qualification in accordance with NorthWestern's O&M sections 5500 and 5510.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of personnel with polyethylene pipe joined through an Electrofusion tapping tee or branch saddle. The inspector shall witness each individual perform a fusion; ensuring proper fusion procedures are followed.

3.0 Material

3.1 The materials fused according to this process will be polyethylene pipe/fittings.

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from 1-1/4" IPS – 12" IPS.

5.0 Equipment

5.1 Electrofusion machine
5.2 Clean non-synthetic cloth
5.3 Isopropyl alcohol
5.4 Approved scraping tool
5.5 Non-oil based marker (Sharpie)
5.6 Appropriate fitting
5.7 Appropriate clamp
5.8 120 volt (AC) energy source

6.0 Procedures – READ COMPLETELY BEFORE QUALIFICATION

6.1 Prepare the fusion joint as described in the Electrofusion Saddle procedures found in this handbook, using 2" IPS PE pipe, and a 2" x ½" Electrofusion tapping tee.

6.2 Visually inspect the fusion for the following:

6.2.1 Proper use of equipment
6.2.2 Correct cleaning procedures
6.2.3 Proper clamping
6.2.4 Proper alignment
6.2.5 Correct lead attachment

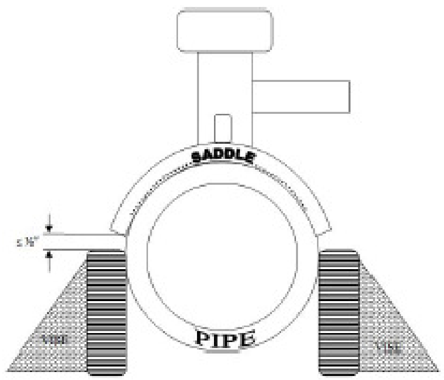
6.3 Ensure that correct fuse/clamp/cooling/rough handling times are identified on both the fitting and the Electrofusion machine.

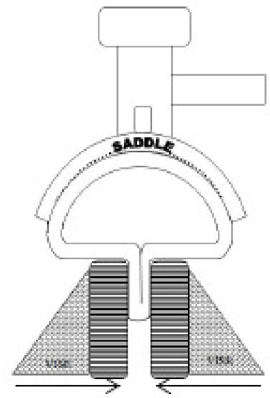
NorthWestern Energy

Gas Standards Subject: Plastic Electrofusion Saddle Qualification		Original Date 06/01/2006	Standard Number 52-RF
Supersedes Standard: 52-RF	REV # 4	Revision Date 04/01/2020	Prepared / Approved By A. Johnson / Committee

6.4 Allow the fusion to cool and perform the Destructive Tests:

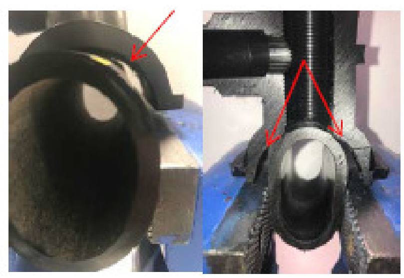
6.4.1 Tapping tees should be left intact for crush testing. Pipe lengths can be cut to the edges of the fitting base. Place the pipe and fitting into a vise so the jaws are within ½" of the bottom of the saddle. Close the vise until the inner pipe walls meet.





6.4.2 Inspect the crushed specimens for separation of the pipe and fitting in the fusion zone. Some minor separation (up to 15%) may be seen at the outermost region of the fusion zone, this does not constitute failure. Ductile failure of the pipe, fitting, or PE insulation around the wires is acceptable. There should be no separation at the fusion interface of the pipe and fitting beyond the 15% at the outermost edges. Refer to the following images for examples of passing and failing results.

Saddle Crush Test – Passing Result



Saddle Crush Test – Failing Result

NorthWestern Energy

Gas Standards Subject: Plastic Mechanical Joining Qualification General		Original Date 06/01/2006	Standard Number 52-RG
Supersedes Standard: 52-RG	REV # 2	Revision Date 09/30/2009	Prepared / Approved By T. Wootton / Committee

1.0 Scope – Mechanical Joining Qualification

The purpose of this standard is to describe NorthWestern Energy's minimum requirements for materials joining qualifications on pipelines, other than by welding, and for the proper qualification of NorthWestern Energy's personnel who join or inspect the joints of polyethylene plastic pipe and appropriate fittings on the Company's distribution system and to accommodate the minimum requirements as set by NorthWestern's O&M sections 5500 and 5510.

2.0 General

2.1 No NorthWestern Energy employee (or contracted personnel by NorthWestern Energy) shall be allowed to join plastic gas pipe on the NorthWestern Energy system without successfully completing an annual plastic joining qualification.

3.0 Qualification Test

3.1 Qualified personnel must observe the joining process to determine proper procedures for mechanical joining are being followed.

3.2 All test specimens must be visually inspected during and after the joining process and be acceptable to that of an approved qualified joint as per manufacturer specifications.

4.0 Certification

4.1 Annual certification records will be kept in a database provided by OQPlus, maintained by the proper resources, and joiners must be tested and re-certified each calendar year, not to exceed 15 months.

4.2 If a qualification certificate is not obtained by a joiner being qualified, the joiner may re-qualify by retaking and passing the qualification test.

4.3 Qualification of mechanical joiners will be revoked if one of the following occurs:

4.3.1 The qualified joiner fails to recertify each calendar year, not to exceed 15 months.

4.3.2 The qualified joiner has 1 joint under that procedure found unacceptable by testing identified in O&M standard 5500.

4.4 If qualification is revoked, the joiner may re-qualify immediately by retaking and passing the plastic joining covered tasks needed for certification on NorthWestern Energy's gas distribution system.

5.0 Quality Assurance

5.1 NorthWestern Energy area management and OQ qualification supervisors are responsible for assurance that only current qualified mechanical joiners perform joints on NorthWestern Energy's gas distribution system.

NorthWestern Energy

Gas Standards Subject: Plastic Mechanical Joining Qualification		Original Date 06/01/2006	Standard Number 52-RH
Supersedes	REV # 1	Revision Date 06/01/2006	Prepared / Approved By N. Hunt / Committee

1.0 Scope – Mechanical Joining – Qualification

This standard describes NorthWestern Energy's minimum requirements for mechanical joining qualification in accordance with NorthWestern's O&M sections 5500 and 5510.

2.0 Process

2.1 This procedure will define the steps necessary for qualification of polyethylene PE 2406 pipe joined through mechanical connections.

2.2 NOTE: Mechanical joining is one of only two methods of joining dissimilar plastics (i.e. Aldyl-A to polyethylene PE 2406). The only other approved method of joining dissimilar plastics is through the use of Electrofusion.

3.0 Material

3.1 The materials joined according to this process will be PE 2406 medium density polyethylene pipe/fittings and mechanical connections (however Aldyl-A pipe, as well as different density PE pipe (i.e. PE 3408) may be joined with this method).

4.0 Pipe Size

4.1 This procedure will cover pipe diameter sizes ranging from 1/2" CTS – 2" IPS.

5.0 Equipment

5.1 Appropriate mechanical connection fitting

5.2 Appropriate mechanical connection tool

5.3 Pipe or tubing cutter

5.4 Clean cloth

6.0 Procedures – READ COMPLETELY BEFORE JOINING

6.1 Prepare the fitting as described in the proper Mechanical Joining procedure found in this handbook using a ½" mechanical connection coupling on an 8 inch long section of ½" PE pipe.

6.2 The attachment of the mechanical connection fitting is to be done under direct observation of a qualified inspector.

6.3 Attach the mechanical fitting.

6.4 Visually inspect the fitting process for the following:

6.4.1 Proper use of equipment

6.4.2 Correct cleaning/joining procedures

6.4.3 Proper alignment

6.4.4 Complete fitting application

NorthWestern Energy

Gas Standards Subject: Plastic Certification Requirements/Tests/Guidelines		Original Date 06/01/2006	Standard Number 52-S
Supersedes Standard: 52-S	REV # 2	Revision Date 09/30/2009	Prepared / Approved By T. Wootton / Committee

1.0 Scope – Certification – Requirements, Tests, Guidelines

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general certification procedures and policies concerning plastic pipe and its qualification requirements, tests, and guidelines. This summary is intended to accommodate NorthWestern Energy's Operator Qualification Plan and best found practices.

2.0 Plastic Fusion Certification

2.1 NorthWestern Energy's (NWE) Operator Qualification (OQ) Plan identifies the covered tasks for qualification, the time interval for which the qualification of the covered task is valid, and the testing method for determining qualifications.

2.1.1 Covered tasks for plastic operator qualifications are: Socket Fusion; Butt Fusion; Saddle Fusion; Electrofusion (Saddle); Electrofusion (Coupling); and Mechanical Connection (Coupling).

2.1.2 Individuals shall re-qualify to join plastic pipe each calendar year, not to exceed 15 months.

2.1.3 NWE's approved testing method is a one on one evaluation, with the qualifier observing all fusion/joining techniques of the employee being qualified. Questions will be asked pertaining to proper fusion/joining procedures throughout qualification. Visual tests and destruction tests will be performed on the employee's fused plastic joints by the qualifier to find failures, however, if the qualifier does not feel that the employee exhibits proper fusion techniques, the employee will not be qualified for that covered task. Qualification is to be done **individually** with no other employee(s) present during examination.

2.1.4 All proper Personal Protective Equipment (PPE) shall be worn during qualification (i.e. safety glasses).

2.1.5 **All fusion equipment shall be in proper working order** (i.e. all heating irons/faces shall be clean and have adequate surfaces, mechanical and electrical equipment shall run appropriately). If fusion/joining equipment is found to be unsatisfactory, qualification may not be performed, resulting in failure(s) for the covered task(s).

2.2 If an employee does not successfully demonstrate he/she is knowledgeable to perform the covered task according to the testing methods established by NWE's Plan, the employee cannot perform the covered task on NorthWestern Energy's system unless re-qualified at a later date.

NorthWestern *Energy*

Gas Standards Subject: Plastic Certification Requirements/Tests/Guidelines		Original Date 06/01/2006	Standard Number 52-S
Supersedes Standard: 52-S	REV # 2	Revision Date 09/30/2009	Prepared / Approved By T. Wootton / Committee

2.3 If the employee fails qualification on a covered task, the employee is not eligible to be re-evaluated on this task for a minimum of **2 days**. During this time period for which the employee is not qualified to perform the covered task, local area management will determine whether the employee will continue the remainder of his present job duties or whether the employee will be reassigned to other job duties (if available) within the local operating area.

2.4 NOTE: If an employee fails qualification on a covered task, retesting will be done at the earliest and most practical time for the qualifier and the employee. The employee will be asked to travel to the qualifier at a later retest time and place (to be determined), however, if the qualifier is available, every effort will be made to accommodate local area needs to perform retests.

2.5 If the employee does not successfully demonstrate his ability to perform a covered task for a second time the employee will, again, not be able to perform the task on NorthWestern Energy's system unless re-qualified at a later date. The employee is not eligible to be re-evaluated on this task for a period of **30 days**. During the time period for which the employee is not qualified to perform the covered task, local management will determine whether the employee will continue with the remainder of his present job duties or whether the employee will be reassigned to other job duties (if available) within the local operating area. The employee and his supervisor will develop a plan and submit this plan to local management for approval containing the steps the employee will take to become knowledgeable in the covered task for which he has failed to qualify.

2.6 If the employee does not successfully demonstrate his ability to perform a covered task for a third time, the employee will, again, not be able to perform the task on NorthWestern Energy's system. NorthWestern Energy will then determine whether the employee will be eligible for further re-evaluation. If further re-evaluation is deemed appropriate, the employee is not eligible to be re-evaluated on this task for a period of **60 days**. The employee and his supervisor will develop a plan and submit this plan to local management for approval containing the steps the employee will take to become knowledgeable in the covered task for which he has failed to qualify.

2.7 If an employee fails a covered task or fails to qualify for multiple covered tasks at the same time, the employee may be subject to NorthWestern Energy's Progressive Discipline Policy to assure the employee understands the importance of meeting the OQ standard for the essential job functions of his position. NorthWestern Energy's Progressive Discipline Policy consists of differing levels of discipline, up to and including termination.

NorthWestern Energy

Gas Standards Subject: Plastic Inspection of Plastic Joints		Original Date 06/01/2006	Standard Number 52-U
Supersedes Standard: 52-U	REV # 2	Revision Date 04/01/2007	Prepared / Approved By N. Hunt / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning the inspection of plastic pipe joints in a construction environment. These procedures are intended to comply with the minimum requirements as set by NorthWestern's O&M section 5500.

2.0 Inspection of Plastic Joints

2.1 No person may carry out the inspection of joints in plastic pipe, required by the CFR, unless that person has been qualified by appropriate training and/or experience and has appropriate experience in evaluating the acceptability of plastic pipe joints under the applicable joining procedure.

2.2 To ensure proper joint appearance and integrity, a qualified NorthWestern Energy employee must examine each joint involved in the installation/inspection process on NorthWestern Energy's gas distribution system prior to joint burial/project completion.

2.3 All plastic joints installed in NorthWestern Energy's gas distribution system by NorthWestern Energy employees, and NorthWestern Energy contracted personnel, must be examined to ensure proper appearance and joint integrity.

2.4 All NorthWestern Energy employees, and NorthWestern Energy contracted personnel must have a current NorthWestern Energy qualification/certification in order to install/inspect plastic fusion joints in a construction environment in NWE's gas distribution system.

2.5 Personnel intending on inspecting fusion joints constructed by others must have their annual plastic certification current.

NorthWestern Energy

52 Plastic 52-W Repair of Plastic Pipe		Original Date 06/01/2006	Standard Number 52-W
Supersedes Standard: 52-W, 4020	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general procedures and policies concerning plastic pipe and its repair. These procedures are intended to accommodate the requirements as set by NorthWestern's O&M section 4020 and the Department of Transportation CFR 49 part 192.311.

2.0 General

2.1 *All damaged, gouged, or kinked sections of plastic pipe are to be repaired or removed from service or not put into service initially, when discovered.* Any section of pipe containing damage resulting in a loss of 10% or more wall thickness, identified in the table below, shall be removed and replaced. Guidance from supervision should be initiated for determining whether to repair or remove the area in question.

Plastic Pipe Dimensions				
Pipe Size	**SDR**	**Pipe OD**	**Minimum Wall Thickness**	**10% of Wall Thickness**
½" CTS	7.0	0.625"	0.090"	0.01"
½" IPS	9.3	0.840"	0.090"	0.01"
¾" IPS	11.0	1.050"	0.095"	0.01"
1" IPS	11.0	1.315"	0.120"	0.01"
1 ¼" IPS	11.0	1.660"	0.151"	0.02"
1 ¼" IPS	10.0	1.660"	0.166"	0.02"
1 ½" IPS	11.0	1.900"	0.173"	0.02"
2" IPS	11.0	2.375"	0.216"	0.02"
3" IPS	11.5	3.500"	0.304"	0.03"
3" IPS	11.0	3.500"	0.318"	0.03"
4" IPS	11.5	4.500"	0.391"	0.04"
4" IPS	11.0	4.500"	0.409"	0.04"
6" IPS	11.5	6.625"	0.576"	0.06"
6" IPS	11.0	6.625"	0.602"	0.06"
8" IPS	11.5	8.625"	0.750"	0.08"
8" IPS	11.0	8.625"	0.784"	0.08"
12" IPS	11.0	12.750"	1.159"	0.12"
12" IPS	9.0	12.750"	1.417"	0.14"

NorthWestern Energy

52 Plastic 52-W Repair of Plastic Pipe		Original Date 06/01/2006	Standard Number 52-W
Supersedes Standard: 52-W, 4020	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

3.0 Repair of Plastic Pipe

3.1 While performing a gas main or gas service repair, ALWAYS be aware of potentially hazardous working conditions caused from blowing gas.

3.2 Wear all proper personal protective equipment (PPE) necessary for hazardous working situations.

3.3 Cross reference area maps to identify approximate facility locations.

3.4 Be aware of possible multiple source systems (radial/loop systems) and proceed accordingly.

3.5 Ensure all underground facilities in the working area are located before digging.

3.6 Follow correct squeeze off procedures found in this handbook or use valves to ensure all sources of gas flow to the working area are completely closed and shut off.

3.7 Cut out damaged pipe and discard.

3.8 Repair plastic gas main or service through correct fusion methods and/or mechanical fittings found in this handbook.

NorthWestern Energy

Gas Standards Subject: Steel Steel General		Original Date 06/01/2006	Standard Number 53-A
Supersedes Standard: 53-A	REV # 2	Revision Date 04/01/2007	Prepared / Approved By K. Meagor / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's (NWE) general policies concerning steel materials, fittings, and procedures found on its natural gas distribution system.

2.0 Steel Pipe and Fittings

2.1 Steel pipe and fittings used to construct NorthWestern Energy's gas distribution system shall be low carbon steel pipe manufactured to meet all applicable American Society for Testing Materials (ASTM) specifications.

2.2 Steel pipe and fittings found on NorthWestern Energy's gas distribution system must be resistant to chemicals with which contact may be anticipated through the use of coatings.

2.3 Dissimilar steel pipe (i.e. stainless pipe) shall not be used nor designed into NorthWestern Energy's system.

2.4 The following pipe sizes shall be utilized for new construction:

¾", 1"; 2"; 3"; 4"; 6", 8", 10", and 12" steel pipe.

NOTE: larger size pipe is allowable but requires engineering to be completed and special welding certifications for joining.

2.4.1 In addition to the pipe sizes mentioned above, the following steel pipe sizes are currently found on NorthWestern Energy's gas distribution system; however, fittings will need to be special ordered:

½", 1-1/4", 1-1/2", 2-1/2", 3-1/2", 16", 20", and 36" steel pipe.

2.5 For a list of allowable fittings and fitting sizes used for maintenance and repair on NWE's gas distribution system, please refer to the Materials and Fittings section of this handbook. Specific fittings and procedures can be found in the hot tapping section of this manual.

3.0 Steel Procedures

3.1 Procedures for welding, coating, protecting, storing and handling have been developed and are listed in this manual.

3.2 Welding procedures have been developed in accordance with Code of Federal Regulations (49CFR192) and American Petroleum Institute (API 1104).

3.2.1 Deviation from the procedures listed herein shall not be allowed in any manner. For further information contact the Welding Engineer.

3.2.2 Only certified individuals and materials shall be used on the distribution system and shall be to the procedure's requirements.

3.2.3 For more information, see the welding section of this manual.

3.3 Storage and handling shall be done in accordance with the manufactures recommended practices or to the methods described in this manual, whichever is more strict. See the storage and Handling section in this manual.

3.4 Appropriate coatings, which are described in the steel section, shall be the only coating applied to any steel pipe on the distribution system.

NorthWestern Energy

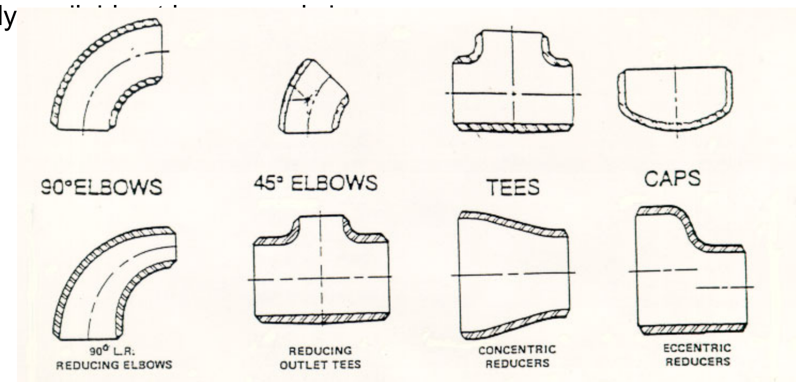
Gas Standards Subject: Steel Steel Materials/Fittings		Original Date 06/01/2006	Standard Number 53-B
Supersedes Standard: 53-B	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general construction procedures and policies concerning standard fittings.

2.0 Standard Weight Steel Butt-Weld Fittings

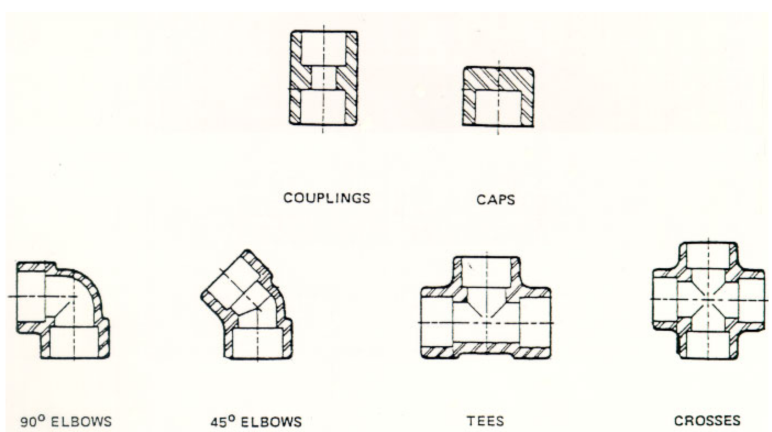
2.1 Standard weight steel butt-weld fittings shall be used exclusively for the fabrication of distribution piping 2" and over. Note: 2" pipe may be butt-welded or socket welded. In certain situations, such as limited space to work, a 4" socket coupling can be used. The additional weight of the 4" socket coupling will need to be considered when providing support for the pipeline. Circumference connected weld fittings are used whenever possible. The fitting must comply with ANSI B16.9 standard. Long radius weld elbows, as well as concentric reducers, are preferred. The following fittings are approved and readily



3.0 Socket Weld Steel Fittings

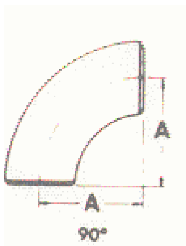
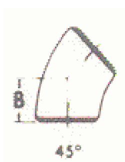
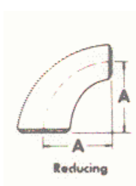
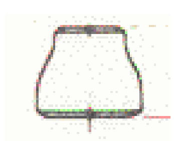
3.1 Socket weld steel fittings must comply with ANSI B16.11. NWE uses socket weld fittings for welded connections less than and including 2" diameter. Note: 2" may be butt-welded or socket welded. You will notice however that socket weld fittings are rated at 2,000 psi, and up. Socket weld fittings are to be arc welded with 6010 electrode. Welders should make certain that there is a **minimum 1/16" gap between the end of the pipe and the stopping ring,** to prevent cracking in the first pass. The following fittings are approved by NWE, for ¾" through 2" diameter pipe. In certain situations, such as limited space to work, a 4" socket coupling can be used. The additional weight of the 4" socket coupling will need to be considered when providing support for the pipeline.

Reducers Are
Also Available



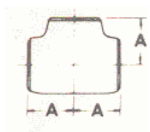
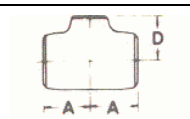
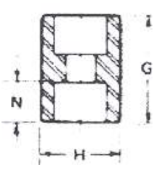
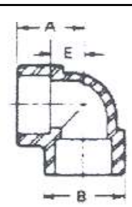
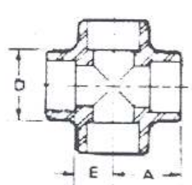
NorthWestern Energy

Gas Standards Subject: Steel Steel Materials/Fittings		Original Date 06/01/2006	Standard Number 53-B
Supersedes Standard: 53-B	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Materials/Fittings	Size	Material Code
90 Degree Long Radius Weld Elbow		
	2”	777-0739
	3”	777-0742
	4”	777-0744
	6”	777-0746
	8”	777-0748
45 Degree Long Radius Weld Elbow		
	2”	777-0819
	3”	777-0823
	4”	777-0824
	8”	777-0828
Reducing Weld Elbow		
	3" x 2"	
	4" x 3"	
Cap		
	2”	777-0490
	3”	777-0512
	4’	777-0514
	6’	777-0516
Reducer		
	3’x 2”	777-1429
	4”x 2”	777-1449
	4”x 3”	777-1452
	6”x 4”	777-1474
	8”x 6”	777-1496

NorthWestern *Energy*

Gas Standards Subject: Steel Steel Materials/Fittings		Original Date 06/01/2006	Standard Number 53-B
Supersedes Standard: 53-B	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

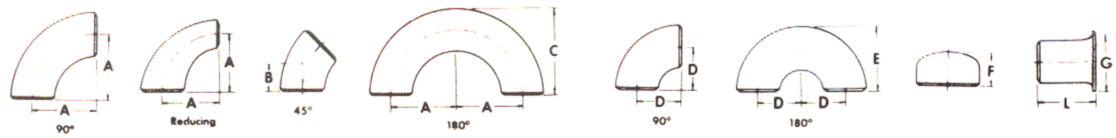
Materials/Fittings	Size	Material Code
Tee		
	2”	777-2209
	3”	777-2212
	4”	777-2214
	6”	777-2216
Reducing Tee		
	3" x 3" x 2"	7772328
	4" x 4" x 2"	7772346
Socket Coupling 3000 LB		
	3/4"	7775025
	1"	7775026
Socket 90 Degree Elbow 3000 LB		
	1"	7774566
Cross		
	2"	7770559
	4"	7770564
Autoperf/Service Tees		
	3/4" x 3/4"	7796454
	NOTE: Socket Weld – 1/2" Service	
	3/4" x 1"	10006551
	NOTE: Socket Weld – 3/4" Service	

NorthWestern Energy

Gas Standards Subject: Steel Steel Materials/Fittings		Original Date 06/01/2006	Standard Number 53-B
Supersedes Standard: 53-B	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

SEAMLESS WELD FITTINGS

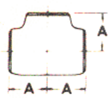
Long Radius Elbows — Short Radius Elbows — Caps — Stub Ends

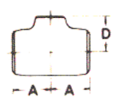


WALL THICKNESS

Nom. Pipe Size	Pipe O.D.	Light Wall	Sch 20	Sch 30	Std	Sch 40	Sch 60	X-Stg.	Sch 80	Sch 100	Sch 120	Sch 140	Sch 160	XX-Stg	A	B	C	D	E	F	L ASA	L Short	G	Nom. Pipe Size
½	.840	...	...	...	.109	.109	...	.147	.147	...	...	...	.187	.294	1½	⅝	1⅞	...	...	...	...	...	...	½
¾	1.050	.083	...	...	.113	.113	...	.154	.154	...	...	...	.218	.308	1⅛	9/16	1 11/16	...	...	...	...	2	...	¾
1	1.315	.109	...	...	.133	.133	...	.179	.179	...	...	...	.250	.358	1½	⅞	2 3/16	1	1⅝	1½	4	2	2	1
1¼	1.660	.109	...	...	.140	.140	...	.191	.191	...	...	...	.250	.382	1⅞	1	2¾	1¼	2 1/16	1½	4	2	2½	1¼
1½	1.900	.109	...	...	.145	.145	...	.200	.200	...	...	...	.281	.400	2¼	1⅛	3¼	1½	2 7/16	1½	4	2	2⅞	1½
2	2.375	.109	...	...	.154	.154	...	.218	.218	...	...	...	.343	.436	3	1⅜	4 3/16	2	3 3/16	1½	6	2½	3⅝	2
2½	2.875	.120	...	...	.203	.203	...	.276	.276	...	...	...	.375	.552	3¾	1¾	5 3/16	2½	3 15/16	1½	6	2½	4⅛	2½
3	3.500	.120	...	...	.216	.216	...	.300	.300	...	...	...	.438	.600	4½	2	6¼	3	4¾	2	6	2½	5	3
3½	4.000	.120	...	...	.226	.226	...	.318	.318	...	...	...	...	...	5¼	2¼	7¼	3½	5½	2½	6	3	5½	3½
4	4.500	.120	...	...	.237	.237	...	.337	.337	...	.438	...	.531	.674	6	2½	8¼	4	6¼	2½	6	3	6 3/16	4
5	5.563	.134	...	...	.258	.258	...	.375	.375	...	.500	...	.625	.750	7½	3⅛	10 5/16	5	7¾	3	8	3	7 5/16	5
6	6.625	.134	...	...	.280	.280	...	.432	.432	...	.562	...	.718	.864	9	3¾	12 5/16	6	9 5/16	3½	8	3½	8½	6
8	8.625	.148	.250	.277	.322	.322	.406	.500	.500	.593	.718	.812	.906	.875	12	5	16 5/16	8	12 5/16	4	8	4	10⅝	8
10	10.750	.165	.250	.307	.365	.365	.500	.500	.593	.718	.843	1.000	1.125	...	15	6¼	20⅜	10	15⅜	5	10	5	12¾	10
12	12.750	.180	.250	.330	.375	.406	.562	.500	.687	.843	1.000	1.125	1.312	...	18	7½	24⅜	12	18⅜	6	10	6	15	12
14	14.000	.250	.312	.375	.375	.438	.593	.500	.750	.937	1.093	1.250	1.406	...	21	8¾	28	14	21	6½	12	...	16¼	14
16	16.000	.250	.312	.375	.375	.500	.656	.500	.843	1.031	1.218	1.438	1.593	...	24	10	32	16	24	7	12	...	18½	16
18	18.000	.250	.312	.438	.375	.562	.750	.500	.937	1.156	1.375	1.562	1.781	...	27	11¼	36	18	27	8	12	...	21	18
20	20.000	.250	.375	.500	.375	.593	.812	.500	1.031	1.281	1.500	1.750	1.968	...	30	12½	40	20	30	9	12	...	23	20
24	24.000	.250	.375	.562	.375	.687	.968	.500	1.218	1.531	1.812	2.062	2.343	...	36	15	48	24	36	10½	12	...	27¼	24
30	30.000	.312	.500	.625	.375	...	...	.500	...	...	...	...	...	...	45	18⅝	...	...	...	...	...	...	...	30

Straight Tees — Reducing Tees — Conc. & Ecc. Reducers





Nom. Pipe Size	Outlet	A	D	L
1	1	1½	...	...
1	¾	1½	1½	2
1	½	1½	1½	2
1¼	1¼	1⅞	...	...
1¼	1	1⅞	1⅞	2
1¼	¾	1⅞	1⅞	2
1¼	½	1⅞	1⅞	2
1½	1½	2¼	...	...
1½	1¼	2¼	2¼	2½
1½	1	2¼	2¼	2½
1½	¾	2¼	2¼	2½
1½	½	2¼	2¼	2½
2	2	2½	...	...
2	1½	2½	2⅜	3
2	1¼	2½	2¼	3
2	1	2½	2	3
2	¾	2½	1¾	3
2½	2½	3	...	...
2½	2	3	2¾	3½
2½	1½	3	2⅝	3½
2½	1¼	3	2½	3½
2½	1	3	2¼	3½
3	3	3⅜	...	...
3	2½	3⅜	3¼	3½
3	2	3⅜	3	3½
3	1½	3⅜	2⅞	3½
3	1¼	3⅜	2¾	3½
3½	3½	3¾	...	...
3½	3	3¾	3⅝	4
3½	2½	3¾	3½	4
3½	2	3¾	3¼	4
3½	1½	3¾	3⅛	4
4	4	4⅛	...	...
4	3½	4⅛	4	4
4	3	4⅛	3⅞	4
4	2½	4⅛	3¾	4
4	2	4⅛	3½	4
4	1½	4⅛	3⅜	4
5	5	4⅞	...	...
5	4	4⅞	4⅝	5
5	3½	4⅞	4½	5
5	3	4⅞	4⅜	5
5	2½	4⅞	4¼	5
5	2	4⅞	4⅛	5
6	6	5⅝	...	...
6	5	5⅝	5⅜	5½
6	4	5⅝	5⅛	5½
6	3½	5⅝	5	5½
6	3	5⅝	4⅞	5½
6	2½	5⅝	4¾	5½
8	8	7	...	...
8	6	7	6⅝	6
8	5	7	6⅜	6
8	4	7	6⅛	6
8	3½	7	6	6
10	10	8½	...	...
10	8	8½	8	7
10	6	8½	7⅝	7
10	5	8½	7½	7
10	4	8½	7¼	7
12	12	10	...	...
12	10	10	9½	8
12	8	10	9	8
12	6	10	8⅝	8
12	5	10	8½	8
14	14	11	...	...
14	12	11	10⅝	13
14	10	11	10⅛	13
14	8	11	9¾	13
14	6	11	9⅜	13
16	16	12	...	...
16	14	12	12	14
16	12	12	11⅝	14
16	10	12	11⅛	14
16	8	12	10¾	14
16	6	12	10⅜	14
18	18	13½	...	...
18	16	13½	13	15
18	14	13½	13	15
18	12	13½	12⅝	15
18	10	13½	12⅛	15
18	8	13½	11¾	15
20	20	15	...	...
20	18	15	14½	20
20	16	15	14	20
20	14	15	14	20
20	12	15	13⅝	20
20	10	15	13⅛	20
20	8	15	12¾	20
24	24	17	...	...
24	20	17	17	20
24	18	17	16½	20
24	16	17	16	20
24	14	17	16	20
24	12	17	15⅝	20
24	10	17	15⅝	20

NorthWestern *Energy*

Gas Standards Subject: Steel Steel Materials/Fittings		Original Date 06/01/2006	Standard Number 53-B
Supersedes Standard: 53-B	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

WEIGHTS AND DIMENSIONS OF SEAMLESS AND WELDED PIPE

PIPE SIZES	O.D. in Inces	5	10	20	30	40	STD	60	80	E.H.	100	120	140	160	Dble. E.H.
⅛	.405	.035 .1383	.049 .1863			.068 .2447	.068 .2447		.095 .3145	.095 .3145					
¼	.540	.049 .2570	.065 .3297			.088 .4248	.088 .4248		.119 .5351	.119 .5351					
⅜	.675	.049 .3276	.065 .4235			.091 .5676	.091 .5676		.126 .7388	.126 .7388					
½	.840	.065 .5383	.083 .6710			.109 .8510	.109 .8510		.147 1.088	.147 1.088				.187 1.304	.294 1.714
¾	1.050	.065 .6838	.083 .8572			.113 1.131	.113 1.131		.154 1.474	.154 1.474				.218 1.937	.308 2.441
1	1.315	.065 .8678	.109 1.404			.133 1.679	.133 1.679		.179 2.172	.179 2.172				.250 2.844	.358 3.659
1¼	1.660	.065 1.107	.109 1.806			.140 2.273	.140 2.273		.191 2.997	.191 2.997				.250 3.765	.382 5.214
1½	1.900	.065 1.274	1.09 2.085			.145 2.718	.145 2.718		.200 3.631	.200 3.631				.281 4.859	.400 6.408
2	2.375	.065 1.604	.109 2.638			.154 3.653	.154 3.653		.218 5.022	.218 5.022				.343 7.444	.436 9.029
2½	2.875	.083 2.475	.120 3.531			.203 5.793	.203 5.793		.276 7.661	.276 7.661				.375 10.01	.552 13.70
3	3.5	.083 3.029	.120 4.332			.216 7.576	.216 7.576		.300 10.25	.300 10.25				.437 14.32	.600 18.58
3½	4.0	.083 3.472	.120 4.973			.226 9.109	.226 9.109		.318 12.51	.318 12.51					.636 22.85
4	4.50	.083 3.915	.120 5.613			.237 10.79	.237 10.79	.281 12.66	.337 14.98	.337 14.98		.437 19.01		.531 22.51	.674 27.54
4½	5.0						.247 12.53			.355 17.61					.710 32.53
5	5.563	.109 6.349	.134 7.770			.258 14.62	.258 14.62		.375 20.78	.375 20.78		.500 27.04		.625 32.96	.750 38.55
6	6.625	.109 7.585	.134 9.289			.280 18.97	.280 18.97		.432 28.57	.432 28.57		.562 36.39		.718 45.30	.864 53.16
7	7.625						.301 23.57			.500 38.05					.875 63.08
8	8.625	.109 9.914	.148 13.40	.250 22.36	.277 24.70	.322 28.55	.322 28.55	.406 35.64	.500 43.39	.500 43.39	.593 50.87	.718 60.93	.812 67.76	.906 74.69	.875 72.42
9	9.625						.342 33.90			.500 48.72					
10	10.75	.134 15.19	.165 18.70	.250 28.04	.307 34.24	.365 40.48	.365 40.48	.500 54.74	.593 64.33	.500 54.74	.718 76.93	.843 89.20	1.000 104.1	1.125 115.7	
11	11.75						.375 45.55			.500 60.07					
12	12.75	.165 22.18	.180 24.20	.250 33.38	.330 43.77	.406 53.53	.375 49.56	.562 73.16	.687 88.51	.500 65.42	.843 107.2	1.000 125.5	1.125 139.7	1.312 160.3	
14	14.0		.250 36.71	.312 45.68	.375 54.57	.437 63.37	.375 54.57	.593 84.91	.750 106.1	.500 72.09	.937 130.7	1.093 150.7	1.250 170.2	1.406 189.1	
16	16.0		.250 42.05	.312 52.36	.375 62.58	.500 82.77	.375 62.58	.656 107.5	.843 136.5	.500 82.77	1.031 164.8	1.218 192.3	1.437 223.5	1.593 245.1	
18	18.0		.250 47.39	.312 59.03	.437 82.06	.562 104.8	.375 70.59	.750 138.2	.937 170.8	.500 93.45	1.156 208.0	1.375 244.1	1.562 274.2	1.781 308.5	
20	20.0		.250 52.73	.375 78.60	.500 104.1	.593 122.9	.375 78.60	.812 166.4	1.031 208.9	.500 104.1	1.280 256.1	1.500 296.4	1.750 341.1	1.968 379.0	
22	22.0		.250 58.07	.375 86.61	.500 114.8		.375 86.61	.875 197.4	1.125 250.8	.500 114.8	1.375 302.9	1.625 353.6	1.875 403.0	2.125 451.1	
24	24.0		.250 63.41	.375 94.62	.562 140.8	.687 171.2	.375 94.62	.968 238.1	1.218 296.4	.500 125.5	1.531 367.4	1.812 429.4	2.062 483.1	2.343 541.9	

BLUE FIGURES – Wall Thickness In Inches **RED FIGURES** – Wt. Per Ft. In Pounds

NorthWestern Energy

Gas Standards Subject: Steel Steel: Coatings, Epoxies, Tapes, Outerwraps, etc.		Original Date 04/01/2015	Standard Number 53-C
Supersedes Standard:	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this guideline is to describe NorthWestern Energy's guidelines for coatings that are to be used on steel main and service gas lines in the NorthWestern Energy Distribution System. Deviation from these guidelines must be requested by local management and approved by engineering.

2.0 General

2.1 Coatings utilized shall be in accordance with the NorthWestern Energy Gas Operations and Maintenance Manual 3320.

2.2 Management shall be responsible to assure that only current qualified individuals and procedures are used to coat steel facilities.

2.3 Sections below show the coatings that are allowed on the NWE system. Deviation from these coatings has to have the manager of cathodic protection's approval, or the manager of gas system integritys approval, or be engineered and approved by a professional engineer.

2.3.1 Testing and trial of new coatings can be approved by the chair of the construction standards.

3.0 Epoxy Coatings

3.1 Epoxy coatings are allowed on pipe that is being delivered from the manufacturer.

3.1.1 Epoxy provided from manufacturer shall be fusion bonded epoxy (FBE).

3.1.2 Epoxy provided from the manufacturer shall be a minimum of 14 mils thick at time of purchase.

3.2 Epoxy is allowed to be utilized on NWE system in a field application with engineering and/or management approval.

3.2.1 Field applied 2-part epoxy shall be Denso (Protal 7200 or Protal 7125) and all preparation of the pipe and FBE coating shall be done per the manufacturer specifications.

3.3 Epoxy coated pipe is not UV stable and will degrade.

3.3.1 If storage is planned beyond 3 years the coating should either be covered or painted over to protect from UV exposure.

3.3.2 If the timeline is unknown or beyond 3 years, the coating shall be evaluated and if necessary removed and replaced with an acceptable coating.

4.0 Abrasion Resistant Coatings

4.1 Abrasion resistance overlay (ARO) coatings should be utilized for boring operations with steel pipe or where soil conditions are believed to be detrimental to the coating of the pipe.

4.2 ARO coatings are applied over the top of FBE.

4.3 ARO may be epoxy based or polymer concrete.

4.4 Typically ARO coatings are applied by the pipe manufacturer or vendor prior to delivery.

4.5 ARO coatings are allowed to be utilized on NWE system in a field application with engineering and/or management approval.

4.5.1 Field applied ARO shall be Denso and all preparation of the pipe and FBE coating shall be done per the manufacturer specifications.

4.6 ARO coatings shall be applied to achieve a minimum of 40 mils of ARO coating

4.6.1 This coating is in addition to the FBE coating so there will be approximately 54-56 mils of coating.

5.0 Tape

5.1 There are several tapes that are allowed on the NWE distribution system. The approved tapes are:

5.1.1 Cold Tape – TapeCoat H35Gray (H35G)

5.1.2 Cold Tape – TapeCoat T-Tape

5.1.3 Wax Tape – Trenton #1 below ground tape

5.1.4 Wax Tape – Trenton #2 above/below tape

5.2 Tape coatings provide adequate protection and when applied correctly will withstand most soil stresses and backfilling applications.

5.3 TapeCoat H35Gray coatings are preferred for boring applications, with appropriate protection.

5.3.1 Wax tape is not allowed for boring applications

6.0 <u>TapeCoat H35G (Stores Code: 2" Roll – 10008393, 4" Roll - 10008407)</u>

6.1 Specifications

6.1.1 Cold applied tape

6.1.2 Integrated primer on 35 mils mastic tape

6.1.3 MAF backing

6.1.4 UV stable

6.1.5 Available in 2" x 75', 4" x 75', & 6" x 75' rolls

6.1.6 Grey backing typically no text or markings, but may have TapeCoat indicated

6.2 Utilization

6.2.1 Is approved for above and below ground use

6.2.2 Can be used for longer runs of pipe

6.2.3 Can be used for butt welded joints

6.2.4 Primer is not necessary unless below 40 degrees F

6.3 Application – this is high level and not all encompassing method for application of tape. Please review the manufacturer's instructions prior to use.

6.3.1 Clean surface of the pipe with brush or wire wheel.

6.3.1.1 If tying into existing coating, prep to a rough texture.

6.3.2 Apply primer (if needed) to the entire surface including any overlap to existing coatings.

6.3.3 Start tape off roll, there is a clear backing on the mastic that needs to be removed as you apply the product.

6.3.4 Tape end should be facing downward on the pipe to limit pulling away from soil.

6.3.4.1 At the end of wrap, cut the tape so end is in downward position.

6.3.4.2 When tying rolls together maintain overlap and start over previous roll

6.3.5 Keep tape under tension and start to wrap the pipe.

6.3.5.1 Keep in mind the starting angle to meet the overlap desired.

6.3.6 Wraps should be relatively wrinkle free.

6.3.7 Maintain a 50% overlap on wraps.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Coatings, Epoxies, Tapes, Outerwraps, etc.		Original Date 04/01/2015	Standard Number 53-C
Supersedes Standard:	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

7.0 TapeCoat T-Tape (Stores Code: 2" Roll – 6730564, 4" Roll - 6730574)

7.1 Specification

7.1.1 Cold applied tape

7.1.2 65 mil mastic tape

7.1.3 MAF backing

7.1.4 Available in 2" x 25', 4" x 25', & 6" x 25' rolls

7.1.5 Grey backing tape with TapeCoat, T-Tape, below ground use only indicated

7.2 Utilization

7.2.1 Is **not** approved for above ground use, below ground use only

7.2.2 Can be used for fittings and odd shapes

7.2.3 Primer is not necessary unless below 40 degrees F

7.3 Application - this is high level and not all encompassing method for application of tape. Please review the manufacturer's instructions prior to use.

7.3.1 Clean surface of the pipe with brush or wire wheel.

7.3.1.1 If tying into existing coating, prep to a rough texture.

7.3.2 Apply primer to the entire surface including any overlap to existing coatings.

7.3.3 Start tape off roll, there is a clear backing on the mastic that needs to be removed as you apply the product.

7.3.4 When beginning the tape on straight pipe, the tape end should be facing downward on the pipe to limit pulling away from soil.

7.3.4.1 At the end of wrap, cut the tape so end is in downward position.

7.3.4.2 When tying rolls together maintain overlap and start over previous roll

7.3.5 Keep tape under tension and start to wrap the pipe.

7.3.5.1 Keep in mind the starting angle to meet the overlap desired.

7.3.6 Wraps should be relatively wrinkle free.

7.3.7 Maintain a 50% overlap on wraps.

7.3.8 The tape can be cut with a knife into shorter pieces as needed when wrapping a fitting or odd shape.

7.3.9 Press and mold the tape around each fitting and smooth out on the straight runs of pipe to insure there are no voids between the tape and the pipe or fitting.

8.0 Trenton Wax Tape #1 (Stores Code: 4" x 9' Roll - 10011656, 6" x 9' Roll - 10018386)

8.1 Specification

8.1.1 Cold applied

8.1.2 70-90 mil microcrystalline wax impregnated in a bonded synthetic fabric

8.1.3 Available in 2" x 9', 4" x 9', 6" x 9', 6" x 18', 9" x 18', and 12" x 18' rolls

8.1.4 Brown in color

8.2 Utilization

8.2.1 Is **not** approved for above ground use, below ground use only

8.2.2 Can be used for fittings and odd shapes

8.2.3 Trenton Temcoat 3000 Primer is needed at all times

8.3 Application - this is high level and not all encompassing method for application of tape. Please review the manufacturer's instructions prior to use.

8.3.1 Clean surface of the pipe with a brush or wire wheel. Pipe surface should be free of loose rust, scale, detachable prior coating, and other foreign matter.

8.3.2 If tying into existing coating, prep to a rough texture.

8.3.3 Wipe surface as clean and dry as possible.

8.3.4 If desired, gloves can be used to apply primer and tape.

8.3.5 Apply a thin, even layer of Trenton Temcoat 3000 Primer to the entire surface including bolt threads and nuts on a flanged fitting, and any overlap to existing coatings. Apply primer by hand, rubbing and pressing the primer firmly onto the surface, especially if the surface is wet, cold or rusty, in order to displace any moisture and ensure adhesion to the surface. The primer penetrates into the surface profile of the pipe.

8.3.6 Begin taping the pipe or fitting using a minimum 1" overlap. Wrap tightly around straight runs of pipe and loosely on fittings to allow the tape to be molded and conformed to the fitting. Use scissors to cut the tape to the desired length.

8.3.7 When beginning the tape on straight pipe, the tape end should be facing downward on the pipe to limit pulling away from soil.

8.3.7.1 At the end of wrap cut with scissors to have end of roll in downward position.

8.3.7.2 New roll starts underneath (apx 2-3") under the previous roll

8.3.8 Press and mold the tape around each fitting and smooth out on straight runs of pipe to insure there are no voids between the tape and the pipe or fitting.

8.3.8.1 In cases where you are taping a flanged fitting, cut the tape in square patches initially to cover the top of the bolts and the nuts more easily before taping the rest of the fitting.

8.3.9 If the pipe size is larger than 10" or if you believe soil conditions or ground conditions require additional support for the wax tape, wrap the tape with Glas-Wrap outerwrap or Moisture Cured (MC) outerwrap (see Section 11.0).

NorthWestern Energy

Gas Standards Subject: Steel Steel: Coatings, Epoxies, Tapes, Outerwraps, etc.		Original Date 04/01/2015	Standard Number 53-C
Supersedes Standard:	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

9.0 <u>Trenton Wax Tape #2 (Stores Code: Riser Kit – 10011655, 2” x 9’ Roll - 10024735, 6” x 9’ Roll – 10017827)</u>

9.1 Specification

9.1.1 Cold applied

9.1.2 70-90 mil microcrystalline wax & solvents impregnated in a bonded synthetic fabric

9.1.3 Available in Riser Kits, which include 50 square pads (6” x 6”) for a service riser

9.1.4 2” x 9” Rolls can be used to spiral wrap risers

9.1.5 6” x 9’ Rolls can be used to “cigarette” wrap risers or spiral wrap larger pipe

9.1.6 Available in 2” x 9’, 4” x 9’, 6” x 9’, 6” x 18’, 9” x 18’, and 12” x 18’ rolls

9.1.7 Gray in color

9.2 Utilization

9.2.1 Approved for above and below ground use

9.2.2 Can be painted after curing

9.2.3 Trenton Temcoat 3000 Primer is needed at all times

9.2.4 Riser sleeve or MCO 110 is needed at all times for protection.

9.3 Application - this is high level and not all encompassing method for application of tape. Please review the manufacturer’s instructions prior to use.

9.3.1 Clean surface of the pipe with a wire brush.

9.3.2 If desired, gloves can be used to apply primer and tape

9.3.3 Apply a thin layer of Trenton Temcoat 3000 Primer to the entire surface of the riser to be wrapped.

9.3.3.1 Firmly rub the primer into the pipe surface

9.3.4 Wrap (spiral or cigarette) the wax tape around the riser and press and mold the tape to smooth out any voids between the tape and the riser and insure a minimum 1” overwrap.

9.3.5 Install a plastic sleeve around the riser or install MC outerwrap (see section 11) around the wax tape to protect the tape and riser.

10.0 <u>Primers for Tape</u>

10.1 Primers help the tapes and coatings bond to the pipelines and help remove any substances and water from the surface of the pipe prior to applying the coating.

10.2 TapeCoat Primer

10.2.1 TapeCoat primer is available in a paint-on application and in aerosol.

10.2.1.1 Paint-on primer comes in a paint like can that is applied with paint brushes labeled Omni Prime (Stores Code: 10004260)

10.2.1.2 Aerosol primer comes in rattle cans labeled Royston Roybond 747 Primer (Stores Code: 10008401)

10.2.2 Omni-Prime can be used at all times with TapeCoat H35Grey or T-Tape, but is mandatory for use at temperatures below 40 degrees F.

10.3 Trenton Wax Tape Temcoat 3000 Primer (Stores Code: 1 Gallon Can – 10011657, 16oz Tub - 10024771)

10.3.1 Temcoat 3000 is a blend of microcrystalline waxes, plasticizers, and corrosion inhibitors just like what is impregnated into the wax tape.

10.3.2 Temcoat 3000 shall be used as a primer at all times before installing Trenton Wax Tape #1 or #2.

11.0 <u>Outerwraps</u>

11.1 Outerwraps are utilized in instances where additional resistance to soil stresses is needed.

11.2 Outerwraps that are available for wax tape are:

11.2.1 Poly-Ply Outerwrap

11.2.2 Glas-Wrap Outerwrap

11.2.3 Moisture Cured Outerwrap 110 (MCO 110)

11.3 Outerwraps that are available for boring are:

11.3.1 X-Wrap

12.0 Poly-Ply Outerwrap (Stores Code: 6” roll - 10011722)

12.1 Specification

12.1.1 Three layers of 0.5 mil, clear, 50-gauge, poly-vinylidene chloride, high-cling plastic

12.1.2 Available in 4” x 50’, 6” x 50’, 9” x 50’, 12” x 50’, & 18” x 36” rolls

12.2 Utilization

12.2.1 Can be used as a barrier between the Trenton Wax Tape and the soil, when the soil may be contaminated with bacteria or chemicals.

12.3 Application - this is high level and not all encompassing method for application of wrap. Please review the manufacturer’s instructions prior to use.

12.3.1 The Poly-Ply outerwrap will stick to itself, so begin by wrapping it around the pipe outside of the new wax tape to anchor it to the pipe.

12.3.2 Proceed to wrap over the wax tape with a minimum of a 1” overlap or as needed around a fitting until all of the wax tape is completely covered.

13.0 Glas-Wrap Outerwrap (Stores Code: 4” roll - 10024733, 6” roll - 10018387)

13.1 Specification

13.1.1 White, resin coated, woven fiber-glass fabric

13.1.2 Available in 4” x 150’, 6” x 150’, and 12” x 150’ rolls

13.2 Utilization

13.2.1 Can be used for additional protection and/or support as an outerwrap for Trenton Wax Tape against light backfill.

13.3 Application - this is high level and not all encompassing method for application of wrap. Please review the manufacturer’s instructions prior to use.

13.3.1 Wearing gloves, apply Glas-Wrap over the #1 Wax-Tape using 1” overlap, rubbing firmly onto the Wax-Tape.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Coatings, Epoxies, Tapes, Outerwraps, etc.		Original Date 04/01/2015	Standard Number 53-C
Supersedes Standard:	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

14.0 <u>Moisture Cured Outerwrap 110 (MCO 110) (Stores Code: 6” x 27’ Roll - 10017475)</u>

14.1 Specification

14.1.1 Moisture cured resin impregnated into a fiberglass fabric for “hard shell” protection

14.1.2 30 mil thickness when cured

14.1.3 Available in 4” x 4’. 4” x 12’, 4” x 27’, 6” x 27’, & 9” x 40’ rolls

14.1.4 MCO 110 has a 2-year shelf life. Because of this, it will probably need to be special ordered for projects, and will not be typical shelf stock.

14.2 Utilization

14.2.1 Approved for both aboveground and belowground applications.

14.2.2 Can be used for additional support and protection as an outerwrap for Trenton Wax Tape #1 or #2.

14.2.3 May be used belowground for pipe sizes larger than 10” and in rocky soils.

14.2.4 May be used aboveground on wax tape riser kits to help protect the riser.

14.3 Application - this is high level and not all encompassing method for application of wrap. Please review the manufacturer’s instructions prior to use.

14.3.1 *Use latex gloves when installing this product (they should be provided with the outerwrap).

14.3.2 On horizontal pipe, start with a downward-facing strip and wrap Trenton MCO 110 outerwrap on to the pipe in a spiral pattern, using a minimum 50% overlap. On a vertical pipe, start at the bottom and spiral up.

14.3.3 Apply only enough tension to prevent slack. The wrap can be repositioned to achieve a proper application.

14.3.4 Make sure the MCO 110 outerwrap is extended out past the underlying coating on both ends for better anchoring.

14.3.5 When a roll ends, overlap the new roll over the previous roll with the beginning edge in a downward-facing direction. Wrap the outerwrap once around the pipe to anchor the new roll before resuming the spiral wrap.

14.3.6 At the end of the last roll, there are two methods to secure the ends:

- Apply MCO outerwrap end adhesive to the existing layer before pressing down the end, in order to prevent possible unraveling before the outerwrap has cured.
- Use typical stretch wrap (saran wrap) over the black MCO 110 to hold and smooth the MCO 110. Apply the stretch wrap, tap with wire brush to make tiny holes for the gas created during curing to escape, remove after 10 minutes.

15.0 X-Wrap (Stores Code: 4" Roll – 10017659)

15.1 Specification

15.1.1 Strongback X-Wrap is a fiber glass cloth impregnated with a water activated resin that is used as a protective outershell over tape, epoxy, etc.

15.1.2 Available in 4" x 30' rolls

15.2 Utilization

15.2.1 Approved for belowground applications

15.2.2 A protective shell which offers mechanical & impact strength for road bores, directional drills, etc.

15.3 Application – this is high level and not all encompassing method for application of wrap. Please review the manufacturer's instructions prior to use.

15.3.1 Use rubber gloves when installing this product.

15.3.2 Remove from Mylar Bag

15.3.3 Spray X-Wrap with water from spray or water bottle

15.3.4 Start at opposite end of pull and spiral wrap with 50% overlap, continuing to spray with water as you wrap towards the leading edge ending with at least TWO full wraps on top of one another forming a leading edge (start 2" behind and end 2" in front).

15.3.5 Wrap with a 150 gauge Poly-Ply, after X-Wrap is hard (will turn yellow), remove Poly-Ply and you are ready to pull bore.

16.0 <u>Trenton Patch Pad (Stores Code: 10026765)</u>

16.1 Specification

16.1.1 Moldable, self-adhesive coating which can conform to a variety of profiles, combined with polymer backing which provides strong mechanical protection for buried applications.

16.1.2 Adhesive 500 mil thickness, Backing 150 mil thickness

16.1.3 4” x 4” patch

16.2 Utilization

16.2.1 <u>Is **not** approved for above ground use, below ground use only</u>

16.2.2 Can be used to cover CadWelds on the pipe

16.2.3 Can be used to cover holidays or coating damage on the pipe

16.2.4 Surface must be clean and dry, no primer required, no curing, immediate backfill.

16.3 Application - this is high level and not all encompassing method for application of the pad. Please review the manufacturer’s instructions prior to use.

16.3.1 Clean surface of the pipe and make sure surface is dry.

16.3.2 Apply adhesive/sticky fact of Trenton Patch-Pad to the surface to be covered and press to conform..

16.3.3 Ensure that the edges of the Patch-Pad are in contact with the (coated) metal surface.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Coatings, Epoxies, Tapes, Outerwraps, etc.		Original Date 04/01/2015	Standard Number 53-C
Supersedes Standard:	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

17.0 CadWeld Patches – Royston Handy Cap (Stores Code: 10017474)

17.1 Specification

17.1.1 Plastic sheet that has a dome filled with a moldable corrosion protection compound which is capped with an adhesive layer.

17.1.2 135 mil thickness

17.1.3 4” x 4” patch

17.2 Utilization

17.2.1 Is **not** approved for above ground use, below ground use only

17.2.2 Can be used to cover CadWelds on the pipe

17.2.3 Use of aerosol primer Royston 747 Primer is mandatory before applying the Handy Cap.

17.3 Application - this is high level and not all encompassing method for application of the cap. Please review the manufacturer’s instructions prior to use.

17.3.1 Clean surface of the pipe with brush or wire wheel and make sure surface is dry.

17.3.1.1 If tying into existing coating, prep to a rough texture.

17.3.2 Apply Royston 747 Primer to the entire surface including any overlap to existing coatings and allow the primer to dry completely.

17.3.3 Remove the release liner from the bottom of the Handy Cap. Bend the Handy Cap inward at the serration when applying to a small diameter pipe. Position and place the Handy Cap over the CadWeld on the pipe.

17.3.4 Push the dome of the Handy Cap firmly into the CadWeld area on the pipe. Push and mold the Handy Cap adhesive so that it forms a complete seal around the CadWeld and wires.

17.3.4.1 When applying make sure to slightly lift the lead wire away from the pipe to insure a seal between the wire and the pipe, then push the wire back down on the pipe and press the edge of the cap firmly so that the area around the wire is completely sealed.

17.3.5 In order to add additional stability for the patch, the Handy Cap and the pipe can be wrapped and covered with Tapecoat H35 if desired.

18.0 Holiday Patches

18.1 A holiday is a void or hole in the coating of the pipeline, so the pipe is exposed.

18.2 When a holiday in the pipeline coating is discovered, the holiday must be repaired.

18.3 Some options for repairing a holiday in the coating are:

18.3.1 Remove the coating around the pipe in the area of the holiday and re-tape the pipe in this area per this standard.

18.3.2 Clean the surface of the pipe around the holiday with a wire brush and prep the surrounding coating to a rough texture. Apply the Temcoat 3000 Primer to the pipe to fill in the holiday. Completely wrap the pipe to cover the holiday with either Wax Tape #1 or a TapeCoat cold applied tape as per this standard.

18.4 An alternative option for repairing a holiday in the coating, primarily when boring is:

18.4.1 Denso Protal 7125 Repair Cartridge

18.4.1.1 Repair coating for damaged FBE and other liquid coated pipelines. Also used as a coating of cadweld areas. Can be used as an abrasion resistant coating (ARO).

18.4.1.2 Can be used down to -4 F^{o}.

18.4.1.3 For the repair of pin hole holidays and damages, up to 1 in^2

18.4.1.4 Refer to manufacturer's instructions for cure times.

18.4.1.5 Please review the manufacturer's instructions prior to use. The repair areas shall be roughened using 80 grit sandpaper and wiped clean with an isopropyl alcohol soaked cloth prior to patching. Material can be applied by mixing until a uniform color is achieved. Material can then be brush applied to specified mil thickness (minimum 20 mils). Cure times are dependent on temperature and will be extended at cooler temperatures.

NorthWestern Energy

Gas Standards Subject: Steel Steel Mains		Original Date 06/01/2006	Standard Number 53-D
Supersedes Standard: 53-D	REV # 6	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this guideline is for the new construction of steel main gas lines in the NorthWestern Energy Distribution System. Deviation from these guidelines must be requested by local management and approved by engineering.

2.0 General

2.1 Procedures utilized to install a steel main shall be in accordance with the NorthWestern Gas Standards which are based on the Code of Federal Regulations (49CFR 192).

2.2 Management shall be responsible to assure that only current qualified individuals and procedures are used to install steel main in the Company's distribution system.

3.0 Material

3.1 API 5L, ASTM A53 or ASTM A106 material shall be used.

3.1.1 The grades of pipe allowed shall be grade B to X52. Grade B and X42 are preferred and should always be sought first. If Grade B and/or X42 is not available, X52 can be used.

3.1.1.1 Deviation from these grades shall require approval by engineering and shall be designed to 49CFR192.105 as detailed in Standard 69-B Steel Pipe Design of this standard.

3.2 Black pipe shall be allowed if wrapped and meets schedule requirements.

3.3 The pipe shall be 2” or greater. Note: See Standard 51, Section 1, paragraph 4 (page 51-1) for any exceptions to this.

3.4 Minimum schedules for pipe are shown on the following table.

STEEL PIPE SCHEDULES					
PIPE DIAMETER	ACTUAL DIAMETER	SCHEDULE	WALL THICKNESS	SCHEDULE	WALL THICKNESS
		SD/NE		MT	
2"	2.375"	40	0.154"	40	0.154"
3"	3.5"	30	0.188"	40	0.216"
4"	4.5"	30	0.188"	40	0.237"
6"	6.625"	NST	0.188"	NST	0.25"
8"	8.625"	20	0.25"	20	0.25"
10"	10.75"	20	0.25"	20	0.25"
12"	12.75"	20	0.25"	20	0.25"

NST - Non-Scheduled Wall Thickness

3.4.1 Deviation from this table shall require approval by engineering and shall be designed to 49CFR192.105 as detailed in Standard 69-B Steel Pipe Design of this standard.

3.4.2 Records of the engineering shall be kept with the job packet.

4.0 Allowable Fittings and Joints

4.1 All welded fittings are allowed.

4.2 Dresser fittings are required adjacent to any cast iron fitting. All other mechanical fittings are not permitted.

4.3 Pipe shall be aligned as straight as possible with a maximum angle of no more than 3 degrees.

4.3.1 Mitered joints shall not be utilized as a means of changing the direction of pipelines. Care shall be taken to align piping as close to 0 degrees of deflection as possible. As a last effort to remedy joint misalignment or field connections, mitered joints may be used with prior knowledgeable supervision approval. Mitered joints that are allowed shall be limited to less than 3 degrees of deflection.

4.3.2 Fittings are the preferred method for direction change. Fields bends are not allowed unless required for a grade change that results in less than a 22-1/2 degree radius bend. Bends shall be completed by an individual that is OQ certified to bend mains using appropriate radius bending equipment. Wrinkle bends are not permitted.

4.3.3 Each field bend in steel pipe must comply with the following:

4.3.3.1 A bend must not impair the serviceability of the pipe.

4.3.3.2 Each bend must have a smooth contour and be free from buckling, cracks, or any other mechanical damage.

4.3.3.3 On pipe containing a longitudinal weld, the longitudinal weld must be as near as practicable to the neutral axis of the bend unless:

4.3.3.3.1 The bend is made with an internal bending mandrel;

or

4.3.3.3.2 The pipe is 12 inches (305 millimeters) or less in outside diameter or has a diameter to wall thickness ratio less than 70.

4.3.3.4 Bends shall not include any circumferential welds.

4.3.3.5 Wrought- steel welding elbows and transverse segments of these elbows may not be used for changes in direction on steel pipe that is 2 inches (51 millimeters) or more in diameter unless the arc length, as measured along the crotch, is at least 1 inch (25 millimeters).

4.3.4 See standard 53-W.

5.0 Coating - Epoxy and Tape

5.1 Coating (Epoxy and Tape) shall be completed in accordance with the coating requirements put forth in this handbook.

6.0 Excavation

6.1 Excavation, boring, bedding and burial depth shall be completed in accordance with the excavation requirements put forth in this handbook.

7.0 Connecting / Joining of Pipe

7.1 Welding shall be done in accordance to the specified welding procedure with a currently certified welder.

7.1.1 Certified welder has to have been certified or completed a weld in the previous six months.

8.0 Testing of Pipe

8.1 All pipe that has been assembled shall be tested in accordance with the testing requirements of this handbook.

8.1.1 Testing shall include but is not limited to the following; Pigging, Purging, Pressure Testing, and Soaping.

9.0 Transportation, Storage, and Handling of Pipe

9.1 Transportation, storage, and handling of pipe shall be done in accordance with NWE standards.

NorthWestern Energy

Gas Standards Subject: Steel Steel Services		Original Date 06/01/2006	Standard Number 53-E
Supersedes Standard: 53-E	REV# 6	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this guideline is for the new construction of steel main gas lines in the NorthWestern Energy Distribution System. Deviation from these guidelines must be approved by local management and require engineering to be completed. This guide shall not be used in any manner for construction of plastic services.

2.0 General

2.1 Procedures utilized to install a steel to steel service shall be in accordance with the NorthWestern Gas Standards which are based on the Code of Federal Regulations (49CFR 192).

2.2 Management shall be responsible to assure that only current qualified individuals and procedures are used to install steel services in the Company's distribution system.

2.3 In no case shall a piggybacked service be allowed without local management's approval.

2.3.1 A piggyback service shall not serve more than two customers.

2.3.2 Piggybacked services shall be marked on riser with standard tagging and on the map (i.e ditch card or mapping system).

3.0 Material

3.1 API 5L, ASTM A53 or ASTM A106 material shall be used.

3.1.1 The grades of pipe allowed shall be grade B to X52. Grade B and X42 are preferred and should always be sought first. If Grade B and/or X42 is not available, X52 can be used.

3.1.1.1 Deviation from these grades shall require approval by engineering and shall be designed to 49CFR192.105 as detailed in Standard 69-B Steel Pipe Design of this standard.

3.2 Service pipe shall be ¾", 1", 2", 4", 6", 8", 10", and 12 inch.

3.3 Schedule 40 pipe shall be the maximum thickness used unless approved by local management and engineered to 49CFR192.105.

3.3.1 Records of the engineering shall be kept with the job packet.

4.0 Allowable Fittings and Joints

4.1 All welded fittings are allowed.

4.1.1 Tees

4.1.1.1 ½” – 1” Autoperf Tees are allowable.

4.1.1.2 2” Service Tee without transition is allowed.

4.1.1.3 Services larger than 2” shall use bottom-out or side-out fittings.

4.2 No mechanical fittings shall be used in new construction of steel services.

4.3 Pipe shall be aligned as straight as possible with a maximum angle of no more than 3 degrees.

4.3.1 Mitered joints shall not be utilized as a means of changing the direction of pipelines. Care shall be taken to align piping as close to 0 degrees of deflection as possible. As a last effort to remedy joint misalignment or field connections, mitered joints may be used with prior knowledgeable supervision approval. Mitered joints that are allowed shall be limited to less than 3 degrees of deflection.

4.3.2 Fittings are the preferred method for direction change. Field bends are not allowed unless for a grade change that results in less than a 22-1/2 degree radius bend on pipe 2” and over. Bends of 90 degrees for pipe smaller than 1” may be completed. All bends shall be completed by an individual that is OQ certified to bend mains using appropriate radius bending equipment. Wrinkle bends are not permitted.

4.3.3 Each field bend in steel pipe must comply with the following:

4.3.3.1 A bend must not impair the serviceability of the pipe.

4.3.3.2 Each bend must have a smooth contour and be free from buckling, cracks, or any other mechanical damage.

4.3.3.3 On pipe containing a longitudinal weld, the longitudinal weld must be as near as practicable to the neutral axis of the bend unless:

4.3.3.3.1 The bend is made with an internal bending mandrel; or

4.3.3.3.2 The pipe is 12 inches (305 millimeters) or less in outside diameter or has a diameter to wall thickness ratio less than 70.

4.3.3.4 Bends shall not include any circumferential welds.

4.3.3.5 Wrought- steel welding elbows and transverse segments of these elbows may not be used for changes in direction on steel pipe that is 2 inches (51 millimeters) or more in diameter unless the arc length, as measured along the crotch, is at least 1 inch (25 millimeters).

4.3.4 See standard 53-W

5.0 Service Riser

5.1 Should be fabricated by local skilled labor or purchased from a reputable dealer that meets NWE's standards.

5.1.1 Local fabrication shall be completed by a currently certified welder per the welding section of the handbook.

5.2 When elbows are required they shall be long radius elbows.

6.0 Coating – Epoxy and Tape

6.1 Coating (Epoxy and Tape) shall be completed in accordance with this coating requirements put forth in this handbook.

7.0 Excavation

7.1 Excavation, boring, bedding and burial depth shall be completed in accordance with the excavation requirements put forth in this handbook.

7.2 All new risers located in concrete or asphalt, or any hard surface, must be sleeved at the ground line to prevent damage.

NOTE: If hard surfacing can be expected in the foreseeable future, incorporate a sleeve on the riser.

8.0 Connecting / Joining of Pipe

8.1 Welding shall be done in accordance with the specified welding procedure with a currently certified welder.

8.1.1 Certified welder has to have been certified or completed a weld in the previous six months.

9.0 Testing of Pipe

9.1 All pipe that has been assembled shall be tested in accordance with the testing requirements of this handbook.

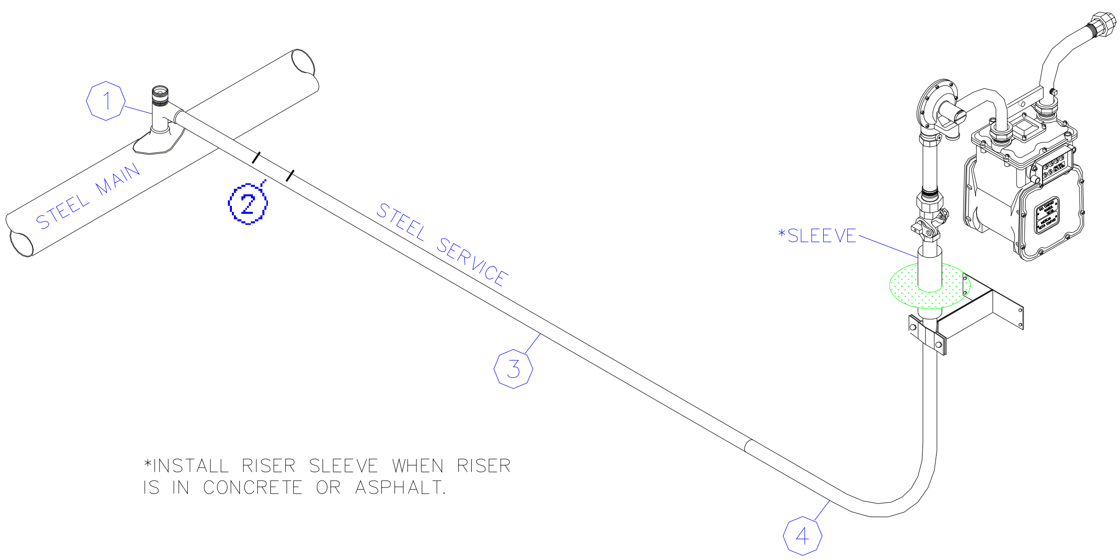
9.1.1 Testing shall include but is not limited to Pigging, Purging, Pressure Testing, and Soaping.

NorthWestern Energy

Gas Standards Subject: Steel Steel Services		Original Date 06/01/2006	Standard Number 53-E
Supersedes Standard: 53-E	REV# 6	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

STEEL TO STEEL SERVICE RISER/METER SET

Maintenance Only, Not New Construction



Materials/Fittings with Sizes Available	**Material Code**
Part 1 – Autoperf/Service Tee	
¾”x ¾” Tee	7796454
¾”x 1” Tee	10006551
Part 2 - EFV	
¾” EFV, 775 scfh	10011733
¾” EFV, 1800 scfh	10011734
1” EFV, 775 scfh	10011735
1” EFV, 1325 scfh	10011736
1” EFV, 1800 scfh	10011737
Part 3 - Pipe	
3/4” Bare Steel	7500105
1” Bare Steel	7500106
¾” Coated Steel	7503505
1” Coated Steel	7503506
Part 4 – Steel to Steel Riser	
3/4” x 3/4”	10002630 (SDNE)
¾” x 1”	

NorthWestern *Energy*

Gas Standards Subject: Steel Installation of Anodes		Original Date 06/01/2006	Standard Number 53-J
Supersedes Standard: 53-J	REV # 6	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general construction procedures and policies concerning installation of magnesium anodes.

2.0 Installation of Anodes

Each magnesium anode installed on a distribution system must comply with following:

2.1 Anodes installed to protect the system should be installed at the main and not on services and deeper than the bottom of the main and off to one side of the main. Soil conditions (i.e. sand) may dictate the need for deviations in depth. Separately protected services may have anodes installed at the service.

2.1.1 Montana – The anode connection to the main shall be made in a test station, it should NOT be directly connected to the main.

2.2 Thermit welding shall be used to attach the anode or test wire to a steel main. When using Thermit welding on steel mains, the charge should be limited to a 15gram cartridge.

2.3 Anode wires or test wires that are connected to the tracer system are attached the same as a service wire - Refer to Tracer Wire Standard 52-L, Figure 3.3a.

2.4 Each bared wire and bared metallic area at the point of connection to the pipeline must be coated with electrical insulation and be compatible with the pipe coating and insulation on the wire.

2.5 When installing anodes on farm-taps the anode should be installed at the tap and not at the end of the service. A test station should be installed with the anode.

2.6 Anode beds (when required) should be installed following engineering project design.

2.7 Appropriate location records will be kept for all anodes that are installed.

2.7.1 Montana - A test station will ensure that it is locatable.

2.8 See drawings – Test Station Anode Installations on an All Plastic Installation and Test Station Anode Installation - Isolation From Steel Pipe.

2.9 Every steel main to plastic main transition in Montana, is required to be cathodically isolated. A Test Station is required. Tracer wire shall be isolated in the test station. Refer to Figure 2 – Isolation from Steel Pipe.

2.10 Every separately protected section of main shall have a test station installed. Refer to Figure 2 – Isolation from Steel Pipe.

2.11 Every cased crossing shall have a test station installed.

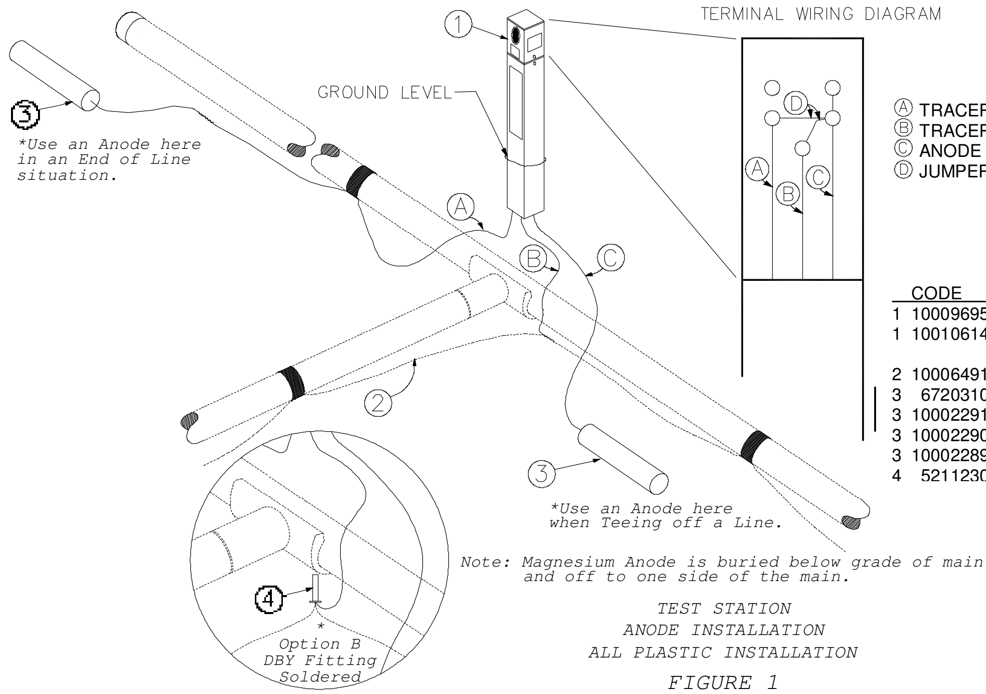
NOTE: Please refer to 63-A (Casing Installation) found in this handbook for more information pertaining to this subject.

2.12 Anodes should be backfilled with compacted native soil, **not** sand, pea gravel or other high resistance material. Anodes should be backfilled while still dry. Do not pre-soak the anode before backfilling, this can lead to premature failure. Anodes can be wet down after backfilling, or left to absorb natural soil moisture.

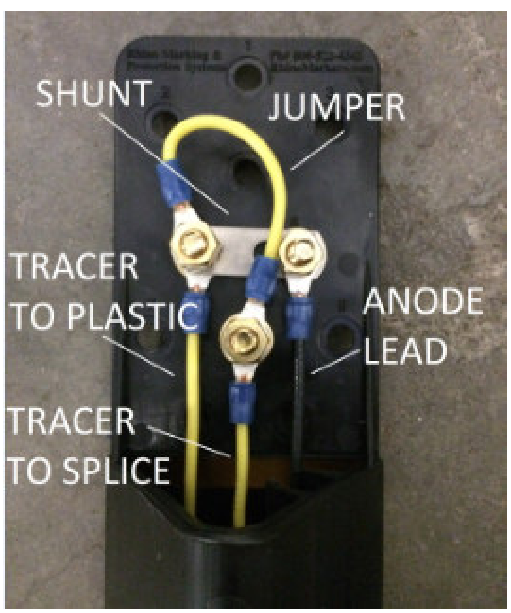
***NorthWestern** Energy*

Gas Standards Subject: Steel Installation of Anodes		Original Date 06/01/2006	Standard Number 53-J
Supersedes Standard: 53-J	REV # 6	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

Figure 1 – All Plastic Installation



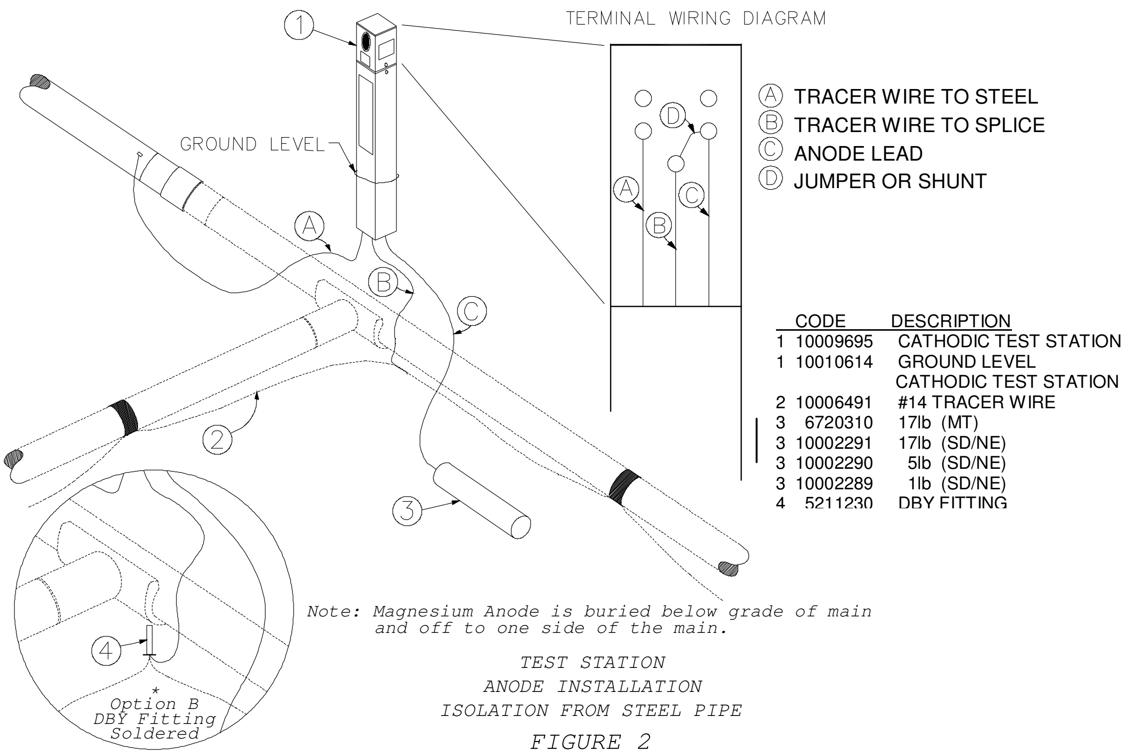
	CODE	DESCRIPTION
1	10009695	CATHODIC TEST STATION
1	10010614	GROUND LEVEL CATHODIC TEST STATION
2	10006491	#14 TRACER WIRE
3	6720310	17lb (MT)
3	10002291	17lb (SD/NE)
3	10002290	5lb (SD/NE)
3	10002289	1lb (SD/NE)
4	5211230	DBY FITTING

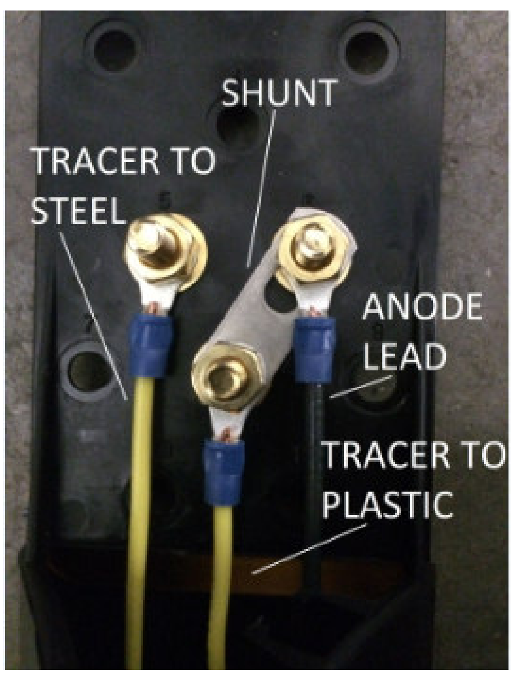


NorthWestern *Energy*

Gas Standards Subject: Steel Installation of Anodes		Original Date 06/01/2006	Standard Number 53-J
Supersedes Standard: 53-J	REV # 6	Revision Date 04/01/2016	Prepared / Approved By AJ / Committee

Figure 2 – Isolation from Steel Pipe





NorthWestern Energy

Steel Hot Tapping		Original Date 06/01/2006	Standard Number 53-K
Supersedes Standard: 53-K	REV# 7	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's requirements for tapping pipelines under pressure. This standard is intended to comply with DOT 49 CFR part 192.627.

2.0 General

2.1 Please refer to Standard 57-B (Pressure Testing Lines) found in this handbook for more information pertaining to this subject.

2.2 Please refer to Standard 57-C (Soaping) found in this handbook for more information pertaining to this subject.

2.3 Please refer to Standard 53-C (Coating) found in this handbook for more information pertaining to this subject.

2.4 Please refer to Standard 53-J (Installation of Anodes) found in this handbook for more information pertaining to this subject.

3.0 Tapping Pipelines Under Pressure

3.1 *The tapping of mains under pressure, referred to as "hot taps",* ***shall only be performed by experienced and qualified crews***. When tapping through a valve, care must be exercised to determine that the pressures which will be encountered are less than the maximum PSIG rating of the tapping equipment, valves, flanges, nipples, screw fittings, etc. Also, consider the limitation of the tapping equipment as related to boring bar travel and recession.

3.2 Manufacturers operating instructions are to be consulted and followed to determine proper procedures in use of tapping and plugging equipment as well as the limitations.

3.3 A qualified instructor shall conduct a formal review of tapping equipment, manufacturer's operating instructions, and a training session, for the use of this equipment as per O.Q. requirements. Documentation for this training will be kept per OQ requirements.

3.4 As a matter of general practice, no-blow service tees shall be used when connecting a new gas service to a live gas line. Extensive use of line stopper equipment is recommended on high and intermediate pressure lines when performing operation, maintenance or installation duties. Bagging equipment may be used on low-pressure lines. The tapping and/or plugging of mains under a planned operation may include the use of the tapping and stopping equipment available in your own Area, as well as other Areas within the Company.

3.5 Care shall be used in setting and removing line stopper plugs, so that gas pressure does not push the operating handle up suddenly, striking the operator. Stand clear when operating these handles.

3.6 As this equipment often extends several feet above the gas line, it shall be protected against being struck by material, equipment, or passing traffic.

3.7 The stopping devices often leak slightly and must not be relied upon for complete gas shut off.

3.8 In certain instances it may be necessary to work live lines. No one other than employees shall be permitted near the work area and when necessary the area shall be roped off or barricaded to exclude un-authorized persons.

3.9 No smoking by employees or other persons shall be allowed near the job. All equipment, vehicles and persons shall be kept in a position so that the wind carrying escaping gas is away from them. When necessary, the man in charge shall assign flagmen to keep persons and vehicles well clear of the area and to guard against smoking or other sources of ignition.

3.10 Whenever a section of metal pipe is to be cut or joined so that its electrical continuity is affected, a metallic electrical bond or jumper shall be established across the point where the cut or joint is to be made to prevent a spark or an arc from occurring.

3.11 An employee shall man a dry chemical fire extinguisher remaining outside the immediate hazard area. This employee will be waiting and watching to assist the men at work and shall only enter the area to extinguish fire or help men out of the area, not assist in the work.

4.0 Steel Service Tapping Tee (Auto-Perf)

4.1 Materials

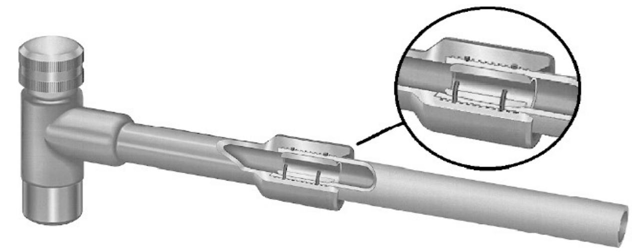
Plastic Service

Material Code 7796767
¾" x ¾" Tee w/ ½" MDPE Transition

Material Code 10005044
¾" x ¾" Tee w/ 1" MDPE Transition

Material Code 10002636
¾" x ¾" Tee w/ ½" CTS MDPE Transition

Material Code 10002637
¾" x ¾" Tee w/ ¾" MDPE Transition
Mueller or GFCP



-18102
/transition

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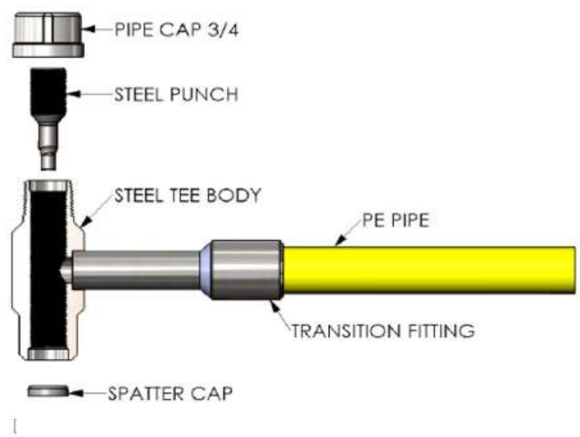
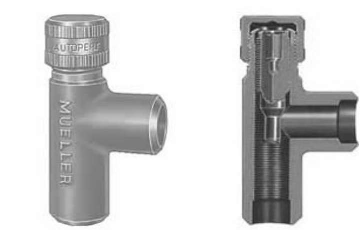
H-18104



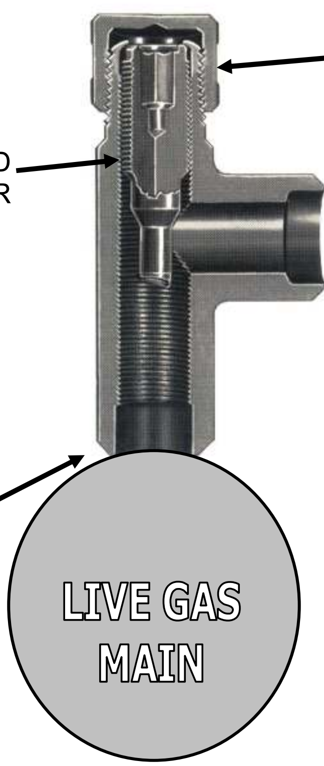
Steel Service

Material Code 7796454
¾" x ¾" Tee
Socket Weld ½" Service

Material Code 10006551
¾" x 1" Tee
Socket Weld ¾" Service



H-18102



SEAL CAP (BUBBLE TIGHT)

THREADED PERFORATOR

SOCKET WELDED ONE SIZE SMALLER THAN OUTLET.

EXAMPLE: ¾" X 1" TEE CAN BE SOCKET WELDED TO A ¾" SERVICE.

SHOULDER ACTS AS SHUT-OFF ONCE THE MAIN HAS BEEN PERFORATED

3/16" MINIMUM FILLET WELD

WELDER QUALIFIED UNDER
53-PB-Part 2
WELDING TEE #MPC-WPS-32

4.2 Steel Service Tapping Tee Installation

4.2.1 Remove the completion cap and perforator from the tee body. Set the perforator aside, taking special care to keep it clean and dry – exposure to oil, dirt or moisture can degrade the special lubricant on the perforator and prevent the perforator from functioning properly. Protect all threads in the body and on the parts from dirt contamination.

- Mueller – Set aside the cap with the perforator
- GFCP – Re-install the cap

4.2.2 Attach the tee body to a main of material and wall thickness appropriate for the perforator, maximum 0.281” wall thickness.

4.2.2.1 Orient the tee, either perpendicular to the main, or parallel to the main. The tee must be square to the main for the perforator to work properly. The perforator tip could break if the perforator contacts the pipe at an angle.

4.2.2.2 When using a Steel Service Tapping Tee that transitions to a plastic service line:

- The tracer wire should be Cad Welded 2” from the outlet of the tee before the fitting is welded to the main.
- If placing the tee parallel with the main, ensure that the plastic transition has a large radius so as not to induce excess stress on the transition point.
- The length of the steel used for the Transition Fitting in the Steel Service Tap Tee is the minimum length required to ensure that the heat generated during the welding process is dissipated and will not migrate to the Polyethylene to Steel Transition Zone. Shortening any steel could cause damage to the fitting.

4.2.2.3 The fillet weld to the gas main should be made on clean/shiny pipe, at least **12” from any other fitting**.

4.2.2.4 If needed, the tee should be saddled with a ½” round file or grinder to give a close fit (no gap over 1/16”).

4.2.2.5 For the GFCP fitting, keep the splatter plug in place to avoid any weld spatter entering the internal threads.

4.2.2.6 After completing the fillet weld, the fitting should be allowed to cool until you can hold your hand on it.

4.2.3 If connecting to plastic, ensure that the reinforcement sleeve is installed at the transition fitting.

4.2.4 Attach the service line to the tee body and extend the line to the first shut-off point.

4.2.5 Pressure test the tee and service line.

4.3 Tapping - Mueller Steel Service Tapping Tee (AutoPerf)

4.3.1 Insert the perforator into the tee body until the top of the perforator is ¼” below the top of the tee opening. DO NOT APPLY ANY LUBRICANT TO THE PERFORATOR, ITS TIP, OR THE TEE BODY.

4.3.2 Crimp the top of the tee.

4.3.2.1 H18097 Compact Crimping Tool: Fully retract anvil face by turning hex nut counter-clockwise. Apply a light coat of cutting grease or oil to the internal threads of the tool and the anvil face. Thread the tool onto the tee body hand tight. Turn the hex nut clockwise until contact is made with the top of the tee body. Using a suitable smooth jawed wrench, turn the hex nut ¾ to one full turn clockwise to crimp the top of the tee. Turn the shaft in the counter-clockwise direction and remove the tool.

4.3.2.2 H-18092 Pressure Rated Crimping Tool: Thread the tool onto the tee body wrench tight. Ratchet the tool shaft ¾ to one full turn clockwise to crimp the top of the tee body. Turn the shaft in the counter-clockwise direction and remove the tool.

4.3.3 Use the Mueller H18090 NO-BLO Operating Wrench, or similar ratchet drive wrench, to rotate the perforator and pierce the main by rotating the ratchet handle clockwise in ¼ turn increments. (To attach the H18090 tool, first engage the tool shaft with the hex socket in the perforator, then attach the tool body to the body of the tee wrench tight.) ONCE THE PERFORATOR CONTACTS THE MAIN, CONTINUE TURNING IN THIS MANNER UNTIL THE PERFORATION IS COMPLETE – DO NOT STOP THE OPERATION OR ATTEMPT TO BACK OUT THE PERFORATOR BEFORE PIERCING THE PIPE. IN THE EVENT OF A FAILED PERFORATION, DO NOT ATTEMPT TO USE SECOND PERFORATOR IN THE SAME TEE BODY.

4.3.4 Once the main is pierced, continue turning clockwise until the perforator seats tightly in the main.

4.3.5 Ratchet the handle counter-clockwise until the perforator firmly contacts the crimped top of the tee, forming a metal to metal seal. Remove tool from tee body.

4.3.6 Install the completion cap using a good grade of pipe thread sealant, and tighten firmly. Install the completion cap obtaining a bubble tight seal and thoroughly check the cap for leakage with the aid of a soap test.

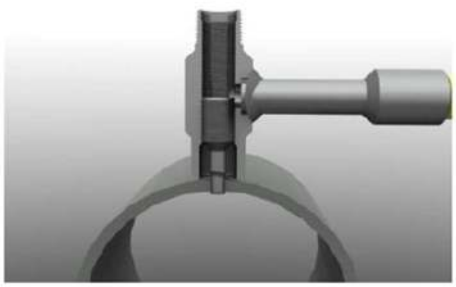
4.4 Tapping - GFCP Steel Service Tapping Tee

4.4.1 Install the perforator into the tee body by hand to avoid cross threading.

4.4.2 Use a ratchet driver and 3/8” extension hex bit to screw down the perforator. Once the perforator comes in contact with the steel main it will take approximately 20 full revolutions to seat the punch onto the steel main.

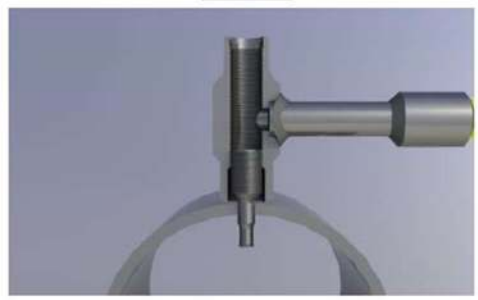
4.4.3 It is IMPORTANT to ensure that the perforator is threaded all the way through the steel main wall to guarantee retention of the steel remnant (see picture).

Picture A:



Detail of first step of the punching process.

Picture B:



Detail of second step of the punching process.

4.4.4 After tapping the steel main, screw the perforator back up to the top of the steel tee body. Apply pipe sealant to the male pipe threads and re-install the pipe cap to a wrench tight joint.

4.5 Completion

4.5.1 Perform bell hole inspection and record pipe to soil reading.

4.5.2 Wrap the fitting and any exposed steel pipe.

4.5.3 Purge the service line at the riser and secure all above ground piping.

4.5.4 Pad the connection with proper compaction under and around the piping. This eliminates dangerous shear forces from overburden and frost.

NorthWestern Energy

Steel Hot Tapping		Original Date 06/01/2006	Standard Number 53-K
Supersedes Standard: 53-K	REV# 7	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

5.0 Service Tee

5.1 Service Tee Materials

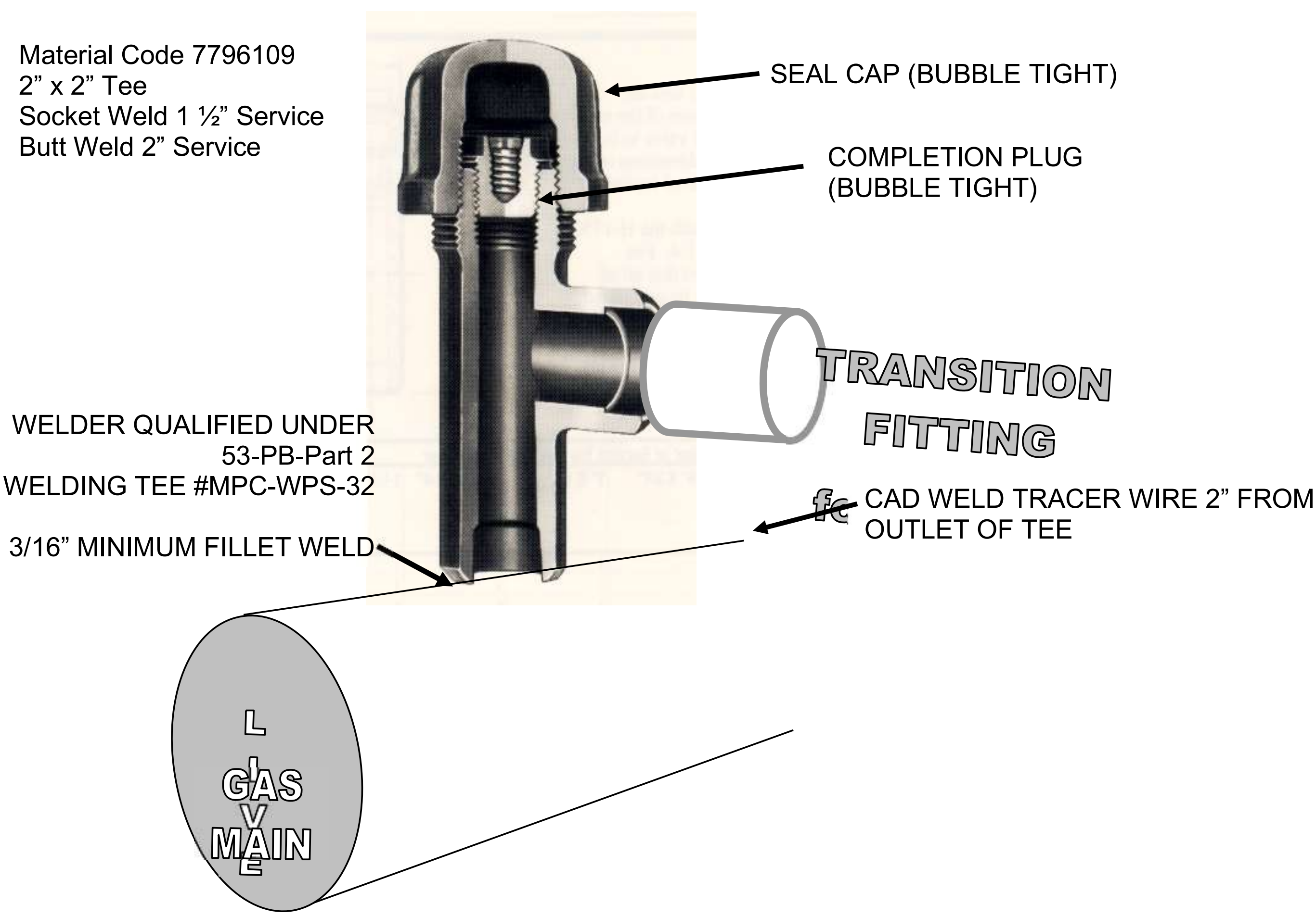
Material Code 7796105 (Auto Perf Tee is preferred)
¾” x ¾” Tee
Socket Weld ½” Service

H-17500

Material Code 7796106 (Auto Perf Tee is preferred)
1” x 1” Tee
Socket Weld ¾” Service

Material Code 7796107
1 ¼” x 1 ¼” Tee
Socket Weld 1” Service

Material Code 7796109
2” x 2” Tee
Socket Weld 1 ½” Service
Butt Weld 2” Service



5.2 Service Tee Installation Procedure

5.2.1 Tracer wire should be Cad Welded 2" from the outlet of the tee before the fitting is welded to the main.

5.2.2 The fillet weld to the gas main should be made to shiny clean pipe, at least **12" from any other fitting**.

5.2.3 The tee should be saddled with a ½" round file or grinder to give a close fit (no gap over 1/16").

5.2.4 **The completion plug should be removed from the tee for welding and air test.**

5.2.5 After completing the fillet weld, the fitting should be allowed to cool until you can hold your hand on it.

5.2.6 Soap test the connection and service line, as well as the riser connections.

5.2.7 Follow **<u>Mueller Instruction Manual Procedures</u>** for all acts performed with Mueller tools. App. B2.

5.2.8 Before drilling the gas main it is always good to set the bit down in the tee and make certain it has plenty of clearance (won't chew up the completion threads or remove the shoulder the stopper sets on). When the Mueller machine is secured in the No-Blo Valve, pull the boring bar all the way up and make sure you can close the valve. Part Numbers (stamped in each part) can be referenced in Small Mueller Machines Tab for all procedures.

5.2.9 Care should always be taken not to drill too fast because the bit may thread into the top of the main and snap off. *Secure the locking mechanism to prevent the bit from spiraling into the pipe.* Make sure the bit will rotate freely before you stop drilling.

5.2.10 **<u>Follow Mueller procedures</u>** to complete the fitting, making sure to get a bubble tight seal with the completion plug.

5.2.11 Perform bell hole inspection and record pipe to soil reading.

5.2.12 Wrap the fitting and any exposed steel pipe.

5.2.13 Purge the service line at the riser and secure all above ground piping.

5.2.14 Pad the connection with proper compaction under and around the piping. This eliminates dangerous shear forces from overburden and frost.

5.2.15 Install the reinforcement sleeve at the transition fitting, if connecting to plastic.

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Steel Hot Tapping		Original Date 06/01/2006	Standard Number 53-K
Supersedes Standard: 53-K	REV# 7	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

6.0 One Piece Line Stopper (Small Mueller Machine)

6.1 One Piece Line Stopper Materials

Material Code 7792018
¾" Line Stopper

Material Code 7792019
1" Line Stopper

Material Code 7792020
1 ¼" Line Stopper

Material Code 7792022
2" Line Stopper

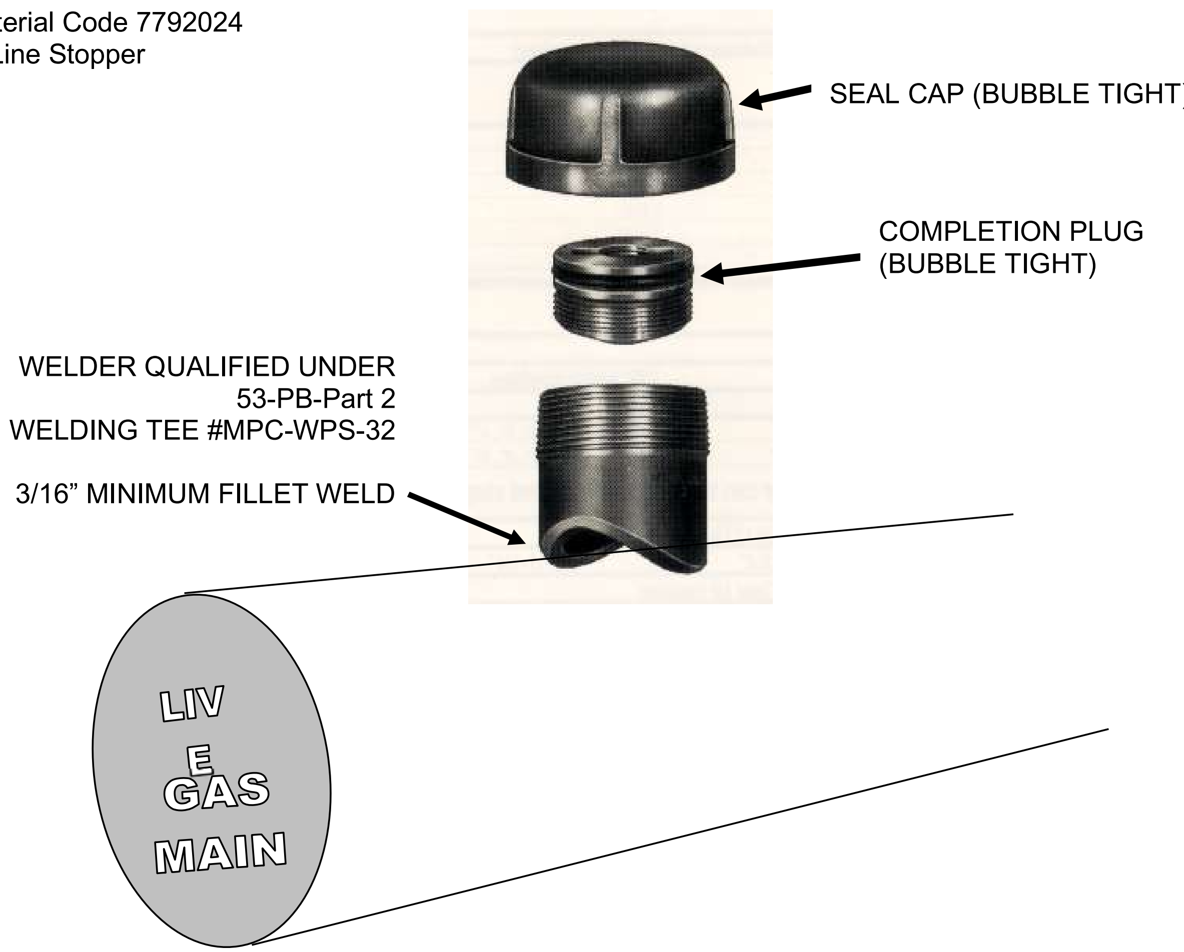
Material Code 7792023
3" Line Stopper

Material Code 7792024
4" Line Stopper

H-17190

¾" to 4" One Piece

Small Mueller
Machine



6.2 One Piece Line Stopper Installation Procedure

6.2.1 The fillet weld to the gas main should be made to shiny clean pipe, at least **12" from any other fitting**.

6.2.2 The fitting should be tacked in four places to prevent distortion (no gap over 1/16").

6.2.3 **The completion plug should be removed from the tee for welding**.

6.2.4 After making the fillet weld, the fitting should be allowed to cool until you can hold your hand on it.

6.2.5 Select the proper valve and drill bit from the tables in **Small Mueller Machine Tab**.

6.2.6 **<u>Follow Mueller procedures</u>** for tapping the main. Before drilling the gas main it is always good to set the bit down in the fitting and make certain it has plenty of clearance (won't chew up the completion threads). When the Mueller machine is secured in the Valve, pull the boring bar all the way up and make sure you can close the valve. **Part Numbers** (stamped in each part) can be reference in **Small Mueller Tapping Machine** for all procedures.

6.2.7 Care should always be taken not to drill too fast because the bit may thread into the top of the main and snap off. *Secure the locking mechanism to prevent the bit from spiraling into the pipe.* Make sure the bit will rotate freely before you stop drilling.

6.2.8 **<u>Follow Mueller procedures</u>** to stop off the fitting, always remembering to expand the rubber stopper slowly (i.e. 90 seconds).

6.2.9 The line downstream of the fitting can usually be blown down to check for a good "stop off" by center punching a small hole in the pipe.

6.2.10 Once the stopper is secure, make the necessary welds and release the stopper. Soap test the joints.

6.2.11 **<u>Follow Mueller procedures</u>** to complete the fitting, making sure to get a bubble tight seal with the completion plug.

6.2.12 Perform bell hole inspection and record pipe to soil reading.

6.2.13 Wrap the fitting and any exposed steel pipe.

6.2.14 Pad the connection with proper compaction under and around the piping. This eliminates dangerous shear forces from overburden and frost.

NorthWestern Energy

Steel Hot Tapping		Original Date 06/01/2006	Standard Number 53-K
Supersedes Standard: 53-K	REV# 7	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

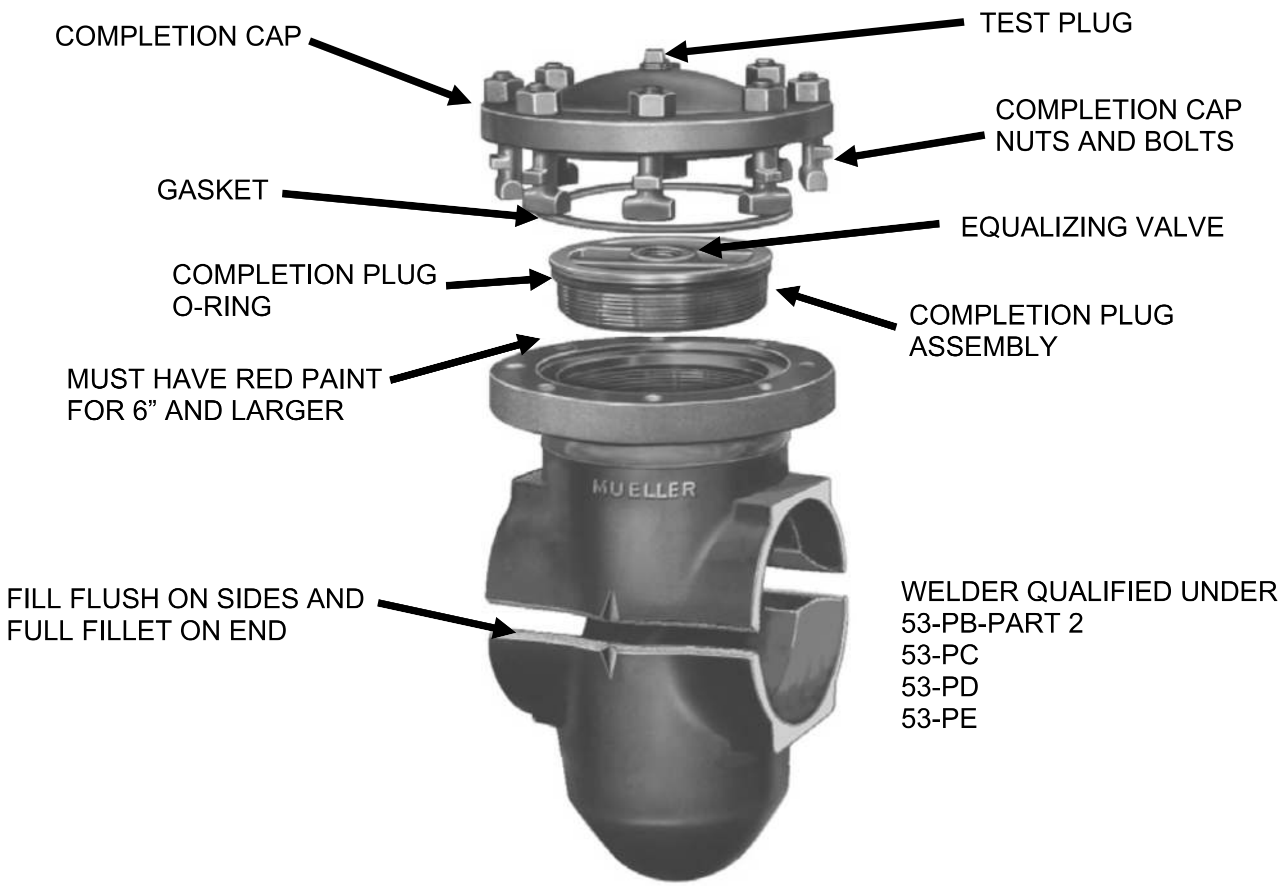
7.0 Two Piece Line Stopper

7.1 Two Piece Line Stopper Materials

Some of these fittings may be available for emergency use, although they are not in stores. For any planned work, the appropriate fittings should be ordered well in advance of the needed time. Other fitting configurations are available.

Thin Wall Fittings and Tapping Equipment can be used successfully on standard wall pipe.

Standard Wall Fittings and Tapping Equipment may not work 100% on the thin wall pipe.



NorthWestern Energy

Steel Hot Tapping		Original Date 06/01/2006	Standard Number 53-K
Supersedes Standard: 53-K	REV# 7	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

7.1 Two Piece Line Stopper Materials (Continued)

Mueller Standard Line Stopper

H-17055

H-17055 ¾”, 1”, and 1 ¼” (250psig)

Material Code 7791905
¾” Line Stopper

Material Code 7791906
1” Line Stopper

Material Code 7791907
1 ¼” Line Stopper

H-17155

H-17155 1 ½” and 2” (250psig)

Material Code 7791908
1 ½” Line Stopper

Material Code 7791909
2” Line Stopper

H-17255 3” and 4” (standard wall, 275psig)

Material Code 7791912
3” Line Stopper

Material Code 7791914
4” Line Stopper

H-17255
or
H-17275

H-17275 6” and 8” (thin wall, 275psig)
Other 6” and 8” configurations are available.

Material Code 7791935
6” Line Stopper

Material Code 7791940
8” Line Stopper

Thin Wall Fittings and Tapping Equipment can be used successfully on standard wall pipe.

7.1 Two Piece Line Stopper Materials (Continued)

Mueller Side-Out Line Stopper
Side-Out fittings work well where the tap needs to stay the same depth as the existing main.

H-17355 3” and 4” (standard wall, 275psig)

Material Code 10008831
3” Side-Out Line Stopper

Material Code 10008832
4” Side-Out Line Stopper

H-17375 6” and 8” (thin wall, 275psig)

Material Code 10021991
6” Side-Out Line Stopper

Material Code 10021992
8” Side-Out Line Stopper

Thin Wall Fittings and Tapping Equipment can be used successfully on standard wall pipe.

7.1 Two Piece Line Stopper Materials (Continued)

Mueller Bottom-Out Line Stopper
Bottom-Out fittings work well where the tap needs to be lower than the existing main.

H-17160 2” (250psig)

Material Code 10002443
2” Bottom-Out Line Stopper

H-17260 3” and 4” (standard wall, 275psig)

Material Code 10002444
3” Bottom-Out Line Stopper

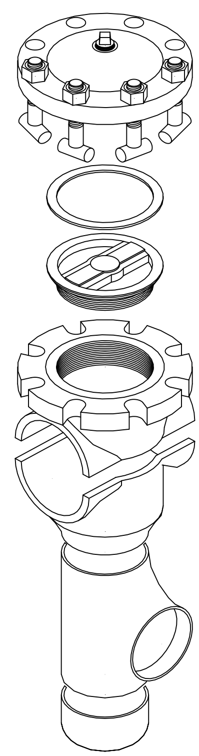
Material Code 10002445
4” Bottom-Out Line Stopper

H-17280 6” and 8” (thin wall, 275psig)
This fitting comes with the bottom opening made with Schedule 40 pipe.
Other 6” and 8” configurations are available.

Material Code 10008300
6” Bottom-Out Line Stopper

Material Code 10000611
8” Bottom-Out Line Stopper

Thin Wall Fittings and Tapping Equipment can be used successfully on standard wall pipe.



The Bottom-Out fitting shall have a tee and a cap welded to the bottom outlet rather than an elbow. This is to trap any debris that may be in the line.

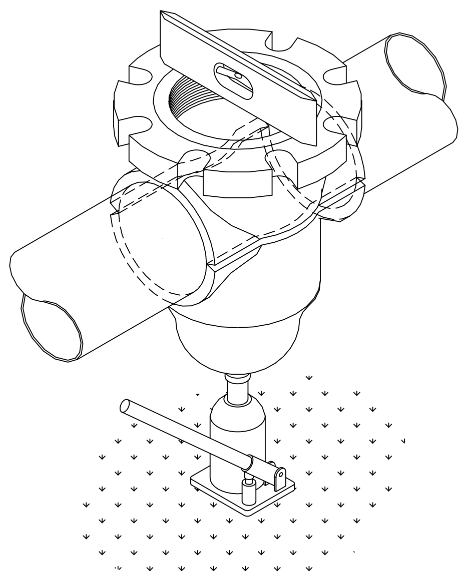
7.2 Two Piece Line Stopper Installation Procedure

7.2.1 The Two Piece Flange Top machine process shall be performed by personnel qualified by experience with this equipment.

7.2.2 When a two piece fitting is required; welders certified with 53-PB-Part 2, 53-PC, 53-PD, and 53-PE shall weld the fitting on the pipe.

7.2.3 Remove all pipeline coating, leaving clean pipe 6" out from each end. Strip the fitting as shown.

7.2.4 Place a bottle jack under the pipeline and set the bottom half. Raise this section until it just touches the pipe.



7.2.5 Set the top section and make sure it is level (perpendicular to the run).

7.2.6 Get an equal gap on the sides and tack weld the top section to the bottom section.

7.2.7 Weld the sides of the fitting first; this welding will shrink the two halves tight to the pipeline.

7.2.8 **DON'T ROTATE THE FITTING TO SPEED UP THE SIDE WELDS, THE FITTING CAN SIEZE TO THE PIPE.**

7.2.9 Fill the sides up flush with weld and fill the ends up to the shoulder.

7.2.10 **FOLLOW MUELLER INSTRUCTION MANUAL PROCEDURES TO TAP AND STOP FITTINGS**.

7.2.11 Perform bell hole inspection and record pipe to soil reading.

7.2.12 Wrap the fitting and any exposed steel pipe.

7.2.13 Pad the connection with proper compaction under and around the piping. This eliminates dangerous shear forces from overburden and frost.

NorthWestern Energy

Gas Standards Subject: Steel Abandonments and Retirement for Steel		Original Date 06/01/2006	Standard Number 53-L
Supersedes Standard: 53-L	REV # 5	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this guideline is for the abandonment / retirement of steel mains and service gas lines in the NorthWestern Energy Distribution System. Deviation from these guidelines must be approved by local management and require engineering to be completed. This guide shall not be used in any manner for construction, retirement, or abandonment of plastic services. These procedures are intended to comply with the requirements as set by NorthWestern's O&M standard 3190.

2.0 General

2.1 Procedures utilized to retire/abandon a steel main or service shall be in accordance with the NorthWestern Gas Standards, which are based on the Code of Federal Regulations (49CFR 192).

2.2 Pipe covered by this standard are: ¾", 1", 1-1/4", 2", 3", 4", 6", 8", 10", and 12".

2.3 Retirement of steel main shall be approved by the Corrosion Department to ensure Cathodic System Integrity.

2.4 When abandoned, all facilities (main, service, and/or vaults) shall be physically disconnected from the system, purged, and sealed at both ends to avoid combustible accumulation.

2.4.1 Vaults shall be filled with acceptable compaction material.

2.4.2 If the volume of gas is minor, mains and services do not need to be purged.

2.5 Management shall be responsible to assure that only current qualified individuals, materials, and procedures are used to retire/abandon steel mains/services in the Company's distribution system.

2.6 The methods that are available for the retirement/abandonment of mains and services in the distribution system fall into 2 catagories. Lines that still have active pressure on them and lines that are abandoned and dead. See section 6.0 for detailed procedures on these methods.

2.6.1 Acceptable methods for retirement of a main/service line that still has active pressure are as follows.

2.6.1.1 For lines through 1 inch, a steel plug method shall be used.

2.6.1.2 For a 1 ¼ inch through 2 inch line, a steel plug or socket cap method may be used.

2.6.1.3 For lines greater than 2 inch, a cap method with a butt weld shall be used. The butt weld cap method may also be used on 2 inch.

2.6.2 Acceptable methods for retirement of an abandoned/dead main/service line are as follows:

2.6.2.1 It is preferred, where practical, to remove the abandoned pipe.

2.6.2.2 For lines through 1 inch a plug method shall be used, either steel or redwood.

2.6.2.3 For 1 ¼ inch lines, steel plugs, redwood plugs, steel caps or steel plates shall be used.

2.6.2.4 For lines over 1 ¼ inch, a steel cap or plate method shall be used.

2.6.3 Foam, earthen plugs, crimping, hammering, bending, edge (zipper) welds, and/or oxyacetylene heating/welding are prohibited and shall not be used in any manner in the retirement of a steel main / service.

Note: Local engineering may specify another method for retirements/abandonments based on location or engineering judgment. Record of deviation from this standard shall be documented and kept in the job packet and noted on the ditch card. Documentation shall include reasons and supporting materials.

3.0 Material

3.1 Accepted materials to be used in the retirement/abandonment of a main or service shall be steel caps, steel plates, steel plugs or redwood plugs. Specific specifications are:

3.1.1 Steel Plugs and Steel Plates

3.1.1.1 Plug material shall be made from hot rolled A36 or equivalent steel.

3.1.1.2 Plate material shall be A-36 or equivalent steel.

3.1.1.3 Steel Caps

3.1.1.3.1 Caps shall be made from A517 or equivalent material.

3.1.1.4 Redwood Plugs

3.1.1.4.1 Redwood plugs for this use are stores coded. #10010511 for pipe ½” to 1 ¼” in diameter.

4.0 Excavation

4.1 Excavation, boring, bedding and burial depth shall be completed in accordance with the excavation requirements put forth in Standard 55 of this handbook.

5.0 Coating – Epoxy and Tape

5.1 Coating (Epoxy and Tape) shall be completed in accordance with the coatig requirements put forth in this handbook.

6.0 Procedure for Retirement / Abandonment

6.1 Lines shall be stopped or bypassed using appropriate and acceptable means (i.e. line stopper/bypass fittings - mains or service tee - services).

6.2 After gas has been confirmed shut off to the retirement / abandonment area, the line may be cut. The only time oxyacetylene may be used is to cut pipe in lieu of a saw after initial cut.

6.3 A line shall be cut in an area that is reasonable and will not create a hazard. Initial cut shall be made using a cold cut method (i.e. hack-saw or pipe cutter).

NOTE: hack-saws can cause sparking! Use safety when making initial cut.

6.3.1 A main line should be cut as to leave enough room to weld a cap on the end of the pipe.

6.3.2 A service line should be cut as close to the service tee as allowable, but shall not be any closer than the socket connection on the tee where the service line is attached.

NorthWestern Energy

Gas Standards Subject: Steel Abandonments and Retirement for Steel		Original Date 06/01/2006	Standard Number 53-L
Supersedes Standard: 53-L	REV # 5	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

6.4 Cut an additional section from the pipe to create room and a spacer between a live line and an abandoned / retired line (see details).

6.4.1 <u>Tee to service line location:</u>

6.4.1.1 For a main line there should be at a minimum 36 inches between the retired/abandoned section of line and the live line. It is preferred that the line will be cut back to the right-of-way or the property line.

6.4.1.2 For services there should be at a minimum 24 inches between the retired/abandoned tee and service line. It is preferred that line will be cut back to the right-of-way or the property line. See Figure 1 below.

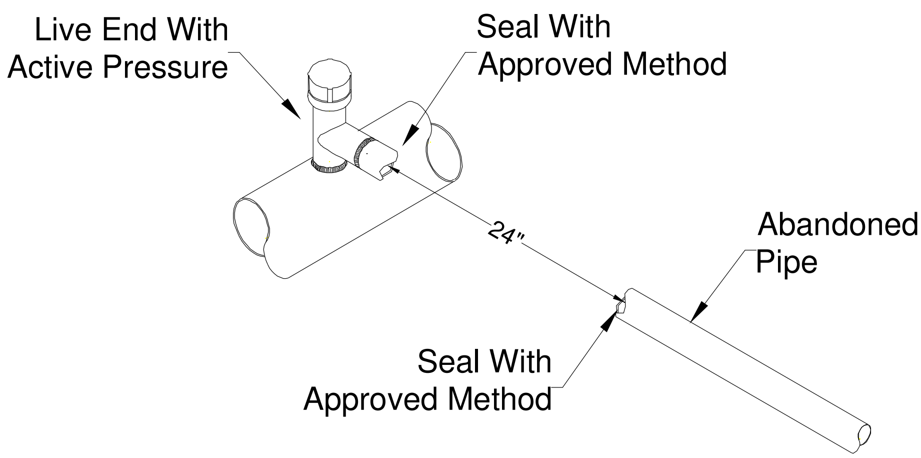


Figure 1. Abandonment of 1" or greater

6.4.1.2.1 Service lines to inside sets should be cut back a minimum of 24” from the foundation or from the sealed end of the service pipe that is in the foundation and sealed using an approved method. See Figure 2 below.

6.4.1.3 Service lines at the foundation should be cut back a minimum of 24" from the foundation and sealed using an approved method

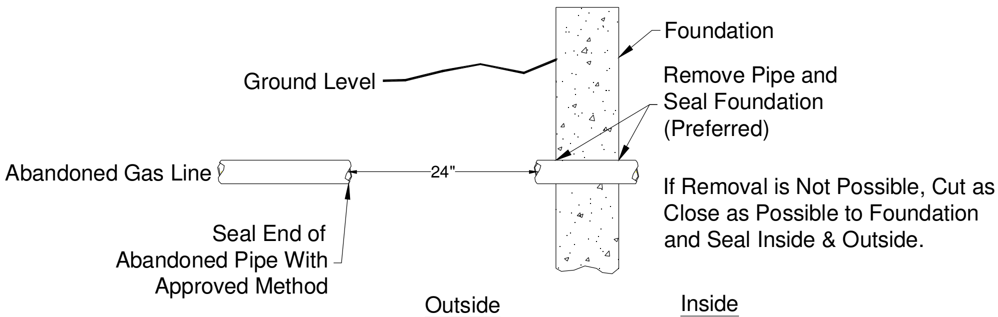


Figure 2. Abandonment of service to inside meter set

6.5 Burn Off/Purging & Pigging

6.5.1 A controlled burn may be used to eliminate gas from the line.

6.5.2 Purging of the retired / abandoned line is required for pipes with a volume greater than acceptable for natural purging. Purging may be completed using a nitrogen atmosphere – See Purging Standard (57-E) for the Nitrogen Capacity Table. This table is only meant as a guideline and values are approximate. However, pigging of the line will accomplish the same results – See the Pigging Standard (57-D).

6.6 The following are procedures for all allowed methods of abandoning/retiring a main/service line.

6.6.1 Steel Plug: After the line has been cut, insert a piece of the round stock into the pipe so that it is A) left exposed outside the pipe approximately ¾ - 1-½ inch(s), or B) completely inserted into the tee / pipe at a depth no greater than ½ inch. The method chosen shall be determined in the field and shall ensure that a sound weld can be completed. A fillet weld shall be used to completely join the pipe and the plug

6.7 Steel Cap or Plate: After the line has been cut, place an appropriate end cap or plate over the pipe and complete a fillet weld that completely joins the pipe and end cap or plate.

6.7.1 Redwood Plug: Insert the redwood plug into the end of the pipe and tap in with a hammer. It should be tapped in far enough that it is difficult to remove by hand. This should only take a couple of taps with the hammer.

6.8 Following the welding process, soaping shall be completed on the live side to ensure soundness and check for leaking.

7.0 <u>Connecting / Joining of Pipe</u>

7.1 Welding shall be done in accordance to the specified welding procedure with a currently certified welder.

NorthWestern Energy

53 Steel 53-M Reinstating Steel Service		Original Date 06/01/2006	Standard Number 53-M
Supersedes Standard: 53-M	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's requirements for the reinstatement of steel service lines. This standard is intended to comply with DOT 49 CFR part 192.725.

2.0 Facilities Reinstatement

2.1 All disconnected service lines must be tested in the same method as a new service line before they may be reinstated, except as described in section 2.2 of this Standard.

2.2 All service lines disconnected from the main line must be tested from the disconnection point to the service line valve by the same method as a new service line; however, if conditions are made to maintain a continuous service (installation of a bypass), any part of the original service line used to maintain the continuous service will not need to be tested.

2.3 If damage to the pipe is found in the vicinity of the service tee, an inspection is required at the service tee. The main and tee shall be closely examined for any damage.

2.4 If a steel service line will be disconnected and reinstated within the same construction project (i.e. leak repair, damage repair, reroute), no further maintenance beyond the pressure test is required.

2.5 If a steel service line will be disconnected and reinstated at a later date within 3 months (i.e. home remodel, major road reroute), the service shall be cathodically protected until reinstated, as well as pressure tested, prior to reinstatement.

2.6 If a steel service line will be disconnected and reinstated at a later date beyond 3 months (i.e. house teardown and rebuild), the service shall be cathodically protected until reinstated, pressure tested, and inspected, prior to reinstatement. The line shall be inspected, at a minimum, at the points of tie-in (connection and riser), and one other location. In the event that there are concerns at the checked locations, the pipe shall be examined, no less than 50%, or a new service shall be installed.

2.7 If any of these requirements cannot be met, the steel service line shall not be reinstated.

NorthWestern Energy

Gas Standards Subject: Steel Steel Welding		Original Date 06/01/2006	Standard Number 53-P
Supersedes Standard: 53-P	REV # 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

These procedures are intended to comply with requirements as set by the Department of Transportation 49 CFR part 192.221, 192.225, 192.227, 192.229, 192.231, 192.233, and 192.235.

2.0 General

2.1 All welding performed on a distribution pipeline facility shall be completed by a qualified welder using a qualified welding procedure.

2.2 It is the responsibility of the Company and area supervision to ensure that only certified welders are completing required welds in the field.

3.0 Qualification of Welders

3.1 Only qualified personnel shall make welds. The test procedures outlined in NorthWestern's O&M manual will be used to qualify welders.

3.2 A welder may only make the types of welds for which they are certified.

3.3 When welds are made, qualified and recommended procedures for the type of welds being made will be followed.

3.4 A copy of qualified and recommended procedures for each type weld will be kept at each Area Office and is readily available for review by any qualified welder.

4.0 Preparation for Welding

4.1 Weld end surfaces shall be free of grease, oil, dirt, paint, oxides, or any other foreign matter.

4.2 Each completed weld bead shall be cleaned by chipping, grinding, filing, or wire brushing to remove slag, spatter, oxides, or other foreign material prior to depositing the successive weld bead.

4.3 The pipe or component must be aligned to provide the most favorable condition for depositing the root bead. This alignment must be preserved while the root bead is being deposited.

4.4 Welding shall be protected from weather conditions that would impair the quality of the completed weld. Protection from these weather conditions shall be employed during the welding operation or welding shall not be performed until the adverse conditions are no longer present.

4.5 The weld area and adjacent pipe shall be free of grinding scars and arc burns. The weld shall be neat and straight in appearance. Start/stops shall not have excessive height from adjacent base material.

4.6 Welding procedures shall be followed for material preparation and joint configuration.

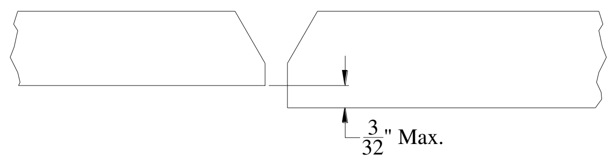
4.7 Mitered joints shall not be utilized as a means of changing the direction of pipelines. Manufactured fittings should be used to change the direction of pipelines in lieu of mitered joints.

4.8 All welded connections shall be visually inspected by an inspector or a qualified welder. A qualified welder is an individual that has passed the specific welding certification and has passed the OQ requirements for NWE.

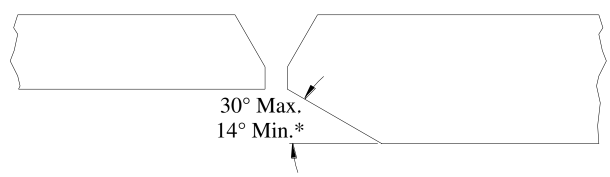
4.9 Welding Equipment and Consumables shall be approved by the company. All working equipment shall be in acceptable operating condition.

4.10 The following diagram shows the acceptable design to weld pipe of unequal wall thickness.

Acceptable Design For Unequal Wall Thickness



If the nominal wall thickness of the adjoining ends do not vary more than 3/32 inch, no special treatment is necessary provided full penetration and bond is accomplished in welding.



Where the nominal internal offset is more than 3/32 inch and there is no access to the inside of the pipe for welding, the transition must be made by a taper cut on the inside end of the thicker section. The taper angle shall not be steeper than 30° nor less than 14°.

* No min. when materials joined nave equal yield strength.

NorthWestern Energy

Gas Standards Subject: Steel Steel: CadWelding Procedure		Original Date 04/01/2007	Standard Number 53-PA
Supersedes Standard: 53-PQ	REV# 3	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general installation procedures and policies concerning CadWelding tracer wire. These procedures are intended to accommodate the minimum requirements as set by NorthWestern Energy.

2.0 General

2.1 Tracer shall be electrically bonded to mains

2.1.1 Brazing of the tracer wire directly to pipe shall not be permitted

2.1.2 Bonding of tracer to mains shall be done via the CadWelding process

2.1.3 CadWelding is an exothermic reaction, which is a violent reaction that will burn until all fuel has been depleted.

2.1.4 This reaction does not require oxygen. Reaction cannot be extinguished with water.

3.0 CadWelding General

3.1 The maximum size charge for CadWelding shall be a 15 gram charge, which is either electronically ignited or is the standard components that must be manually mixed.

3.2 The charge is electronically ignited.

3.3 Limiting the charge to this size (15 gram) allows for welding of #4AWG to steel pipe

3.4 When large size conductor is required follow the procedure presented below.

3.5 The following are guidelines for safe installation of CadWeld

3.5.1 As pipe diameter goes up hoop stress also goes up

3.5.2 Heat dissipation will be affected by the thermal characteristics of the material being joined

3.5.3 Heat dissipation will be affected by the rate of flow of the material while making the weld

3.5.4 The pipe strength will be affected by the temperature of the pipe

3.5.5 The following table indicates the minimum recommended pipe size to safely CadWeld.

Minimum Recommended Pipe Size for CadWelding

Nominal Pipe Size	Schedule	Wall Thickness
1/2"	40	0.109
3/4"	40	0.113
1" to 2"	10	0.109
2-1/2" to 4"	10	0.12
5" to 8"	5	0.19
10" and Larger	5	>0.19

4.0 CadWelding Procedure

4.1 Inspect the mold and attachment chains (see Figure 1).

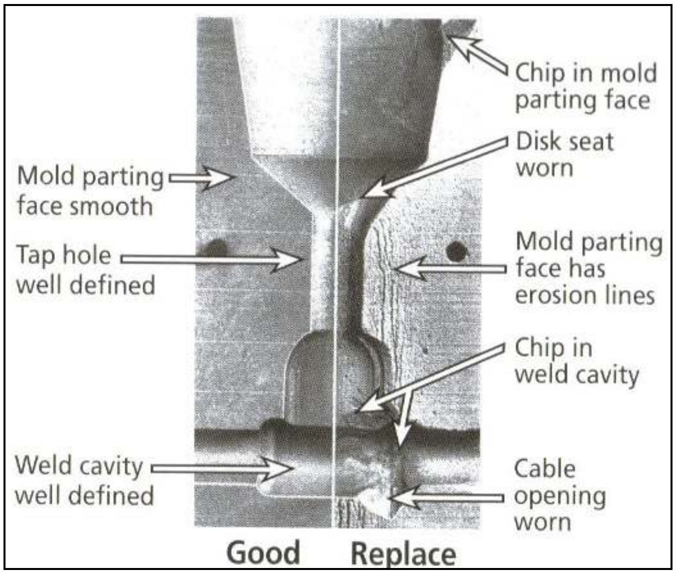


Figure 1. Comparison of good and worn molds

4.2 Damaged or loose molds or chains should be changed.

4.3 Dry the mold and conductors

4.3.1 Generally, air-drying or towel drying is satisfactory; however, in some instances heating of the molds may be required to remove moisture.

4.3.2 If the steel is moist the water must be driven off using a torch. Any carbon deposits shall be removed before welding.

4.4 Clean the conductor and base metal to bright metal.

4.4.1 All contaminants must be removed from the area of connection. Mill scale, paint, or other coatings must be removed by using grinder or rasp. Use of wire brush is not satisfactory.

4.4.2 Grease must be removed by safety solvent.

4.4.3 Galvanized surfaces shall be cleaned to bright metal using emery cloth, wire brush, or rasp. **NOTE:** Galvanizing is harmful if inhaled; thus, use of a respirator is strongly recommended.

NorthWestern Energy

Gas Standards Subject: Steel Steel: CadWelding Procedure		Original Date 04/01/2007	Standard Number 53-PA
Supersedes Standard: 53-PQ	REV# 3	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

4.5 Clamp welder to the pipe using the pipe clamps in either the horizontal or vertical position – see section 6 for appropriate welders and clamps (See Figure 2).

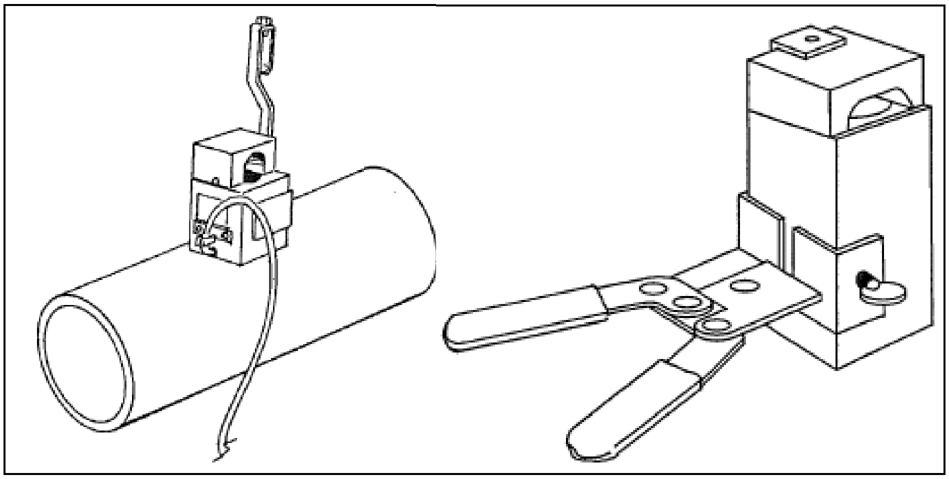


Figure 2. Horizontal and vertical mold

4.5.1 Welder shall be centered on the pipe

4.5.2 It is important to contain the molten Copper.

4.5.2.1 If welder does not fit securely on the pipe, a dam should be made with window glaze putty.

4.6 Place the ends of the cable in the mold. Strip approximately ½" of tracer before inserting.

4.6.1 If the conductor is #4 AWG or less a single cadweld may be used

4.6.2 If the conductor is greater than #4 AWG then the following method shall be used to CadWeld the conductor.

4.6.2.1 Separate the stranded wires into individual wires or bundles that are equivalent to #4 AWG.

4.6.2.2 Each wire or bundle shall be individually CadWelded to the pipe (See Figure).

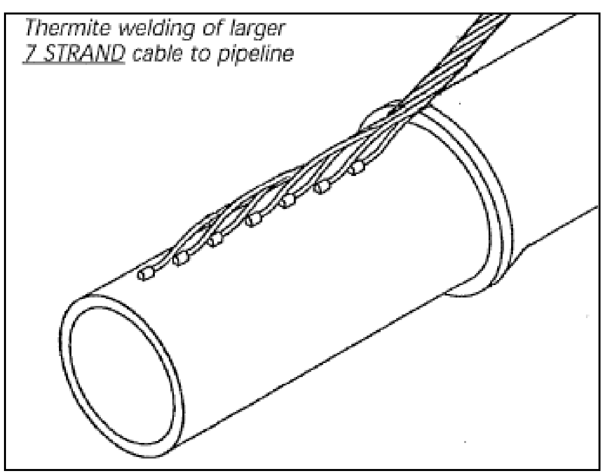


Figure 3. Connection of wires larger than #4 AWG

4.7 Close the handles to lock the mold.

4.8 Currently there are two methods for igniting the CadWeld, which require two different charges; specifically, there is the separate CadWeld charge that all the materials are separate and are manually mixed and there is CadWeld Plus, which is a bladder that has all the materials in one package.

4.8.1 For the CadWeld Charge (See Figure 4):

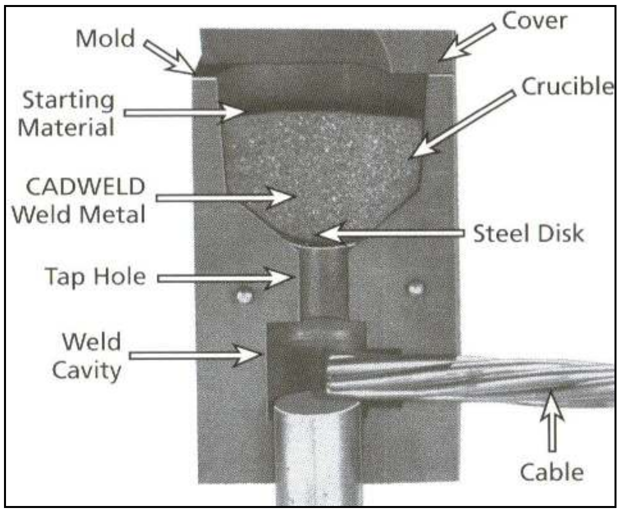


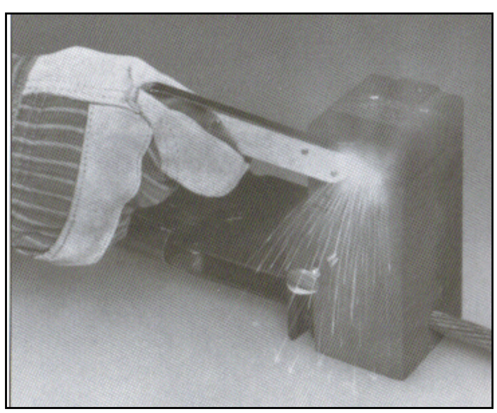
Figure 4. Manually mixed CadWeld charge

4.8.1.1 Drop the metal disk into the mold

4.8.1.2 Dump the metal into the mold

4.8.1.3 Sprinkle the starting materials over the weld metal and onto the lip of the mold

4.8.1.4 Close the cover and ignite with the striker as shown.



Gas Standards Subject: Steel Steel: CadWelding Procedure		Original Date 04/01/2007	Standard Number 53-PA
Supersedes Standard: 53-PQ	REV# 3	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

4.8.2 For the CadWeld Plus Charge:

4.8.2.1 Place the bladder into the mold with the disk down and leads out of the mold (See Figure 5).

Figure 5. Installation of CadWeld Plus charge

NOTE: The approved charge for the CadWeld Plus is a 15 gram charge – **black ring**.

4.8.2.2 Attach leads to the electronic ignitor and ignite the charge (See Figure 6)

Figure 6. Attachment of electronic ignitor to charge

4.9 Open the mold after the metal solidifies

4.10 Remove slag from weld and mold

4.11 Protect the CadWeld

4.11.1 Preformed covers are available to cover the weld prior to sealing (10017474).

NorthWestern Energy

Gas Standards Subject: Steel Steel: CadWelding Procedure		Original Date 04/01/2007	Standard Number 53-PA
Supersedes Standard: 53-PQ	REV# 3	Revision Date 04/01/2020	Prepared / Approved By AJ / Committee

5.0 CadWeld Inspection

5.1 Proper inspection of a CadWeld connection relies on the judgment of the field personnel. A close look at the size, color, surface finish, and porosity of the connection.

5.2 Size:

5.2.1 No portion of the conductor within the confines of the weld should be exposed.

5.2.2 Maximum depression under the riser on the horizontal connection (after slag removal) should be no lower than the top of the conductor.

5.3 Color:

5.3.1 The color of a CadWeld connection is best seen after a light wire brushing.

5.3.2 Color should be normally gold to bronze in color

5.3.2.1 Occasionally it may be silvery at the top

5.3.2.2 Connection to cast iron or galvanized surfaces can result in silvery color due to materials being joined.

5.4 Surface Finish:

5.4.1 Surface of a CadWeld should be reasonably smooth and free of major slag deposits.

5.4.1.1 If slag deposits cover more than 20% of the connection surface, or if any cable strands are exposed after slag removal, the connection shall be rejected.

5.5 Porosity:

5.5.1 Connection should be essentially free from porosity.

5.5.1.1 Excessive porosity is normally the result of the contaminants (water, oil, dirt, etc.) in the mold or on the conductor.

5.5.1.2 A few pinholes may be present on the riser.

5.5.1.2.1 Depth of the pinholes shall not exceed beyond the center of the conductor.

6.0 CadWeld Materials and Stores Items

6.1 The following items are the approved materials and components for the CadWelding process.

CadWelding Materials

Process	Material	Catalog Number	Stores Number
Electronic Ignition	15 gram CadWeld Plus charge (20 ct)	CA15PLUSF33	10007815
	Electronic Ignitor	PLUSCU	NA
Striker Ignition	15 gram CadWeld charge (20 ct)	CA15	NA
	Spark Pistol	CA320	NA
Both Processes	Horizontal Pipe Clamp (Chain)	CAB-320	NA
	Horizontal Pipe Mold (3/4 - 3.5")*	CAHAA-1GA	NA
	Horizontal Pipe Mold (4 and larger)*	CAHAA-1G	NA
	Vertical Pipe Clamp (Chain)	CAB-319	NA
	Vertical Pipe Mold (3/4 - 3.5")*	CAVST-1GA	NA
	Vertical Pipe Mold (4 - 10")*	CAVST-1GB	NA
	Complete Tool Box	CAT-343	NA
	MoldSealer	CAT-329	NA
	Mold Sealer 2#	CAT-403	NA
* To only order molds specify M on end of catalog number			

7.0 Coating – Epoxy and Tape

7.1 Coating (Epoxy and Tape) shall be completed in accordance with the coating requirements put forth in this handbook.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Welding Threadolet or Weldolet #MPC-WPS-28		Original Date 06/01/2006	Standard Number 53-PB-Part 1
Supersedes Standard: 53-PJ	REV # 2	Revision Date 06/01/2009	Prepared / Approved By T.Wootton / Committee

1.0 Scope

The purpose of this document is to establish a written procedure for the welding of a threadolet or weldolet onto line pipe.

2.0 Welding Process

2.1 The welding shall be done by the shielded metal arc welding method (SMAW).

3.0 Pipe And Fitting Materials

3.1 The pipe shall conform to the requirements of API 5L X-42, API 5L X-52, API 5L Grade B, ASTM A53 Grade B, and/or ASTM A106 Grade B. A carbon steel, standard weight Bonney threadolet or weldolet shall be used (ASTM A105, 3000#).

4.0 Diameter Group – Wall Thickness Group

4.1 This procedure allows the welding of pipe and fittings having an outside diameter of 2-3/8” to 20”, and a wall thickness of 1/8” and greater.

5.0 Joint Design

5.1 Where the threadolet saddles on the run pipe, the welding bevel provides for a full or complete penetration single bevel groove weld (Fig. 1), tapering to a single vee groove weld (Fig. 2).

LONGITUDINAL AND TRANSVERSE SECTIONAL VIEWS OF WELDOLET PROPERLY WELDED[1]

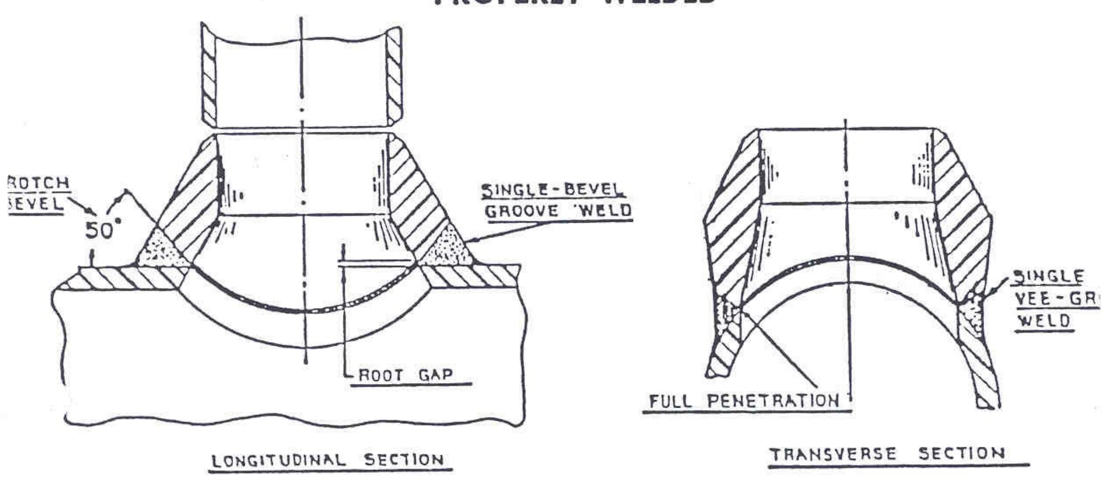


FIG. 1
Wide bases or footings at crotch section distribute internal and external stresses.
Gradual changes of section eliminate stress concentration.
Funnel shaped opening provides improved flow conditions.

FIG. 2
Note the blending of the skirt section of the Weldc to the run pipe to avoid abrupt change in intersecti Throat of weld at this point is designated by the weld bevel.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Welding Threadolet or Weldolet #MPC-WPS-28		Original Date 06/01/2006	Standard Number 53-PB-Part 1
Supersedes Standard: 53-PJ	REV # 2	Revision Date 06/01/2009	Prepared / Approved By T.Wootton / Committee

6.0 Filler Metal And Number Of Beads

6.1 The filler metal shall conform to the requirements of AWS Specification 5.1 (E6010) or 5.5 (E7010).The size of the electrode and the sequence of beads shall be as shown in Fig. 3.

7.0 Electrical Characteristics

7.1 Direct current, reverse polarity shall be used. Amperage and voltage for each size electrode shall be maintained within the ranges shown in Figure 3.

Figure 3:

Welding Pass	Electrode Diameter	Amperage Range
First Pass	3/32"	40-75
	1/8"	75-140
Second Pass	3/32"	40-75
	1/8"	75-140
Filler Pass(es)	3/32"	40-75
(as required)	1/8"	75-140
	5/32"	90-175
Cap Pass	1/8"	75-140
	5/32"	90-175

8.0 Time Lapse Between Passes

8.1 This procedure allows a maximum of five (5) minutes between passes.

9.0 Cleaning

9.1 The base metal shall be cleaned with a wire brush or power driven buffer to remove all rust, mill scale, or other residue. All slag of flux remaining on any bead of welding shall be removed by hand or power driven buffers before laying the next successive bead.

10.0 Preheat, Postheat

10.1 Unless it is required by the Engineering Department of NorthWestern Energy, preheat is only required when the ambient temperature is 32 degrees Fahrenheit or less. When preheating is required, the minimum preheat temperature shall be 100 degrees Fahrenheit. The temperature is to be monitored by the use of temperature indicating crayons, pellets, or paints. Postheat is not mandatory unless it is specifically required by the Engineering Department of NorthWestern Energy.

11.0 Standards Of Acceptability

11.1 Visual inspection of welding shall be conducted to ensure that welding is performed in accordance with this procedure. The manner of depositing the weld metal shall be such that the weld merges smoothly into the side walls of the welding groove, and there exists no undercutting or overlap on the adjoining base metal. Haphazard arc striking (arc burn) on the base material adjacent to the weld groove is prohibited by this procedure.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Welding Tee #MPC-WPS-32		Original Date 06/01/2006	Standard Number 53-PB-Part 2
Supersedes Standard: 53-PP	REV# 3	Revision Date 05/12/2011	Prepared / Approved By K. Murphy / Committee

1.0 <u>Scope</u>

The purpose of this document is to establish a written procedure for the welding of Mueller No-Blo Service Tees (H-17500 series), Valve Tees (H-17650 series), or Curb Valve Tees (H-17800 series) to line pipe. The maximum pressure that the pipeline is to be operated when welding takes place on that pipeline is outlined in the O&M manual.

2.0 <u>Welding Process</u>

2.1 The welding shall be done by the shielded metal arc welding method (SMAW).

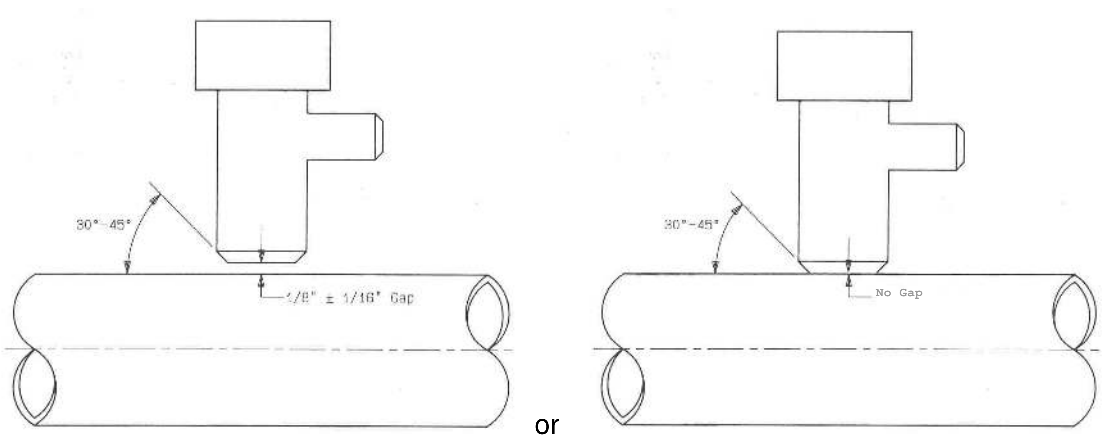
3.0 <u>Pipe And Fitting Materials</u>

3.1 Refer to Standards 53-D, "Steel Main Construction", and 53-E "Steel Service Construction" for pipe and fitting specifications for steel pipe additions associated with this tapping tee installation. A forged steel Mueller tee shall be used.

4.0 <u>Joint Design</u>

4.1 The joint geometry is a single bevel groove weld as shown in Figure 1. The tee can be installed as shown either with or without a gap.

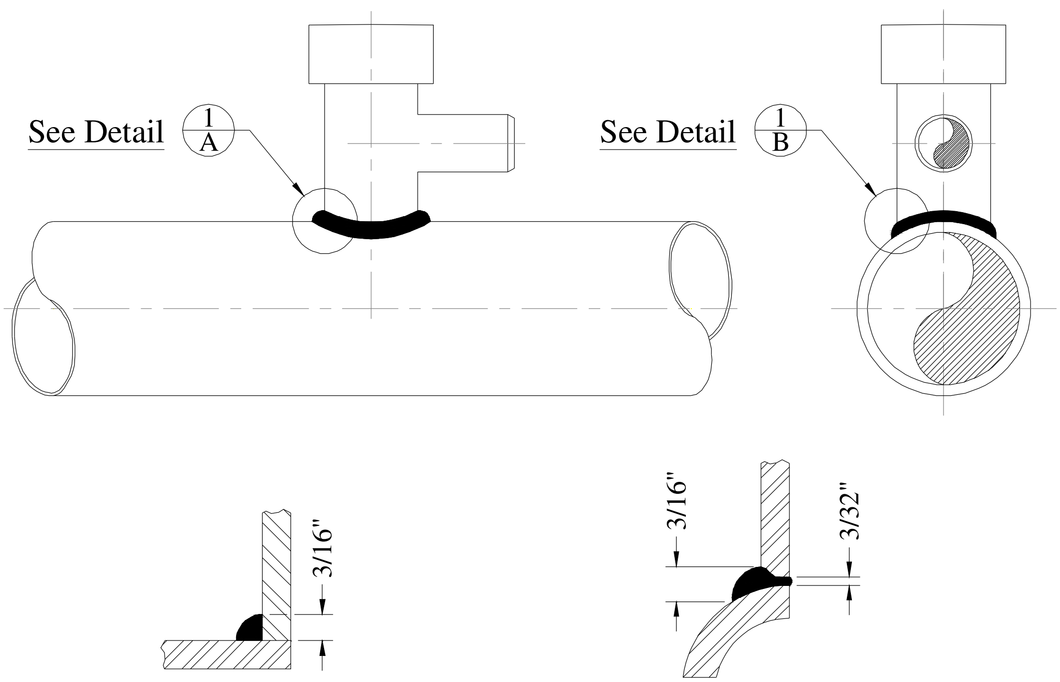
Figure 1: Welding Groove to Mueller Tees



NorthWestern Energy

Gas Standards Subject: Steel Steel: Welding Tee #MPC-WPS-32		Original Date 06/01/2006	Standard Number 53-PB-Part 2
Supersedes Standard: 53-PP	REV # 3	Revision Date 05/12/2011	Prepared / Approved By K. Murphy / Committee

Welding Groove For Mueller Tees



Detail 1/A

Low Pressure
MPC-WPS-25A

Detail 1/B

Low Pressure
MPC-WPS-32

5.0 Filler Metal And Number Of Beads

5.1 The filler metal shall conform to the requirements of AWS Specification 5.1 (E6010) or 5.5 (E7010). The size of the electrode and the sequence of beads shall be as shown in Figure 2.

NorthWestern Energy

Gas Standards Subject: Steel Steel: Welding Tee #MPC-WPS-32		Original Date 06/01/2006	Standard Number 53-PB-Part 2
Supersedes Standard: 53-PP	REV# 3	Revision Date 05/12/2011	Prepared / Approved By K. Murphy / Committee

6.0 Electrical Characteristics

6.1 Direct current, reverse polarity shall be used. Amperage and voltage for each size electrode shall be maintained within the ranges shown in Figure 2.

Figure 2:

Welding Pass	Electrode Range	Amperage Range	Voltage Range
Stringer	3/32”	40-90	20-35
	1/8”	75-130	25-40
	5/32”	90-185	25-40
Hot Pass	1/8”	75-130	25-40
	5/32”	90-185	25-40
Fill Pass(es)	1/8”	75-130	25-40
(as required)	5/32”	90-185	25-40
	3/16”	140-225	25-40
Cap Pass	5/32”	90-185	25-40
	3/16”	140-225	25-40

7.0 Time Lapse Between Passes

7.1 This procedure allows a maximum of five (5) minutes between passes.

8.0 Cleaning

8.1 The base metal shall be cleaned with a wire brush or power driven buffer to remove all rust, mill scale, or other residue. All slag of flux remaining on any bead of welding shall be removed by hand or power driven buffers before laying the next successive bead.

9.0 Preheat, Postheat

9.1 Unless it is required by the Engineering Department of NorthWestern Energy, preheat is only required when the ambient temperature is 32 degrees Fahrenheit or less. When preheating is required, the minimum preheat temperature shall be 100 degress Fahrenheit, and the preheat zone shall extend 2” from the fillet weld and the bevel of each pipe. Postheat is not mandatory unless it is specifically required by the Engineering Department of NorthWestern Energy. Preheat and/or postheat temperatures should be monitored by the use of temperature indicating crayons, pellets, or paints.

10.0 Standards Of Acceptability

10.1 Visual inspection of welding shall be conducted to ensure that welding is performed in accordance with this procedure. The manner of depositing the weld metal shall be such that the weld merges smoothly into the side walls of the welding groove, and there exists no undercutting or overlap on the adjoining base metal. Haphazard arc striking (arc burn) on the base material adjacent to the weld groove is prohibited by this procedure.

***NorthWestern** Energy*

Gas Standards Subject: Steel Steel: Butt Welding X42 and Under, Less than 3/16" WT		Original Date 06/01/2006	Standard Number 53-PC
Supersedes Standard: 53-PF & 53-PG	REV # 3	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE:	GTS-WPS-SMAW-BW-A211, Previously GTS-WPS-BW1
1 Welding Process:	Shielded Metal Arc Butt Weld
2 Qualifying Code:	API 1104, Nineteenth Edition
3 Test Pipe Material Grade:	API 5LX X-42
4 Test Pipe Dia. and W.T.:	6" O.D. and 0.156" W.T.
5 Pipe Grade Qualified:	LESS THAN OR EQUAL TO API 5L X-42
6 Pipe Diameter Qualified:	2-3/8" through 12-3/4" O.D.
7 Wall Thickness Qualified:	Less than 0.188" W.T.
8 Weld Joint Design and Parameters:	Refer to applicable sketch, Page 2
9 Filler Metal:	AWS E6010 Root or Table 1 - Group 1 in API 1104 19th Ed
10 Electrical Characteristics:	Direct Current - Reverse Polarity (DCEP)
11 Position of Weld Sample:	Horizontal (5G) FIXED
12 Direction of Welding:	Vertical Down
13 Welding Technique:	Stringer
14 Number of Welders:	One or Two Welders
15 Time Lapse Between Passes:	5 Minutes Maximum Between Bead and Hot Pass - All Other Passes as Soon as Practical
16 Type of Line-up Clamp:	External/Internal
17 Removal of Line-Up Clamp:	After 50% of Root Pass Completed (Evenly Spaced) with External. After 100% Completed with Internal.
18 Method of Weld Cleaning:	Power Grinding and Power Brushing
19 Preheat Temperatures:	Unless otherwise specified by the Gas Transmission and Storage Engineering Department of NorthWestern Energy, preheat is only required when the ambient temperature is 32 degrees Fahrenheit or less. When preheating is required, the minimum preheat temperature shall be 200 degrees Fahrenheit, and the preheat zone shall extend longitudinally at least two (2) inches from the bevel of each pipe. The temperature is to be monitored by temperature indicating crayons, pellets, or paints. No postheat is needed. Protect exposed welds from moisture until cool.
20 Post-heat Temperature:	None required
21 Speed of Travel:	Refer to Page 2
22 Shield Gas:	None required

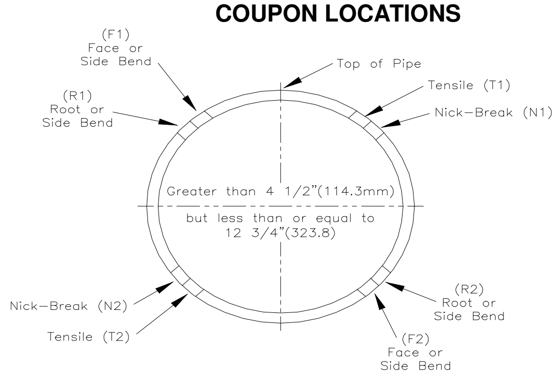
NorthWestern *Energy*

Gas Standards Subject: Steel Steel: Butt Welding X42 and Under, Less than 3/16" WT		Original Date 06/01/2006	Standard Number 53-PC
Supersedes Standard: 53-PF & 53-PG	REV # 3	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE: GTS-WPS-SMAW-BW-A211, Previously GTS-WPS-BW1

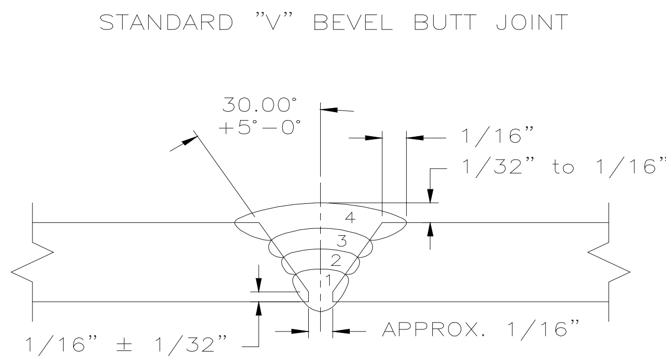
Filler Metal group	Root Group 1		Filler / Cap Group 10				
Bead Number	1 (Alternate)	1	2	3	4	5	6
Electrode Diameter	1/8"	3/32"	1/8"	1/8"			
A.W.S. Designation	E6010	E6010	E6010	E6010			
Voltage Range	23-28	23-28	23-28	23-28			
AMP	85-115	85-115	110-140	95-125			
AC DC X STR Rev X	IF REQUIRED BY WALL THICKNESS USE BEAD 3 PARAMETERS FOR ALL INTERMEDIATE PASSSES						
Wire Speed - IPM	N/A	N/A	N/A	N/A			
Travel Speed - IPM	6-16	6-16	6-16	6-16			

COUPON LOCATIONS



BEAD SEQUENCE

STRIPPER PASSES OPTIONAL FOR PASSES 4-6



WELDING PROCEDURE QUALIFICATION:

Welding Procedure:	GTS-WPS-SMAW-BW-A211
Material Used to Qualify Procedure:	API 5L X-42
Diameter:	6.625 inch
Wall Thickness:	0.156 inch
Grade:	API 5L X-42

TENSILE STRENGTH TEST

Test Specimen No.	Failure Pipe	Failure Weld	Specimen Width	Specimen Thickness	Specimen Area	Gauge Factor	Pound Pull	Tensile Strength
T1	X				0.16455		11,036.0	67,070.0
T2	X				.17394		11,685.0	67,181.0

BEND TEST AND NICK BREAK TEST

Root or Side Bend		Face or Side Bend		Nick Break			
Specimen No.	Results	Specimen No.	Results	Specimen No.	Results	Specimen No.	Results
R1	Pass	F1	Pass	N1	Pass		
R2	Pass	F2	Pass	N2	Pass		

Welder Brent Duocett Title 1st Class Craftsman

Location Deer Lodge Fab Shop Welding Machine Lincoln 400 Model 400

Weld Tested by Daniel D. Pfeifer Title CWI / Supervisor Date 1/5/2005

Approved by Kevin Goroski Title GT&S Engineer Date 12/28/2012

NorthWestern *Energy*

Gas Standards Subject: Steel Steel: Butt Welding X42 and Under, 3/16" - 3/4" WT		Original Date 06/01/2006	Standard Number 53-PD
Supersedes Standard: 53-PH & 53-PI	REV # 3	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE:		GTS-WPS-SMAW-BW-A221, Previously GTS-WPS-BW2
1	Welding Process:	Shielded Metal Arc. Butt Weld
2	Qualifying Code:	API 1104, Nineteenth Edition
3	Test Pipe Material Grade:	API 5L X-42
4	Test Pipe Dia. and W.T.:	8.625" 0.25" W.T.
5	Pipe Grade Qualified:	LESS THAN OR EQUAL TO API 5LX 42
6	Pipe Diameter Qualified:	2.375" Through 12 3/4" O.D.
7	Wall Thickness Qualified:	0.188" W.T. through 0.750" W.T.
8	Weld Joint Design and Parameters:	Refer to applicable sketch, Page 2
9	Filler Metal:	AWS E6010 Root and E7010 Remaining Passes
10	Electrical Characteristics:	Direct Current - Electrode Positive (DCEP)
11	Position of Weld Sample:	Horizontal (5G) FIXED
12	Direction of Welding:	Vertical Down
13	Welding Technique:	Stringer
14	Number of Welders:	A Minimum of one Welders for Field Welds
15	Time Lapse Between Passes:	5 Min. Max. Between Root and Hot Pass; Remaining passes within 24 hours
16	Type of Line-up Clamp:	External/Internal
17	Removal of Line-Up Clamp:	After 50% of Root Pass Completed with External. After 100% Completed with Internal.
18	Method of Weld Cleaning:	Power Grinding and Power Brushing
19	Preheat Temperatures:	NOT REQUIRED WHEN TEMPERATURE IS ABOVE 40° F, Preheat shall be used to remove all traces of water when present. At temperatures below 40° F the preheat temperature shall be 100° F min. to 350° F max. Pipe or fittings with carbon equivalent over 0.42% shall be preheated to 200° F min to 300° F max. SEE NOTE BELOW
20	Post-heat Temperature:	None required
21	Speed of Travel:	Refer to Page 2
22	Shield Gas:	None required

NOTE:

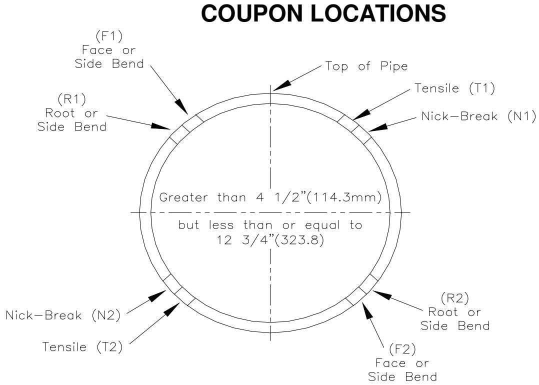
NorthWestern *Energy*

Gas Standards Subject: Steel Steel: Butt Welding X42 and Under, 3/16" - 3/4" WT		Original Date 06/01/2006	Standard Number 53-PD
Supersedes Standard: 53-PH & 53-PI	REV # 3	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE: GTS-WPS-SMAW-BW-A221, Previously GTS-WPS-BW2

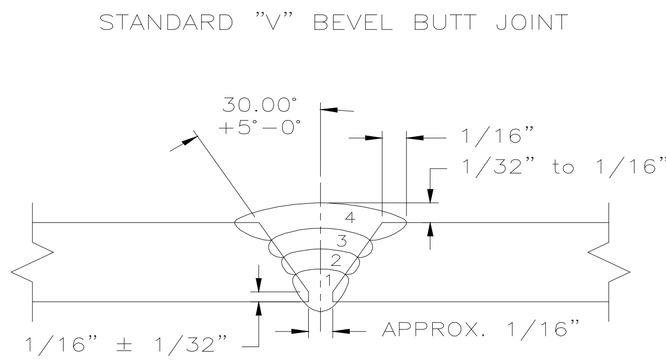
Filler Metal group	Root Group 1		Filler / Cap Group 1				
Bead Number	1 (Alternate)	1	2	3	4	5	6
Electrode Diameter	1/8"	5/32"	5/32"	5/32"			
A.W.S. Designation	E-6010	E-7010	E-7010	E-7010			
Voltage Range	25-30	26-32	26-32	26-32			
AMP	95-125	150-185	150-185	125-155			
AC / DC X / STR / Rev X	IF REQUIRED BY WALL THICKNESS USE BEAD 3 PARAMETERS FOR ALL INTERMEDIATE PASSSES						
Wire Speed - IPM	N/A	N/A	N/A	N/A			
Travel Speed - IPM	6-16	6-16	6-16	6-16			

COUPON LOCATIONS



BEAD SEQUENCE

STRIPPER PASSES OPTIONAL FOR PASSES 4-6



WELDING PROCEDURE QUALIFICATION:

Welding Procedure:	GTS-WPS-SMAW-BW-A221
Material Used to Qualify Procedure:	API 5L X-42
Diameter:	8.625"
Wall Thickness:	0.25"
Grade:	X-42

TENSILE STRENGTH TEST

Test Specimen No.	Failure Pipe	Failure Weld	Specimen Width	Specimen Thickness	Specimen Area	Gauge Factor	Pound Pull	Tensile Strength
T1					0.27875		20,744.0	74,527.0
T2					.25950		19,476.0	75,052.0
T3								
T4								

BEND TEST AND NICK BREAK TEST

Root or Side Bend		Face or Side Bend		Nick Break			
Specimen No.	**Results**	**Specimen No.**	**Results**	**Specimen No.**	**Results**	**Specimen No.**	**Results**
R1	Pass	F1	Pass	N1	Pass	N3	
R2	Pass	F2	Pass	N2	Pass	N4	
R3		F3					
R4		F4					

Welder Brent Doucett Title Pipeline Welders

Location Deer Lodge Fab Shop Welding Machine 300 Amp Model Miller XMT 300

Weld Tested by Dan Pfeifer Title CWI/ Supervisor Date 1/5/2005

Approved by Kevin Goroski Title GT&S Engineer Date 12/28/2012

***NorthWestern** Energy*

Gas Standards Subject: Steel Steel: Butt Welding X46 - X52, 3/16" - 3/4" WT		Original Date 06/01/2006	Standard Number 53-PE
Supersedes Standard: 69-G	REV # 2	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE:	GTS-WPS-SMAW-BW-B221, Previously GTS-WPS-BW3
1 Welding Process:	Shielded Metal Arc. Butt Weld
2 Qualifying Code:	API 1104, Nineteenth Edition
3 Test Pipe Material Grade:	API 5LX X-52
4 Test Pipe Dia. and W.T.:	8.625" O.D. and 0.322" W.T.
5 Pipe Grade Qualified:	API 5LX X-46 thru API 5LX X-52
6 Pipe Diameter Qualified:	2.375" Through 12 3/4" O.D.
7 Pipe Wall Thickness Qualified:	0.188" W.T. through 0.750" W.T.
8 Weld Joint Design and Parameters:	Refer to applicable sketch, Page 2
9 Filler Metal:	AWS E6010 Root and E7010 Remaining Passes
10 Electrical Characteristics:	Direct Current - Reverse Polarity (DCEP)
11 Position of Weld Sample:	Horizontal (5G) FIXED
12 Direction of Welding:	Vertical Down
13 Welding Technique:	Stringer
14 Number of Welders:	One or Two Welders
15 Time Lapse Between Passes:	5 Min. Max. Between Root and Hot Pass; All Other Passes As Soon As Practical
16 Type of Line-up Clamp:	External/Internal
17 Removal of Line-Up Clamp:	After 50% of Root Pass Completed with External. After 100% Completed with Internal.
18 Method of Weld Cleaning:	Power Grinding and Power Brushing
19 Preheat Temperatures:	NOT REQUIRED WHEN TEMPERATURE IS ABOVE 40° F, Preheat shall be used to remove all traces of water when present. At temperatures below 40° F the preheat temperature shall be 100° F min. to 350° F max. Pipe or fittings with carbon equivalent over 0.42% shall be preheated to 200° F min to 300° F max. SEE NOTE BELOW
20 Post-heat Temperature:	None required
21 Speed of Travel:	Refer to Page 2
22 Shield Gas:	None required

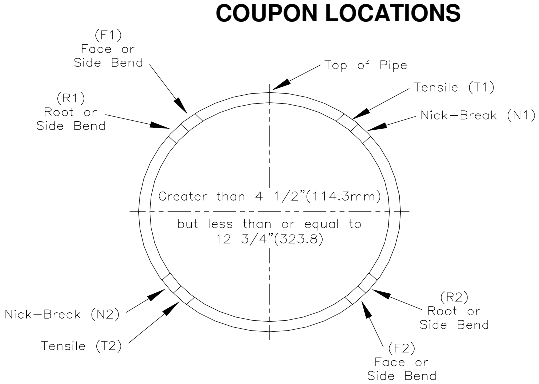
NorthWestern *Energy*

Gas Standards Subject: Steel Steel: Butt Welding X46 - X52, 3/16" - 3/4" WT		Original Date 06/01/2006	Standard Number 53-PE
Supersedes Standard: 69-G	REV # 2	Revision Date 04/01/2015	Prepared / Approved By D. Pfeifer / Committee

PIPE WELDING PROCEDURE: GTS-WPS-SMAW-BW-B221, Previously GTS-WPS-BW3

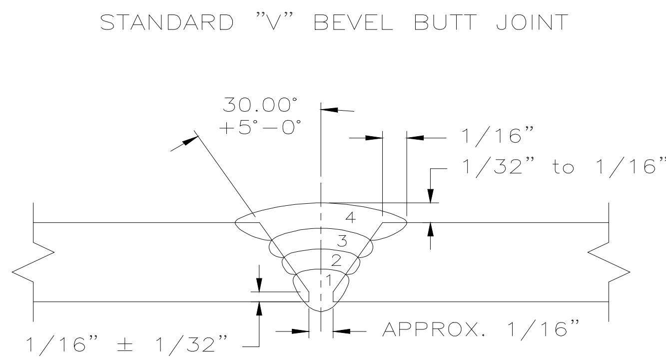
Filler Metal group	Root Group 1		Filler / Cap Group 10				
Bead Number	1 (Alternate)	1	2	3	4	5	6
Electrode Diameter	1/8"	5/32"	5/32"	5/32"	3/16"		
A.W.S. Designation	E6010	E6010	E7010	E7010	E7010		
Voltage Range	25-30	26-32	26-32	26-32	26-32		
AMP	95-125	125-155	150-180	150-180	150-180		
AC / DC X / STR / Rev X	IF REQUIRED BY WALL THICKNESS USE BEAD 3 PARAMETERS FOR ALL INTERMEDIATE PASSSES						
Wire Speed - IPM	N/A	N/A	N/A	N/A	N/A		
Travel Speed - IPM	6-16	6-16	6-12	6-12	6-12		

COUPON LOCATIONS



BEAD SEQUENCE

STRIPPER PASSES OPTIONAL FOR PASSES 4-6



WELDING PROCEDURE QUALIFICATION:

Welding Procedure:	GTS-WPS-SMAW-BW-B221
Material Used to Qualify Procedure:	API 5L X-52
Diameter:	8.625"
Wall Thickness:	0.322"
Grade:	API X-52

TENSILE STRENGTH TEST

Test Specimen No.	Failure Pipe	Failure Weld	Specimen Width	Specimen Thickness	Specimen Area	Gauge Factor	Pound Pull	Tensile Strength
T1	X				0.35259		25,318.0	71,808.0
T2	X				0.35742		25,968.0	72,654.0

BEND TEST AND NICK BREAK TEST

Root or Side Bend		Face or Side Bend		Nick Break			
Specimen No.	**Results**	**Specimen No.**	**Results**	**Specimen No.**	**Results**	**Specimen No.**	**Results**
R1	Pass	F1	Pass	N1	Pass		
R2	Pass	F2	Pass	N2	Pass		

Welder	Brent Doucett	Title	1st Class Craftsman		
Location	Deer Lodge Fab Shop	Welding Machine	Lincoln 400	Model	400
Weld Tested by	Daniel D. Pfeifer	Title	CWI/Supervisor	Date	1/5/2005
Approved by	Kevin Goroski	Title	GT&S Engineer	Date	12/28/2012

NorthWestern *Energy*

Gas Standards Subject: Steel Repair Procedures for Steel Pipe and Welds		Original Date 06/01/2006	Standard Number 53-R
Supersedes Standard: 53-R	REV# 6	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's requirements for the repairing of steel pipe and welds. This standard is intended to comply with DOT 49 CFR Part 192.309 and 192.245.

2.0 General

2.1 *Each defect or damage such as corrosion, pitting, nicks, or scrapes that impairs the serviceability of a length of steel pipe must be repaired or removed.* Guidance from supervision should be initiated for determining whether to repair or remove the area in question. *If a repair is made by grinding or filing, the remaining wall thickness must at least be equal to either:*

2.1.1 *The minimum thickness required by the tolerances in the specification to which the pipe was manufactured;*

or

2.1.2 *The nominal wall thickness required for the design pressure of the pipeline.*

2.2 *Pipe defects such as gouges or grooves, laminations, split ends, arc-burns, and other defects in the pipe shall be removed by sectioning out the damage portion of the pipe as a cylinder.*

2.3 *Pipe defects such as gouges, grooves, arc burns or dents may not be repaired by any method including insert patching, pounding out or grinding.*

2.4 A qualified individual shall do repair or removal of defects.

2.5 Repair welding shall be completed with a qualified welding procedure.

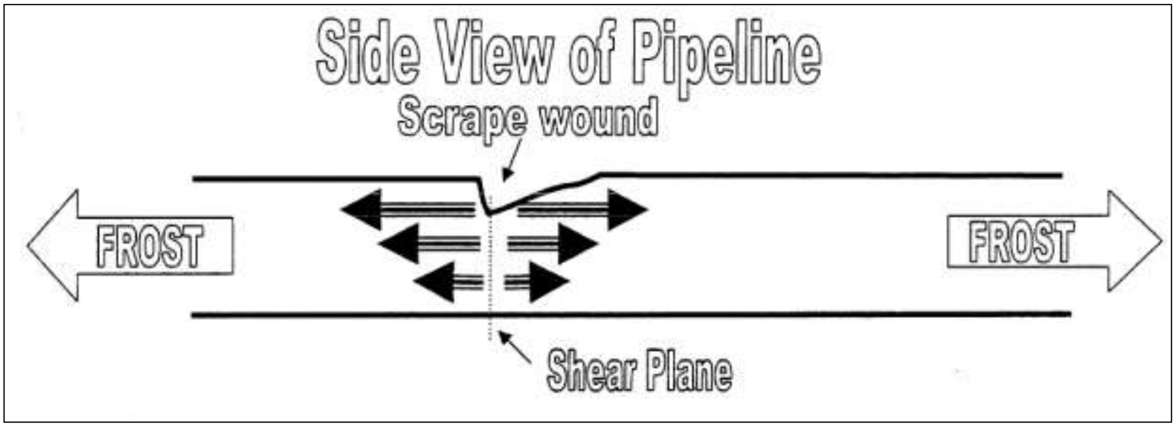
2.6 Each weld that does not meet the acceptance requirements shall be removed or repaired.

2.7 Arc strikes/burns are strictly prohibited. Arc burns rapidly heat and cool the material causing a change in the metallurgy and create a hardened brittle area that will fracture at a lower force than the rest of the material surrounding the arc strike.

2.8 Dents, gouges, and scrapes shall be removed or repaired. Dents and gouges weaken the material is two ways:

2.8.1 Roundness is critical to the pipe's properties. Changes in the roundness of the pipe create internal forces at these locations and increase the stress concentrations at the gouge or dent.

2.8.2 Change the metallurgy of the pipe and cause a loss of important material property-toughness. The area of the interest gets "work hardened" and becomes hard and brittle; thus it will fracture at a lower force than the surrounding ductile material.



2.9 All materials shall be inspected before being put into the system to ensure that the component is free from damage.

2.9.1 Any defect and/or damage that impairs the serviceability of the pipe by more than 50% of the wall thickness shall be repaired or removed.

2.9.2 Any process to remove a defect shall not remove an excess amount of material.

2.9.3 Anything requiring removal of more than 8% of wall thickness shall require complete removal, or repair via sleeve or fitting. Filing or grinding is not allowed if it requires the removal of more than 8% of wall thickness.

2.10 Inspection shall be done to any distribution main or service line prior to commissioning the line. Inspection shall be done to the company's, applicable federal, state, and local requirements.

2.10.1 Inspector has the right to order repair, removal and/or replacement of any component that, in the inspector's judgment, does not meet the requirements stated above.

2.11 Inspection and remedial action for corrosion on existing steel pipelines is identified in O&M Standard 3360.

3.0 <u>Repair Methods</u>

3.1 General repair methods include:

- Filing of damages or defects
- Grinding to repair a defect in a weld
- Grinding for a surface repair of pipe (not recommended)
- Weld-O-Lets or no-Blo tees
- Full Encirclement
- Half soles

3.2 Filing Method

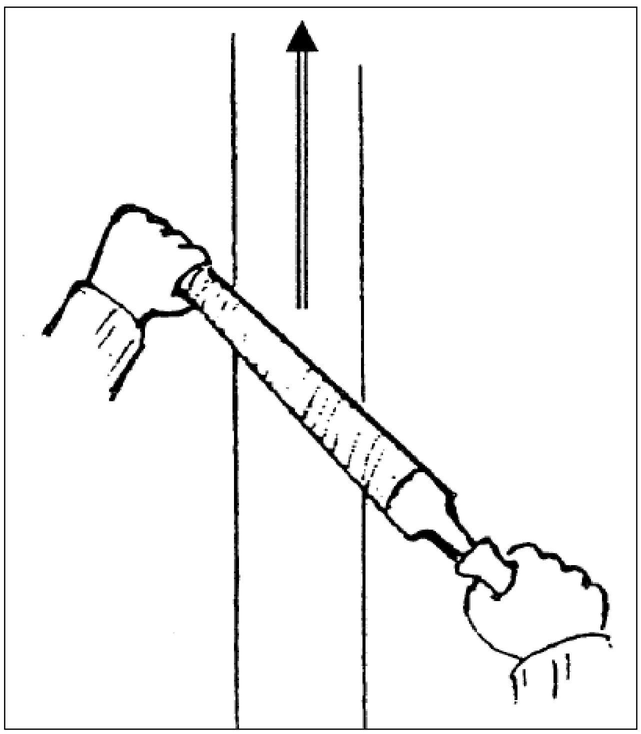
3.2.1 Filing is typically only done on scratched pipe.

3.2.2 Using a file, file the area until the scratch cannot be sensed visually or with a fingernail.

3.2.2.1 Excessive filing is not permitted. If filing more than a 1/32", this is not a scratch.

3.2.2.2 Filing shall not exceed requirements of 2.8.

3.2.2.3 Files shall be used so that all file marks are parallel with the pipe



3.3 Grinding to repair a defect in a weld

3.3.1 Use of a grinder to repair a defect in a weld is allowed.

3.3.2 Do not mix welding processes, meaning if the joint was brazed or oxyacetylene welded it should be sectioned out. Mixing of processes can lead to weld cracking.

3.3.3 Determining the necessary wheel, will depend on the defect.

3.3.4 The intent of this repair is to remove material; specifically the weld metal in the area of the defect.

3.3.5 Requirements of 2.8 do not apply to repair of welds.

3.4 Grinding for the surface repair on pipe (not recommended)

3.4.1 Grinding is not recommended as a repair method for surface defects or damages outside a weld.

3.4.2 Use of a grinding wheel or cutting wheel is not allowed for surface defects or damages. These wheels will remove material too quickly and heats this area, which is already hardened.

3.4.3 If a grinder is utilized for surface defects/damages, a polishing wheel shall be used.

3.4.4 Use of a polishing wheel on surface issues is not to remove quantities of metal, it is to lightly remove stress risers and minimally affect the contour of the pipe.

3.4.5 The polishing wheel shall be similar to filing in that any marking shall be in line with the pipe (see detail for filing above).

3.4.6 Use of a grinder shall meet the requirements of 2.8.

3.5 Weld-O-Let/No-Blo

3.5.1 Weld-O-Lets and No-Blo fittings may be used to cover a variety of smaller defects or damages (i.e. corrosion pit, isolated gouge, etc.).

3.5.2 Weld-O-Lets and No-Blo fittings may be used to encapsulate retired appurtenances on mains (i.e. swing joint nipples on mains).

3.5.3 The fitting shall completely cover the defect

3.5.3.1 If the defect is too large to use this method, a full encirclement fitting should be utilized.

3.5.3.2 When encapsulating an appurtenance care should be taken to ensure that the joining method does not contact or impair with the encapsulation method.

3.5.3.3 Mixing of joining methods shall be avoided.

3.5.3.3.1 For example, if the appurtenance was brazed to the pipe, the braze should not make any contact with the encapsulation. This will contaminate the weld.

3.5.4 If possible or required the defect or damage should be filed to remove any sharp edges or stress risers.

3.5.4.1 See filing section 3.2

3.5.5 Fitting will be welded utilizing an approved NWE WPS.

3.6 Full Encirclements (Split Sleeves)

3.6.1 Full encirclements shall be a purchased item from an approved manufacturer.

3.6.2 Full encirclements (split sleeves) shall be a manufactured and purchased item.

3.6.2.1 Full encirclements cannot be built in house, **unless they are designed and stamped by a Professional Engineer.**

3.6.2.2 Notification to the standards lead is required if 3.6.2.1 is utilized.

3.6.3 The following are full encirclements (split sleeves, manufactured by Dresser, that are stores coded:

Size	Stores Code
2”	7795730
3”	7795695
4”	7795696
6”	7795697
8”	7795698
10”	7795699
12”	7795700

3.6.4 Longer full encirclements are available from Dresser if necessary.

3.6.4.1 In some situations smaller full encirclements may be cut and welded together to make a longer encirclement. This requires discussion with the standards lead or welding engineer.

3.6.5 Full encirclements shall be welded with a qualified welder and an approved NWE WPS.

3.7 Half Soles

3.7.1 Half Soles shall be a manufactured and purchased item.

3.7.1.1 Half soles cannot be built in house, **unless they are designed and stamped by a Professional Engineer.**

3.7.1.2 Altering of a half sole to a “patch” is not allowed by the manufacturer, **but can be done if designed and stamped by a Professional Engineer.**

3.7.1.3 Notification to the standards lead is required if either 3.6.1.1 or 3.6.1.2 are utilized.

4.0 Repair of Welded Joints

4.1 In no way should a crack be attempted to be repaired. Remove the joint area and re-weld.

4.2 Specific welding procedures for the pipe size that is being welded shall be consulted for correct parameters including preheat and electrodes.

4.3 If the repair is at the root, the area shall be ground thin and using a hacksaw cut in a new gap, and re-weld the root.

4.4 Defects shall be removed to sound weld metal using a grinder, file or hacksaw (see Section 3.3 for specifics on grinding). To ensure complete defect removal:

4.4.1 Remove the defect until it cannot be seen then go slightly (approx 1/16") deeper.

4.4.2 Taper the ends and edges of the defect until the defect cannot be seen then remove an additional 1/8" in length on both sides of the defect.

4.5 Visual acceptance of the repair shall be done immediately following the welding process.

5.0 Repair of a Dented or Gouged Pipe

5.1 Pipe shall be inspected for dents, gouges, and scratches.

5.2 When a dent or gouge is found the pipe shall be examined for roundness of the pipe. If the pipe is not a true cylinder, then it shall be removed and a new piece inserted.

5.3 For gouges and dents that have kept the roundness of the pipe, repair shall be completed by cylindrical repair. The repair methods in 3.0 can be used to repair a dent or gouge damage/defect.

6.0 Repair of Scratched Pipe

6.1 If a pipe has a coating damage and is not distorted from a true cylinder, should be checked for scratches before rewrapping.

6.1.1 Dragging a fingernail across the location can sense scratches.

6.2 The repair methods show in 3.0 can be used to repair scratched pipe.

6.2.1 Typically a scratch is light on the surface so filing should be attempted prior to encapsulation.

7.0 Coating – Epoxy and Tape

7.1 Coating (Epoxy and Tape) shall be completed in accordance with the coating requirements put forth in this handbook

NorthWestern Energy

53 Steel 53-U Steel to Plastic Transition		Original Date 06/01/2006	Standard Number 53-U
Supersedes Standard: 53-U	REV# 4	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe transition fitting installation.

2.0 Installation

2.1 Transition Fittings typically come with a beveled weld end. If needed, bevel the steel section of the transition to the applicable WPS.

2.2 Do not shorten the steel. The length of the steel used for the Transition Fitting is the minimum length required to ensure that the heat generated during the welding process is dissipated and will not migrate to the Polyethylene to Steel Transition Zone. Shortening any steel could cause damage to the fitting.

2.3 Fit up to the steel pipe shall be as parallel as possible. In any event the fit up shall not have an angle change greater than 3 degrees.

2.4 Soap connections.

3.0 Materials

MDPE (yellow)	Stores Code
½” CTS x ¾” NOM	10002730
½” IPS x ¾” NOM	7792119
1” IPS x 1” NOM	7792120
1 ¼” x 1 ¼” NOM	7792121
2” IPS x 2” NOM	7792122
3” IPS x 3” NOM	7792123
4” IPS x 4” NOM	7792124
6” IPS x 6” NOM	7792180
8” IPS x 8” NOM	7792182

NorthWestern Energy

Gas Standards Subject: Steel Visual Inspection Criteria		Original Date 06/01/2006	Standard Number 53-V
Supersedes Standard: 53-V	REV# 2	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this guideline is for the nondestructive examination of welded joints on the NorthWestern Energy Distribution System. This guide shall not be used in any manner for construction, retirement, or abandonment of plastic services. These procedures are intended to comply with the minimum requirements as set by NorthWestern's O&M standard 5000.

2.0 General

2.1 The following criteria is taken from API 1104.

2.2 Visual inspection shall be completed by an individual that has appropriate traning and experience to ensure that the weld is completed to the specific procedure and that a satisfactory weld has been completed.

2.3 If a weld is found to not meet the criteria set in this document then it shall be removed or repaired per NorthWestern Energy Guidelines.

3.0 Visual Inspection Requirements

3.1 **Weld Must Contain Neat Workmanlike Appearance (Section 6.4)** – shall be reflected by the weld. Weld area and adjacent pipe shall be free of grinding scars and excessive arc burns. The weld shall be neat and straight in appearance. Start/stops shall not have excessive height from adjacent base material.

3.2 **Undercutting (IU) and (EU) (Section 9.7)** – Undercutting adjacent to the final bead on the outside of the pipe shall not be more than 1/32 inch deep or 12.5% of the pipe wall thickness, whichever is smaller, and there shall not be more than 2 inches of undercutting in any continuous 12" length of weld.

3.3 **Incomplete Fusion (IF) (Section 9.3.4)** – is defined as a surface imperfection between the weld metal and base metal that is open to the surface. IF shall be unacceptable if any of the following conditions are met:

a. Length of an individual imperfection exceeds 1in.

b. Aggregate length of indications in any continuous 12in. length of weld exceeds 1in.

c. Aggregate length of indications exceeds 8% of the weld length in any weld less than 12 in. in length.

3.4 **Cracks (Section 9.3.10)** – Shall be unacceptable when any of the following conditions exists:

a. The crack, of any size or location in the weld, is not a shallow crater crack or star crack.

b. The crack is a shallow crater crack or star crack whose length exceeds 5/32".

3.5 **Inadequate Penetration without high-low (IP) (Section 9.3.1)** -- is defined as the incomplete filling of the weld root. IP shall be unacceptable when any of the following conditions exists:

a. The length of and individual indication of IP exceeds 1in.

b. The aggregate length of IP in any continuous 12in. length of weld exceeds 1in.

c. The aggregate length of indications of IP exceeds 8% of the weld length in any weld less than 12in.

3.6 **Inadequate Penetration due to high low (IPD) (Section 9.3.2)** – is defined as the condition that exists when one edge of the root is exposed (or unbonded) because adjacent pipe or fitting joints are misaligned. IPD shall be unacceptable when any of the following conditions exists:

a. The length of IPD exceeds 2 inches.

b. The aggregate length of indications of IPD in any continuous 12-inch length of weld exceeds 3 inches.

3.7 **Burn-Through (BT) (Section 9.3.7)** -- is defined as a portion of the root bead where excessive penetration has caused the weld puddle to be blown into the pipe.

3.7.1 For pipe with an outside diameter greater than or equal to 2-3/8 inches, a BT shall be unacceptable if:

a. The maximum dimension exceeds ¼”.

b. The maximum dimension exceeds the thinner of the nominal wall thicknesses joined.

c. The sum of the maximum dimensions of separate BT’s, exceeds ½ “ in any continuous 12-inch length of weld or the total length, whichever is less.

3.7.2 For pipe with an outside diameter less than 2-3/8”, a BT shall be unacceptable if:

a. The maximum dimension exceeds ¼”.

b. The maximum dimension exceeds the thinner of the nominal wall thicknesses joined.

c. More than one BT of any size is present.

3.8 **Surface Porosity (Section 9.3.9)** – Any indication of Surface Porosity, or holes appearing in the final cap is considered as a rejectable indication.

3.9 **Accumulation of Imperfections (AI) (Section 9.3.12)** – Excluding incomplete penetration due to high-low and undercutting, any accumulation of imperfections (AI) shall be considered a defect should any of the following conditions exist:

a. The aggregate length of indications in any continuous 12-in. length of weld exceeds 2 in, or

b. The aggregate length of indications exceeds 8% weld length.

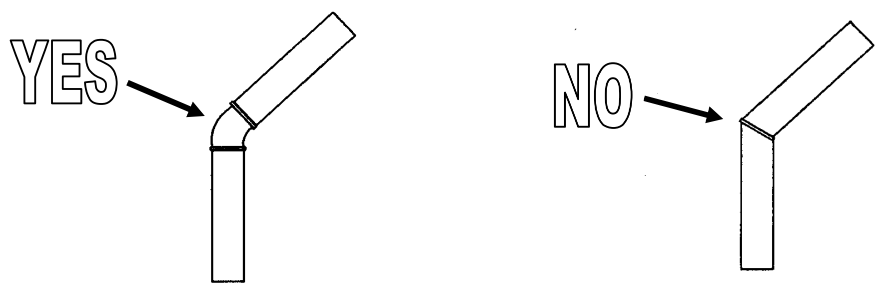
3.10 **Weld Profile** - The weld profile shall have a gradual transition into the base material. The weld face shall not be greater than 1/8” higher than the base material; nor, shall the bead width be more than 1/8” wider than the weld joint.

NorthWestern Energy

Gas Standards Subject: Steel Miter Joints and Custom Tube Turns		Original Date 06/01/2006	Standard Number 53-W
Supersedes Standard: 53-W	REV# 3	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Miter Joints

1.1 Mitered joints shall not be utilized as a means of changing the direction of pipelines. Pipe fitters are expected to sag or bend (no wrinkles) piping to get a perpendicular weld joint. When an abrupt turn is required, a long radius weld elbow can be cut to the angle needed and allow perpendicular weld joints. An example for making a custom tube turn is shown in the following figures.

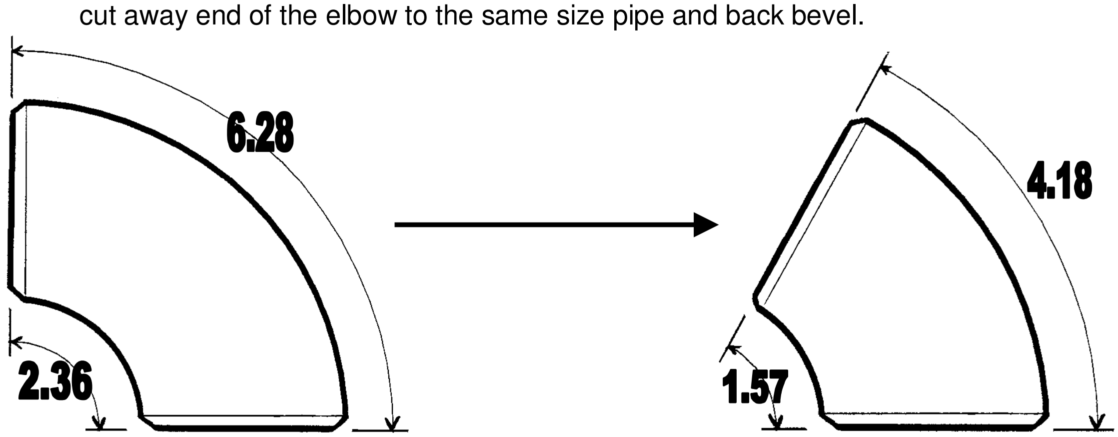


1.2 Care shall be taken to align piping as close to 0 degrees of deflection as possible. As a last effort to remedy joint misalignment or field connections, mitered joints may be used with prior knowledgeable supervision approval. Mitered joints that are allowed shall be limited to less than 3 degrees of deflection.

2.0 Custom Tube Turn

EXAMPLE FOR 60 DEGREE ELBOW

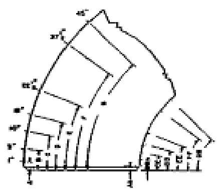
1. $\frac{\text{Angle Needed}}{90} = \frac{60}{90} = .67$ = This is your Factor
2. Measure the Back X Factor = 6.28 X .67 = 4.18
3. Measure the Throat X Factor = 2.36 X .67 = 1.57
4. Lay out the fitting
5. If you have a pipe beveler and an adjustable level, the fitting can be flame cut. Tack weld the cut away end of the elbow to the same size pipe and back bevel.

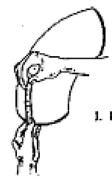


NorthWestern Energy

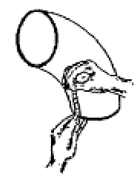
Gas Standards Subject: Steel Miter Joints and Custom Tube Turns		Original Date 06/01/2006	Standard Number 53-W
Supersedes Standard: 53-W	REV# 3	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

HOW TO CUT ODD-ANGLE ELBOWS





1. MEASURE DISTANCE ON OUTSIDE ARC



2. MEASURE DISTANCE ON INSIDE ARC

3. WRAP TAPE AROUND ELBOW AND MARK CUTTING LINE

ODD DEGREE LONG RADIUS ELBOWS

NOM SIZE	OUTSIDE ARC						
	A	B	C	D	E	F	G
2	5/64	3/8	23/32	1 3/32	1 21/32	2 3/4	3 9/32
2½	3/32	7/16	29/32	1 11/32	2 1/32	3 3/8	4 1/16
3	7/64	9/16	1 1/8	1 5/8	2 15/32	4 3/32	4 29/32
3½	1/8	5/8	1 9/32	1 29/32	2 27/32	4 3/4	5 11/16
4	9/64	23/32	1 7/16	2 5/32	3 1/4	5 13/32	6 15/32
5	3/16	29/32	1 25/32	2 11/16	4 1/32	6 23/32	8 1/16
6	7/32	1 1/16	2 5/32	3 7/32	4 27/32	8 1/16	9 21/32
8	9/32	1 7/16	2 27/32	4 9/32	6 13/32	10 11/16	12 13/16
10	11/32	1 25/32	3 9/16	5 11/32	8	13 11/32	16
12	7/16	2 1/8	4 1/4	6 3/8	9 9/16	15 31/32	19 5/32
14	1/2	2 7/16	4 7/8	7 5/16	11	18 5/16	22
16	9/16	2 13/16	5 19/32	8 3/8	12 9/16	20 15/16	25 1/8
18	5/8	3 1/8	6 9/32	9 7/16	14 1/8	23 9/16	28 9/32
20	11/16	3 1/2	7	10 15/32	15 23/32	26 3/16	31 13/32
22	3/4	3 27/32	7 11/16	11 17/32	17 9/32	28 13/16	34 9/16
24	27/32	4 3/16	8 3/8	12 9/16	18 27/32	31 13/32	37 11/16
26	29/32	4 17/32	9 3/32	13 5/8	20 13/32	34 1/32	40 27/32
30	1 1/32	5 1/4	10 15/32	15 3/4	23 9/16	39 1/4	47 1/8
34	1 5/32	5 29/32	11 27/32	17 13/16	26 23/32	44 17/32	53 3/8
36	1 7/32	6 1/4	12 17/32	18 7/8	28 7/32	47	56 17/32
42	1 7/16	7 5/16	14 5/8	22	32 31/32	54 31/32	65 15/16

ODD DEGREE LONG RADIUS ELBOWS

NOM SIZE	INSIDE ARC						
	AA	BB	CC	DD	EE	FF	GG
2	1/32	5/32	5/16	15/32	23/32	1 3/16	1 7/16
2½	3/64	3/16	13/32	19/32	29/32	1 1/2	1 13/16
3	3/64	1/4	1/2	23/32	1 3/32	1 13/16	2 5/32
3½	1/16	9/32	9/16	27/32	1 9/32	2 1/8	2 9/16
4	1/16	5/16	21/32	31/32	1 15/32	2 7/16	2 15/16
5	5/64	13/32	13/16	1 1/4	1 27/32	3 3/32	3 23/32
6	3/32	1/2	1	1 1/2	2 7/32	3 23/32	4 15/32
8	1/8	11/16	1 11/32	2	3 1/32	5 1/32	6 1/32
10	5/32	27/32	1 11/16	2 17/32	3 25/32	6 5/16	7 9/16
12	7/32	1	2 1/32	3 1/16	4 9/16	7 19/32	9 1/8
14	1/4	1 7/32	2 7/16	3 21/32	5 1/2	9 5/32	11
16	9/32	1 13/32	2 13/16	4 3/16	6 9/32	10 15/32	12 5/8
18	5/16	1 9/16	3 1/8	4 23/32	7 1/16	11 25/32	14 1/8
20	11/32	1 3/4	3 1/2	5 1/4	7 27/32	13 3/32	15 11/16
22	3/8	1 29/32	3 27/32	5 3/4	8 5/8	14 3/8	17 9/32
24	13/32	2 3/32	4 3/16	6 9/32	9 7/16	15 11/16	18 27/32
26	15/32	2 9/32	4 17/32	6 13/16	10 7/32	17 1/32	20 13/32
30	17/32	2 5/8	5 1/4	7 7/8	11 25/32	19 5/8	23 9/16
34	19/32	2 31/32	5 29/32	8 29/32	13 3/8	22 9/32	26 11/16
36	5/8	2 13/16	6 1/4	9 7/16	14 1/8	23 5/8	28 1/4
42	23/32	3 21/32	7 5/16	10 19/32	16 1/2	26 3/8	32 31/32

NorthWestern Energy

Gas Standards Subject: Regulator Stations Farm Tap Installation – MT Only		Original Date 01/01/2007	Standard Number 54-A
Supersedes Standard: 54-A	REV # 1	Revision Date 01/01/2007	Prepared / Approved By K. Shuttlesworth / Committee

1.0 Scope

The purpose of this standard is to establish basic guidelines for the installation of a new farm tap to balance the needs of the Gas Transmission & Storage group with those of Distribution Operations.

2.0 General

New farm taps will only be installed by mutual consent of Gas Transmission & Storage (GTS) and Distribution Operations. All requests for service to new customers via a new farm tap will be submitted to the Director of Gas Transmission and Storage by the involved Division or area manager.

3.0 Guidelines

The following guidelines will be used in determining if a transmission line will be tapped:

3.1 A piggable line will not be tapped if a parallel line with existing taps is available at a reasonable cost.

3.2 Costs for extra equipment, time and material to perform needed procedures like purge taps, shut down and re-light customers during inline inspection or hydro testing, or any of the required procedure that GTS performs to meet NWE's Integrity Management Plan (IMP) that affect the tap, will be considered when deciding the feasibility of the tap.

3.3 Customers will need to be made aware of any outages, estimated durations and frequency that may be associated with IMP activities in the future.

3.4 A transmission line should not be tapped if an existing distribution source is with ½ mile of prospective load point; extenuating circumstances such as natural barriers, major transportation corridors may be considered. In these cases, written justification for variation from this guideline shall be submitted to the vice-presidents of distribution and transmission for approval.

NorthWestern Energy

Gas Standards Subject: Regulator Stations Farm Tap and Regulator Stations Under 22,000scfh		Original Date 11/15/2009	Standard Number 54-B
Supersedes Standard: 54-B	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning farm tap or small regulator station installations.

2.0 Definition

2.1 A station typically is installed where a pressure reduction is required from a transmission line or a high-pressure distribution line to deliver gas to a lower pressure distribution system. The station consists of all Company-owned material and equipment installed from the outlet of the high-pressure line tap to the point of connection with downstream piping operating at normal distribution pressures.

2.2 Station piping will consist of piping 2" and less in nominal pipe size.

2.3 Typically at a station the downstream pressure will operate at less than 100 psig. The upstream pressure in the pipeline may or may not exceed 20% SMYS depending on whether the upstream line is considered transmission or high-pressure distribution.

3.0 Responsibility

3.1 The Company shall furnish the station and maintain all regulators and reliefs. Only authorized employees or agents of the Company are allowed to connect the Company's stations, turn on gas where it has been turned off, or alter any of the Company's station equipment or gas lines.

3.2 The Company shall set and maintain all pressures related to the installation.

3.3 The Company authorized employee on a regular basis should perform general maintenance.

3.4 Installations in Montana requires the engineer/estimator to review standard 54-A. Also the Gas Transmission and Storage Department's Operation and Maintenance Manual, Tab 4, as well as form #3485 MOC should be consulted for further requirements and complete steps necessary to satisfy these documents. Montana Retail operations personnel shall enter the appropriate station code in CIS for all delivery point meters that are supplied by a station. Refer to information presented at the end of this standard for a list of station codes for transmission pipeline line segments.

4.0 Location

4.1 Each station will be installed in either a private utility easement or a public right-of-way approved for such use.

4.2 Each station should be installed in a readily accessible location and be protected from traffic or other damage.

4.3 It is recommended that all sites be selected to avoid swampy or low-lying areas where flooding could occur.

4.4 Stations should be located in an area that provides access in all weather conditions when possible.

4.5 When possible each site should avoid man-made obstructions that could cause safety related concerns during emergency operations such as overhead power lines.

5.0 <u>Station Installations: General Information</u>

5.1 Each station should be installed level and in a workmanship like manner.

5.2 All installations will be painted appropriately. All metal surfaces shall be painted with a primer compatible with cover paint. Barricades should be painted with a safety yellow. Exposed pipe should be painted gray or as dictated by permitting requirements for the applicable pipeline.

NOTE: In Montana GTS has painting requirements for their sections of pipes. Please consult GTS for coloring guidelines.

6.0 <u>Connection of Piping</u>

6.1 Each connection to downstream piping shall be made so as to minimize anticipated stresses upon the connected piping.

6.2 The type of piping joint used shall be suitable for the pressure-temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain maximum end force due to internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or to the weight of the piping system and its contents.

6.3 Rigid pipe joints shall be threaded, flanged, or welded. Fittings and pipe used shall be approved for use in gas piping systems. There shall be no threaded fittings below grade. All welded joints exposed to transmission/high pressure distribution line pressure shall be performed by certified welders certified to the same procedures as the pipeline being tapped (i.e. API1104 for all transmission taps and some high pressure distribution). All welded joints exposed to distribution system pressures will comply with the requirements of all applicable standards contained in section 53 of this manual

6.4 Station assemblies shall be electrically isolated from the gas transmission pipeline by installation of a dielectric union rated for the MAOP of the upstream pipeline. The installation should include a cathodic test station conforming to the guidelines set forth in standard 55-F. Test leads and tracer wire installations, including attachment to gas pipelines, shall conform to standard 52-L.

6.5 Plastic distribution systems shall not be electrically connected to the gas transmission pipeline as a source of cathodic protection without approval from the appropriate department. Any electrical bonding approved between the upstream system and the downstream system should be with a removable jumper contained within the cathodic test station.

7.0 General Design

7.1 Protection from traffic or outside damage:

7.1.1 Protection should be provided by at minimum with a set of steel pipe or guard tubing barricades or livestock panels on all sides of the installation.

7.1.2 Fencing may provide protection for the installation.

7.1.2.1 Inside the fencing a 5' clearance should be allowed between the fence and the piping to provide for space to work on the installation.

7.1.3 The ground surface under and around barricaded or fenced stations should be covered with gravel/rock to facilitate vegetation control and to provide all weather access.

7.1.4 A building may provide protection for the installation due to weather or operational conditions. The following issues also need consideration:

7.1.4.1 Inside the building, three feet of clearance should be allowed around the set to allow for space to work around the installation. Three feet of clearance in front of the station, or a door that exposes the front of the station assembly for inspection and repairs is required.

7.1.4.2 The building should provide adequate ventilation at the roofline and ground level to avoid build up of vapors in the enclosed space.

7.1.4.3 All regulator or relief venting shall be piped outside the building and have a rain cap installed.

7.1.4.4 If electrical wiring is required inside the building it shall meet Class I Division I requirements.

7.1.5 Above ground containers can be utilized to provide protection to the installation in lieu of either barricades or buildings, but is not preferred.

7.1.6 Installation of regulation and relief valve assemblies below grade is strongly discouraged.

7.2 Piping material

7.2.1 Pipe material shall conform to material lists in drawings included in this standard. Items not covered shall be used in accordance with information provided in the material sections contained within standards 53-D and 53-E presented in this handbook.

7.3 Station valves

7.3.1 Each station shall have a valve installed on the inlet piping at a distance from the regulator sufficient to permit operation of the valve during an emergency that might preclude access to the station.

7.3.2 The remote valve when below grade shall be enclosed inside a valve box or similar protective structure.

7.3.3 Valves shall be installed to allow for isolation of the regulator(s) and relief(s) for operational testing, maintenance and repair procedures.

7.3.4 Valves used on the installation should be equal in size to that of the associated regulator or relief bodies.

7.3.5 When possible all valves should be self lubricated type.

7.3.6 Isolation valves to the relief will be full opening and offer a lock open feature. Separate isolation valves to a relief are not required if isolated with an associated regulator in station assemblies with multiple runs, each equipped with full relief capacity.

7.3.7 By-pass valves should be the same size as the inlet and outlet valve, be hand operable and have a locking feature.

7.4 Station regulation

7.4.1 Regulators shall be sized for maximum anticipated volume at the minimum anticipated inlet pressure.

7.4.2 When multiple regulators are installed, each regulator should be capable of carrying the entire load independent of the other regulator. When load exceeds individual regulator capacity, an engineering review should be initiated to determine if modification is necessary to restore such capacity or upgrade the installation.

7.4.3 In multiple regulator installations each regulator will be of the same body size, unless otherwise specified after review by engineering.

7.4.4 All regulators installed will be capable of operating under the full MAOP of the upstream or delivery piping.

7.4.5 The operating spring range for installed regulators should be a band that contains the desired downstream set point.

7.4.6 The standard regulator for station installations will be the Fisher model 627 with a 1/8” orifice and a spring range from 15 – 40 psig. Please note the capacities of this regulator in Table 1. Load requirements outside of these ranges need to be reviewed by engineering or the local gas supervisor. Note: in Montana installation of Fisher model 630 regulators may be allowed for economic or technical considerations as approved by engineering of the local gas supervisor.

Table 1

Fisher 627, 1/8" Orifice - Capacities in Scfh

Spring Range	Outlet Pressure Setting	Intlet Pressure (psig)	Type 627 3/4" Body	Type 627 1" Body	Type 627 2" Body
5 - 20 psig	20 psig	30	620	620	620
		50	1,000	1,000	1,000
		60	1,170	1,170	1,170
		100	1,800	1,800	1,800
		150	2,580	2,580	2,580
		200	3,370	3,370	3,370
		300	4,910	4,910	4,910
		500	8,090	8,090	8,090
		750	12,000	12,000	12,000
		1,000	14,600	16,000	16,000
		1,250			
		1,500			
		1,750			
		2,000			
15 - 40 psig	40 psig	60	1,090	1,090	1,090
		75	1,370	1,370	1,370
		100	1,790	1,790	1,800
		150	2,580	2,580	2,580
		200	3,370	3,370	3,370
		300	4,910	4,910	4,910
		500	8,090	8,090	8,090
		750	12,000	12,000	12,000
		1,000	16,000	16,000	16,000
		1,250	18,000	19,000	19,000
		1,500	21,000	22,000	22,000
		1,750			
		2,000			

Capacity table reproduced from Fisher Bulletin 71.1:627

7.5 Station relief valves

7.5.1 Stations shall be equipped with external relief valves sized to meet the requirements of section 7.5.2 below. Any internal relief capacity of the station regulator shall be disregarded in determination of relief capacity.

7.5.2 Relief valves shall be properly sized such that the relief is capable of venting the maximum wide open capacity of the regulator it monitors, while maintaining the maximum downstream delivery pressure plus allowable build up as defined in O&M standard 1020.

7.5.3 The standard relief valve to be used for station installations will be the Fisher 289H with a 15 – 50 psig spring range. Relief requirements in addition to or in replacement for the 289H need to be reviewed by engineering or the local gas supervisor.

7.5.4 When possible the relief valve should be installed so as to provide overpressure protection to the distribution piping system when the hard by-pass is used.

7.6 Regulator and relief vents

7.6.1 The vents shall be piped with the opening pointed down and with all openings screened for insect protection.

7.6.2 The vents should be installed in a location where natural gas naturally vents and installed appropriately to ensure water cannot enter the vent.

7.6.3 Be protected from damage caused by submergence in areas where flooding may occur.

7.7 Miscellaneous requirements

7.7.1 Odorization of the natural gas stream is to be provided by the company.

7.7.2 Installation for heaters on regulator pilots should be considered where icing conditions might occur. Options for heating the pilot gas stream are available with either a catalytic heater or a vortex heater.

7.7.3 A removable strainer should be considered where appropriate. When installed a strainer should be upstream of regulation and be maintainable. An appropriate strainer would be a “Y” style strainer.

7.7.4 Pressure gauges or pressure taps for recording the inlet pressure, the outlet pressure and the intermediate pressure, when appropriate, should be installed.

7.7.5 If the installation is planned to serve a single residence, refer to the excess flow valve (EFV) section contained within this handbook regarding installation.

7.7.6 When a hard by-pass is installed an orifice union may be installed in the by-pass line. The table below shows approximate capacities of the by-pass orifice union.

1/8" Orfice Union Capacity (cft/hr)

Downstream Pressure (psi)	Differential Pressure (psi)				
	100	200	300	400	500
30 - 60	1,700	3,200	4,700	6,200	7,700

NOTE: When using the by-pass line, downstream pressure shall be monitored and the by-pass valve shall be attended without interruption to assure that MAOP of the distribution system is not exceeded. A restricting device, such as an orifice union, does not provide pressure control.

8.0 Off-Standard Installations

8.1 It is recognized that the standard stations presented herein will not satisfy every requirement and no attempt has been made to cover all conditions. Field personnel are advised that variations in equipment and piping arrangements from standards must be designed and installed under the direction of gas engineering.

9.0 Drawings and Equipment Lists

These drawings and equipment lists have been relocated to the Gas Distribution SharePoint.

NorthWestern Energy

Gas Standards Subject: Regulator Stations Farm Tap and Regulator Stations Under 22,000scfh		Original Date 11/15/2009	Standard Number 54-B
Supersedes Standard: 54-B	REV# 4	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

10.0 MT CIS Codes

CODE	ALL AREAS
0100	BTE BUTTE DEFAULT
0109	BTE WARM SPRINGS 3" TAP
0110	BTE MORAL JUNCTION TO ANACONDA
0111	BTE DRL COMP TO MORAL JCT
0112	BTE THREE FORKS TO DIL TAP
0113	BTE DILLON TAP TO 9 MILE
0114	BTE 9 MILE TO BTE COMPRESS
0115	BTE BUTTE COMPRESS TO BUTTE
0130	BTE DILLON TAP TO TWIN BRIDGES
0131	BTE TWIN BRIDGES TO SHERIDAN
0132	BTE TWIN BRIDGES TO DILLON
0133	BTE DILLON TO PFIZER
0140	BTE MORAL JUNCTION TO BUTTE
0190	BTE DRL COMP TO GARRISON
0191	BTE GARRISON TO DRUMMOND (INC)
0192	BTE DRUMMOND TO HALL
0193	BTE HALL TO MAXVILLE
0194	BTE MAXVILLE TO PHILIPSBURG
0195	BTE DRUMMOND TO BONNER TAP
0199	BTE BUTTE
0200	GTF GREAT FALLS DEFAULT
0232	GTF FLATHEAD TAP TO CUT BANK
0240	GTF ML#1 TO VALIER (INC 4")
0265	GTF REIBELING TAP - SUN RIVER
0266	GTF SUN RIVER TO GTF CHECK
0270	GTF CON CK TO SO SIDE CITY
0271	GTF SO SIDE CON TO GALLUP LANE
0273	GTF GALLUP CY LN TP-20 EMG
0282	GTF TELSTAD TO PARALLEL TP
0283	GTF PARALLEL TAP-GTF CHECK
0290	GTF VALIER TAP TO ML #2
0291	GTF ML#2 TO CHO (INC CHO 4")
0292	GTF CHOTEAU TO ML #3
0293	GTF ML#3 TO AUGUSTA
0296	GTF FLOWEREE
0297	GTF LEDGER LINE

CODE	ALL AREAS
0299	GTF GREAT FALLS
0300	BIL BILLINGS DEFAULT
0350	BIL DRY CREEK
0351	BIL SHOSHONE LINE
0352	BIL CENEX TAP
0360	BIL BIG COULEE TO HRW TAP
0361	BIL HRW TAP TO HARLOWTON
0362	BIL HRW TAP TO LEWISTOWN
0371	BIL RDL TAP TO ABSORK COMP
0372	BIL CMB TAP TO LAKE BASIN
0373	BIL LEWISTOWN TO HEATH
0374	BIL EAST LN-BIG COULEE TAP
0390	BIL ABSAROKEE COMP TO BGT
0399	BIL BILLINGS
0600	BOZ BOZEMAN DEFAULT
0610	BOZ BOZEMAN TO BELGRADE
0611	BOZ BELGRADE - THREE FORKS
0612	BOZ THREE FORKS-DILLON TAP
0690	BOZ ABSAROKEE COMP TO BGT
0691	BOZ BIG TIMBER TO LIVINGSTON
0692	BOZ LIVINGSTON TO BOZEMAN
0699	BOZ BOZEMAN
0700	HEL HELENA DEFAULT
0710	HEL HELENA JCT TO ELLISTON
0711	HEL ELLISTON TO DRL COMP
0750	HEL HELENA JCT TO HEL #2
0751	HEL HELENA #2 TO HELENA #1
0752	HEL HELENA #1 TO EAST HELENA
0753	HEL EAST HEL TO JEFF CITY
0754	HEL JEFF CITY TO BOULDER
0795	HEL WOLF CREEK TO HELENA JCT
0799	HEL HELENA
0800	KAL KALISPELL DEFAULT
0830	KAL CARWAY TO FLATHEAD TAP
0831	KAL FLATHEAD TP-FLATHEAD CHECK
0850	KAL FLATHEAD CHECK-E GLACIER

CODE	ALL AREAS
0851	KAL EAST GLACIER TO SUMMIT
0852	KAL SUMMIT TO WEST GLACIER
0853	KAL W GLACIER-HUNGRY HORSE
0854	KAL HUNGRY HRS-WHITEFISH TAP
0855	KAL WHITEFISH TAP-WHITEFISH
0856	KAL WHITEFISH TAP TO KALISPELL
0857	KAL BIG MOUNTAIN TAP
0899	KAL KALISPELL
0900	MIS MISSOULA DEFAULT
0970	MIS HAMILTON CHK TO LOLO
0971	MIS LOLO TO STEVENSVILLE
0972	MIS STEVENSVILLE – HAMILTON
0995	MIS DRUMMOND TO BONNER TAP
0996	MIS BONNER TAP TO MILLTOWN
0997	MIS MILLTOWN TO GRANT CREEK
0998	MIS GRANT CREEK TO WALDORF
0999	MIS BONNER TAP TO HAMILTON CHK
1100	HVR HAVRE DEFAULT
1130	HVR UTOPIA-RUDYARD (INC RUD)
1131	HVR RUDYARD TO HAVRE
1132	HVR HAVRE TO BOX ELDER
1133	HVR BOX ELDER-CHI (INC CHI.)
1134	HVR CHINOOK TO BOWES
1150	HVR BOWES TO FORT BELKNAP
1160	HVR UTOPIA TO TELSTAD
1182	HVR TESTAD TO PARALLEL TAP
1196	HVR BIG SANDY TO GREAT FALLS
1197	HVR HAVRE
1198	HVR HAVRE
1199	HVR HAVRE
9999	NORMAL GAS METER

NorthWestern Energy

Gas Standards Subject: Regulator Stations Regulator Station Installations		Original Date 11/15/2009	Standard Number 54-C
Supersedes Standard: 54-C	REV# 2	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning new regulator station installations.

2.0 Regulator Station - Definition

2.1 A regulator station is installed where a pressure reduction is required from one distribution line to deliver gas to a lower pressure distribution system. The regulator station consists of all Company-owned material and equipment installed from the outlet of the higher-pressure system to the point of connection with downstream system operating at the lower distribution pressure.

2.2 Regulator station piping will consist of piping 6" and less in nominal pipe size and regulators of 4" body size or less. Regulator stations need to be reviewed by engineering and the local gas supervisor.

3.0 Responsibility

3.1 The Company shall be responsible for all regulators and reliefs within the station. Only authorized employees or agents of the Company are allowed to operate valves, work on regulators or reliefs, or alter any of the Company's regulation equipment.

3.2 The Company shall set and maintain all pressures related to the regulator station installation.

3.3 The Company authorized employee should perform maintenance as outlined in the Gas Operating and Maintenance Standards 3200, 3210, 3220 and 3230.

3.4 Installations in Montana requires the engineer or local supervisor to complete form 3320.

4.0 Location

4.1 Each regulator station will be installed on either private property, a private utility easement or a public right-of-way approved for such use.

4.2 Each regulator station should be installed in a readily accessible location and be protected from traffic or other damage.

4.3 It is recommended that all regulator station sites be selected to avoid swampy or low-lying areas where flooding could occur.

4.4 Regulator stations should be located in an area that provides access in all weather conditions when possible.

4.5 When possible each regulator station should avoid man-made obstructions that could cause safety related concerns during emergency operations such as overhead power lines.

5.0 Regulator Station Installations: General Information

5.1 Each reg station should be installed level and in a workmanship like manner.

5.2 All reg station installations will be suitably painted or coated to protect from atmospheric corrosion.

6.0 Connection of Piping

6.1 Each connection to downstream piping shall be made so as to minimize anticipated stresses upon the connected piping.

6.2 The type of piping joint used shall be suitable for the pressure-temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain maximum end force due to internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or to the weight of the piping system and its contents.

6.3 Rigid pipe joints shall be threaded, flanged, or welded. Fittings and pipe used shall be approved for use in gas piping systems. There shall be no threaded fittings below grade.

7.0 General Design

7.1 Protection from traffic or outside damage

7.1.1 Protection should be provided by at minimum with a set of steel pipe barricades on all sides of the regulator station.

7.1.2 Fencing may provide protection for the regulator station.

7.1.2.1 Inside the fencing a 5' clearance should be allowed between the fence and the station to provide for space to work on the installation.

7.1.2.2 Once construction is completed the fenced in area should be graveled/rocked to provide all weather access.

7.1.3 A building may provide protection for the reg station due to weather or operational conditions. The following issues also need consideration:

7.1.3.1 Inside the building 3' should be allowed around the station to allow for space to work around the installation.

7.1.3.2 The building should provide adequate ventilation at the roofline and ground level to avoid build up of vapors in the enclosed space.

7.1.3.3 All regulator or relief venting shall be piped outside the building.

7.1.3.4 If electrical wiring is required inside the building it shall meet Class I Division I requirements.

7.1.4 Above ground or belowground containers can be utilized to provide protection to the installation in lieu of barricades, fencing or buildings.

7.2 Piping material

7.2.1 Pipe material shall be used in accordance with information provided in the material sections contained within standards 53-D and 53-E presented in this handbook.

7.3 Regulator station valves

7.3.1 A remote inlet valve should be located approximately 25’ from the above ground structure when possible.

7.3.1.1 When placed above grade the valve shall be protected by barricades or fencing.

7.3.1.2 When below grade the valve shall be enclosed inside a valve box or similar protective structure.

7.3.2 Valves shall be installed on both the inlet and outlet of the regulator, the inlet to the relief and in the by-pass line.

7.3.3 Valves used on the regulator run should be equal in size to that of the associated regulator or at most two body sizes larger.

7.3.4 When possible all valves should be self-lubricating type and of plug, gate or ball valve design and have a locking feature.

7.3.5 Isolation valves to the relief will be the same body size as that of the relief, full port and offer a lock open feature.

7.3.6 By-pass valves should be the same size as the by-pass line, be hand operable and have a locking feature.

7.3.7 Key or zone valves are defined in O&M standard 3260 and station valves that meet these requirements shall be recorded and maintained as outlined in this standard.

7.4 Station regulation

7.4.1 Regulators shall be sized for maximum anticipated volume at the minimum anticipated inlet pressure to the station.

7.4.2 The size of the above ground piping should be large enough to maintain the velocity of the gas flowing through the station piping at or below 120 ft/sec.

7.4.2.1 The velocity can be approximated by the following equation:

$$V = 748Q/PD^2$$

V = velocity in ft/sec

Q = capacity in Mscf/hr

P = pressure in psia

D = the inside diameter of the pipe in inches

7.4.3 When multiple regulators are installed, it is suggested but not required that each regulator be capable of carrying the entire load independent of the other regulator.

7.4.4 All regulators installed will be capable of operating under the full MAOP of the upstream piping.

7.4.5 The operating spring range for installed regulators should be within a band that contains the desired downstream set point.

7.4.6 Various possible regulators are shown in Table 1 through Table 5. Load requirements outside of these ranges need to be reviewed by engineering and the local gas supervisor.

NorthWestern Energy

Gas Standards Subject: Regulator Stations Regulator Station Installations		Original Date 11/15/2009	Standard Number 54-C
Supersedes Standard: 54-C	REV# 2	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Table 1

Regulators for 20 psig Delivery

Regulator Type	Body Size	Orifice	Capacity (scfh) 50 psig Inlet	60 psig Inlet	75 psig Inlet	100 psig Inlet	150 psig Inlet
Fisher 627	1"	3/16"		2640	3176	4070	5850
Fisher 627	1"	1/4"	4090	4750	5710	7310	10500
Fisher 299	2"	3/8"	9550	11090	13314	17020	24440
Fisher 299	2"	3/4"	35140	41440	22185	52260	
Fisher 1098-EGR	2"	STD Cage	175000	210600	264000	337000	484000
Fisher 399/EZR	2"				228000	291000	419000
Fisher 99	2"	7/8"	34000	42000	47000	59000	86000
Fisher 99	2"	1 1/8"	57000	65000	78000	99000	143000
Mooney Flowgrid	2"		87000	103000	127000	167000	240000
Fisher 1098-EGR	3"	STD Cage	350000	424400	536000	685000	984000
Fisher 399/EZR	3"				430000	550000	790000
Mooney Flowgrid	3"		260000	311000	384000	511000	734000
Fisher 1098-EGR	4"	STD Cage	549000	662800	847000	1083000	1554000
Fisher 399/EZR	4"				675000	863000	1239000
Mooney Flowgrid	4"		476000	571000	709000	962000	1382000

Regulators for 30 psig Delivery

Regulator Type	Body Size	Orifice	Capacity (scfh) 50 psig Inlet	60 psig Inlet	75 psig Inlet	100 psig Inlet	150 psig Inlet
Fisher 627	1"	3/16"					
Fisher 627	1"	1/4"					
Fisher 299	2"	3/8"	8950	10850	13164	17020	24440
Fisher 299	2"	3/4"	32300	39600	47190	59840	
Fisher 1098-EGR	2"	STD Cage	152000	189000	244500	337000	484000
Fisher 399/EZR	2"		131000	163000	211000	291000	419000
Fisher 99	2"	7/8"	28000	37000	47000	59000	86000
Fisher 99	2"	1 1/8"	47000	62000	78000	99000	113000
Mooney Flowgrid	2"		77000	96000	122000	163000	240000
Fisher 1098-EGR	3"	STD Cage	302000	378600	493500	685000	984000
Fisher 399/EZR	3"		242000	303600	396000	550000	790000
Mooney Flowgrid	3"		229000	288800	368000	481000	734000
Fisher 1098-EGR	4"	STD Cage	470000	592600	776500	1083000	1555000
Fisher 399/EZR	4"		373000	471000	618000	862000	1239000
Mooney Flowgrid	4"		416000	525000	674000	906000	1382000

Values not published or values are interpolated -
Regulator is not useable for these values -

Table 2

Table 3

NorthWestern Energy

Gas Standards Subject: Regulator Stations Regulator Station Installations		Original Date 11/15/2009	Standard Number 54-C
Supersedes Standard: 54-C	REV# 2	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Regulators for 40 psig Delivery

Regulator Type	Body Size	Orifice	Capacity (scfh) 50 psig Inlet	60 psig Inlet	75 psig Inlet	100 psig Inlet	150 psig Inlet
Fisher 627	1"	3/16"		2530	3080	4070	5850
Fisher 627	1"	1/4"		4510	5640	7310	10500
Fisher 1098-EGR	2"	STD Cage	115000	151900	207250	299500	484000
Fisher 399/EZR	2"			143000	189000	265667	419000
Fisher 99	2"	7/8"	21000	30000	45000	59000	86000
Fisher 99	2"	1 1/8"	35000	50000	74000	99000	143000
Mooney Flowgrid	2"		59000	84000	114000	158000	240000
Fisher 1098-EGR	3"	STD Cage	235000	309900	422250	609500	984000
Fisher 399/EZR	3"			264000	351667	497778	790000
Mooney Flowgrid	3"		175000	251000	343000	476000	734000
Fisher 1098-EGR	4"	STD Cage	370000	488500	666250	962500	1555000
Fisher 399/EZR	4"			409000	547333	777889	1239000
Mooney Flowgrid	4"		314000	454000	625000	873000	1382000

Table 4

Regulators for 50 psig Delivery

Regulator Type	Body Size	Orifice	Capacity (scfh) 50 psig Inlet	60 psig Inlet	75 psig Inlet	100 psig Inlet	150 psig Inlet
Fisher 627	1"	3/16"					
Fisher 627	1"	1/4"					
Fisher 1098-EGR	2"	STD Cage			210000	301333	484000
Fisher 399/EZR	2"				175000	256333	419000
Fisher 99	2"	7/8"		23000	37000	59000	86000
Fisher 99	2"	1 1/8"		38000	62000	99000	143000
Mooney Flowgrid	2"			63000	102000	151000	233000
Fisher 1098-EGR	3"	STD Cage			420000	608000	984000
Fisher 399/EZR	3"				322000	478000	790000
Mooney Flowgrid	3"			189000	306000	454000	705000
Fisher 1098-EGR	4"	STD Cage			630000	938333	1555000
Fisher 399/EZR	4"				498000	745000	1239000
Mooney Flowgrid	4"			340000	554000	828000	1299000

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Gas Standards Subject: Regulator Stations Regulator Station Installations		Original Date 11/15/2009	Standard Number 54-C
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Table 5

Regulators for 60 psig Delivery

Regulator Type	Body Size	Orifice	Capacity (scfh) 50 psig Inlet	60 psig Inlet	75 psig Inlet	100 psig Inlet	150 psig Inlet
Fisher 627	1"	3/16"			2760	4010	5850
Fisher 627	1"	1/4"			4880	7000	10500
Fisher 1098-EGR	2"	STD Cage			165000	280000	484000
Fisher 399/EZR	2"					241000	393000
Fisher 99	2"	7/8"			30000	53000	86000
Fisher 99	2"	1 1/8"			50000	99000	143000
Mooney Flowgrid	2"				83000	141000	228000
Fisher 1098-EGR	3"	STD Cage			330000	560000	984000
Fisher 399/EZR	3"					447000	732000
Mooney Flowgrid	3"				250000	423000	690000
Fisher 1098-EGR	4"	STD Cage			525000	880000	1555000
Fisher 399/EZR	4"					691000	1137000
Mooney Flowgrid	4"				450000	769000	1267000

NOTE: Regulating capacities listed in tables 1 through 5 are not the capacities required for maximum wide-open capacity for relief sizing calculations. Capacities shown in tables 1 through 5 are not applicable when used in an operator-monitor configuration, for those capacities refer to manufacturer data.

7.5 Reg station relief valves

7.5.1 Relief valves for the station shall be installed downstream of all regulation.

7.5.2 Relief valves shall be properly sized such that the relief is capable of venting the maximum wide open capacity of the regulator(s) it monitors, from the point of the regulator discharge, while maintaining the maximum downstream delivery pressure plus allowable build up as defined in O&M standard 1020. Back pressure build-up may need to be considered for the piping between the last regulator and the relief valve so as not to exceed equipment and piping MAOPs on the station.

7.5.3 Relief valves are not required if a monitor regulator is installed in series in each regulator run.

7.5.3.1 If a relief valve is installed in a station with monitor regulators, it will be done only as a token relief. A token relief is not sized for wide open flow but instead is used as an indicator to identify when the working regulator in a monitor set has exceeded the desired set point.

7.5.4 Possible relief choices for installation are shown in table 6. Relief requirements in addition to or in replacement for any of the listed reliefs need to be reviewed by engineering and the local gas supervisor.

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Table 6

Relief Choices

Fisher 289 H 1" Body		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20	15 to 50 psig	1D7455 27142
30	15 to 50 psig	1D7455 27142
40	15 to 50 psig	1D7455 27142
50		
60		

Fisher 289 HH 1" Body		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20		
30		
40	45 to 75 psig	1D7455 27142
50	45 to 75 psig	1D7455 27142
60	45 to 75 psig	1D7455 27142

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Fisher 1805 2"		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20	10 to 50 psig	1D6659 27022
30	10 to 50 psig	1D6659 27022
40	10 to 50 psig	1D6659 27022
50	35 to 125 psig	1E5436 27142
60	35 to 125 psig	1E5436 27142

Fisher 1805-6358 2"		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20	10 to 40 psig	1B788327022
30	10 to 40 psig	1K748527202
40	35 to 125 psig	1K748527202
50	35 to 125 psig	1K748527202
60	35 to 125 psig	1K748527202

Fisher 63EG 2" through 4" Body		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20	10 to 40 psig	1E3925 27022
30	10 to 40 psig	1E3925 27022
40	35 to 125 psig	1K7485 27202
50	35 to 125 psig	1K7485 27202
60	35 to 125 psig	1K7485 27202

Fisher 399/EZRG 2" through 6" Body		
Regulator Set Pressure (psig)	Relief Spring Range Available	Part Number
20	20 to 40 psig	1E3925 27022
30	20 to 40 psig	1E3925 27022
40	35 to 125 psig	1K7485 27202
50	35 to 125 psig	1K7485 27202
60	35 to 125 psig	1K7485 27202

Mooney 2" through 6" Body		
Regulator Set Pressure (psig)	Relief Spring Range Available	Pilot Part Number
20	10 to 40 psig	FP-16
30	10 to 40 psig	FP-16
40	25 to 90 psig	FP-17
50	25 to 90 psig	FP-17
60	25 to 90 psig	FP-17

Flowsafe F70PR 2x3, 4x6 & 6x8		
Regulator Set Pressure (psig)	Relief Range Available	Pilot Number
20	5 to 285 psig	F100
30	5 to 285 psig	F100
40	5 to 285 psig	F100
50	5 to 285 psig	F100
60	5 to 285 psig	F100

7.6 Regulator and relief vents

7.6.1 The vents shall be piped with the opening pointed down and with all openings screened for insect protection.

7.6.2 The vents should be installed in a location where natural gas naturally dissipates and installed appropriately to ensure water cannot enter the vent.

7.6.3 Be protected from damage caused by submergence in areas where flooding may occur.

7.6.4 When appropriate rain caps should be installed.

7.7 Miscellaneous requirements

7.7.1 Installation for heaters on regulator pilots should be considered where icing conditions might occur. Options for heating the pilot gas stream are available with either a catalytic heater or a vortex heater.

7.7.2 A removable strainer should be installed. When installed a strainer should be upstream of regulation and be maintainable. An appropriate strainer would be a “Y” style strainer.

7.7.3 Pressure gauges or pressure taps for recording the inlet pressure, the outlet pressure, the by-pass line and the intermediate pressure, when appropriate, should be installed.

8.0 Off-Standard Installations

8.1 It is recognized that the standard regulator stations presented herein will not satisfy every requirement and no attempt has been made to cover all conditions. Field personnel are advised that variations in equipment and piping arrangements from standards must be designed and installed under the direction of engineering.

9.0 Drawings

These drawings and equipment lists have been relocated to the Gas Distribution SharePoint.

NorthWestern Energy

55 Pipeline Installation 55-A General Installation, Clearance, and Depth		Original Date 04/01/2007	Standard Number 55-A
Supersedes Standard: 55-F, B, 4100	Revision 5	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general procedures and policies concerning the general installation, clearance, and depth of electric, gas, and telecommunications utilities.

This standard is intended to comply with the requirements as set by the DOT 49 CFR part 192.317, 192.319(b), 192.321, 192.325, 192.327, 192.361(a)(b)(d)(g), and 192.375.

2.0 Pre-Construction

2.1 As required by State law, installation must not begin until all existing underground utilities in the area to be installed have been located and marked for the excavator, or until the excavator has been notified that there are not existing underground utilities in the area. Call for existing underground utility locations at least two days prior to excavation. To obtain such locates, call the appropriate locate center in your area.

Montana:	Utilities Underground Location Center		1-800-424-5555 or 811
	UDIG		1-800-551-8344 or 811
		or	1-800-755-8344 or 811
Nebraska:	Diggers Hot Line		1-800-331-5666 or 811
South Dakota:	One Call		1-800-781-7474 or 811

2.2 Excavating by the customer or a customer's contractor may reduce the overall cost to the customer when utilities are installed. Specifications shown here which refer to "excavations by the customer" apply to the customer or contractors hired by the customer.

2.3 Necessary permits and easements shall be obtained.

2.4 For excavations installed by the customer, it shall be the customer's responsibility to obtain such permits and easements.

2.5 Natural gas, electric, and telecommunications utilities are allowed in the same installation per these specifications. Other utilities such as sewer and water are not allowed in the same installation. Metered and unmetered facilities are not allowed in the same installation (for example, customer owned secondary wire is not allowed in the same trench as utility owned primary wire).

2.6 The customer may have telephone and/or cable TV installed in the same installation with gas and electric utilities, provided the installation meets NorthWestern Energy specifications herein, and all concerned parties agree on such placement. This is a common practice known as "joint use". NorthWestern Energy will make these arrangements for ditches installed by NorthWestern Energy employees.

2.7 It is the customer's responsibility to coordinate such arrangements with other utilities if the customer wishes to install their own ditch.

2.8 All parties (customer, contractors, and NorthWestern Energy employees) shall excavate according to all appropriate local, state, and federal guidelines, rules, and regulations such as OSHA and the DOT.

2.9 Any installations done by parties other than NWE shall meet NWE standards and be done by OQ qualified personnel. An inspection of backfilling will be done by NWE personnel. For trenches installed by the customer, it shall be the customer's responsibility to barricade and backfill the excavation.

NorthWestern Energy

55 Pipeline Installation 55-A General Installation, Clearance, and Depth		Original Date 04/01/2007	Standard Number 55-A
Supersedes Standard: 55-F, B, 4100	Revision 5	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

3.0 General Installation

3.1 Care should be taken to prevent damage to the pipe while installing. Refer to the Standard on Transportation, Handling, and Storage for proper handling of pipe and pipeline components.

3.2 *Pipe must be installed so as to minimize shear or tensile stresses, minimize anticipated piping strain and external loading, and protect the pipe coating from damage.*

3.3 *Plastic pipe must be installed below ground level.*

3.4 *Plastic pipe shall be installed with tracer wire for locating purposes. Tracer wire may not be wrapped around the pipe. Tracer wire must be resistant to corrosion damage.* Refer to Standard on Tracer Wire for more information.

3.5 *Plastic pipe that is installed in a vault or any other below grade enclosure must be completely encased in gas-tight metal pipe and fittings that are adequately protected from corrosion.* This is not standard construction at NWE and would need to be approved with Asset Management if implemented.

3.6 *Plastic pipe that is not encased must have a minimum wall thickness of 0.090 inch, except that pipe with an outside diameter of 0.875 inch or less may have a minimum wall thickness of 0.062 inch.* Plastic pipe that is purchased through NWE Warehouses meets this standard.

3.7 *Plastic pipe that is being encased must be inserted into the casing pipe in a manner that will protect the plastic. The leading end of the plastic must be closed before insertion* to keep foreign material out of the pipe. Refer to the Standard on Casings or the Standard on Plastic Service Installation (Insertion), whichever is applicable, for more information.

4.0 Protection from Hazards

4.1 *Each Distribution line or main must be protected from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads.*

4.2 *Each above ground distribution 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.*

5.0 Underground Clearance

5.1 *Each pipeline shall be installed with adequate clearance from any other underground structure, not associated with the pipeline, in order to allow proper maintenance and to protect against damage that might result from proximity to other structures.* Minimum clearance from any other underground structure should be 12 inches. *If this clearance cannot be attained, the distribution line shall be protected from damage that might result from the proximity of other structure(s).*

5.2 *Each plastic pipeline shall be installed with sufficient clearance, or shall be insulated from any source of heat in order to prevent the heat from impairing the integrity of the pipeline.*

6.0 Depth of Cover

6.1 Cover shall be defined as the measurement from the top of the pipe, or fitting, to the top of the ditch.

6.2 Each buried main is encouraged to be installed with at least 30 inches of cover. *Minimum cover shall be at least 24 inches of cover.*

6.3 Each buried service is encouraged to be installed with at least 24 inches of cover in public right-of-way and at least 18 inches of cover in private property. *Minimum cover shall be at least 18 inches of cover in public right-of-way and at least 12 inches of cover in private property.*

6.4 *All pipe which is installed in a navigable river or stream shall have a minimum cover of 48 inches in soil or 24 inches in consolidated rock between the top of the pipe and the natural bottom.*

6.5 *Where an underground structure prevents the installation of a main or service with the minimum cover stated, the main or service may be installed with less cover if it's provided with additional protection to withstand anticipated external loads.* Contact supervision and/or Gas Standards for guidance on determining the additional protection when this occurs.

6.6 Be aware of depth of cover while installing High Volume Tapping Tee (HVTT) fittings. Consider NorthWestern Energy standard 30 inch cover (to top of fitting) and accommodate for the increase in height. Also be aware that branch saddle fittings are available for installation, which may alleviate this situation.

6.7 To maintain depth, pipelines may require supplementary weights installed on the pipe to counteract any buoyancy forces experienced. Contact supervision and/or Gas Standards for guidance if this occurs.

6.8 Maximum allowable depth of cover should be 5 feet. This may be waived in construction practices, but local area supervision/engineering must be notified and area should be properly mapped showing the deviated depth location.

6.9 Depth at railroad crossings must comply with the respective railroad company. In the case of conflicting specifications, the most stringent shall apply. In some cases, a casing will not be required if the gas line is below a specified depth. Installing at the specified depth is preferred, casings are not preferred.

6.10 Depth at highway crossings must comply with Federal, State, County, Municipal, or other public or private authority having jurisdiction. In the case of conflicting specifications, the most stringent shall apply.

7.0 Summary of Burial Depths and Clearances

Depth	Recommended	Minimum
Gas Main Pipeline and Appurtenances	30”	24”
Gas Service Pipeline and Appurtenances	18”	12”
Electric Primary Cable (601 to 50000V)	36” (NESC Table 353-1)	30”
Electric Secondary Cable (0-600V)	30” (NESC Table 353-1)	24”
Telecommunications Cable	24” (NESC Table 353-1)	

Clearance	Minimum
Any Gas to Any Electric	12” (NESC 352A
Any Gas to Any Telecommunications	12”
Any Electric to Other Electric or Telecommunications	12” (NESC 352A), unless the “random lay” requirements of NESC 352C and 354 are met, then no deliberate separation is required.
Specified burial depth and clearances apply surface to surface between pipes, cables, etc., and all associated appurtenances.	

8.0 Methods of Installation

More specific information on these methods are in the subsequent standards.

8.1 Open Excavation

8.2 Utility Culverts (Ducts)

8.3 Trenchless Technology (Boring/Pulling In)

8.4 Plowing/Planting

8.5 Casings

8.6 Bridge Crossings

NorthWestern Energy

55 Pipeline Installation 55-B Open Excavation		Original Date 06/01/2006	Standard Number 55-B
Supersedes 52-F, 55-B, 55-E, 4100	Revision 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning open excavation, backfill, and compaction.

This standard is intended to comply with the requirements as set by the DOT 49 CFR part 192.319(b) and 192.361(b).

2.0 Excavation and Trench

2.1 The trench shall be inspected prior to installing the pipe.

2.2 The trench bottom should be relatively even and provide uniform support for the pipe. The trench should be free of rocks or sharp objects or other debris that may damage the pipe or coating material. Trenches containing sharp or solid rock shall be padded with sand or other fine grained material.

2.3 The bottom of the excavation should have a smooth grade and be free of rocks, stones, or gravel in excess of 1 inch. If this is not possible, a 2-inch thick bed of sand or clean soil shall be placed in the bottom of the excavation.

2.4 Excavations must be of sufficient depth and width to allow for the proper placement and installation of gas, electric, and/or telecommunications utilities. Appropriate dimensions are given in the attached drawings for many different combinations of utilities.

2.5 Excavations should follow straight lines between staked points to the extent possible.

2.6 All excavations shall comply with the OSHA "Construction Standard for Excavations - 29 CFR part 192.650, 192.651, and 192.652 Sub part P". Also refer to Section 16 of the NWE Safety, Health, and Environmental Handbook.

2.7 Precautions should be taken in preventing injuries to trees, shrubbery, lawns, drives, fences, buildings, or other improvements located along the site of the work.

2.8 The amount of installed pipe exposed in a trench in urban areas shall not exceed a distance of one-half mile. Pipe should be covered with proper backfill material as soon as practical after installation.

2.9 Amount of open trench through streets and urban areas shall not be in excess of that allowed by the Company and governmental body having jurisdiction.

2.10 Blasting will be allowed only in specific, non-congested areas, as permitted by local authorities and the Company. All person conducting blasting activities will have all appropriate licensing.

2.11 The time excavating is done should be closely coordinated with the time of installation of utilities in the excavation so that open excavation time is kept to a minimum. Open excavations shall be adequately barricaded or otherwise protected to ensure public safety.

3.0 Pipe in Trench

3.1 Main and service lines must be continuously supported along their entire lengths by firm, clean material. Blocking shall not be used to support pipelines across excavated sections.

3.2 Gas lines must be laid on properly tamped earth, and any voids under the line must be filled and tamped to assure adequate support.

3.3 Special care must be taken to assure proper support at transition points from plastic to steel and at service taps to ensure support of the plastic line on compacted soil. Special protective sleeves shall be used at service taps.

3.4 Plastic pipe should be allowed to “snake” along the bottom of the trench to reduce stresses caused by temperature changes.

3.5 Steel pipe installation should easily fit in the ditch and minimize stresses to pipeline.

3.6 To warn of potential digging hazards, warning tape is optional and may be installed on 2 inch or larger mains, approximately 12 inches above the plastic main on plowed or trenched construction areas.

4.0 <u>Backfill, Compaction, and Bedding</u>

4.1 Large rocks, frozen earth, and decomposable debris, such as wood, should not be used in backfill material. To assure no damage occurs during the backfill operation, pipe shall be protected with native fines or imported material for cover.

4.2 Backfill must not contain any sharp or foreign objects, and backfill within 4” of any pipe or cable must be free of materials that could damage the pipe or cable.

4.3 *Backfilling shall be completed in a manner that does not damage pipe wall or coating and provide firm support under the pipe.* Backfill material shall not contain any sharp objects; if spoils contain objects that may damage the pipe, additional protection of the pipe shall be employed. Padding the pipeline within 12 inches of pipe, application of a shielding wrap on the pipe, or other identified protection of pipe shall be employed to ensure pipe damage does not occur.

4.4 With excavations in “solid rock”, suitable material shall be placed in the excavation bottom to a minimum depth of four (4) inches under the pipe, on either side of the pipe to completely fill the width of the excavation, and to a minimum depth of six (6) inches above the top of the pipe.

4.5 In areas where severe settling is a concern, a stiff, no-shrink backfill slurry mix may be used to meet 95% proctor densities. It is recommended that pipe systems are bedded with 6 inches of suitable backfill between the slurry mix and the pipe. Slurry mix should not come into contact with pipe due to possible expansion and contraction of pipe wrap material.

4.6 Throwing of debris or any other foreign substance into the pipeline ditch is not permitted. Clean up all materials from construction and place in proper receptacles.

4.7 Stress can occur from shear forces acting on system pipe as backfilling and compaction operations take place. Compaction must be carefully done to prevent the development of stress caused by settlement of the backfill material.

4.8 Backfill must be adequately compacted in accordance with agency having jurisdiction (such as City, County, or State). Backfill within 6 inches of cable or other utilities must be hand compacted. A minimum of 6 inches of backfill shall be maintained before the use of hand operated mechanical compactors. A minimum of 18 inches of backfill shall be maintained before the use of heavy hydraulic/mechanical compactors.

NorthWestern Energy

55 Pipeline Installation 55-B Open Excavation		Original Date 06/01/2006	Standard Number 55-B
Supersedes 52-F, 55-B, 55-E, 4100	Revision 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

5.0 Trench Examples

Services and Secondary w/Natural Gas Service
Random Separation

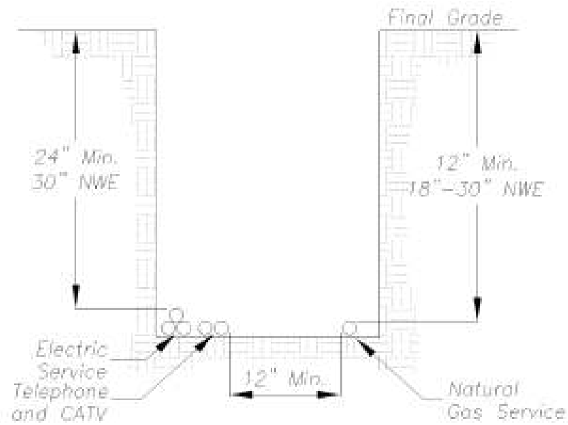


Figure 1.

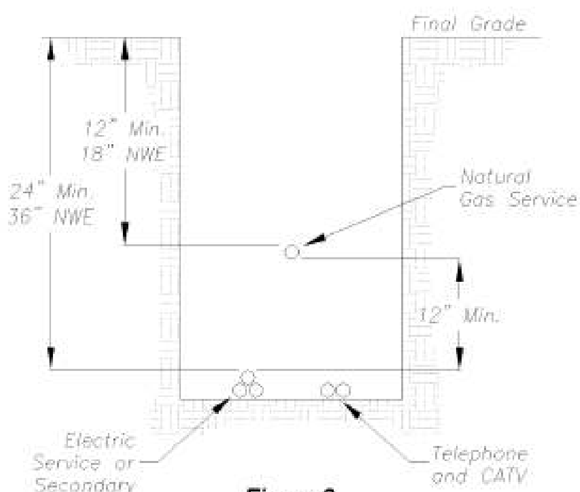


Figure 2.

NorthWestern Energy

55 Pipeline Installation 55-B Open Excavation		Original Date 06/01/2006	Standard Number 55-B
Supersedes 52-F, 55-B, 55-E, 4100	Revision 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

Services and Secondary w/Natural Gas Service

Deliberate Separation

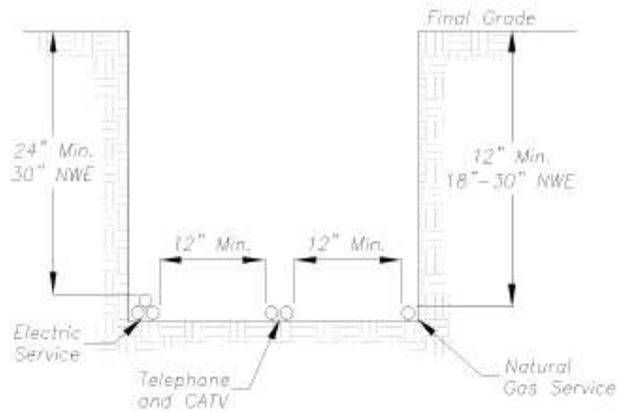


Figure 3.

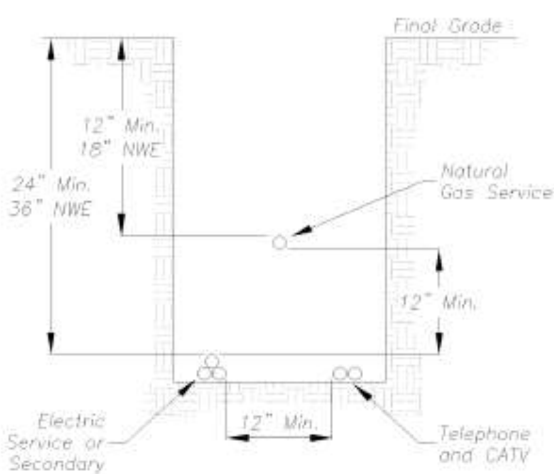


Figure 4.

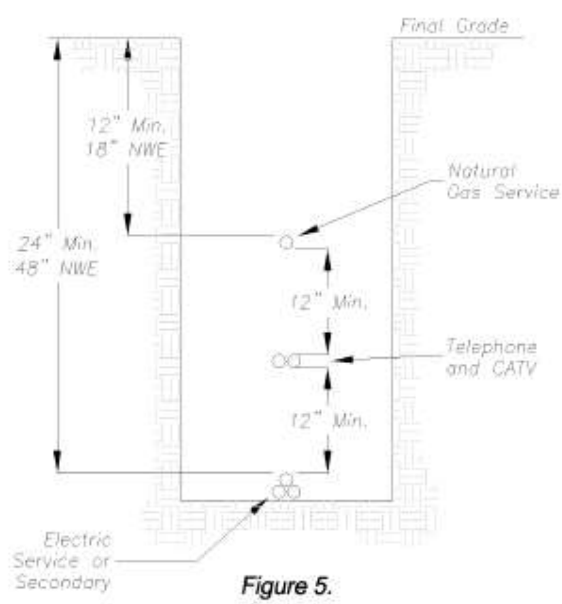


Figure 5.

NorthWestern Energy

55 Pipeline Installation 55-B Open Excavation		Original Date 06/01/2006	Standard Number 55-B
Supersedes 52-F, 55-B, 55-E, 4100	Revision 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

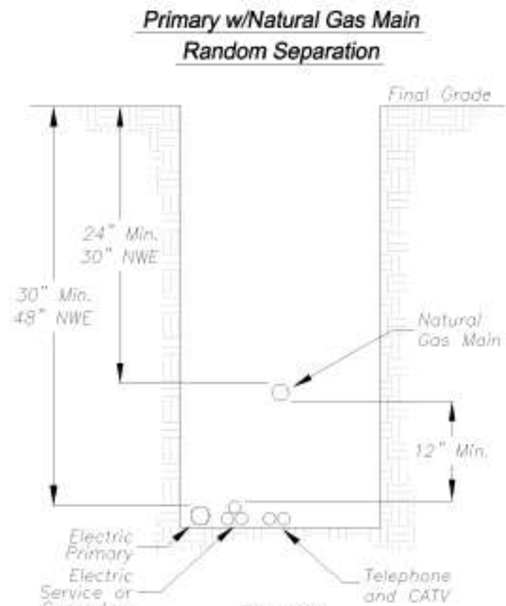


Figure 1.

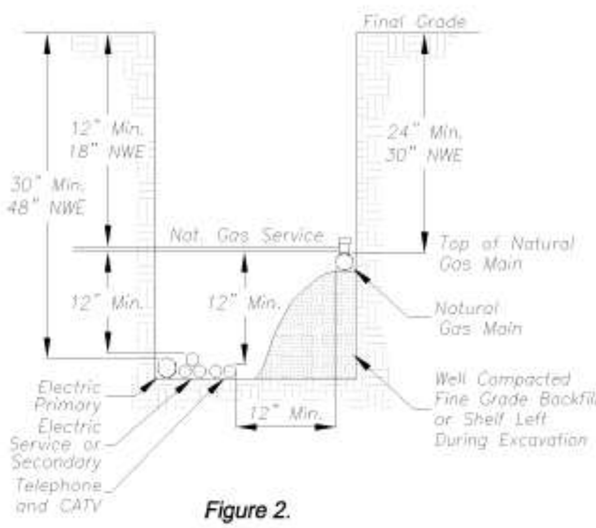


Figure 2.

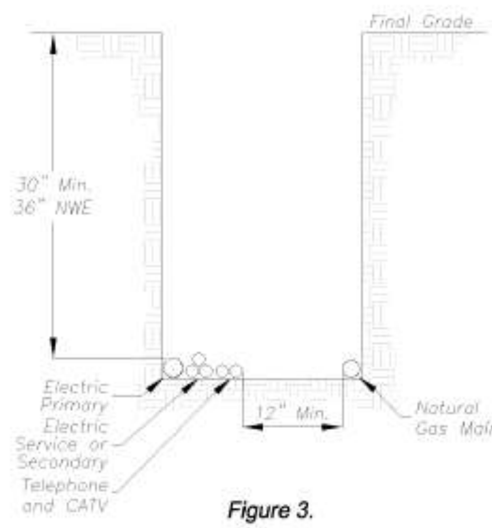


Figure 3.

NorthWestern Energy

55 Pipeline Installation 55-B Open Excavation		Original Date 06/01/2006	Standard Number 55-B
Supersedes 52-F, 55-B, 55-E, 4100	Revision 5	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

Primary w/Natural Gas Main
Deliberate Separation

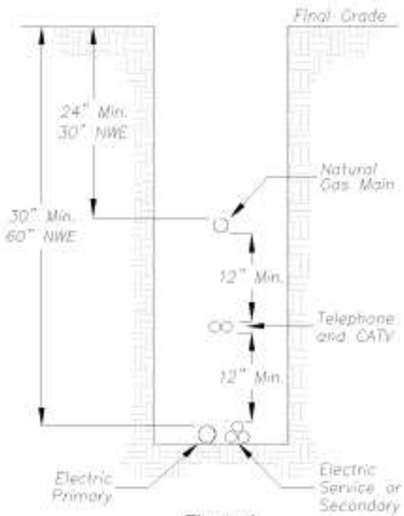


Figure 4.

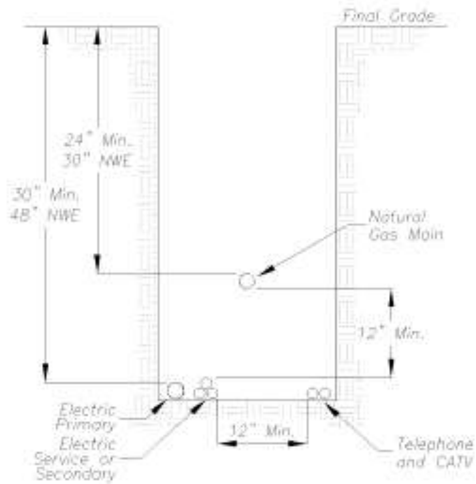


Figure 5.

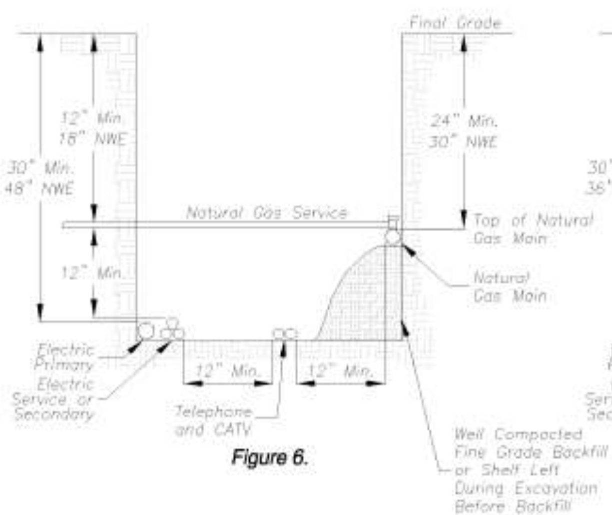


Figure 6.

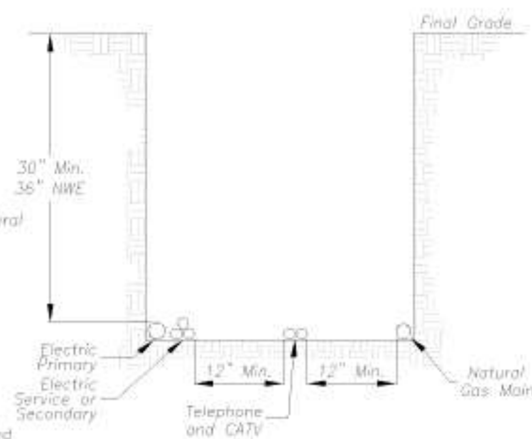


Figure 7.

NorthWestern Energy

55 Pipeline Installation 55-C Culverts and Ducts		Original Date 06/01/2006	Standard Number 55-C
Supersedes Standard: 55-B	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose for a utility culvert (duct), as shown in these standards, is to provide for a sleeve under a road way for future utility facilities. Often roads and approaches are constructed well in advance of the utilities. In these cases, a utility culvert (duct) can be installed to avoid having to open cut or bore under the roadway in order to install the utilities at a later date. For growth related extension the cost of the installed utility culverts (ducts) will be borne by the developer. The intent of this standard is for NWE to provide the customer with the appropriate utility culver/duct drawing, together with additional notes to tailor the design drawings for the specific application.

2.0 General

2.1 These utility culvert/duct drawings are not necessarily approved by any other utility. Get all other utilities approval prior to installing a utility culvert/duct for them.

2.2 These drawings are general in nature. Location specific details are not included. Do not install any utility culvert/ducts without first getting specific design and location approval from the local NWE Construction Engineer/Estimator, and also any other utility that may be expected to use the culverts/ducts.

2.3 Specific design details include, but are not limited to: (1) culvert/duct diameter, (2) culvert/duct length, (3) culvert/duct orientation with respect to each other and other facilities, (4) culvert/duct location, etc.

2.4 A culvert/duct intended for natural gas can only be used for a natural gas line. No other type of facility will be allowed in it.

2.5 A culvert/duct intended for electric supply may under some circumstances share the space with communications facilities. If space cannot be shared with communications, then install two separate culverts/ducts, one for electric supply and one for communications. See Underground Electric Standards 30-C-2 for rules governing Deliberate Separation and Random Separation between electric supply and communications facilities.

2.6 Separation between, and burial depths of, utility culverts/ducts is important and must be followed as per these drawings and/or any modifications by the appropriate utility representatives.

2.7 Utility culvert/ducts must be installed so that they are straight and that there is a line of sight through them.

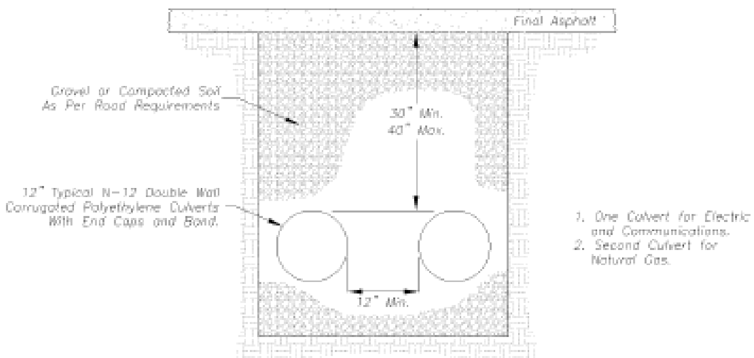
2.8 Cap the ends of each culvert/duct and mark each end with a durable above or below ground marker.

2.9 Backfill material and compaction requirements must meet the specifications of the road design. It is the culvert/duct installer's responsibility to obtain and meet these specifications.

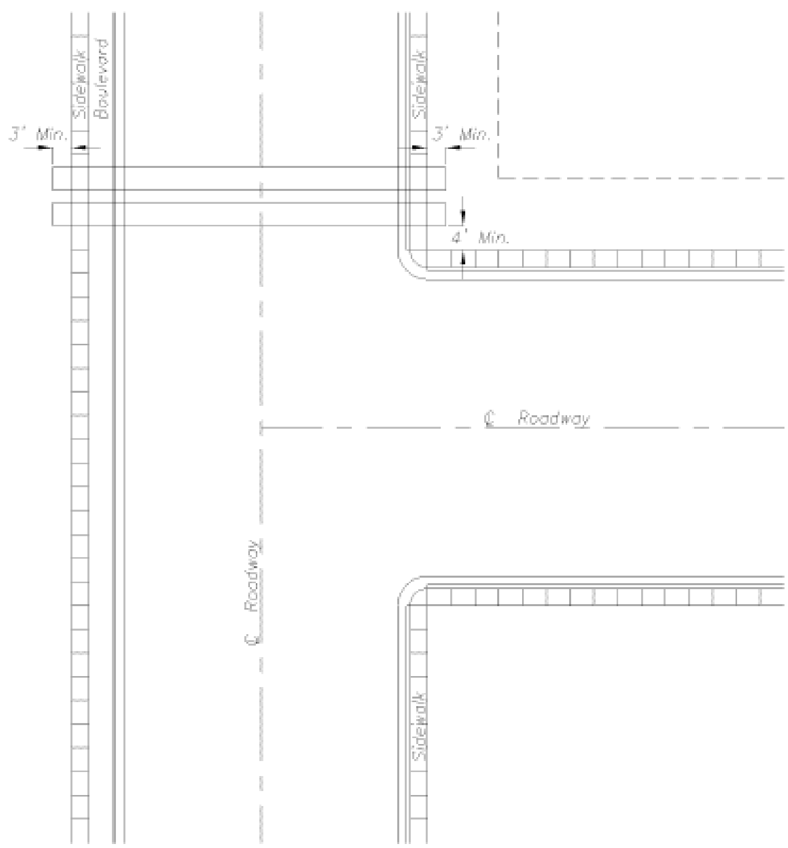
NorthWestern Energy

55 Pipeline Installation 55-C Culverts and Ducts		Original Date 06/01/2006	Standard Number 55-C
Supersedes Standard: 55-B	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Utility Culvert Requirement
Random Separation



Cross Section

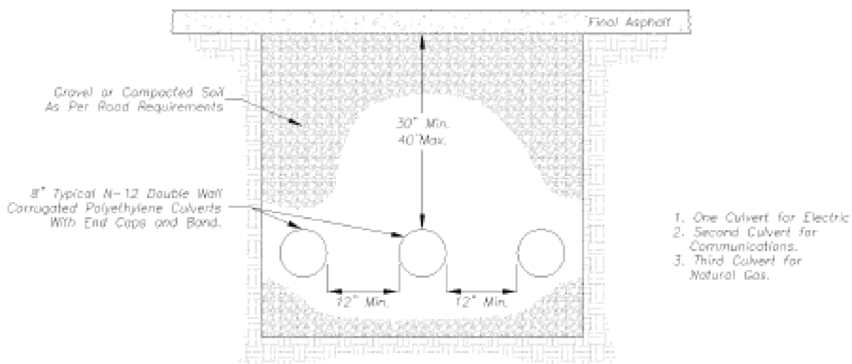


Plan View

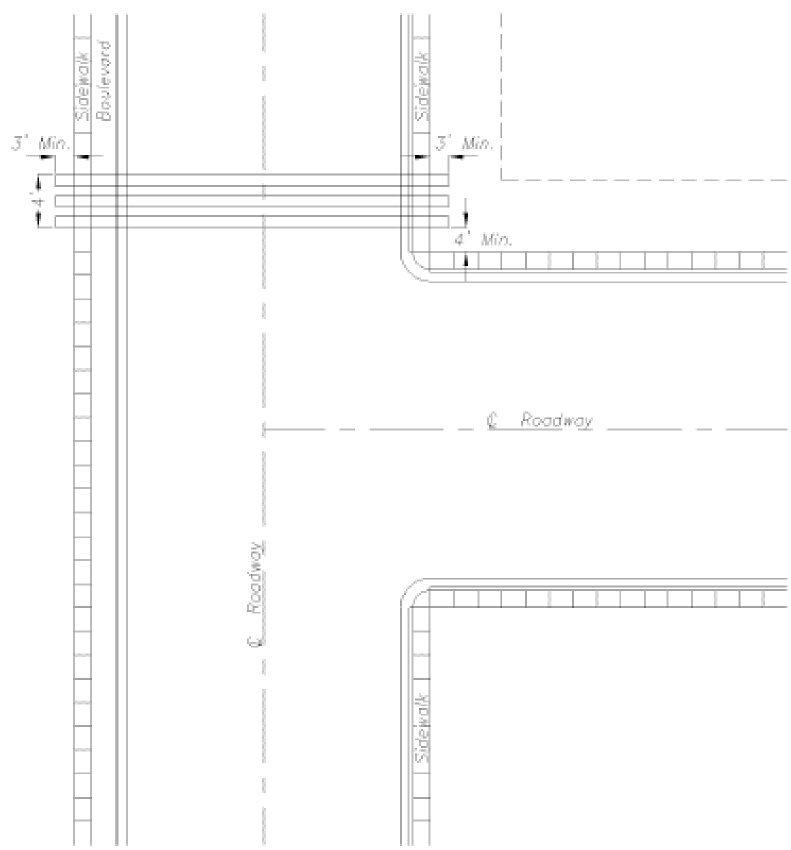
NorthWestern Energy

55 Pipeline Installation 55-C Culverts and Ducts		Original Date 06/01/2006	Standard Number 55-C
Supersedes Standard: 55-B	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

Utility Culvert Requirement
Deliberate Separation



Cross Section



Plan View

NorthWestern Energy

55 Pipeline Installation 55-D Trenchless Technology		Original Date 04/01/2007	Standard Number 55-D
Supersedes Standard: 55-D	Revision 9	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning trenchless installations of polyethylene plastic pipe and steel pipe. Trenchless construction includes such construction methods as tunneling, mircotunneling (MTM), horizontal directional drilling (HDD) also known as directional boring, pipe ramming (PR), pipe jacking (PJ), pipe pulling, moling, horizontal auger boring (HAB), and other methods for the pulling of pipelines below the ground with minimal excavation. For simplicity, this will be referred to as boring in this standard. Using a plow to pull the pipe through the ground is covered under this standard. For example, if the reel of pipe is stationary, while the plow is moving is covered under this standard. Using a plow, where the pipe is planted into the ground at the machine is covered in the Standard on Plowing and Planting.

This standard is intended to comply with the requirements as set by the DOT 49 CFR part 192.329 and 192.376.

2.0 General

2.1 Bores shall be installed as perpendicular to roadways, crossings, waterways, etc. as is possible or practical.

2.2 A general knowledge of the soil conditions will be a factor for locating the bore site. When poor or rocky soil conditions are expected a sub-soil survey may be completed to determine the type of sub-soil to be encountered in the installation. Soil borings or seismic studies are recommended and numerous soil borings may be necessary if large amounts of gravel, boulders, or rocks are encountered. A minimum of one soil bore is recommended at each side of a creek or waterway crossing.

2.3 Consider pre-installation pressure tests when crossing rivers, railroads, interstates, or anywhere the repair would be difficult and costly. The pre-installation pressure test is to detect any material or fabrication defects while the pipe is above ground and can be repaired easier and less costly.

Refer to the Standard on Pressure Testing Lines.

3.0 Depth and Clearance

3.1 Refer to the Standard on General Installation, Clearance, and Depth for overall requirements. The following requirements are specific to boring.

3.2 All distribution lines (mains and services) must be installed with at least 12 inches of clearance from any other underground utility such as electric, telephone, and cable television. When boring, 24 inches is preferred. Clearance must be maintained from utility surface edge, to utility surface edge.

3.3 All utility lines within a minimum of 18” radius from the outer edges of the bore path shall be exposed (potholed) before the bore begins. If a greater distance is specified by State or local regulations, the greater distance is required.

3.4 Utility occupancy on Highway Right Of Way for bored installations/crossings should meet the following requirements:

3.4.1 All crossings should be at a minimum 42 inches below the ditch line.

3.4.2 Boring pits should be at a minimum 10 feet from the end of road width.

3.4.3 Crossings should be as close as practicle to right angles to the roadway.

3.4.4 Always check local area jurisdictions for more information pertaining to occupancy rules and regulations along or under Highway Right Of Way prior to installation as they may differ according to region.

4.0 Records

4.1 A bore log should be provided by the drill operator to NWE. The bore log should include the depth, and pitch. For large projects, the engineer may request that the bore log also include information on pulling force. The bore log should be kept in the physical project file and/or SAP. This is not required for moling or pipe pulling.

4.2 Deviated depth locations (more than 5ft) should be properly mapped showing the deviated depth location and installation date.

5.0 Boring Polyethylene Pipe

5.1 Requirements

5.1.1 Anytime a bore is required under an interstate, railroad, or navigable waterway, the permitting process may require a pre-construction bore design and/or an as-built profile. Supervision and/or Gas Standards should be contacted for guidance when this occurs.

5.1.2 This standard covers all bores that meet the following circumstances. If any of these requirements cannot be maintained, contact supervision and/or Gas Standards for guidance.

- Up to 15ft deep.
- With an elevation change of 20' or less (over uneven terrain).
- Up to and including 1,500ft long.
- With entry angles of the pipe between 5-10 degrees (8.75 - 17.6% Grade) and exit angles of the pipe between 8-20 degrees (14.1 - 36.4% Grade). If angles are steeper, consider making the bore longer, or digging a bigger bell hole to start the bore at a lower depth.
- With a minimum bore radius (ft.) of 50 x the *actual* pipe diameter (in). For example, a 12" diameter pipe must have a 54' bore radius or larger.

$$R \geq 50 (D_{actual})$$

$$R \geq 50(12.75\text{in}) \geq 637.5'' \geq 53.125'$$

This is for SDR 11/11.5 (NWE standard pipe). Consult Gas Standards for other SDRs.

If the radius is smaller, consider making the bore longer, and/or digging a bigger bell hole to start the bore at a lower depth to increase the radius.

This is an industry requirement, and cannot be disregarded. However, this is rarely an issue because the bore radius is generally limited by the drill rod's bending capability, not the polyethylene pipe.

5.1.3 In non-standard circumstances, a pre-construction bore design may be necessary and an as-built profile should be produced by the boring contractor if the technology is available.

5.2 Materials

5.2.1 Consider using a lower SDR (thicker wall) if the pipe will be subjected to scratches, and for greater pullback strength.

5.2.2 Consider the use of High Density Polyethylene (black) pipe, if the pipe may be damaged by rocks or other debris during the boring process, and for greater pullback strength.

5.2.3 Consider using sleeves to protect the pipe, if the pipe may be subjected to greater pullback strength and/or scratches and gouges. A larger diameter pipe can be bored as a sleeve. Then the carrier pipe can be inserted through the sleeve.

5.3 Pipe Installation

5.3.1 Butt fuse the necessary length of plastic pipe for the pull back process and consider a preliminary pressure test of piping. Socket fusions, electrofusions and/or mechanical joints are allowed on 2" and smaller pipe. Butt fusion is preferred on 2".

5.3.2 Before the plastic pipe is pulled back, install a cap, "dead end", or other device on the pipe to prevent contaminants from entering the pipe during the pullback process.

5.3.3 When using a directional bore, ensure the appropriate backreamer head is attached to the leading end of the drill string to enlarge the pilot bore diameter during the pullback process. Required minimum backreamer sizes are in the summary table at the end of this section.

5.3.4 Ensure sufficient clearance is maintained between the drill path and any underground facilities or structures during all phases of the boring and reaming process, as well as during the pullback process (12" required, 24" preferred).

5.4 Weak-Link Installation

5.4.1 When directionally boring polyethylene pipe the use of a weak-link during pull back of the pipe shall be employed.

5.4.2 The Summary Table at the end of this section includes the following approved weak links. Refer to the Table for the specific options available by size and material, and the requirements of each.

5.4.2.1 Condux Pins - Pins can be re-used, but should be inspected prior to each use. Inspect for damage such as bending, gouges, scratches, and/or corrosion; these damages may lead to a weak link device breaking prematurely.

5.4.2.2 DCD Manufacturing Pins - Pins and wires cannot be re-used.

5.4.2.3 Cumberland Manufacturing Weak Links

5.4.2.4 Smaller diameter pipe

5.4.2.5 Other products/methods may be used with the approval of the Asset Management Department.

5.4.3 The weak-link device should be attached between the swivel on the backreamer and the pipe end. One end is attached to the leading end of the pipe being pulled back and the other end is mechanically attached to the swivel.

5.4.4 If there is a weak link break, be cautious when pulling the pipe out of the ground, tensile forces can build up in the pipe.

5.4.4.1 If the pipe is to be re-used:

- Pipe must be pulled out of the ground with another weak link device.
- Pipe must be fully inspected for damage prior to re-use.

5.5 Tracer Wire Installation

5.5.1 Refer to the Standard on Contact and Tracer Wire for overall requirements. The following requirements are specific to boring.

5.5.2 Tracer wire and/or tracer wire casing must be pulled back with the main and/or service pipe in the bore (cannot be done in a separate bore).

5.5.3 When boring mains and services, it is recommended that the tracer wire installed be stronger, either by having a higher tensile strength (EHS – Extra High Strength - 1000-7758), or by having a larger diameter size. Installing these types of tracer wires will reduce potential damage in the continuity of the wire during construction.

5.5.4 Securely connect the tracer wire at or near the pullback head.

5.5.5 Do not wrap the tracer wire around the plastic pipe.

5.5.6 For gas mains installed through directional boring, it is an option to include a minimum ½-inch plastic pipe be included in the bore pull through, as a tracer wire casing. The ½-inch pipe will assist in maintaining the integrity and continuity of the wire. Consider larger casing for rockier soils or longer bores.

5.6 Handling

5.6.1 Pull an additional 3% of the total length of the pipe to allow for stress relaxation. During pullback, the pipe is subjected to axial forces and resultant linear stretching caused by the frictional drag on the pipe.

5.6.2 After the pullback is complete, pull approximately 10 additional feet of pipe through the entrance pit to examine pipe for scratches or gouges.

5.6.3 Before any tie-ins or pressure tests are made, allow the pipe to recover from tensile and thermal stresses for a period of time equal to, or greater than, twice the elapsed pull time for the pullback process.

5.6.4 When pulling over rough surfaces, to prevent damage to the pipe during the pullback process, consider using rollers or other padding devices to protect the pipe from rough surfaces.

5.6.5 If the pipe will be exposed for long periods of time (overnight or longer), it is recommended to seal the ends of the pipe with a mechanical or fused fitting to prevent contamination.

5.6.6 When pulling through rocky/cobble terrain, consider using a protective sleeve over the weak link and first portion of the pipe. This prevents cobble from falling between the weak link and the pipe, thus causing a “pull point.” This also prevents the linkage between the weak link and the pipe to round a corner too sharply and get caught. This also helps expand the hole that the pipe is being pulled through. For example, a 2” piece of steel pipe and a 2” cap with a hole cut in the top works well as a protective sleeve for services.

8” Protective Sleeve

2” Protective Sleeve

5.6.7 When pipe pulling or moling, consider using a larger swivel prior to the weak link to act as a “backreamer” and expand the path. It also helps keep the line straighter and prevent the path from becoming too oval, as it is pulled through the hole.

5.6.8 The pipe may require cleaning by pigging or other suitable means if evidence of contamination exists. Pigging is required for 4” main and larger.

Refer to the Standard on Pigging.

5.7 Inspection

5.7.1 The pipe shall be inspected after installation by checking the surface of the pipe at the point of exit from the bored hole. If damage greater than 10% of the pipe wall thickness is evident, continue the pullback process until the damage depth is acceptable. This does not apply when boring a sleeve (as discussed in section 5.2.3), but the carrier pipe will need to be inspected after the insertion through the sleeve.

5.7.2 If there is continued evidence of damaged pipe, consider re-drilling the boring path using a larger backreamer head or a modified trajectory path.

NorthWestern Energy

55 Pipeline Installation 55-D Trenchless Technology		Original Date 04/01/2007	Standard Number 55-D
Supersedes Standard: 55-D	Revision 9	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

MDPE (Yellow) Trenchless Technology Summary

Pipe Size	Minimum Back-Reamer Size	Maximum MDPE (Yellow) Pipe Size	Cumberland Weak Link	Condux Swivel and Pin	DCD Swivel, Pin(s), and Pin Configuration	DCD Break-Away Pin Torque	Minimum Additional feet of Pipe	Recovery Time	Pigging	10% Gouge
½" CTS	2"	NA	NA	NA	Pin Swivel - 00550-005 Pin Kit-Green 1001-7891 or Wire Swivel - 00551-010 Wire Kit-Beige 1001-8058	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01"
½" IPS	2"	NA	WL050I-2406 1/2" IPS Weak Link	Swivel - 0802-1015 Pin - Slate/Violet 1001-7861	Pin Swivel - 00550-005 Pin Kit-Black 1001-8059 or Wire Swivel - 00551-010 Wire Kit-Pink 1001-8056	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01"
¾" IPS	2"	1/2" IPS	WL250-2406 3/4" IPS Weak Link	Swivel - 0802-1025 Pin - Blue/White 1001-7850	Pin Swivel - 00550-005 Pin Kit-White 1001-7844 or Wire Swivel - 00551-010 Wire Kit-Grey 1001-8054	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01"
1" IPS	2"	3/4" IPS	WL330I-2406 1" IPS Weak Link	Swivel - 0802-1040 Pin - Blue/Black 1001-7858	Pin Swivel - 00550-005 Pin Kit-Yellow 1001-7846	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01"
2" IPS	4"	1 1/4" IPS	WL550-2406 2" IPS Weak Link	Swivel - 0802-1130 Pin - Brown/Yellow 1001-7862	Connector - 00560-010 E-1000 lb, Orange, 1001-7841	Orange - 36 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Recommend	.02"
3" IPS	6"	2" IPS	WL650-2406 3" IPS Weak Link	Swivel - 0801-9600 Pin - Violet/Green 1001-7854	Connector - 00560-010 A- 750 lb, Yellow, 1001-7848 C- 750 lb, Yellow, 1001-7848 E-1000 lb, Orange, 1001-7841	Yellow - 27 in-lbs Yellow - 27 in-lbs Orange - 36 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Recommend	.03"
4" IPS	8"	3" IPS	WL740-2406 4" IPS Weak Link	Swivel - 0801-9900 Pin - Slate/Yellow 1001-7849	Connector - 00560-010 A-1500 lb, Red, 1001-7839 C-1500 lb, Red, 1001-7839 E-1500 lb, Red, 1001-7839	Red - 49 in-lbs Red - 49 in-lbs Red - 49 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.04"
6" IPS	10"	4" IPS	WL744-2406 6" IPS Weak Link	Swivel - 0802-9200 Pin - Red 1001-7860	Connector - 00560-010 A-2000 lb, Blue, 1001-7838 B-2000 lb, Blue, 1001-7838 C-2000 lb, Blue, 1001-7838 D-2000 lb, Blue, 1001-7838 E-1500 lb, Red, 1001-7839	Blue - 68 in-lbs Blue - 68 in-lbs Blue - 68 in-lbs Blue - 68 in-lbs Blue - 68 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.06"
8" IPS	12"	6" IPS	WL746-2406 8" IPS Weak Link	Swivel - 0802-9700 Pin - Brown 1001-7863	Connector - 00560-020 A-8000 lb, Blue, 1001-7866 C-8000 lb, Blue, 1001-7866	Blue - 360 in-lbs Blue - 360 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.08"

NorthWestern Energy

55 Pipeline Installation 55-D Trenchless Technology		Original Date 04/01/2007	Standard Number 55-D
Supersedes Standard: 55-D	Revision 9	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

HDPE (Black) Trenchless Technology Summary

Pipe Size	Minimum Back-Reamer Size	Maximum HDPE (Black) Pipe Size	Cumberland Weak Link	Condux Swivel and Pin	DCD Swivel, Pin(s), and Pin Configuration	DCD Break-Away Pin Torque	Minimum Additional feet of Pipe	Recovery Time	Pigging	10% Gouge
½” CTS	2”	NA	NA	Swivel - 0802-1015 Pin - Slate/Violet 1001-7861	Pin Swivel - 00550-005 Pin Kit-Black 1001-8059 or Wire Swivel - 00551-010 Wire Kit-Black 1001-8057	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01”
½” IPS	2”	NA	WL050I-3408 1/2" IPS Weak Link	Swivel - 0802-1020 Pin - Green/Orange 1001-7857	Pin Swivel - 00550-005 Pin Kit-White 1001-7844 or Wire Swivel - 00551-010 Wire Kit-Grey 1001-8054	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01”
¾” IPS	2”	1/2" IPS	WL250-3408 3/4" IPS Weak Link	Swivel - 0802-1030 Pin - Brown/Red 1001-7853	Pin Swivel - 00550-005 Pin Kit-White 1001-7844 or Wire Swivel - 00551-010 Wire Kit-Grey 1001-8054	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01”
1” IPS	2”	3/4" IPS	WL330I-3408 1" IPS Weak Link	Swivel - 0802-1045 Pin - Blue/Yellow 1001-7859	Pin Swivel - 00550-005 Pin Kit-Blue 1001-7847	NA	3% of bore length + 10ft	Twice the elapsed pull time	NA	.01”
2” IPS	4”	1 1/4" IPS	WL550-3408 2" IPS Weak Link	Swivel - 0802-1160 Pin - Black/White 1001-7855	Connector - 00560-010 E-1500 lb, Red, 1001-7839	Red - 49 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Recommend	.02”
3” IPS	6”	2" IPS	WL650-2408 3" IPS Weak Link	Swivel - 0807-6100 Pin - Blue/Yellow 1001-7852	Connector - 00560-010 A- 750 lb, Yellow, 1001-7848 B-1000 lb, Orange, 1001-7841 C- 750 lb, Yellow, 1001-7848 D-1000 lb, Orange, 1001-7841	Yellow - 27 in-lbs Orange - 36 in-lbs Yellow - 27 in-lbs Orange - 36 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Recommend	.03”
4” IPS	8”	3" IPS	WL740-3408 4" IPS Weak Link	Swivel - 0802-2100 Pin - Brown/Green 1001-7851	Connector - 00560-010 A-1000 lb, Orange, 1001-7848 B-1500 lb, Red, 1001-7839 C-1000 lb, Orange, 1001-7848 D-1500 lb, Red, 1001-7839 E- 750 lb, Yellow, 1001-7846	Orange - 36 in-lbs Red - 312 in-lbs Orange - 36 in-lbs Red - 312 in-lbs Yellow - 27 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.04”
6” IPS	10”	4" IPS	WL744-3408 6" IPS Weak Link	Swivel - 0802-9600 Pin - White 1001-7856	Connector - 00560-010 A-2500 lb, Green, 1001-7840 B-2500 lb, Green, 1001-7840 C-2500 lb, Green, 1001-7840 D-2500 lb, Green, 1001-7840 E-2500 lb, Green, 1001-7840	Green - 85 in-lbs Green - 85 in-lbs Green - 85 in-lbs Green - 85 in-lbs Green - 85 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.06”
8” IPS	12”	6" IPS	WL746-3408 8" IPS Weak Link	Swivel - 0807-5600 Pin - Black 1001-7864	Connector - 00560-020 A-7000 lb, Red, 1001-7842 C-7000 lb, Red, 1001-7842 E-7000 lb, Red, 1001-7842	Red - 312 in-lbs Red - 312 in-lbs Red - 312 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.08”

NorthWestern Energy

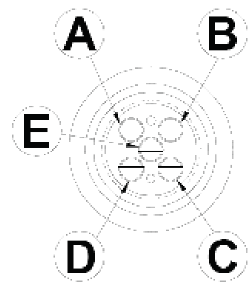
55 Pipeline Installation 55-D Trenchless Technology		Original Date 04/01/2007	Standard Number 55-D
Supersedes Standard: 55-D	Revision 9	Revision Date 06/01/2024	Prepared / Approved By AJ / Committee

HDPE (Black) Trenchless Technology Summary

Pipe Size	Minimum Back-Reamer Size	Maximum HDPE (Black) Pipe Size	Cumberland Weak Link	Condux Swivel and Pin	DCD Swivel, Pin(s), and Pin Configuration	DCD Break-Away Pin Torque	Minimum Additional feet of Pipe	Recovery Time	Pigging	10% Gouge
12 " IPS SDR 11	16"	Call	Call	Swivel - 0807-5940 Pin - Orange 1001-7865	Connector - 00560-020 A-9000 lb, Green, 1001-7843 B-9000 lb, Green, 1001-7843 C-9000 lb, Green, 1001-7843 D-9000 lb, Green, 1001-7843 E-9000 lb, Green, 1001-7843	Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.12"
12" IPS SDR 9	16"	Call	Call	Swivel - 0807-5940 Pin - Orange 1001-7865	Connector - 00560-020 A-9000 lb, Green, 1001-7843 B-9000 lb, Green, 1001-7843 C-9000 lb, Green, 1001-7843 D-9000 lb, Green, 1001-7843 E-9000 lb, Green, 1001-7843	Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs Green - 396 in-lbs	3% of bore length + 10ft	Twice the elapsed pull time	Required	.14"

DCD Pin Location Reference

*Note: Uneven pin distribution may result in up to 10% higher breaking point.



PIN LOCATION REFERENCE

6.0 Boring Steel Pipe

6.1 Requirements

6.1.1 Anytime a bore is required under an interstate, railroad, or navigable waterway, the permitting process may require a proactive bore design and/or an as-built profile. Supervision and/or Gas Standards should be contacted for guidance when this occurs.

6.1.2 This standard covers all bores that meet the following circumstances. If any of these requirements cannot be maintained, contact supervision and/or Gas Standards for guidance.

- Up to 15ft deep.
- With an elevation change of 20' or less (over uneven terrain).
- With entry angles of the pipe between 5-10 degrees (8.75-17.6% Grade) and exit angles of the pipe between 8-20 degrees (14.1-36.4% Grade). If angles are steeper, consider making the bore longer, or digging a bigger bell hole to start the bore at a lower depth.
- With a minimum bore radius (ft.) of 100 x the nominal pipe diameter (in). For example, a 4" diameter pipe must have a 400' bore radius or larger.

$$R \geq 100 (D_{nom})$$

$$R \geq 100(4) \geq 400'$$

If the radius is smaller, consider making the bore longer, and/or digging a bigger bell hole to start the bore at a lower depth to increase the radius.

If the minimum radius still cannot be maintained, then a pre-construction bore design and an as-built profile **is required**. Supervision and/or Gas Standards should be contacted for guidance when this occurs.

6.1.3 In non-standard circumstances, a pre-construction bore design may be necessary and an as-built profile should be produced by the boring contractor if the technology is available.

6.2 Materials

6.2.1 Refer to the Standard on Coatings for overall requirements. The following requirements are specific to boring.

- Abrasion Resistant Overcoat (ARO) steel pipe is required when boring.
- Welded joints shall be coated with Tape Coat H35G or 2-Part Epoxy. An additional protective wrap shall be used at the joint, X-Wrap (or equivalent) will be used to protect the weld and the pipe when boring.
- Denso Repair Cartridges are an option to repair holidays.

6.2.2 Consider the use of higher grade steel (Grade X52) pipe for greater pullback strength. Grade X52 is ideal in situations where the pipe will not be tapped (railroad, river, interstate crossings). However, in situations where the pipe will be tapped it is recommended to use Grade B or Grade X42.

6.2.3 Consider the use of thicker wall steel pipe if the pipe may be damaged by rocks or other debris during the boring process, and for greater pullback strength. For example, in SDNE, 4” pipe normally has a wall thickness of 0.188”. Consider using a 0.237” wall thickness (Schedule 40), if soil conditions necessitate it.

6.2.4 Casings may be required by State or local regulations. A larger diameter pipe can be bored as a casing. Then the carrier pipe can be inserted through the casing.

Refer to the Standard on Casing Installation.

6.3 Pipe Installation

6.3.1 Weld the necessary length of steel pipe for the pull back process and consider a preliminary pressure test of piping. Mechanical joints shall not be pulled through bore holes.

6.3.2 Before the steel pipe is pulled back, install a cap, “dead end”, or other device on the pipe to prevent contaminants from entering the pipe during the pullback process.

6.3.3 When using a directional bore, ensure the appropriate backreamer head is attached to the leading end of the drill string to enlarge the pilot bore diameter during the pullback process. Required minimum backreamer sizes are in the summary table at the end of this section.

6.3.4 Ensure sufficient clearance is maintained between the drill path and any underground facilities or structures during all phases of the boring and reaming process, as well as during the pullback process (12” required, 24” preferred).

6.4 Handling

6.4.1 An inspection of the pipe coating should be completed before installation. The pipe and weld joints should be inspected with the use of a holiday detector or “jeep”.

6.4.2 All steel pipe should be monitored for holidays or other damage at the point of entry into the bore hole.

6.4.3 When pulling over rough surfaces, to prevent damage to the pipe during the pullback process, consider using rollers or other padding devices to protect the pipe from rough surfaces.

6.4.4 If the pipe will be exposed for long periods of time (overnight or longer), it is recommended to seal the ends of the pipe with a welded or mechanical fitting to prevent contamination.

6.4.5 The pipe may require cleaning by pigging or other suitable means if evidence of contamination exists. Pigging is required for 4” main and larger.

Refer to the Standard on Pigging.

6.5 Inspection

6.5.1 All steel pipes should be inspected for the condition of the coating or damage to the pipe at the exit of the bore hole. Any imperfections or damage to the coating (holidays) shall be repaired.

Refer to the Standards on Inspection of Materials, and Coatings.

6.5.2 Any imperfections or damage to the steel pipe surface shall be evaluated and repaired. If damage to the steel pipe surface is evident, continue the pullback process until there is no evidence of damaged pipe.

Refer to the Standards on Inspection of Materials, and Repair Procedures for Steel Pipe.

6.5.3 If there is continued evidence of damage to the steel pipe surface (not coating), re-drill the boring path using a larger backreamer head or a modified trajectory path or consult engineering for inspection.

Steel Boring Summary			
Pipe Size	**Wall Thickness**	**Minimum Back-Reamer Size**	**Pigging**
¾”	0.113	2”	NA
1”	0.133	2”	NA
2”	0.154	4”	Recommended
3"	0.188 (SDNE Only)	6"	Recommended
3”	0.216	6”	Recommended
4"	0.188 (SDNE Only)	8"	Required
4”	0.237	8”	Required
6"	0.188 (SDNE Only)	10"	Required
6”	0.25	10"	Required
6"	0.28	10"	Required
8"	0.25	12"	Required
10"	0.25	14"	Required
12"	0.25	16"	Required

NorthWestern Energy

55 Pipeline Installation 55-F Plowing (MT) / Planting (SD/NE)		Original Date 06/01/2006	Standard Number 55-F
Supersedes Standard: 55-C	Revision 4	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's procedures and policies concerning plastic pipe plowing/planting. Pipe Plowing/Planting is the installation of pipe by pulling a plow blade through the ground.

Using a plow, where the pipe is **planted into the ground at the plow** is covered under this standard.

Using a plow to pull the pipe through the ground is covered under the Standard on Trenchless Technology.

2.0 General

2.1 Plowing and planting involve cutting a narrow trench, and feeding the pipe into the trench through a shoe or chute fitting just behind the trench cutting equipment (blade). The shoe or chute should feed the pipe into the bottom of the cut. The pipe's path through the shoe or chute should be as friction free as practicable.

2.2 Plastic pipe shall be plowed in at the minimum depth and clearances. Refer to the Standard on General Installation, Clearance, and Depth for more information.

2.3 Chutes designed for plowing plastic pipe shall be made so that the pipe is not bent to a radius less than 13 times the pipe diameter for SDR 11 and 11.5 (typical SDR) or 10 times the pipe diameter for SDR 9 (1/2" CTS). This is the short term bending radius.

2.4 Plowing through a chute is not allowed on 4 inch or larger pipe without the approval of the area supervisor and examination of the radius and construction of the plow chute. This is due to the high probability of oval deformation in the pipe. If larger pipe is going to be plowed through a chute, it is good practice to dig up the pipe and check for ovality in standard increments (typically 500ft).

2.5 Tracer Wire Installation

2.5.1 Tracer wire installed while plowing should be stronger, either by having a higher tensile strength (EHS - Extra High Strength, 1000-7758), or by having a larger diameter size. Installing these types of tracer wires will reduce potential damage in the continuity of the wire during construction. For more information on tracer wire installation, please refer to the Standard on Tracer Wire.

2.5.2 Tracer wire and/or tracer wire casing must be pulled back with the main and/or service pipe in the plow (cannot be done in a separate plow).

2.5.3 For gas mains installed through plowing and planting, it is an option to include a minimum ½ inch plastic pipe in the plow as a tracer wire casing. The ½ inch pipe will assist in maintaining the integrity and continuity of the wire. Consider larger casing pipe for rockier soils or longer bores.

2.6 Warning tape is optional and may be installed on 2 inch or larger mains or services, approximately 12 inches above the plowed plastic pipe to warn of potential digging hazards.

NorthWestern Energy

55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
Supersedes Standard: 55-J	Revision 6	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and design for casing installation.

This standard is intended to comply with the requirements as set by the DOT 49 CFR part 192.323.

2.0 General

2.1 NorthWestern Energy does not require casings. It is NorthWestern Energy preference that casings be avoided when possible. However, there are times when other entities, such as the railroad or highway department, require casings as part of their occupancy permit. When required by other entities, this is the standard for casings.

2.2 Every attempt should be made to avoid using steel pipe as a carrier in a steel casing, due to possible galvanic corrosion.

2.3 All casings used on a distribution line under railroad or highway, must comply with the following.

2.3.1 Casings should be at least 2 ***pipe sizes*** larger than the carrier pipe. For example, 4" carrier pipe would require an 8" casing.

2.3.2 Every cased crossing shall have a test station installed.

2.3.3 It is preferred for the casing to be uncoated pipe.

2.3.3.1 If casing is uncoated, do not install an anode.

2.3.3.2 If casing is coated, install an anode.

2.3.4 Please refer the following diagrams of a Typical Installation of Cased Crossings.

2.3.5 *Casings must be designed to withstand all superimposed loads.*

2.3.6 *If there is a possibility of water entering the casing, the ends must be sealed. This is to avoid any type of corrosion environment.*

2.3.7 *In the event that the ends of an un-vented casing are sealed, and the sealing is strong enough to retain the maximum allowable operating pressure of the pipe, the casing must be designed to hold this MAOP pressure at a stress level of no more than 72% of SMYS.*

2.3.8 *Vents, if installed, must be protected from any inclement, weather to prevent water damage and corrosion.* Vents are not required per NWE standards, but may be required by permitting agency (DOT, RR, etc.). The vent on the drawing is only required if required by permitting agency.

3.0 Steel Carrier Pipe

3.1 Prior to inserting the steel carrier into the steel casing, the interior of the steel casing should be checked for obstructions, such as weld spatter, slag, and/or filler metal. The insulators/spacers can get caught on these obstructions. Pigging the casing is also an option when a good visual inspection is not possible.

3.2 If inserting a steel carrier into a steel casing, pipe insulators/spacers shall be used to separate the inserted carrier steel pipe from casing steel pipe. Spacing shall be dictated through manufacturer specifications.

4.0 Plastic Carrier Pipe

4.1 Plastic pipe being encased must be inserted into the casing pipe in such a manner that will protect the plastic.

4.1.1 The leading end of the plastic must be closed before insertion.

4.1.2 Inserted pipe must be padded with adequate backfill beneath and around where it emerges from the casing to prevent any damage from shear stresses.

4.1.3 A starter ditch of sufficient length should be opened to allow the plastic pipe to be inserted without excessive bending or buckling.

4.1.4 Casing pipe should be prepared to prevent any possibility of sharp edges, projections, or abrasive material form damaging the plastic pipe during or after insertion. This may be accomplished through the use of pigs or reamers.

4.1.5 It is recommended to pull a test piece of the same size plastic pipe through the casing for examination prior to actual insertion.

4.1.6 The edge of the casing opening should be shielded by use of a sleeve to prevent possible damage of the plastic pipe being inserted. A traffic cone used as a funnel/sleeve during insertion may aid in preventing this type of damage.

4.1.7 The Allowable Tensile Load (ATL) of plastic pipe being pulled through casing pipe should not be exceeded. Refer to the Standard on Trenchless Technology for more information.

5.0 Design and Materials

5.1 The following materials are manufactured by GPT Industries and are available from Groebner and/or Pro-Kote.

5.2 The following design and materials are limited to 400’. For installations over 400’, consult Engineering.

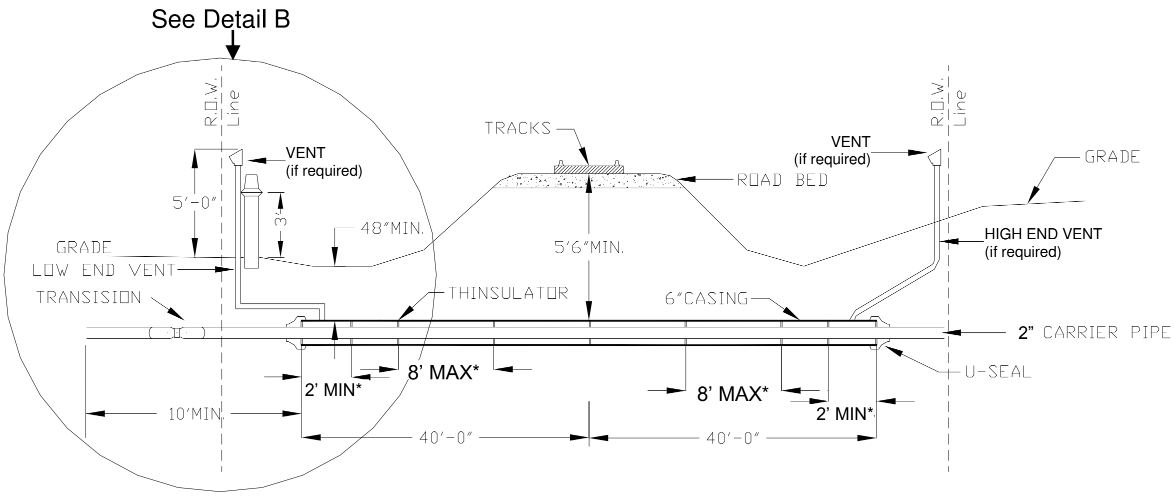
NorthWestern Energy

55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
Supersedes Standard: 55-J	Revision 6	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

FIGURE 1 - TYPICAL INSTALLATION OF CASED CROSSINGS

Detail of Pipe Under Railroad Track

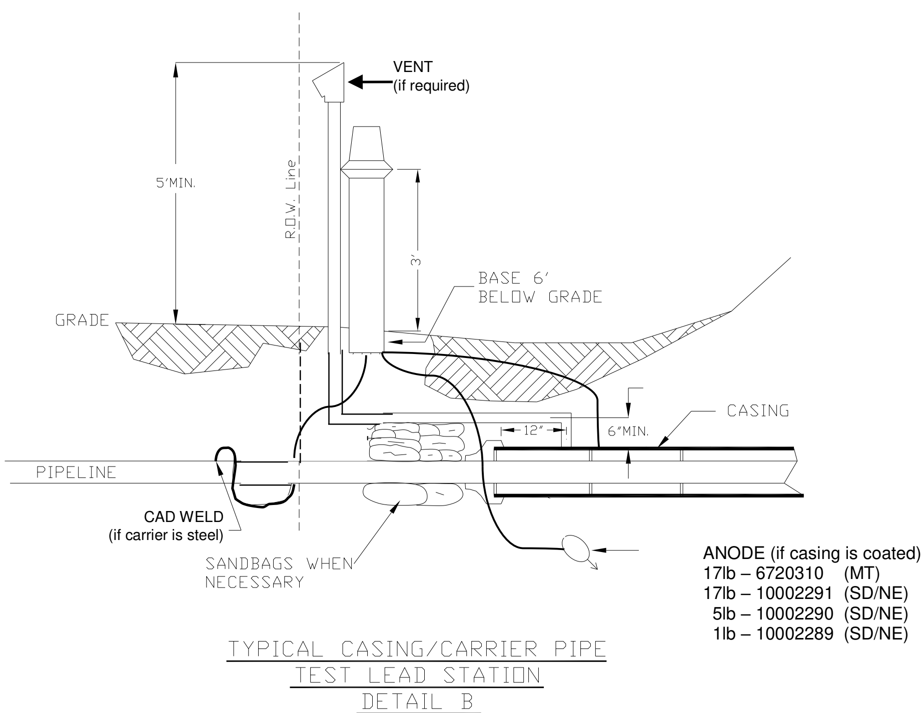
Detail A



* Refer to manufacturer's specifications. These are the specifications for the spacers in this drawing.

NOTE:
VENTS MUST BE AT EDGE OF R.O.W.

Detail B



NorthWestern Energy

55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
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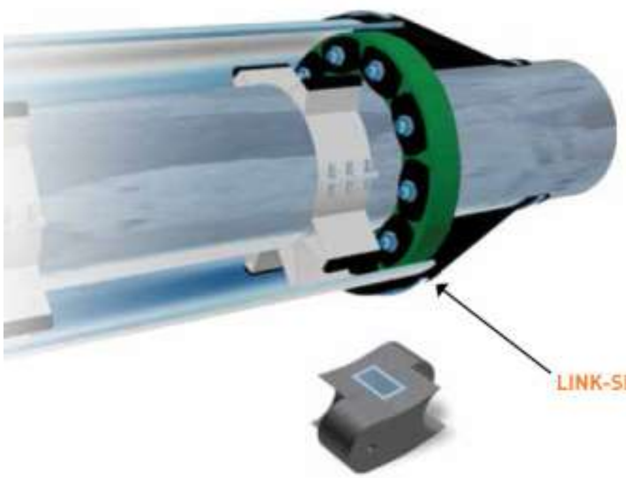
FIGURE 2 LINK SEAL

Casing End Seals - Link-Seal® Modular Seals

FOR DOUBLE SEALING PIPELINE CASING ENDS WHEN CARRIER PIPE IS CENTERED IN CASING



LINK-SEAL® MODULAR SEALS WITH REINFORCED CENTERING BLOCKS

A Link-Seal® modular seal assembly installed at each end of pipeline casings provides positive, hydrostatic protection against the entry of water, soil or other backfill materials and reduces corrosion and ice damage. If casing isolators are not used, starting with 14" diameter assemblies, we suggest Link-Seal® modular seals with "centering blocks" in 25% of the links. These centering blocks fit into molded openings in the Link-Seal® modular seals and are positioned in the lower 90° of each assembly. GPT centered casing isolators should also be placed within two feet of casing ends.

400 SERIES

For Casings Two Pipe Sizes Larger than Carrier Pipe

CARRIER X CASING PIPE IPS NOMINAL	COMPLETE CASING SEAL ASSEMBLY CONSISTS OF:			BASIC LINK-SEAL® SIZE USED	COMPLETE ASSEMBLY ORDER NO.
	PLAIN LINKS	LINKS WITH CENTERING BLOCKS	TOTAL LINKS		
2" x 6"	5	0	5	LS-410	26*
3" x 6"	7	0	7	LS-360	36*
4" X 8"	7	0	7	LS-475	48*
6" X 10"	10	0	10	LS-475	610*
8" X 12"	12	0	12	LS-475	812*
10" X 14"	10	0	10	LS-425	1014*
12" X 16"	12	0	12	LS-425	1216*
14" X 18"	9	4	13	LS-400	1418
16" X 20"	11	4	15	LS-400	1620
18" X 22"	13	4	17	LS-400	1822
20" X 24"	13	5	18	LS-400	2024
22" X 26"	16	5	20	LS-400	2226
24" X 28"	17	5	22	LS-400	2428
26" X 30"	17	6	23	LS-400	2630
28" X 32"	18	7	25	LS-400	2832
30" X 34"	20	7	27	LS-400	3034
32" X 36"	21	8	29	LS-400	3236
34" X 38"	22	8	30	LS-400	3438
36" X 40"	24	8	32	LS-400	3640

* = Centering Blocks are not required and not available for these models.(Maximum coating 3/16" thick - Casing pipe walls should not exceed 0.500" except for casing sizes 12", 14" and 16", which should not have a wall thickness greater than 0.312")

500 SERIES

For Casings Three Pipe Sizes Larger than Carrier Pipe

CARRIER X CASING PIPE IPS NOMINAL	COMPLETE CASING SEAL ASSEMBLY CONSISTS OF:			BASIC LINK-SEAL® SIZE USED	COMPLETE ASSEMBLY ORDER NO.
	PLAIN LINKS	LINKS WITH CENTERING BLOCKS	TOTAL LINKS		
4" X 10"	6	0	6	LS-500	410**
6" X 12"	7	0	7	LS-500	612**
8" X 14"	11	0	11	LS-575	814**
10" X 16"	7	3	10	LS-525	1016
12" X 18"	9	3	12	LS-525	1218
14" X 20"	9	4	13	LS-500	1420
16" X 22"	11	4	15	LS-500	1622
18" X 24"	12	4	16	LS-500	1824
20" X 26"	13	5	18	LS-500	2026
22" X 28"	14	6	20	LS-500	2228
24" X 30"	15	6	21	LS-500	2430
26" X 32"	17	6	23	LS-500	2632
28" X 34"	18	6	24	LS-500	2834
30" X 36"	19	7	26	LS-500	3036
32" X 38"	21	7	28	LS-500	3238
34" X 40"	21	8	29	LS-500	3440
36" X 42"	23	8	31	LS-500	3642
42" X 48"	27	9	36	LS-500	4248
48" X 54"	30	11	41	LS-500	4854
54" X 60"	34	12	46	LS-500	5460

** = Centering Blocks are not required for these applications. (Maximum coating 3/16" thick - Casing pipe walls should not exceed 0.500" except for casing sizes 16" and 18" which should not have a wall thickness greater than 0.312")

NorthWestern Energy

55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
Supersedes Standard: 55-J	Revision 6	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

Link-Seal® Modular Seals - Installation Techniques

1. Center the pipe, cable or conduit in wall opening or casing. Make sure the pipe will be adequately supported on both ends. Link-Seal® modular seals are not intended to support the weight of the pipe.

2. Loosen rear pressure plate with nut just enough so links move freely. Connect both ends of belt around the pipe.

3. Check to be sure all bolt heads are facing the installer. Extra slack or sag is normal. Do not remove links if extra slack exists. Note: On smaller diameter pipe, links may need to be stretched.

4. Slide belt assembly into annular space. For larger size belts, start inserting Link-Seal® modular seal assembly at the 6 o'clock position and work both sides up toward the 12 o'clock position in the annular space.

5. Using a hand socket or off-set wrench ONLY, start at 12 o' clock. Do not tighten any bolt more than 4 turns at a time. Continue in a clockwise manner until links have been uniformly compressed. (Approx. 2 or 3 rotations)

6. Make 2 or 3 more passes at 4 turns per bolt MAXIMUM, tightening all bolts clockwise until all sealing elements "bulge" around all pressure plates. On type 316 stainless steel bolts, hand tighten ONLY without power tool.

7. If the seal doesn't appear to be correct using the instructions provided, Call GPT at 800-423-2410.

Installation Notes: The Link-Seal® modular seal bolt heads are usually recessed below the wall opening or the edge of casing pipe and therefore a socket or offset wrench must be used.
Hand Tools: Use 5/16" hex or #6 screwdriver for LS-200. 1/2" hex requires 3/8" drive socket wrench. 9/16" and 3/4" hex requires 1/2" drive socket wrench. (Tools not provided.)

LINK-SEAL® MODULAR SEAL - DO'S

1. Make sure pipe is centered.
2. Install the belt with the pressure plates evenly spaced.
3. Install the exact number of links indicated in sizing charts.
4. Check to make sure pipe is supported properly during backfill operations. Note: Link-Seal® modular seals are not intended to support the weight of the pipe.
5. Make sure seal assembly and pipe surfaces are free from dirt.
6. For tight fits, use non-polluting liquid detergent to assist with installation.

LINK-SEAL® MODULAR SEAL - DON'TS

1. Don't Install the belt with the pressure plates aimed in irregular directions. (Staggered)
2. Don't Install Link-Seal® modular seals where weld-beads or other irregular surfaces exist without consideration of the sealing requirements.
3. Don't torque each bolt completely before moving on to the next.
4. Don't use high speed power tools (450 rpm or more)
5. Do not use power tools on Link-Seal® modular seal 316 stainless steel bolts.
6. Don't use grease installing Link-Seal® modular seals.

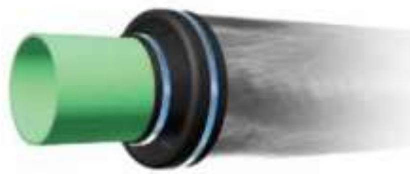
NorthWestern Energy

55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
Supersedes Standard: 55-J	Revision 6	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

FIGURE 3 END-SEAL

MODEL S STANDARD PULL-ON END SEALS | ENERGY MARKET

(For New Installations)
Model S Standard Pull-on End Seals are flexible and easily installed on Nominal Steel & IPS casing/carrier pipe combinations. GPT Model S end seals are extremely robust, resistant to wide variations in environmental conditions while eliminating the possibility of foreign material entering the opening between carrier and casing pipes.



BENEFITS/FEATURES

- Quick and Easy Installation
- May be stocked
- Screwdriver Is Only Tool Required for Installation
- Designed To Last for the Life of the Piping System
- Heavy Duty Stainless Steel Hose Clamps Supplied

MODEL W WRAP AROUND END SEALS | WATER/ENERGY MARKET

(For New and Existing Installations)
Model W Wrap Around End Seals are designed to accommodate customer supplied specifications so they may be used for any size casing/carrier differential. GPT Model W end seals are extremely robust, resistant to wide variations in environmental conditions while eliminating the possibility of foreign material entering the opening between carrier and casing pipes.

BENEFITS/FEATURES

- Custom Made to Order
- Quick and Easy Installation
- Carrier Pipe Does Not Need To Be Centered Within Casing
- Can Be Installed on Existing Casing Installations
- Screwdriver Is Only Tool Required for Installation
- Designed To Last for the Life of the Piping System
- Heavy Duty Stainless Steel Hose Clamps Supplied
- Self-Curing Seam - Simply Remove Plastic Backing and Press Together

INSTALLATION TECHNIQUES - MODEL C AND S END SEALS (NEW INSTALLATION ONLY)

Prior to installing the final carrier pipe section into casing, slide end seal loosely onto carrier pipe making sure large opening of end seal is facing toward casing pipe. Position end seal on carrier pipe so it will be near the casing opening after the insertion of the carrier pipe is complete.

1. Prepare outside surfaces by removing dirt from casing and carrier pipes.
2. After carrier pipe is completely inserted into casing and end seal is correctly positioned relative to both casing and carrier pipes, secure large end (casing end) with stainless steel hose/banding clamp. Hose/banding clamp should be positioned at least 1" (25.4cm) from the end of the casing pipe. Tighten screw with a standard screwdriver to secure end seal to casing pipe.
3. Fold end seal into an "S" shape so it will protrude into the casing. This is done to relieve stress during backfilling and allow for expansion and contraction both during and after installation is complete. The small end of the end seal will slide toward the casing as the "S" is constructed.
4. Position banding clamp approximately 1" from the small end of the end seal (on the carrier pipe) and tighten with a standard screwdriver to secure end seal to carrier pipe.

INSTALLATION TECHNIQUES - MODEL W END SEALS (NEW OR RETROFIT APPLICATIONS)

1. Prepare outside surfaces by removing dirt from casing and carrier pipe.
2. Wrap end seal around both carrier and casing pipes, making sure the widest portion of the end seal is wrapped around the casing pipe.
3. Overlap the edges of the end seal with the release papers facing each other.
4. Remove release papers and firmly press together along the entire edge of the sealing area. Repeat the pressing process to make sure seam is tight.
5. Secure large end (casing end) with stainless steel hose/banding clamp. Hose/banding clamp should be positioned at least 1" (25.4cm) from the end of the casing pipe. Tighten screw with a standard screwdriver to secure end seal to casing pipe.
6. Fold end seal into an S shape so it will protrude into the casing. This is done to relieve stress during backfilling and allow for expansion and contraction both during and after installation is complete. The small end of the end seal will slide toward the casing as the S is constructed.
7. Position banding clamp approximately 1" from the small end of the end seal (on the carrier pipe) and tighten with a standard screwdriver to secure end seal to carrier pipe.

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55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
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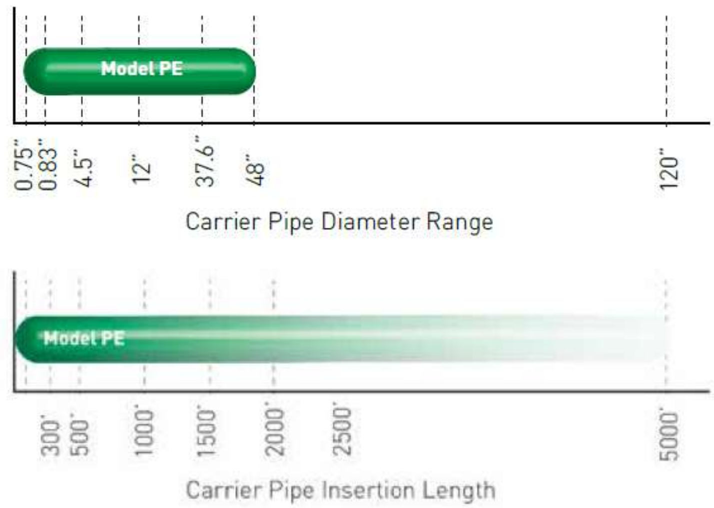
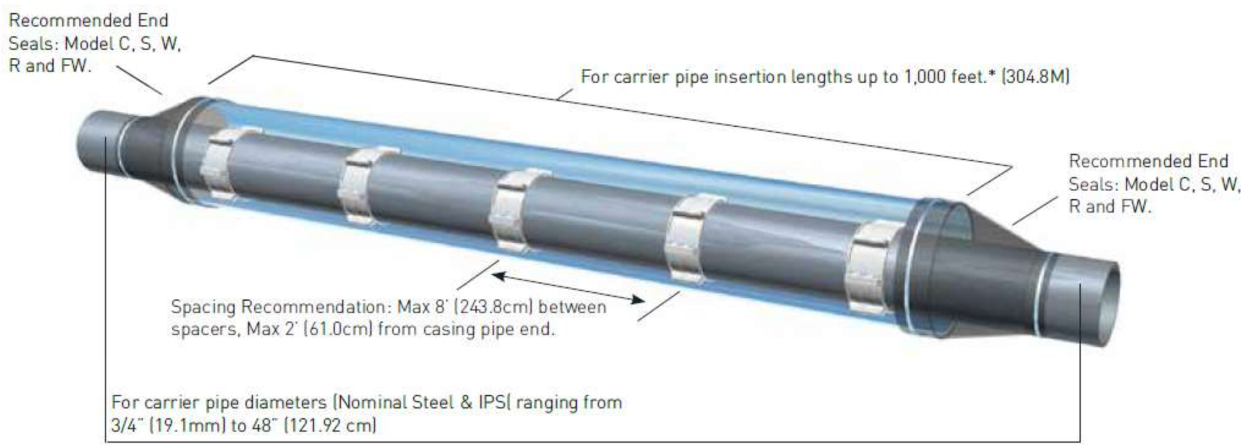
FIGURE 4 CASING SPACERS

Casing Spacer Models - Non-Metallic, Model PE



Contact GPT if longer insertions over 1000 ft.



FEATURES/BENEFITS

- Ribbed inner surface prevents slippage & guards against coating damage.
- Molded from virgin polyethylene material.
- Lightweight for ease of handling and installation.
- Screwdriver is only tool needed for installation.
- Eliminates the need for grout, blown sand or pea gravel.

TARGETED USE - ENERGY

Model PE Casing Spacers are designed for smaller diameter steel or polyethylene carrier pipes (ANSI O.D. pipe without a bell mechanical joint). We do not recommend that they be used on any carrier pipe over 24" (61.0cm) in diameter or for installations over 400 feet (121.9M) long without consulting with GPT. PE Isolators should not be used on concrete carrier pipe.

High density (linear), injection molded virgin Polyethylene casing isolators/spacers provide positive electrical isolation, high abrasion resistance and low coefficient of friction for a wide variety of double containment carrier/casing pipe applications. They are extremely light in weight and easy to handle during installation.

A ribbed inner surface prevents slippage and guards against carrier pipe coating damage while the outer surface may include any one of several molded runners to accommodate 2" (50.8mm) x 4" (101.6mm) or larger carrier/casing differentials. One piece solid molded segments provide for maximum load bearing. Hardware includes cadmium plated steel bolts and nuts. A screwdriver is the only tool needed for installation.

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55 Pipeline Installation 55-J Casings		Original Date 06/01/2006	Standard Number 55-J
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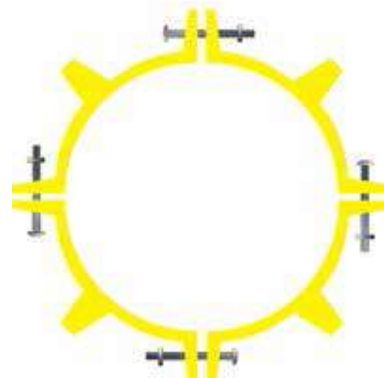
Casing Spacer Models - Non-Metallic, Model PE



MATERIAL SPECIFICATIONS

Specification	ASTM Test	Value
Band/Runner Segments		Injection Molded Virgin Polyethylene
Tensile Strength	D638, D651	3,100 - 5,500 psi (218 - 387 kg/cm²)
Compressive Strength	D693	3,200 psi (225kg/cm2)
Water Absorption	D570	0.1%
Temperature		180°F. Max. (82°C)
Impact Strength	D256	1.5-2.0 ft lb/in. (0.8-1.07 newton-meters/cm)
Dielectric Strength	D149	450 Volts/Mil.
Color		White
Liner - None		
Runners - Size and Configurations 3/4" (19mm) through 12" (305mm) = 2-piece with molded-in runners 14" (356mm) and larger = Multiple segments with molded-in runners.		
Hardware Metallic - Bolts and Square Nuts = Plated Steel		

BAND WIDTH AND RUNNER HEIGHT

Model Size	Band Width	Runner Height
3/4 x 2	3.0" (76.19mm)	5/16" (7.94mm)
1 x 3	3.0" (76.19mm)	1/2" (12.7mm)
1-1/4 x 3	3.0" (76.19mm)	1/2" (12.7mm)
1-1/2 x 3	3.0" (76.19mm)	1/2" (12.7mm)
2 x 4	4.0" (101.6mm)	5/8" (15.88mm)
2-1/2 x 5	4.0" (101.6mm)	5/8" (15.88mm)
3 x 6	4.0" (101.6mm)	5/8" (15.88mm)
4 x 6	4.0" (101.6mm)	9/16" (14.29mm)
4 x 8	4.0" (101.6mm)	1" (25.4mm)
6 x 8	4.0" (101.6mm)	9/16" (14.29mm)
6 x 10	4.0" (101.6mm)	1" (25.4mm)
8 x 10	4.0" (101.6mm)	9/16" (14.29mm)
8 x 12	5.0" (127.0mm)	1" (25.4mm)
10 x 14	5.0" (127.0mm)	7/8" (22.23mm)
12 x 16	5.0" (127.0mm)	7/8" (22.23mm)
All multiple segments* (4" differential)	6.25" (158.75mm)	1" (25.4mm)
All multiple segments* (6" differential)	6.25" (158.75mm)	1-1/2" (38.1mm)

Position in Casing

NorthWestern Energy

55 Pipeline Installation 55-K Bridge Attachments		Original Date 06/01/2006	Standard Number 55-K
Supersedes Standard: 69-D	Revision 2	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

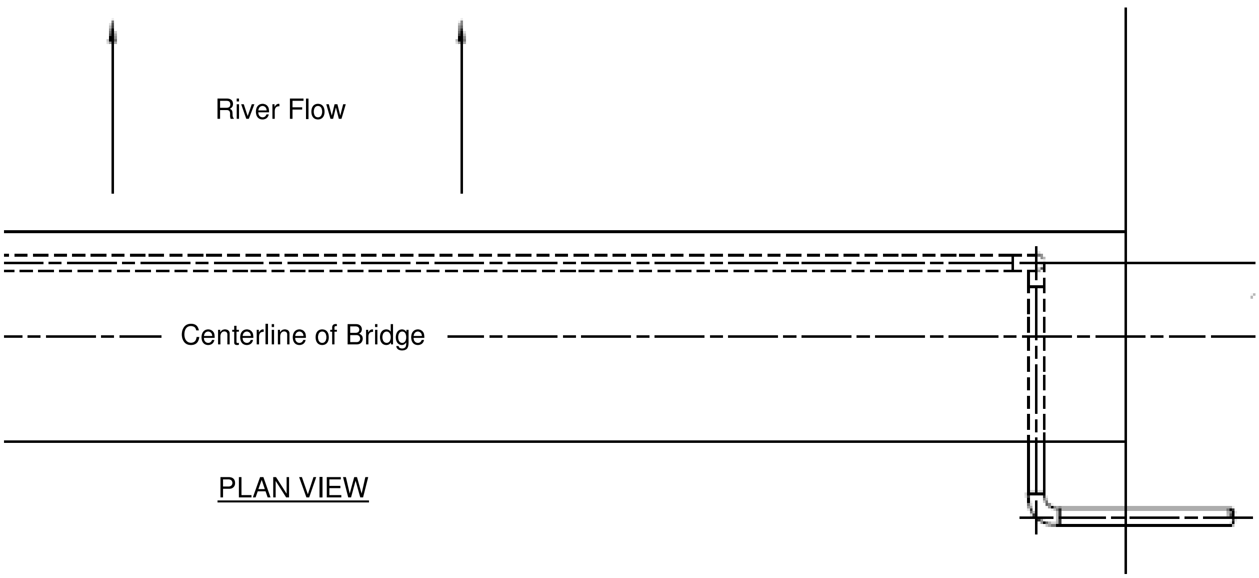
The purpose of this standard is to describe the requirements of NorthWestern Energy's general design procedures and policies concerning bridge attachments.

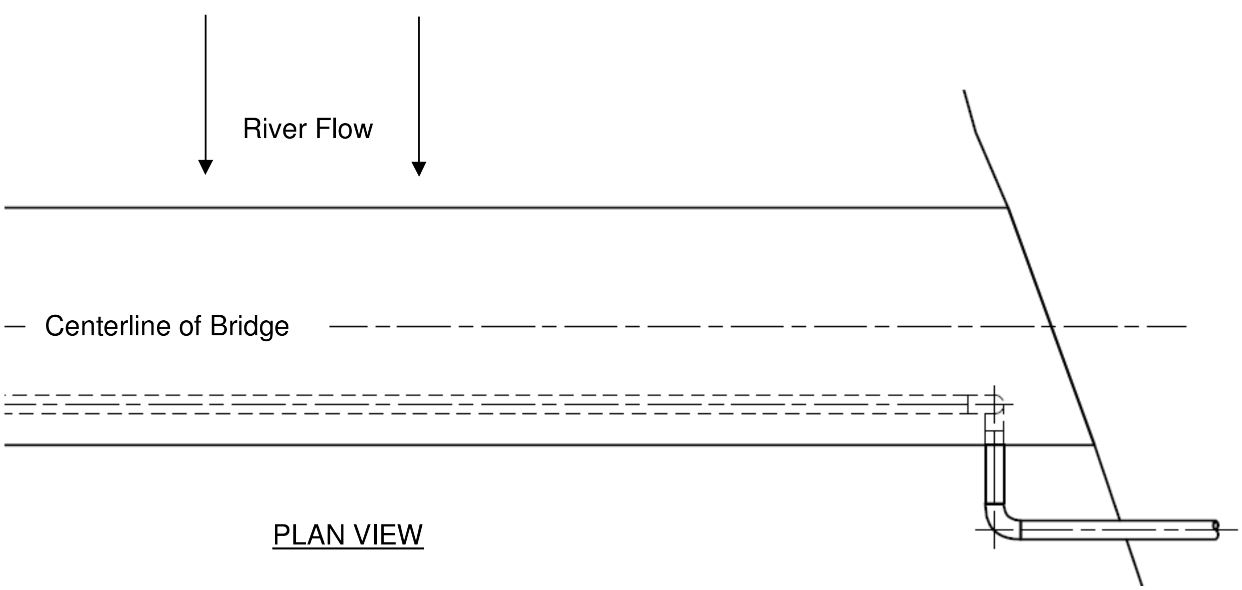
Bridge attachments are not always required and should be avoided when possible; Trenchless Technology (directional boring) is preferred.

2.0 Placement

2.1 It is preferred that the pipe be away from the bridge at the point of leaving the ground, not under the bridge, or attached to the bridge foundation. Examples below.

2.2 It is preferred to install the pipe on the downstream side of the bridge. Examples below.





NorthWestern Energy

55 Pipeline Installation 55-K Bridge Attachments		Original Date 06/01/2006	Standard Number 55-K
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3.0 Thermal Expansion

3.1 When installing pipe on a bridge expansion and contraction of the pipe shall be considered. The formula for determining the amount of expansion/contraction of the pipe is:

$$E=\Delta T(.000006)L$$

Where:

E = expansion length

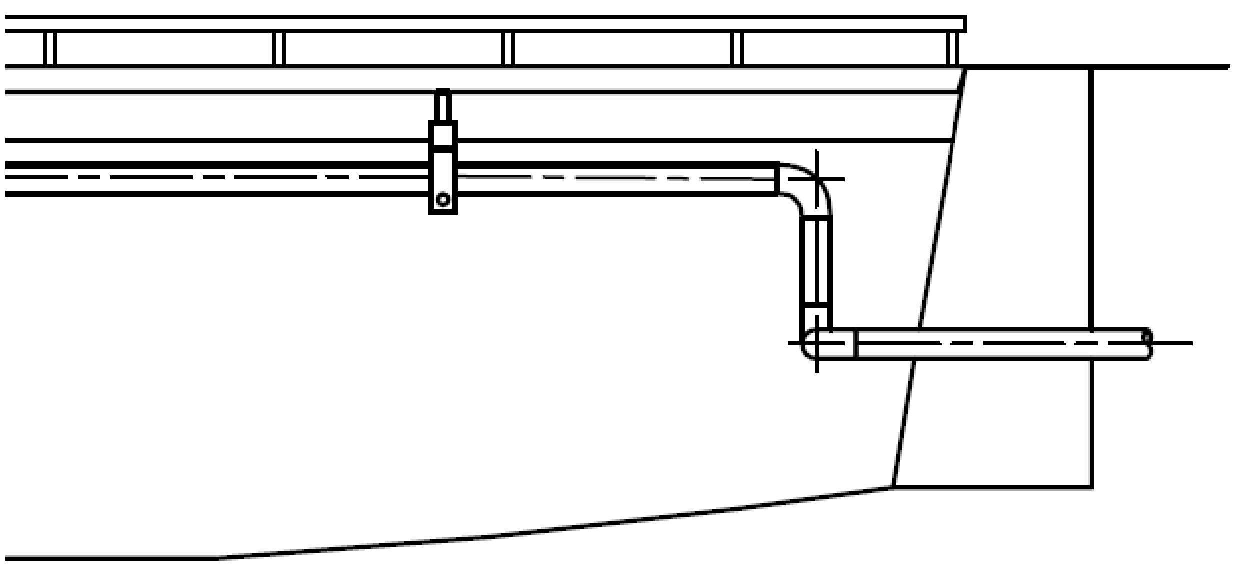
ΔT = the temperature difference experienced by the pipe

.000006 = the coefficient of expansion of steel

L = horizontal length of the pipe being installed

An expansion joint absorbs, as lateral deflection, the thermal expansion of the long horizontal pipe run. The benefit of this arrangement is that the anchoring to restrain the pressure thrust is confined to the short pipe leg that is the expansion joint. The long pipe is in tension from its pressure thrust and does not require extensive guiding. A directional anchor (the ground) is located at the lower elbow, with the freedom to permit the growth of the horizontal pipe. The upper elbow is attached to a main anchor (pipe hanger), and is the fixed point from which all the deflections are calculated.

3.2 Standard Symmetrical Expansion U-Bend – It is preferred to use a standard U-Bend. The picture below is the "right" half of the U-Bend. The other half is on the "left" side of the bridge.



3.3 Manufactured Expansion Joint – Manufactured expansion joints are available, but will need to be engineered. A US Bellows catalog is available on Sharepoint. Consultation/design with the manufacturer is recommended.

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4.0 Materials

4.1 Standard Materials

- Steel Pipe
- Wax Tape #2 (6" x 9' Roll – 10017827, other sizes available)
- Trenton TemCoat 3000 Primer (10011657)
- Optional - MC Outerwrap (6" x 27' Roll – 10017475, other sizes available)

4.2 Bridge Attachment Materials (NW Pipe)

- Adjustable Roller Hanger
- Clevis Insulator
- All-Thread
- Non-Conductive Roller
- Bridge Attachment

5.0 Max Horizontal Spacing Between Pipe Supports for Standard Weight Steel Pipe

Span Between Supports																		
Nom. Pipe Size (In.)	1	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	30
Span Water (Ft.)	7	9	10	11	12	13	14	16	17	19	22	23	25	27	28	30	32	33
Steam, Gas, Air (Ft.)	9	12	13	14	15	16	17	19	21	24	26	30	32	35	37	39	42	44

NorthWestern Energy

55 Pipeline Installation 55-K Bridge Attachments		Original Date 06/01/2006	Standard Number 55-K
Supersedes Standard: 69-D	Revision 2	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

6.0 UV Coating and Sizing

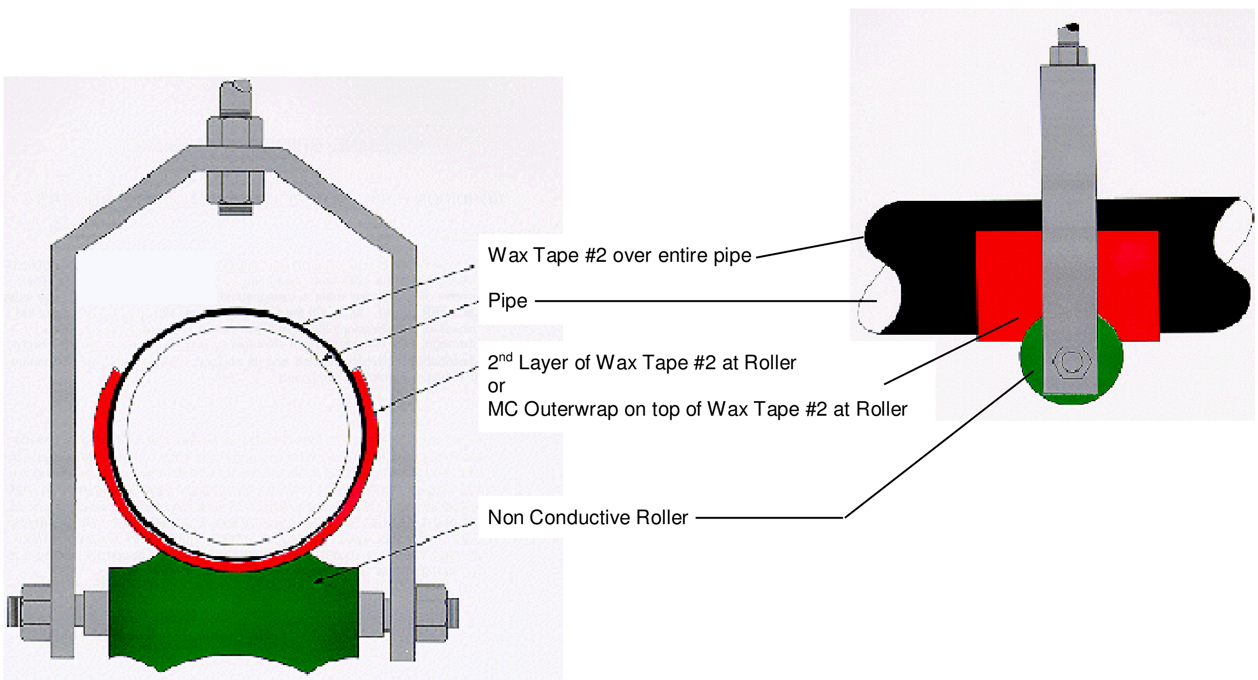
6.1 In most cases, the bridge attachment materials will need to be a size larger than the pipe. For example, 6" pipe will need bridge attachment materials sized for 8" pipe.

This is due to the UV coating. Steel pipe will need to be wrapped in Wax Tape #2. At the rollers, a second layer of Wax Tape #2 or the MC Outerwrap over the first layer of Wax #2 is required.

The weight of the pipe on the hanger will push and press the wax primer deeper into the pores of the pipe. It is suggested to use extra primer at the area of the hanger.

These extra layers of coating will need to be taken into account when sizing bridge attachment materials.

- Wax Tape #2 – Thickness, 70-90 mil (0.07 – 0.09 inches)
- Moisture Cured (MC) Outerwrap – Thickness 30 mil (0.03 inches)



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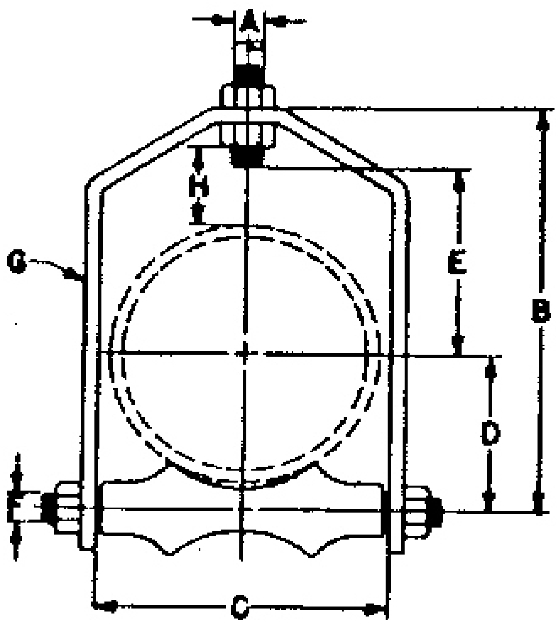
7.0 Adjustable Roller Hanger

7.1 Includes 1 Steel Clevis, 1 Roll Axle, and Nuts.



8.0 All-Thread

8.1 The length of the all-thread will need to be determined in the field, taking into account clearances from the bridge, other pipelines, etc.

8.2 The diameter of the all-thread is determined using the table below.

PIPE SIZE	ROD SIZE				ROD TAKE OUT	AXLE	STEEL SIZE	ADJUST.	MAX LOAD LBS.	WT. LBS/EA.
	A	B	C	D	E	F	G	H		
2	3/8		3 1/4			3/8				
3	1/2	6 3/8	3 7/8	2 1/4	3 1/8	1/2	3/16 X 1 1/4	1 5/8	310	2.2
4	5/8	7 9/16	4 15/16	2 13/16	3 5/8	1/2	1/4 X 1 1/2	1 5/8	475	3.2
5	5/8	9 1/8	6	3 7/16	4 1/2	5/8	3/8 X 1 3/4	1 15/16	685	6.3
6	3/4	10 5/16	7 1/8	4	5	3/4	3/8 X 2	1 7/8	780	9.3
8	7/8	12 11/16	9 1/4	5 1/8	6 1/8	7/8	3/8 X 2 1/2	2	780	14.5
10	7/8	15 1/16	11 1/4	6 3/8	7 1/4	7/8	3/8 X2 1/2	2 1/16	965	18.8

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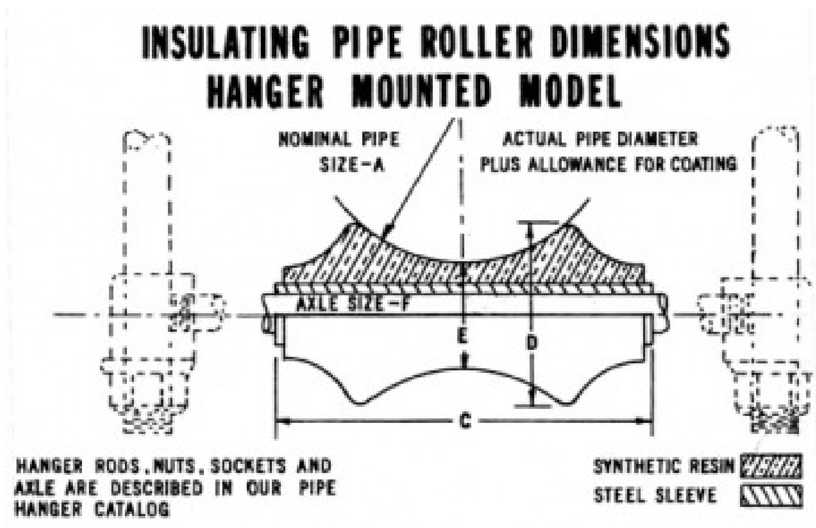
55 Pipeline Installation 55-K Bridge Attachments		Original Date 06/01/2006	Standard Number 55-K
Supersedes Standard: 69-D	Revision 2	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

9.0 Pipe Rollers

9.1 Pipe Rollers will be on non-conductive material. This is to electrically insulate pipelines from bridge structure while absorbing vibration and reducing chafing on pipe hanger parts. Cast Iron rollers can chaff the pipe coating by vibration of the bridge and movement of the pipe.



NOMINAL PIPE SIZE	C	D	E	F
2	2 5/8	1 1/4	13/16	3/8
3	3 3/4	1 5/8	7/8	1/2
4	4 3/4	2	1 3/8	1/2
5	5 13/16	2	1 1/8	5/8
6	6 7/8	2 3/4	1 3/4	3/4
8	8 7/8	3 1/8	2 1/8	7/8
10	11	3 5/8	2 1/8	7/8

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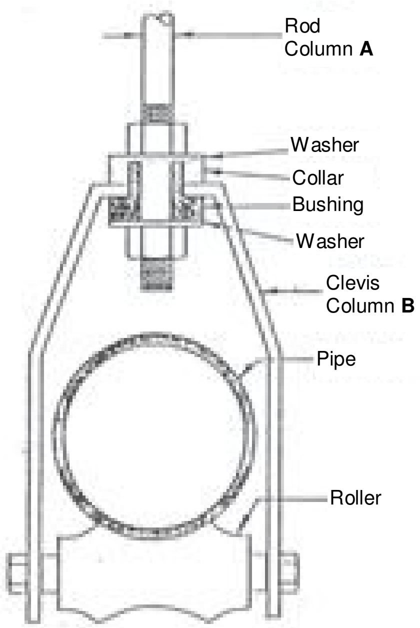
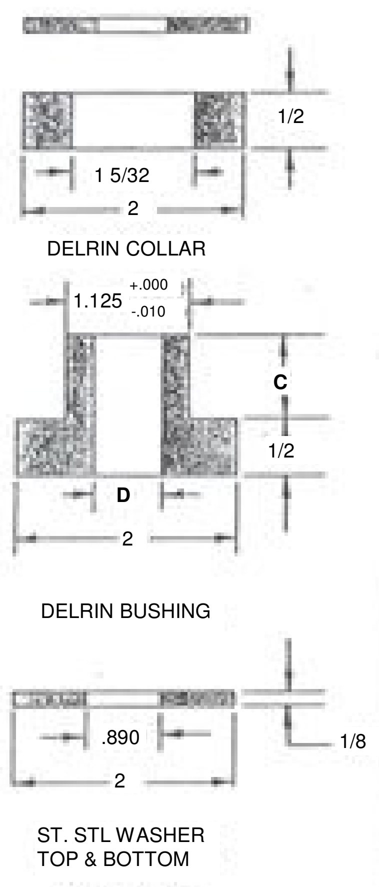
10.0 <u>Clevis Insulator</u>

10.1 Clevis Insulators are to be used to isolate the pipe from the hanger and prevent shorting of the pipe to the hanger. In the event the pipe were to contact the hanger the clevis insulator prevents any metal contact between the main's clevis hanger and any supporting structures. The insulators are to be used in conjunction with Non-Conductive Rollers on clevis hanger because even minor alignment problems frequently result in pipe to hanger contact. Clevis insulator collars and bushings are fabricated from DuPont Delrin, washers are stainless steel.



CLEVIS INSULATOR COMPONENTS



NOMINAL PIPE SIZE	Hanger Rod Diameter **A**	Clevis Stock Size **B**	Bushing Neck Height **C**	I.D. Bushing **D**
2	3/8	1/4 x 2 1/2	11/16	25/64
3	1/2	1/4 x 2 1/2	11/16	33/64
4	5/8	1/4 x 2 1/2	11/16	41/64
5	5/8	3/8 x 2 1/2	27/32	41/64
6	3/4	3/8 x 2 1/2	27/32	25/32
8	7/8	3/8 x 2 1/2	27/32	57/64
10	7/8	1/2 x 2 1/2	31/32	57/64

NorthWestern Energy

55 Pipeline Installation 55-K Bridge Attachments		Original Date 06/01/2006	Standard Number 55-K
Supersedes Standard: 69-D	Revision 2	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

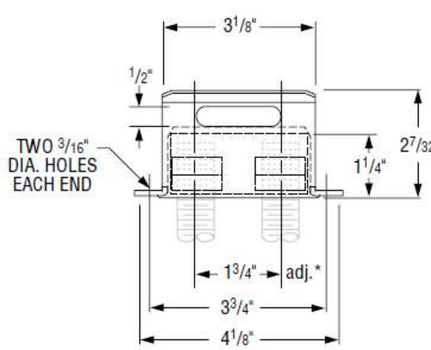
11.0 New Bridge Attachments

The ANVIL Figure 281 Wedge Type Concrete Inserts are NWE's preferred method of attachment. However, the bridge owner may also need to approve.

Manufacturer: Anvil
Size Range: 3⁄8" through 7⁄8"
Material: Carbon steel body; malleable iron nut
Finish: Plain or Zinc Plated
Service: Upper attachment for suspending pipe or conduit from concrete ceiling.
Installation:
1. Nail insert to wooden forms.
2. Where convenient, reinforcing rods may be placed in the opening through the top of the insert, or short lengths of reinforcing rod may be wired to the insert prior to pouring concrete. However, note that the specified load ratings and approvals are not dependent on the use of any reinforcing rods in contact with the insert.

3. After concrete is poured and forms removed, insert screw driver into slot in knockout plate and snap it out.
4. The nut may be put on the rod before inserting in the insert body. Then, turn rod so that elongated nut lies across the slot; screw rod through nut until rod is firmly against the top of the recess.

Features:
• Nut may be put on hanger rod before insertion, avoiding need of locating nut in insert body prior to inserting rod.
• Insert nut, when located in position, wedges against the sloping sides of insert, providing greater support than if resting on lower edge of the insert body.
• Wedge-shaped body is so held by concrete in compression thus increasing load carrying capacity.
• Easily removed knockout plate.
• Rod can be adjusted along complete length of slot.
• One body for six sizes of rod.
Ordering: Specify figure number, name and size of nut.



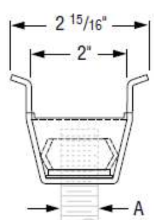


FIG. 281: LOAD (LBS) WEIGHT (LBS) DIMENSIONS (IN)			
	Hanger Rod Diameter **A**	Max Load	Weight
Insert Complete With Nut	3/8	730	0.82
	1/2	1,130	0.86
	5/8	1,200	0.89
	3/4		0.86
	7/8		0.93

12.0 Existing Bridge Attachments

In the case of an existing bridge, there are several concrete inserts, attachments, clamps, and brackets available in the ANVIL catalog on SharePoint. The bridge owner may also have preferences and/or specifications.

13.0 Cathodic Test Stations

13.1 Steel Crossing in a Plastic System – A cathodic test station is required at one of the transition fittings, not on both transition fittings. The test station can be on either side of the crossing.

13.2 Steel Crossing in a Steel System – Consult the local cathodic technician. A test station is normally not required, unless the cathodic technician has a special need (no nearby test points, inaccessible attachment, etc.).

14.0 Valves

14.1 Consult the DOT Coordinator and the local planning engineer to evaluate the need for valves.

NorthWestern Energy

55 Pipeline Installation 55-L Line Markers, Locate and Test Stations		Original Date 06/01/2006	Standard Number 55-L
Supersedes Standard: 55-F	REV# 6	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

These procedures are intended to comply with the requirements as set by the Department of Transportation 49 CFR part 192.707.

2.0 Line Markers

2.1 Shall be an approved marker.

Marker – 10009732

Anchor – 10009733

2.2 All markers shall have the following information located on them:

2.2.1 The word "Warning," "Caution," or "Danger" followed by the words "Gas Pipeline". The lettering must be at least one inch high with one-quarter inch stroke.

2.2.2 The company name, "NorthWestern Energy", and the phone number should be visible. The respective locations should have, at a minimum, the following numbers:

Montana 1-888-467-2427
Nebraska: 1-800-245-6977
South Dakota: 1-800-245-6977
Any other phone numbers shall be clearly identified.

2.3 Locations

2.3.1 Gas line markers shall be located at each of the following locations:

2.3.1.1 Public road crossings and railroad crossings in outlying areas/rural locations (class 1 & 2).

2.3.1.2 Above ground sections of gas lines and devices which are accessible to the public, such as accessible above ground valves, farm taps, reg stations, and bridge crossings.

2.3.1.3 Other locations deemed necessary by division or district gas personnel to reduce the possibility of damage or interference.

2.3.2 The following locations, should be given consideration:

2.3.2.1 River and large canal crossings where the gas line is not in a traveled roadway.

2.3.2.2 Under ground valve locations

3.0 <u>Locate Stations & Test Stations</u>

3.1 Test/Locate stations should be located at each of the following locations:

3.1.1 Every separately protected section of main shall have a test station installed. Refer to Figure 2 – Isolation from Steel Pipe.

3.1.2 Every cased crossing shall have a test station installed.

NOTE: Please refer to 63-A (Casing Installation) found in this handbook for more information pertaining to this subject.

3.1.3 When installing anodes on farm-taps, a test station should be installed with the anode. The anode should be installed at the tap and not at the end of the service.

3.1.4 Every steel main to plastic main transition in Montana, is required to be cathodically isolated. A Test Station is required. Tracer wire shall be isolated in the test station. Refer to Figure 2 – Isolation from Steel Pipe.

3.1.5 When installing substantially long runs of gas main pipe, if no other means of locating are available, it is encouraged to install a test/ locate station in an area deemed practical.

3.1.6 Test/Locate stations shall be placed where needed and where most practical.

3.1.7 Test/Locate station installations should be at the closest convenient locations.

3.1.8 Line markers (used as test/locate stations) should be placed at main line intersections and potential future growth stub outs, as common good construction practices.

NOTE: Tracer wire should be installed through/up line markers on stub outs.

3.2 All test/locate stations installed on NorthWestern Energy's gas distribution system should be referenced on local area maps.

3.3 A section of tracer wire shall be attached to all test/locate stations and shall be accessible to potential locators above ground level. The tracer wire must be spliced below ground to the plastic main for continuing runs or ended above ground at main line stopping points (i.e. future growth stub outs).

For more information on Tracer Wire Installation, please refer to the correlating section in this handbook (Section 52-L), or NorthWestern Energy's Gas Operations and Maintenance Handbook.

3.4 All test/locate stations shall have the following information located on them:

3.4.1 The word “Warning,” “Caution,” or “Danger” followed by the words “Gas Pipeline”. The lettering must be at least one inch high with one-quarter inch stroke.

3.4.2 The company name, “NorthWestern Energy”, and the phone number should be visible. The respective locations should have, at a minimum, the following numbers:

Montana 1-888-467-2427

Nebraska: 1-800-245-6977

South Dakota 1-800-245-6977

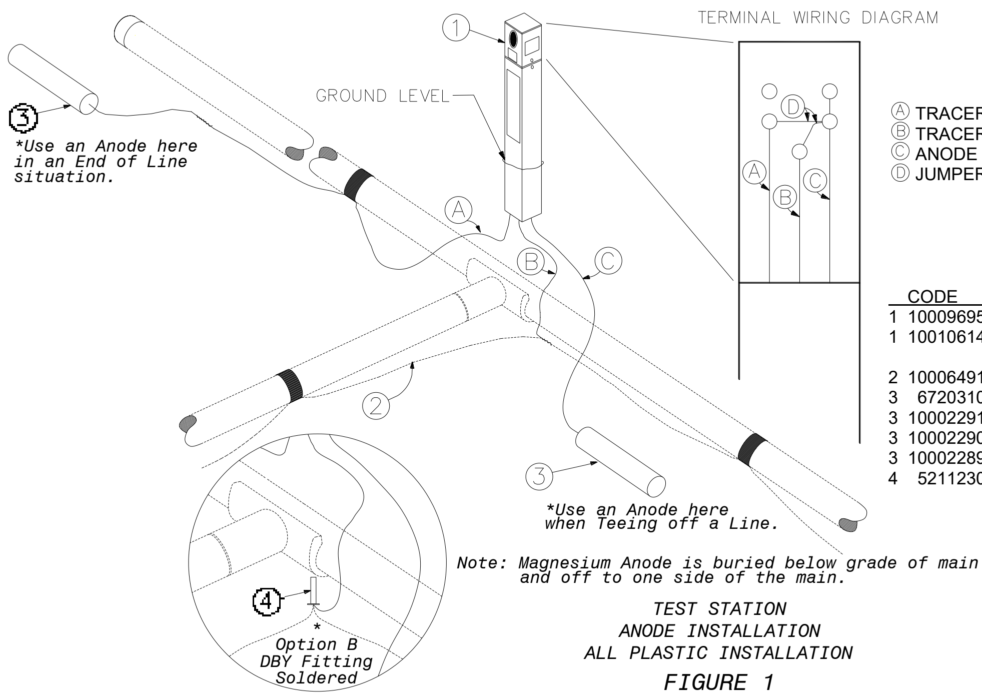
Any other phone numbers shall be clearly identified.

3.5 Test stations shall be installed as described in figures 1 and 2 depending on specific application.

NorthWestern Energy

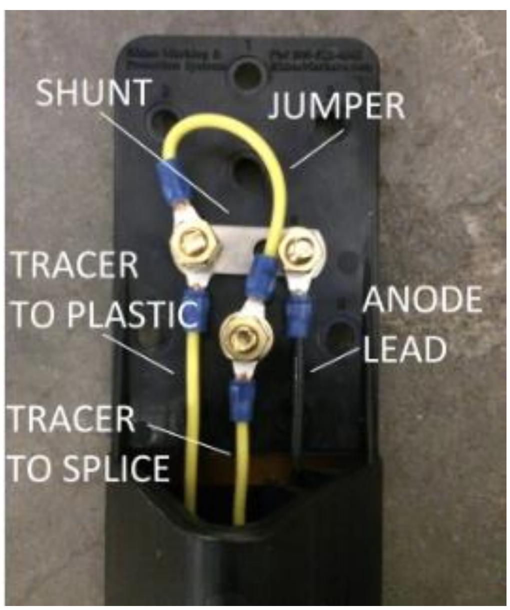
55 Pipeline Installation 55-L Line Markers, Locate and Test Stations		Original Date 06/01/2006	Standard Number 55-L
Supersedes Standard: 55-F	REV# 6	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Figure 1 – All Plastic Installation



Ⓐ TRACER WIRE TO PLASTIC
Ⓑ TRACER WIRE TO SPLICE
Ⓒ ANODE LEAD
Ⓓ JUMPER OR SHUNT

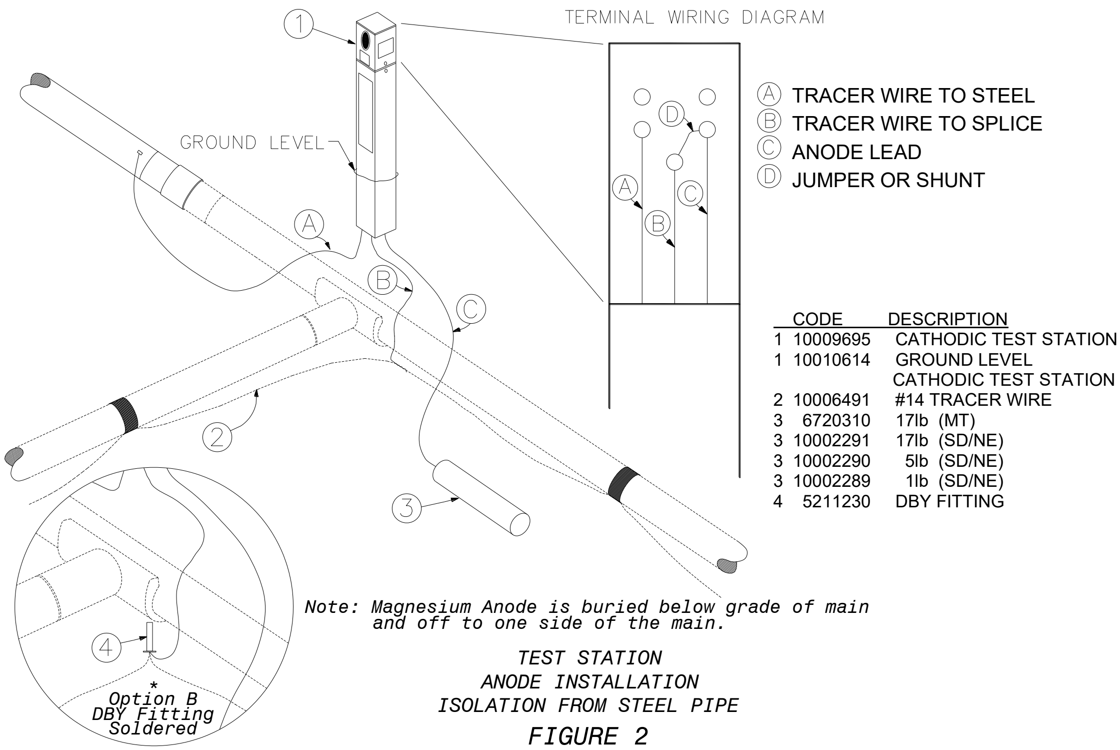
	CODE	DESCRIPTION
1	10009695	CATHODIC TEST STATION
1	10010614	GROUND LEVEL CATHODIC TEST STATION
2	10006491	#14 TRACER WIRE
3	6720310	17lb (MT)
3	10002291	17lb (SD/NE)
3	10002290	5lb (SD/NE)
3	10002289	1lb (SD/NE)
4	5211230	DBY FITTING

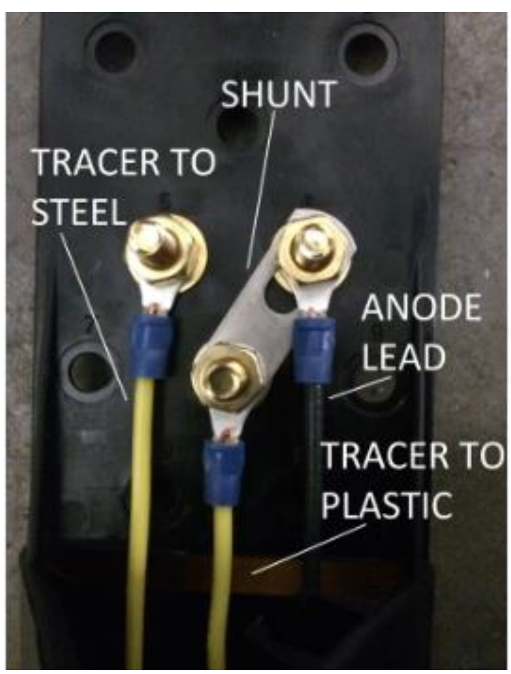


NorthWestern Energy

55 Pipeline Installation 55-L Line Markers, Locate and Test Stations		Original Date 06/01/2006	Standard Number 55-L
Supersedes Standard: 55-F	REV# 6	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Figure 2 – Isolation from Steel Pipe





NorthWestern Energy

Gas Standards Subject: Testing/Purging Pressure Testing Lines		Original Date 06/01/2006	Standard Number 57-B
Supersedes Standard: 57-B	REV # 5	Revision Date 04/01/22	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the requirements of NorthWestern Energy's general procedures and policies for pressure testing lines. These procedures are intended to accommodate the requirements set forth by DOT CFR part 192.505, 192.507, 192.609, and 192.725.

2.0 General

2.1 A new segment of pipeline may not be operated, nor an existing segment of pipeline returned to service that has been relocated, reinstated, or replaced, until:

2.1.1 It has been tested in accordance with this standard and O & M standard 1020 to substantiate the maximum allowable operating pressure.

2.1.2 Each potentially hazardous leak has been located and eliminated.

3.0 Pressure Testing Medium

3.1 *The test medium must be liquid (hydro-water), air, natural gas, or inert gas (nitrogen) that is*:

3.1.1 *Compatible with the material of which the pipeline is constructed.*

3.1.2 *Relatively free of sedimentary materials.*

3.1.3 *Except for natural gas, nonflammable.*

3.2 Pressure testing using air is NWE's preferred testing method.

3.3 In some instances a hydro pressure test may be substituted in lieu of the air pressure test. Please refer to the standard on Hydrostatic Pressure Testing for more information.

4.0 Pressure Testing Duration

4.1 Pressure testing times shall follow the recommended time in table 1.

4.1.1 Pressure tests on mains greater than 4 inches in diameter or 1000 ft or greater in length should be recorded using a chart or digital recorder.

Table 1. Required Pressure Testing Times

Distribution Section (Steel and Plastic)	Minimum Test Duration
Services less than 500 ft	10 minutes
Services greater than 500 ft Mains and **Farm Taps** less than 1000 ft	1 hour
Mains and **Farm Taps** greater than 1000 ft	8 hours

5.0 Pressure Test Head

5.1 New main lines should be pressure tested through the use of service lines, which minimize the static electricity that may potentially build up on the pipe. Pressure testing can be done from the service closest to the end of the main. If there is not a service within 10 Ft of the end of the main, then the end of the main shall be the pressure test point.

5.1.1 Pressure test shall be done through a test head.

5.1.2 The use of mechanical couplings to attach a test head to the end of either a steel or plastic main for testing will not be permitted due to safety related concerns.

NOTE: The exception to this is the use of a slip on test heads that is specifically designed for this purpose.

6.0 Pressure Gauges, Digital Recorders, and Chart Recorders

6.1 Pressure testing shall be performed with pressure gauges, digital recorders or chart recorders with the following characteristics as applicable:

6.1.1 It is able to accurately read 5% maximum increments of the maximum gauge pressure.

6.1.2 It has a 2” minimum gauge face or be electronic.

6.1.3 It has a maximum range of 2.25 times testing pressure or less.

7.0 Pressure Testing Failure

7.1 Any pressure drop identified during a pressure test shall be handled in the manner identified below. Disposition of pressure tests shall be documented, including any leaks located and repaired during the pressure test(s).

7.1.1 Pressure drop identified using pressure gauges shall cause either:

7.1.1.1 Piping not to be placed in natural gas service until gauge is left on an additional equal amount of time as original test with no pressure drop.

7.1.1.2 Or the leakage is located, repaired, and the segment is re-tested.

7.1.2 Pressure drop identified using pressure recording devices shall cause either:

7.1.2.1 The pressure test shall be deemed to be satisfactory if a maximum pressure drop of 5% occurs within the first 20% of the time duration of the pressure test, and then the pressure holds with little or no pressure drop with exception to pressure changes due to temperature variations.

7.1.2.2 The pressure test fails if any pressure drop occurs in remaining 80% of the time duration of the pressure test (after the first 20% of the time of the pressure test) with no subsequent increase in recorded pressure due to temperature variations. The leakage shall be located, repaired and the segment shall be re-tested.

8.0 Test Pressure

8.1 Test pressures shall be completed at either, a minimum of 100 psig or 1.5 times the desired MAOP, whichever is greater (i.e. A 100 psig pressure test achieves a MAOP of 66 psig). Additional information on NWE's MAOP's by each division/district/area's current gate/district/border regulator station can be found in 59-A Table 2.

8.2 Pressure tests of all pipelines shall be done at a pressure no less than 100 psig and is preferred to be completed at 120psig.

8.3 If air or an inert gas is to be used as the test medium on steel pipe, the maximum hoop stress limitation is 40% of SMYS. If natural gas is to be used to test steel pipe, the maximum hoop stress limitation of any locaton is 30% of SMYS.

8.4 MAOP's greater than 100 psig:

If, during the test, the segment is to be stressed to 20% or more of SMYS and natural gas, inert gas, or air is the test medium, the following must occur:

8.4.1 A leak test must be made at a pressure between 100 p.s.i. gage and the pressure required to produce a hoop stress of 20 percent of SMYS; or

8.4.2 The line must be walked to check for leaks while the hoop stress is held at approximately 20 percent of SMYS.

8.4.3 The pressure must be maintained at or above the test pressure in accordance with table 1, but not less than 1 hour.

Table 2. NWE Maximum Allowable Operating Pressure for Polyethylene Pipe Systems

SDR	PE2406/PE2708 **YELLOW**	PE3408/PE3608/PE4710 **BLACK** Manufactured **Prior** to January 22, 2019	PE4710 **BLACK** Manufactured **After** to January 22, 2019
11.5	76		
11	80	100	125*
9		125	

DOT Regulations only allow a 125 psi max for natural gas polyethylene pipe systems regardless of the material's Maximum Allow able Operating Pressure (MAOP).

*Requires Approval of Gas Standards and Asset Management

9.0 Pressure Testing Services with Discontinuation of Service

9.1 Discontinuation of service is considered to occur any time a service line is broke, cut, or severed anywhere in the service line.

NOTE: Shall not pressure test against a service tee that has already been punched or against a squeeze tool.

9.2 When a service is discontinued, even for brief periods of time, the service line from the point of disconnection to the meter shall be pressure tested and recorded as if it were a new installation per this standard.

9.2.1 This includes services that are being cut over for a reroute, highway project, or any other reason.

9.2.2 The new pipe shall be tested with the service line.

9.2.3 Complete pressure test as directed in Section 3 of this standard.

9.2.4 The final tie-in shall be checked for leaks.

10.0 Pre-Testing Main Pipe Retained for Future Use

10.1 Pre-testing of pipe segments less than 100ft, or pipeline components, may be completed with the same duration as identified in this standard. The test pressure should be identified to cover the desired MAOP of the given distribution system(s) where the pre-tested pipe will be used.

10.2 Pre-testing of pipe segments over 100ft, may be completed with the same duration as identified for main lines. The test pressure should be identified to cover the desired MAOP of the given distribution system(s) where the pre-tested pipe will be used.

10.3 All pressure tests will be charted and the chart retained with test records.

10.4 Pre-tested pipe records shall be retained, for the life of the system, in the following manner:

10.4.1 A log book for pre-tested pipe shall be retained. A Pre-tested Pipe Record Form (# 3776) can be found on iConnect in the forms catalog.

NorthWestern Energy

Gas Standards Subject: Testing/Purging Pressure Testing Lines		Original Date 06/01/2006	Standard Number 57-B
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10.4.2 The log book shall capture the following information

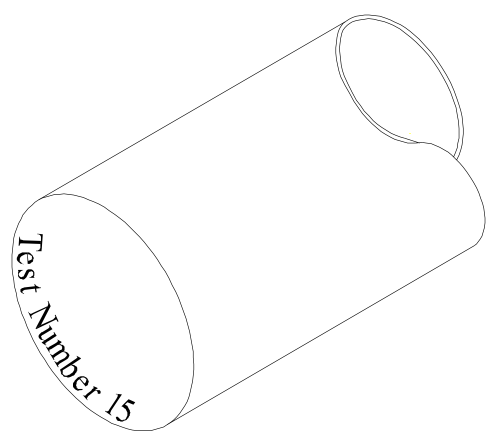
10.4.2.1 Unique test number
10.4.2.2 Date of the test
10.4.2.3 *Roll number tested (indicated on the pipe)
10.4.2.4 **Unique number for sticks (unique test number from the log book)
10.4.2.5 Lot number for the pipe
10.4.2.6 Grade/density of the pipe
10.4.2.7 Size and SDR/wall of the pipe
10.4.2.8 Length of the pretested pipe
10.4.2.9 Who is testing the pipe (full name only, no initials)
10.4.2.10 Test medium
10.4.2.11 Test Pressure
10.4.2.12 Test duration

* Plastic only and only on rolls of pipe
** Straight sticks of pipe, plastic and steel, need to have a unique identifier, which can be the unique test number from the log book

10.5 Once the pipe has been pre-tested it shall be marked in the following manner:

10.5.1 Rolls – a weatherproof tag shall be attached to the roll/reel indicating the unique test number

10.5.2 Sticks – Mark the inside of the pipe with the unique test number



10.5.3 It will be very important to maintain the test number on the remaining pipe as pieces of pipe are cut off for installation/use.

10.5.3.1 For smaller diameter pipes (1/2”, ¾” and 1”), as pipe is removed from the roll/reel, the unique test number shall be recorded on the outside of the pipe with a permanent marker. As this pipe is installed the number needs to be retained on the remaining segment.
10.5.3.2 For larger diameter pipes (2” and greater), as pipe is removed from the roll/reel or stick, the unique testing number will be recorded on the inside of the pipe with a permanent marker (as shown above). As this pipe is installed the number needs to be retained on the remaining segment.

11.0 Records

11.1 Each operator shall make and retain for the useful life of the pipeline, a record of each test performed under 192.505 and 192.507. The record must contain at least the following information:

11.1.1 The operators name, the name of the operator's employee responsible for making the test, and the name of any test company used.

11.1.2 Test medium used

11.1.3 Test pressure

11.1.4 Test duration

11.1.5 Date of test

11.1.6 Description and location of facility being tested (Work Order # may be substituted for this description).

11.1.7 Pressure recording charts, or other record of pressure readings.

11.1.8 Elevation variations, whenever significant for the particular test.

NOTE: In NorthWestern Energy areas, because of the terrain and pressure testing values, the elevation variations are insignificant

11.1.9 Leaks and failures noted and their disposition.

11.2 Pressure Test Failure – All pressure testing failures shall be documented. Documentation of the failed pressure test shall be noted as "failed test" with the cause, if known. Depending on location and what facility was being tested, the failed test shall be documented in the following manner:

11.2.1 Main – A failed test shall be documented on either a main card or the order for the main installation. A subsequent acceptable test shall be documented on the main card or order with the failed test information.

11.2.2 Service – A failed test shall be documented on the ditch card for the service. A subsequent acceptable test shall be documented with the failed test information on the ditch card.

11.3 The pressure test for service lines shall be documented on the ditch card and signed off by the foreman or technician in charge of the work. The information listed in 11.1 shall be recorded on the ditch card. This ditch card shall be filed in a permanent file at the operating center.

11.4 The pressure test for mainlines shall be documented on the construction order or main card and signed off by the foreman or technician in charge of the work. The information listed in 11.1 shall be recorded on the construction order or main card. This record shall be kept in a permanent file at the operating center for the life of the facility.

11.5 Each pipeline segment pressure tested to a pressure above 20% SMYS that has a separate written pressure test required shall be kept for the life of the pipeline. Records for the specific written pressure test(s) must contain the same information listed in 11.1.

11.6 Each pipeline segment that will operate at a hoop stress less than 30% SMYS and will operate at or above 100 psig shall have the test records retained for the life of the pipeline.

11.7 When installing pipe that has been pretested, a copy of the log and chart shall be attached to the service order or on the ditch/service card depending on the installation type. The rest of the process shall follow as described above for each installation.

NorthWestern Energy

Gas Standards Subject: Testing/Purging Soaping		Original Date 06/01/2006	Standard Number 57-C
Supersedes Standard: 57-C	REV# 3	Revision Date 01/01/2015	Prepared / Approved By AJ / Committee

1.0 Scope

This standard is used to describe NorthWestern Energy's procedure for soaping joints and fittings not possible to be tested during pressure tests.

2.0 Procedure

2.1 Following the connection of any pipe in NorthWestern Energy's system, the connection point, be it a weld, threaded fitting, or fusion, shall be soap tested to ensure a sound connection.

2.2 Following the tapping of any tee in NorthWestern Energy's system, the threaded connection on the tee (the cap), shall be soap tested.

2.3 Soaping shall be completed on a cooled weld or fusion with an approved solution or a 50/50 soap to water mixture.

2.4 Solution shall be applied directly to the connection, weld, or fusion joint.

2.5 No bubbles shall be formed at the point of application

2.5.1 If bubbles are seen;

2.5.1.1 Threaded connection shall be examined and remade/tightened if possible, or

2.5.1.2 Welds shall be examined and removed, or if possible repaired to stop leak.

2.5.1.3 Fusions shall be removed and a new fusion completed.

NorthWestern Energy

Gas Standards Subject: Testing/Purging Pigging		Original Date 06/01/2006	Standard Number 57-D
Supersedes Standard: 57-D	REV# 3	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning pigging of mains.

2.0 Pigging of Mains

2.1 All mains 4" and larger should be pigged. This is regardless of the length.

2.2 Consider pigging lines smaller than 4" if there is water in the pipe, dirt in the pipe, if the pipe has been installed for a long period of time, or if the pipe was installed in such a way that it may have contamination (such as boring).

2.2 The use of various pigs is recommended based on installation conditions.

2.3 Bare foam pigs are recommended for use in plastic pipe and polyurethane coated criss cross pigs are recommended for steel pipe.

Bare Foam Pig

Criss Cross Pig

2.4 Several passes with a pig may be needed depending upon individual conditions.

2.5 Bare foam pigs can be purchased as light-density bare swabs (2 pound per cubic foot) or as medium-density bare pig (5 pound per cubic foot). Light-density is used for removing water and light-duty wiping of plastic pipe. Medium-density is used for heavy-duty wiping of plastic pipe.

2.6 Criss cross pigs can be purchased as medium-density (5 pounds per cubic foot) or as heavy-density (8 pounds per cubic foot). Medium-density is used for regular-duty wiping of steel pipe. Heavy-density is used for heavy-duty wiping of steel pipe.

NorthWestern Energy

57 Testing/Purging 57-E Purging		Original Date 06/01/2006	Standard Number 57-E
Supersedes Standard: 57-E	REV# 5	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope:

The purpose of this standard is to describe NorthWestern Energy's requirements for purging lines. This standard is intended to comply with DOT 49 CFR part 192.629.

2.0 General (192.629)

2.1 When a pipeline is being purged of air by use of gas, the gas must be released into one end of the line in a moderately rapid and continuous flow. If gas cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the gas.

2.2 When a pipeline is being purged of gas by use of air, the air must be released into one end of the line in a moderately rapid and continuous flow. If air cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the air.

3.0 Safety

3.1 After connection to live lines, new lines shall be completely purged of air, until CGI reads 100% gas.

3.2 Caution must be used to prevent any approach of unauthorized persons or vehicles into the purging area during the operation. Sufficient help must be employed to accomplish these practices throughout the purging operation.

3.3 Purging, especially plastic pipe, can be very dangerous due to plastic's tendency to build up a static electric charge that could potentially ignite a gas-air mixture.

3.4 A CGI shall be used to ensure that the line is properly purged before any welding, cutting, fusing, or any other type of activity providing a potential ignition source is performed on the line.

3.5 Blowing out and cleaning of new pipelines should be done with compressed air rather than gas. This avoids needless risk, and loss of product.

4.0 Purge Points

4.1 Purge points are the locations where purging gas is either added to, or vented from, the pipeline being purged. These are sometimes referred to as injection points and vent points.

4.2 Purge points (injection and vent) shall include a method for the control of gas during a purging operation. Methods may include, but are not limited to:

- Plastic tapping tee with a riser and valve (service line)
- Steel Save-A-Valve fitting, gate valve (for stopping machine), and a valve for controlling
- Pipeline Valves
- Stoppers
- Plastic test head and valve
- Plastic squeeze tools

NOTE: Squeeze tools used for the control of gas shall be grounded.

NOTE: If using squeeze tools, the same area shall not be resqueezed – this includes partially removing a full squeeze (to purge) and reapplying. The manufacturer constitutes this as multiple squeezes at the same location.

4.3 New main line should be purged through the use of service lines, which minimizes the static electricity that may potentially build up on the pipe. Purging should be done from the service closest to the end of the main. If there is not a service within 10ft of the end of the main, the end of the main will be the purge point.

4.4 Mains without a service within 10ft of the end will be purged using a test head and valve at the open end after a pressure test has been completed. Connect to the existing main and purge through the test head.

4.5 When purging multiple pipe segments only one purge point should be vented at a time.

- The farthest vent point should be vented first.
- Then the next farthest vent point should be vented.

5.0 Purging Methods

5.1 Details of the methods are in the following sections.

- **Purge Velocity –** Purge velocity must be maintained to minimize mixing of gas and air.
- **Nitrogen Slug** – Large mains, as well as significantly long mains, may require the use of nitrogen, induced ahead of the gas, to act as a barrier to prevent a combustible mixture of air and gas to form in the pipeline.
- **Nitrogen Fill** – In some instances filling the pipeline with an inert gas is appropriate. In these instances, complete filling of the line shall be accomplished.

6.0 Purge Velocity

6.1 If a pipeline is being purged of air through the use of natural gas (and vice versa), the gas, and/or air, must be released into one end of the pipeline in a continuous, moderately rapid flow; specifically the velocity shall be minimum 200 linear feet per minute.

6.2 If the gas main is being purged into service, the main will be purged of air through the use of natural gas:

- Determine Purge Points
  - The introduction and flow of natural gas into the new main, shall be controlled by valve, stopper, or plastic squeeze tool placed on the existing pipe upstream of the tie in point.
  - A vent point will need to be deterimined/installed to accommodate the venting of air.
- Natural gas from the existing pipeline, is introduced into the new main until the vent point is 100% gas.

6.3 If the gas main is being purged out of service, the main will be purged of natural gas through the use of air:

- Determine Purge Points
  - An injection point with a valve, will need to be installed to accommodate the introduction of air.
  - A vent point will need to be determined/installed to accommodate the venting of natural gas.
- Air from a compressor is introduced into the main until the vent point is 0% gas.

Compressor Ratings to Obtain 200 linear feet per minute

Pipe Size (in)	Min. Compressor rating (cu.ft./min.)
2 Inch	5
3 Inch	12
4 Inch	25
6 Inch	50
8 Inch	75
10 Inch	125
This table should be used in the purging process to ensure that 200 linear ft per minute is achieved. This table should not be used if purging over 1/2 mile of pipe and if using compressors rated other than 100 psi. Larger compressors may be used on smaller pipe.	

NorthWestern Energy

57 Testing/Purging 57-E Purging		Original Date 06/01/2006	Standard Number 57-E
Supersedes Standard: 57-E	REV# 5	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

7.0 Nitrogen Slug

7.1 If air or natural gas, cannot be supplied in a sufficient enough quantity to prevent the formation of a potentially hazardous mixture of gas and air, there are two techniques to purge the line using a slug of inert gas (nitrogen).

- A slug of inert gas can be released into the pipeline prior to the purging medium (natural gas or air), or
- Use of a physical barrier, such as a pig, where one pig is inserted followed by a slug of inert gas then a second pig that will be pushed by the purging medium (natural gas or air). This should be utilized with caution. Purging with the use of a pig may not provide adequate force to propel the pig to the end othat the pipeline is being purged toward; additionally, the piping arrangement may not allow insertion/removal of the pig.

7.2 A delay of more than 3 minutes between addition of the inert gas and the following air or gas may destroy the slug.

7.3 If the gas main is being purged into service, the main will be purged of air through the use of a nitrogen slug, followed by natural gas:

- Determine Purge Points
  - An injection point with a valve, will need to be installed to accommodate the introduction of nitrogen.
  - The introduction and flow of natural gas into the new main, shall be controlled by valve, stopper, or plastic squeeze tool placed on the existing pipe upstream of the tie in point.
  - A vent point will need to be determined/installed to accommodate the venting of air, followed by nitrogen.
- Nitrogen, from a cylinder, is introduced into the new main until the desired cubic feet is injected (see table).
- Within 3 minutes, natural gas from the existing pipeline is introduced into the new main until the vent point is 100% gas.

7.4 If the gas main is being purged out of service, the main will be purged of natural gas through the use of a nitrogen slug, followed by air:

- Determine Purge Points
  - An injection point with a valve, will need to be installed to accommodate the introduction of nitrogen, followed by air.
  - A vent point will need to be deterimined/installed to accommodate the venting of natural gas, followed by nitrogen.
- Nitrogen, from a cylinder, is introduced into the main until the desired cubic feet is injected (see table).
- Within 3 minutes, air from a compressor is introduced into the main until the vent point is 0% gas.

NorthWestern Energy

57 Testing/Purging 57-E Purging		Original Date 06/01/2006	Standard Number 57-E
Supersedes Standard: 57-E	REV# 5	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

Recommended Nitrogen Slug Size

Cubic Feet of Nitrogen Needed to Purge the Following Lengths of Pipe*						
Length of Pipe to be Purged in Feet	**Length of Pipe to be Purged in Miles****	**Pipe Diameter (in)**				
		4"	6"	8"	10"	12"
0 - 1,000	0 - 0.19	7	24	54	107	184
1,000 - 2,000	0.19 - 0.38	8	28	73	126	216
2,000 - 4,000	0.38 - 0.76	11	36	83	165	282
4,000 - 6,000	0.76 - 1.14	13	44	103	200	348
6,000 - 8,000	1.14 - 1.52	15	52	123	236	418
8,000 - 10,000	1.52 - 1.89	18	60	143	270	484
10,000 - 15,000	1.89 - 2.84	24	82	188	372	640
15,000 - 20,000	2.84 - 3.79	30	102	238	468	808
20,000 - 25,000	3.79 - 4.73	36	124	288	528	976
25,000 - 30,000	4.73 - 5.68	42	146	338	588	1144
30,000 - 40,000	5.68 - 7.58	55	186	432	1042	1470
40,000 - 50,000	7.58 - 9.47	67	228	530	1234	1820
50,000 - 60,000	9.47 - 11.36	80	270	630	1426	2170
60,000 - 70,000	11.36 - 13.26	92	312	730	1618	2520
70,000 - 80,000	13.26 - 15.15	101	354	830	1812	2870
* From the Gas Engineer's Handbook						
** 5,280ft = 1 mile						

8.0 <u>Nitrogen Fill</u>

8.1 If the required slug of inert gas is longer than the pipeline being purged (large diameter, short length), then filling the pipeline with an inert gas (nitrogen) is appropriate.

8.2 If air or natural gas, cannot be supplied quickly enough to prevent the mixture of gas and air, then filling the pipeline with an inert gas (nitrogen) is appropriate.

8.3 If the gas main is being purged into service, the main will be purged of air through the use of nitrogen. Then the main will be purged of nitrogen through the use of natural gas.

- Determine Purge Points
    - An injection point with a valve, will need to be installed to accommodate the introduction of nitrogen.
    - The introduction and flow of natural gas into the new main, shall be controlled by valve or plastic squeeze tools placed on the existing pipe upstream of the tie in point.
    - A vent point will need to be deterimined/installed to accommodate the venting of air, and then nitrogen.
- Nitrogen, from a cylinder, is introduced into the new main until it's filled (see table).
- Natural gas from the existing pipeline is introduced into the new main until the vent point is 100% gas.

8.4 If the gas main is being purged out of service, the main will be purged of natural gas through the use of nitrogen. Then the main will be purged of nitrogen through the use of air.

- Determine Purge Points
    - An injection point with a valve, will need to be installed to accommodate the introduction of nitrogen and air.
    - A vent point will need to be deterimined/installed to accommodate the venting of natural gas, and then nitrogen.
- Nitrogen, from a cylinder, is introduced into the new main until it's filled (see table).
- Using the same injection point, air from a compressor is introduced into the main until the vent point is 0% gas.

Nitrogen K Bottle Capacity

One K Bottle (228scf) of Nitrogen will fill the following length of pipe		
	Pipe Length	
Pipe Size	Plastic	Steel
4"	3,100'	2,550'
6"	1,450'	1,150'
8"	850'	650'
This table is a guideline only Lengths are to the nearest 50'		

NorthWestern Energy

Gas Standards Subject: Metering & Regulating General		Original Date 06/01/2006	Standard Number 59-A
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning customer meter and regulator installation.

2.0 General

2.1 A meter set (meterfit) refers to all Company-owned material and equipment installed from the outlet of the service riser valve to the point of connection with the customer's piping.

2.2 The standard meter bar assembly will be used on all new single meter residential and new single meter commercial loads where space permits.

2.3 The company shall furnish, set, and maintain all gas meters and service regulators. Only authorized employees or agents of the Company are allowed to connect the Company's meters or service lines, turn on gas where it has been turned off, or alter any of the Company's gas metering equipment or service lines.

2.4 There are many combinations of gas meters, regulators, and reliefs that can be used to serve loads. The following standards are NWE standard meters, regulators, and reliefs that will be the most effective both from an operating and economic standpoint.

2.5 It is recognized that the standard meters, regulators, and reliefs presented herein will not satisfy every requirement and no attempt has been made to cover all conditions. Field personnel are advised that variations in pressures, equipment and piping arrangements from standards must be designed and installed under the direction of Engineering or the Gas Supervisor.

2.6 ***All new meter sets installed, will have properly sized over pressure protection.***

3.0 Existing Meter Sets

3.1 Anything more than a meter change, regulator replacement, or minor regulator repair should be a re-build. Routine periodic meter changes will require that the current standard meter be installed and current standard regulator should be installed, however a re-build to the current meter set standard is not required unless a change in load, operating pressure, or regulator size adjustments is required. The standard meter bar assembly will be used on all re-built single meter sets where space permits.

3.2 Under ordinary circumstances, field repair of regulators is limited to replacing orifices and seats. This work is to be completed by trained personnel authorized to do so.

3.3 Changing of regulator and relief valve orifices or spring to sizes not shown on these standards must be approved and authorized by Engineering or a Gas Supervisor.

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Sizing and Selection		Original Date 06/01/2006	Standard Number 59-B
Supersedes Standard: 59-A	REV# 11	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe NorthWestern Energy's procedures and policies concerning customer meter, regulator, and relief sizing and selection. All the standard regulators and reliefs are designed to meet or exceed the requirements of DOT 49CFR part 192.199 by the manufacturer.

2.0 Delivery Pressures

2.1 Standard Metering Pressure

- The standard natural gas pressure for residential, light commercial, and light industrial applications is 1/4 psig (pounds per square inch gauge). This is equivalent to 7 inches water column and 4 ounces per square inch. This standard pressure is also referred to as the "Standard Metering Pressure" in several areas of this standard.
- The standard propane pressure for residential, light commercial, and light industrial applications is 0.4 psig. This is equivalent to 11 inches water column.

2.2 Factored Metering

- Metering of gas at pressures over 1/4 psig is commonly done to reduce the cost of metering installations and to accommodate the needs of customers. The Factored Metering Pressures (over 1/4 psig) are ½, 2, 5, 10, or 15 psig (pounds per square inch gauge).
- The following pressure tags are available and should be used to convey the pressure.

Pressure Tags - To be used on meter to convey **DELIVERY** pressure	
1/2 psig	1000-7306
2 psig	1000-7307
5 psig	1000-7308
10 psig	1000-7309
15 psig	1000-7310

- The factor is a mathematical pressure correction, which shall be applied to the registered consumption. This factor must be determined from the Pressure Factor Tables or calculated using the following formula:

$$F = \frac{A + P_m}{P_b}$$

Where: F = Factor

A = Atmospheric pressure (See Table 1 or 2)

P_m = Metering Pressure (ex. - 2 psig)

P_b = Base Pressure (Atmospheric press. +1/4, or (14.9 psig for MT Tier I or II customers)

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Sizing and Selection		Original Date 06/01/2006	Standard Number 59-B
Supersedes Standard: 59-A	REV# 11	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

3.0 Meter Sizing

3.1 Meter and regulator combinations are to be selected on their capacity to serve the maximum (peak) load.

- The total BTU requirements of all connected appliances capable of operating simultaneously are added.
- To determine the gas load in cubic feet, divide this total by 1000.
- Apply a diversity factor.
- Use this maximum load for selecting the meter and regulator combination which best applies to each situation.
- There is a “Gas Checksheet” and a “Gas Checksheet Tutorial” available on Sharepoint, to help determine Meter and Regulator combinations.

3.2 All new gas meters set shall be equipped to correct the amount of gas measured to a base temperature of 60°F, or have an associated index or instrument that will correct for temperature.

3.3 Installing meters outside of this standard must be approved by the Meter Shop, this includes but is not limited to other rotary meters, other diaphragm meters, turbine meters, and ultrasonic meters.

3.4 Diaphragm Meters

- The AL-1000 and AL-800 may be used with an electronic corrector.
- An example of when an AL-1000 or an AL-800 would be used with an electronic corrector is if a customer needs line pressure, but does not need the capacity that a 3M Rotary has at line pressure. An AL1000 with a 100 psig MAOP and an electronic corrector can be used. The electronic corrector would be set up as a pressure only, as the AL-1000 is temperature compensated. A regulator could be downstream of the meter if necessary.

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Sizing and Selection		Original Date 06/01/2006	Standard Number 59-B
Supersedes Standard: 59-A	REV# 11	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

DIAPHRAGM METER SPECIFICATIONS (SCFH)

Model	MT Material Codes[1]	MAOP Max Case Pressure[2]	Pressure Drop[3]	7" w.c.	½ psig	2 psig	5 psig	10 psig	15 psig
AL-175		5	1"	273	277	301	348		
AL-225		5	1"	225	228	258	327		
AC-250	720-0215	5	1"	303	307	334	386		
AL-425	720-0225	10	1"	542	550	597	690	822	
AC-630	720-0230	25	1"	900	1030	1105	1275	1500	1725
AL-800	720-0255	20	1 ½"	1,450	1,471	1,600	1,850	2,200	2,570
AL-800	720-0256	100	1 ½"	1,450	1,471	1,600	1,850	2,200	2,570
AL-1000[4]	720-0258	25	1 ½"	1800	1826	2000	2300	2800	3191
AL-1000[4]	1000-6741	100	1 ½"	1800	1826	2000	2300	2800	3191
AL-1400	720-0265	100	1 ½"	2,600	2,638	2,800	3,300	4,000	4,609
AL-2300	720-0275	100	1 ½"	4,300	4,362	4,600	5,500	6,600	7,622
AL-5000	720-0285	100	1 ½"	9,300	9,435	10,200	11,800	14,300	16,485
A5-225		5	½"	225	228	267	365		
A5B		5	½"	175	178	207	284		
A35B		10	½"	650	659	770	1054	1,853	
A80B		25	½"	1,200	1,217	1,320	1,519	1,831	2,127
A250B		100	½"	3,000	3,044	3,301	3,796	4,578	5,318
A500B		100	½"	4,800	4,870	5,281	6,074	7,325	8,508
R175		5	½"	175	178	199	240		
R200		5	½"	200	204	227	274		
R250		5	½"	250	255	284	342		
R275		5	½"	275	280	312	376		
S175		5	½"	175	178	199	240		
S175RM		5	½"	175	178	199	240		
S1A-C		5	½"	241	246	274	330		
S1ACI		5	½"	241	246	274	330		
SR200		5	½"	200	204	227	274		
S250		5	½"	250	255	284	342		
S3		100	½"	540	550	613	739	949	1158

[1] SDNE does not material code their meters.
[2] A meter may not be used at a pressure that is over the manufacturer's MAOP.
[3] Differential Pressure across the meter used for Capacities listed in the table.
[4] AL-1000 may be used with an electronic corrector
Meters shaded in grey are historical

3.5 Rotary Meters

- Roots recommends Maximum Flange Bolt Torque of 55 ft-lbs lubricated / 60 ft-lbs non lubricated
- TC vs CD Rotary Meters

Rotary meters come in two versions, TC and CD. The CD is a non-temperature compensated meter with a counter and an instrument drive. An Electronic Corrector must be used with a CD.

There are times when a CD version with an Electronic Corrector is more economical.

A CD version rotary meter is installed upstream of the regulator. This allows the rotary meter to operate at line pressure, thus allowing a higher capacity through the rotary meter. Therefore, a smaller rotary meter can be used. A smaller rotary meter is more economical.

However, a CD Rotary requires an Electronic Corrector and annual maintenance, which are added costs.

In the case of a Tier II customer, annual maintenance is already required, so this cost is negated. Also, a communication device is required. An Electronic Corrector can act as the communication device, so this cost is also negated. Hence, in the instance of a Tier II customer, a smaller CD Rotary meter is usually more economical than a larger TC Rotary meter.

ROTARY METER SPECIFICATIONS

Model		15C175	3M175	5M175	7M175	11M175	16M175
Stores Code	**CD**		**720-0305**	**720-0314**	**720-0315**	**720-0311**	**720-0313**
	TC	**720-0303**	**720-0304**	**720-0306**	**720-0308**	**720-0310**	**720-0312**
psig at METER INLET		Corrected Capacity at METER INLET Pressure (scfh)					
7" w.c.		1,500	3,000	5,000	7,000	11,000	16,000
2		1,700	3,300	5,600	7,800	12,200	17,800
5		2,000	4,000	6,600	9,200	14,500	21,100
10		2,500	5,000	8,300	11,600	18,200	26,500
15		3,000	6,000	10,000	14,000	22,000	31,900
20		3,500	7,000	11,700	16,300	25,700	37,400
25		4,000	8,000	13,400	18,700	29,400	42,800
30		4,500	9,000	15,100	21,100	33,200	48,200
40		5,500	11,100	18,500	25,900	40,600	59,100
50		6,600	13,100	21,900	30,600	48,100	70,000
60		7,600	15,200	25,300	35,400	55,600	80,800
70		8,600	17,200	28,700	40,100	63,000	91,700

Capacities based on 14.4psia Atmosphere and 14.73 Base pressure.

4.0 Regulator Sizing

4.1 Meter and regulator combinations are to be selected on their capacity to serve the maximum (peak) load.

- The total BTU requirements of all connected appliances capable of operating simultaneously are added.
- To determine the gas load in cubic feet, divide this total by 1000.
- Apply a diversity factor. Use this maximum load for selecting the meter and regulator combination which best applies to each situation.
- There is a “Gas Checksheet” and a “Gas Checksheet Tutorial” available on Sharepoint, to help determine Meter and Regulator combinations.

4.2 First Cut Regulators will be avoided if possible.

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Sizing and Selection		Original Date 06/01/2006	Standard Number 59-B
Supersedes Standard: 59-A	REV# 11	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

4.3 Regulators for 7” w.c. Delivery

Regulators for 7" w.c. Delivery

			CAPACITY										OVER PRESSURE PROTECTION			
			10	15	20	30	40	50	60	80	100	125				
Regulator Type	Size	Orifice	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	Below Transition	**Transition Pressure	Above Transition	Max Inlet Pressure
Itron B42R* ***	3/4" x 1"	1/8" x 3/16"	390	470	550	700	870	1,020	1,190	1,590	1,870	2,280	Internal	-----------	NA	125
American 1813C*	3/4" Outlet	1/8" x 3/16"	350	425	500	600	750	875	1,000	1,300	1,600	2,000	Internal	-----------	NA	125
American 1813C*	1" Outlet	1/8" x 3/16"	350	425	500	600	750	875	1,000	1,300	1,600	2,000	Internal	-----------	NA	125
American 1813C*	1" Outlet	3/16"	700	900	1,100	1,400	1,700	2,050	2,400	2,450	2,500		Internal	93 psig	1- 1" 289L	100
American 1813C-HC*	1 1/4" Outlet	3/16"	600	950	1,100	1,500	1,800	2,150	2,500	3,150	3,800		Internal	93 psig	1- 1" 289L	100
American 1813C-HC*	1 1/4" Outlet	1/4"	1,100	1,300	1,900	2,500	3,200	3,800	4,400				Internal	47 psig	1- 1" 289L	60
Fisher CS800IQ*	2" x 2"	3/8"	2,520	3,130	4,230	6,290	7,850	9,280	10,810	13,740	16,630	20,320	Internal	120 psig	NA	120
Fisher CS800IQ	2" x 2"	1/2"	4,840	7,760	9,200	11,850	14,100	16,740	19,390	25,530	25,530		Internal	60 psig	See Table	100
Fisher CS800IQ	2" x 2"	5/8"	9,100	12,000	14,550	18,720	22,910	24,430	24,360				Internal	35 psig	See Table	60
Fisher CS800IQ	2" x 2"	3/4"	12,450	16,170	19,090	23,010	25,910	27,340	19,730				Internal	19 psig	See Table	60
Fisher 299 (int reg)*	2" x 2"	1/2"	6,220	7,670	8,960	11,540	14,120	16,700	19,280	24,440	5,640	5,640	See Table			150
Fisher 299 (int reg)*	2" x 2"	3/4"	12,500	10,500	11,500	16,830	25,500	22,500	19,500	4,500	4,500	4,500				150
Fisher 299 (ext reg)	2" x 2"	1/2"	6,220	7,670	8,960	11,540	14,120	16,700	19,280	24,440	29,600	36,050				150
Fisher 299 (ext reg)	2" x 2"	3/4"	13,040	16,480	19,250	24,800	30,350	35,890	41,440	52,540	63,630	77,500				150

* Off-the-shelf Configuration

** The transition pressure is the inlet pressure at which additional relief capacity is required.

Reliefs for 7" w.c. Delivery (External Reliefs should be set at 15" w.c.)

			CAPACITY									
			10	15	20	30	40	50	60	80	100	125
Regulator Type	Size	Orifice	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet
Itron B42R* ***	3/4" x 1"	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C*	3/4" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C*	1" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C*	1" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	
American 1813C-HC*	1 1/4" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	
American 1813C-HC*	1 1/4" Outlet	1/4"	Internal	Internal	Internal	Internal	Internal	1-1" 289L	1-1" 289L			
Fisher CS800IQ*	2" x 2"	3/8"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L
Fisher CS800IQ	2" x 2"	1/2"	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	1-1" 289L	2-1" 289L	
Fisher CS800IQ	2" x 2"	5/8"	Internal	Internal	Internal	Internal	1-1" 289L	1-1" 289L	2-1" 289L			
Fisher CS800IQ	2" x 2"	3/4"	Internal	Internal	1-1" 289L	1-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H			
Fisher 299 (int reg)*	2" x 2"	1/2"	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L	2-1" 289L	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (int reg)*	2" x 2"	3/4"	2-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -
Fisher 299 (ext reg)	2" x 2"	1/2"	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L	2-1" 289L	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (ext reg)	2" x 2"	3/4"	2-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Sizing and Selection		Original Date 06/01/2006	Standard Number 59-B
Supersedes Standard: 59-A	REV# 11	Revision Date 04/01/2022	Prepared / Approved By AJ / Committee

4.4 Regulators for 14" w.c. Delivery

Regulators for 14" w.c. Delivery

			CAPACITY										OVER PRESSURE PROTECTION			
Regulator Type	Size	Orifice	10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet	Below Transition	**Transition Pressure	Above Transition	Max Inlet Pressure
American 1813C	3/4" Outlet	1/8" x 3/16"	350	425	500	600	750	875	1,000	1,300	1,600	2,000	Internal	-----------	NA	125
American 1813C	1" Outlet	1/8" x 3/16"	350	425	500	600	750	875	1,000	1,300	1,600	2,000	Internal	-----------	NA	125
American 1813C	1" Outlet	3/16"	700	900	1,100	1,400	1,700	2,050	2,400	2,450	2,500		Internal	93 psig	1- 1" 289L	100
American 1813C-HC	1 1/4" Outlet	3/16"	600	950	1,100	1,500	1,800	2,150	2,500	3,150	3,800		Internal	93 psig	1- 1" 289L	100
American 1813C-HC	1 1/4" Outlet	1/4"	1,100	1,300	1,900	2,500	3,200	3,800	4,400				Internal	47 psig	1- 1" 289L	60
Fisher CS800IQ	2" x 2"	3/8"	2,720	3,700	4,700	6,440	7,770	9,190	10,900	12,550	14,100	16,120	Internal	120 psig	NA	120
Fisher CS800IQ	2" x 2"	1/2"	4,250	5,700	7,950	10,310	10,540	10,770	11,000	12,550	14,100		Internal	60 psig	See Table	100
Fisher CS800IQ	2" x 2"	5/8"	6,500	9,600	11,700	12,400	13,020	14,500	14,900				Internal	35 psig	See Table	60
Fisher CS800IQ	2" x 2"	3/4"	9,200	14,400	16,200	18,220	18,680	19,140	19,600				Internal	19 psig	See Table	60
Fisher 299 (int reg)	2" x 2"	1/2"	6,220	7,670	8,960	11,540	14,120	16,700	19,280	24,440	5,640	5,640	See Table			150
Fisher 299 (int reg)*	2" x 2"	3/4"	12,500	10,500	11,500	16,830	25,500	22,500	19,500	4,500	4,500	4,500				150
Fisher 299 (ext reg)	2" x 2"	1/2"	6,220	7,670	8,960	11,540	14,120	16,700	19,280	24,440	29,600	36,050				150
Fisher 299 (ext reg)	2" x 2"	3/4"	13,040	16,480	19,250	24,800	30,350	35,890	41,440	52,540	63,630	77,500				150

** The transition pressure is the inlet pressure at which additional relief capacity is required.

Reliefs for 14" w.c. Delivery (External Reliefs should be set at 1 psig)

			CAPACITY									
Regulator Type	Size	Orifice	10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet
American 1813C*	3/4" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C*	1" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C*	1" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	
American 1813C-HC*	1 1/4" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	
American 1813C-HC*	1 1/4" Outlet	1/4"	Internal	Internal	Internal	Internal	Internal	1-" 289L	1-1" 289L			
Fisher CS800IQ*	2" x 2"	3/8"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289L	1-1" 289L
Fisher CS800IQ	2" x 2"	1/2"	Internal	Internal	Internal	Internal	Internal	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L	
Fisher CS800IQ	2" x 2"	5/8"	Internal	Internal	Internal	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L			
Fisher CS800IQ	2" x 2"	3/4"	Internal	1-1" 289L	1-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H			
Fisher 299 (int reg)*	2" x 2"	1/2"	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (int reg)*	2" x 2"	3/4"	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -	- ENG -
Fisher 299 (ext reg)	2" x 2"	1/2"	1-1" 289L	1-1" 289L	2-1" 289L	2-1" 289L	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (ext reg)	2" x 2"	3/4"	2-1" 289L	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -	- ENG -

NorthWestern *Energy*

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4.5 Regulators for 2 psig Delivery

Regulators for 2 psig Delivery

			CAPACITY										OVER PRESSURE PROTECTION			
Regulator Type	Size	Orifice	10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet	Below Transition	**Transition Pressure	Above Transition	Max Inlet Pressure
American 1813C*	3/4" Outlet	1/8" x 3/16"	350	425	500	650	800	950	1,100	1,400	1,700	2,100	Internal	-----------	NA	125
American 1813C	1" Outlet	1/8" x 3/16"	350	425	500	650	800	950	1,100	1,400	1,700	2,100	Internal	-----------	NA	125
American 1813C*	1" Outlet	3/16"	600	800	1,000	1,300	1,700	2,100	2,500	2,500	2,500		Internal	60	1- 1" 289H	100
American 1813C-HC	1 1/4" Outlet	3/16"	600	850	1,000	1,500	1,900	2,200	2,500	2,500	2,500		Internal	60	1- 1" 289H	100
American 1813C-HC	1 1/4" Outlet	1/4"	850	1,200	1,700	2,500	2,500	2,500	2,500				Internal	30	1- 1" 289H	60
Fisher CP400	1 1/4" x 1 1/4"	3/8"	2,800	3,800	4,700	6,000	6,000	6,000	4,500	2,900			See Table			80
Fisher CP400	1 1/4" x 1 1/4"	1/2"	4,100	5,000	5,000	3,200	3,200	3,200	3,200							60
Fisher CP400	2" x 2"	3/8"	3,100	4,000	4,600	6,000	6,000	6,000	6,000	6,000						80
Fisher CP400	2" x 2"	1/2"	4,400	6,100	7,100	7,100	7,100	7,100	7,100							60
Fisher CS820IQ*	2" x 2"	3/8"	3,100	4,150	4,930	6,170	7,920	9,090	10,860	13,700	16,580	20,190	Internal	82	See Table	125
Fisher CS820IQ	2" x 2"	1/2"	5,380	7,440	9,100	11,770	14,780	17,550	20,470	25,840	30,980		Internal	50	See Table	100
Fisher CS820IQ	2" x 2"	5/8"	7,250	10,230	12,570	16,960	20,790	24,300	28,340	30,680			Internal	37	See Table	80
Fisher CS820IQ	2" x 2"	3/4"	8,730	12,410	15,870	20,850	24,670	26,400	28,340	30,680			Internal	24	See Table	80
Fisher 299 (int reg)	2" x 2"	1/2"	5,840	7,580	8,960	11,540	14,120	16,700	19,280	24,440	29,840	17,520	See Table			175
Fisher 299 (int reg)	2" x 2"	3/4"	12,040	15,990	19,250	27,800	27,070	28,970	25,770	25,500	14,260	13,260				150
Fisher 299 (ext reg)	2" x 2"	1/2"	5,810	7,580	8,960	11,540	14,120	16,700	19,280	24,440	29,600	36,050				175
Fisher 299 (ext reg)	2" x 2"	3/4"	12,040	15,990	19,250	24,800	30,350	35,890	41,440	52,540	63,630	77,500				150

* Off-the-shelf configuration (comes with 2 psig spring)

** The transition pressure is the inlet pressure at which additional relief capacity is required.

Reliefs for 2 psig Delivery (External Reliefs should be set at 3 psig)

			CAPACITY									
Regulator Type	Size	Orifice	10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet
American 1813C	3/4" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C	1" Outlet	1/8" x 3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
American 1813C	1" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289H	1-1" 289H	
American 1813C-HC	1 1/4" Outlet	3/16"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289H	1-1" 289H	
American 1813C-HC	1 1/4" Outlet	1/4"	Internal	Internal	Internal	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H			
Fisher CP400	1 1/4" x 1 1/4"	3/8"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H		
Fisher CP400	1 1/4" x 1 1/4"	1/2"	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	1-2" 289H	1-2" 289H			
Fisher CP400	2" x 2"	3/8"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H		
Fisher CP400	2" x 2"	1/2"	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	1-2" 289H	1-2" 289H			
Fisher CS820IQ*	2" x 2"	3/8"	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289H	1-1" 289H
Fisher CS820IQ	2" x 2"	1/2"	Internal	Internal	Internal	Internal	Internal	Internal	1-1" 289H	2-1" 289H	2-1" 289H	
Fisher CS820IQ	2" x 2"	5/8"	Internal	Internal	Internal	Internal	1-1" 289H	1-1" 289H	2-1" 289H	1-2" 289H		
Fisher CS820IQ	2" x 2"	3/4"	Internal	Internal	Internal	1-1" 289H	2-1" 289H	2-1" 289H	2-2" 289H	2-2" 289H		
Fisher 299 (int reg)	2" x 2"	1/2"	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (int reg)	2" x 2"	3/4"	2-1" 289H	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -	- ENG -
Fisher 299 (ext reg)	2" x 2"	1/2"	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (ext reg)	2" x 2"	3/4"	2-1" 289H	1-2" 289H	1-2" 289H	2-2" 289H	2-2" 289H	2-2" 289H	- ENG -	- ENG -	- ENG -	- ENG -

4.6 Regulators for 5 psig Delivery

Regulators for 5 psig Delivery

Regulator Type	Size	Orifice	CAPACITY 10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet	OVER PRESSURE PROTECTION Below Transition	**Transition Pressure	Above Transition	Max Inlet Pressure
Fisher CP400*	1 1/4" x 1 1/4"	3/8"	2,500	3,200	4,100	6,000	6,000	6,000	6,000	5,500			See Table			80
Fisher CP400	1 1/4" x 1 1/4"	1/2"	3,100	4,300	6,000	6,000	6,000	4,300	4,300							60
Fisher CP400*	2" x 2"	3/8"	2,600	3,800	4,600	6,400	7,700	7,800	7,800	6,700						80
Fisher CP400	2" x 2"	1/2"	3,300	5,000	6,400	8,700	8,700	8,700	8,800							60
Fisher 299 (int reg)	2" x 2"	1/2"	5,050	7,280	8,850	11,540	14,120	16,700	19,280	24,440	29,600	36,050				175
Fisher 299 (int reg)	2" x 2"	3/4"	10,350	15,150	18,640	24,340	27,670	30,570	29,390	31,410	22,150	21,590				80
Fisher 299 (ext reg)	2" x 2"	1/2"	5,050	7,280	8,850	11,540	14,120	16,700	19,280	24,440	29,600	36,050				175
Fisher 299 (ext reg)	2" x 2"	3/4"	10,350	15,150	18,640	24,800	30,350	35,890	41,440	52,540	63,630	77,500				150

* Off-the-shelf configuration (comes with 5 psig spring)
Grey shading indicates off-the-shelf orifice

Reliefs for 5 psig Delivery (External Reliefs should be set at 7 psig)

Regulator Type	Size	Orifice	CAPACITY 10 psig inlet	15 psig inlet	20 psig inlet	30 psig inlet	40 psig inlet	50 psig inlet	60 psig inlet	80 psig inlet	100 psig inlet	125 psig inlet
Fisher CP400*	1 1/4" x 1 1/4"	3/8"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H		
Fisher CP400	1 1/4" x 1 1/4"	1/2"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H			
Fisher CP400*	2" x 2"	3/8"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H		
Fisher CP400	2" x 2"	1/2"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H			
Fisher 299 (int reg)	2" x 2"	1/2"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H
Fisher 299 (int reg)	2" x 2"	3/4"	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-2" 289H	2-2" 289H	2-2" 289H
Fisher 299 (ext reg)	2" x 2"	1/2"	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H
Fisher 299 (ext reg)	2" x 2"	3/4"	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-2" 289H	2-2" 289H	2-2" 289H

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4.7 Regulators for 10 psig Delivery

Regulators for 10 psig Delivery

			CAPACITY										OVER PRESSURE PROTECTION			
			10	15	20	30	40	50	60	80	100	125				
Regulator Type	Size	Orifice	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	Below Transition	**Transition Pressure	Above Transition	Max Inlet Pressure
Fisher CP400	1 1/4" x 1 1/4"	3/8"		2,700	3,200	5,700	7,100	7,100	7,500	7,500			See Table			80
Fisher CP400	1 1/4" x 1 1/4"	1/2"		3,900	5,500	7,100	7,100	7,100	7,500							60
Fisher CP400	2" x 2"	3/8"		3,000	3,100	5,900	7,600	9,200	9,200	9,200						80
Fisher CP400	2" x 2"	1/2"		3,600	5,100	8,800	9,900	9,900	9,900							60
Fisher 299 (int reg)	2" x 2"	1/2"		5,690	8,210	11,440	14,120	16,700	19,280	24,440	29,600	36,050				175
Fisher 299 (int reg)	2" x 2"	3/4"		11,640	17,000	24,150	28,660	33,230	35,410	41,270	35,310	35,740				150
Fisher 299H (ext reg)	2" x 2"	1/2"		5,690	8,210	11,540	14,120	16,700	19,280	24,440	29,600	36,050				175
Fisher 299H (ext reg)	2" x 2"	3/4"		11,640	17,000	24,150	30,350	35,890	41,440	52,540	63,630	77,500				150

None of these are off-the-shelf configurations (spring must be changed to achieve 10 psig)

Grey shading indicates off-the-shelf orifice

Reliefs for 10 psig Delivery (External Reliefs should be set at 12 psig)

			CAPACITY									
			10	15	20	30	40	50	60	80	100	125
Regulator Type	Size	Orifice	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet	psig inlet
Fisher CP400	1 1/4" x 1 1/4"	3/8"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H		
Fisher CP400	1 1/4" x 1 1/4"	1/2"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H			
Fisher CP400	2" x 2"	3/8"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H		
Fisher CP400	2" x 2"	1/2"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H			
Fisher 299 (int reg)	2" x 2"	1/2"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H
Fisher 299 (int reg)	2" x 2"	3/4"		1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	- ENG -	- ENG -
Fisher 299H (ext reg)	2" x 2"	1/2"		1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H
Fisher 299H (ext reg)	2" x 2"	3/4"		1-1" 289H	1-1" 289H	1-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	2-1" 289H	- ENG -	- ENG -

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4.8 Regulators Stores Codes and Specifications

			Orifice			Spring				
Manufacturer	**Regulator**	**Stores Code**	Size	Stores Code	Manufacturer Part Number	Range	Stores Code	Manufacturer Part Number	Color	**Notes**
Itron	B42R	**10011812**	1/8" x 3/16"	N/A	N/A	6" to 8" w.c.	N/A	762645	Brown	Alternative Residential Regulator
Internal Relief										
3/4" x 1"	90 Deg Angle									
American	1813C	**10011800**	1/8" x 3/16"	N/A	72494P030	5.5" to 8.5" w.c.	N/A	70017P044	Yellow	SDNE Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
3/4" x 3/4"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C	**10011795**	1/8" x 3/16"	N/A	72494P030	5.5" to 8.5" w.c.	N/A	70017P044	Yellow	Standard Residential Regulator
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
3/4" x 1"	90 Deg Angle					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C	**10011798**	1/8" x 3/16"	N/A	72494P030	5.5" to 8.5" w.c.	N/A	70017P044	Yellow	Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
3/4" x 1"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C	**10011918**	1/8" x 3/16"	N/A	72494P030	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
1" x 1"	90 Deg Angle					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C*	**7000212**	3/16"	N/A	72494P020	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
3/4" x 1"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C*	**7000213**	3/16"	N/A	72494P020	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
1" x 1"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C-HC*	**10017929**	3/16"	N/A	72494P020	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Standard Commercial Regulator
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
1" x 1 1/4"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C-HC*	**10017542**	3/16"	N/A	72494P020	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Maintenance
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
1 1/4" x 1 1/4"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C-HC*	**7000214**	1/4"	N/A	72494P021	5.5" - 8.5" w.c.	N/A	70017P044	Yellow	Standard Commercial Regulator
Internal Relief						6" to 15" w.c.	10011811	70017P042	Purple	
1" x 1 1/4"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C	**10017927**	1/8" x 3/16"	N/A	72494P030	5.5" to 8.5" w.c.	N/A	70017P044	Yellow	SDNE Maintenance
Internal Relief	2 PSIG					6" to 15" w.c.	10011811	70017P042	Purple	
3/4" x 3/4"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	
American	1813C	**10017932**	3/16"	N/A	72494P020	5.5" to 8.5" w.c.	N/A	70017P044	Yellow	SDNE Maintenance
Internal Relief	2 PSIG					6" to 15" w.c.	10011811	70017P042	Purple	
1" x 1"	180 Deg Straight					1.5 to 2 psig	7060070	70017P049	Red/Red	

Shaded areas indicate standard regulator configuration. For other configurations the spring and/or orifice will need to be changed.

Orifices and springs are the same parts for the 1813C and the 1813C-HC

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4.8 Regulators Stores Codes and Specifications (Continued)

			Orifice			Spring				
Manufacturer	**Regulator**	**Stores Code**	Size	Stores Code	Manufacturer Part Number	Range	Stores Code	Manufacturer Part Number	Color	**Notes**
Fisher	CS800IQ	**10010615**	3/8"	N/A	GE29703X012	5.5" - 8.5"	N/A	GE30338X012	Black	Maintenance
Internal Relief			1/2"	10009564	GE29704X012	** 10" - 16" w.c.	10009592	GE30340X012/ GE29773X042	White Spring / Green Disk	
1 1/4" x 1 1/4"	180 Deg Straight		5/8"		GE29705X012					
			3/4"	10009565	GE29706X012					
Fisher	CS800IQ	**10009563**	3/8"	N/A	GE29703X012	5.5" - 8.5"	N/A	GE30338X012	Black	
Internal Relief			1/2"	10009564	GE29704X012	** 10" - 16" w.c.	10009592	GE30340X012/ GE29773X042	White Spring / Green Disk	
2" x 2"	180 Deg Straight		5/8"		GE29705X012					
			3/4"	10009565	GE29706X012					
Fisher	CS820IQ	**10010616**	3/8"	N/A	GE29703X012	1 - 2.5 psig	N/A	GE30342X012	Blue	Maintenance
Internal Relief			1/2"	10009564	GE29704X012	2.5 - 5.5 psig	10009584	GE30343X012	Yellow	
1 1/4" x 1 1/4"	180 Deg Straight		5/8"		GE29705X012					
			3/4"	10009565	GE29706X012					
Fisher	CS820IQ	**10009562**	3/8"	N/A	GE29703X012	1 - 2.5 psig	N/A	GE30342X012	Blue	
Internal Relief			1/2"	10009564	GE29704X012	2.5 - 5.5 psig	10009584	GE30343X012	Yellow	
2" x 2"	180 Deg Straight		5/8"		GE29705X012					
			3/4"	10009565	GE29706X012					
Fisher	CP400	**10009071**	3/8"	N/A	T1122309012	2 - 5 psig	N/A	GE27213X012	Orange Stripe	Maintenance
Pressure Loaded			1/2"	10008984	T1122009012	10-20 psig	10008983	GE30200X012	Purple Stripe	
1 1/4" x 1 1/4"	180 Deg Straight									
Fisher	CP400	**10008981**	3/8"	N/A	T1122309012	2 - 5 psig	N/A	GE27213X012	Orange Stripe	
Pressure Loaded			1/2"	10008984	T1122009012	10-20 psig	10008983	GE30200X012	Purple Stripe	
2" x 2"	180 Deg Straight									
Fisher	299H		1/2"	7060016	1H979409022	1-3.25 psig	7060062	T13593T0012	Light Blue	
Internal Registration, Pilot Loaded		**7000350**	3/4"	N/A	1H979509022	5" - 9" w.c.	N/A	T13589T0012	Yellow	
2" x 2"	180 Deg Straight		1"	7060018	1H979609022	5 - 16 psig	7060064	T13600T0012	Red	
Shaded areas indicate standard regulator configuration. For other configurations the spring and/or orifice will need to be changed.										
** With the 10" - 16" w.c. spring (for the 14" w.c. set) there is a disk that needs to be installed along with the spring change. These parts will come under the same material code number in stores.										

5.0 Relief Valve Sizing

5.1 A properly sized relief valve shall be used with all meter sets installed after January 19, 2006, either internal or external.

5.2 A relief valve must be capable of venting the maximum capacity of the regulator it monitors at maximum upstream pressure with standard maximum downstream build up. These are specified in the regulator tables.

5.3 The relief valve to be used to supplement the internal relief capacity of regulators and to provide relief where required is the Fisher Series 289. One or more of these relief valves shall be installed to adequately protect a system, this is specified in the regulator tables. They are available in several body sizes. Where a Fisher Series 289 is not sufficient, an engineer will design.

5.4 Maximum Downstream Buildup

- The following values are the Maximum Downstream Buildup allowed on a system to protect downstream regulator, appliances, and piping from overpressure conditions. These are not relief valve set points. These are to be used for customer reliefs only, not for regulator stations.

Delivery Pressure	Max. Downstream Buildup
7”, 11”, 14” w.c.	2 psig
2 psig	4 psig
5 psig	10 psig
10 psig	16 psig
15 psig	21 psig

5.5 Set Points and Specifications

- The following values are the relief valve set points.

Fisher 289 L, 1" Body - Stores **7903218**				
Delivery Reg Set Pressure	Relief Valve Set Point	Spring Range	Part Number	Spring Color
7" w.c.	15” WC	12 to 40” WC	13A7916 X012	Silver
14” w.c.	1 psig	12 to 40” WC	13A7916 X012	Silver

Fisher 289 H, 1" Body – Stores **7903215**				
Delivery Reg Set Pressure	Relief Valve Set Point	Spring Range	Part Number	Spring Color/ Stores No.
2 psig	3 psig	1 to 4.5 psig	1F8269 27052	Pink/**7060050**
5 psig	7 psig	4 to 15 psig	1D8923 27022	Red/
10 psig	12 psig	4 to 15 psig	1D8923 27022	Red/

Fisher 289 H, 2" Body – Stores **7903217**				
Delivery Reg Set Pressure	Relief Valve Set Point	Spring Range	Part Number	Spring Color
7" wc	15” WC	7” to 18” wc	1B5365 27052	Blue/**7060056**
14” wc	1 psig	.5 to 2.25 psig	1B5366 27052	Gray
2 psig	3 psig	1.75 to 7 psig	1B5368 27052	Green/**7060054**
5 psig	7 psig	4 to 10 psig	1B5369 27052	Red Stripe

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Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

1.0 <u>Scope</u>

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's procedures and policies concerning meter set design. A meter set (meterfit) refers to all Company-owned material and equipment installed from the outlet of the service riser valve to the point of connection with the customer's piping.

2.0 <u>Gas Meter Locations</u>

2.1 NorthWestern Energy will approve a suitable location for the meter installation.

2.2 The preferred location is at the primary building. Deviation from this practice requires engineering or supervisor approval.

2.3 It is recommended that all meter sets be installed outside.

2.4 In the event that a meter has to be set inside, the regulator shall be installed outside and the meter must be located in a ventilated place.

2.5 The center of the regulator vent should not be less than three (3) feet from any source of ignition or any source of heat that might damage the meter. See section on location of regulator vent terminals for further information.

2.6 *Each meter and service regulator, inside or outside of a building, must be installed in a readily accessible location.* Each meter and service regulator should be installed in a visible location. This to aid in service situations and emergency operations.

2.7 *Each meter and service regulator must be protected from damage.*

2.7.1 Adequate working space should be provided around the meter.

2.7.2 Where feasible, gas meters and regulators will be located outside in an area that is protected from damage by traffic. Gas meters that may be damaged by errant vehicles or equipment should have barricades installed to protect them.

2.7.3 The site should avoid hazards such as snow and ice unloading from overhead structures.

2.7.4 The site should maintain adequate distances from openings to the structure to avoid possible damage.

2.7.5 In certain situations the customer will be responsible for all costs associated with the protection from errant vehicles, equipment or other foreseeable damage.

2.8 Each meter and service regulator must be protected from corrosion.

2.9 Whenever possible, the lockwing or shutoff valve should be positioned in such a way as to be easily accessible.

3.0 <u>Prohibited Gas Meter Locations</u>

3.1 Under fire escapes

3.2 Under interior stairways

3.3 Under show windows

3.4 Inside engine, boiler, or electric meter rooms

3.5 Under any deck that is 5 feet or lower

3.6 It is recommended that meters not be set inside buildings

NorthWestern Energy

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4.0 Regulator/Relief Vent Terminal Locations

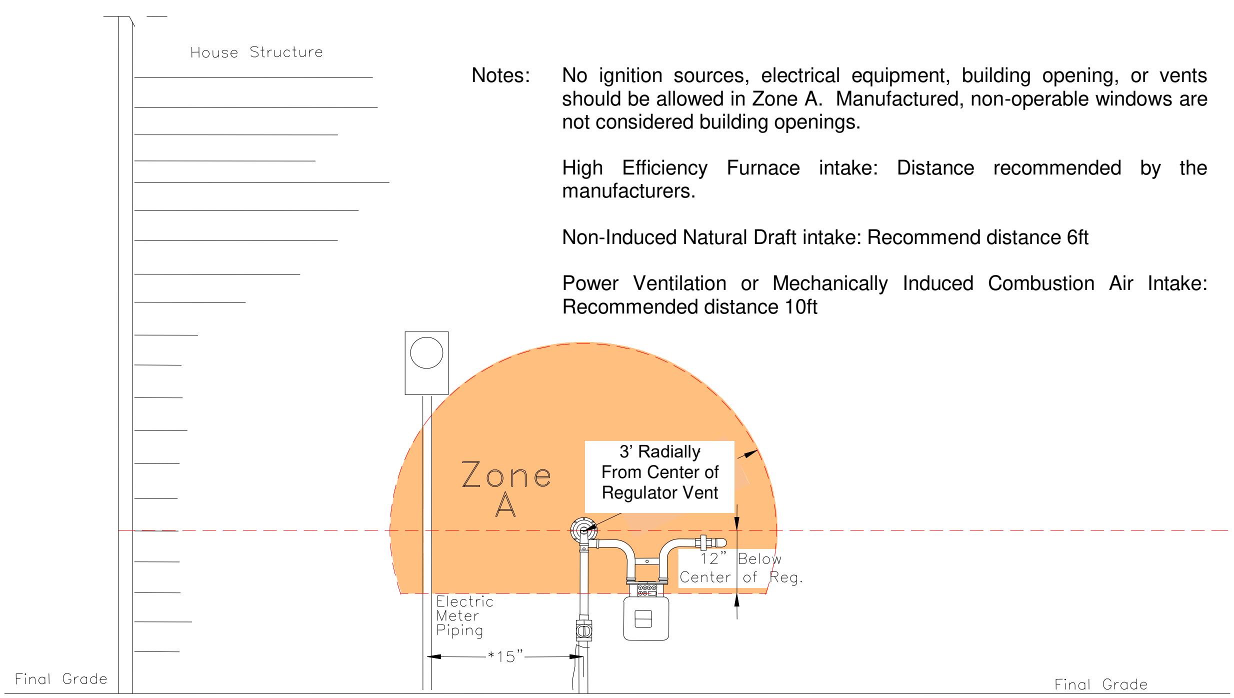
4.1 The vent terminal on all service regulators must conform to the following:

4.1.1 Each regulator/relief vent must be installed or piped with the opening pointed down and be equipped with a screen so as to be rain and insect resistant.

4.1.2 Each regulator and relief valve vent terminal must be located at a place where gas from the vent can escape freely into the atmosphere and away from any opening into a building. Refer to the following drawing for preferred/desirable meter location requirements.

4.1.3 Regulator and relief valve vent terminals must be located such that water cannot enter from roof drains or automatic sprinkler systems.

4.1.4 Be protected from damage caused by submergence in areas where flooding may occur.



*Electric Meter Clear Zone: The edge of gas piping or the gas meter should be at least 15" from the vertical centerline of the electrical meter. No gas piping should pass under the meter.

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5.0 <u>Vent Line Design</u>

5.1 The vent lines from regulators and relief valves cannot be piped with a common line.

5.2 When venting relief valves or regulators into a stack, the stack shall be plated and concreted off at ground level and have a minimum of two, ½" holes drilled near the bottom to provide for moisture run out.

5.3 Relief valve and regulator vent lines piped up through a roof shall terminate above the roofline and have a rain cap installed.

5.4 Increase the vent pipe size diameter 1 pipe size diameter (1", 1 ¼", 1 ½", 2", etc.)_for every 10 feet of pipe needed to get to the desired outside location. Use the table below for fittings.

Equivalent Lengths of Pipe Fittings and Valves								
Type of Valve or Fitting	Lengths in Feet of Standard Pipe							
	Nominal Pipe Size in Inches							
	1/2"	3/4"	1	1-1/4"	1-1/2"	2	2-1/2"	3
Standard 90 Elbow	1.7	2.2	2.7	3.7	4.3	5.5	6.5	8.0
Standard 45 Elbow	0.8	1.0	1.2	1.6	2.0	2.5	3.0	3.7
Long Sweep Elbow	1.0	1.3	1.7	2.3	2.7	3.5	4.2	5.3
Close return bend	3.7	5.1	6.2	8.5	10.0	13.0	15.0	19.0

Fisher Natural Gas Technologies Application Guide

6.0 <u>Connections to Customer Piping</u>

6.1 Each connection to a customer's fuel piping shall be made so as to minimize anticipated stresses upon the connected piping and the meter.

6.2 Gas meters shall be supported or connected to rigid piping so as not to exert a strain on the meter except:

6.2.1 Where flexible connectors are used to connect a gas meter to downstream piping at mobile homes, the meter shall be supported by a post or bracket placed in a firm footing or by other means providing equivalent support.

6.3 The type of piping joint used shall be suitable for the pressure-temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain maximum end force due to internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or to the weight of the piping system and its contacts.

6.4 Rigid pipe joints shall be threaded, flanged, or welded. Fittings and pipe used shall be of at least standard weight (schedule 40) steel and shall be approved for use in gas piping systems.

6.4.1 When CSST is used in the customers piping, it is NWE preference that the termination at the meter connection is 1" black iron pipe to the 1st support. The black iron pipe will be adequately attached to that support. A manufactured CSST through the rim termination fitting is acceptable for the connection between CSST and black iron pipe on the exterior of the home. All piping connecting the meter to the termination fitting must be black iron pipe that is properly supported.

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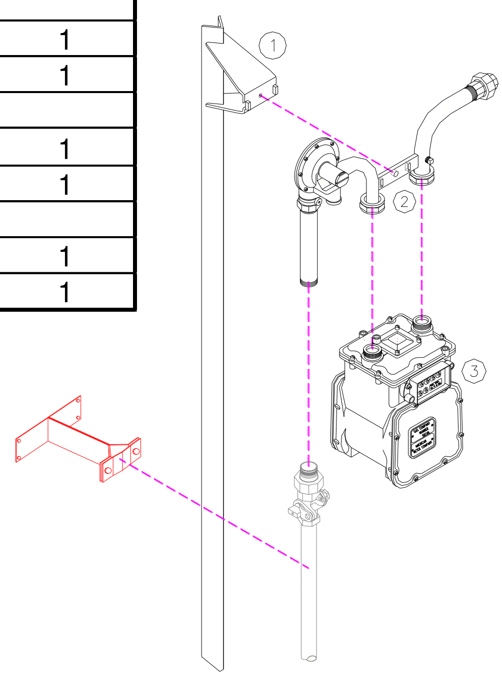
7.0 Standard Meter Sets

7.1 The following drawings are NWE standard meter sets. Having chosen the proper meter and regulator required to serve a customer, the appropriate drawing is referenced and the meter and regulator installed according to that drawing. The drawings are intended to show the general arrangement of all required components. Modifications to piping and fitting arrangements may be field determined as long as all the specified components are installed in the proper order with the proper clearances.

8.0 Residential Meter Set

LIST OF MATERIALS			
No.	**Code**	**Description**	**Quantity**
Choose One			
1	10002465	5' Angle Post and Meter Bracket	1
1	7790105	Riser Support Meter Bracket	1
Choose One			
2	10001796	SDNE Meter Set Assembly	1
2	10011797	MT Meter Set Assembly	1
Choose One			
3	NIS	SDNE AC 250 Meter	1
3	7200215	MT AC 250 Meter	1



ERTs (Maintenance)	
Code	**Description**
10008840	ERT, for use with American 800 - 5000 Meter
10008839	ERT, for use with American 175 - 630 Meter

Meters come with ERTS, this list is for replacing ERTs (maintenance, not new construction)

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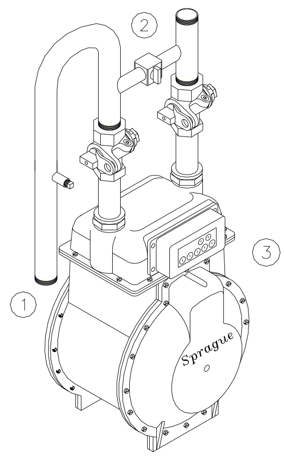
9.0 Small Commercial or Large Residential Meter Set



LIST OF MATERIALS			
No.	**Code**	**Description**	**Quantity**
1	*	Regulator	1
2	10007646	1 1/4" Meter Set Assembly, 30 Lite, 8.25" CC	1
3	7200225	MT American AL425 Meter	1
3	7200230	MT American AC630 Meter	1
2	10007645	1 1/4" Meter Set Assembly, 45 Lite, 11" CC	1
3	7200258	MT American AL1000 Meter	1
2	10007644	1 1/4" Sprague Meterfit Assembly, #3-4 Sprague, 7" CC	1
3	NIS	SDNE American AL425 Meter	1
2	10007643	1 1/4" Sprague Meterfit Assembly, #3-4 Sprague, 8.25" CC	1
3	NIS	SDNE American AC630 Meter	1
2	10007642	1 1/4" Sprague Meterfit Assembly, #5 Sprague, 11" CC	1
3	NIS	SDNE Sprague 1000	1
3	NIS	SDNE American AL1000	1

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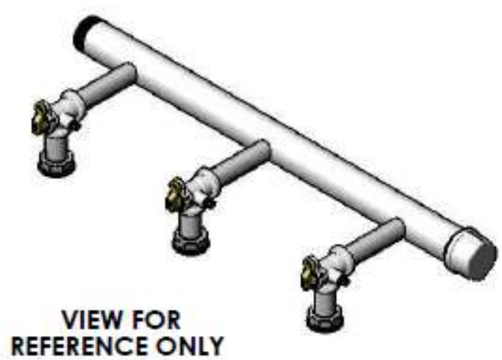
10.0 <u>Multi-Unit Residential and Small Commercial Meter Sets</u>

10.1 When more than one gas meter is set on the same service riser, they shall all be set at one location. Each meter shall have a readily accessible upstream valve as close as practical to the meter.

10.2 In multiple gas meter installations, each gas piping system shall be identified and permanently tagged by the owner of the facility prior to establishing service at the meter.

10.3 If setting more than 10 residential meters and/or meters larger than 425, engineering is required to determine the size of the vertical pipe as well as the header size.

Lyall Pre-Made Assembly



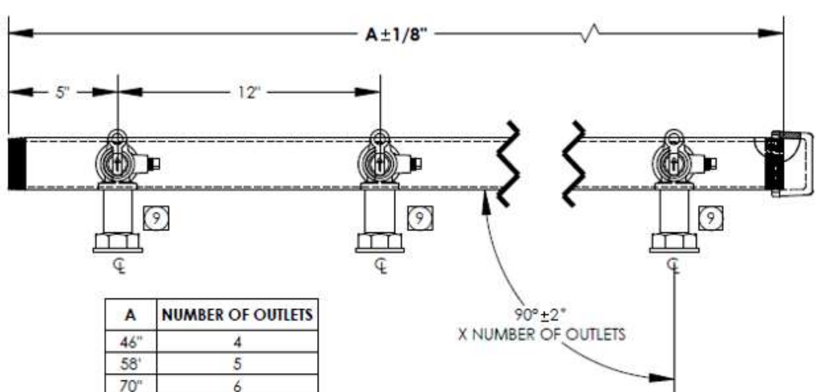
2 Meter
Assembly MT – 10007944
Assembly SD/NE – 10011854

3 Meter
Assembly MT – 10007943
Assembly SD/NE – 10011855

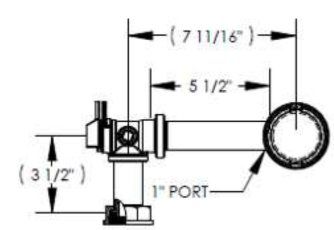
4 Meter available, but not normally stocked
Assembly MT – 10017421
Assembly SD/NE – 10011857

5 Meter
Assembly MT – 10008547
Assembly SD/NE – 10011858

6 Meter available, but not normally stocked
Assembly MT – 10017422
Assembly SD/NE – 10011859



A	NUMBER OF OUTLETS
46"	4
58'	5
70"	6
34"	3
22"	2



To Build at NWE:

HEADER PIPE: 2" SCHEDULE 40 GRADE B

OUTLET PIPE: 1" SCHEDULE 40 GRADE B

A9 VALVE w/ 20 LITE METER SWIVEL (MT): 1001-8126

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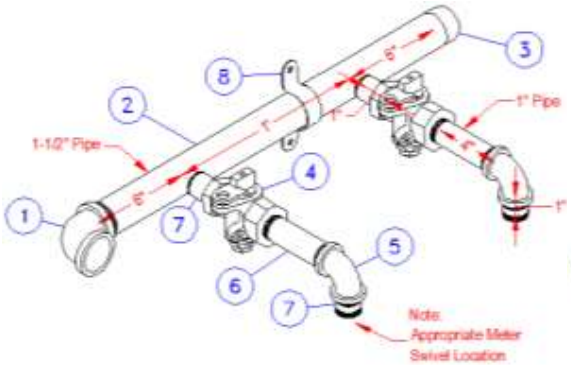
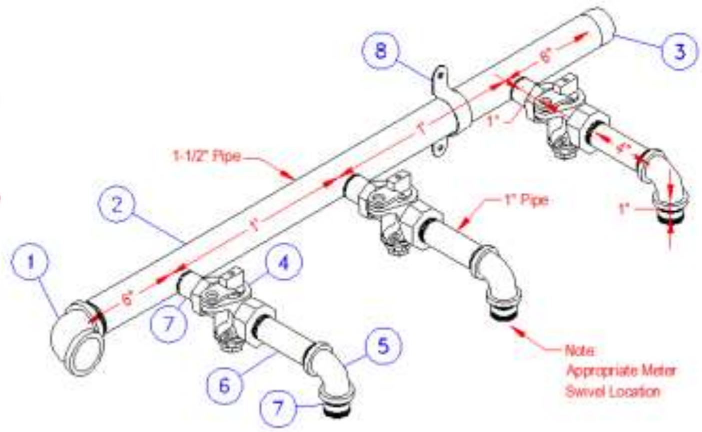
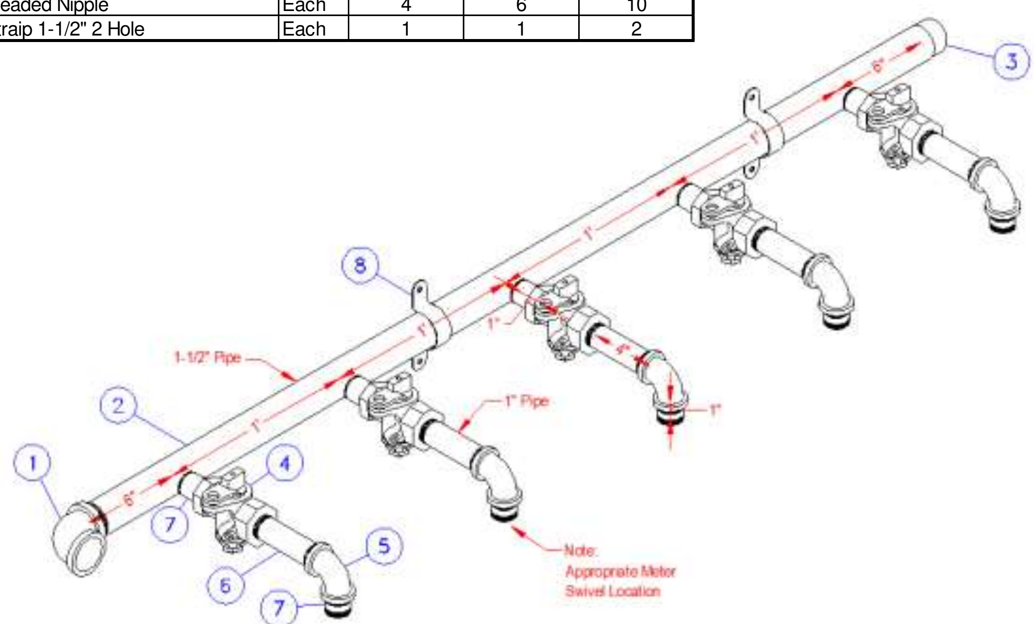
NWE Assembly





List of Materials						
				2 Meters	3 Meters	5 Meters
No.	SAP #	Description	Unit	Quantity	Quantity	Quantity
1	770-6080	1-1/2" Threaded Elbow	Each	1	1	1
2	750-0108	1-1/2" Pipe, Bare, Schedule 40	Feet	2	3	5
3	777-0490	1-1/2" Welded Cap	Each	1	1	1
4	1000-2786	1" Service Lockwing Non-Insulated Valve	Each	2	3	5
5	770-6060	1" Threaded Elbow	Each	2	3	5
6	772-6040	1" x 4" Threaded Nipple	Each	2	3	5
7	772-6020	1" x 2" Threaded Nipple	Each	4	6	10
8	1000-1504	Conduit Straip 1-1/2" 2 Hole	Each	1	1	2



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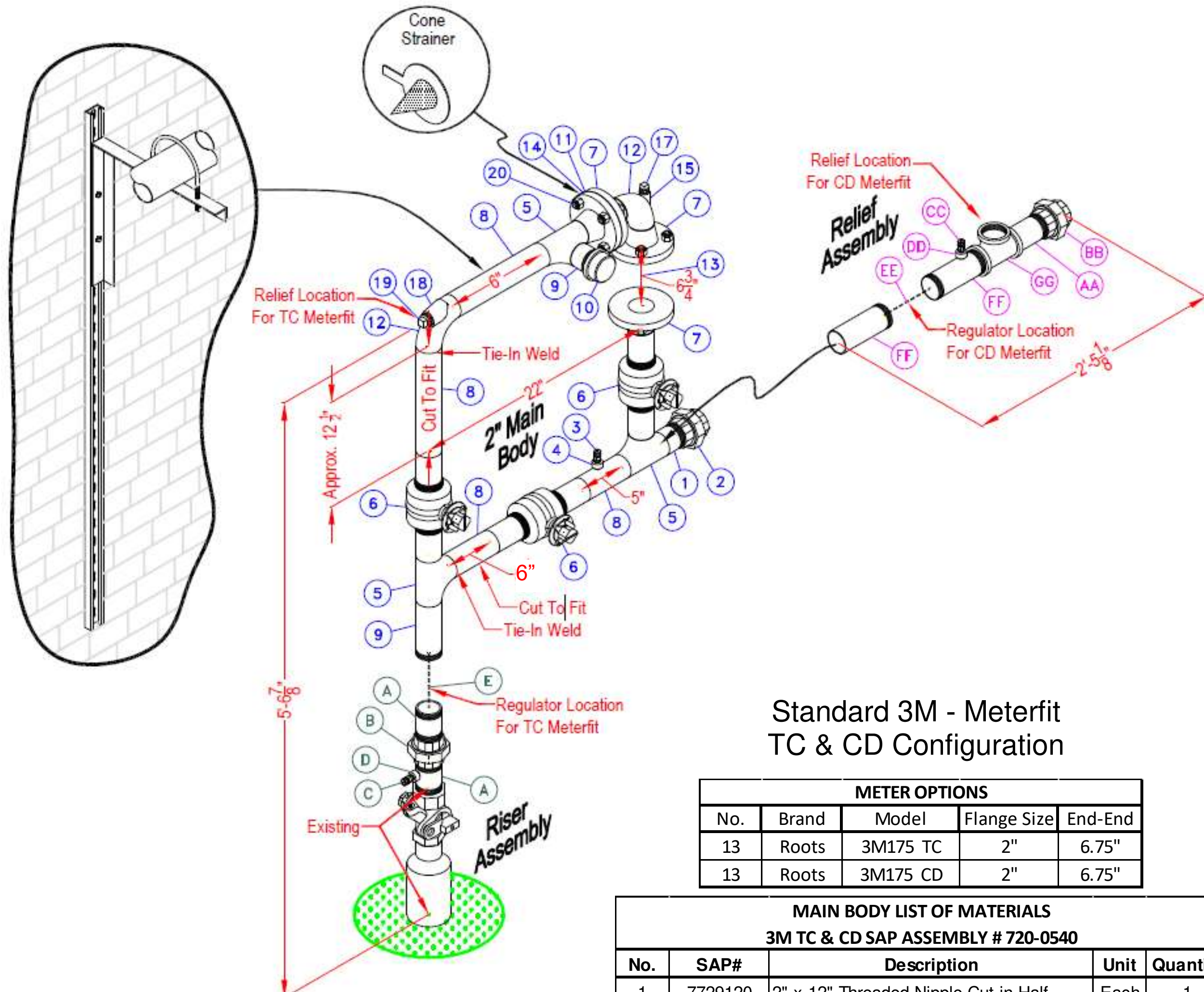
11.0 Standard 3M Meter Set – TC & CD Configuration



Standard 3M - Meterfit
TC & CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
13	Roots	3M175 TC	2"	6.75"
13	Roots	3M175 CD	2"	6.75"

RISER ASSEMBLY LIST OF MATERIALS				
No.	SAP#	Description	Unit	Quantity
A	10002517	2" x 3 1/2" Threaded Nipple	Each	2
B	10002751	2" Insulated Union (SDNE)	Each	1
B	10018221	2" Insulated Union (MT)	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	*	Regulator	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS				
No.	SAP#	Description	Unit	Quantity
AA	10002517	2" x 3 1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union (SDNE)	Each	1
BB	10018221	2" Insulated Union (MT)	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	*	Regulator	Each	1
FF	7729060	2" x 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1

MAIN BODY LIST OF MATERIALS 3M TC & CD SAP ASSEMBLY # 720-0540				
No.	SAP#	Description	Unit	Quantity
1	7729120	2" x 12" Threaded Nipple Cut in Half	Each	1
2	10002751	2" Insulated Union (SDNE)	Each	1
2	10018221	2" Insulated Union (MT)	Each	1
3	10002558	1/4" Pete's Test Plug	Each	1
4	10006662	1/4" Threadolet	Each	1
5	7772209	2" Welded Tee	Each	3
6	10008633	2" Full Port Ball Valve	Each	3
7	7910170	2" Flat Faced Weld Neck Flange	Each	4
8	7500109	2" Schedule 40 Bare Pipe	Feet	4
9	7729060	2" x 6" Threaded Nipple Cut in Half	Each	2
10	7702090	2" Threaded Cap	Each	1
11	7922017	2" Cone Strainer	Each	1
12	7770739	2" Long Radius Welded Elbow	Each	2
13		Rotary Meter	Each	1
14	10006804	Gasket, 2", Fiber Ring	Each	2
15	10007681	1/2" Elbowlet	Each	1
17	7711040	1/2" BMI Plug	Each	1
18	10010463	1" Elbowlet	Each	1
19	7711060	1" BMI Plug	Each	1
20	10010453	5/8" x 3 1/2" Teflon Stud Bolt w/2H Nuts	Each	4

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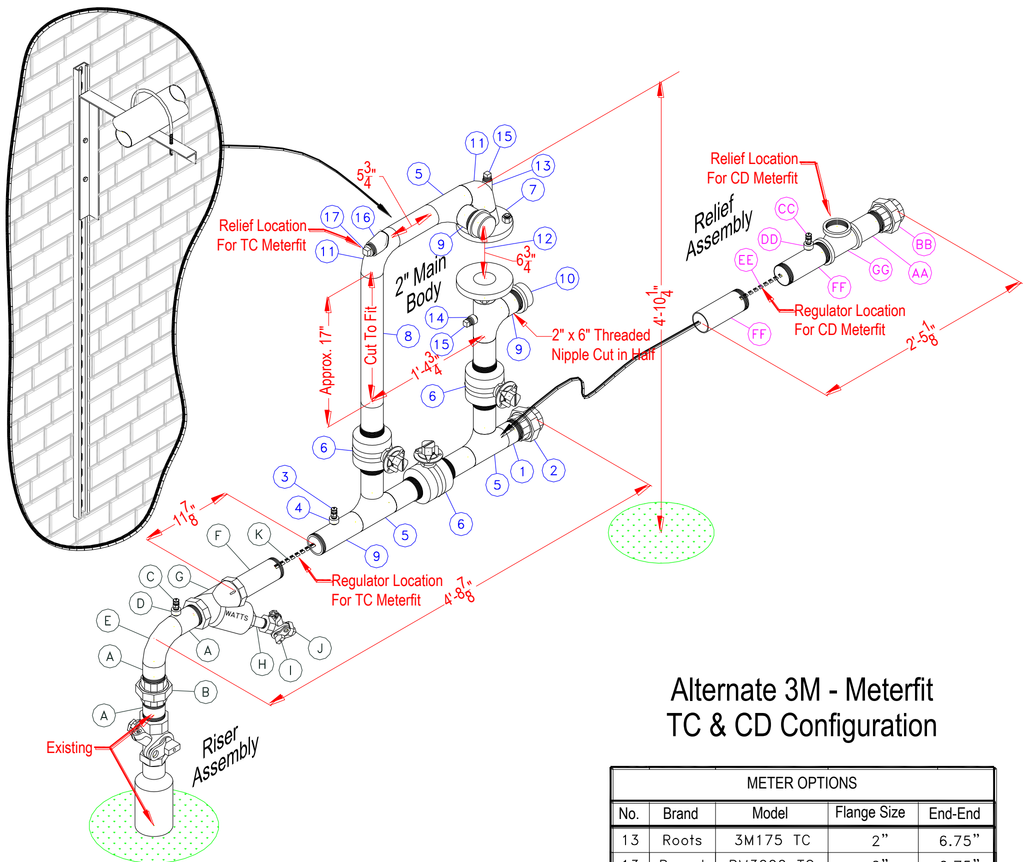
Alternate 3M Meter Set – TC & CD Configuration



Alternate 3M - Meterfit
TC & CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
13	Roots	3M175 TC	2"	6.75"
13	Romet	RM3000 TC	2"	6.75"
13	Roots	3M175 CD	2"	6.75"
13	Romet	RM3000 CD	2"	6.75"

RISER ASSEMBLY LIST OF MATERIALS

ID	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	3
B	10002751	2" Insulated Union	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	7770739	2" Elbow Welded Grade B	Each	1
F	7729060	2" X 6" Threaded Nipple	Each	1
G	7922015	2" Strainer Screwed	Each	1
H	7725025	Nipple, Black Steel, 3/4" x 2-1/2"	Each	1
I	7900265	Cock, Meter, 3/4" Lockwing	Each	1
J	7711050	Plug, BMI, 3/4"	Each	1
K	·	Regulator	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
AA	10002517	2" X 3-1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	·	Regulator	Each	1
FF	7729060	2" X 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1

MAIN BODY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
1	10002517	2" X 3-1/2" Threaded Nipple	Each	1
2	10002751	2" Insulated Union	Each	1
3	10002558	1/4" Pete's Test Plug	Each	1
4	10006662	1/4" Threadolet	Each	1
5	7772209	2" Welded Tee	Each	4
6	10006801	2" Full Port Ball Valve	Each	3
7	7910170	2" Flat Faced Weld Neck Flange	Each	2
8	7500109	2" Schedule 40 Bare Pipe	Feet	3
9	7729060	2" X 6" Threaded Nipple Cut In Half	Each	2
10	7702090	2" Threaded Cap	Each	2
11	7770739	2" Long Radius Welded Elbow	Each	2
12	·	Rotary Meter	Each	1
13	10007681	1/2" Elbowlet	Each	1
14	10006682	1/2" Threadolet	Each	1
15	7711040	1/2" BMI Plug	Each	2
16	10010463	1" Elbowlet	Each	1
17	7711060	1" BMI Plug	Each	1

Revision Date: 11-5-2012

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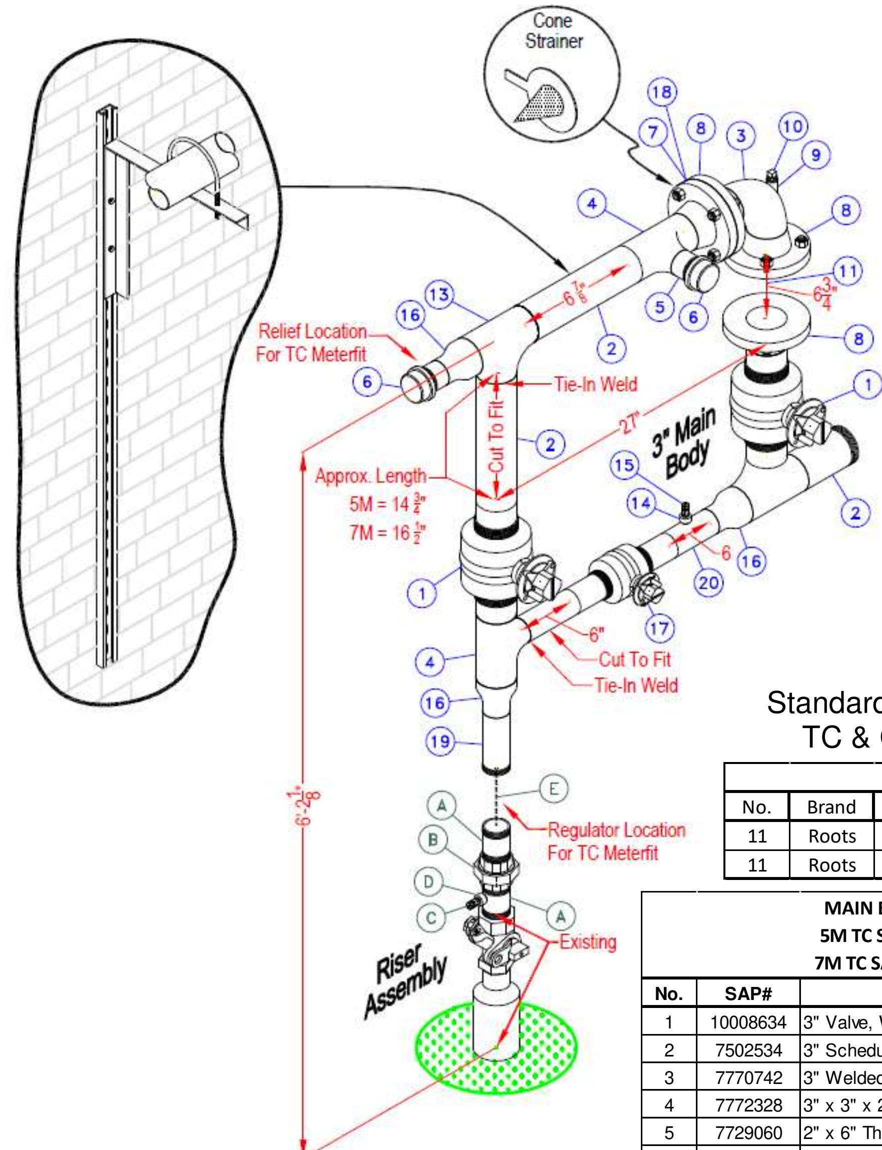
13.0 Standard 5M & 7M Meter Set – TC & CD Configuration



Standard 5M & 7M - Meterfit
TC & CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	5M175 TC	3"	6.75"
11	Roots	7M175 TC	3"	9.50"

MAIN BODY LIST OF MATERIALS 5M TC SAP ASSEMBLY # 720-0542 7M TC SAP ASSEMBLY # 1000-7894				
No.	SAP#	Description	Unit	Quantity
1	10008634	3" Valve, Weld, Ballomax, Concave-Bore	Each	2
2	7502534	3" Schedule 40 Bare Pipe	Feet	4
3	7770742	3" Welded Elbow	Each	1
4	7772328	3" x 3" x 2" Welded Reducing Tee	Each	2
5	7729060	2" x 6" Threaded Nipple Cut in Half	Each	2
6	7702090	2" Threaded Cap	Each	2
7	7922018	3" Cone Strainer	Each	1
8	7910173	3" Flat Face Weld Neck Flange	Each	4
9	10007681	1/2" Elbowlet	Each	1
10	7711040	1/2" BMI Plug	Each	1
11	*	Rotary Meter	Each	1
13	7772212	3" Welded Tee	Each	2
14	10006662	1/4" Threadolet	Each	1
15	10002558	1/4" Pete's Test Plug	Each	1
16	7771429	3" X 2" Welded Reducer	Each	3
17	10008633	2" Valve, Weld, Ballomax, Concave-Bore	Each	1
18	10006811	Gasket, 3", NA Ring, 150# ANSI	Each	2
19	7729120	2" x 12" Threaded Nipple Cut in Half	Each	1
20	7500109	2" Schedule 40 Bare Pipe	Feet	1
21	10010453	5/8" x 3 1/2" Teflon Stud Bolt w/2H Nuts	Each	4

RISER ASSEMBLY LIST OF MATERIALS				
No.	SAP#	Description	Unit	Quantity
A	10002517	2" x 3 1/2" Threaded Nipple	Each	2
B	10002751	2" Insulated Union (SDNE)	Each	1
B	10018221	2" Insulated Union (MT)	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	*	Regulator	Each	1

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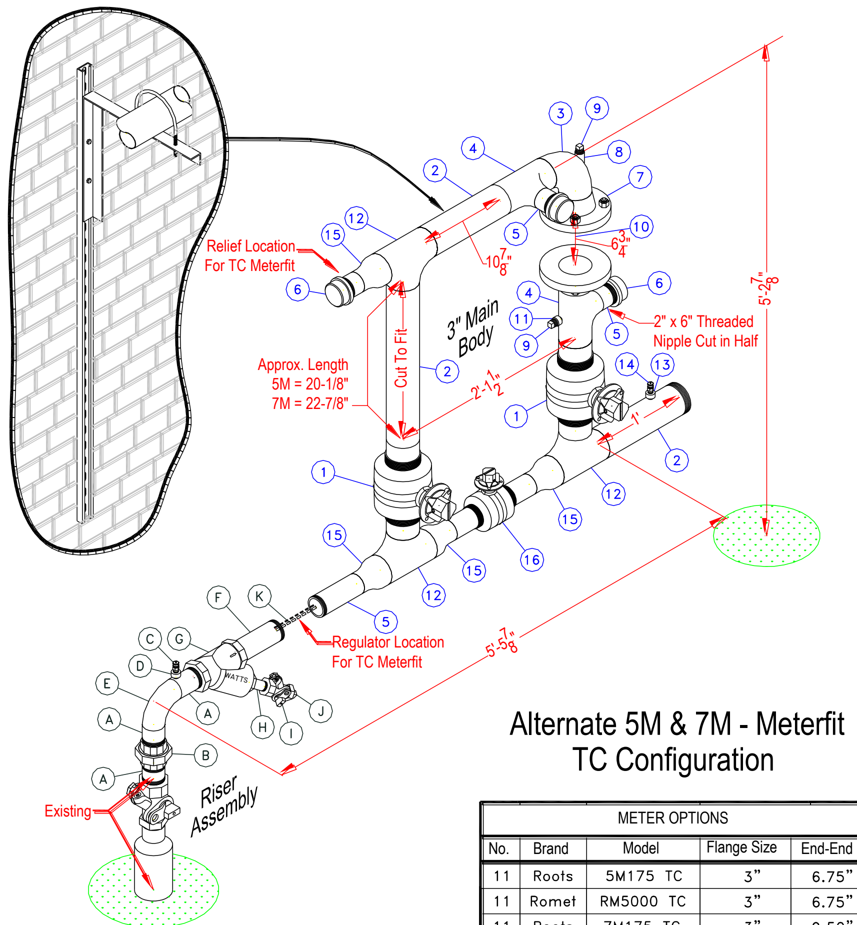
14.0 Alternate 5M & 7M Meter Set – TC Configuration



Alternate 5M & 7M - Meterfit TC Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	5M175 TC	3"	6.75"
11	Romet	RM5000 TC	3"	6.75"
11	Roots	7M175 TC	3"	9.50"
11	Romet	RM7000 TC	3"	9.50"

MAIN BODY LIST OF MATERIALS				
No.	SAPP #	Description	Unit	Quanity
1	10006802	3" Full Port Ball Valve	Each	2
2	10002527	3" Schedule 40 Bare Pipe	Feet	4
3	7770742	3" Welded Elbow	Each	1
4	7772328	3" X 3" X 2" Welded Reducing Tee	Each	2
5	7729060	2" X 6" Threaded Nipple Cut In Half	Each	3
6	7702090	2" Threaded Cap	Each	3
7	7910173	3" Flat Face Weld Neck Flange	Each	2
8	10007681	1/2" Elbowlet	Each	1
9	7711040	1/2" BMI Plug	Each	2
10	-	Rotary Meter	Each	1
11	10006682	1/2" Threadolet	Each	1
12	7772212	3" Welded Tee	Each	3
13	10006662	1/4" Threadolet	Each	1
14	10002558	1/4" Pete's Test Plug	Each	1
15	7771429	3" X 2" Welded Reducer	Each	4
16	10006801	2" Full Port Ball Valve	Each	1

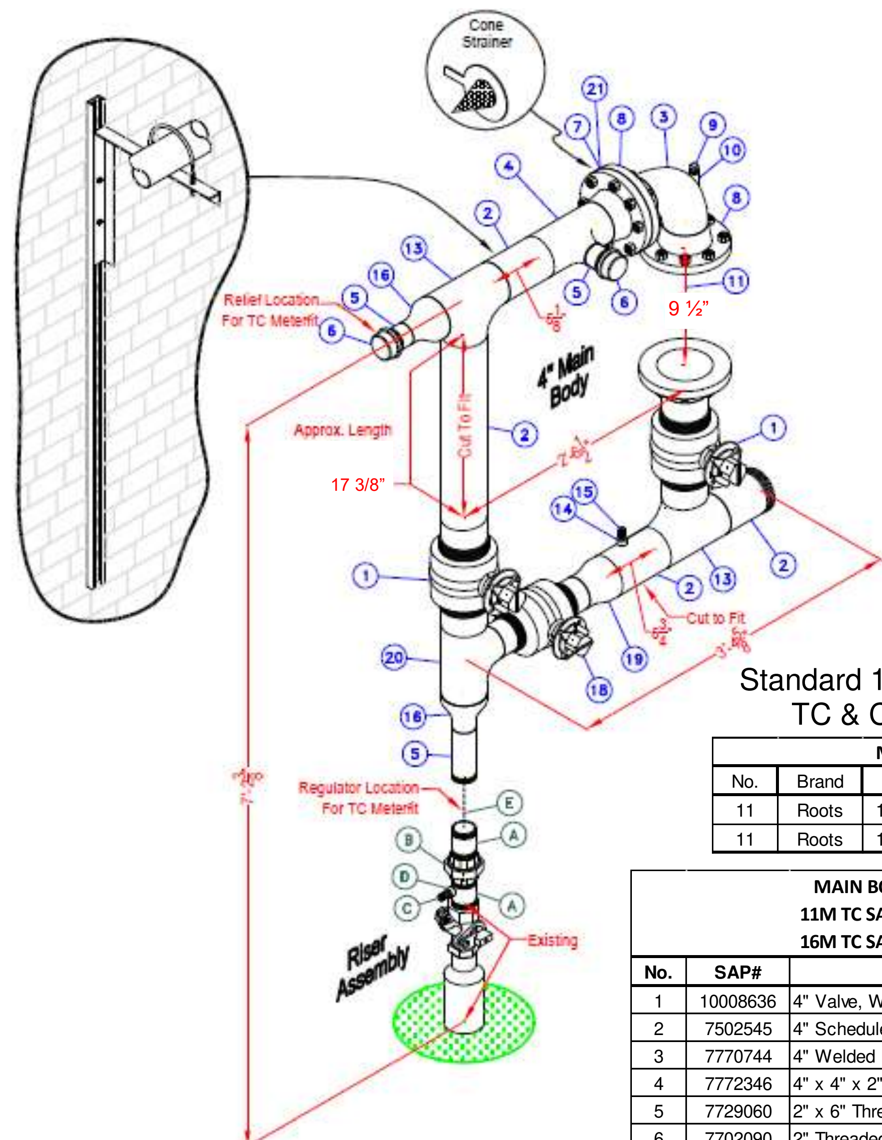
RISER ASSEMBLY LIST OF MATERIALS				
ID	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	3
B	10002751	2" Insulated Union	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	7770739	2" Elbow Welded Grade B	Each	1
F	7729060	2" X 6" Threaded Nipple	Each	1
G	7922015	2" Strainer Screwed	Each	1
H	7725025	Nipple, Black Steel, 3/4" x 2-1/2"	Each	1
I	7900265	Cock, Meter, 3/4" Lockwing	Each	1
J	7711050	Plug, BMI, 3/4"	Each	1
K	-	Regulator	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

15.0 Standard 11M & 16M Meter Set – TC & CD Configuration



Standard 11M & 16M - Meterfit
TC & CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	11M175 TC	4"	9.50"
11	Roots	16M175 TC	4"	9.50"

MAIN BODY LIST OF MATERIALS 11M TC SAP ASSEMBLY # 1000-7896 16M TC SAP ASSEMBLY # 1000-7898				
No.	SAP#	Description	Unit	Quantity
1	10008636	4" Valve, Weld, Ballomax, Concave-Bore	Each	2
2	7502545	4" Schedule 40 Bare Pipe	Feet	5
3	7770744	4" Welded Elbow	Each	1
4	7772346	4" x 4" x 2" Welded Reducing Tee	Each	1
5	7729060	2" x 6" Threaded Nipple Cut in Half	Each	2
6	7702090	2" Threaded Cap	Each	2
7	7922020	4" Cone Strainer	Each	1
8	7910175	4" Flat Faced Weld Neck Flange	Each	4
9	7711040	1/2" BMI Plug	Each	1
10	10007681	1/2" Elbowlet	Each	1
11	*	Rotary Meter	Each	1
13	7772214	4" Welded Tee	Each	2
14	10006662	1/4" Threadolet	Each	1
15	10002558	1/4" Pete's Test Plug	Each	1
16	7771449	4" X 2" Welded Reducer	Each	2
17	10006812	Gasket, 4", NA Ring, 150# ANSI	Each	2
18	10008634	3" Valve, Weld, Ballomax, Concave-Bore	Each	1
19	7771452	4" x 3" Welded Reducer	Each	1
20	7772348	4" x 4" x 3" Welded Reducing Tee	Each	1
21	10010453	5/8" x 3 1/2" Teflon Stud Bolt w/2H Nuts	Each	8
22	7729120	2" x 12" Threaded Nipple Cut in Half	Each	1

RISER ASSEMBLY LIST OF MATERIALS				
No.	SAP#	Description	Unit	Quantity
A	10002517	2" x 3 1/2" Threaded Nipple	Each	2
B	10002751	2" Insulated Union (SDNE)	Each	1
B	10018221	2" Insulated Union (MT)	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	*	Regulator	Each	1

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
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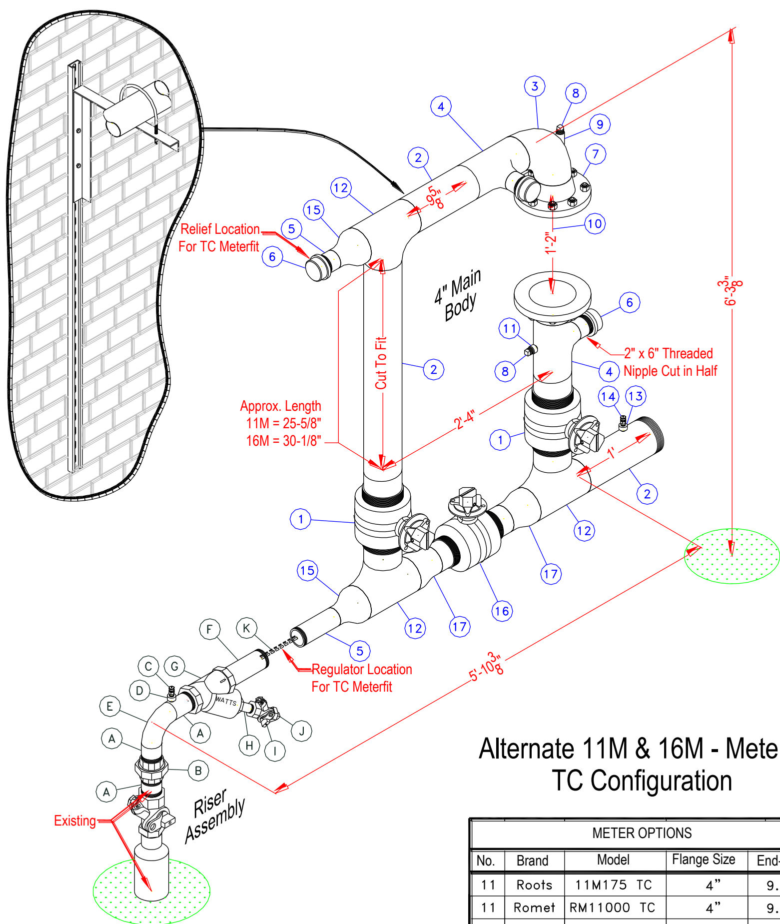
16.0 Alternate 11M & 16M Meter Set – TC Configuration



Alternate 11M & 16M - Meterfit
TC Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	11M175 TC	4"	9.50"
11	Romet	RM11000 TC	4"	9.50"
11	Roots	16M175 TC	4"	14.00"
11	Romet	RM16000 TC	4"	9.50"
11	Romet	RM23000 TC	4"	9.50"

MAIN BODY LIST OF MATERIALS				
No.	SAPP #	Description	Unit	Quanity
1	10006803	4" Full Port Ball Valve	Each	2
2	10002528	4" Schedule 40 Bare Pipe	Feet	5
3	7770744	4" Welded Elbow	Each	1
4	7772346	4" X 4" X 2" Welded Reducing Tee	Each	2
5	7729060	2"X 6" Threaded Nipple Cut In Half	Each	3
6	7702090	2" Threaded Cap	Each	3
7	7910175	4" Flat Faced Weld Neck Flange	Each	2
8	7711040	1/2" BMI Plug	Each	2
9	10007681	1/2" Elbowlet	Each	1
10	·	Rotary Meter	Each	1
11	10006682	1/2" Threadolet	Each	1
12	7772214	4" Welded Tee	Each	3
13	10006662	1/4" Threadolet	Each	1
14	10002558	1/4" Pete's Test Plug	Each	1
15	7771449	4" X 2" Welded Reducer	Each	2
16	10006802	3" Full Port Ball Valve	Each	1
17	7771452	4" X 3" Welded Reducer	Each	2

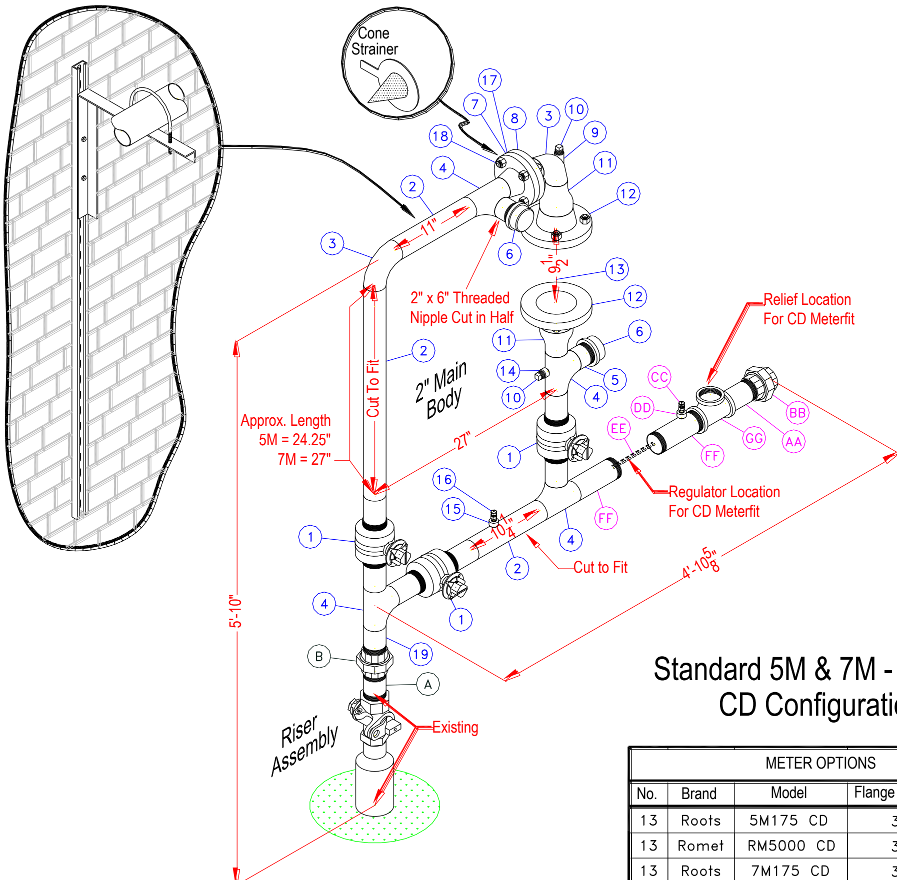
RISER ASSEMBLY LIST OF MATERIALS				
ID	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	3
B	10002751	2" Insulated Union	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	7770739	2" Elbow Welded Grade B	Each	1
F	7729060	2" X 6" Threaded Nipple	Each	1
G	7922015	2" Strainer Screwed	Each	1
H	7725025	Nipple, Black Steel, 3/4" x 2-1/2"	Each	1
I	7900265	Cock, Meter, 3/4" Lockwing	Each	1
J	7711050	Plug, BMI, 3/4"	Each	1
K	·	Regulator	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

17.0 Standard 5M & 7M Meter Set – CD Configuration



Standard 5M & 7M - Meterfit CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
13	Roots	5M175 CD	3"	6.75"
13	Romet	RM5000 CD	3"	6.75"
13	Roots	7M175 CD	3"	9.50"
13	Romet	RM7000 CD	3"	9.50"

MAIN BODY LIST OF MATERIALS
5M CD SAP ASSEMBLY #10007893
7M CD SAP ASSEMBLY #10007895

No.	SAPP #	Description	Unit	Quanity
1	10006801	2" Full Port Ball Valve	Each	3
2	7500109	2" Schedule 40 Bare Pipe	Feet	4
3	7770739	2" Welded Elbow	Each	2
4	7772209	2" Welded Tee	Each	4
5	7729060	2" X 6" Threaded Nipple Cut In Half	Each	1
6	7702090	2" Threaded Cap	Each	2
7	7922017	2" Cone Strainer	Each	1
8	7910170	2" Flat Face Weld Neck Flange	Each	2
9	10007681	1/2" Elbowlet	Each	1
10	7711040	1/2" BMI Plug	Each	2
11	7771429	3" X 2" Welded Reducer	Each	2
12	7910173	3" Flat Face Weld Neck Flange	Each	2
13	·	Rotary Meter	Each	1
14	10006682	1/2" Threadolet	Each	1
15	10006662	1/4" Threadolet	Each	1
16	10002558	1/4" Pete's Test Plug	Each	1
17	10006804	Gasket, 2", Fiber Ring	Each	2
18	10010453	5/8"x3" Teflon Stud Bolt w/2H Nuts	Each	4
19	10002517	2" X 3-1/2" Threaded Nipple	Each	1

RISER ASSEMBLY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	1
B	10002751	2" Insulated Union	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS

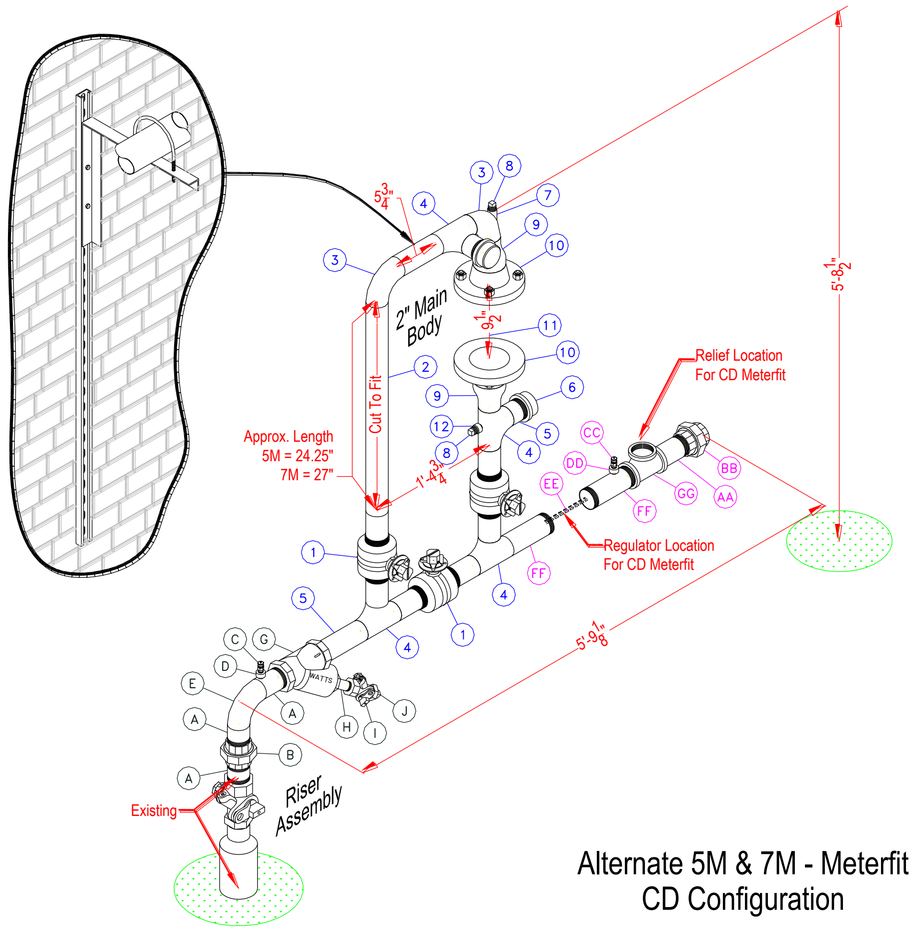
No.	SAPP #	Description	Unit	Quanity
AA	10002517	2" X 3-1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	·	Regulator	Each	1
FF	7729060	2" X 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

18.0 Alternate 5M & 7M Meter Set – CD Configuration



Alternate 5M & 7M - Meterfit
CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
13	Roots	5M175 CD	3"	6.75"
13	Romet	RM5000 CD	3"	6.75"
13	Roots	7M175 CD	3"	9.50"
13	Romet	RM7000 CD	3"	9.50"

RISER ASSEMBLY LIST OF MATERIALS				
ID	SAPP #	Description	Unit	Quantity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	3
B	10002751	2" Insulated Union	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	7770739	2" Elbow Welded Grade B	Each	1
F	·	.	Each	·
G	7922015	2" Strainer Screwed	Each	1
H	7725025	Nipple, Black Steel, 3/4" x 2-1/2"	Each	1
I	7900265	Cock, Meter, 3/4" Lockwing	Each	1
J	7711050	Plug, BMI, 3/4"	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS				
No.	SAPP #	Description	Unit	Quanity
AA	10002517	2" X 3-1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	·	Regulator	Each	1
FF	7729060	2" X 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1

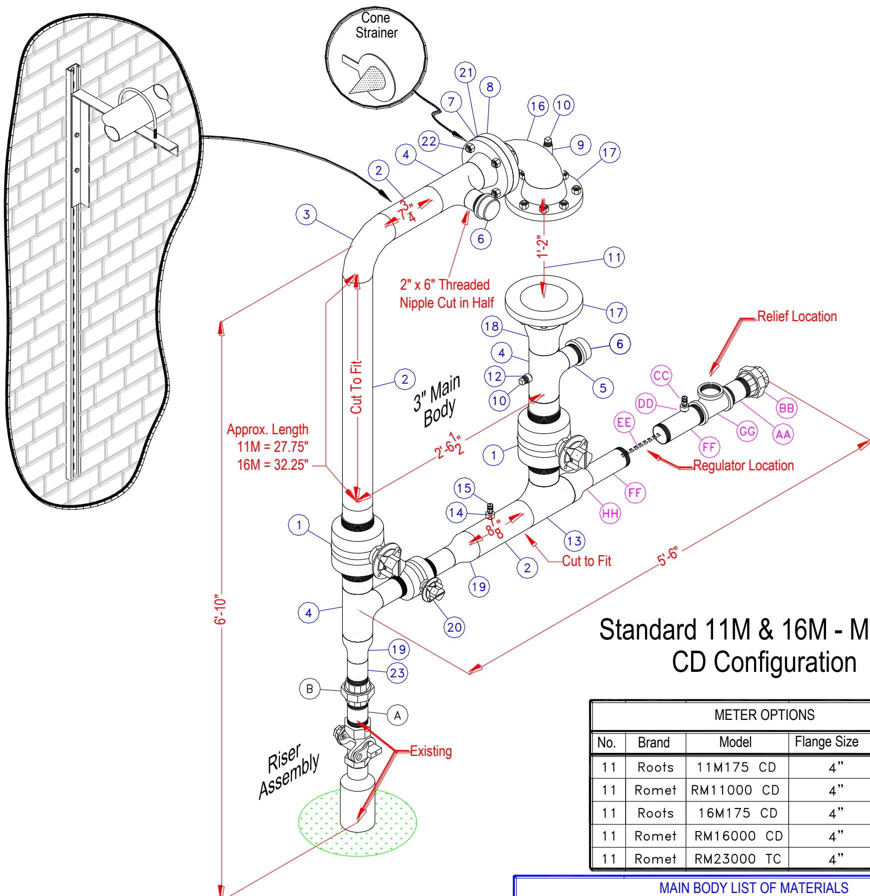
MAIN BODY LIST OF MATERIALS				
No.	SAPP #	Description	Unit	Quanity
1	10006801	2" Full Port Ball Valve	Each	3
2	7500109	2" Schedule 40 Bare Pipe	Feet	4
3	7770739	2" Welded Elbow	Each	2
4	7772209	2" Welded Tee	Each	4
5	7729060	2" X 6" Threaded Nipple Cut In Half	Each	2
6	7702090	2" Threaded Cap	Each	2
7	10007681	1/2" Elbowlet	Each	1
8	7711040	1/2" BMI Plug	Each	2
9	7771429	3" X 2" Welded Reducer	Each	2
10	7910173	3" Flat Face Weld Neck Flange	Each	2
11	·	Rotary Meter	Each	1
12	10006682	1/2" Threadolet	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

19.0 Standard 11M & 16M Meter Set – CD Configuration



Standard 11M & 16M - Meterfit
CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	11M175 CD	4"	9.50"
11	Romet	RM11000 CD	4"	9.50"
11	Roots	16M175 CD	4"	14.00"
11	Romet	RM16000 CD	4"	9.50"
11	Romet	RM23000 TC	4"	9.50"

RISER ASSEMBLY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	1
B	10002751	2" Insulated Union	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
AA	10002517	2" X 3-1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	-	Regulator	Each	1
FF	7729060	2" X 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1
HH	7771429	3" X 2" Welded Reducer	Each	1

MAIN BODY LIST OF MATERIALS
11M CD SAP ASSEMBLY #10007897
16M CD SAP ASSEMBLY #10007899

No.	SAPP #	Description	Unit	Quanity
1	10006802	3" Full Port Ball Valve	Each	2
2	10002527	3" Schedule 40 Bare Pipe	Feet	5
3	7770742	3" Welded Elbow	Each	1
4	7772328	3" X 3" X 2" Welded Reducing Tee	Each	3
5	7729060	2" X 6" Threaded Nipple Cut In Half	Each	1
6	7702090	2" Threaded Cap	Each	2
7	7922018	3" Cone Strainer	Each	1
8	7910173	3" Flat Face Weld Neck Flange	Each	2
9	10007681	1/2" Elbowlet	Each	1
10	7711040	1/2" BMI Plug	Each	2
11	-	Rotary Meter	Each	1
12	10006682	1/2" Threadolet	Each	1
13	7772212	3" Welded Tee	Each	1
14	10006662	1/4" Threadolet	Each	1
15	10002558	1/4" Pete's Test Plug	Each	1
16	7771452	4" X 3" Reducing Welded Elbow	Each	1
17	7910175	4" Flat Face Weld Neck Flanges	Each	2
18	7771452	4" X 3" Welded Reducer	Each	1
19	7771429	3" X 2" Welded Reducer	Each	2
20	10006801	2" Full Port Ball Valve	Each	1
21	10006811	Gasket, 3", Fiber Ring	Each	2
22	10010453	5/8"x3" Teflon Stud Bolt w/2H Nuts	Each	4
23	10002517	2" X 3-1/2" Threaded Nipple	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

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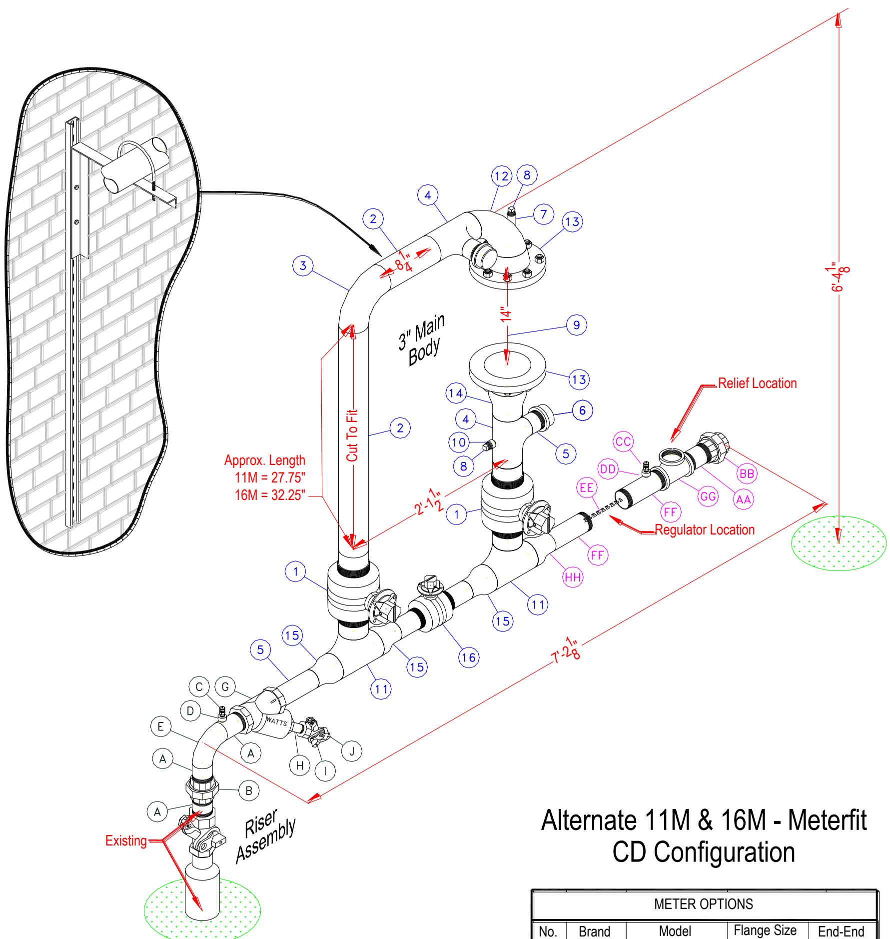
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

20.0 Alternate 11M & 16M Meter Set – CD Configuration



Alternate 11M & 16M - Meterfit
CD Configuration

METER OPTIONS				
No.	Brand	Model	Flange Size	End-End
11	Roots	11M175 CD	4"	9.50"
11	Romet	RM11000 CD	4"	9.50"
11	Roots	16M175 CD	4"	14.00"
11	Romet	RM16000 CD	4"	9.50"
11	Romet	RM23000 TC	4"	9.50"

RISER ASSEMBLY LIST OF MATERIALS

ID	SAPP #	Description	Unit	Quanity
A	10002517	2" X 3-1/2" Threaded Nipple	Each	3
B	10002751	2" Insulated Union	Each	1
C	10002558	1/4" Pete's Test Plug	Each	1
D	10006662	1/4" Threadolet	Each	1
E	7770739	2" Elbow Welded Grade B	Each	1
F	.	.	Each	.
G	7922015	2" Strainer Screwed	Each	1
H	7725025	Nipple, Black Steel, 3/4" x 2-1/2"	Each	1
I	7900265	Cock, Meter, 3/4" Lockwing	Each	1
J	7711050	Plug, BMI, 3/4"	Each	1

RELIEF ASSEMBLY LIST OF MATERIALS

No.	SAPP #	Description	Unit	Quanity
AA	10002517	2" X 3-1/2" Threaded Nipple	Each	1
BB	10002751	2" Insulated Union	Each	1
CC	10002558	1/4" Pete's Test Plug	Each	1
DD	10006662	1/4" Threadolet	Each	1
EE	.	Regulator	Each	1
FF	7729060	2" X 6" Threaded Nipple	Each	2
GG	7714090	2" Screwed Tee	Each	1
HH	7771429	3" X 2" Welded Reducer	Each	1

MAIN BODY LIST OF MATERIALS

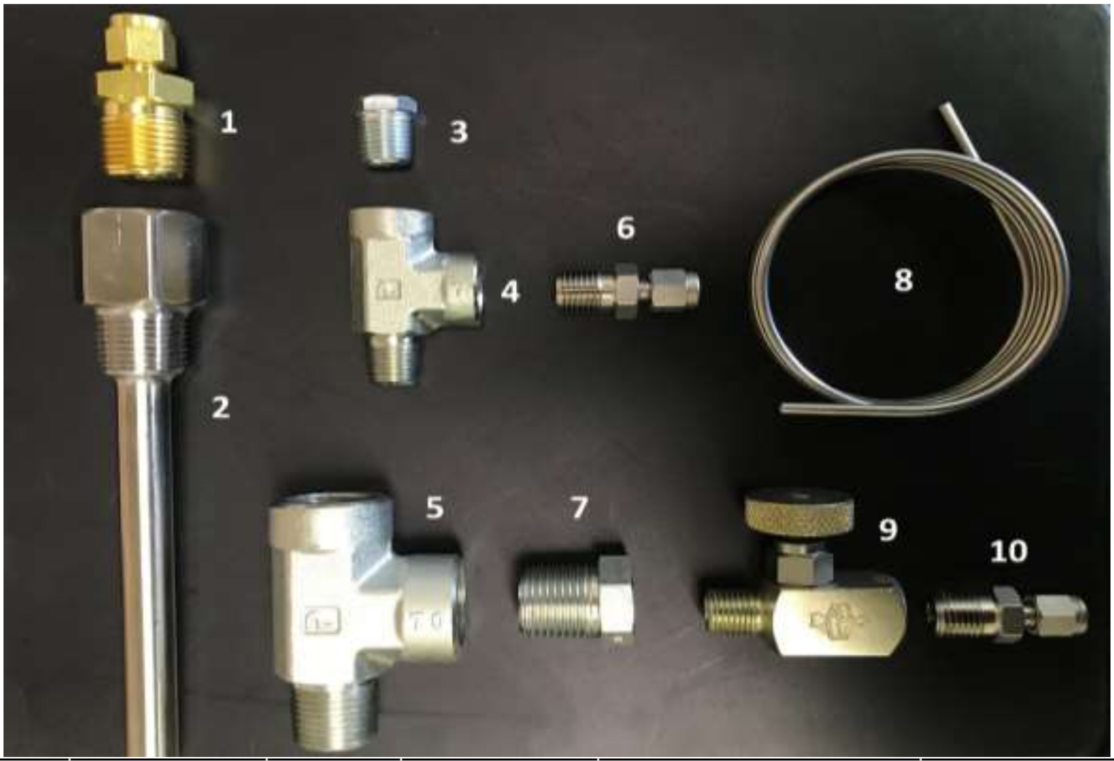
No.	SAPP #	Description	Unit	Quanity
1	10006802	3" Full Port Ball Valve	Each	2
2	10002527	3" Schedule 40 Bare Pipe	Feet	5
3	7770742	3" Welded Elbow	Each	1
4	7772328	3" X 3" X 2" Welded Reducing Tee	Each	2
5	7729060	2" X 6" Threaded Nipple Cut In Half	Each	2
6	7702090	2" Threaded Cap	Each	2
7	10007681	1/2" Elbowlet	Each	1
8	7711040	1/2" BMI Plug	Each	2
9	.	Rotary Meter	Each	1
10	10006682	1/2" Threadolet	Each	1
11	7772212	3" Welded Tee	Each	2
12	7771452	4" X 3" Reducing Welded Elbow	Each	1
13	7910175	4" Flat Face Weld Neck Flanges	Each	2
14	7771452	4" X 3" Welded Reducer	Each	1
15	7771429	3" X 2" Welded Reducer	Each	3
16	10006801	2" Full Port Ball Valve	Each	1

Revision Date: 11-5-2012

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Design		Original Date 06/01/2006	Standard Number 59-C
Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

21.0 Rotary Meter Installation



Connector Parts List

Number	Stores Code	Quantity	MFG Part #	Description	Manufacturer
1	10023109	1	B-400-1-8BT	1/2"Male NPT X 1/4" OD Compression Bored Through Adapter	Swagelok
2	10023110	1	9020089S	1/2" NPT 4 1/2" U Thermowell 304SS	Eagle Research
3	10023122	1	01CP-4	1/4" Hex Plug	Parker
4	10023124	1	012T-4-4	1/4" Male Run Tee	Parker
5	10023123	1	012T-8-8	1/2" Male Run Tee	Parker
6	10023107	2	200-1-4	1/4" x 1/8" OD Compression Adapter	Swagelok
7	10023121	1	0102-8-4	1/2" x 1/4" Hex Bushing	Parker
8	NIS	3'		1/8" .035 Wall SS304 Tubing	Parker
9	7902866	1	H5RDC-22	1/4" Straight Needle Valve	Anderson Greenwood

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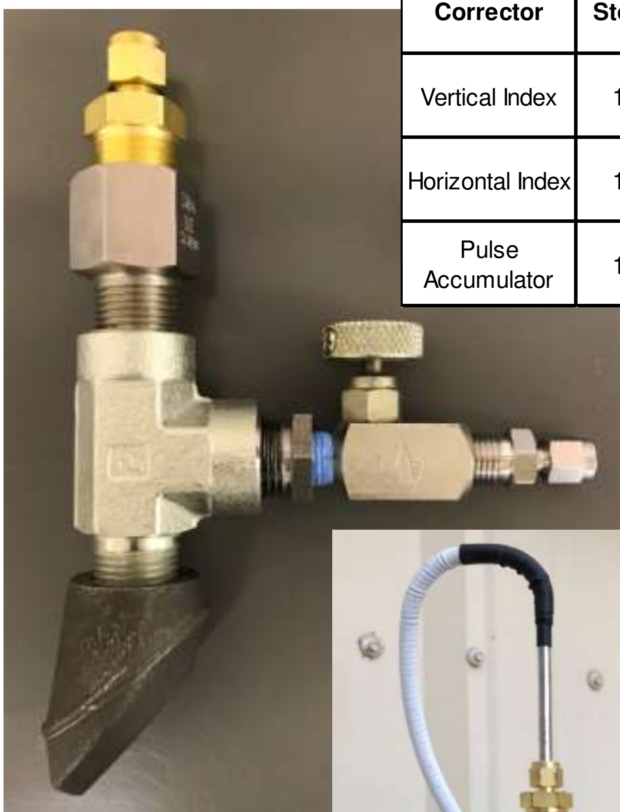
Corrector Stores Codes

Corrector	Stores Code	MFG Config	Application
Vertical Index	10008955	XARTU/1 - 1292F	10',100',1000' Output Drive Meters
Horizontal Index	10007231	XARTU/1-754F	5',10',100',1000' Output Drive Meters
Pulse Accumulator	10007485	XARTU/1-291F	Combined Fixed Temp and Fixed Pressure Meters



NorthWestern Energy

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Supersedes Standard: 59-A	REV# 12	Revision Date 01/01/2024	Prepared / Approved By AJ / Committee

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Installation		Original Date 06/01/2006	Standard Number 59-D
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning customer meter and regulator installation.

2.0 General

2.1 All gas meter sets and associated piping are to be installed in a workmanlike manner, free from excessive piping strain, straight and level. Piping and fittings (with the exception of brass valves) should be painted to protect the piping from atmospheric corrosion and provide an acceptable appearance to the public.

3.0 Transportation, Handling, and Storage

3.1 **Gas meters have delicate internal mechanisms and shall be handled with care at all times**. Gas meters shall always be secured and transported in an upright position with the inlet and outlet connection of the meter capped to prevent dirt, moisture or foreign material from entering. All piping and fittings shall be removed before transporting and storing.

3.2 Rotary meters shall not be transported with oil in the reservoir, either before installation or after removal.

3.3 Old meters that will not be put back in service shall also be handled with care throughout the removal, transportation, and proving process. This is to ensure that the final proving data is accurate.

4.0 Steel Lines Must Be Electrically Bonded Before Separating - This Includes Meter Changes

4.1 Proper jumpering of all steel gas lines is required to prevent electric shock or ignition of gas or other combustibles. Underground power lines, telephone cables, cathodic protection units, lightning strikes, and power lines faults can cause a harmful voltage to exist at any instant between two ends of separated pipe.

4.2 Meter sets are to be properly jumpered before the meter is removed or disconnected from house piping. Meter sets must be jumpered with a good jumper cable (copper wire) with insulated handles. In jumpering, connect jumper cable to the upstream meter stop valve first, and then connect to the house side of the meter. A jumper will be installed prior to installing a bypass hose that may be reinforced with metal wire. These hoses may draw an arc when connected or disconnected as well.

4.3 As the cathodic protection level on our system is increased, you may expect to see a minimal arc upon jumpering. If a large arc is created, report the situation to supervision before proceeding with the meter change and investigate the level of voltage present and its source.

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Installation		Original Date 06/01/2006	Standard Number 59-D
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

5.0 Installing Gas Meter and Regulator Sets

5.1 Control lines and fittings shall be Stainless Steel or Black Iron. Control lines will be installed in such a manner to be protected from damage.

5.2 Large Diaphragm meters should be supported by a solid, level footing or concrete pad to avoid settling and pipe strain.

5.3 Rotary meters should be supported by the piping being bracketed to the wall or structure such that the meter is level in all directions. The meter should never be in a bind from misaligned piping or flanges. **Flange bolts should be tightened to no more than 55 ft-lbs lubricated / 60 ft-lbs non-lubricated**.

5.4 The oil reservoir on rotary meters shall be filled to the proper level. The proper level is to the center of the site gauge. If the oil reservoir is improperly filled, either over filled or under filled, the meter can be damage.

6.0 Testing and Purging Gas Meter Sets

6.1 This information is for residential and some small commercial sets and may not apply to commercial/industrial customers.

6.2 Before gas is introduced into a system of new gas piping or into an existing system that has been shut off, the entire system shall be checked to determine that there are no open fittings or ends and that all manual valves on equipment are closed and all unused valves at outlets are closed and plugged or capped. All appliances must be checked to be certain that all units are off (shut-in condition).

6.3 If the meter set is equipped with an outlet valve, it is to be opened first. This is to be done very slowly until the valve is fully open. Next, crack the inlet valve to start filling the meter and start the meter operating. Then open the meter inlet valve fully.

6.4 If the system will be turned over to the customer and the meter set is equipped with a customer owned outlet valve, the outlet valve will remain closed and gas will be introduced to the meter only. At this point the system is turned over to the customer and downstream piping is their responsibility. Ensure this is permitted by local codes and tariffs.

6.5 CAUTION: Very small differential pressures across a diaphragm meter can cause severe internal damage. This damage is avoided by turning all valves very slowly in the order prescribed.

6.6 As soon as the valves are open, the piping system shall be checked to be certain no gas is escaping. Checking for leakage can be done by carefully observing the test dial of the meter and listening for the sound of gas flowing.

6.7 There are 2 methods to determine if the customer's piping is installed free of leaks. The first is a visual check of a pressure test. When local codes governing the testing of customer piping exist, the testing shall be conducted in accordance with those codes. In SD/NE, NFPA 54 guidelines will be followed.

Otherwise in MT customers must pressure test all new natural gas piping systems at 10 to 15 p.s.i. for at least 15 minutes before use. Disconnect all appliances and cap shut-off valves before testing to avoid damaging appliance regulators. In Montana when no other entity is inspecting the customer piping, NorthWestern Energy requires our representative to witness this test. The second is by performing a meter spot test. Any time a pressure test has not been observed directly by NWE personnel a meter spot test shall be performed. This is accomplished by allowing gas to escape through a test tap until the

NorthWestern Energy

Gas Standards Subject: Metering & Regulating Meter Set Installation		Original Date 06/01/2006	Standard Number 59-D
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

meter test hand is on the upstroke. The test tap is then closed or plugged and the meter test hand observed for a minimum of ten minutes. If the test hand moves under the shut in conditions previously described, a leak exists. All gas shall be shut off and the piping system repaired before proceeding.

6.8 After the piping is tested and found to be free of leaks, the system may be purged. Purging must be conducted in accordance with the State adopted version of the fuel gas code.

7.0 Adjusting Gas Regulators

7.1 Regulators should be adjusted for proper outlet pressure with the appliances operating.

7.1.1 For measurement, this pressure should be set at the inlet of the meter.

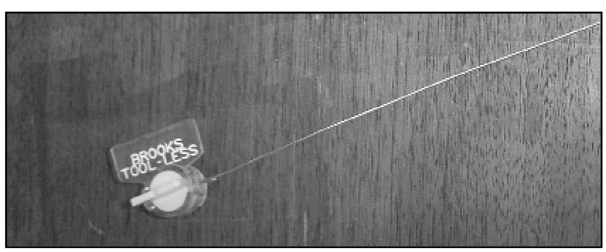
7.1.2 For residential metering, the pressure may be set at the test plug on the meter bar, if a LycoSaver Probe is used. It is still preferred to set the pressure on the inlet of the meter.

7.1.3 For larger commercial metering, an attempt should be made to set under actual load conditions.

7.2 If the regulator cannot be set with the appliances operating, they can be adjusted by bleeding gas from a test connection or open line to simulate a load. When adjusting inside regulators, gas used for adjusting shall be piped outside.

8.0 Sealing of Regulators

8.1 All customer regulators installed, adjusted, or maintained should, when practical and possible, be sealed with a wire tamper resistant seal. All regulators that operate at or above 14" w.c. that are installed, adjusted, or maintained shall be sealed with a wire tamper resistant seal. The purpose of this seal is to deter the adjustment of NWE's regulators by un-authorized persons, and at minimum alert service team members that un-authorized adjustment may have been done. Seals come in two lengths 10" (10006121) and 16" (10006122).



9.0 Records

9.1 On Service Orders for any Set Meter or Meter Change Order, the "Metering Pressure" is to be entered on the order. Due to the importance and complex nature of factored metering, gas supervisors must assume the responsibility of making sure that factored meters are properly entered in the Customer Information System (CIS) for billing.

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Gas Standards Subject: Metering & Regulating Atmospheric Pressure Tables		Original Date 06/01/2006	Standard Number 59-F
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

1.0 Scope

The scope of this standard is to provide lists of atmospheric pressure for the cities served by NorthWestern Energy. **These are the Atmospheric Pressures used by CIS, and should always be used when setting up instruments or calculating billing corrections.**

2.0 General

2.1 If a new installation is at an elevation that is significantly different from the distribution system, a different town code with the new atmospheric pressure may have to be established.

2.2 If no data on the altitude of the installation is available from maps, surveys, or other sources, a barometer can be used to measure the atmospheric pressure and the average calculated. Contact the Gas Measurement Department for assistance in this area.

3.0 Base Pressure

3.1 All measured volume corrected by the CIS system is to be metered at or corrected by factor to the average atmospheric pressure plus 1/4 psig. This is commonly called the “Local Base Pressure”. Other customers (Tier I and II) are commonly measured at a base pressure of 14.9 psig in MT or 14.73 psig in SD/NE. CIS converts volume from local base to 14.9 psig in MT or 14.73 psig in SD/NE.

4.0 Base Pressure or Base Volume Index

4.1 Base pressure or base volume indexes are used to measure gas at line or distribution pressures. They are calibrated for each individual installation and must be recalibrated and serviced annually. A Base Pressure Index (BPI) corrects for pressure only, a Base Volume Index (BVI) corrects for pressure and gas temperature. BVI’s are used on non-temperature compensated meters. These instruments have two reads associated with them. It is NWE standard to read Un-Corrected volume in Hundreds of Cubic Feet (ccf) and Corrected volume in Thousands of Cubic Feet (mcf).

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Gas Standards Subject: Metering & Regulating Atmospheric Pressure Tables		Original Date 06/01/2006	Standard Number 59-F
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

5.0 Montana

Atmosphere, Local Base Pressures, and Local Metering Factors (for clocking purposes only, not billing)

Location	Local Atm.	Local Base	½ psig	2 psig	5 psig	10 psig	15 psig
Absarokee	12.70	12.95	1.02	1.14	1.37	1.75	2.14
Amsterdam	12.48	12.73	1.02	1.14	1.37	1.77	2.16
Anaconda	12.36	12.61	1.02	1.14	1.38	1.79	2.19
Augusta	12.68	12.93	1.02	1.14	1.37	1.75	2.14
Barber	12.00	12.25	1.02	1.14	1.39	1.80	2.20
Belfry	12.00	12.25	1.02	1.14	1.39	1.80	2.20
Bigfork	13.30	13.55	1.02	1.13	1.35	1.72	2.09
Big Mountain	12.38	12.63	1.02	1.14	1.38	1.77	2.17
Big Sandy	13.34	13.59	1.02	1.13	1.35	1.72	2.09
Big Timber	12.36	12.61	1.02	1.14	1.37	1.76	2.14
Billings	13.00	13.25	1.02	1.14	1.37	1.77	2.16
Boulder	12.27	12.52	1.02	1.14	1.38	1.78	2.18
Box Elder	12.93	13.18	1.02	1.13	1.36	1.74	2.12
Bozeman	12.39	12.64	1.02	1.14	1.38	1.77	2.17
Brady	12.78	13.03	1.02	1.13	1.36	1.75	2.13
Browning	13.00	13.25	1.02	1.14	1.37	1.77	2.16
Butte	11.94	12.19	1.02	1.14	1.39	1.80	2.21
Carter	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Cascade	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Chester	13.13	13.38	1.02	1.13	1.36	1.73	2.10
Chinook	13.49	13.74	1.02	1.13	1.35	1.71	2.07
Choteau	12.80	13.05	1.02	1.13	1.36	1.75	2.13
Clancy	12.61	12.86	1.02	1.14	1.37	1.76	2.15
Clinton	12.98	13.23	1.02	1.13	1.36	1.74	2.11
Columbia Falls	13.19	13.44	1.02	1.13	1.35	1.73	2.10
Columbus	12.91	13.16	1.02	1.13	1.36	1.74	2.12
Conrad	12.95	13.20	1.02	1.13	1.36	1.74	2.12
Coram	13.12	13.37	1.02	1.13	1.36	1.73	2.10
Corvallis	12.96	13.21	1.02	1.13	1.36	1.74	2.12
Deer Lodge	12.45	12.70	1.02	1.14	1.37	1.77	2.16
Dillon	12.20	12.45	1.02	1.14	1.38	1.78	2.18
Drummond	12.74	12.99	1.02	1.13	1.37	1.75	2.14
Dutton	13.00	13.25	1.02	1.13	1.36	1.74	2.11

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5.0 Montana (continued)

Atmosphere, Local Base Pressures, and Local Metering Factors (for clocking purposes only, not billing)

Location	Local Atm.	Local Base	½ psig	2 psig	5 psig	10 psig	15 psig
East Glacier	12.34	12.59	1.02	1.14	1.38	1.77	2.17
East Helena	12.77	13.02	1.02	1.13	1.36	1.75	2.13
Elliston	12.23	12.48	1.02	1.14	1.38	1.78	2.18
Fairfield	12.72	12.97	1.02	1.13	1.37	1.75	2.14
Florence	13.10	13.35	1.02	1.13	1.36	1.73	2.10
Floweree	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Fort Benton	13.38	13.63	1.02	1.13	1.35	1.72	2.08
Fort Shaw	12.93	13.18	1.02	1.13	1.36	1.74	2.12
Gallatin Gateway	12.45	12.70	1.02	1.14	1.37	1.77	2.16
Garrison	12.80	13.05	1.02	1.13	1.36	1.75	2.13
Gildford	13.28	13.53	1.02	1.13	1.35	1.72	2.09
Great Falls	13.03	13.28	1.02	1.13	1.36	1.73	2.11
Greycliff	12.74	12.99	1.02	1.13	1.37	1.75	2.14
Hamilton	12.92	13.17	1.02	1.13	1.36	1.74	2.12
Harlem	13.51	13.76	1.02	1.13	1.35	1.71	2.07
Harlowton	12.63	12.88	1.02	1.14	1.37	1.76	2.15
Havre	13.45	13.70	1.02	1.13	1.35	1.71	2.08
Helena	12.74	12.99	1.02	1.13	1.37	1.75	2.14
Hingham	13.18	13.43	1.02	1.13	1.35	1.73	2.10
Hungry Horse	13.15	13.40	1.02	1.13	1.35	1.73	2.10
Inverness	13.05	13.30	1.02	1.13	1.36	1.73	2.11
Jefferson City	12.45	12.70	1.02	1.14	1.37	1.77	2.16
Joplin	13.05	13.30	1.02	1.13	1.36	1.73	2.11
Judith Gap	12.43	12.68	1.02	1.14	1.37	1.77	2.16
Kalispell	13.22	13.47	1.02	1.13	1.35	1.72	2.10
Kremlin	13.28	13.53	1.02	1.13	1.35	1.72	2.09
Laurel	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Lewistown	12.75	13.00	1.02	1.13	1.37	1.75	2.13
Livingston	12.36	12.61	1.02	1.14	1.38	1.77	2.17
Logan	12.65	12.90	1.02	1.14	1.37	1.76	2.14
Lohman	13.14	13.39	1.02	1.13	1.35	1.73	2.10
Lolo	13.10	13.35	1.02	1.13	1.36	1.73	2.10
Loma	13.40	13.65	1.02	1.13	1.35	1.71	2.08

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5.0 Montana (continued)

Atmosphere, Local Base Pressures, and Local Metering Factors (for clocking purposes only, not billing)

Location	Local Atm.	Local Base	½ psig	2 psig	5 psig	10 psig	15 psig
Manhattan	12.59	12.84	1.02	1.14	1.37	1.76	2.15
Martin City	13.15	13.40	1.02	1.13	1.35	1.73	2.10
Missoula	13.01	13.26	1.02	1.13	1.36	1.74	2.11
Moore	12.65	12.90	1.02	1.14	1.37	1.76	2.14
Muir	12.30	12.55	1.02	1.14	1.38	1.78	2.18
Philipsburg	12.14	12.39	1.02	1.14	1.38	1.79	2.19
Pondera Oil Field	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Reed Point	12.90	13.15	1.02	1.13	1.36	1.74	2.12
Red Lodge	12.02	12.27	1.02	1.14	1.39	1.79	2.20
Roberts	12.43	12.68	1.02	1.14	1.37	1.77	2.16
Rudyard	13.14	13.39	1.02	1.13	1.35	1.73	2.10
Shawmut	12.75	13.00	1.02	1.13	1.37	1.75	2.13
Sheridan	12.22	12.47	1.02	1.14	1.38	1.78	2.18
Simms	12.93	13.18	1.02	1.13	1.36	1.74	2.12
Sommers	13.24	13.49	1.02	1.13	1.35	1.72	2.09
Springdale	12.30	12.55	1.02	1.14	1.38	1.78	2.18
Stevensville	13.02	13.27	1.02	1.13	1.36	1.73	2.11
Sun River	13.00	13.25	1.02	1.13	1.36	1.74	2.11
Three Forks	12.68	12.93	1.02	1.14	1.37	1.75	2.14
Townsend	12.78	13.03	1.02	1.13	1.36	1.75	2.13
Trident	12.65	12.90	1.02	1.14	1.37	1.76	2.14
Twin Bridges	12.42	12.67	1.02	1.14	1.37	1.77	2.16
Valier	12.81	13.06	1.02	1.13	1.36	1.75	2.13
Vaughn	13.02	13.27	1.02	1.13	1.36	1.73	2.11
Victor	13.02	13.27	1.02	1.13	1.36	1.73	2.11
West Glacier	13.09	13.34	1.02	1.13	1.36	1.73	2.11
Whitefish	13.18	13.43	1.02	1.13	1.35	1.73	2.10
Whitehall	12.54	12.79	1.02	1.14	1.37	1.76	2.15
Wickes	12.74	12.99	1.02	1.13	1.37	1.75	2.14
Willow Creek	12.65	12.90	1.02	1.14	1.37	1.76	2.14
Wolf Creek	12.90	13.15	1.02	1.13	1.36	1.74	2.12

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Gas Standards Subject: Metering & Regulating Atmospheric Pressure Tables		Original Date 06/01/2006	Standard Number 59-F
Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

6.0 South Dakota / Nebraska

Atmosphere, Local Base Pressures, and Local Metering Factors
(for clocking purposes only, not billing)

Location	Local Atm.	Local Base	½ psig	2 psig	5 psig	10 psig	15 psig
Aberdeen, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Alda, NE	13.08	13.33	1.02	1.13	1.36	1.73	2.11
Alexandria, SD	14.02	14.27	1.02	1.12	1.33	1.68	2.03
Altamont, SD	13.79	14.04	1.02	1.12	1.34	1.69	2.05
Arlington, SD	13.78	14.03	1.02	1.12	1.34	1.69	2.05
Aurora, SD	13.89	14.14	1.02	1.12	1.34	1.69	2.04
Big Stone City, SD	14.10	14.35	1.02	1.12	1.33	1.68	2.03
Bristol, SD	13.81	14.06	1.02	1.12	1.34	1.69	2.05
Brookings, SD	13.89	14.14	1.02	1.12	1.34	1.69	2.04
Bryant, SD	13.78	14.03	1.02	1.12	1.34	1.69	2.05
Canistota, SD	13.91	14.16	1.02	1.12	1.34	1.69	2.04
Castlewood, SD	13.87	14.12	1.02	1.12	1.34	1.69	2.04
Clark, SD	13.78	14.03	1.02	1.12	1.34	1.69	2.05
Clear Lake, SD	13.78	14.03	1.02	1.12	1.34	1.69	2.05
Conde, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
DeSmet, SD	13.84	14.09	1.02	1.12	1.34	1.69	2.05
Dimock, SD	14.02	14.27	1.02	1.12	1.33	1.68	2.03
Doland, SD	14.02	14.27	1.02	1.12	1.33	1.68	2.03
Estelline, SD	13.86	14.11	1.02	1.12	1.34	1.69	2.05
Ethan, SD	14.02	14.27	1.02	1.12	1.33	1.68	2.03
Ferney, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Fordham, SD	13.93	14.18	1.02	1.12	1.33	1.69	2.04
Frankfort, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Goodwin, SD	13.72	13.97	1.02	1.13	1.34	1.70	2.06
Grand Island, NE	13.80	14.05	1.02	1.12	1.34	1.69	2.05
Groton, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Hayti, SD	13.87	14.12	1.02	1.12	1.34	1.69	2.04
Hazel, SD	13.82	14.07	1.02	1.12	1.34	1.69	2.05
Holmquist, SD	13.81	14.06	1.02	1.12	1.34	1.69	2.05
Howard, SD	13.91	14.16	1.02	1.12	1.34	1.69	2.04
Huron, SD	14.07	14.32	1.02	1.12	1.33	1.68	2.03
Kearney, NE	13.65	13.90	1.02	1.13	1.34	1.70	2.06
Kranzburg, SD	13.71	13.96	1.02	1.13	1.34	1.70	2.06

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Supersedes Standard: 59-A	REV# 10	Revision Date 04/01/2017	Prepared / Approved By AJ / Committee

6.0 South Dakota / Nebraska (continued)

Atmosphere, Local Base Pressures, and Local Metering Factors (for clocking purposes only, not billing)							
Location	**Local Atm.**	**Local Base**	**½ psig**	**2 psig**	**5 psig**	**10 psig**	**15 psig**
LaBolt, SD	14.01	14.26	1.02	1.12	1.33	1.68	2.03
Lake Norden, SD	13.87	14.12	1.02	1.12	1.34	1.69	2.04
Lake Preston, SD	13.84	14.09	1.02	1.12	1.34	1.69	2.05
Madison, SD	13.86	14.11	1.02	1.12	1.34	1.69	2.05
Marion, SD	13.97	14.22	1.02	1.12	1.33	1.69	2.04
Menno, SD	14.03	14.28	1.02	1.12	1.33	1.68	2.03
Milbank, SD	14.10	14.35	1.02	1.12	1.33	1.68	2.03
Mitchell, SD	14.06	14.31	1.02	1.12	1.33	1.68	2.03
Monroe, SD	13.94	14.19	1.02	1.12	1.33	1.69	2.04
Mount Verdon, SD	14.00	14.25	1.02	1.12	1.33	1.68	2.04
North Platte, NE	13.35	13.60	1.02	1.13	1.35	1.72	2.08
Oldham, SD	13.83	14.08	1.02	1.12	1.34	1.69	2.05
Olivet, SD	14.07	14.32	1.02	1.12	1.33	1.68	2.03
Parker, SD	14.03	14.28	1.02	1.12	1.33	1.68	2.03
Parkston, SD	14.00	14.25	1.02	1.12	1.33	1.68	2.04
Raymond, SD	13.97	14.22	1.02	1.12	1.33	1.69	2.04
Redfield, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Revillo, SD	14.09	14.34	1.02	1.12	1.33	1.68	2.03
Scotland, SD	14.03	14.28	1.02	1.12	1.33	1.68	2.03
Spencer, SD	14.01	14.26	1.02	1.12	1.33	1.68	2.03
Tripp, SD	13.95	14.20	1.02	1.12	1.33	1.69	2.04
Turton, SD	14.04	14.29	1.02	1.12	1.33	1.68	2.03
Verdon, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Vienna, SD	13.79	14.04	1.02	1.12	1.34	1.69	2.05
Volga, SD	13.88	14.13	1.02	1.12	1.34	1.69	2.04
Warner, SD	14.05	14.30	1.02	1.12	1.33	1.68	2.03
Webster, SD	13.78	14.03	1.02	1.12	1.34	1.69	2.05
Willow Lake, SD	13.81	14.06	1.02	1.12	1.34	1.69	2.05
Yale, SD	14.03	14.28	1.02	1.12	1.33	1.68	2.03

NorthWestern Energy

Gas Standards Subject: Metering & Regulating MAOP Tables		Original Date 06/01/2006	Standard Number 59-G
Supersedes Standard: 59-A	REV# 11	Revision Date 01/01/2026	Prepared / Approved By AJ / Committee

1.0 Scope

The scope of this standard is to provide lists of Maximum Allowable Operating Pressures (MAOP) for the Gate Stations, District Regulators, and Border Stations served by NorthWestern Energy.

This standard has been relocated to the Gas Distribution SharePoint, so that it can be updated on an as needed basis.

NorthWestern Energy

Gas Standards Subject: Valves Valves: System Valve Criteria		Original Date 06/01/2006	Standard Number 61-A
Supersedes Standard: 61-A	REV# 3	Revision Date 01/01/2024	Prepared / Approved By DS/AJ / Committee

1.0 Scope

The purpose of this standard is to set the parameters for the requirements of NorthWestern Energy's general design procedures and policies concerning valves installed on distribution systems. These procedures are intended to comply with the requirements as set by the Department of Transportation CFR 49 Part 192.181.

2.0 Valve Design and Construction

2.1 Valves installed on a main within a gas distribution system shall meet the criteria set forth in Construction Standards 61-B, 61-C or 61-D, as appropriate.

3.0 Valve Placement

3.1 Each high-pressure distribution system must have valves spaced to reduce the time to shut down a section of main in an emergency. The valve spacing is determined by the operating pressure, the size of the mains, and the local physical conditions.

3.1.1 Typically, valves should be available in order to isolate a portion of a distribution system that generally serves 500 customers, or less. However, isolation of 500 or fewer customers may not always be practical and is left to the discretion of the design engineer and local operating area.

3.1.1.1 Consideration may be given to how the location of the valves used to isolate a section of distribution system may affect supply to the remainder of the distribution system.

3.1.1.2 Consideration may also be given to the effect on certain types of customers such as hospitals, schools, commercial and industrial users, when determining valve locations (either the ability to maintain gas supply to these types of customers, or the ability to isolate these types of customers from sources of gas supply).

3.1.1.3 Consideration should be given to mobile home parks in areas susceptible to damaging winds. Mobile homes are more vulnerable to damage during windstorms and these areas may have to be shut down in an emergency.

3.2 Each distribution system may have valves installed to aid in construction or maintenance activities. Following are suggested locations of valves installed on distribution systems:

3.2.1 At any reduction in main size,

3.2.2 Small runs off a larger header,

3.2.3 At any lateral tap off a main.

NorthWestern Energy

Gas Standards Subject: Valves Valves: System Valve Criteria		Original Date 06/01/2006	Standard Number 61-A
Supersedes Standard: 61-A	REV# 3	Revision Date 01/01/2024	Prepared / Approved By DS/AJ / Committee

4.0 Designation of Valves

The valves referred to in 3.1 are those necessary for the sectionalizing of the distribution system, so that an operator can isolate a particular section of the distribution system in an emergency, and shall be considered "key"/"zone". All systems have at least one "key"/"zone" valve. Valves for sectionalizing should be considered at the following locations:

4.1 Inlet and/or outlet valve(s) at a pressure regulation station. For NWE Distribution the valve at the outlet of the regulator station or farm tap will be considered the "zone" valve and will be maintained annually not to exceed 15 months.

4.2 Principal feed(s) to business districts and class 4 locations.

4.3 Valves that meet the following:

4.3.1 Reasonable for a sectionalizing plan.

4.3.2 Number of customers

4.3.3 Volume of gas

4.3.4 Environment

4.3.5 Response time / valve accessibility

4.4 If a valve does not meet the criteria stated in 4.1 through 4.3, it should be classified as a "non critical" valve.

4.4.1 Non critical valves shall be designated to one of the following:

4.4.1.1 Convenience Valve

4.4.1.2 Construction Valve

4.5 Once a valve is classified as "non critical":

4.5.1 Underground valves do not need to be maintained.

4.5.2 Aboveground valves are subject to atmospheric corrosion reports

5.0 "Key" / "Zone" Valves

5.1 Each valve on a main installed for operating or emergency purposes must comply with the following:

5.1.1 The valve must be placed in a readily accessible location to make it easy to operate in an emergency.

5.1.2 The operating stem or mechanism must be readily accessible.

5.1.3 If the valve is installed in a buried box or enclosure, the box or enclosure must be installed so as to avoid causing external loads to the main.

5.2 Valves meeting the designation of key/zone valves shall be added to the annual key/zone valve list and maintained in accordance with O&M Standard 3260.

5.3 Mapping of all valve installations is critical. All information shall be given to drafting for proper documentation.

1.0 Scope

The purpose of this standard is to set the parameters for the requirements of NorthWestern Energy's general design procedures and policies concerning steel valves. These procedures are intended to comply with the requirements as set by the Department of Transportation CFR 49 part 192.145.

2.0 Valves

2.1 Each valve must meet the minimum requirements, or equivalent of API 6D. The valves are to be weld type ANSI Class 150 shown below. A valve may not be used under operating conditions that exceed the applicable pressure-temperature ratings contained in those requirements.

2.2 All valves will be full ported to allow for pigging of the main.

2.3 Each valve must be able to meet the anticipated operating conditions.

2.4 Valves having shell components made of ductile iron may be used at pressures less than 80% of the pressure ratings for comparable steel valves at their listed temperature if the following items are met.

2.4.1 The temperature-adjusted service pressure does not exceed 1000 psig, and

2.4.2 Welding is not used on any ductile iron component in the fabrication of the valve shells or their assembly.

Balon 285psig (ANSI Class 150) Underground Pipeline		
	2"	10006801
	3"	10006802
	4"	10006803
BROEN Ballomax 285psi (ANSI Class 150) Underground Pipeline		
	2"	10004661
	4"	10004662
	6"	10004663
BROEN Ballomax 285psi (ANSI Class 150) Underground Pipeline		
	8"	10009106
BROEN Ballomax 285psi (ANSI Class 150) Above Ground (Meter Sets)		
	2"	10008633
	3"	10008634
	4"	10008636

3.0 Valve Installation

3.1 No below ground steel valves shall be installed in a plastic system.

All below ground valves shall be installed in a buried box or enclosure. The box or enclosure must be installed so as to avoid causing external loads to the main.

4.0 Valve Placement

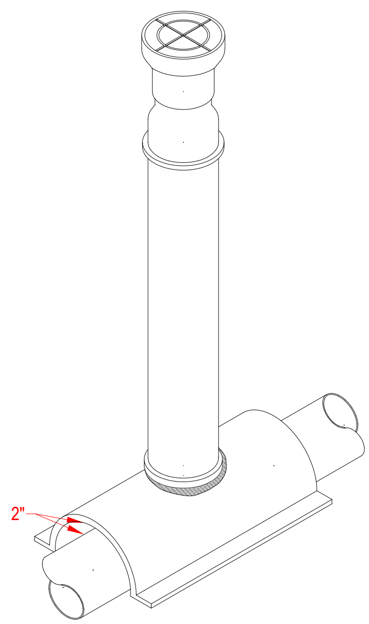
Refer to construction standard 61-A for considerations related to valve placement in gas distribution systems.

5.0 Valve box installation

Valve boxes are to be installed with compacted backfill and proper blocking or arched bottom so as not to be supported by the pipe. See diagram below for spacing between the top of the pipe to the bottom of the arched piece on the valve box. Valve boxes are stores coded.

Bases: # 10006641 for valves 2" through 4", # 10009123 for valves 6" to 10"

Top assembly: consisting of 2 adjusting parts and a lid (fits both bases) #6760176



NorthWestern Energy

Gas Standards Subject: Valves Valves: Plastic Valves		Original Date 06/01/2006	Standard Number 61-C
Supersedes Standard: 61-C	REV# 3	Revision Date 08/01/2022	Prepared / Approved By AJ / DS / Committee

1.0 Scope – Plastic Valve Installation

The purpose of this standard is to describe the requirements of NorthWestern Energy's general installation procedures and policies concerning plastic valves. These procedures are intended to comply with the requirements as set by the Department of Transportation CFR 49 part 192.145 and 192.193.

2.0 Valve Design

2.1 All plastic valves installed into NorthWestern Energy's system must have a maximum service pressure rating for temperatures that equal or exceed the maximum service temperature.

2.2 All plastic valves installed by NorthWestern Energy must be fully ported, tested, rated for pressure and temperature, and certified by the Manufacturer in accordance to DOT certification.

3.0 Valve Installation

3.1 Plastic valves installed in coiled plastic pipe must be suitably restrained to prevent any rotation that may occur. Sections of straight pipe may be used on both sides of the valve to reduce this rotation effect.

3.2 All valves installed in plastic pipe must be placed to protect the plastic material against excessive torsional or shearing loads from both valve shutoff operation and any other secondary stresses that may be exerted through the valve or its enclosure.

3.3 Steel valves shall not be installed on plastic mains (below ground) in order to reduce torsional loading on the main and to eliminate potential cathodic protection concerns.

3.4 If the valve is installed in a buried valve box or enclosure, the valve box must be installed with compacted backfill and proper blocking or must have an arched bottom to avoid using the plastic pipe as support for the structure. Refer to construction standard 61-B, paragraph 5.0 for additional instruction.

3.5 The use of valves is encouraged on pipe main diameters larger than three (3) inches to minimize the squeezing of large pipe.

4.0 Valve Placement

4.1 Refer to construction standard 61-A for considerations related to valve placement in gas distribution systems.

5.0 Valve Box Installation

5.1 Refer to construction standard 61-B, paragraph 5.0 for instruction on valve box installation.

NorthWestern Energy

Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

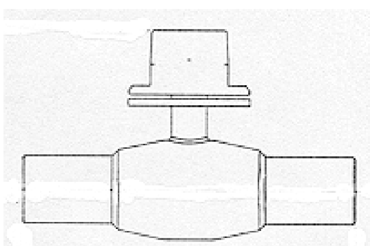
1.0 Scope

The purpose of this standard is to set the parameters for the requirements of NorthWestern Energy's general design procedures and policies concerning steel valves installed in plastic mains. These procedures are intended to comply with the requirements as set the Department of Transportation CFR 49 part 192.145 and 192.193.

2.0 Valve Design

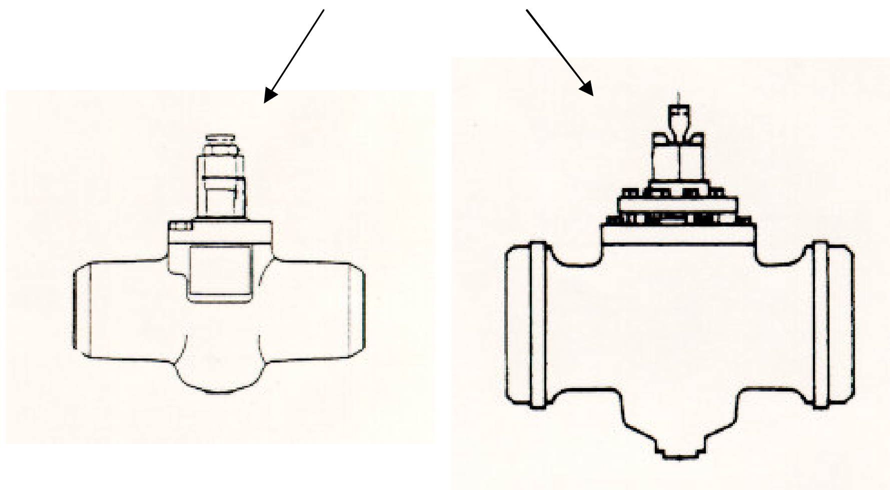
2.1 Each steel valve must meet the minimum requirements, or equivalent of API 6D. The valves are to be weld type or flanged type ANSI Class 150 shown below. A valve may not be used under operating conditions that exceed the applicable pressure-temperature ratings contained in those requirements.

Ball Type



3/4" thru 8"

Plug Type



GATE VALVE

2.2 Each valve installed in plastic pipe must be designed so as to protect the plastic 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.

2.2.1. The valve must have a maximum service pressure rating for temperatures that equal or exceed the maximum service temperature

2.2.2. All valves used by NWE are tested, rated for pressure and temperature, and certified by the Manufacturer according to DOT certification.

2.3 Each valve must be able to meet the anticipated operating conditions.

2.4 Valves having shell components made of ductile iron may be used at pressures less than 80% of the pressure ratings for comparable steel valves at their listed temperature if the following items are met.

2.4.1. The temperature-adjusted service pressure does not exceed 1000 psig, and

2.4.2. Welding is not used on any ductile iron component in the fabrication of the valve shells or their assembly.

NorthWestern Energy

Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

3.0 Valve Installation

3.1 Refer to figures 1 through 4 for detail of installation of this valve assembly.

3.2 No below ground steel valves shall be installed in a plastic system.

3.3 Steel hairpin valves may be installed above ground in a plastic system. Bolsters/barricades shall be used to protect the valve from anticipated damage.

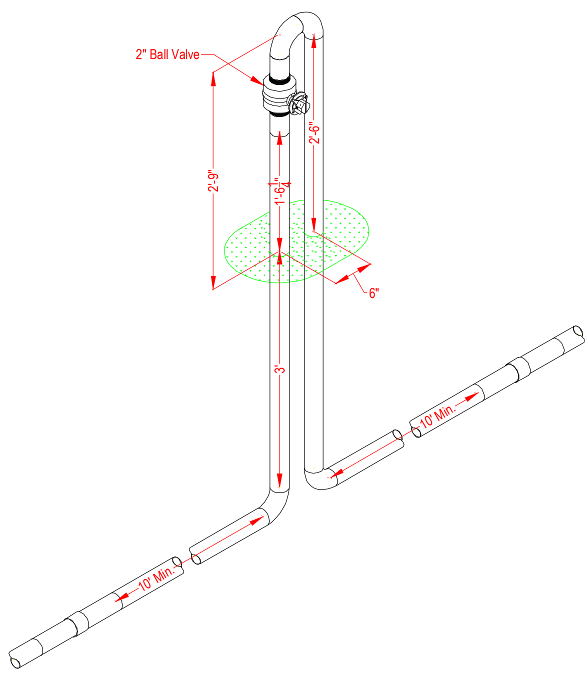
3.4 Any above ground hairpin valves, installed on plastic mains, will have a minimum of ten (10) feet of steel pipe installed on the inlet side of the below grade inlet elbows, and ten (10) feet of steel pipe installed on the outlet side of the below grade outlet elbows.

3.5 Hairpins in plastic systems are considered separately protected and shall have cathodic protection & test stations. Refer to O&M standard 3330 for corrosion control monitoring requirements imposed on separately protected sections of pipelines.

4.0 Valve Placement

Refer to construction standard 61-E for considerations related to valve placement in gas distribution systems.

Figure 1: Ball Valve Installations



NorthWestern Energy

Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

Figure 2: Plug Valve Installations

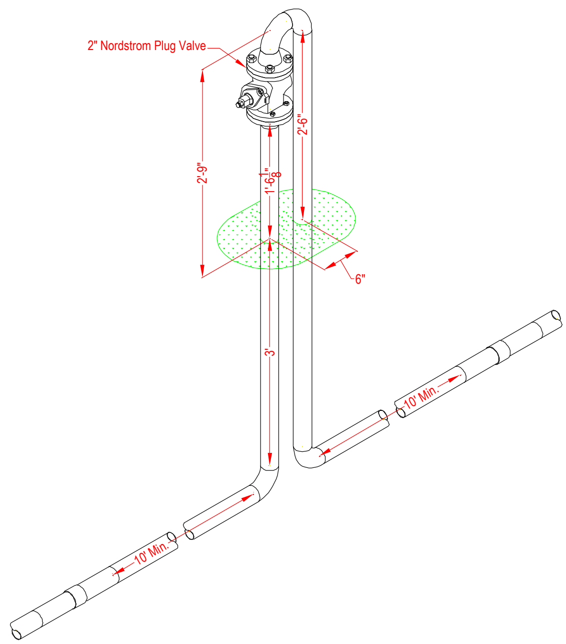
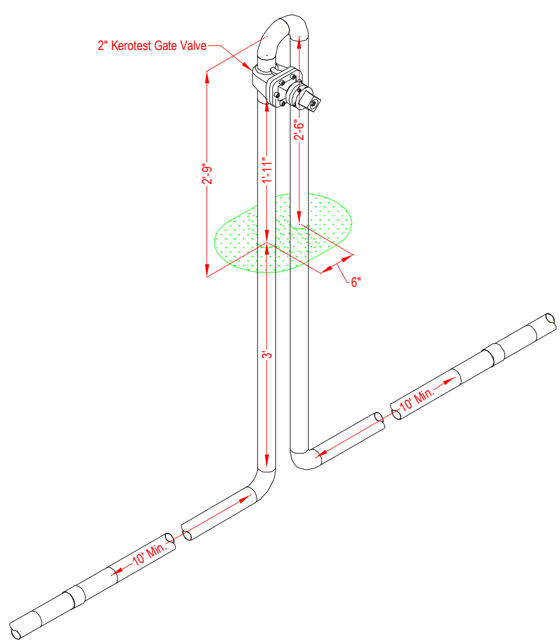


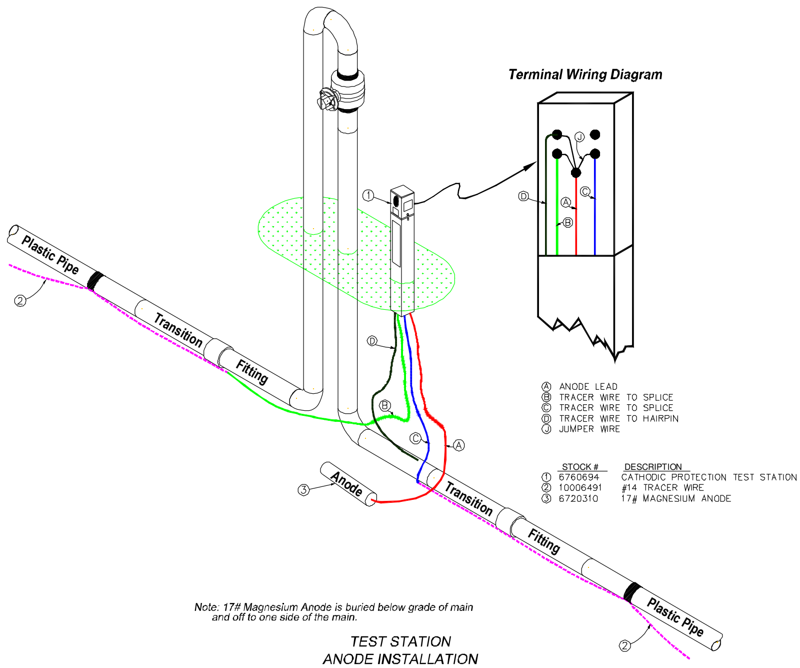
Figure 3: Gate Valve Installations



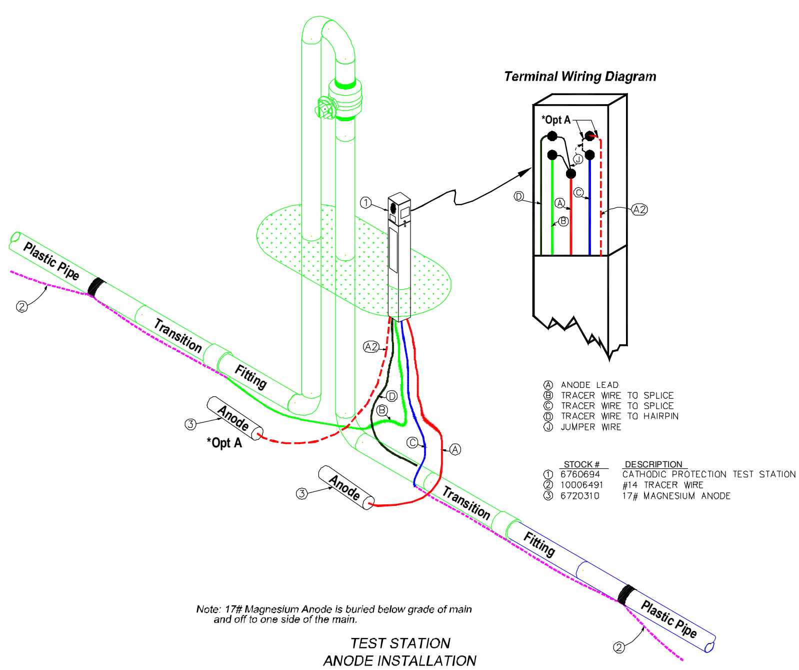
NorthWestern Energy

Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

Figure 4: Cathodic Protection on all SteelValves in Plastic Systems



TEST STATION
ANODE INSTALLATION
PLASTIC TO PLASTIC (NO ISOLATION)
FIGURE 1

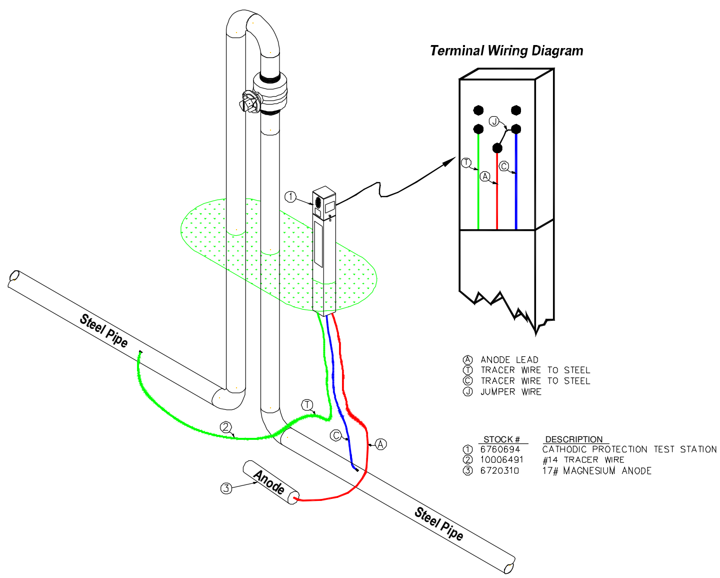


TEST STATION
ANODE INSTALLATION
PLASTIC TO PLASTIC (ISOLATION)
FIGURE 2

NorthWestern Energy

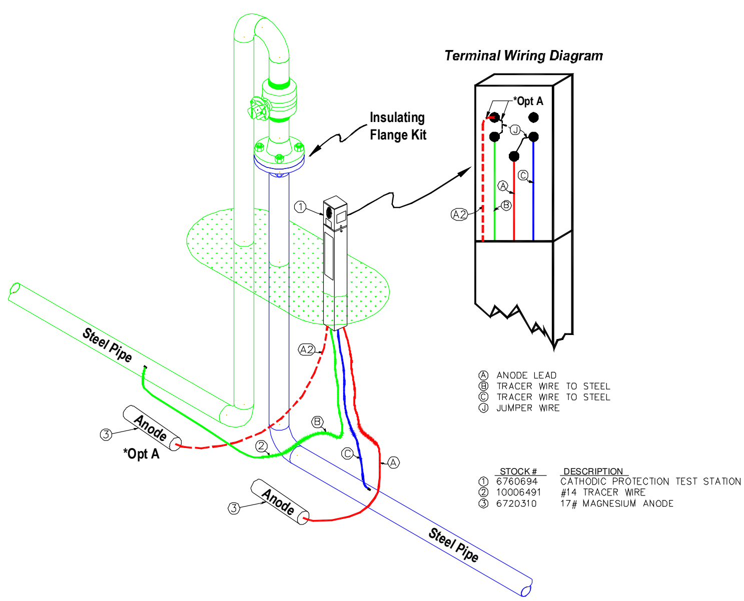
Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

Figure 4: Cathodic Protection on Valves (cont.)



Note: 17# Magnesium Anode is buried below grade of main and off to one side of the main.

TEST STATION
ANODE INSTALLATION
STEEL TO STEEL (NO ISOLATION)
FIGURE 3



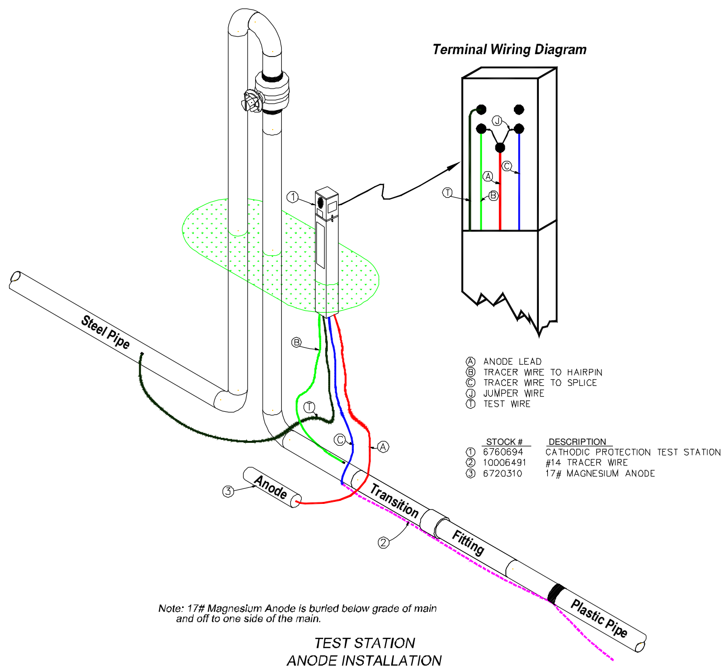
Note: 17# Magnesium Anode is buried below grade of main and off to one side of the main.

TEST STATION
ANODE INSTALLATION
STEEL TO STEEL (ISOLATION)
FIGURE 4

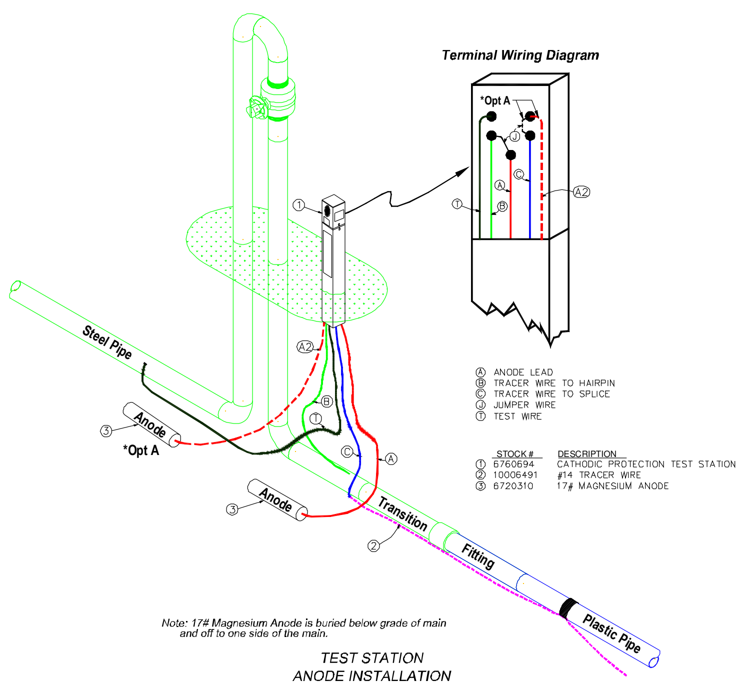
NorthWestern Energy

Gas Standards Subject: Valves Valves: Steel Valve in Plastic Main (Hairpins)		Original Date 06/01/2006	Standard Number 61-D
Supersedes Standard: 61-D	REV# 3	Revision Date 05/25/2010	Prepared / Approved By D. Sampson / Committee

Figure 4: Cathodic Protection on Valves (cont.)



TEST STATION
ANODE INSTALLATION
STEEL TO PLASTIC (NO ISOLATION)
FIGURE 5



TEST STATION
ANODE INSTALLATION
STEEL TO PLASTIC (ISOLATION)
FIGURE 6

NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV# 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

1.0 Scope

This standard describes NorthWestern Energy's requirements for Excess Flow Valve application in accordance with DOT 49 CFR part 192.381, 192.383, 192.385, and the PIPES Act of 2006.

2.0 *Definitions*

2.1 ***Branched service line*** *(piggy back line) means a gas service line that begins at the existing service line or is installed concurrently with the primary service line but serves a separate residence.*

2.2 ***Replaced service line*** *means a gas service line where the fitting that connects the service line to the main is replaced or the piping connected to this fitting is replaced.* As a guideline, it is good practice to install an EFV when working on the service line in the easement, alley, or road where the main is installed.

2.3 ***Service line serving a single-family residence*** *means a gas service line that begins at the fitting that connects the service line to the main and serves only one single-family residence (SFR).*

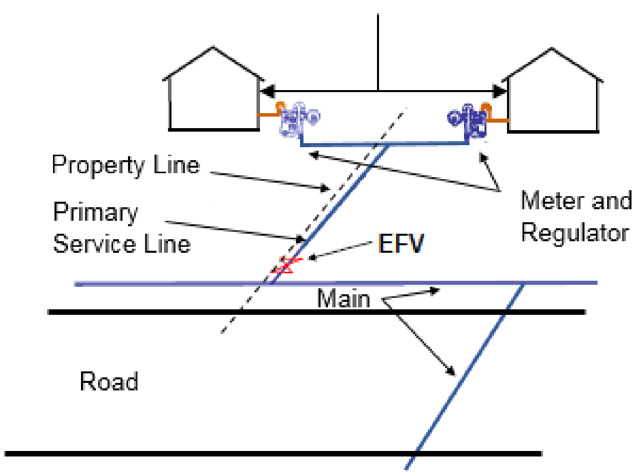
2.4 ***Manual service line shut-off valve*** *means a curb valve or other manually operated valve located near the service line that is safely accessible to operator personnel or other personnel authorized by the operator to manually shut off gas flow to the service line, if needed.*

3.0 *Installation Requirement*

Each operator must install an EFV that meets the performance requirements of 192.381, on any ***new or replaced*** *service line serving the following types of services before the line is activated*:

3.1 *A single service line serving a single-family residence.* This has been required since 02/12/10 (192.383).

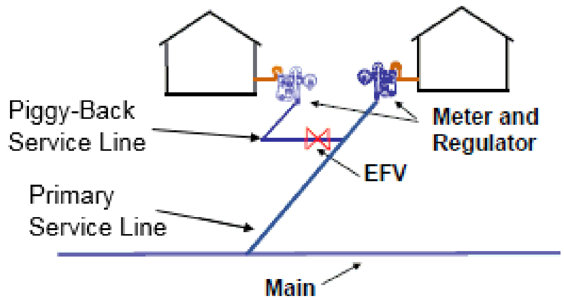
3.2 *A branched service lines to a single family residence installed concurrently with the primary single family residence service line.* Meaning, a single EFV may be installed near the main to protect both the primary service line and a piggy back service line. This option only applies to two single family residential services.



NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV # 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

3.3 *A branched service line to a single family residence installed off a previously installed single family residence service line that does not contain an EFV.* Meaning, a newly installed piggy back line will require an EFV, if the primary service line does not already contain an EFV.



3.4 *Multifamily residences (condos, apartments).*

3.5 *Commercial services.*

Summary

	Single Family Residence		Multifamily Residences		Commercial	
Capacity	< 9,091 scfh	>= 9,091 scfh	< 9,091 scfh	>= 9,091 scfh	< 9,091 scfh	>= 9,091 scfh
Single Service	EFV	Call Standards	EFV	Valve	EFV	Valve
Piggyback Service	One EFV at the main to cover both branches, or One EFV for the new branch.	Call Standards	EFV for new branch	One Valve for the new branch, or One Valve at the main to cover both branches	EFV for new branch	One Valve for the new branch or One Valve, at the main to cover both branches

* Call standards for situations involving low pressures (less than 10psig)

4.0 ***<u>Exceptions to EFV installation requirement</u>***

An operator need not install an excess flow valve if one or more of the following conditions are present:

4.1 *The service line operates at a pressure of 10psig or less throughout the year*.

4.2 *The operator has prior experience with contaminants in the gas stream that could interfere with the EFV's operation or cause loss of service to a customer*.

4.3 *An EFV could interfere with necessary operation or maintenance activities, such as blowing liquids from the line*.

4.4 *An EFV meeting the performance standards in 192.381 is not commercially available to the operator*. Above 9,000scfh, EFVs are limited. If an EFV is commercially available, it is required. As of the latest edition of this manual, EFVs up to 9,091scfh (anticipated load based on installed meter capacity) are commercially available. If an EFV is NOT commercially available, i.e. anticipated load is above 9,091scfh, then the following is required:

4.4.1 Single family residences – Contact NWE DOT Coordinator or Gas Standards.

4.4.2 Branched services lines – Contact NWE DOT Coordinator or Gas Standards.

4.4.3 Multifamily residences (condos, apartments) – In areas of higher pressures, the largest EFV (9,091scfh) may be able to be used for larger loads. Contact Gas Standards for guidance. If the largest EFV cannot be used, then a manual service line shut-off valve is required.

4.4.4 Commercial services – In areas of higher pressures, the largest EFV (9,091scfh) may be able to be used for larger loads. Contact Gas Standards for guidance. If the largest EFV cannot be used, then a manual service line shut-off valve is required.

5.0 Records

5.1 The manufacturer, model and size of the EFV shall be recorded on the proper NorthWestern Energy service (ditch) card. It is required that on the service (ditch) card, the distance that the EFV is from either the main, the service split, or the riser is recorded.

5.2 Manual shut-off valves will be recorded on the ditch card and mapped.

5.3 In the event that an excess flow valve is not installed on a service line due to prior experiences with contaminants, documentation should be kept indicating why the EFV was not installed at that location.

6.0 Location

6.1 EFV Location

6.1.1 *All Excess Flow Valves should be installed at or as near to NorthWestern Energy's mains as practical*.

6.1.2 Instances where a service will be installed from steel main, the service will transition from steel to plastic, as close to the tap as practical. The remainder of the service will be plastic with the appropriate EFV installed in accordance with this standard. **New steel services shall not be installed to single-family residences.**

6.1.3 Replaced service line - As a guideline, it is good practice to install an EFV when working on the service line in the easement, alley, or road where the main is installed.

6.2 Manual Service Line Shut-Off Valve Location

6.2.1 The valve should be placed in a location easily accessible by emergency workers. The valve should be installed as close to the main as practical, while considering protection from hazards.

6.2.2 A Manual Service Line Shut-Off Valve does not have to be an underground valve.

7.0 Costs

7.1 Labor and material costs for the EFV is part of normal business and included in the estimated costs for a NEW service.

7.2 The customer will bear the costs of the labor and material to install a customer requested EFV on an EXISTING service.

8.0 Sizing Excess Flow Valves

When in doubt, contact Gas Standards.

8.1 When sizing an Excess Flow Valve and associated service the following factors need to be known:

- Maximum anticipated connected customer gas load in scfh.
- The maximum anticipated length of the service downstream of the EFV in feet.
- Based on the parameters above in some situations a larger diameter service could be required to accommodate a correctly sized EFV.

EFV LOAD SIZING TABLE - MDPE (YELLOW)

					Length (ft) of Service for each Pipe Diameter*					
Area	Material Code	Off the Shelf Size	EFV Model	Max Load (scfh)	1/2" CTS	1/2" IPS	3/4" IPS	1" IPS	1 1/4" IPS	2" IPS
MT/SD/NE	10007305		NorthWestern EFV Tag							
SD/NE	10002765	1/2" CTS	UMAC Series 350	364	145					
MT	7900280	1/2" IPS	UMAC Series 700	630		421	1527			
MT	7900280	1/2" IPS	Lyall Series 775	705		273	990	2887		
MT	10025477	1/2" IPS	GFCP 800 Purple Series	720		108	384	1105	2980	
MT/SD/NE	10008231	3/4" IPS	UMAC Series 700	630		421	1527			
MT/SD/NE	10025471	3/4" IPS	GFCP 700 Orange Series	630		380	1357			
MT/SD/NE	10024687	3/4" IPS	IPEX/Friatec Electrofusion	677			1806			
MT/SD/NE	10018151	3/4" IPS	UMAC Series 1100	990		186	675	1968		
MT/SD/NE	10025476	3/4" IPS	GFCP 1100 Gray Series	990		171	612	1760		
MT/SD/NE	10018282	3/4" IPS	UMAC Series 1800	1800		45	162	473	1291	
MT/SD/NE	10025472	3/4" IPS	GFCP 1800 Green Series	1800		49	174	501	1352	
MT/SD/NE	10025478	1" IPS	GFCP Series 700 Orange	630		380	1357	3903		
MT/SD/NE	7900282	1" IPS	Lyall Series 775 Model 855	777		221	803	2341		
MT/SD/NE	10025473	1" IPS	GFCP Series 1100 Gray Series	990		171	612	1760		
MT/SD/NE	10024683	1" IPS	IPEX/Friatec Electrofusion	1100		204		2155		
MT/SD/NE	10008232	1" IPS	Lyall Series 1200 Model 1320	1200		76	278	809	2210	
MT/SD/NE	10025474	1" IPS	GFCP Series 1800 Green Series	1800		49	174	501	1352	
SD/NE	10018152	1" IPS	UMAC Series 2600	2340		19	70	205	560	
MT	10018152	1" IPS	Lyall Series 2600	2340		19	68	198	541	
MT/SD/NE	10025475	1" IPS	GFCP Series 2600 Pink Series	2340		11	38	109	293	1794
MT/SD/NE	10008296	1 1/4" IPS	UMAC Series 1100	990		186	675	1968	5374	
MT/SD/NE	10008297	1 1/4" IPS	UMAC Series 1800	1800		45	162	473	1291	
MT/SD/NE	10008298	1 1/4" IPS	UMAC Series 2600	2340		19	70	205	560	
MT/SD/NE		1 1/4" IPS	GFCP Series 2600 Pink Series	2340		11	38	109	293	1794
MT/SD/NE	10008299	2" IPS	UMAC Series 5500	5000		10	38	111	303	1899
MT/SD/NE	10018153	2" IPS	UMAC Series 10000	9000		3	11	31	86	536

NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV# 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

EFV LOAD SIZING TABLE - STEEL

Area	Material Code	Off the Shelf Size	EFV Model	Max Load (scfh)	Length (ft) of Service for each Pipe Diameter		
					3/4" Steel	1" Steel	2" Steel
MT/SD/NE	*10011733	3/4" Steel	Lyall Series 775	705	931	2948	
MT/SD/NE	10011734	3/4" Steel	Lyall Series 1800	1636	69	217	
SD/NE	10023503	3/4" Steel	UMAC Series 2600	2340	64	202	
MT/SD/NE	*10011735	1" Steel	Lyall Series 775	705	931	2948	
MT/SD/NE	*10011736	1" Steel	Lyall Series 1200 Model 1320	1091	343	1086	
MT/SD/NE	10011737	1" Steel	Lyall Series 1800	1636	69	217	
MT/SD/NE	10023101	2" Steel	UMAC Series 5500	5000	36	113	1332
MT/SD/NE	10023102	2" Steel	UMAC Series 10000	9000	10	32	667

Steel is for maintenance and retrofitting only, not new construction.

EFV LOAD SIZING TABLE - HDPE (BLACK)

Area	Material Code	Off the Shelf Size	EFV Model	Max Load (scfh)	Length (ft) of Service for each Pipe Diameter					
					1/2" CTS	1/2" IPS	3/4" IPS	1" IPS	1 1/4" IPS	2" IPS
MT/SD/NE	10024687	3/4" IPS	IPEX/Friatec Electrofusion	677			1806			
SD/NE	10018521	3/4" IPS	UMAC Series 1800	1800		45	162	473	1291	
MT/SD/NE	10024683	1" IPS	IPEX/Friatec Electrofusion	1100		204		2155		
SD/NE	10024263	2" IPS	UMAC Series 5500	5000		10	38	111	303	1899
SD/NE	10024261	2" IPS	UMAC Series 10000	9000		3	11	31	86	536

EFV LOAD SIZING TABLE - NO DIG TOOL

Area	Material Code	Off the Shelf Size	EFV Model	Max Load (scfh)	Length (ft) of Service for each Pipe Diameter					
					1/2" CTS	1/2" IPS	3/4" IPS	1" IPS	1 1/4" IPS	2" IPS
MT/SD/NE	10017655	1/2" CTS	UMAC Series 550	495	69					
MT	10017582	1/2" IPS	UMAC Series 550	495		408				
MT	10017656	1" IPS	UMAC Series 550	495				4340		

8.2 The maximum flow rate, of the load served through an EFV, should be based on an emergency operating pressure of 10 psig. Therefore do not exceed the maximum flow rates for each EFV, as listed. If the customer's load exceeds the maximum flow rates of the available EFV's, as listed in the table, then consult Gas Standards for the proper selection and sizing of the EFV. The capacities in the above tables are conservative. Depending on the situation, Gas Standards may determine that the listed capacity can be exceeded in certain situations. If an EFV of sufficient capacity is not commercially available, then a manual shut-off valve is required.

8.3 The tables above, the NWE **standard** configurations of EFVs on services are in **LARGER BOLD print**. When retro-fitting, and/or there are supply issues, EFVs can be used on alternate pipe sizes (diameters). The capacity is the defining part of the valve in the Excess Flow Valve and does not change if the pipe size changes. The service length is dependent on the pipe size ***of the service***. Alternate pipe sizes and coordinating pipe lengths are in smaller, non-bold print. Contact Gas Standards with any questions.

8.4 Examples: Given the following, determine the appropriate EFV, pipe size, and length.

8.4.1 Given: An SD/NE customer with a connected load of 250 scfh, having an anticipated service length of 120 feet.

Based on the table, the UMAC Series 350 EFV will work for this load.

8.4.2 Given: A Montana customer with a connected load of 400 scfh, having an anticipated service length of 650 feet.

Based on capacity, the 1/2" IPS Lyall Model 775 is appropriate. But, the maximum length of a 1/2" IPS service is only 273 feet. In this case, use the 1" IPS Lyall Model 855 with a 1" IPS service to serve this customer, since the maximum service length of the 1” IPS EFV is 2,341 feet.

8.4.3 Given: A Montana customer in the Gallatin Valley (60psig MAOP), has called in to increase their gas load. They currently have a 150ft long, ½” IPS service, with a standard Lyall Series 775 (7900280). They are increasing their load to 800scfh, which is larger than the listed capacity for that EFV. Does this EFV and service need to be replaced with a 1” service?

Contact Gas Standards. Based on the MAOP of the area (60psig), and the proximity to the nearest regulator station, the existing EFV and service size may be sufficient. Gas Standards can determine.

If the existing EFV and service size are not sufficient, then the EFV can be replaced with a GFCP 1100 Gray Series in ¾” IPS (10025476) or 1” IPS (10025473), with two reducers. The EFV will need to be replaced, but not the entire service.

NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV# 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

9.0 Installation

9.1 The Excess Flow Valve must be installed with the arrow pointing in the direction of gas flow. The valve will fail to operate if installed in the wrong direction.

9.2 Dirt or other debris must not be allowed inside of the Excess Flow Valve housing.

9.3 Excess Flow Valves installed on a service must be identified at the service riser with a permanent label (enclosed in EFV package), or tag to indicate an EFV is installed in the service line. NorthWestern stocks an EFV tag that may be used in the event that the manufacturer does not provide one or a more durable tag is needed. The stores number for this tag is shown in previous table. Placement of labels from the manufacturer should be applied on the service riser directly below the riser valve. If a tag is used it should be installed on the riser valve. Refer to the appropriate service installation drawing in standard 52-G.

10.0 Initial pressurizing of services with an EFV

10.1 Close the downstream riser valve.

10.2 Slowly pressurize inlet side of EFV.

10.3 Wait for pressures to equalize across the EFV.

10.4 Make sure all connections downstream to the riser valve are secure and fully gas tight.

10.5 It is recommended when purging a service with an EFV installed that a known orifice be used to limit the flow. The appropriate orifice sizes are reflected in the following table for various installations. The proper orifice will ensure a flow rate that eliminates a potentially hazardous mixture of air and gas while purging. After installing the proper orifice SLOWLY open the riser valve to purge the gas service of any air. Opening the riser valve quickly may cause the EFV to close prematurely in which case you must repeat steps 5.1, 5.3 and 5.4. If the EFV is unintentionally tripped due to purging, refer to following tables for reset times.

	ORIFICE SIZE FOR PURGING (TO ENSURE EFV DOES NOT TRIP) EFV MODEL									
	1/2" CTS UMAC Series 350	1/2" IPS Lyall Model 775	3/4" IPS UMAC Series 700	3/4" IPS UMAC Series 1100	1" IPS Lyall Model 855	1" IPS Lyall Model 1320	1" IPS Lyall Model 2600	1-1/4" IPS UMAC Series 2600	2" IPS UMAC Series 5500	2" IPS UMAC Series 10,000
ORIFICE SIZE	3/32"	1/8"	1/8"	1/8"	1/8"	3/16"	17/64"	17/64"	13/32"	13/32"

	ORIFICE SIZE FOR PURGING (TO ENSURE EFV DOES NOT TRIP) EFV MODEL				
	Lyall Model 775 3/4" Steel	Lyall Model 1800 3/4" Steel	Lyall Model 775 1" Steel	Lyall Model 1320 1" Steel	Lyall Model 1800 1" Steel
ORIFICE SIZE	1/8"	15/64"	1/8"	3/16"	15/64"

11.0 Resetting an existing EFV after closure

11.1 CAUTION, all EFV's are equipped with an internal bypass. Bypass flow rates can vary dependant on manufacturer, model and installation pressure. Therefore appropriate PPE and precautions need to be taken when working on a damaged service with an EFV installed. This also means the EFV will reset itself after the service line has been repaired.

11.2 Apply a squeeze off tool downstream of the EFV but upstream of the damaged section of pipe to prevent the escape of the bypass flow. This will begin the process of re-pressurizing the service line up to the squeeze off tool and the resetting of the EFV. Close the downstream riser valve.

11.3 Repair all damage to the service line downstream of the EFV location. All downstream piping must be made gas tight.

11.4 Wait for the EFV to reset before releasing the squeeze off tool. See Table 6.0 for reset times. SLOWLY release the squeeze off tool to avoid unintentionally tripping the EFV.

11.5 Break the connection of the service between the riser valve and regulator. Purge the service line as necessary. Refer to table for the proper orifice size.

11.6 If the EFV is tripped due to purging, refer to following tables for reset times.

NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV# 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

LYALL EFV RESET TIMES *pmd 3/19/08*

Reset Times for EFV (in Min:Sec)

	Inlet Pressure	Length of Service					
		50	100	150	200	250	300
1/2" IPS	10	0:59	1:55	2:50	3:46	4:41	5:37
	20	1:24	2:43	4:02	5:21	6:39	7:58
	30	1:38	3:10	4:41	6:13	7:44	9:16
	40	1:47	3:26	5:06	6:46	8:25	10:05
	50	1:53	3:38	5:23	7:08	8:54	10:39
	60	1:57	3:46	5:36	7:25	9:14	11:04

Reset Times for EFV (in Min:Sec)

	Inlet Pressure	Length of Service					
		50	100	150	200	250	300
1" IPS	10	2:31	4:59	7:27	9:55	12:23	14:50
	20	3:35	7:05	10:35	14:04	17:34	21:04
	30	4:10	8:14	12:18	16:22	20:25	24:29
	40	4:32	8:58	13:23	17:48	22:14	26:39
	50	4:48	9:28	14:08	18:48	23:28	28:09
	60	4:59	9:50	14:41	19:32	24:23	29:14

Note: all times are from Lyall EFV calculator on their website.

LYALL EFV RESET TIMES *ajj 04/01/15*

Reset Times for EFV (in Min:Sec)

	Inlet Pressure	Length of Service					
		50	100	150	200	250	300
3/4" Steel	10	1:30	2:57	4:23	5:50	7:16	8:43
	20	2:08	4:11	6:14	8:17	10:19	12:22
	30	2:29	4:52	7:15	9:37	12:00	14:23
	40	2:42	5:18	7:53	10:28	13:04	15:39
	50	2:51	5:35	8:20	11:04	13:48	16:32
	60	2:58	5:49	8:39	11:29	14:20	17:10

Reset Times for EFV (in Min:Sec)

	Inlet Pressure	Length of Service					
		50	100	150	200	250	300
1" Steel	10	2:24	4:44	7:04	9:25	11:45	14:05
	20	3:24	6:43	10:02	13:21	16:40	19:59
	30	3:58	7:49	11:40	15:32	19:23	23:14
	40	4:19	8:30	12:42	16:54	21:06	25:17
	50	4:33	8:59	13:25	17:51	22:17	26:42
	60	4:44	9:20	13:56	18:32	23:08	27:45

Note: all times are from Lyall EFV calculator on their w ebsite

NorthWestern Energy

Gas Standards Subject: Valves Excess Flow and Manual Service Line Valve		Original Date 06/01/2006	Standard Number 61-E
Supersedes Standard: 61-E	REV# 12	Revision Date 05/01/2025	Prepared / Approved By AJ / Committee

UMAC EFV RESET TIMES *SCA 3/25/08*

Reset Times for EFV (in Hrs:Min:Sec)

1/2" CTS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:00:15	0:00:30	0:00:46	0:01:01	0:01:17	0:01:32
20	0:00:17	0:00:34	0:00:52	0:01:09	0:01:27	0:01:44
30	0:00:20	0:00:40	0:01:00	0:01:20	0:01:40	0:02:01
40	0:00:21	0:00:43	0:01:05	0:01:26	0:01:48	0:02:10
50	0:00:22	0:00:45	0:01:08	0:01:31	0:01:54	0:02:17
60	0:00:25	0:00:51	0:01:17	0:01:42	0:02:08	0:02:34

Reset Times for EFV (in Hrs:Min:Sec)

1/2" IPS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:00:32	0:01:04	0:01:37	0:02:09	0:02:41	0:03:14
20	0:00:37	0:01:14	0:01:51	0:02:28	0:03:05	0:03:43
30	0:00:43	0:01:26	0:02:09	0:02:52	0:03:36	0:04:19
40	0:00:46	0:01:33	0:02:19	0:03:06	0:03:53	0:04:39
50	0:00:49	0:01:38	0:02:27	0:03:17	0:04:06	0:04:55
60	0:00:55	0:01:51	0:02:46	0:03:42	0:04:37	0:05:33

Reset Times for EFV (in Hrs:Min:Sec)

3/4" IPS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:00:57	0:01:55	0:02:52	0:03:50	0:04:47	0:05:45
20	0:01:05	0:02:10	0:03:15	0:04:20	0:05:25	0:06:31
30	0:01:15	0:02:30	0:03:45	0:05:01	0:06:16	0:07:31
40	0:01:20	0:02:41	0:04:02	0:05:23	0:06:44	0:08:05
50	0:01:25	0:02:50	0:04:15	0:05:40	0:07:06	0:08:31
60	0:01:35	0:03:11	0:04:47	0:06:23	0:07:59	0:09:35

Reset Times for EFV (in Hrs:Min:Sec)

1" IPS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:01:26	0:02:52	0:04:18	0:05:45	0:07:11	0:08:37
20	0:01:39	0:03:18	0:04:57	0:06:36	0:08:15	0:09:54
30	0:01:55	0:03:50	0:05:45	0:07:40	0:09:36	0:11:31
40	0:02:04	0:04:08	0:06:12	0:08:17	0:10:21	0:12:25
50	0:02:11	0:04:22	0:06:33	0:08:45	0:10:56	0:13:07
60	0:02:28	0:04:56	0:07:24	0:09:52	0:12:20	0:14:48

Reset Times for EFV (in Hrs:Min:Sec)

11/4" IPS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:02:13	0:04:27	0:06:41	0:08:55	0:11:09	0:13:23
20	0:02:32	0:05:05	0:07:38	0:10:11	0:12:43	0:15:16
30	0:02:57	0:05:54	0:08:51	0:11:48	0:14:45	0:17:42
40	0:03:10	0:06:21	0:09:31	0:12:42	0:15:53	0:19:03
50	0:03:21	0:06:42	0:10:03	0:13:24	0:16:45	0:20:06
60	0:03:46	0:07:33	0:11:19	0:15:06	0:18:52	0:22:39

Reset Times for EFV (in Hrs:Min:Sec)

2" IPS	Length of Service					
Inlet Pressure	50	100	150	200	250	300
10	0:04:47	0:09:35	0:14:23	0:19:11	0:23:58	0:28:46
20	0:05:28	0:10:56	0:16:24	0:21:52	0:27:21	0:32:49
30	0:06:20	0:12:41	0:19:01	0:25:22	0:31:42	0:38:03
40	0:06:49	0:13:38	0:20:28	0:27:17	0:34:07	0:40:56
50	0:07:12	0:14:24	0:21:36	0:28:48	0:36:00	0:43:12
60	0:08:06	0:16:13	0:24:19	0:32:26	0:40:32	0:48:39

Note: all times are calculated based on UMAC published bypass rates

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: River and Creek Crossings		Original Date 06/01/2006	Standard Number 63-B
Supersedes Standard: 63-B	REV# 2	Revision Date 04/01/2016	Prepared / Approved By K. Murphy / Committee

1.0 Scope

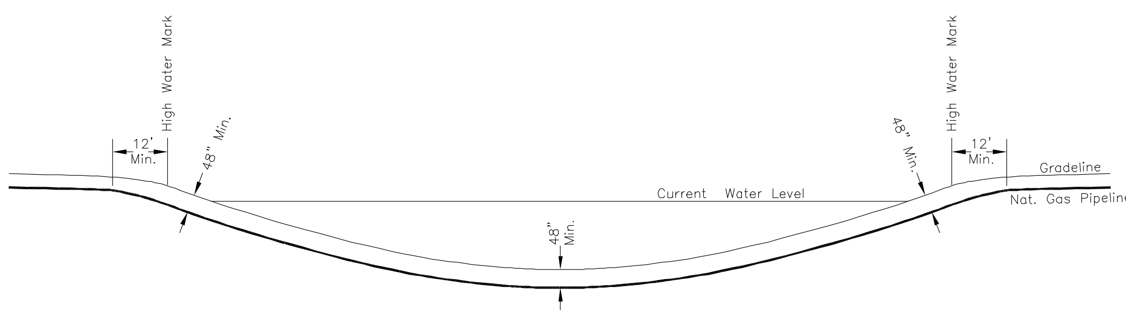
The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning lake, drainage ditch, creek, stream, river, adjacent low land and flood plain crossings. These procedures are intended to comply with the minimum requirements as set by NorthWestern's O&M standard 4100.

2.0 River and Creek Crossings

2.1 All applicable permits will be acquired prior to any construction work being done. All work shall be done within the requirements of the permit. These installations shall be done following engineering specifications and any changes need to be approved by engineering.

2.2 Boring is the recommended method of crossing waterways. However, there may be cases where boring is not practical. Refer to Standard 55-D (Trenchless Technology).

2.3 Crossings that will be open trenched shall be accomplished as follows: The trench for said pipe shall be excavated to a width of at least twelve (12) inches greater that the O.D. of the pipe to be placed therein and shall be a depth sufficient to provide the minimum cover as directed by standard 55-C. The beginning point of the crossing will be a minimum of 12 feet inland from the high water mark of the stream. The pipe will be at a depth of 48 inches when it reaches the high water mark and maintain that depth under the stream bed to the high water mark on the opposite bank and slope up to standard depth at 12 feet inland from that high water mark. See Diagram below. That section of the pipe to be laid across such streams and adjacent low land shall be covered with rock shield, where necessary, and shall be weighted with river clamps and/or pipeline anchors placed as and where directed by the design.



2.4 Crews shall conduct operations so as not to hinder the flow of water.

2.5 All crossings will have proper pipeline markers installed. Refer to Line Markers, Locate Stations, and Test Stations Standard 55-F.

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: Road Crossings		Original Date 06/01/2006	Standard Number 63-C
Supersedes Standard: 63-C	REV# 2	Revision Date 04/01/2016	Prepared / Approved By K. Murphy / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general construction procedures and policies concerning road crossings.

2.0 Road Crossings

This shall include all work, equipment, materials not furnished by the Company, and all other labor, equipment and material necessary for the construction of pipeline ready for use by NorthWestern Energy across roadways (Federal, State, County).

2.1 All hard surface roadway crossings will be bored. Refer to Trenchless Technology Standard 55-D.

2.2 All applicable permits will be acquired prior to any construction work being done.

2.3 The construction requirements of the Highway Department will be followed. These may vary by State and County.

3.0 Pipe line markers

3.1 Pipe line markers will be installed at all roadway crossings. Refer to Line Markers, Locate Stations, and Test Stations Standard 55-F.

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

McElroy No. 28 – Hydraulic Butt Fusion Machine

Quick Reference Guide
(For Butt Fusion installations – 2" IPS through 8" IPS)

SAFETY:

Safety while performing any plastic joint installation is the most important thing. Always be aware of yourself, your fellow co-workers, your environment, and the equipment you are using. Always wear proper Personal Protective Equipment (Hard Hat, Safety Boots, Safety Glasses, and any other applicable PPE that may be required for the install situation).

Please note there are many hazards involved with the use of this equipment:

- Hydraulic Leaks may puncture your skin
- Heating Irons and Electric Motors are not explosion proof
- Electrical Components can be a source of electrical shock
- Crush Point areas – keep fingers, feet, arms legs and head out of the jaw area (Always check pipe alignment with a pencil or similar object, not your fingers)
- Facer blades are sharp and can cut (Never attempt to remove shavings when the facing unit is running or when in the facing position)
- Heating Iron is extremely hot and can burn clothing and skin (Always keep the heater in its insulated heater stand when not in use)

BUTT FUSION PREPARATION:

These procedures are intended as a brief overview of the McElroy No. 28 Hydraulic Butt Fusion Machine and may not include all fusion situations encountered in the field. Please read the Operators Manual thoroughly if you have any additional questions. Please also consult the proper Butt Fusion procedures found in your Construction Standards and Guidebook for reference on fusion time cycles, fusion pressures, and cooling times.

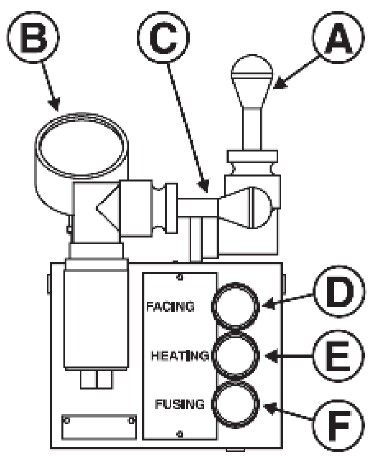
- **Check Oil Level**
  - Check oil level in sight gauge on filler spout and add oil if necessary
- **Connect Machine To Power**
  - Plug machine's electrical cord into an adequate power source
- **Prepare Heating Iron**
  - Heater should never be used without butt fusion heater plates installed
  - Allow heater to warm-up to operating temperature
    - Butt Fusion heating temperatures can be either 500ºF(+/-10) or 440ºF(+/-10). Please Note: The lower temperature setting may be useful in keeping a more consistent heating temperature throughout the entire heating surface

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

- **Set Pipe Supports**
    - Set up pipe stands and adjust height so the pipe is in line with the jaws
- **Install Clamping Inserts**
    - Select and install appropriate clamping inserts for the pipe that is being fused
    - Clamping inserts are required for all sizes except 8" IPS
- **Pump Motor**
    - Plug pump motor electrical cord into a proper power source
    - Turn on hydraulic pump motor and note pressure at the relief valve
    - Set the system pressure to **900 psi** for most pipe sizes and SDR's
    - When facing heavy wall pipe, it may be necessary to increase the pressure to **1200 psi**. Reduce the pressure to 900 psi when facing is complete due to prolonged operation at increased pressure overheating the oil

<u>HYDRAULIC MANIFOLD BLOCK:</u>



A) The carriage control valve, mounted on the top of the manifold, determines whether the carriage is moving left, right, or is in neutral.

B) A 1500 psi gauge is mounted on top of the manifold.

C) The selector valve, mounted on the front of the manifold, selects a reduced pressure from one of the pressure reducing valves.

Each pressure reducing valve is labeled with a different function:

D) The top valve adjusts facing pressure to a maximum of 400 psi.

E) The middle valve adjusts heating pressure to a maximum of 400 psi.

F) The bottom valve adjusts fusion pressure to a maximum of 1500 psi.

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

CALCULATING BUTT FUSION PRESSURES:

The heating and fusion pressures can be calculated by using the McElroy fusion pressure calculator/slide ruler.

- **For hydraulically operated fusion machines, the Gauge (Fusion) Pressure is the Theoretical Fusion Pressure + Drag Pressure (PD).**
  - PD is determined in the field by bringing the faced pipe ends within 2 in. of each other and increase the pressure on the carriage until it starts moving. Back off the pressure until the carriage is barely moving and record the drag pressure in psig.
  - The Theoretical Fusion pressure can be calculated using the fusion pressure calculator (slide rule device that is included with machine). Or Table 7.2.

McElroy No. 28 Hydraulic Fusion Machine – Pressure Guidelines

Pipe Size	Target Theoretical Fusion Pressure (psig)
2" IPS SDR 11	23
3" IPS SDR 11.5	49
4" IPS SDR 11.5	80
6" IPS SDR 11.5	174
8" IPS SDR 11.5	295
8" IPS SDR 11	308
10" IPS SDR 11	478
12" IPS SDR 11	672
12” IPS SDR 9	803

Theoretical Fusion Pressure (from table above)	TFP
+ Drag Pressure (Determined in field, **MINIMUM 30psig**)	+ P_D
= **Gauge (Fusion) Pressure**	= P_G

NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

DETERMINING DRAG PRESSURES:

- **Always add the appropriate drag pressure to the calculated gauge pressure determined for fusion.**
  - After facing the pipe move the carriage so that the pipe ends are approximately 2 inches apart
  - Shift the carriage control valve to the middle (neutral position)
  - Select the heating mode, and adjust the middle pressure reducing valve to its lowest pressure by turning the valve **counterclockwise**
  - Shift the carriage control valve to the left
  - Gradually increase the pressure by turning the valve **clockwise** – increase the pressure until the carriage moves
  - Quickly reduce the heating pressure valve counterclockwise until the carriage is just barely moving
  - Record this actual drag pressure
  - Take the pressure, determined from the fusion calculator/slide ruler (Or from the table above), and then add the actual measured drag pressure. This will be the actual fusion pressure to set the bottom pressure reducing valve.

BUTT FUSION PROCEDURES:

- **Loading Pipe Into Machine**
  - Clean the inside and outside of pipe ends that are to be fused
  - Open the upper jaws and insert pipe in each pair of jaws with applicable inserts installed
  - Let the ends of the pipe protrude approximately 1 inch past the face of the jaws
- **Positioning Pipe In Machine**
  - Swing the facer into place
  - With the carriage control valve lever, move the carriage toward the fixed jaws, while watching the gap at each end of the facer rest buttons
  - When the pipe is in contact with the facer, the gap seen indicates the amount of material that will be removed for a complete face off
  - Tighten the outside jaws
  - Hand tighten the inside clamp knobs

NorthWestern Energy

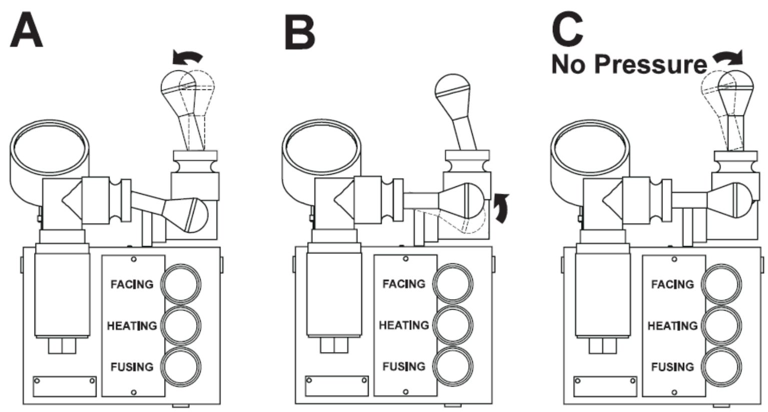
Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

- **Facing The Pipe**
  - Move the carriage to the right
  - Open the ball valve on the facer motor
  - Assure the selector valve handle is up in the facing position
  - Move the carriage control valve to the left
  - If the facer stalls – adjust the facing pressure so the facer continues to cut
  - Let the carriage bottom out on facer stops
  - Turn facer off
  - Move carriage to the right so the facer can be removed
- **Remove Facer**
  - Release the trigger lock and swing the facer out to its storage position
  - Remove shavings from pipe ends
  - Do Not Touch faced pipe ends
  - Inspect both pipe ends for complete face off (If face off is incomplete you must reload the pipe into the machine)
- **Alignment**
  - Check pipe joint for proper alignment (Do not use finger to check for proper high/low misalignment)
  - If pipe is not lined up, tighten the high side jaw to bring into alignment (Always tighten the high side – Never loosen the low side)
  - Reface pipe ends if any adjustment is made (to true up pipe ends)
  - When pipe is properly aligned – bring the pipe ends together under fusion pressure ensure that there is no unacceptable gap between the pipe ends and that no slippage occurs (If either is found you must reload the pipe into the machine)
- **Position Carriage For Heater Insertion**
  - Move carriage to the right to open a gap large enough to insert the heater by moving the carriage selector valve handle to the up (facing) position and the carriage control valve handle to the right
- **Select The Fusion Position**
  - Move the selector valve handle down to the fusing position
- **Inserting Heater**
  - Verify heater temperature through use of a pyrometer
  - Insert heater between pipe ends

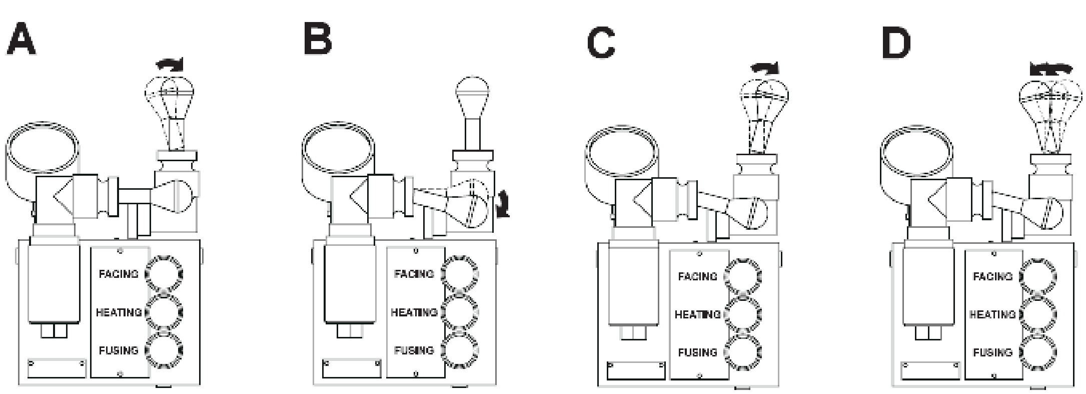
NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

- **Heating The Pipe**
  - (A) Move the carriage to the left, bringing the heater into contact with both pipe ends (control valve lever left)
  - (B) Move selector valve handle to center position (heating)
  - (C) If heating pressure is not required, allow the pressure to stabilize at the lowest setting and return carriage control valve handle to neutral position (center)



- **Fusing The Pipe**
  - (A) Shift carriage control valve to neutral position (if it is not already in that position)
  - (B) Shift the selector valve handle to fusion position (down)
  - (C) Move the carriage to the right (by moving the control valve handle to the right) just enough to remove the heating iron
  - Quickly remove the heating iron
  - (D) Quickly move the carriage to the left (by move the control valve handle to the left) bringing the pipe ends together under the previously calculated and set fusion pressure (Please refer to the table listed earlier in this summary)
  - Allow joint to cool under pressure according to pipe fusion standards



NorthWestern Energy

Gas Standards Subject: Miscellaneous Miscellaneous: McElroy No. 28 Hydraulic Machine		Original Date 06/01/2009	Standard Number 63-D
Supersedes Standard: 63-D	REV# 1	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

- **Removing Pipe**
  - After joint has cooled for the pipe fusion standard, shift the carriage control valve handle to the neutral (center) position
  - Loosen all clamp knobs (both movable and fixed) and remove the pipe from the machine through the use of lifts
  - Position the pipe for the next joint and repeat all previous procedures – be aware that the Drag Pressure Adder may have changed.

BUTT FUSION TIME CYCLE REFERENCES:

Butt Fusion Time Cycle Guidelines

Pipe Size	**Minimum Melt Bead Size**	***Approximate Heating Cycle Time 400°F to 450°F**	****Minimum Fusion/Cool Pressure Time**		**Minimum Cooling Time Prior to pulling, installation, rough handling**		**Pipe Temperature Prior to Pressure Testing**
2" IPS SDR 11	1/16 inches	**0 min, 58 s**	2 min, 30 s	+	30 min	+	ambient
3" IPS SDR 11.5	1/16 inches	**1 min, 22 s**	3 min, 30 s	+	30 min	+	ambient
4" IPS SDR 11.5	3/16 inches	**1 min, 45 s**	4 min, 30 s	+	30 min	+	ambient
6" IPS SDR 11.5	3/16 inches	**2 min, 35 s**	6 min, 30 s	+	30 min	+	ambient
8" IPS SDR 11.5	1/4 inches	**3 min, 22 s**	9 min	+	30 min	+	ambient
8" IPS SDR 11	1/4 inches	**3 min, 31 s**	9 min	+	30 min	+	ambient
10" IPS SDR 11	1/4 inches	**4 min, 23 s**	11 min	+	30 min	+	ambient
12" IPS SDR 11	1/4 inches	**5 min, 12 s**	13 min	+	30 min	+	ambient
12" IPS SDR 9	1/4 inches	**6 min, 22 s**	16 min	+	30 min	+	ambient

*Provided by McElroy McCalc. It should be emphasized that these approximate heating times are strictly guidelines. Certain conditions will almost always exist, which result in longer or shorter heating times. The most important guideline is to achieve a complete melt pattern.

**Determined using equation in 52-PA Section 8.8 to find the minimum. Then rounded up for simplification.

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Plastic Pipe Design		Original Date 06/01/2006	Standard Number 69-A
Supersedes Standard: 69-A	REV# 4	Revision Date 02/01/2019	Prepared / Approved By AJ/ Committee

1.0 Scope – Plastic Pipe Design

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general design procedures and policies concerning plastic pipe and its design properties.

2.0 Design of Plastic Pipe

2.1 The NWE standard design pressure for plastic pipe is determined in accordance with either of the following formulas and through use of Table 2.1:

$$P = 2S\frac{t}{(D-t)}0.32 \qquad P = \frac{2S}{(SDR-1)}0.32$$

Where:

P = Design pressure, gage, (psig)

S = For thermoplastic pipe the HDB determined in accordance with the listed specifications at a temperature equal to 73ºF, 100ºF, 120ºF, or 140ºF, (psig).

t = Specified wall thickness, (in)

D = Specified outside wall diameter, (in)

SDR = Standard dimension ratio, the ratio of the average specified outside diameter to the minimum specified wall thickness.

Table 2.1 – HDB of PE Pipe at 73ºF (*S* in design pressure formula)

Temperature (ºF)	Hydrostatic Design Basis (HDB) (psig)	ASTM D 2513 Designation
73	1250	PE2306
73	1250	PE2406
73	1600	PE3408

2.2 In special projects, with the permission of Gas Assets, the design pressure for plastic pipe, **manufactured after January 22, 2019**, is determined in accordance with either of the following formulas and through use of Table 3.1.

$$P = 2S\frac{t}{(D-t)}0.40 \qquad P = \frac{2S}{(SDR-1)}0.40$$

Where:

P = Design pressure, gage, (psig)

S = For thermoplastic pipe the HDB determined in accordance with the listed specifications at a temperature equal to 73ºF, 100ºF, 120ºF, or 140ºF, (psig).

t = Specified wall thickness, (in)

D = Specified outside wall diameter, (in)

SDR = Standard dimension ratio, the ratio of the average specified outside diameter to the minimum specified wall thickness.

Table 3.1 – HDB of PE Pipe at 73ºF (*S* in design pressure formula)

Temperature (ºF)	Hydrostatic Design Basis (HDB) (psig)	ASTM D 2513 Designation
73	1250	PE2306
73	1250	PE2406/2708
73	1600	PE3408/3608/4710

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Plastic Pipe Design		Original Date 06/01/2006	Standard Number 69-A
Supersedes Standard: 69-A	REV# 4	Revision Date 02/01/2019	Prepared / Approved By AJ/ Committee

3.0 Design Limitations for Plastic Pipe

3.1 The design pressure for thermoplastic pipe manufactured after July 14, 2004 may exceed a gauge pressure of 100 psig given the following conditions are met:

3.1.1 The design pressure does not exceed 125 psig.

3.1.2 The material is PE2406 or PE3408 as specified within proper ASTM standards.

NOTE: NorthWestern Energy will not use PE3408 unless system pressure is greater than 76 psig.

3.1.3 The nominal pipe size is 12 inches (IPS) or less.

3.1.4 The design pressure is determined in accordance with the design equation defined in 3.0 of this section.

3.2 Plastic pipe may not be used when the operating temperatures of the pipe will be one of the following:

3.2.1 Below –20°F.

3.2.2 In the case of thermoplastic pipe, above the temperature at which the HDB used in the design formula is determined, except that in the case of reinforced thermosetting plastic pipe, above 150°F.

3.2.3 The wall thickness for thermoplastic pipe may not be less than .062 inches.

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Steel Pipe Design		Original Date 06/01/2006	Standard Number 69-B
Supersedes Standard: 69-B	REV# 3	Revision Date 06/01/2009	Prepared / Approved By K. Meagor / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's (NWE) general design procedures and policies concerning steel pipe.

2.0 Steel Pipe

2.1 Steel pipe is qualified if it was manufactured according to the American Petroleum Institute's line pipe specification, 5L (API 5L) and it meets one of the requirements given within the Pipeline Safety Regulations in Section 192.55.

3.0 Steel Pipe Design

The allowable design pressure for steel pipe can be calculated from the following equation.

$$P = \left(\frac{2St}{D}\right)(F)(E)(T)$$

P = Design pressure in pounds per square inch gage.

S = Yield strength in pounds per square inch.

D = Nominal outside diameter of the pipe in inches.

t = Nominal wall thickness of the pipe in inches.

F = Determined design factor.

E = Determined longitudinal joint factor.

T = Determined temperature derating factor.

4.0 Yield Strength (S) for Steel Pipe

4.1 Pipe that is manufactured in accordance with a specification listed in section I of appendix B of part 192, such as API 5L line pipe, the yield strength to be used in the design formula is the SMYS stated in the listed specification, when that value is known.

4.2 For pipe that is manufactured according to a specification other than the provided list in section I of appendix B of part 192, follow the guidelines that are given in part 192.107.

5.0 Nominal Wall Thickness (t) for Steel Pipe

5.1 To determine the unknown wall thickness of steel pipe, measure the wall thickness at one end of the pipe at the four quarter points.

5.2 When the pipe is of uniform grade, size, and thickness and there are more than 10 lengths, the larger of 10 or 10 percent of the individual lengths need to be measured. The rest of the pipe will be verified by applying a gauge set to the minimum thickness found by the measurement. Use the wall thickness found in the commercial specifications that is just below the average of all the measurements taken for the nominal wall thickness of the design formula. However, the nominal wall thickness used may not be more than 1.14 times the smallest measurement taken on the pipe.

6.0 Design Factor (F) for Steel Pipe

6.1 Because it is intended that NWE will operate all pipelines at 20% SMYS or less, a design factor of 0.4 will be used to determine the maximum allowable design pressure for a pipeline.

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Steel Pipe Design		Original Date 06/01/2006	Standard Number 69-B
Supersedes Standard: 69-B	REV# 3	Revision Date 06/01/2009	Prepared / Approved By K. Meagor / Committee

7.0 Longitudinal Joint Factor (E) for Steel Pipe

7.1 The longitudinal joint factor to be used in the design formula is determined according to the following table.

Specification	Pipe Class	Longitudinal Factor (E)
ASTM A 53	Seamless	1.00
	Electric Resistance Welded	1.00
	Furnace Butt Welded	.60
ASTM A 106	Seamless	1.00
ASTM A 333 / A 333 M	Seamless	1.00
	Electric Resistance Welded	1.00
ASTM A 381	Double Submerged Arc Welded	1.00
ASTM A 671	Electric Fusion Welded	1.00
ASTM A 672	Electric Fusion Welded	1.00
ASTM A 691	Electric Fusion Welded	1.00
API 5 L	Seamless	1.00
	Electric Resistance Welded *	1.00
	Electric Flash Welded	1.00
	Submerged Arc Welded	1.00
	Furnace Butt Welded	.60
Other	Pipe Over 4 Inches	.80
Other	Pipe 4 Inches or Less	.60

* Denotes the pipe most commonly used by NorthWestern.

8.0 Temperature Derating Factor (T) for Steel Pipe

8.1 The temperature derating factor to be used in the design formula shall be 1.00.

NorthWestern Energy

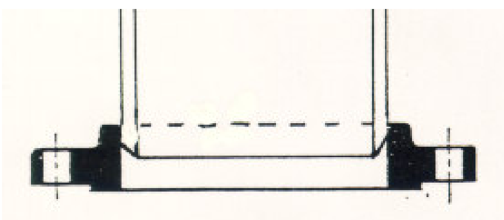
Gas Standards Subject: Engineering Engineering: Flange and Accessory Design		Original Date 06/01/2006	Standard Number 69-C
Supersedes Standard: 69-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

1.0 Scope

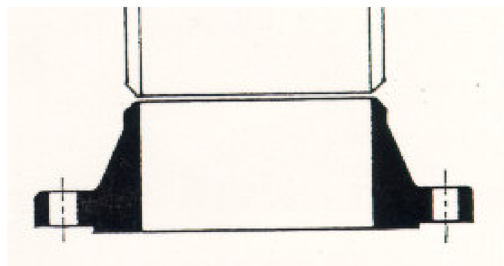
The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general design procedures and policies concerning flanges and flange accessories. These procedures are intended to comply with the minimum requirements as set by NorthWestern's O&M standard 4220.

2.0 Flanges & Flange Accessories

2.1 Each flange or flange accessory (other than cast iron) must meet the minimum requirements of ASME/ANSI B16.5, MSS Sp-44, or the equivalent. ANSI Class 150 Forged Steel flanges shall be used with new installations. Slip on type, or Weld Neck (standard bore) type, flanges may be used. Specify Flat Face Flange for connecting to cast iron. Special applications as well as any installation over 150 class shall be approved by a supervisor.



SLIP-ON



WELD NECK

2.2 Flat faced flanges are required for use on rotary meter sets. See Table 2.

2.3 Each flange assembly must be able to withstand the maximum pressure at which the pipeline is to be operated and to maintain its physical and chemical properties at any temperature to which it is anticipated that it might be subjected while in service.

2.4 Each flange on a flanged joint in cast iron pipe must conform in dimensions, drilling, face and gasket design to ASME/ANSI B16.1 and be cast integrally with the pipe, valve, or fitting.

3.0 Bolts and Gaskets

3.1 Bolts and gaskets should be requested when flanges are ordered. If bolts are needed, get the largest diameter, course thread, Grade 5 (minimum) bolt that will work.

3.2 B7 Ready rod or all thread should be used for stud bolts. 2H nuts are to be used. A minimum of one thread shall be showing past the nut.

3.3 If additional gaskets are needed, a standard Garlick ring gasket should be requested from the vendor. Full Face Gaskets and Flat Faced Flanges shall be used for Class 25 or Class 125 CAST IRON FLANGES.

3.4 Table 1 specifies bolting pattern and bolt lengths for flange to flange installations.

3.5 Engineering shall specify any installation over class 150.

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Flange and Accessory Design		Original Date 06/01/2006	Standard Number 69-C
Supersedes Standard: 69-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

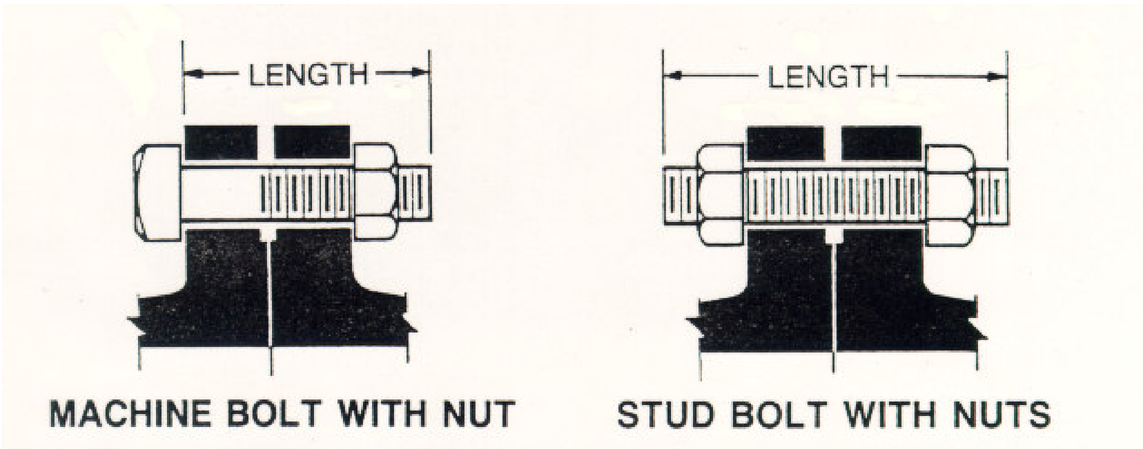


TABLE 1

BOLTING PATTERN AND BOLT LENGTHS FOR FLANGE TO FLANGE INSTALLATIONS					
Pipe Size	Diameter of Bolt Circle	Diameter of Bolt Holes	Number of Bolts	Diameter of Bolts	Stud Bolt Flat and Raised Face
2	4.75	0.75	4	5/8	3 1/4
2 1/2	5.50	0.75	4	5/8	3 1/4
3	6.00	0.75	4	5/8	3 1/2
3 1/2	7.00	0.75	8	5/8	3 1/2
4	7.50	0.75	8	5/8	3 1/2
5	8.50	0.88	8	3/4	3 3/4
6	9.50	0.88	8	3/4	3 3/4
8	11.75	0.88	8	3/4	4
10	14.25	1.00	12	7/8	4 1/2
12	17.00	1.00	12	7/8	4 1/2

NorthWestern Energy

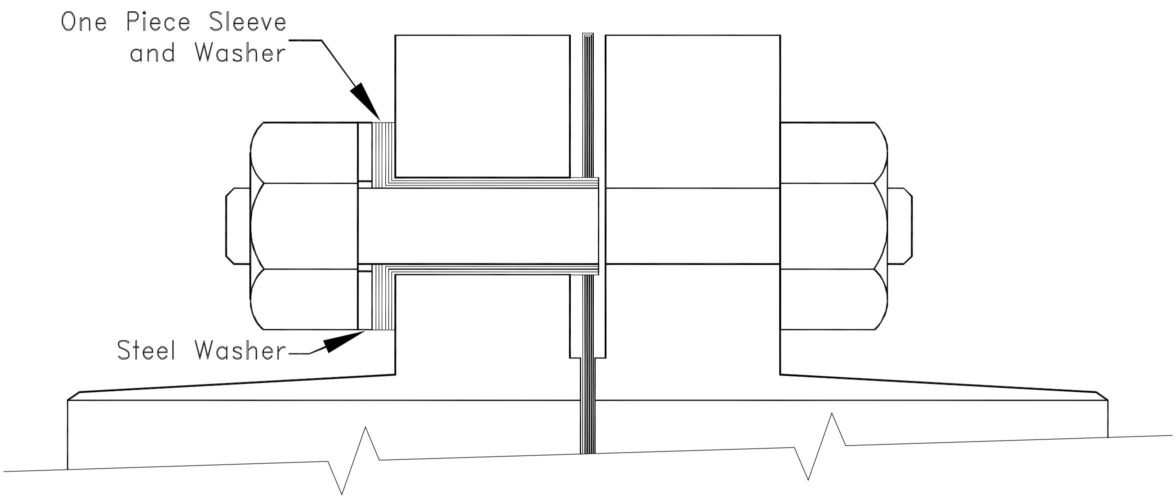
Gas Standards Subject: Engineering Engineering: Flange and Accessory Design		Original Date 06/01/2006	Standard Number 69-C
Supersedes Standard: 69-C	REV# 3	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

TABLE 2

FLANGE HARDWARE SPECIFICATION TABLE BY METER MODEL				
Meter Model	Flange	Bolts	Washers	Gaskets
RM1000-RM1500 RM30-RM40	ANSI 150 2" Flat Face	5/8"-11 x 1.5" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 2" Full Face x 1/8" thick Compressed Fiber (2 Required)
RM2000-RM3000 RM55-RM85	ANSI 150 2" Flat Face	5/8"-11 x 1.75" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 2" Full Face x 1/8" thick Compressed Fiber (2 Required)
RM5000-RM7000 R140-RM200	ANSI 150 3" Flat Face	5/8"-11 x 2" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 3" Full Face x 1/8" thick Compressed Fiber (2 Required)
RM11000-RM23000 RM300-RM650	ANSI 150 4" Flat Face	5/8"-11 x 2.5" long Hex Head, SAE Grade 5 Steel, Zinc Plated (16 Required)	Flat; Steel; Zinc Plated (16 Required)	ANSI 150 4" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 1.5M	ANSI 150 2" Flat Face	5/8"-11 x 1.5" long Hex Head, SAE Grade 5 Steel, Zinc Plated (4 Required)	Flat; Steel; Zinc Plated (4 Required)	ANSI 150 2" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 3M	ANSI 150 2" Flat Face	5/8"-11 x 1.5" long Hex Head, SAE Grade 5 Steel, Zinc Plated (4 Required)	Flat; Steel; Zinc Plated (4 Required)	ANSI 150 2" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 5M	ANSI 150 3" Flat Face	5/8"-11 x 1.75" long Hex Head, SAE Grade 5 Steel, Zinc Plated (4 Required)	Flat; Steel; Zinc Plated (4 Required)	ANSI 150 3" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 7M	ANSI 150 3" Flat Face	5/8"-11 x 1.75" long Hex Head, SAE Grade 5 Steel, Zinc Plated (4 Required)	Flat; Steel; Zinc Plated (4 Required)	ANSI 150 3" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 11M	ANSI 150 4" Flat Face	5/8"-11 x 1.75" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 4" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 16M	ANSI 150 4" Flat Face	5/8"-11 x 1.75" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 4" Full Face x 1/8" thick Compressed Fiber (2 Required)
ROOTS 23M	ANSI 150 6" Flat Face	3/4"-10 x 2" long Hex Head, SAE Grade 5 Steel, Zinc Plated (8 Required)	Flat; Steel; Zinc Plated (8 Required)	ANSI 150 6" Full Face x 1/8" thick Compressed Fiber (2 Required)

4.0 Insulating Flange Kits

4.1 Insulated sleeves and washers are to be used on all installations. One set of one-piece sleeves and washers will be installed on the upstream side of the flange installation. See diagram below.



NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Special Use Welding Procedures		Original Date 06/01/2006	Standard Number 69-F
Supersedes Standard: 69-F	REV# 2	Revision Date 04/01/2015	Prepared / Approved By AJ / Committee

1.0 Scope

This section is intended for use on special projects. The procedures included here in are not to be used in NorthWestern Energy's typical work environment. Engineering shall determine that special application that requires use of these procedures. Altering or using outside the intended application of the procedures is not allowed. If assistance or clarification is required consult with the welding engineer.

2.0 General

Each of the procedures require welders to be qualified to the procedures. See NorthWestern Energy's O&M manual for welder certification – standard 5002.

2.1 Welders that have qualified to the Apendix C tests are not qualified to use these procedures.

2.2 Welders that have qualified to the API 1104 single qualification are certified to X65-R1 and no other unless they have performed a single qualification to another WPS.

2.3 Welders that have qualified to API 1104 multiple qualification are certified to use all procedures include here in, with exception to WPS 29A.

3.0 Overview

The procedures will be briefly describe here; however, each procedure should be reviewd for correct.

3.1 Procedure 500B is for welding of pipe from X60 strength to one that has x42 or grade B strength.

3.2 Procedure 500C is for welding of pipe from X65 strength to pipe that has X52 strength.

3.3 Procedure X65-R1 is for welding X65 pipe to X 65 pipe with diameters of 6-5/8 to 8-5/8" with wall thickness of 3/16 to ¾".

3.4 Procedure 29A is for completing fillet welds using low hydrogen electrodes.

4.0 Work Plan

Before using these procedures a work plan shall be developed. Instances where the scope of the work procedure does not match a listed welding procedure the welding engineer should be contacted. Key items that the work plan should include are:

4.1 Scope,

4.2 Location,

4.3 Grade, type, and size of the material that is being used.

4.4 Procedure that should be used, and

4.5 Welder that will be doing the welding.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: X60 MPC-WPS-500B		Original Date 06/01/2006	Standard Number 69-FA
Supersedes Standard: 69-H	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

1.0 Scope

This procedure was established under the requirements of Part 192.225 of the "Code of Federal Regulations" and Section 2 of the seventeenth edition of API 1104, "Standard for Welding Pipelines and Related Facilities." This procedure allows the welding of steel pipe, butt weld end valves, fittings and flanges that meet the requirements of Part 192 of the "Code of Federal Regulations." Reference NorthWestern Energy's O&M standards 5000 & 5001.

- PIPE DIAMETER: 2 3/8" to 12 ¾"
- PIPE WALL THICKNESS: 0.188" to 0.750"
- PIPE SPECIFICATIONS: Grade B/ 5LX42 / 5LX-60

2.0 Process

The welding shall be done by the shielded metal arc welding method (SMAW).

3.0 Pipe and Fitting Materials

This procedure allows the welding of standard line pipe meeting the requirements of API 5LX-60 to standard line pipe meeting the requirements of 5LX-42 or Grade B, or to fittings meeting the requirements of ANSI B16.9 or MSS-SP 75, specifically Grade B or Y-42.

4.0 Diameter and Wall Thickness

This procedure allows the welding of pipe and fittings having an outside diameter from 2 3/8" and above and a wall thickness from 0.188" to 0.750", inclusive.

5.0 Joint Design

The joint geometry shall be as shown in Figure 1. This joint may be machined, ground, or flame cut.

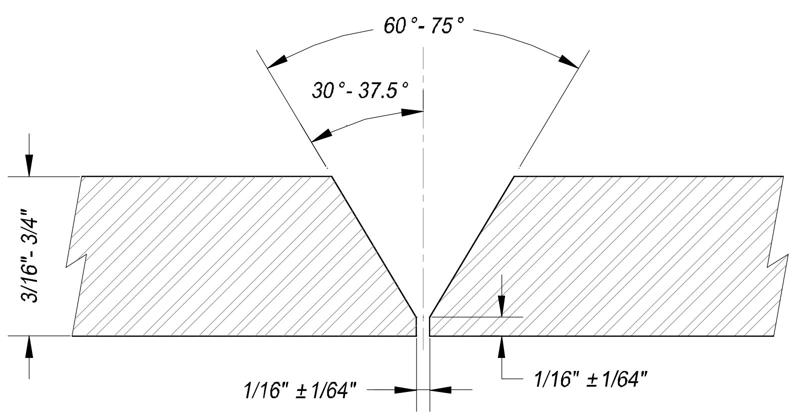


Figure 1

6.0 Filler Metal and Number of Beads

The filler metal shall conform to the requirements of AWS Specification A5.5. The size of the electrode and the sequence of beads shall be as shown in Figure 2.

7.0 Electrical Characteristics

Direct current, electrode positive (DCEP) reverse polarity, shall be used on all the passes. Amperage and voltage for each size electrode shall be maintained within the ranges shown in Figure 2.

Figure 2: Amperage and voltage requirements relative to electrode size and weld pass.

Welding Pass	Electrode Size	Amperage Range	Voltage Range	Travel Speed
Stringer (1st)	1/8	80-110	21-27	7-13 ipm
Hot Pass (2nd)	5/32	135-165	22-28	9-15 ipm
Filler #1 (3rd)	5/32	110-140	22-28	7-13 ipm
Filler #2 (4th)	5/32	110-140	22-28	10-16 ipm
Cap (5th)	5/32	95-125	22-28	4-10 ipm

8.0 Position

Welding shall be done with the pipe in the fixed position.

9.0 Direction of Welding

Downhill welding only is permitted by this procedure.

10.0 Time Lapse between Passes

Maximum time between the completion of the root bead and the start of the second bead (hot pass) shall be five (5) minutes.

11.0 Type of Line Clamps (if used)

Internal or external line-up clamps may be used to align the joint, with a maximum of 1/16" high-low at any point on the perimeter of the pipe.

12.0 Removal of Line-up Clamps

Internal or external line-up clamps shall not be removed until at least 50 percent of the root bead has been completed, provided that the completed portion of the root bead is in approximately equal segments, evenly distributed around the circumference of the joint.

13.0 Cleaning

Prior to welding, the welding groove shall be cleaned with hand or power-driven buffers. The root pass shall be ground to clean metal with a grinder. All slag or flux remaining on any welding bead shall be removed by power-driven buffers or grinders before laying the next successive bead.

14.0 <u>Preheat / Postheat</u>

Preheating prior to welding is required. The minimum preheat temperature shall be 200 degrees Fahrenheit, and the preheat zone shall extend longitudinally at least (3) inches from the bevel of each pipe. The temperature is to be monitored by temperature-indicating crayons. Postheat shall be in the form of insulating blankets if the ambient temperature is below 32 degrees Fahrenheit.

15.0 <u>Speed of Travel</u>

Speed of travel for making the root bead shall be 7 to 13 inches per minute; the hot pass shall be 9 to 15 inches per minute; filler number 1 shall be 7 to 13 inches per minute; filler number 2 shall be 10 to 16 inches per minute and the cap shall be 4 to 10 inches per minute

16.0 <u>Standards of Acceptability</u>

Visual inspection of welding shall be conducted to ensure that welding is performed in accordance with this procedure. Welds requiring non-destructive testing shall meet the standards of acceptability as set forth in Section 6 of API 1104. Any weld not meeting these requirements shall be removed or repaired in accordance with the Company's written procedure. Haphazard arc striking (arc bum) on the base metal adjacent to the weld groove is prohibited by this procedure.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: X52-X65 MPC-WPS-500C		Original Date 06/01/2006	Standard Number 69-FB
Supersedes Standard: 69-I	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

1.0 Scope

This procedure was established under the requirements of Part 192.225 of the "Code of Federal Regulations" and Section 2 of the seventeenth edition of API 1104, "Standard for Welding Pipelines and Related Facilities." This procedure allows the welding of steel pipe, butt weld end valves, fittings and flanges that meet the requirements of Part 192 of the "Code of Federal Regulations". Reference NorthWestern Energy's O&M standards 5000 & 5001.

- PIPE DIAMETER: 2 3/8" to 12 ¾"
- WALL THICKNESS: 0.188" to 0.750"
- SPECIFICATIONS: 5LX-52 / 5LX-65

2.0 Process

The welding shall be done by the shielded metal arc welding method (SMAW).

3.0 Pipe and Fitting Materials

This procedure allows the welding of standard line pipe meeting the requirements of API-5LX-65 to standard line pipe meeting the requirements of API-5LX-52, or to fittings meeting the requirements of ANSI-B16.9 or MSS-SP 75, specifically Y-52.

4.0 Diameter and Wall Thickness

This procedure allows the welding of pipe and fittings having an outside diameter from 2 3/8" and above and a wall thickness from 0.188" to 0.750", inclusive.

5.0 Joint Design

The joint geometry shall be as shown in Figure 1. This joint may be machined, ground, or flame cut.

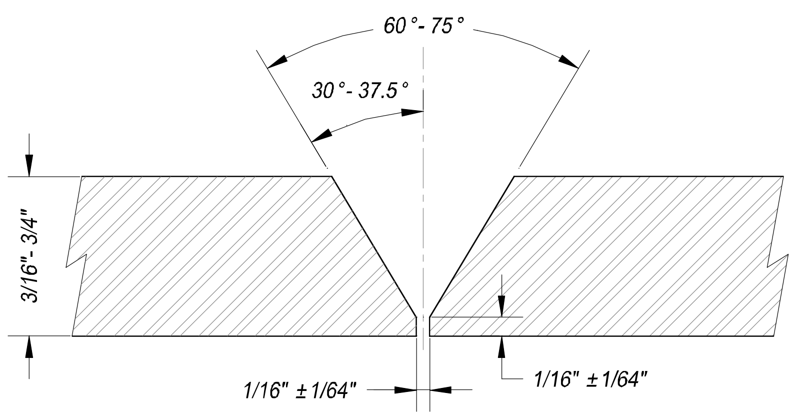


Figure 1

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: X52-X65 MPC-WPS-500C		Original Date 06/01/2006	Standard Number 69-FB
Supersedes Standard: 69-I	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

6.0 Filler Metal and Number of Beads

The filler metal shall conform to the requirements of AWS Specification A5.5. The size of the electrode and the sequence of beads shall be as shown in Figure 2.

7.0 Electrical Characteristics

Direct current, electrode positive (DCEP) reverse polarity, shall be used on all the passes. Amperage and voltage for each size electrode shall be maintained within the ranges shown in Figure 2.

Figure 2:Amperage and voltage requirements relative to electrode size and weld pass.

Welding Pass	Electrode Size	**Amperage Range**	**Voltage Range**	**Travel Speed**
Stringer (1st)	1/8	90-120	20-26	12-18 ipm
Hot Pass (2nd)	5/32	125-155	27-33	7-13 ipm
Filler #1 (3rd)	5/32	110-140	26-32	4-10 ipm
Filler #2 (4th)	5/32	110-140	26-32	4-10 ipm
Cap (5th)	3/16	115-145	23-29	4-10 ipm

8.0 Position

Welding shall be done with the pipe in the fixed position.

9.0 Direction of Welding

Downhill welding only is permitted by this procedure.

10.0 Time Lapse between Passes

Maximum time between the completion of the root bead and the start of the second bead (hot pass) shall be five (5) minutes.

11.0 Type of Line Clamps (if used)

Internal or external line-up clamps may be used to align the joint, with a maximum of 1/16" high-low at any point on the perimeter of the pipe.

12.0 Removal of Line-up Clamps

Internal or external line-up clamps shall not be removed until at least 50 percent of the root bead has been completed, provided that the completed portion of the root bead is in approximately equal segments, evenly distributed around the circumference of the joint.

13.0 Cleaning

Prior to welding, the welding groove shall be cleaned with hand or power-driven buffers. The root pass shall be ground to clean metal with a grinder. All slag or flux remaining on any welding bead shall be removed by power-driven buffers or grinders before laying the next successive bead.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: X52-X65 MPC-WPS-500C		Original Date 06/01/2006	Standard Number 69-FB
Supersedes Standard: 69-I	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

14.0 Preheat / Postheat

Preheating prior to welding is required. The minimum preheat temperature shall be 200 degrees Fahrenheit, and the preheat zone shall extend longitudinally at least (3) inches from the bevel of each pipe. The temperature shall be monitored by using temperature-indicating crayons. Postheat shall be in the form of insulating blankets if the ambient temperature is below 32 degrees Fahrenheit.

15.0 Speed of Travel

Speed of travel for making the root bead shall be 12 to 18 inches per minute; the hot pass shall be 7 to 13 inches per minute; filler number 1 shall be 4 to 10 inches per minute; filler number 2 shall be 4 to 10 inches per minute and the cap shall be 4 to 10 inches per minute.

16.0 Standards of Acceptability

Visual inspection of welding shall be conducted to ensure that welding is performed in accordance with this procedure. Welds requiring non-destructive testing shall meet the standards of acceptability as set forth in Section 6 of API 1104. Any weld not meeting these requirements shall be removed or repaired in accordance with the Company's written procedure. Haphazard arc striking (arc burn) on the base metal adjacent to the weld groove is prohibited by this procedure.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: X65 NWE-SD-X65-R1		Original Date 06/01/2006	Standard Number 69-FC
Supersedes Standard: 69-J	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

1.0 Scope

This procedure was established under the requirements of the Department of Transportation CFR 49 Part 192.225 and in accordance with the "Welding of Pipelines and Related Facilities" Nineteenth Edition of API 1104, Section 5 and NorthWestern Energy's O&M standards 5000 & 5001.

This procedure is limited to the welding of steel line pipe, butt weld prepared valves, fittings, and flanges that meet the requirements of Department of Transportation Part 192, with diameters 6.625" through 8.625", for pipe wall thickness range of 0.188" to 0.750", inclusive, and for materials of pipe specification API 5L X65.

- PIPE DIAMETER: 6 5/8" to 8 5/8"
- WALL THICKNESS: 0.188" to 0.750"
- SPECIFICATIONS: 5LX-65

2.0 Process

All welding shall be performed using shielded metal arc welding (SMAW).

3.0 Pipe and Fitting Materials

All materials welded in accordance with this procedure shall meet the specified yield strength requirements (minimum and maximum) for grade X65 as specified by "API Specification 5L, Forty-Second Edition".

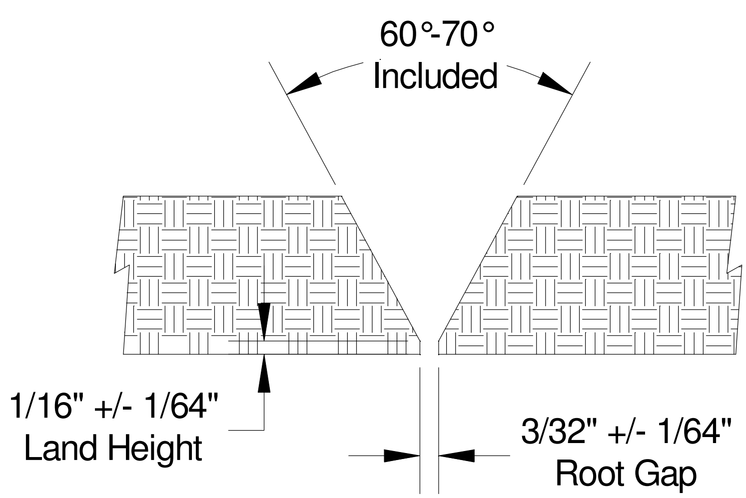
4.0 Diameter and Wall Thickness

This procedure allows the welding of pipe and fittings with outside diameters of 6.625" and 8.625" with wall thickness of 0.1875" to 0.750", inclusive.

5.0 Joint Design

The joint design and geometry shall be as illustrated in Figure 1. The joint design may be machined, ground, or flame cut.

FIGURE 1: Joint design with bevel, land and root gap requirements.



6.0 Filler Metal and Number of Beads

The filler metal used in accordance with this procedure shall conform to the requirements of AWS Specification A5.1 and A5.5 for the designated electrodes E6010 and E8010-G, respectively. AWS Specification A5.1 E6010 shall only be used in performing the root (bead) pass and AWS Specification A5.5 E8010-G for all subsequent passes. The size of electrodes and the bead sequence shall be as shown Table 1.

7.0 Electrical Characteristics

Only direct current, reverse polarity (DCEP) is allowed in accordance with this procedure. Table 1 provides the amperage and voltage ranges that shall be maintained relative to electrode size and weld pass.

Table 1: Amperage and voltage requirements relative to electrode size and weld pass.

Weld Pass	Electrode Size	Amperage Range	Voltage Range
Stringer Bead	3/32”	45-95	20-35
	1/8”	75-125	20-35
Hot Pass	1/8”	80-135	23-40
	5/32”	100-180	23-40
Fill Pass	1/8”	80-135	23-40
(as required)	5/32”	100-180	23-40
Cap Pass	1/8”	80-135	23-40
	5/32”	100-180	23-40

8.0 Position

Welding shall be performed with the pipe in the fixed position.

9.0 Direction of Welding

Verticle-down progression only, is permitted by this procedure.

10.0 Time Lapse between Passes

The maximum time between completion of the root bead and the start of the second pass (hotpass) shall not exceed five minutes.

11.0 Type of Line Clamps (if used)

Internal or external line-up clamps may be used to align the joint. The alignment of abutting pipe ends shall minimize the offset between surfaces. For pipe ends of the same nominal thickness the offset shall not exceed 1/16 inch.

12.0 Removal of Line-up Clamps

Internal alignment clamps shall not be relaxed until 100 percent of the root bead has been completed. External alignment clamps shall not be removed until at least 25 percent of the root bead has been completed, provided the completed portion of the root bead is in approximately equal segments evenly distributed about the circumference of the joint.

13.0 Cleaning

All rust, dirt, and foreign matter shall be removed from the bevel surface before welding. The bevel surface includes the area on the inside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the bead surface before the next bead is applied. Power tools may be used. The finished weld and immediately adjacent pipe must be cleaned of all flux, smoke and weld splatter.

14.0 Preheat / Postheat

Preheat is not required unless any one of the following conditions exist: ambient temperatures less than 50 degrees Fahrenheit, high humidity/moisture is present, or specified by the NorthWestern Energy Engineering Department. When preheat is necessary a minimum preheat of 250 degrees Fahrenheit shall be applied. Preheat temperatures shall be measured a minimum of 2 inches each side of the beveled joint and at spaced intervals along the pipe circumference that will ensure temperature requirements are met over the entire weld joint. Postheat is not required unless otherwise specified by the NorthWestern Energy Engineering Department.

15.0 Speed of Travel

The speed of travel shall be within the range of 8 to 14 inches per minute for the root pass, and may vary for all subsequent passes.

16.0 Standards of Acceptability

Visual inspection of welding shall be conducted to ensure that welding is performed in accordance with this procedure. Welds requiring non-destructive testing shall meet the standards of acceptability as set forth in Section 6 of API 1104. Any weld not meeting these requirements shall be removed or repaired in accordance with the Company's written procedure. Haphazard arc striking (arc burn) on the base metal adjacent to the weld groove is prohibited by this procedure.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: Low Hydrogen Fillet WPS-29A		Original Date 06/01/2006	Standard Number 69-FD
Supersedes Standard: 69-K	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

1.0 Scope

This procedure was established under the requirements of Part 192.225 of the "Code of Federal Regulations" and the second edition of API 1107, "Recommended Pipe Line Maintenance Welding Practices" for the installation of full encirclement split tees, Mueller Line Stopper Fittings, and full encirclement welding reinforcing sleeves (Dresser Styles 110 & 220 and Edwards Split Casing) Reference NorthWestern's O&M standards 5000 & 5001.

2.0 Welding Process

The welding shall be done manually by the shielded metal arc welding method (SMAW).

3.0 Pipe And Fitting Materials

Pipe material shall have a specified minimum yield strength of 42,000 psi or less. Fitting material shall have a specified minimum yield strength of 50,000 psi or less.

4.0 Diameter Group – Wall Thickness Group

The diameter of the pipe and fittings shall be 2-3/8" through 20", and the wall thickness of the fittings shall be 3/16" through 3/4" inclusive.

5.0 Pipeline Operating Conditions

The maximum pressure that the pipeline is to be operated when welding takes place on that pipeline is outlined in the O&M manual. Welding shall not take place when ambient conditions exist that would tend to adversely affect the quality of the weld. If possible, flow in the pipeline shall be stopped during welding in order to avoid rapid cooling.

6.0 Joint Design

The joint design consists of a slightly convex (convexity not to exceed 1/8") fillet weld where the sleeve is welded to the carrier pipe. These fillet welds shall only be made when the sleeve will contain pressure. The split sleeve, casing or tee is joined by two longitudinal butt welds. These joints and the proper welding sequence are shown in Figures 1 and 2.

7.0 Filler Metal And Number Of Beads

The filler metal shall conform to the requirements of AWS Specification A5.1 (E7018). The minimum number of welding passes for the groove welds shall be five (5). The minimum number of welding passes for the fillet welds shall be three (3). The longitudinal butt welds shall be completed before starting the fillet welds. One fillet weld shall then be completed and allowed to cool prior to beginning the other fillet weld. The size of the electrode used for the fillet and groove welds shall be either 3/32" or 1/8".

8.0 Electrical Characteristics

Direct current, reverse polarity shall be used. The amperage and voltage for the electrodes shall be maintained within the following ranges:

3/32" 80-120 amps & 24-34 volts

1/8" 90-150 amps & 22-30 volts

9.0 Direction Of Welding

Uphill welding only is permitted by this procedure.

NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: Low Hydrogen Fillet WPS-29A		Original Date 06/01/2006	Standard Number 69-FD
Supersedes Standard: 69-K	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

10.0 Cleaning

The welding joints prior to and during welding shall be cleaned with hand or power driven buffers prior to depositing the next successive weld pass. The ends of the groove welds, at the fillet weld intersections, shall be ground prior to beginning the fillet welds.

11.0 Speed Of Travel

The maximum speed of travel for all passes shall be between 2 and 8 ipm.

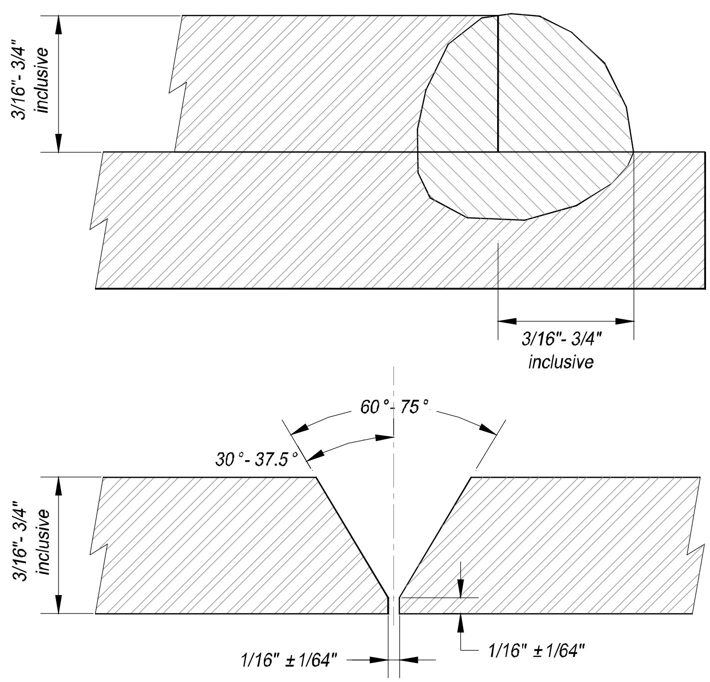
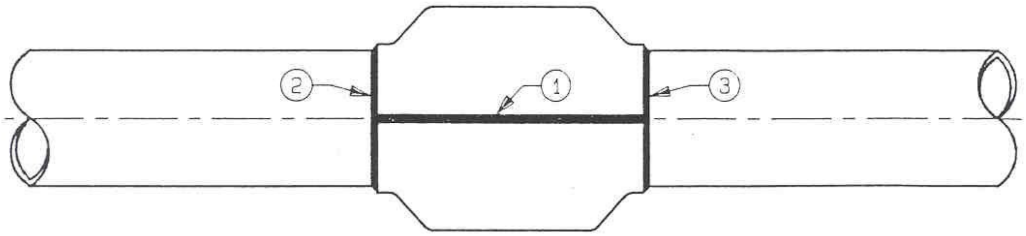


Figure 1

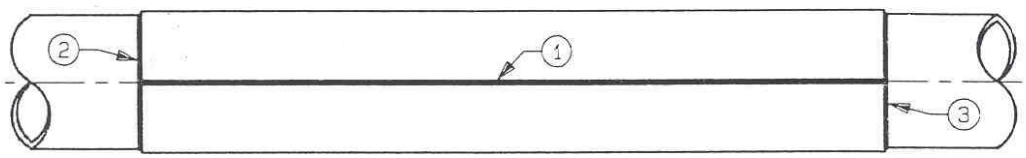
NorthWestern Energy

Gas Standards Subject: Engineering Special Use Welding: Low Hydrogen Fillet WPS-29A		Original Date 06/01/2006	Standard Number 69-FD
Supersedes Standard: 69-K	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee



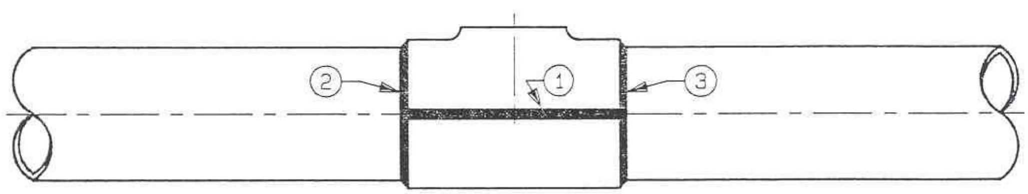
Dresser Reinforcing Sleeve - Style 220

1 2 3 = Sequence Of Welds



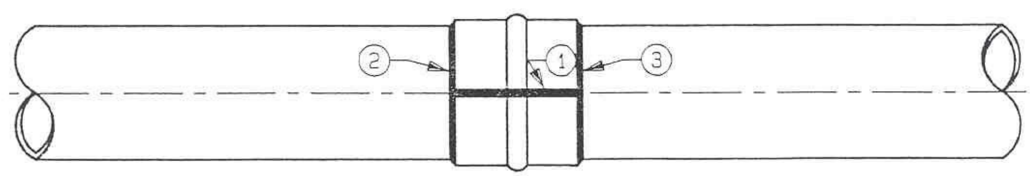
Edwards Split Casing

1 2 3 = Sequence Of Welds (See Note)



Split Tee

1 2 3 = Sequence Of Welds



Dresser Reinforcing Sleeve - Style 110

1 2 3 = Sequence Of Welds

NOTE:
When split casing only provides reinforcement and will not contain pressure, the end fillet welds 2 and 3 shall not be made.

Figure 2

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Hydrostatic Pressure Test		Original Date 06/01/2006	Standard Number 69-L
Supersedes Standard: 69-L	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

1.0 Scope

The purpose of this standard is to describe the minimum requirements of NorthWestern Energy's general procedures and policies for hydrostatic pressure testing distribution gas lines. These procedures are intended to accommodate the minimum requirements set forth by the Department of Transportation's 49CFR part 192.619 and NorthWestern Energy's O&M standard 1020.

2.0 General

2.1 Hydrostatic pressure testing is a special procedure and should only be used when required or no other method will suffice. A written plan shall be drafted for the use of this testing procedure.

2.2 Hydrostatic pressure tests typically have the lowest direct costs, but the highest associated operational impacts. Direct costs include isolating line, purging product from the line, filling line with water, repairs, drying line, and reinstating line. All of these activities can only take place after the line has been removed from service.

2.3 It is suggested that a reliable, experienced company be brought in to complete the hydrostatic test. An experienced contractor can make this method of testing less expensive and timely.

2.3.1 A contractor must provide the company with operator qualification documentation to ensure that all personnel are adequately qualified.

2.3.2 All roles and responsibilities should be clearly defined.

2.4 Water supply and disposal is a key factor to be considered before using a hydrostatic pressure test.

2.4.1 Water used in a hydrostatic pressure test should be potable water if not then it should not exceed the following requirements

- Silt ------- Less than 100 ppm
- Saline ---- Less than 2000 ppm
- PH -------- Between 6 and 9

2.4.2 When pumping from a stream or other local water source a filtration device should be used that is capable of removing 99% of all particles to 90 microns in diameter. Tests should be done at the suction side and the discharge side to ensure the filtration is working correctly.

2.4.3 Tests shall be run on the water after testing to determine the correct disposal method. Not all test water can be discharged on the ground or into local water with out contamination concerns.

2.5 After years of studies on hydrostatic pressure tests the following key points have been determined:

2.5.1 The predictability of failure pressure levels for defects located along the longitudinal axis based on the known axial length and maximum depth of defects.

2.5.2 Smaller defects will fail as the pressure is increased.

2.5.3 As pressure is increased, ductile tearing will occur resulting in the growth of defects that may hold initial pressure levels but could later fail with subsequent pressure increase.

2.5.4 Hydrostatic testing is an effective method for locating defective pipe.

2.5.5 Hydrostatic testing is a reliable method for detection of defective joints and system components.

2.6 Hydrostatic testing are executed in a systematic manner that includes:

2.6.1 Assignment of responsibility for company and contractor

2.6.2 Test requirements including cleaning, filling, and pressure testing

2.6.3 Water displacement and drying of test section.

2.6.4 Analysis and reporting of test results.

3.0 <u>Requirements</u>

3.1 NorthWestern Energy or, if contracted out, the Contractor shall furnish, at his sole cost and expense, all the labor, service, and materials, and all of the plant and equipment necessary to complete the hydrostatic testing, cleaning, and drying of the completed pipelines in accordance with the requirements of these specifications.

3.2 The specific distribution pipeline shall be hydrostatically tested as two test sections. The hydrostatic test pressure for the distribution pipeline shall be set, adjusted, monitored and recorded, along with temperature, at the south end test header. The test pressure and temperature shall also be monitored and recorded at the north end test header. The following table summarizes the significant locations for the hydrostatic test:

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Hydrostatic Pressure Test		Original Date 06/01/2006	Standard Number 69-L
Supersedes Standard: 69-L	REV # 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee

EXAMPLE **PIPELINE TEST SECTION**				
Location	**Stationing**	**Elevation**	**Pipe**	**Pressure/ %SMYS**
#1 North Test Header	0+00	3858	20” 0.250” X65	1571 +/-10 psig 96%
#1 High Point	104+83	4080	20” 0.250” X65	1475 +/- 10 psig 91%
#1 Low Point & South Test Header	242+81	3810	20” 0.250” X65	1592 +/- 10psig 97%

Note: Per 49 CFR Part 192 Subpart L section 192.619 ***Maximum allowable operating pressure: Steel or plastic pipelines*** *paragraph (a):*

Except as provided in paragraph (c) of this section, no person may operate a segment of steel or plastic pipeline at a pressure that exceeds the lowest of the following:

(ii) For steel pipe operated at 100 p.s.i.g. or more, the test pressure is divided by a factor determined in accordance with the following table:

Class Location	Factors[1], segment		
	Installed before (Nov.12, 1970)	Installed after (Nov. 11, 1970)	Converted under §192.14
1…………..	1.1	1.1	1.25
2…………..	1.25	1.25	1.25
3…………..	1.4	1.5	1.5
4…………..	1.4	1.5	1.5

So……if in a 500 MAOP system with class 3 areas, the minimum hydrostatic test pressure at the elevation high spot will be 750 psig – do not allow this to go under during your hydrostatic test. With a pipeline design MAOP pressure of 20 percent of SMYS, the low spot pressure ***(750 psig + (___ ft elevation difference between high and low X 0.433 psi/ft))*** *may exceed what the valves, etc. are good for. This is unlikely with small elevation changes, but they need to be checked. Make sure the low-end pressure does not exceed allowable test pressure on valves (if testing through valves), etc. (usually valves are tested at 1.5 their maximum operating pressure – check with the valve manufacturer). Also, NEVER test against a closed valve, as it will wreck the seats if the test pressure is higher than its maximum operating pressure. Always have valves cracked open and blind flange if necessary.*

3.3 NorthWestern Energy or, if contracted out, the contractor shall provide the following equipment in good working order:

3.3.1 High-pressure digital or deadweight gauges, nominal range 0 to 3,000 psig, with 1-psig increments of pressure. Gauges shall be calibrated within 90 days of the start of hydrostatic testing by a recognized testing laboratory. Contractor shall present the test certificate to the Company Representative prior to use.

3.3.2 Portable type pressure recorders, 0 to 3,000 psig nominal range, 12", chart drive, 24-hour movement, complete with charts, ink, and replacement nibs. Recorders shall be calibrated immediately prior to use.

3.3.3 Portable type temperature recorders, temperature elements fully compensated, 30°F to 120°F nominal temperature range, 12", chart drive, 24-hour movement, complete with charts, ink, and replacement nibs. Recorders shall be calibrated immediately prior to use. Refer to Drawing 0-12710-2, Temperature and Pressure Recorder Installation for Hydrostatic Test.

3.3.4 Water fill pump(s) with the capacity to fill the test sections at a minimum rate of 750-gpm against a static head of 500 feet.

3.3.5 Positive displacement pumps having a minimum pressure capability of 3,000-psig.

3.3.6 Air compressor(s) to provide a minimum pressure capability of 600-psig and a minimum volume capability of 900-cfm.

3.3.7 A minimum of two hydrostatic test headers designed for a minimum of 3,000 psig. Test headers must be capable of launching and receiving four polyethylene pigs, two at a time. Refer to Drawing A-12718-1, Typical Hydrostatic Test Header.

3.3.8 Pipe, flanges, valves, fittings, gaskets, studs and bolts, weldolets and hoses for connecting test equipment to the test headers on the pipelines.

3.3.9 An enclosed, leakproof, properly lighted and heated test house, of sufficient size to house the pressure recorders, digital or deadweights gauges, and test personnel at the data procurement site at both ends of the test section.

4.0 Hydrostatic Pressure Testing of Steel

4.1 **Cleaning Prior to Hydrostatic Pressure Testing**

4.1.1 Before making final tie-ins or hydrostatic testing, each line section shall be internally cleaned with air-driven pigs (Girard Maxi-brush poly pigs or equivalent) supplied by Contractor to assure line is clear of all obstructions. The Contractor shall provide, without interference with other construction operations, compressors, equipment and personnel necessary for fabricating, installing, and removing of manifolds, launchers, and traps; installing and removing pigs; locating and removing stuck pigs; and all other work connected with pigging and cleaning the line. A minimum of two cleaning runs shall be made, with a minimum of fifteen minutes duration between launching of the cleaning pigs. If, in the opinion of the Company Representative, the second pig does not produce a clean pipeline, the Contractor shall run additional pigs until line is clean.

4.1.2 If pig or pipe-cleaning devices fail to pass through due to obstructions, Contractor will locate and repair such obstructions at Contractor's own expense. Company Representative must be present when Contractor inserts pig in line, removes it, or opens line to remove obstructions.

4.2 Contractor shall excavate the bell holes, if required, for the installation of the test manifolds. Contractor shall install test manifolds prior to testing and remove them upon completion of the dewatering the pipeline. The test manifolds are to be constructed as shown on Drawing A-12718-1, Typical Hydrostatic Test Header or another design provided by the Contractor if prior approval is obtained from Company Representative. Company shall tie-in the successfully tested pipelines to the cross-tie assemblies on both ends of each pipeline.

4.3 The Company shall provide all water for hydrostatic testing. Contractor shall be responsible for any required transportation, removal, testing, and proper desposal of the water from the supply source to the point of injection into the pipeline. NOTE: An adequate water source is required. Make sure the water source is adequate to fill the pipe and complete the test.

4.4 Contractor shall fill the pipeline with water. There shall be four polyethylene pigs (Girard SCC Polypig or equivalent) installed in the test manifold prior to filling the pipeline with water. The water shall be injected into the pipeline with two (2) pigs in front of the water and two (2) pigs remaining behind in the test header. The Contractor shall supply the polyethylene pigs required for filling, dewatering, cleaning, and drying the pipeline.

4.5 Upon completion of the fill, the pressure in the test section shall be increased to 1500-psig, as measured and recorded at the injection test header for each pipeline. The 1500-psig will be locked in and allowed to stabilize to the Company Representative's satisfaction prior to commencing the hydrostatic test. Typically, allow water to stabilize to ground temperature overnight and allow minute amounts of air trapped in the pipe to absorb – may not happen at your pressures. Pressure up to ¾ of your test pressure for stabilization.

4.6 Once the hydrostatic test pressure has been established, the hydrostatic test pressure may vary, as shown in the tables above, before water is added or removed. At no time may the pressure fall below the minimum pressure requirement of your high point test pressure (1.5 X MAOP of Pipeline).

4.6.1 The increase in pressure from 1500-psig to test pressure shall be accomplished by a low volume, high pressure squeeze pump. Squeeze pump shall have a known volume per stroke and a stroke counter or flow meter installed so a pressure/volume curve may be plotted by Company during the squeeze. The hydrostatic test shall be conducted by maintaining the pressure within the pressure range previously indicated for at least 8-hours. The pressure and temperature shall be recorded at the test headers at both ends of the pipelines during the entire hydrostatic test. All pressure recorders are to be calibrated by deadweight gauge at the start and end of test at the test pressure and witnessed by Company Representative. After the test period is started, Contractor shall monitor the pump site pressure and shall re-pressure or bleed the section before the pressure varies beyond the limits of the required test pressure. Contractor shall maintain a pressure-time log at the pump site with readings taken at a minimum of 15-minute intervals.

4.6.2 All temperature and pressure charts shall be marked on the front with time on and off, test header location, and the digital or deadweight gauge start and end readings taken. The back of each chart shall have the following information recorded:

- *Date and hour chart is placed on and taken off.*
- *Location of recorder by station number.*
- *Location in test section - appropriate Test Header.*
- *Test medium - Water.*
- *Project name and number –*

  i.e. 6" Mitchell Ethanol Pipeline - PR ______ Network ______
- Signatures of the Contractor and Company representatives.

4.7 If, during the testing, a leak or failure becomes apparent, the Company shall start keeping an accurate record of labor, equipment and other charges associated with finding and repairing the leak or failure so that charges can be assessed to the proper party after the cause of the leak is determined. Contractor shall be responsible for locating any leaks or failures. If the failure is in the seam of the pipe, the entire joint in which the seam failure exists shall be removed from the pipeline. The Contractor shall remove a minimum of twelve (12) inches of pipe on each side of other failures. If the failure occurs during the eight (8) hour period, a retest for an additional eight (8) hour period is required after stabilization is reached.

4.8 In the event that any defects are discovered during hydrostatic testing which are due to faulty materials provided by the Company:

4.8.1 The Company shall furnish all materials necessary to replace any material originally furnished by it and proved to be defective, and any other installation damaged because of such defective materials.

4.8.2 Contractor shall furnish all labor, equipment, and other materials necessary to replace material furnished by the Company proved to be defective and to replace any installation damaged because of such defective materials, and the Company shall reimburse Contractor for the actual costs incurred in accordance with Paragraph C12 of the General Conditions.

4.9 In the event that any defects are discovered during hydrostatic testing which are due, in the sole opinion of the Company Representative, to inferior workmanship or faulty materials furnished by Contractor:

4.9.1 The Contractor shall remedy, without cost to the Company, all defects in the work due to or resulting from inferior workmanship or faulty material furnished by Contractor.

4.9.2 Contractor shall otherwise bear the full cost of all damages to the Company due to or resulting from inferior workmanship or faulty material furnished by Contractor.

4.10 **Cleaning and Drying After Hydrostatic Pressure Tests**

4.10.1 Upon completion of the hydrostatic test, Contractor shall dewater the pipeline with pigs supplied by the Contractor. A minimum of two separate dewatering runs are required. The first pig shall be received prior to the launching of the second pig. Additional dewatering runs shall be made if required in the opinion of the Company Representative. The Company shall acquire the water disposal site.

4.10.2 Contractor shall supply the following equipment in good working order for the cleaning and drying operation.

4.10.2.1 Air compressors for supplying pigging air equipped with aftercoolers, separators, coalescers and/or hydrocarbon filters sized for the air compressor and capable of achieving air quality of 2 to 3 parts per milllion absolute.

4.10.2.2 When required to supply dry air, air compressors will discharge through desiccant dryers sized for the compressor flows and capable of achieving –90 degrees Fahrenheit air at atmospheric conditions.

4.10.3 After the pipeline is dewatered, two wiping pig runs shall be made with dry air using one double dish coated poly pig in each run. The pigs shall be supplied by the Contractor. The Company Representative shall determine if additional wiping pig runs shall be made.

4.10.4 Upon completion of the wiping pig runs, the Contractor shall commence running with dry air, lightweight, open-cell polyurethane foam absorbent pigs (1 lb/cu.ft.) until one, in the opinion of the Company Representative, is recieved dry. A minimum of six (6) drying runs, with three absorbent pigs per run will be required. Pigs to be supplied by the Contractor. Each absorbent pig shall be allowed to make one run only. The Contractor shall be responsible for air filter bags to contain discharged dust if in close proximity to residences or at the request of the Company Representative.

4.10.5 After the drying runs, the Contractor shall run with dry air, one brush pig followed by two lightweight open-cell ployurethane foam absorbent pigs (1 lb./cu.ft). It will be the decision of the Company Representative if additional runs are required.

4.10.6 Following the brush pig runs, lightweight, open-cell polyurethane foam absorbent pigs (1 lb./cu.ft.) will again be run with dry air to remove loosened mill scale/debris from the pipeline. The pipeline will be considered clean when the pigs are recieved light in weight and color with a maximum depth of dirt contamination on the pigs of ¼". Company Representative shall determine depth of contamination.

4.10.7 The air flow in the pipeline shall then be checked to determine the dew point. The target dew point is –40 degrees F air at atmospheric conditions at the pig receiving end.

5.0 <u>Internal Geometric Inspection</u>

5.1 After completion of a successful hydrostatic test and the drying of the pipeline, Contractor shall run an internal geometric inspection pig through the pipeline to insure the line does not contain dents greater than 1/4 ". Payment for internal geometric inspection shall be made in accordance with Exhibit "C", Unit Price Schedule.

5.2 Contractor shall provide all labor, materials, supervision, equipment, and transportation required to gauge the internal bore of the pipeline. The Contractor shall prepare a detailed report of the survey findings and submit three copies to the Company.

5.3 The Contractor shall run the geometric tool through the pipeline propelled with dry air at the manufacturer's recommended velocity. The velocity shall be maintained as constant as is possible. Any significant increase in compression pressure occurring during survey operations, which may be attributable to the device being held stationary by an obstruction, shall be recorded and reported immediately to the Company Representative.

5.4 The geometric tool shall be designed to measure and locate sharp reductions and ovalities, and have a distance accuracy of ± 0.1 %. The geometric tool shall be able to detect dents, wrinkles, buckles, out-of-roundness, and flat spots.

5.5 Acceptability of the pipeline shall be verified only against a continuous data measurement record throughout the entire length of the pipeline. Should any part of the data measurement record (survey data) be missing, then the Contractor shall perform a rerun.

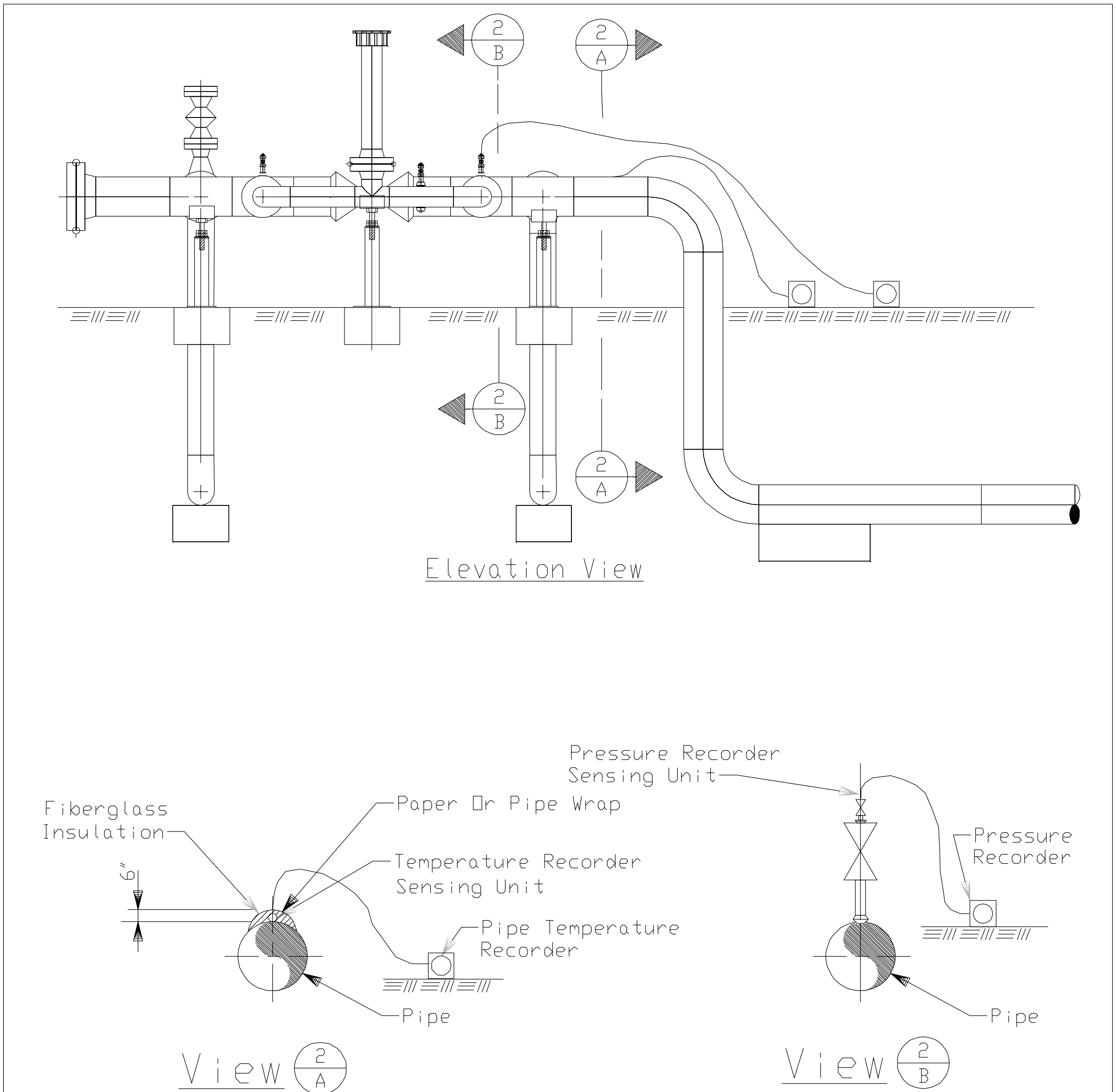
5.6 Upon completion of a successful geometric tool run, the recorded data shall be downloaded and examined. The data shall be reviewed by a qualified technician to facilitate an immediate correlation of the data information to the condition of the pipeline.

5.7 All reductions exceeding 1/4" shall be excavated and repaired at Contractor's expense.

5.8 The geometric survey final report shall be a detailed report and will include the survey data in its entirety. All anomalies shall be marked on the survey data log, along with an expanded view, analyzed, and categorized. The final report shall have a compilation of all anomalies and shall indicate pipeline features, anomaly features, size and length of the anomalies, and pipeline footage, and distance to the nearest line marker or benchmark location.

NorthWestern Energy

Gas Standards Subject: Engineering Engineering: Hydrostatic Pressure Test		Original Date 06/01/2006	Standard Number 69-L
Supersedes Standard: 69-L	REV# 1	Revision Date 06/01/2006	Prepared / Approved By K. Meagor / Committee



NOTES:

1.) TR1- Recording (Calibrated) thermometer with bulb flat on pipe covered with 6" fiberglass insulation, paper. To be set prior to filling line. See Section 2/A for method of installation.

2.) Location of Temperature & Pressure connections to be out of ground water.

3.) Contractor to furnish all material and instruments.

4.) Recorders to be operational prior to beginning water fill.

Rev. 0 04/29/99

Temperature & Pressure Recorder Installation For Hydrostatic Tests		
MPC THE MONTANA POWER COMPANY		
DRAWN Waggoner		DATE 4-29-99
CHECKED		SCALE None
ENGINEERED		APPROVED
ROLL	FRAME	DWG NO 0-12710-2

NorthWestern Energy

Gas Standards Subject: Engineering
Engineering: Hydrostatic Pressure Test

Supersedes Standard: 69-L	REV # 1	Original Date 06/01/2006 Revision Date 06/01/2006	Standard Number 69-L Prepared / Approved By K. Meagor / Committee

Specifications

Index No.	No. / Unit	Size	Description
C-1	4	2"	Plug, steel
C-2	1	16"	Cap, 0.375" Wall API 5L-X52
N-1	4	2" x 3"	Nipple, Sch. 80, 0.218" wall, TBE, ASTM A106-B
P-1	1	16" x	Pipe, 0.312" wall, BBE, API 5L-X65, determine
			length in field
S-1	3	18"-12" x 2"	3000# Thredolet
S-2	1	18"-12" x 2"	Flat-o-Let
V-1	4	2"	3000 lb. ANSI Full Opening Ball Valve

Weld Details and Notes

All welding procedures and welders must meet the requirements of paragraphs 192.225 and 192.227 respectively of D.O.T. Rules, Subpart E - Welding Steel in Pipelines. Welding shall be done in accordance with one of the following Mont. Power Co. welding procedures:

- MPC-WPS-5: for pipe 2-3/8" O.D. through 12-3/4" O.D. having a wall thickness of 3/16" or less.
- MPC-WPS-7: for pipe 2-3/8" O.D. through 12-3/4" O.D. having a wall thickness of 3/16" to 1/2".
- MPC-WPS-11: for pipe over 12-3/4" O.D. having a wall thickness of 3/16" to 1/2".
- MPC-WPS-26: for the welding of a thredolet or weldolet onto a line pipe.

Test to following pressures before using on pipeline:

16" header - Hydro-test to 2400 psi for 4 hrs. minimum.

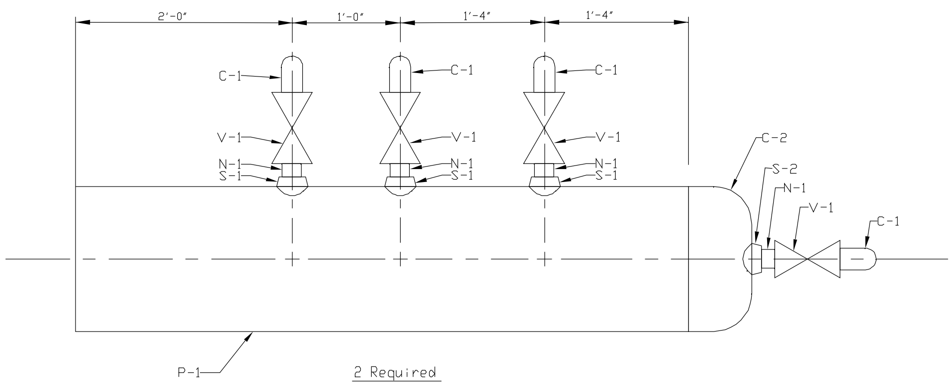
All pipe and fittings to comply with one or more of the following specifications, unless otherwise specified.

Pipe:
1" & 2" ASTM A106, Grade B
16" API 5L-X65

Weld Fittings: ANSI B16.9
MSS SP-75

NOTES:

1. Maximum Hydrostatic Test Pressure:
   16" Header - 2400#
2. Remove all burrs and shavings from inside pipe after drilling or cutting all holes.
3. Before testing headers install plugs, and open all valves.



2 Required

ROLL	FRAME	NO	REVISION	DATE	BY	APP'D	REFERENCE DRAWING	DWG. NO.
		4	Change Logo	2/06	JR			
		3	Change Title	10/03	SG			
		2	Revised	8/2001	JFR			
		1	Updated	7/2001	JFR			

NorthWestern Energy

DRAWN	B. Waggoner	DATE	05/05/99
CHECKED		SCALE	None
ENGINEERED		APPROVED	

0 1" 2"

16" Typical Hydrostatic Test Header

ROLL	FRAME	DWG. NO.	SH.
		A-12718-1	1 OF 1

Attachment LIUNA 1.3b

NorthWestern Master Services Agreement (MTU NPS)

MASTER SERVICES AGREEMENT

This Master Services Agreement ("*Agreement*") is made effective as of the ___ day of ____, 20__, by and between ________________, a __________ organized under the State of ________, with a principal place of business at ______________ ("*Contractor*"), and NorthWestern Choose an item. d/b/a NorthWestern Energy ("*NorthWestern*"), a corporation organized under the State of Choose an item..

NorthWestern and Contractor agree as follows:

1. SERVICES DESCRIPTION.

1.1 Description. This Agreement governs the performance of services requested periodically by NorthWestern from Contractor during the Term of this Agreement, as described in an individual Statement of Services utilizing the form attached to this Agreement as Exhibit 1 or individual purchase/service orders (for clarity also referenced herein as a "*Statement of Services*"), incorporated herein by this reference (the "*Services*"). Unless specifically agreed by NorthWestern in writing, Contractor shall furnish all labor, equipment, parts and materials and is responsible for all performance means, methods, techniques, sequences and procedures and for coordinating all portions of the Services.

This Agreement does not commit NorthWestern to order any Services. However, all Services provided by Contractor to NorthWestern during the Term of this Agreement, whether or not the subject of a specific Statement of Service, are subject to the terms and conditions of this Agreement unless specifically governed by another written agreement between the parties.

1.2 Representatives. NorthWestern's Representative is identified in each Statement of Services. NorthWestern's Representative shall represent and act on behalf of NorthWestern with the ability to bind NorthWestern.

Contractor's representative for the purposes of this Agreement is identified in each Statement of Services. Contractor's Representative shall represent and act on behalf of the Contractor with the ability to bind Contractor.

1.3 Agreement Documents. All Services shall be performed in accordance with the requirements of this Agreement and the attached Exhibits. The Exhibits incorporated as part of the Agreement include the following:

1.3.1 Exhibit 1 - Form of Statement of Services
1.3.2 Exhibit 2 - Form of Lien Release
1.3.3 Exhibit 3 - Insurance Requirements
1.3.4 Exhibit 4 - Form of Change Order

1.4 Inclusion; Order of Precedence; Conflicts. The Agreement and Exhibits are to be considered complementary, and the Services include all services and work that should be customarily included within the general scope and magnitude of the Services. In the event of a conflict between this Agreement and the Exhibits, the body of this Agreement governs. Each amendment or Change Order will take precedence over that part of the Agreement for which it supersedes.

2. TERM AND SCHEDULE.

2.1 Term. The term of this Agreement will be effective the date first written above, and ends on the ___ day of ______, 20__ ("*Term*"). If any Statement of Service is in process upon expiration of the Term, this Agreement will continue in effect until completion or termination of the applicable Services. Time is of the essence in the performance of each and every obligation by Contractor.

2.2 Schedule. Contractor shall perform the Services in accordance with the time schedule set forth in the Statement of Services. Contractor shall complete the Services on or before the date established in the Statement of Services.

2.3 Progress Reports and Schedule Updates. Contractor shall furnish progress reports as to the completion of the Services in a manner and form as directed by the NorthWestern Representative. Contractor shall continuously monitor, forecast, report, and control the progress of the Services in accordance with the time schedule for performance to insure the completion of the Services within the specified time period.

3. PAYMENT AND INVOICING.

3.1 Payment. NorthWestern shall compensate Contractor in accordance with the compensation terms and conditions set forth in the Statement of Services.

3.2 Invoicing. Invoices must be delivered to **NorthWestern Energy, Attn: Accounts Payable, 11 E Park St. Butte, MT 59701. Email invoices must be sent to: accountspayable@northwestern.com.** All invoices must reference CLM000XXXX and name the NorthWestern's Representative identified in the Statement of Services. Each invoice must provide such detail as to allow NorthWestern to compute the amount due for Services performed and material or parts supplied. Payment will be made within 30 days after NorthWestern's receipt of an undisputed invoice. Payment does not relieve Contractor from any obligation under this Agreement or constitute a waiver of any right or claim arising from the performance of the Services.

3.3 Withholding. NorthWestern may decline to pay an invoice, in whole or in part, to the extent necessary to protect NorthWestern from: (i) a breach by Contractor of any of its material obligations under the Agreement; (ii) third party claims filed against NorthWestern for which Contractor has an indemnification obligation under this Agreement; (iii) Contractor's failure to properly pay its subcontractors (except to the extent of NorthWestern's non-payment of undisputed invoices); and (iv) damage to NorthWestern arising out of acts or omissions of Contractor. NorthWestern may also decline to pay unsubstantiated or unsupported amounts invoiced. In the event of a withholding, NorthWestern shall pay the undisputed portion and notify Contractor of the amount withheld and the basis for the withholding. If payment is withheld for any of the reasons set forth in this Section, such payment will be made when the grounds for withholding have been removed.

3.4 Audits. Upon reasonable notice, NorthWestern or its designated third party representative may examine any books, records, or other documents of Contractor directly relating to the performance of the Services and, with the exception of lump sum payment arrangements, the cost and compensation thereof. Contractor shall cooperate in this effort and make employees and records reasonably available.

3.5 Lien Releases. Contractor shall pay promptly and prevent any default in all obligations incurred for the purchase of materials, equipment, labor, services and taxes related to the completion of the Services. Upon request by NorthWestern, Contractor shall furnish to NorthWestern lien releases, with Contractor's invoices, conditioned only upon Contractor's receipt of payment of said invoice. If any lien is filed or claim occurs, Contractor shall remove the lien or indemnify and defend NorthWestern. If Contractor fails to remove such lien or claim within 7 calendar days after receipt of NorthWestern's written notice, NorthWestern may proceed to file a bond pursuant to applicable law or otherwise remove such lien or claim, and Contractor shall pay NorthWestern all costs and expenses incurred by NorthWestern in so doing, including reasonable attorneys' fees and court costs. Contractor shall deliver to NorthWestern partial lien waivers (upon request) using the form attached as Exhibit 2.

3.6 Claims for Additional Compensation. Upon the occurrence of any event during the course of the Services for which Contractor intends to submit a claim for extra compensation or damages for any reason in addition to the compensation set forth in the Statement of Services which has not been approved by Change Order as provided in Section 10, Contractor shall give NorthWestern notice in writing of such intent within 30 days after gaining knowledge of the occurrence of such event. Absent notice, such claim will be deemed to have been waived by Contractor. Notice will in no way constitute acceptance by NorthWestern of the validity of such claim.

3.7 Release of Liability. Contractor's acceptance of the final payment under each Statement of Services constitutes a release to NorthWestern from all payment claims and payment liability for Services performed.

4. SUSPENSION AND TERMINATION.

4.1 Suspension. NorthWestern may, without cause, order Contractor to suspend, delay or interrupt the Services in whole or in part, for such period of time as NorthWestern may determine. Upon reinstatement of the Services, the schedule of the applicable Statement of Services will be amended by the parties. Suspension of Services does not automatically entitle Contractor to additional compensation. NorthWestern shall reimburse Contractor for reasonable direct costs incurred, provided the suspension, delay or interruption is not caused by Contractor. Any claim by Contractor for an adjustment of compensation due to a suspension, delay or interruption ordered by NorthWestern must be made in writing and will be mutually negotiated in good faith by the parties.

4.2 Termination for Convenience. NorthWestern may, in its sole discretion, terminate any Statement of Services or terminate the Agreement for its convenience, in whole or in part, at any time upon 15 days' written notice to Contractor. In the event of a termination for NorthWestern's convenience pursuant to this Section 4.2, Contractor shall be entitled, as its sole and exclusive remedy, payment for Services completed and reasonable direct costs incurred by reason of such termination along with reasonable overhead and profit on the Services executed. In no event will Contractor be entitled to any prospective, anticipated, or lost profits or any damages of any type with respect to the terminated portion of the Services. Upon request, Contractor shall provide a full and complete itemized accounting of all reimbursable costs.

4.3 Termination for Cause. NorthWestern may, after providing Contractor 15 days' written notice and opportunity to cure, terminate any Statement of Services or terminate the Agreement upon the occurrence of Contractor default, which includes the following: (i) refusal or failure to supply enough properly skilled employees or proper equipment and materials; (ii) bankruptcy, insolvency or failure to make payment to subcontractors or suppliers for labor and materials; (iii) disregard of applicable law or regulations; or (iv) a material breach of any provision of the Agreement. Contractor is not entitled to reimbursement of costs, lost profit or any adjustment of the compensation set forth in the Statement of Services due to a termination ordered by NorthWestern pursuant to this Section 4.3.

4.4 Right to Complete Services. Upon termination of any Statement of Services, NorthWestern may take control of the site of the Services and of all materials and finish the Services by whatever reasonable method NorthWestern deems expedient. NorthWestern may deduct reasonable and verifiable direct costs of completing the Services from payments then or thereafter due the Contractor.

4.5 Preservation. Upon receipt of notice from NorthWestern of a suspension or termination, Contractor shall cease operations as directed by NorthWestern, take actions necessary for the protection and preservation of the Services, and except for Services directed to be performed prior to the effective date of suspension or termination in the notice, and Contractor shall suspend or terminate (as directed by NorthWestern) all existing subcontracts and purchase orders and take such other action as may be directed by NorthWestern.

5. INSPECTION AND ACCEPTANCE.

5.1 Progress Inspections. NorthWestern may appoint individuals to inspect the Services to monitor progress and ensure compliance with the Agreement, including inspections at the point of fabrication of equipment and materials, sub-assembly, preparation for shipment or elsewhere. Contractor shall provide reasonable access and assistance required by NorthWestern for inspections of the Services.

The Statement of Services may identify specific points in the manufacture, fabrication, assembly or inspection and test cycles requiring observation by a representative of NorthWestern. If required by the Statement of Services, Contractor shall provide NorthWestern with 7 calendar days advance notice of impending hold or witness points. If inspection is required, and Services is performed prior to providing NorthWestern the opportunity to perform the inspection, upon request Contractor shall uncover such Services for inspection. The cost of uncovering the Services shall be borne by Contractor.

Inspectors have the authority to reject Services that do not conform to the requirements of the Statement of Services. If Contractor objects to the decision of an inspector, Contractor may make a written appeal to the NorthWestern Representative. Progress inspections do not constitute acceptance of the Services, and do not relieve Contractor from performing the Services in accordance with the Statement of Services.

5.2 Subsystem Inspection and Acceptance. If the Statement of Services require completion and turnover of a subsystems or distinct portions of the Services, upon completion of such subsystem or distinct portion of the Services NorthWestern shall inspect the Services for compliance with the Statement of Services pursuant to the procedures set forth in this Section 5. Contractor shall furnish all reasonable assistance required by the NorthWestern's Representative for an inspection of any subsystem or distinct portion of the Services. NorthWestern's acceptance of the completion of a subsystem or distinct portion of the Services does not relieve Contractor of its obligations to fully complete the Services.

5.3 Final Inspection and Acceptance. Upon completion of the Services, Contractor shall provide written notification to NorthWestern's Representative. Upon receipt of such notice, NorthWestern's Representative or his/her designee shall promptly perform a final inspection of the Services. A final inspection does not constitute a waiver of any right or warranty; however, a satisfactory final inspection by NorthWestern's Representative or his/her designee constitutes acceptance of the Services. If NorthWestern fails to inspect the Services within 15 days after receipt of notice of completion from Contractor, the date of the notice of completion shall be deemed an acceptance for the sole purpose of the initiation of the warranty period.

5.4 Correction of Rejected Services. NorthWestern's inspectors have the authority to reject Services which are defective or do not conform to the requirements of the Agreement. Upon receipt of written notice, Contractor shall promptly correct Services rejected by NorthWestern. Contractor shall bear all costs of correcting such rejected Services, including additional testing and inspections and compensation for NorthWestern's services and expenses made necessary thereby.

6. WARRANTY.

6.1 Warranty. Contractor shall perform the Services in accordance with standards of care, skill and diligence normally provided by professionals in the performance of similar Services. Contractor warrants the Services are free from defect in workmanship, title and design (if Contractor is performing engineering services) and the Services conform to the requirements of the Agreement. All Services not conforming to these requirements will be considered defective.

6.2 Parts and Material Warranty. Contractor warrants that parts and materials incorporated into the Services will be new, undamaged, of good quality, free from defects in title and in accordance with the requirements of the Agreement. Parts and materials not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and rejected. Parts and material warranties provided by the manufacturer are in addition to the Contractor's warranty, and shall be assigned to NorthWestern on or before acceptance of the Services.

6.3 Warranty Period. Contractor warrants the Services, parts and materials for the full warranty period. The warranty commences upon final acceptance of the Services and continues for one calendar year from the date of the final acceptance by NorthWestern. Any repair or replacement of Services, parts or materials furnished pursuant to Section 6.4 carries warranties on the same terms as set forth above, except that the warranty period is for a period of one year from the date of such repair or replacement.

6.4 Correction of Defects. If the Services or any part thereof is determined to be defective during the warranty period, Contractor shall, upon written notice and NorthWestern making the site of the Services available for correction, and at Contractor's expense, repair, replace or correct the defective Services. The cost of field labor associated with the repair, replacement or correction of defective Services, including parts and materials, will be borne by Contractor.

If Contractor is required to perform warranty repair or replacement work at the site of the Services, Contractor, at its own expense, shall complete such repair or replacement in compliance with the applicable conditions of this Agreement. Any repair or replacement of defective Services disrupting the commercial operation at the site of the Services will be coordinated with NorthWestern's operating personnel to minimize disruption of NorthWestern's ongoing operations. NorthWestern may require around-the-clock repair, including weekends and holidays. All costs incidental to such efforts are to be borne by Contractor.

If Contractor has not started to make necessary repairs, replacement or correction of the Services within 10 days after NorthWestern has notified Contractor of a defect in the Services, and NorthWestern has not granted Contractor additional time to respond, NorthWestern is authorized to make the repairs or replacement or to order repairs or replacement to be done by a third party, with the cost paid by Contractor.

In the event of an emergency where, in the reasonable judgment of NorthWestern, delay would cause serious loss or damage to the property or the safety of persons, repairs or replacement of the Services may be immediately made by NorthWestern or a third party chosen by NorthWestern. The reasonable cost of the repairs or replacement of the Services will be paid by Contractor.

6.5 Intellectual Property. Contractor warrants the Services and any portion thereof do not infringe upon any patent, copyright, trademark, trade secret or other intellectual property right. To the extent the Services incorporate Contractor's proprietary or protected intellectual property, Contractor hereby grants NorthWestern an irrevocable, nonexclusive, royalty-free license for use of the same solely in connection with the operation, maintenance, repair, or alteration of NorthWestern's facilities and business operations. If the Services or any part thereof becomes subject to a claim of infringement, misappropriation, or any related injunction, or if Contractor believes it may be subject to such a claim, Contractor shall remedy the same at its expense by replacing or modifying the allegedly infringing element(s) without loss of functionality or securing for NorthWestern the right to continue to use such element(s).

7. INDEMNIFICATION.

7.1 Indemnification. To the fullest extent permitted by law Contractor shall indemnify, defend, and hold harmless NorthWestern and its officers, directors, employees and representatives from and against any and all claims, causes of action, proceedings, demands or suits (collectively "*Claim(s)*") and any and all judgments, liabilities, losses, expenses, damages, fines or penalties, including court costs, reasonable attorneys' fees, costs and interest (collectively "*Liabilities*"), to the extent such Claims and Liabilities arise from or in connection with: (i) Claims of third parties relating to the performance of Services by Contractor, its subcontractors and respective agents and representatives; (ii) Claims by any governmental authority arising from violations or alleged violations of applicable law during the performance of Services by Contractor, its subcontractors and respective agents and representatives; (iii) Claims that the Services or any portion thereof infringe upon any patent, copyright, trademark, or other intellectual property right, or constitutes an unauthorized disclosure of any trade secret; or (iv) Claims by any governmental authority for taxes that are the responsibility of Contractor, its subcontractors and respective agents under this Agreement. Contractor's indemnity obligation does not apply to the extent Claims or Liabilities arise or result from the negligent or intentionally wrongful acts or omissions of NorthWestern. In the event of concurrent negligence, Liabilities will be borne by each party in proportion to its share of the negligence.

7.2 Procedural Requirements. Contractor's obligation to defend NorthWestern is independent of and in addition to Contractor's duty to indemnify and hold NorthWestern harmless. If any person or entity asserts a Claim for which NorthWestern could be held liable, then Contractor shall also have a duty to defend NorthWestern. If any Claims arise for which NorthWestern is entitled to indemnity, Contractor shall promptly give written notice to NorthWestern and provide a copy of any correspondence, pleading and legal process, along with a detailed description of the Claim. Contractor shall engage legal counsel reasonably acceptable to NorthWestern to assume the defense and shall contest, pay, settle or compromise any such Claim on such terms and conditions as Contractor may determine; provided Contractor shall not enter into any settlement or consent to entry of any judgment without the written consent of NorthWestern that does not include an unconditional release from all Claims and Liabilities, includes a statement as to an admission of fault, culpability or failure to act by or on behalf of NorthWestern, or imposes any conditions, future obligations or limitations on NorthWestern.

8. **INSURANCE**.

Prior to the commencement of Services, Contractor shall satisfy the insurance requirements set forth in Exhibit 3, attached hereto and incorporated herein by this reference.

9. **DAMAGE LIMITATION**.

NorthWestern is not liable to Contractor for any indirect, incidental, consequential, special, exemplary or punitive damages arising from or related to this Agreement, its performance, enforcement, breach or termination, such as, but not limited to, loss of revenue, anticipated profits, or loss of business.

10. PERFORMANCE OF SERVICES.

10.1 Representations. Contractor represents that Contractor: (i) has examined the Agreement and Statement of Services; (ii) is familiar with and has satisfied itself as to all federal, state, and local laws and regulations that may impact cost, progress or performance of the Services; and (iii) has notified NorthWestern of all conflicts, errors and ambiguities Contractor discovered in the Agreement and Statement of Services; (iv) is financially capable of fulfilling all of its obligations under this Agreement and there are no legal or administrative proceedings pending or threatened that could adversely affect its performance; and (v) is experienced and qualified, organized and equipped to perform the Services.

10.2 Cooperation. If other work is being done at the same time and place as the Services, Contractor shall cooperate and coordinate with other contractors and NorthWestern's personnel to promote the efficient completion of the Services and to minimize disruption of business operations of NorthWestern.

10.3 Access to Site of Services. NorthWestern shall provide Contractor reasonable access to the site of the Services.

10.4 Cleaning Up. Contractor shall keep the site of the Services in a clean and orderly manner at all times and shall remove all rubbish and refuse daily. At completion of the Services, Contractor shall remove from the site waste materials, Contractor's tools, equipment and machinery and surplus materials. Contractor shall restore and replace in a suitable manner all public and private property damaged in the performance of the Services which was not a part of the Services and shall leave the site free and clear from all obstructions and safety hazards. Should Contractor fail to comply with the foregoing, NorthWestern may perform the clean up, removal or remediation at Contractor's expense.

10.5 Modifications.

10.5.1 Change Orders. NorthWestern may at any time request changes in the Services within the general scope of the Agreement consisting of additions, deletions or other revisions. All mutually agreed upon changes in the Services will be authorized by a Change Order using the form attached as Exhibit 4 and incorporated herein by this reference. The Change Order will set forth the mutually agreed upon revisions, if any, to the compensation paid, schedule of performance and Term of the Agreement.

10.5.2 Minor Changes in the Services. NorthWestern may direct minor changes in the Services without a Change Order in the event such changes: (i) do not involve adjustment in the compensation or extension of the Term, and (ii) are reasonably consistent with the intent of the Agreement and Statement of Services. Such changes will be documented and are binding on NorthWestern and Contractor.

10.6 Subcontractors.

10.6.1 Written Approval. Specific portions of the Services may be performed by subcontractors; provided that Contractor may not subcontract all or substantially all of the Services. Contractor shall not subcontract the performance of the

Services or any portion thereof without first obtaining the written approval of NorthWestern's Representative.

10.6.2 Right to Reject. Services performed by a subcontractor without the approval of NorthWestern's Representative may be rejected or accepted at NorthWestern's discretion. Subcontractors who fail to perform the Services in a satisfactory manner shall be terminated by Contractor upon notice from NorthWestern's Representative.

10.6.3 No Contractual Relationship. The performance of any portion of the Services by a subcontractor does not create a contractual relationship between NorthWestern and such subcontractor.

10.6.4 Contractor's Obligations. Nothing herein relieves Contractor of its responsibility for the full and complete performance of the Services under the Agreement. Contractor shall be as fully responsible for the acts or omissions of any subcontractor as it is for its own acts or omissions. Contractor shall require each subcontractor to comply with the terms and conditions of this Agreement. Any notice required by this Agreement is considered notice to any affected subcontractor.

10.7 Removal of Personnel. If NorthWestern is dissatisfied with the performance of any Contractor employee or subcontractor, NorthWestern shall notify Contractor and the parties will attempt to resolve such issues on a mutually agreeable basis. If the issues are not resolved to NorthWestern's satisfaction, Contractor shall remove the individual personnel or subcontractor from performing Services under this Agreement.

10.8 Laws, Regulations and Permits. Contractor shall comply fully with applicable workers' compensation requirements and all other applicable federal, state and local laws, regulations, and ordinances. Contractor will obtain and keep current, at Contractor's expense, all permits, certificates and licenses necessary for the performance of the Services. Permits obtained by Contractor shall be maintained at the site of the Services and copies shall be available to NorthWestern on request.

10.9 NERC Compliance.

10.9.1 Compliance. Contractor shall at all times comply with NorthWestern's security management information protection program implementing NERC's CIP Reliability Standards for Bulk Electric Power Systems of North America.

10.9.2 Access Restricted. If any personnel of Contractor require key card access to a restricted area or electronic access to a protected system, Contractor shall identify such individual to NorthWestern Representative and provide requested verification documentation and information. Such individuals are subject to background checks from time to time during the Term of this Agreement. Access to any restricted area or protected system by Contractor personnel without strict adherence to NorthWestern's protection program is a material breach of this Agreement. NorthWestern is entitled to deny access to any individual for whom access is proposed if such individual at any time does not meet NorthWestern's requirements under its security program, including execution of waivers and other documentation required by NorthWestern as a condition of granting or maintaining such access. If any individual granted key card access to a restricted area or electronic access to a protected system no longer requires such access, Contractor shall immediately collect such individual's key card and give notice of the individual's name, the date on which access was no longer needed and return the key card to the individual designated by NorthWestern.

10.9.3 Training. As a condition of NorthWestern granting access to any personnel proposed by Contractor, such individual must take (and retake as necessary) all NERC-related training required by NorthWestern. NorthWestern may require such individual to demonstrate competence in the subject of such training as a further condition to gaining or maintaining access.

10.9.4 The foregoing requirements set forth in this Section 10.9 constitute the NERC requirements applicable to Contractor, its subcontractors and any others for whom Contractor is responsible. NorthWestern may audit and inspect any and all such information regarding compliance or non-compliance with NERC and CEII requirements.

10.10 Equal Opportunity and Affirmative Action. The parties hereby incorporate 41 C.F.R. 60-1.4(a)(7); 29 C.F.R. Part 471, Appendix A to Subpart A; 41 C.F.R.60-300.5(a)ii; and 41 C.F.R. 60-741.5(a), if applicable. Contractor shall abide by the requirements of 41 C.F.R. 60-300.5(a) and 41 C.F.R. 741.5(a). These regulations prohibit discrimination against qualified protected veterans, and qualified individuals on the basis of disability, respectively, and require affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified protected veterans and qualified individuals with disabilities, respectively.

10.11 Nonexclusive. This Agreement is not exclusive. NorthWestern may retain the services of other contractors for similar work and Contractor may perform services for third parties.

10.12 Inspection of Site. Contractor has examined the site of the Services and is informed as to existing and reasonably discoverable conditions and limitations, including all laws, ordinances and regulations affecting the performance of the Services. Failure to examine the site of the Services does not relieve Contractor of any obligations set forth herein. Contractor is responsible for locating all utilities at the site of the Services.

10.13 Delivery, Title and Risk of Loss.

10.13.1 Delivery. Delivery terms for material and equipment is DDP destination pursuant to Incoterms 2020. Contractor shall arrange for all transportation, freight, storage, and transfer costs (including duties and similar charges) of every kind and nature in connection with the Services.

10.13.2 Title. Legal and equitable title to materials and equipment will pass to NorthWestern upon delivery to the site of the Services. The passage of title does not release Contractor from its responsibility to fully carry out the obligations under the Agreement and does not relieve Contractor from full responsibility for the care, custody and control of such materials and equipment.

10.13.3 Risk of Loss. Risk of loss to the Services remains with the Contractor until the Services are completed and accepted by NorthWestern pursuant to the terms of the Agreement. Unless caused by an act or omission of NorthWestern, any loss or damage to the Services prior to final acceptance is the responsibility of Contractor and Contractor shall promptly repair or replace such lost or damaged Services.

10.14 Labor Relations. Contractor is responsible for labor peace among its employees and those of its subcontractors and will assist NorthWestern in maintaining labor harmony during the performance of the Services. Contractor shall at all times exert its best efforts and judgment to adopt and implement policies and practices designed to avoid work stoppages, slowdowns, disputes, or strikes by its personnel, when reasonably possible and practical under the circumstances. Contractor shall advise NorthWestern promptly and in writing of any actual, anticipated, or threatened labor disturbance that might affect the timely completion of the Services. In the event of a labor disturbance, Contractor shall take immediate steps, at its own expense, to alleviate or resolve the matter.

10.15 Site Security. Contractor shall take all precautions and measures as may be necessary to secure the site of the Services at all hours, including evenings, holidays and non-work hours. Contractor shall install and maintain, as required by existing conditions, safeguards such as signs and warnings against hazards and safety regulations. Contractor is responsible for all required notifications to property owners and users of adjacent property and utilities.

10.16 Contraband. No individual will perform Services while under the influence of any illegal/controlled substance or alcohol. Contractor shall advise its employees, subcontractors and agents that the use, possession and/or distribution of illegal drugs, drug-related paraphernalia or weapons during the performance Services is strictly prohibited. Contractor agrees to comply with all postings and notices located on NorthWestern's property and with all policies, rules, and regulations of NorthWestern.

10.17 Location of Underground Facilities. Contractor is responsible for locating and marking the location of any underground facilities (including but not limited to pipelines, utility supply, delivery or service lines and communication facilities) in accordance with the applicable law. Contractor shall make every effort to avoid damage to underground facilities and shall be responsible for any damage which may occur.

10.18 Design and Engineering. If the Services include any design component, Contractor shall engage engineers professionally licensed within the jurisdiction where the Services are performed, and shall design the applicable portions of the Services in accordance with Statement of Services. Contractor shall prepare all drawings, specifications, calculations, plans, reports and other design documentation (collectively the "*Design Documents*") for such portions of the Services. In accordance with the schedule for performance, and prior to commencing any subsequent related phase of the Services, Contractor shall deliver preliminary Design Documents to NorthWestern in an agreed electronic format (with hard copy upon request). NorthWestern shall review and approve, approve with comments or reject Design Drawings within 15 calendar days after NorthWestern's receipt of the same. Notwithstanding the foregoing, NorthWestern is not responsible for the accuracy or completeness of such Design Documents or for any defects, deficiencies, or inadequacies therein or any failure of the design to comply with the requirements set forth in the Statement of Services. In no event will any review, comment, or approval of NorthWestern, or acceptance or acknowledgment of any of the Services, in any way relieve Contractor of any of its obligations, including responsibility for errors and omissions, confirmation of quantities, selection of fabrication processes, techniques, the accuracy of the dimensions, details and the quality of its instruments of service prepared in connection with the Services as well as its responsibility for the quality, integrity, safety, and timely performance of the Services. Design Documents requiring certification or seal must be certified or sealed by a professional engineer, licensed and qualified to perform engineering services in jurisdiction of the site of the Services.

10.19 Copies and As-Built Drawings. Contractor shall maintain in good order at the site of the Services at least one record copy of any Design Documents, marked currently to record changes made during the performance of the Services and one record copy of approved shop drawings, product dates, samples and other submittals required by Contractor, all of which will be available to NorthWestern for inspection and use at all times. As a condition of final acceptance, any as-built drawings shall be delivered by Contractor to NorthWestern, as well as a set of reproducible record drawings (in native and other formats requested by NorthWestern) showing all changes to Design Documents made during performance of the Services.

11. PROTECTION OF PERSONS, PROPERTY AND THE ENVIRONMENT.

11.1 Safety of Persons and Property. Contractor is responsible for the safety of employees and others and the implementation of safety programs during the performance of the Services. Contractor shall comply with the safety requirements of the Occupational Safety and Health Act, pipeline safety rules and regulations promulgated by the Department of Transportation, and other applicable laws and regulations. Contractor agrees to maintain its tools, equipment, and vehicles in safe operating condition, and take all other actions necessary to provide a safe working environment. Contractor shall provide, install, and maintain all necessary barricades, suitable danger signals and flag persons, and shall take all necessary precautions for the protection of the property. Contractor shall promptly remedy damage and loss to property caused in whole or in part by Contractor at the site of the Services or adjacent thereto, such as damage to trees, shrubs, lawns, pavement, roadways, structures and utilities not designated for removal or relocation.

11.2 Hazardous Substances. Contractor shall observe and comply with all federal, state and local environmental laws and regulations during the performance of the Services.

11.2.1 Hazardous Substances and Labeling. Contractor shall supply NorthWestern with a Safety Data Sheet ("*SDS*") for any hazardous substances to be used during the performance of the Services prior to conducting activities at the site of the Services. Contractor shall also provide NorthWestern with a list of the maximum quantities of such hazardous substances to be used during the Services. All Contractor personnel involved in performing the Services shall be properly trained and experienced in the use, handling and cleanup of the hazardous substances. All hazardous substances and petroleum products brought onto the site of the Services and any hazardous waste and used petroleum products generated during the performance of the Services must be plainly and properly labeled.

11.2.2 Spills and Contamination. Contractor shall immediately notify NorthWestern verbally and promptly thereafter in writing of the presence and location of any spill, leak or unintended release of any hazardous substance, chemical or petroleum product during the performance of the Services, and shall take appropriate steps necessary to protect persons, property and the environment. If Contractor discovers any prior environmental contamination, Contractor shall cease performance of affected Services, secure the contaminated area against intrusion, notify NorthWestern and take appropriate steps for which Contractor is qualified and deems necessary to protect persons, property and the environment.

11.2.3 Spill Control and Containment. Contractor shall comply with applicable spill prevention, control, countermeasure (SPCC) rules and regulations during performance of the Services.

11.3 Waste Removal. Contractor is responsible for the removal and disposal of all hazardous and non-hazardous substances, waste, waste material, or refuse generated by Contractor from the site of the Services in compliance with applicable federal, state and local laws and regulations. Contractor shall pay all costs associated with removal and disposal unless otherwise agreed upon in writing by NorthWestern.

11.4 Prohibition Against Discharge of Processed/Treated/Waste Water. Contractor shall comply with all applicable federal, state and local regulations associated with the management, generation, disposal and discharge of storm, processed, treated, or waste water associated with the Services. Contractor shall pay all costs associated with the removal and disposal of storm, processed, treated, or waste water unless otherwise agreed upon in writing by NorthWestern.

11.5 Storm Water Requirements. If the Services may cause one or more acres of land to be disturbed, Contractor shall notify NorthWestern prior to commencing the Services. Disturbed areas include, but are not limited to: (i) areas cleared of vegetation where erosion may occur (including vehicle traffic areas); (ii) vehicle or equipment storage areas where erosion may be caused; (iii) areas of spoils piles; (iv) areas where active Services may occur; and (v) any other areas where Services activity may cause erosion.

If one or more acres of land will be disturbed, Contractor will not proceed with the Services until a valid Storm Water Discharge Permit ("*SWDP*") has been obtained and a project-specific Storm Water Pollution Prevention Plan, also known as Storm Water Management Plan ("*SWMP*"), is developed. Contractor shall comply with the provisions in the SWDP and the SWMP. Contractor will repair at its own cost and to the satisfaction of NorthWestern any damage caused by Contractor to storm water control structures. Contractor will notify NorthWestern immediately after any storm event that causes erosion at the site of the Services or if controls are inadequate or ineffective in retaining sediment-laden runoff within the site of the Services.

12. OWNERSHIP OF DOCUMENTS.

All technical information, documents, and reports, in whatever medium or format, including but not limited to, data, specifications, drawings, designs, plans, records, reports and proposals prepared by Contractor during the performance of the Services are the exclusive property of NorthWestern upon payment by NorthWestern. To the extent the Services incorporate Contractor's proprietary or protected intellectual property, Contractor hereby grants NorthWestern an irrevocable, nonexclusive, royalty-free license for use of the same solely in connection with the operation, maintenance, repair, or alteration of NorthWestern's facilities and business operations.

13 DELAYS.

13.1 Force Majeure. If Contractor is delayed at any time in the commencement or progress of the Services by any unforeseeable condition, event, or circumstance beyond Contractor's control, then the schedule of performance for completion of the Services will be extended by Change Order for such reasonable time as the parties mutually agree. Contractor is only entitled to an extension of the time to perform the Services if, and to the extent: (i) such condition, event, or circumstance is not within the reasonable control of Contractor; (ii) such condition, event, or circumstance, despite the exercise of reasonable diligence, could not be prevented, avoided or removed by Contractor; (iii) such condition, event, or circumstance has a material adverse effect on the ability of Contractor to fulfill its obligations under this Agreement; and (iv) Contractor has taken reasonable precautions and exercised due care in order to avoid the effect of such condition, event, or circumstance on Contractor's ability to fulfill its obligations under this Agreement and to mitigate the consequences thereof. An extension of the time for performance is Contractor's sole and exclusive remedy for such delay.

13.2 Exclusions from Force Majeure. Notwithstanding the foregoing, Contractor is not entitled to an extension of time to complete the Services upon the occurrence of the following events, conditions or circumstances:

13.2.1 Late delivery of materials and equipment required for the Services (except to the extent caused by the occurrence of an independent condition, event, or circumstance satisfying the requirements of Section 13.1);

13.2.2 Shortages of labor, supervisors or personnel or strikes or other labor disturbances affecting Contractor or any of its subcontractors; provided such strike or labor disturbance is not caused by a subcontractor or laborers utilized at the request of NorthWestern;

13.2.3 Late performance as a consequence of any violation of applicable law or decisions of a governmental authority related to the conduct of Contractor or any subcontractor;

13.2.4 Breakdown, loss, or damage to or theft of equipment or materials (except when directly due to the occurrence of an independent condition, event, or circumstance satisfying the requirements of Section 13.1); and

13.2.5 Increased costs of the Services, general economic, or industry conditions.

13.3 Weather Delays. If adverse weather conditions are the basis for a request for additional time, such claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled Services. Inclement or adverse weather is not a prima facie reason for an extension of the time for performance of the Services, and Contractor shall make every effort to continue Services under prevailing conditions. Contractor shall consider normal seasonal weather days in the planning and scheduling of the Services to ensure completion within the time for performance. No time extensions will be granted for Contractor's failure to consider and account for normal seasonal weather.

13.4 Notice Requirements. Contractor shall deliver notice of any delay or potential delay within 3 days after the occurrence of the event giving rise to the delay or the potential delay. The notice will include a description of the reason for the delay or potential delay and the actions Contractor is undertaking to remediate or avoid any delay.

This Agreement may be terminated by NorthWestern for its convenience pursuant to Section 4.2 if an event of force majeure hereunder causes a delay in excess of 90 days after notice of delay is delivered pursuant to this Section 13.4.

14. TAXES.

14.1 Sales, Gross Receipt, Use and Contractor's Excise. Contractor shall obtain all necessary tax licenses for all jurisdictions where Services are performed. Contractor is responsible for the collection and payment of all sales, consumer, use, contractor's excise and similar taxes for the Services performed.

14.2 Wage and Other Taxes. Contractor shall pay all payroll and other related employment compensation taxes for Contractor's employees, and federal, state and other taxes that may be assessed on Contractor's net income, net worth, license, privilege or gross receipts.

14.3 Import and Custom Duties. Contractor is responsible for payment of, or for obtaining exemption from, all import and customs duties, licenses and taxes imposed on imported materials or equipment, as well as other cost associated with clearing such items for delivery to NorthWestern.

15. APPLICABLE LAW, FORUM AND DISPUTE RESOLUTION.

15.1 Applicable Law and Forum. This Agreement is governed in all respects by the laws of the State Choose an item.. Any action arising out of this Agreement must be brought in state or federal courts of the State Choose an item. and Contractor consents to the jurisdiction of such courts in any such action or proceeding and waives any objection to venue therein. Process in any action or proceeding referred to in the preceding sentence may be served on either party electronically.

15.2. Dispute Resolution. When a dispute has arisen and negotiations between the parties have reached an impasse, either party may give the other party written notice of the dispute. In the event such notice is given, the parties shall attempt to resolve the dispute promptly by negotiations between representatives who have authority to settle the controversy and who are at a higher level of management than the persons with direct responsibility for the matter. The representatives shall confer in person or by telephone promptly to attempt to resolve the dispute. If the dispute has not been resolved by negotiation within 30 days of the notice, then either party may proceed to a court of competent jurisdiction.

16. <u>CONFIDENTIALITY AND CEII</u>.

16.1 NorthWestern desires to maintain the confidentiality of proprietary information furnished pursuant to this Agreement. Confidential Information must be used by Contractor strictly for the performance of this Agreement and for no other purpose. Contractor shall not, without the prior written permission of NorthWestern, disclose Confidential Information acquired from NorthWestern; provided that nothing herein prohibits Contractor from disclosing Confidential Information to its directors, officers and employees, agents and subcontractors who reasonably need to have access to such Confidential Information for the performance of the Services. The term "*Confidential Information*" includes designs, drawings, plans, business information or like information and any other written information, data, correspondence or other tangible materials disclosed orally, electronically or in any form, by NorthWestern as well as data, findings, results, or recommendations developed by Contractor in connection with the performance of the Services. Confidential Information includes all information as described herein, whether or not marked "*Confidential*" or "*Proprietary*".

16.2 All Confidential Information remains the property of NorthWestern and, upon request, will be returned at termination or upon the expiration of the Agreement. Contractor's confidentiality obligation hereunder does not extend to information which: (i) is already public or becomes available to the public through no fault of Contractor; (ii) was in the possession of Contractor prior to receipt from NorthWestern; or (iii) Contractor can demonstrate that such information was independently developed by Contractor without reference to NorthWestern's information. If compelled by a governmental authority, applicable law or discovery to disclose any Confidential Information, Contractor shall make reasonable efforts to resist disclosure and shall notify NorthWestern in writing prior to making any disclosure in order to provide NorthWestern a reasonable opportunity to either waive any objection to such disclosure or request a remedy from the appropriate authority. Contractor shall cooperate with NorthWestern in efforts to obtain such a remedy. If NorthWestern waives its objections or is unsuccessful in its request for a remedy or fails to make such a request, Contractor will only furnish that portion of the Confidential Information that is legally required.

16.3 The parties acknowledge that a violation of this Section 16 would cause irreparable harm to the NorthWestern for which no adequate remedy at law exists. Contractor therefore agrees that, in addition to any other remedies available, NorthWestern is entitled to seek injunctive relief to enforce the terms of this Section, including to prevent a breach or contemplated breach hereof, without proof of actual damages or the posting of any bond or security, which posting is hereby waived to the fullest extent permitted by applicable law.

16.4 All public relations matters arising out of or in connection with the Services is the sole responsibility of NorthWestern. Contractor shall obtain NorthWestern's prior written approval of the text of any announcements, publications, photographs, or other type of communication concerning the Services which Contractor or its subcontractors wish to release for publication. Permission may be withheld in NorthWestern's sole discretion.

16.5 CEII. Contractor may be granted access to information classified by the Federal Energy Regulatory Commission as "critical energy infrastructure information" ("*CEII*"). As a recipient of CEII, Contractor shall: (i) only use CEII solely in connection with its performance of the Services; (ii) notify subcontractors, consultants and advisors who receive CEII of the confidentiality requirements of this Agreement; (iii) not knowingly use CEII for an illegal or non-legitimate purpose; (iv) maintain CEII in a secure place and limit access to such parties who need to know the information and agree to be bound by the confidentiality requirements of this Agreement; and (v) return or destroy the CEII within 15 days of a written request by NorthWestern or the termination of this Agreement. NorthWestern may audit Contractor's compliance with these non-disclosure requirements. Violation of these requirements may result in criminal or civil sanctions against Contractor.

17. MISCELLANEOUS.

17.1 Independent Contractor. Contractor is an independent contractor and not the employee, agent or representative of NorthWestern. Contractor has the responsibility for and control over the means and details of performing the Services. This Agreement cannot be construed to create an employment relationship between NorthWestern and Contractor or a partnership, joint venture or joint undertaking between the parties.

17.2 Rights and Remedies. Duties and obligations imposed by this Agreement and rights and remedies available herein are in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

17.3 Assignment. The Agreement is personal to Contractor. Contractor shall not assign this Agreement, in whole or in part, without the prior written consent of NorthWestern.

17.4 Entire Document. The Agreement represents the entire agreement between NorthWestern and Contractor and supersedes any prior negotiations, representations or agreements, either written or oral. Covenants or representations not contained or incorporated therein are not binding upon the parties. Commercial terms and conditions incorporated into Contractor's invoices are of no effect.

17.5 Severability. If any provision of the Agreement, or the application thereof, is to any extent held invalid or unenforceable, the remainder of the Agreement will not be affected thereby, and each and every remaining provision will be valid and binding to the fullest extent permitted by law; provided, however, the parties agree to negotiate in good faith and reform this Agreement to as closely as possible resemble the original intent and allocation of risks and benefits.

17.6 Notices. Written notice shall be deemed to have been duly served if delivered in person to the individual for whom it was intended, or if delivered at or sent by registered or certified mail to the business address identified in this Agreement. Written notice may be provided by e-mail, and is effective upon confirmation of receipt. For purposes of written notice, the following addresses shall be used (unless otherwise set forth in the Statement of Services):

NORTHWESTERN	**CONTRACTOR**
NORTHWESTERN ENERGY	___________________________
11 E. Park St.	___________________________
Butte, MT 59701	___________________________
Attn: ________________	Attn: _____________________
Phone: _______________	Phone: ____________________
Email: ________________@northwestern.com	Email: _____________________

17.7 Successors and Assigns. This Agreement is binding upon and inures to the benefit of the heirs, legal representatives, successors and assigns of the parties.

17.8 No Waiver. No course of dealing or failure of NorthWestern or Contractor to enforce strictly any term, right or condition of this Agreement may be construed as a waiver of such term, right or condition. No express waiver of any term, right or condition of this Agreement will operate as a waiver of any other term, right or condition.

17.9 Amendments. This Agreement will not be modified, amended or changed in any respect except by a Change Order or by an instrument in writing signed by authorized representatives of the parties.

17.10 No Third Party Beneficiary. This Agreement is for the exclusive benefit of the NorthWestern and Contractor and does not constitute a third party beneficiary agreement and may not be relied upon or enforced by a third party.

17.11 Non-Recourse. The obligations of NorthWestern under this Agreement do not constitute obligations of any shareholder, officer, director or employee of NorthWestern and no claim or action may be brought or maintained against any such individuals.

17.12 Authority. Each party represents that it has full power and authority to enter into and perform this Agreement and the person signing this Agreement on behalf of each party has been properly authorized and empowered to sign this Agreement.

17.13 Survival. Each of the terms, conditions and obligations set forth in Sections 6, 7, 9, 12, 15, 16 and 17 shall survive the termination or expiration of this Agreement for the maximum period allowed under applicable law.

17.14 Counterparts. This Agreement may be executed in counterparts, which together constitute one instrument. Copies of this fully executed instrument have the same force and effect as the original.

17.15 Affiliate Transactions. Contractor agrees that NorthWestern's Affiliates may request Services pursuant to the terms and conditions of this Agreement. The term "Affiliate" as used in this paragraph shall mean any entity controlling, controlled by or under common control with NorthWestern. All references in this Agreement to NorthWestern shall refer equally to an Affiliate requesting Services from Contractor hereunder. Notwithstanding anything in this Agreement or a Statement of Services to the contrary, it is understood that the obligations of each Affiliate shall be exclusively the obligations of the transacting company and that non-transacting Affiliates have no liability whatsoever in connection therewith. It is further agreed that each Affiliate is severally and not jointly liable to Contractor and no Affiliate shall have financial or other responsibility or liability for any Services that was not furnished for such Affiliate.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed effective the day and year first above written.

NORTHWESTERN ENERGY

____
(signature)

____
(printed name)

____

____
(date)

CONTRACTOR

____
(signature)

____
(printed name)

____ (title)
(title)

____
(date)

EXHIBIT 1

FORM OF STATEMENT OF SERVICES

Pursuant to the terms and conditions of the Master Services Agreement dated effective as of _______________, 20__, by and between NorthWestern Corporation d/b/a NorthWestern Energy ("*NorthWestern*") and_________________ ("*Contractor*"), the parties hereby agree as follows:

1. Services.

2. Schedule.

3. Payment Terms.

4. Rate Schedule (If time and material).

5. Representatives.

NorthWestern's Representative for this Statement of Service is _________. The contact information for NorthWestern's Representative is _________.

Contractor's Representative for this Statement of Service is _________. The contact information for Contractor's Representative is: _________.

6. Entire Agreement. This Statement of Service and the above-referenced Agreement constitute the complete understanding of the parties with respect to the Services specified herein.

The parties have executed this Statement of Service on the date(s) indicated below.

NORTHWESTERN:	CONTRACTOR:
______________________	______________________
(signature)	(signature)
______________________	______________________
(name printed)	(name printed)
______________________	______________________
(title)	(title)
______________________	______________________

(date) (date)

EXHIBIT 2

FORM OF LIEN RELEASE

WAIVER AND RELEASE OF LIEN RIGHTS

STATE OF ____________)
)
COUNTY OF ___________)

COMES NOW, ______________, a ________ organized under the laws of the State of Montana, whose address is ______________________________ ("*Contractor*"), and hereby represents that all bills for labor, materials, lands, licenses, and other expenses for which a lien might be filed associated with Master Services Agreement __________ Statement of Services Number ________ have been fully satisfied and paid and for value received does hereby release lien claims against Northwestern Corporation, d/b/a NorthWestern Energy, ("*NorthWestern*") and its property, and Contractor hereby covenants and agrees, for itself, its successors and assigns, that Contractor shall defend and save harmless NorthWestern and its affiliates from and against any and all said liens or demands of laborers, mechanics, subcontractors, materialmen or others.

IN WITNESS WHEREOF, I have hereunder set my hand in behalf of Contractor this ____ day of ____________, 20___ at ________________, ____.
(City) (State) (Zip Code)

CONTRACTOR

By: ____

Title: ______________________________________

ACKNOWLEDGEMENT

STATE OF ____________)
)
COUNTY OF ____________)

On the ____ day of ________________, 20__, before me, the undersigned officer, personally appeared ___________________, who acknowledged himself/herself to be the ___________________ of _____________________, and that he/she as such __________________, being authorized to do so, executed the foregoing instrument for the purposes therein contained, by signing the name of the company by himself/herself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

____
Notary Public

(SEAL) My Commission Expires: ________________

EXHIBIT 3

INSURANCE REQUIREMENTS

Insurance requirements:

1. Prior to commencement of performance under this Agreement, Contractor shall secure and maintain all insurance required as evidenced by Paragraph 10 below.

2. Contractor shall maintain in effect at all times during the performance of the Services, insurance in accordance with the applicable laws relating to workers' compensation and employers' liability insurance, regardless of whether such coverage or insurance is mandatory or merely elective under the law.

3. Required insurance coverage is to be purchased at Contractor's expense.

4. If the scope of Services is significantly expanded, NorthWestern reserves the right to increase the required coverage or require additional endorsements or policies of insurance.

5. Contractor shall notify NorthWestern of any erosion of aggregate limits under any of the insurance policies, and if requested, purchase additional limits of coverage as may be deemed by NorthWestern to satisfy Contractor's coverage obligations.

6. Contractor shall maintain such insurance in full force and effect at all times until:

6.1. all the Contractor's obligations under this Agreement have been fully performed, the Services have been accepted by NorthWestern, and all operations by Contractor and its subcontractors (including but not limited to removal of equipment and other property) on or about the site of the Services have been concluded;

6.2. in the instance of completed operations and products liability coverage, until the expiration of one year after Contractor's obligations under this Agreement have been fully performed; and

6.3. in the instance of professional liability coverage, two years from project completion or three years from acceptance of the Services.

7. Contractor is obligated to ensure that any policies of insurance that Contractor carries as insurance against loss of or damage to Contractor and subcontractor property (including, but not limited to, tools, equipment and vehicles) or against liability for property damage or bodily injury (including death) shall:

7.1. be placed with such insurers having an A.M. Best rating of A-VII or better (not applicable to professional liability).

7.2. with the exception of workers' compensation and employers' liability

7.2.1 be endorsed to name NorthWestern as an additional insured with respect to any liabilities assumed under this Agreement; and

7.2.2 apply severally and not collectively to each insured against whom claim is made or suit is brought, except that the inclusion of more than one insured shall not operate to increase the insurance company's limits of liability as set forth in the insurance policy.

7.3. include within automobile coverage(s), owned, non-owned, hired and borrowed vehicles.

7.4. be primary insurance with respect to the interest of NorthWestern as additional insured and any insurance maintained by NorthWestern is excess and not contributory insurance with the insurance required hereunder.

7.5. include a waiver of the insurer's right of subrogation against NorthWestern. Contractor also hereby waives all rights of subrogation against NorthWestern.

7.6. provide that the policies will not be canceled or their limits or coverage reduced or restricted without endeavoring to provide at least 30 days prior written notice to the Contract Administration Department, NorthWestern Energy, 11 E Park St. Butte, Montana 59701.

NorthWestern will look to Contractor’s insurer for coverage for claims arising from the negligent acts or omissions of Contractor and its subcontractors.

8. Contractor shall instruct and require its insurance agent/broker to complete and return an insurance certificate, in an ACORD form, as evidence that insurance policies providing the required coverage, limits and additional insured provisions as outlined within this Exhibit 3 are in full force and effect. Contractor shall be fully responsible for all deductibles and self-insured retentions related to insurance provided herein. NorthWestern will not accept the use of the following Additional Insured Endorsement - CG 2426 – Amendment of Insured Contract Definition.

   Prior to commencement of the Services, the completed insurance certificate form must be returned to the Contract Administration Department, NorthWestern Energy, 11 E Park St. Butte, Montana 59701.

9. The insurance requirements of this Agreement and acceptability to NorthWestern of insurers and insurance to be maintained by Contractor and its subcontractors are not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the insured under this Agreement. Contractor is solely responsible for the level of insurance coverage it requires of its subcontractors.

10. MINIMUM GENERAL REQUIREMENTS.

$1,000,000 General Liability
$1,000,000 Automobile Liability
Statutory Workers’ Compensation
Employers’ Liability - $1,000,000 each accident; $1,000,000 disease - policy limit; and $1,000,000 disease – each employee
TBD - Excess Liability
TBD – Pollution Liability

TBD – Professional Liability

EXHIBIT 4

CHANGE ORDER FORM

CHANGE ORDER

NORTHWESTERN ENERGY CHANGE ORDER: _________

CONTRACTOR: ____________________________________

DESCRIPTION **AGREED VALUE**

Original Compensation: _________

Value of Change Orders to Date: _________

Value of this Change Order: _________

Currently Approved Compensation: _________

SCHEDULE IMPACT

Calendar days added to schedule: _________

Calendar days deducted from schedule: _________

Revised completion date of Services: _________

The Agreement, with any amendments and Change Orders to date, is modified to the extent and in the manner described herein. Contractor acknowledges that it has taken into consideration the cumulative effect of this Change Order and all prior Change Orders, and all incremental costs resulting therefrom are included in the pricing of this Change Order.

ACCEPTED BY CONTRACTOR: ____ DATE: __________________

AUTHORIZED BY NORTHWESTERN: _________________________________ DATE: __________________

Attachment LIUNA 1.3c

NorthWestern Contractor Safety

Contractors

8. Contractors

8.1 General

A. A contractor, as used in the context of this section, refers to contractors in the collective sense, including the contract company, its supervisors, and its employees.

B. NorthWestern Energy continues to expect its contractors to accept primary responsibility for job safety and the day-to-day implementation of proper safety and health programs and training. NorthWestern Energy has the same high expectations for the safety performance of its outside contractors as it does for its own workforce.

C. All persons at the job site, whether NorthWestern Energy or contractor employee, shall take appropriate action to correct unsafe work conditions, especially those that pose a serious risk for injuries or property damage to employees or the public.

D. All contractors performing work for NorthWestern Energy will do so under the terms and conditions of contracts generated and approved by the Contracts Administration Department.

E. It is the contractor's responsibility to perform all work in strict accordance with all applicable codes and statutes, federal, state, and local rules and regulations. Failure of the contractor to comply with said standards and regulations shall be cause for suspension of the work until such conditions are eliminated or corrected. Neither the requirements that the contractor follow said practices and applicable laws, rules, and regulations, nor NorthWestern Energy's right to inspect and/or suspend the work, shall relieve the contractor of the sole responsibility to maintain safe and healthful working conditions. Further, the contractor shall not require any employee employed in the performance of the contract to engage in work under conditions which are unsanitary, hazardous, or dangerous to an employee's health or safety.

F. Contractors are solely responsible for training and education of employees under its control. Personnel shall be trained in all aspects and potential hazards of the operation to which the contractor's employees are exposed.

G. Typically, a NorthWestern Energy employee is designated as the "Company Representative" on all contracts. When possible and practical, all communication with the contractor shall be through the Company Representative.

8.2 Contractor Roles and Responsibilities

A. The contractor holds ultimate responsibility for the safety and health of their employees.

B. The contractor fulfills the obligation and duty to provide a safe and healthy workplace for employees and any subcontractors that they employ.

C. The contractor reports serious incidents to the NorthWestern Energy Company Representative immediately.

D. The contractor actively promotes an effective safety culture amongst its employees and maintains a successful safety and health program.

8.3 Substations and Other Potentially Energized Facilities

A. NorthWestern Energy requires all personnel entering substations or working on NWE facilities and property to adhere to the requirements of the Occupational Safety and Health Administration (OSHA). In particular, special consideration shall be given to the applicability of 29 CFR 1910.269, OSHA's standard on "Electric Power Generation, Transmission, and Distribution".

B. Only those personnel who are "qualified" (as defined by OSHA) and authorized (by mutual agreement of NorthWestern Energy and the contractor) shall be permitted to enter substations or work around energized NWE facilities.

   1. OSHA defines as "qualified" (29 CFR 1910.269) only those employees who are trained and competent in all of the following:

      a) The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment.

      b) The skills and techniques necessary to determine the nominal voltage of exposed live parts.

      c) The minimum approach distances corresponding to the voltages to which the qualified person will be exposed.

      d) The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.

C. When a person is not actually working on the electrical system, he/she needs to know how to keep himself/herself and objects a safe distance away from energized parts.

D. For purposes of this specific section, "Substations and Other Potentially Energized Facilities", contractor employees not certified as "qualified" by the contractor (as per the definition above) are considered as "unqualified" under the OSHA regulations. Under no conditions will contractors allow unqualified employees to approach energized equipment (50 kV and below) any closer than ten (10) feet, or as specified by OSHA regulation.

8.4 Access to NorthWestern Energy Facilities

A. Uncontrolled access to NorthWestern Energy facilities should only be granted to contractors qualified to perform the work in a safe manner.

B. A qualified NorthWestern Energy employee shall be present any time unqualified contractors are working in Company facilities, such as substations and gas gate stations.

C. Barricading may be used to assist in providing safe work areas for contractors within NorthWestern Energy facilities. This does not replace the need for a formal contractor qualification process.

D. Contractors must wear appropriate PPE for the hazards specific to the task. Contractors shall follow general NorthWestern Energy PPE requirements while within our facilities.

8.5 Loaned Employees

A. Loaned employees are defined as contractor employees working under the direct supervision of a NorthWestern Energy employee.

B. Typically, the following provisions shall apply to loaned employees, unless other specific arrangements have been made under the contract:

1. Personal protective equipment

   a) Provision for personal protective equipment – The contractor must provide all necessary PPE for his/her employees' use.

   b) Use of personal protective equipment - Contractor employees must wear appropriate PPE when working on NorthWestern Energy projects or property as follows:

      1) Safety glasses with side shields – All jobsites, substations, shops, yards and warehouses when engaged in work activities.

      2) Hardhats – Same as above.

      3) Flame or arc protective clothing – At all jobsites while performing work activities that have a potential for arc or flash fire exposure.

4) Specialized equipment such as rubber gloves and sleeves, respiratory protection, etc. – As needed to protect employees from the specific hazards involved.

2. Training

a) Provision of training – The contractor must provide all training to his/her employees to meet applicable codes and regulations.

b) Required training – Contractor employees must have received training before engaging in the following activities on NorthWestern Energy projects, systems or property:

1) Natural gas emergency response – 24 hour Hazardous Materials Technician training to be involved in controlling natural gas releases or First Responder Operations Level to assist in protecting the public and property during such releases.

2) Rubber gloving – Be knowledgeable in the NorthWestern Energy rubber gloving procedures.

3) Taking Clearances – Be knowledgeable in NorthWestern Energy clearance procedures and have a current, approved switching qualification form on file at the Northwestern Control Center.

c) Documentation of training – The contractor must provide training documentation requested by NorthWestern Energy within ten business days. Training records include those listed above as well as records that are pertinent to compliance activities.

3. NorthWestern Energy Safety and Health Rules

a) In addition to the above, contractor employees are required to comply with all NorthWestern Energy safety and health rules, procedures, policies, etc.

b) Loaned employees, working under the direct supervision of a NorthWestern Energy employee, are required to attend daily job briefing sessions and sign the NorthWestern Energy – Job Briefing Form.

4. Incident Reporting - NorthWestern Energy must be made aware of incidents that occur to employees who are not on our payroll if we directly supervise these employees on a day-to-day basis (loaned employee as described above).

8.6 Contractor Noncompliance

A. If situations occur where noncompliance with the contract is observed and/or reported, the Company Representative for that contract (and contractor) will be notified as soon as possible, preferably in writing. The Company Representative will contact the responsible person for the contractor and discuss the situation. Once the situation is resolved, the person who reported the noncompliance should be notified as to the outcome of the situation.

B. If a situation involving a contractor is observed which is imminently dangerous, the NorthWestern Energy employee should attempt to intervene as soon as possible and attempt to convince the contractor supervisor to shut the job down. The situation shall be reported to the Company Representative as soon as possible. If the matter has not been resolved, the Company Representative will take the necessary measures to resolve the situation.

C. Differing opinions between the contractor and NorthWestern Energy on adequacy of existing or proposed protective measures, equipment, procedures, or devices shall be resolved as follows:

   1. The contractor shall not start or continue using the measure, procedure, equipment, or devices, or expose employees to associated hazards until the differences have been resolved.
   2. Upon resolution of the differing opinions, either with or without an independent professional's input, the questionable measure, procedure, equipment, or device shall be brought into conformance with the agreed upon solution.
   3. Obtaining engineering data or retaining the services of an independent professional engineer to assist in resolving the issue(s) remains a contractor responsibility.

8.7 Job Briefings/Tailboard

A. In some cases, it may be necessary to conduct job briefings (also known as pre job meetings) with contractors prior to the start of work. It is the responsibility of the Company Representative to ensure each contractor is aware of NorthWestern Energy's requirements (as listed above). If the contractor has not worked for NorthWestern Energy or the Company Representative is not absolutely sure that the contractor understands all requirements, the job briefing is required.

B. When the job briefing is required, written documentation should be generated by the Company Representative to affirm discussion of the following details:

1. Acknowledgment of job hazards specific to the project. For example, in the case of a substation, specific hazards may include what facilities are energized;
2. Acknowledgment of job hazards in general;
3. Safe work procedures and precautions, including adequate personal protective equipment;
4. Security, access, and notification procedures and requirements;
5. Public safety issues and concerns; and
6. Emergency contact information.