INFRA PIPE SOLUTIONS

BUTT FUSION JOINING PROCEDURE AND QUALIFICATION GUIDE

TECHNICAL BULLETIN

1. INTRODUCTION

The procedures outlined in this document are qualified for use with Infra Pipe's Sclairpipe and Wehogas product lines.

2. SCOPE

This document outlines the procedures for joining polyethylene pipe & fittings by butt fusion.

Materials that have been pre-qualified to be joined by this fusion procedure are within the nominal melt index range of 0.05 to 0.25 gm/10 minutes (190°C/ 2.16 Kg), or a high load melt flow of 6 to 17 gm/10 minutes (190°C/21.6 Kg), and a nominal density range of 0.936 to 0.958 g/cc.

3. OVERVIEW

In butt fusion joining, mating surfaces are prepared, mating faces are melted with a hot-plate heater, the heater is removed, and the melted surfaces are pressed together and held under pressure. As the molten materials cool, they mix and fuse into a permanent, monolithic joint. Infra Pipe fusion procedures require specific tools and equipment for the sizes of pipe and fittings being joined.

- Butt fusion is used to make end-to-end joints between “butt” or plain end pipes and fittings that have the same outside diameter and like wall thickness.[1]

NOTE: This document refers only to the fusing aspect of the installation process. For detailed information on the proper laying of pipe, see ASTM D2321 and D2774.

[1] “*Like wall thickness”* means that the pipe or fitting ends being butt fused do not exceed one SDR difference, for example, SDR 9.0 to SDR 11.0.

4. REGULATIONS FOR GAS PIPE JOINING

4.1.U.S. regulations

When used to join Infra Pipe polyethylene gas pipe and fittings, Infra Pipe fusion joining procedures are qualified in accordance with U.S. Department of Transportation Regulations.

- D.O.T. Regulations require that each joint in a gas piping system must be made in accordance with written procedures that have been proved by test or experience to produce strong gastight joints (49 CFR, Part 192 § 192.273(b)).

- D.O.T. Regulations require that written procedures for butt fusion joining of polyethylene gas piping must be qualified before use by subjecting specimen joints to required test procedures (CFR 49, Part 192, §192.283(a)).

- D.O.T. Regulations require that all persons who make joints in polyethylene gas piping must be qualified under the operators written procedures (CFR 49, Part 192, §192.285(a)).

    - D.O.T. Regulations require that the gas system operator must ensure that all persons who make or inspect joints are qualified (CFR 49, Part 192, §192.285(d) & § 192.287).

This bulletin has been developed to assist those responsible for the fusion joining of Infra Pipe products in meeting the requirements of CFR 49, Part 192, §192.285 as it applies to heat fusion, or other state or local codes or regulations, or company or client requirements, if any, as they apply to the qualification of individuals in joining Infra Pipe products by heat fusion.

CAUTION – Infra Pipe polyethylene piping products cannot be joined with adhesives or solvent cement. Joining by hot air (hot gas) welding, or extrusion welding techniques and joining by pipe threading are not recommended for pressure service.

4.2.Canadian regulations

When used to join Infra Pipe polyethylene gas pipe and fittings, Infra Pipe fusion joining procedures are qualified in accordance with Canadian Standards Association Regulations.

- CSA Regulations require that joints in polyethylene piping shall be designed and installed to withstand the longitudinal forces caused by contraction of the pipes or by external loadings. (CSA Z662-15. 12.7.13.2)

- CSA Regulations require that joints in polyethylene piping shall be made by personnel who are qualified in the applicable procedures. (CSA Z662-15, 12.7.3)

- CSA Regulations require that heat fusion joints shall be made in accordance with documented procedures that have been proven by tests. Fusion tools thermostatically controlled and electrically heated must be designed specifically for butt fusion and must be used only for the purpose for which they are designed. Direct application of heat using a torch or open flame is prohibited. (CSA Z662-15, 12.7.8.1)

- CSA Regulations require that heat fusion joints shall not be made between different grades of polyethylene pipe materials, unless their compatibility is certified by the manufacturers or proven by tests. (CSA Z662-15, 12.7.8)

- The Alberta Energy and Utilities Board requires that automated data logging equipment be used to record the fusion parameters used to make each joint. Each joint must be permanently identified, allowing the corresponding data log to be looked up at any point throughout the duration of the pipe's lifetime. (Directive 077)

5. PRECAUTIONS

5.1. Static electricity

Polyethylene plastic pipe does not readily conduct electricity. A static electricity charge can buildup on inside and outside surfaces, and stay on the pipe surface until some grounding device such as a tool or a person comes close enough for the static electricity to discharge to the grounding device.

Discharging one part of the pipe surface will not affect other charged areas because static electricity does not readily flow from one area to another. Polyethylene pipe cannot be discharged by attaching grounding wires to the pipe.

WARNING – Fire or Explosion – Static electricity can ignite a flammable gas or combustible dust atmosphere.

A static electricity discharge to a person, a tool, or a grounded object close to the pipe surface can cause an electric shock or a spark that can ignite a flammable gas or combustible dust atmosphere causing fire or explosion.

- In gas utility applications, static electricity can be a potential safety hazard. Where a flammable gas-air mixture may be encountered and static charges may be present, such as when repairing a leak, squeezing off an open pipe, purging, making a connection, etc., precautions to prevent electrical arcs from being struck are necessary[1]. Observe all Company (pipeline operator, utility, contractor, etc.) procedures for static electricity safety and control, including procedures for discharging static electricity and requirements for personal protection.

- Take steps to discharge static electricity from the surface of a polyethylene gas pipe. Such steps include wetting the entire exposed pipe surface with a conductive anti-static liquid or dilute soap and water solution, then covering or wrapping the entire wetted, exposed pipe surface with a grounded wet burlap, conductive poly film, or wet tape conductor. The external covering should be kept wet by occasional re-wetting with anti-static solution. The veering or tape should be suitably grounded such as to a metal pin driven into the ground.

- Steps that discharge the outer surface do not discharge the inner surface of the pipe. Squeeze-off purging, venting, cutting, etc., can still result in a static electricity discharge. When appropriate, ground tools and remove all potential sources of ignition.

[1] See the AGA Plastic Pipe Manual For Gas Service

- Appropriate safety equipment should be used.

- Do not use polyethylene pipe for handling dry grain or coal where a static electricity discharge may ignite a combustible dust atmosphere and cause an explosion or fire.

5.2.Electric tools

WARNING – Fire or explosion – Electric tools or fusion equipment may not be explosion-proof and may ignite a flammable gas or flammable dust atmosphere.

DO NOT operate electrical devices that are not explosion proof in a flammable gas or flammable dust atmosphere. When a flammable gas-air mixture may be present, observe all gas system operator (pipeline or utility company, and contractor) safety procedures for the use of electric tools and equipment.

5.3.Protection against shear and bending loads

Protective measures such as protective sleeves and properly placed, compacted backfill are necessary at a connection where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe. Protective measures are necessary for all types of plastic and non-plastic branch connections including heat fusion, mechanical, and electrofusion types. A protective sleeve and properly placed, compacted backfill are generally used together, but whether or not a protective sleeve is installed, the area surrounding the connection must be embedded in a properly placed, compacted backfill to protect the polyethylene pipe against shear and bending loads.

For additional information on protection against shear and bending loads, at branch connections, and where PE pipe penetrates a structure or enters or exits a casing, see ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.

5.4.Liquid hydrocarbon permeation

When present, liquid hydrocarbons may permeate (solvate) polyethylene pipe. Liquid hydrocarbon permeation may occur when liquid hydrocarbons are present in the pipe, or where soil surrounding the pipe is contaminated with liquid hydrocarbons, or where liquid hydrocarbon condensates can form in gas pipelines. All types of liquid hydrocarbons (aromatic, paraffinic, etc.) have a similar effect, and the relative effect on different polyethylene pipe resins is essentially the same.

CAUTION – Once polyethylene pipe has been permeated with liquid hydrocarbons, heat fusion or electrofusion joining is not recommended because liquid hydrocarbons will leach out during heating and contaminate the joint. Liquid hydrocarbon permeated polyethylene pipe should be joined using suitable mechanical connection methods.

Liquid hydrocarbon contamination is indicated by a rough, sandpaper-like, bubbly, or pockmarked surface when a fusion heating iron is removed from the pipe surface, and may be indicated by discoloration or by a hydrocarbon fuel odor.

Mechanical joining products (fittings, components, etc) must be installed in accordance with the instructions of the mechanical joining product manufacturer. Obtain these instructions from the mechanical joining product manufacturer. The mechanical joining

product manufacturer determines the capabilities of his product and its suitability for use with polyethylene pipe.

5.5.Leakage at fusion joints

WARNING – Correctly made fusion joints do not leak. When pressurized, leakage at faulty fusion joint may immediately precede catastrophic separation and result in violent and dangerous movement of piping or parts and the release of pipeline contents under pressure. Never approach or attempt to repair or stop leaks while the pipeline is pressurized. Always depressurize the pipeline before making corrections. Faulty fusion joints must be cut out and redone.

5.6.Handling

Polyethylene piping is a tough, robust material, but it is not immune to damage. Improper handling or abuse can damage piping, compromise system performance and result in injury or property damage. Polyethylene piping should be unloaded and moved with proper handling and lifting equipment. Use fabric slings. Do not use chains or wire ropes. Do not roll or drop pipe off the truck, or drag piping over sharp rocks or other abrasive objects. Store piping so that the possibility of mechanical damage is minimized.

5.7.Fusion in cold weather

In cold weather polyethylene becomes more sensitive to impact and less flexible. Use additional care in handling. When temperatures are very cold, avoid sharp impact such as dropping the pipe from moderate heights. Cold pipes will be harder to bend or uncoil. 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.

Remove all frost, ice, or snow from the OD and ID surfaces of areas to be fused. Surfaces must be clean and dry before fusing.

Polyethylene pipe and fittings will contract slightly in the cold. Most butt fusion equipment will accommodate the slightly reduced diameter of cold pipe.

When fusing in cold weather the time required to obtain the proper melt may increase.

- Maintain the specified heating tool surface temperature. Do not increase heating tool surface temperature.
- Do not apply pressure during zero pressure heating steps.
- Do not increase joining pressure.
- In butt fusion, melt bead size determines heating time; so the procedure automatically compensates when cold pipe requires longer time to form the proper melt bead size.

Additional information on fusion in cold weather can be found in ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

5.8. Key factors for quality fusions

Quality fusion requires all of the required tools and equipment, and following all of the steps in the procedure in the correct sequence. The fusion procedure prepares and aligns the surfaces, heats the mating surfaces to the proper melt consistency, joins the surfaces together under pressure, then cools the joint under pressure. Faulty fusion is caused by improper or defective equipment, omitting steps or doing things out of sequence. Faulty fusion may be hazardous.

Training and experience provide knowledge and proficiency in what to do, what to expect, and recognizing potential problems in advance. Inadequately trained or inexperienced persons can produce poor quality fusions, and they may expose themselves or others to hazards. Federal safety regulations require that persons making joints in gas systems must be qualified in the pipeline operator's qualified fusion procedures. (See Regulations for Gas Pipe Joining)

The key factors below are necessary for quality fusion are:

- Fusion tools and equipment must be correct for the job, and in proper working order;

Each fusion procedure requires specific tools and equipment to do the job properly. Using poorly maintained, damaged, or incorrect tools and equipment can cause a poor fusion, and may be hazardous. Use only the correct tools and equipment for the job. Do not use defective or improper tools or equipment. Follow the equipment manufacturer's procedure for equipment maintenance.

- The fusion operator must be proficient in tool and equipment use and operation, and proficient in fusion procedure;

The operator should be thoroughly familiar with the tools and equipment and their use and operation. Improper use or an incorrect operating sequence can cause a poor fusion, and may be hazardous. Know how to use the equipment, and follow the manufacturer's instructions.

- Pipe and fitting surfaces must be clean and properly prepared;

Dirty or contaminated, or poorly prepared surfaces that do no mate together properly cannot produce a quality fusion. Clean and prepare the surfaces before joining. If contamination is reintroduced, clean the surfaces again.

- Heating tool surfaces must be clean, undamaged and at the correct surface temperature;

Heating tool faces have non-stick coatings for quick, complete release from melted polyethylene. Dirty or contaminated heating tool faces can cause poor fusion, and damaged coatings may not release properly from the melt. Use only wooden implements, and clean, dry non-synthetic (cotton) cloths or paper towels to clean heating tool faces. Never use spray chemicals or metal tools on heating tool faces.

The specified temperature is the temperature on the surfaces that contact the pipe or fitting being joined, not the heating tool thermometer temperature. Use a pyrometer or infrared thermometer to check for uniform temperature across both of the component contact surfaces. (Temperature indication crayons are not preferred. If used,

temperature-indicating crayons must never be applied to a surface that contacts a pipe or fitting.) Uneven temperature may indicate a faulty heater. The heater thermometer measures the internal temperature, which is usually higher than surface temperature, however, heating tool temperature can be verified by checking the thermometer to ensure that the heating tool is maintaining the temperature. When checking surface temperature with a pyrometer or infrared thermometer, note the heating tool thermometer reading. Check the heating tool thermometer reading before each fusion to verify that the heating tool is maintaining temperature properly. Incorrect or non-uniform temperature can cause poor fusion.

5.9.Before You Start:

- Inspect pipe lengths and fittings for unacceptable cuts, gouges, deep scratches or other deleterious defects. Damaged products should not be used.

- Toe-in or necking down is normal at pipe ends, but may need to be removed when only one of the ends to be joined displays ‘toe-in’. Ensure toe-in does not result in excess wall misalignment.

- Remove surface damage at pipe ends that could compromise the joining surfaces or interfere with fusion tools or equipment.

- Be sure all required tools and equipment are on site, in proper working order and fueled up.

- The pipe and fitting surfaces where tools and equipment are fitted must be clean and dry. Use CLEAN, dry, non-synthetic (cotton) cloths or paper towels to remove dirt, snow water and other contamination.

- Shield heated fusion equipment and surfaces from inclement weather and winds. A temporary shelter over fusion equipment and the fusion operation may be required.

- Relieve tension in the line before making connections.

When joining coiled pipe, making an s-curve between pipe coils can relieve tension. In some cases, it may be necessary to allow pipe to equalize to the temperature of its surroundings. Allow pulled-in pipes to relax for several hours to recover from tensile stresses.

- Pipes must be correctly aligned before making connections.

WARNING – Impact Hazard – Do no bend pipe into alignment against open butt fusion clamps. The pipe may spring out and cause injury or damage. Pipe must be aligned before placing it into butt fusion equipment.

- Trial fusions.

A trial fusion, preferably at the beginning of the day, can verify fusion procedure and equipment settings for the actual jobsite conditions. Allow trial fusions to cool completely before cutting straps and testing by bending straps until the ends touch. Figure 1 illustrates ASTM F2620 test specimen dimensions for bent strap testing for pipes having

a wall thickness of 1” (25mm) or less. The full wall side bending is recommended for wall thickness greater than 1".

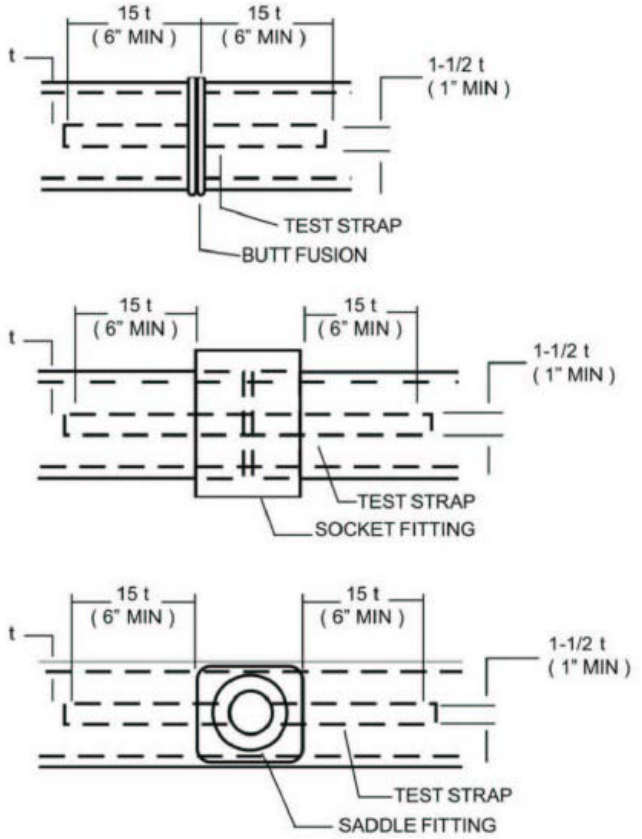

Figure 1 ASTM F2620 Specimens for bent strap tests

Bent strap test samples may be bent back on themselves or twisted through 180 degrees. If the sample breaks at the location of the fusion, this is an indication that the appropriate conditions were not established to permit satisfactory fusion to occur. It is a ‘qualitative measure’ only and requires experience on the part of the operator/technician, in order to properly evaluate the efficacy of a fusion weld.

6. BUTT FUSION

6.1.Set-Up parameters

Heating Tool Surface Temperature: 425°F ± 25°F (218°C ± 14°C)

Heating tool surfaces must be up to temperature before fusion begins. Prior to starting, all points on both heating tool surfaces where the heating tool surfaces will contact the pipe or fitting ends must be within the prescribed temperature range. The temperature difference between any two points on the heating tool fusion surfaces must not exceed 20°F (11°C) for equipment for pipe smaller than 18-in (450 mm) diameter, or 35°F (19°C) for larger equipment. Heating tool surfaces must be clean. For heavy wall pipe (wall thickness ≥ 1.5″), it is preferable to be in the lower half of the allowable temperature range.

When the properly heated mating surfaces are brought together, the force required to make the joint is the force that is necessary to roll the fusion melt beads over to the pipe surface. This is determined visually.

Interfacial Pressures

Drag Pressure	Variable
Contact Pressure	30 ±5 psi (172 ± 35 kPa)
Joining Pressure	25 – 90 psi (172 – 620 kPa) for pipe walls < 1.5” 25 – 50 psi (172 – 345 kPa) for pipe walls ≥ 1.5”

Required interfacial pressure is used as the basis for calculating the hydraulic pressure for a hydraulic butt fusion machine, or the applied force (measured using a torque wrench) for a manual machine. Interfacial pressures vary based on whether the pipe wall is considered 'heavy' (1.5”) or not. The correct hydraulic fusion joining pressure settings are calculated based on the type of butt fusion machine as well as the pipe OD and DR.

The following formula is used to calculate the required hydraulic pressure on a butt fusion machine:

$$HP = \frac{0.785 \times (OD^2 - ID^2) \times IP}{PA} + DP$$

OD = Outside Diameter (in)
ID = Inside Diameter (in)
IP = Interfacial Pressure (psi)
PA = Piston Cross Sectional Area (in2)
DP = Drag Pressure (psi)

For hydraulic machines, the interfacial pressure, the fusion surface area, the machine’s carriage cylinder size and internal drag pressure, and if necessary, the pressure needed to overcome external drag resistance, are used to calculate hydraulic pressure required. The equipment manufacturer’s instructions can be used as a guide to calculate the drag pressure value.

Interfacial pressure and fusion machine hydraulic fusion joining pressure gauge settings are not the same!

For every fusion joint, the system drag force must be measured to assure the proper compensation is applied to the fusion force. In most cases, the system drag will be the inherent drag in the hydraulic components of the machine for which the manufacturer will have a recommended value to use. However, to assure this had not changed due to the system set-up (ground slope or length of pipe being moved), it should be checked using the following procedure:

Slowly adjust upward the machine hydraulic control, or slowly increase torque on manually operated machines, to initiate carriage movement. The System Drag Pressure is the gauge pressure at which the carriage starts to move on hydraulic fusion machines. The System Drag Force is the observed force or torque at which the carriage starts to

move on manually operated fusion machines. Repeat this measurement to verify the observed reading.

The maximum OD high-low misalignment allowed in the butt fusion procedure is to be less than 10% of the pipe minimum wall thickness. It is also allowable to fuse pipes of unequal dimension ratios, as long as the two pipes are within one standard DR increment of each other. However, fusing two different DR's requires that the misalignment be less than 10% of the minimum wall thickness of the thinner walled pipe.

6.2.Procedure

6.2.1. Secure

Clean the inside and outside of the component (pipe or fitting) ends by wiping with a clean, dry, lint-free cloth or paper towel. Remove all foreign matter. Align the components with the machine, place them in the clamps and then close the clamps. Do not force pipes into alignment against open fusion machine clamps. (When working with coiled pipe, if possible "S" the pipes on each side of the machine to compensate for coil curvature and make it easier to join.) Component ends should protrude past the clamps enough so that facing will be complete. Bring the ends together and check high-low alignment. Adjust alignment as necessary by tightening the high side down.

6.2.2. Face

Place the facing tool between the component ends, and face them to establish smooth, clean, parallel mating surfaces. Complete facing produces continuous circumferential shavings from both ends. Fusion equipment operators should check to confirm that the circumferential shavings are continuous. Face until there is a minimal distance between the fixed and moveable clamps. Some machines have facing stops. If stops are present, face down to the stops. Remove the facing tool and clear all shavings and pipe chips from the component ends. Do not touch the component ends with your hands after facing.

6.2.3. Align

Bring the component ends together, check alignment and check for slippage against fusion pressure. Look for complete contact all around both ends with no detectable gaps, and outside diameters in high-low alignment (except for the misalignment permitted in section 6.1). If necessary, adjust the high side by tightening the high side clamp. Do not loosen the low side clamp because components may slip during fusion. Re-face if high low alignment is adjusted.

6.2.4. Melt

Verify that the heating tool is maintaining the correct temperature. (See Section 5.8) Place the heating tool between the component ends, and move the ends against the heating tool. The initial contact should be under moderate pressure (known as contact pressure) to ensure full contact. Hold contact pressure very briefly then lower to drag pressure without breaking contact. Contact pressure must be relieved at the first indication of melt completely around the pipe ends. Procedures for releasing the pressure in the hydraulic cylinder that creates interfacial pressure vary

by manufacturer. Review the equipment manufacturers recommended procedure to ensure that only drag pressure is applied during the soak cycle. Hold the ends against the heating tool using only drag pressure. Beads of melted polyethylene will form against the heating tool at the component ends. When the proper melt bead size is formed (see Table 1), quickly separate the ends and remove the heating tool.

During heating, the melt bead will expand out flush to the heating tool surface, or may curl slightly away from the surface. If the melt bead curls significantly away from the heating tool surface, unacceptable pressure during heating may be indicated.

Table 1 – Melt Bead Sizes for Corresponding Pipe Sizes

Pipe (OD) [Outside Diameter, in. (mm)]	*"A" Minimum Bead Size, in. (mm)*. Measured from the heater plate.
<2.37 (60)	1/32 (1)
≥ 2.37 (60) ≤ 3.5 (89)	1/16 (1.5)
> 3.5 (89) ≤ 8.62 (219)	3/16 (5)
> 8.62 (219) ≤ 12.75 (324)	1/4 (6)
> 12.75 (324) ≤ 24 (610)	3/8 (10)
> 24 (610) ≤ 36 (900)	7/16 (11)
> 36 (900) ≤ 65 (1625)	9/16 (14)

6.2.5. Join

Immediately after heating tool removal. Quickly inspect the melted ends, which should be flat, smooth, and completely melted. If the melt surfaces are acceptable, immediately and in a continuous motion, bring the ends together and apply the correct joining pressure. Do not slam. Where the equipment permits, 'ramping up' to the joining pressure is desirable. Apply enough joining pressure to roll both melt beads over to the pipe surface.

A concave melt surface is unacceptable (Figure 2); it indicates pressure during heating. Do not continue. Allow the component ends to cool and start over.

Figure 2 - Unacceptable Concave Melt Appearance

The correct joining pressure will form a double bead that is rolled over to the surface on both ends.

6.2.6. Hold

Hold joining pressure against the ends until the joint is cool. The joint is cool enough for gentle handling when the double bead is cool to the touch. Cool for about 30 – 90 seconds per inch of pipe diameter. Do not try to shorten cooling time by applying water, wet cloths or the like. Avoid pulling, installation, pressure testing and rough handling for at least an additional 30 minutes[1]. Heavier wall thickness pipes require longer cooling times.

6.2.7. Inspect

Visually inspect and compare the joint against the butt fusion bead inspection acceptance guideline in Figure 3. The v-groove between the beads should not be deeper than half the bead height above the pipe surface.

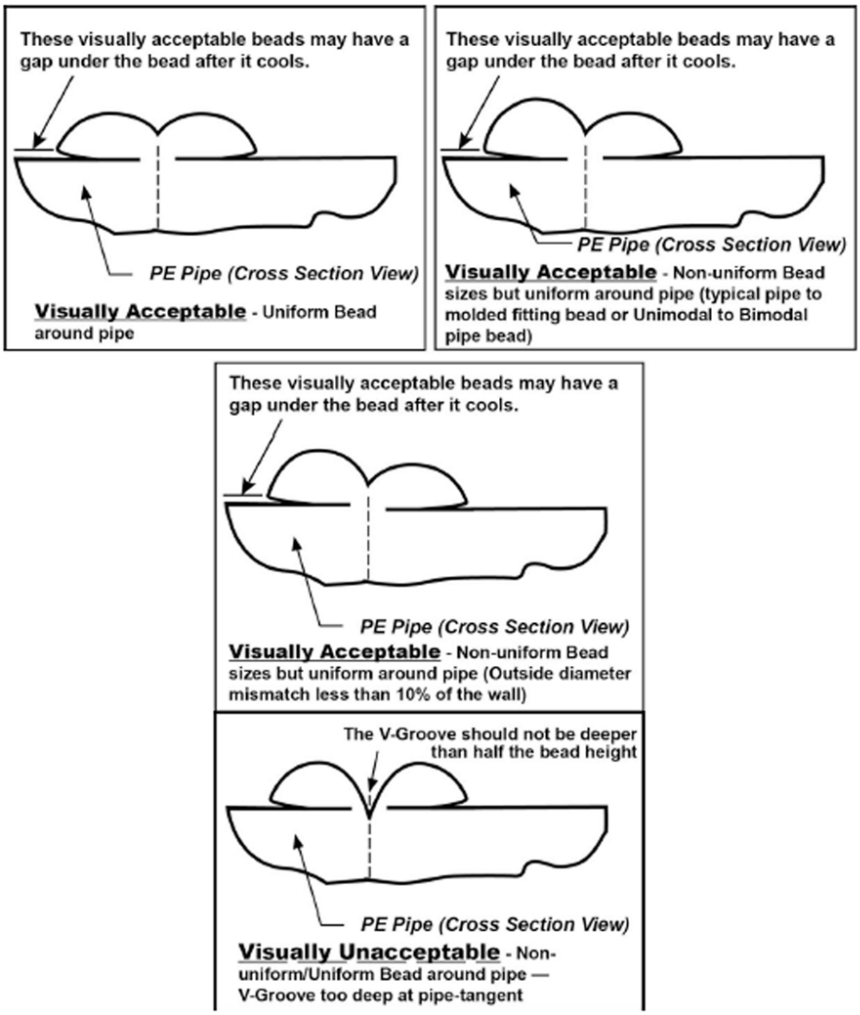

Figure 3 – Outside Diameter Butt Fusion Bead Guideline as per ASTM F2620

[1] Allow pipe to cool to ambient temperature for pipe to be used in directional drilling applications or pipe otherwise subject to high tensile loads.

- When butt fusing to molded fittings, the fittings side bead may have an irregular appearance. This is acceptable provided the pipe side bead is correct.

- It is not necessary for the internal bead to roll over to the inside surface of the pipe.

- When butt fusing pipe of dissimilar polyethylene materials, melt bead size may vary due to differences in melt index. This is acceptable provided the melt bead size is sufficient.

Table 2 - Butt Fusion Bead Troubleshooting Guide

Observed Condition	Possible Cause
Excessive double bead width	Overheating; Excessive joining force
Double bead v-groove too deep	Excessive joining force; Insufficient heating; Pressure during heating
Flat top on bead	Excessive joining force; Overheating
Non-uniform bead size around pipe	Misalignment; Defective heating tool; Worn equipment; Incomplete facing
One bead larger than the other	Misalignment Component slipped in clamp; worn equipment Defective heating tool; Incomplete facing dissimilar material – see note above.
Beads too small	Insufficient heating; Insufficient joining force
Beads not rolled over to surface	Shallow v-groove – Insufficient heating & insufficient joining force Deep v-groove – Insufficient heating & excessive joining force
Beads too large	Excessive heating time
Squareish outer bead edge	Pressure during heating
Rough, sandpaper-like, bubbly, or pockmarked melt bead surface	Hydrocarbon contamination

6.3.Butt Fusion Qualifying Procedure

6.3.1.

Prepare a sample joint. Pipes on either side of the joint should be at least 6” (150 mm) or 15 times the wall thickness in length. Observe the joining process to determine that the correct procedure is being followed.

6.3.2.

Visually inspect the sample joint and compare it to a sample or picture of an acceptable joint.

6.3.3.

Allow the sample to cool completely – for not less than one hour.

6.3.4.

Cut the sample joint lengthwise along the pipe into at least three straps that are at least 1” (25 mm) or 1.5 wall thicknesses wide.

6.3.5.

Visually inspect the cut surface at the joint and compare to a sample or picture of an acceptable joint. There should be no gaps, voids, misalignment, or unbonded areas.

6.3.6.

Bend the straps until the ends of the strap touch.

6.3.7.

If flaws are observed in the joint, compare appearance with pictures of unacceptable joints. Prepare a new sample joint using correct joining procedure, and repeat the qualifying procedure.

Figure 4 - Acceptable Appearance

Ongoing Butt Fusion Qualifying

The Alberta EUB has specific requirements for the ongoing qualifying of joints when fusing ISO PE 80 or PE 100 (Bimodal HDPE). Make reference to Directive 077 to ensure these requirements are met.

6.4.Acceptable Fusions

- Proper double roll back bead
- Proper alignment

Figure 5 - Acceptable fusions

6.5.Unacceptable Fusions

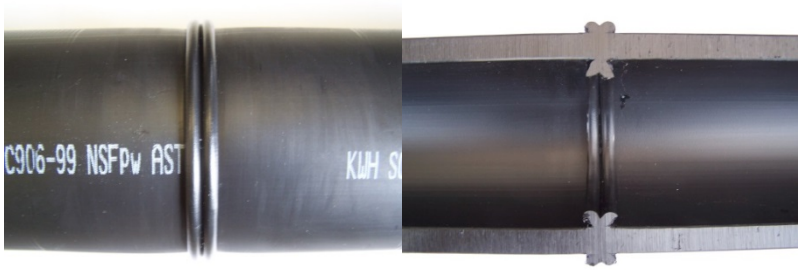

Figure 6 - Excessive heat time or too much applied pressure
(melt bead too large)

Figure 7 - Pipe misalignment
(high-low misalignment)

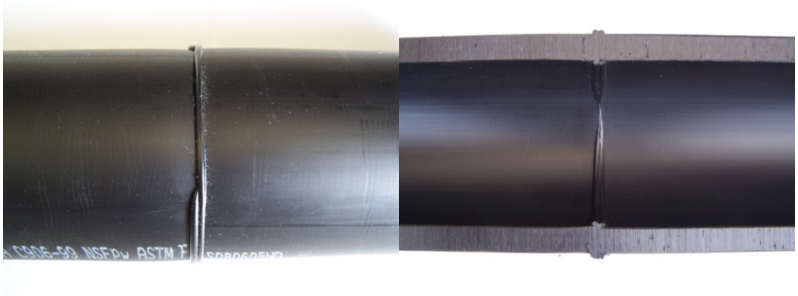

Figure 8 - Incomplete facing or insufficient heat time

Figure 9 - Field mitered joint(pipe angled in the fusing unit)

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