Socket Fusion

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Summary of Changes

Minor revisions were made in the Equipment and Safety Concerns sections. Additional information was added in step 4 of Socket Fusion Considerations section. Please see step 7 and 8 of Procedure section as additional instructions were added.

Overview

This standard describes the PE socket fusion procedure, including the correct use of tools and required heating times. The PE socket fusion procedure involves pushing an end of prepared pipe into a socket fusion fitting. This fitting may be a coupling (normally for joining lengths of pipe), elbow, tee, or end cap.

Audience

This document is intended for FortisBC (Gas) Operations Managers, Operations Supervisors, Distribution Service Agents (DSAs), Construction Supervisors, Instructors, Trades Trainers and all field personnel involved in the fusing of polyethylene materials.

Contents

Equipment

- Heater Plate/ Heating Iron
- Auxiliary handle
- Appropriate size heater faces
- Chamfering tool (Anodized aluminum)
- Cold ring and depth gauge
- Approved grounded PE pipe cutters (Ratchet shears)
- Lint free wipes
- 99.9% Isopropyl wipes Stopwatch (Timer)

- 120 VAC power source
- Pyrometer
- Shelter to protect fusion area and equipment
- Inspection mirror

Safety Concerns

- Do not attach or remove heating faces when the tool is hot. Hot tools present a safety hazard and can strip threads on the heater plate.
- Some socket fusion operations require more than one person (Table 1).
- In case of gas presence in bell hole- Plug heating tool into a power source away from any ignition points. Heating tool is not explosion proof. Once heating tool reaches temperature unplug and continue with socket fusion in bell hole.

Table 1: Personnel Requirements for Socket Fusion Operations

Pipe Size	Location	Personnel Requiring PE Certification	Non-Certified Assistants Required
15 mm	in crew vehicle bench vise	1	none
26 mm	in crew vehicle bench vise	1	none
15 mm	field	1	1
26 mm	field	1	1

Socket Fusion Considerations

Important Notes:

1) It is critical to inspect all tools prior to fusion to ensure proper maintenance has been completed. Inspect all tools and equipment at the beginning of each work period to make sure all tools are in good working order. Make sure all the required tools, equipment, and fittings are accessible during the socket fusion process.

IMPORTANT: Inspect heater faces for damage and contamination. If contamination or damage are present (black markings or gouges) replace asap.

2) **PIPE PREPARATION** and the prevention of **CONTAMINATION** are critical to the socket fusion process. Careful attention must be given to shield contamination from fusion areas as well as proper chamfering and cleaning procedures.

3) Socket fusion fittings are to be stored in a clean dry area free of contaminated products such as oil, grease, etc. It is recommended to store fittings in bags.

Note 3: Attach the proper heater faces to the heating tool and bring the surface temperature of the tool faces to 490°F to 510°F (254°C to 266°C) with a target temperature of 500°F (260°C). Use a pyrometer, or other temperature measuring device, before every fusion 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.

FUSION IN COLD WEATHER

Socket Fusion is generally not recommended below -4°F (-20°C) without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating. Contact SML for further information and guidance. (ASTM F2620-20a)

Important: You must check iron temperature prior to every fusion.

Procedure

Refer to **CRL# 1397** Excavating, **CRL# 1220** Locating Buried Gas Piping, **CRL# 1783** Excavating Safety and **CRL# 1385** Emergency First Response - Working with Escaping Gas, prior to any work.

1. Check the equipment.
   - Inspect the heating faces for scratches or marks on the Teflon coating, dents or burrs, and cleanliness.
   - Replace any damaged faces.
     - They may create invisible faults in a fusion.

2. Assemble the equipment.
   - Attach the correct size heating faces to the heating tool.
   - Screw down the mounting bolts snugly and evenly. Do not over-tighten the screws.

CAUTION:

Do not attach or remove heating faces when the tool is hot. This may cause the stripping of the screw threads in the heater faces and the heating tool.

3. **A - Preheat the heating tool (Wooden handle heaters only)**
   - Keep the tool in the insulated bag until using it.
   - The gauge must read 254° C to 266°C (490° F to 510° F) with a target temperature of 500°F when the tool has attained operating temperature. A thermo-switch on the tool controls and maintains the pre-set temperature.
   - If the heating tool requires adjustment, use the thermostat adjustment screw (Unplug Heating Iron)
     - To increase the temperature, turn the screw counterclockwise.
     - To lower the temperature, turn the screw clockwise.
     - One complete turn will increase or decrease the temperature by 55° C (100° F).
   - Check both faces of the heating tool with a pyrometer.
     - This testing ensures even heat across the tool face.
     - Check the temperature before every fusion

   B - Preheat the heating tool (Plastic handle heaters only)

     - Keep the tool in the insulated bag until using it
     - The gauge must read 254° C to 266°C (490° F to 510° F) with a target temperature of 500°F. When the tool has attained operating temperature a thermo-switch on the tool controls and maintains the pre-set temperature.
     - If the heating tool requires adjustment, use the potentiometer adjustment knob.
     - Turn the dial to the desired increment of temperature increase or decrease
     - Check both faces of the heating tool with a pyrometer. This testing ensures even heat across the tool face. Check the temperature before every fusion

   C. Prepare the PE pipe for socket fusion installation

   - Visually inspect proposed fusion area of gas pipe for imperfections.
   - Clean the pipe fusion area with an isopropyl alcohol wipe or lint free wipe and 99.9% isopropyl alcohol and allow to dry and evaporate before proceeding. Spray Isopropyl on lint free wipe not on pipe.
   - Clean the pipe and Chamfer the pipe ends.

Note: This Chamfer tool must be constructed of either Delrin Plastic or anodized aluminum. Bare tool aluminum tools can carry contaminants and are not to be used on FortisBC piping.

   - Chamfering eases entry of the pipe into the socket.

- Turn the chamfering tool twice to create the proper bevel across the face.

4. Clean and dry the pipe end.
   - Remove all dirt and moisture using a clean lint free wipe and 99.9% Isopropyl
     - Do not use polyester or nylon.
     - Clean, dry surfaces are essential for proper heating and fusion.

5. Install the cold ring on the pipe end against the depth gauge chamfer tool to ensure proper stab depth
   - This operation ensures the proper depth when inserting the pipe into the socket, helps "round" elliptical pipe, and prevents over-stabbing.
   - Install and hold the depth gauge chamfer tool on the end of the pipe. **Note:** This tool must be constructed of either Delrin Plastic or anodized aluminum. Bare tool aluminum tools can carry contaminants and are not to be used on FortisBC piping.
   - Clamp the cold ring securely on the pipe end.
   - Reject and redo any socket fusion joint without a properly affixed cold ring.

6. Check the socket fitting.
   - Make sure the socket fitting is the correct size.
   - Make sure it is free from damage or irregularities such as mold flash, misalignment, dirt, oil and or previously heated.
   - Clean fitting with a lint free wipe and 99.9% isopropyl

7. Perform the heating cycle.
   - Determine the correct heating duration for the pipe size.

Table 2: Socket Fusion Heating Cycles for 2608/2707/2708 PE

Pipe Size	Heating Cycle Duration	Holding Time To Set	Additional Cooling Time
15 mm	6 – 7 sec	30 sec	5 min
26 mm	8 – 10 sec	30 sec	5 min

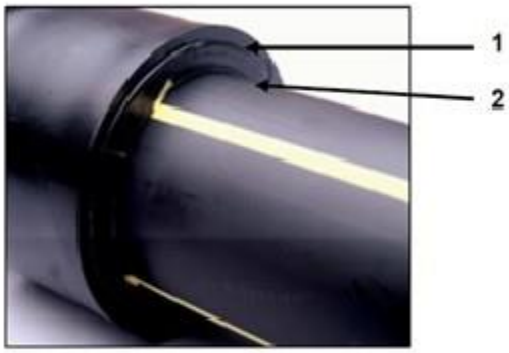
NOTE: Allow the joint to cool an additional five (5) minutes before exposing the joint to any type of stresses (that is, burial, testing or fusing the other end of the fitting.

- Check that the heating tool temperature gauge reads 254° C to 266°C (490° F to 510°F) with a target temperature of 500°F.
- Clean heater faces with a dry, clean lint free wipe prior to fusion
- Time the heating cycle with a Non-interruptible device such as a stopwatch or a timer (not a cellphone).
    - The heating cycle starts only after the pipe and the fitting bottom out on the heater faces.

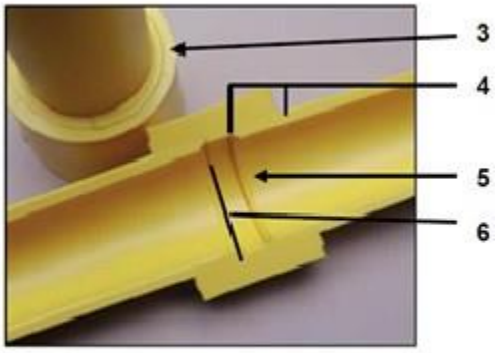
8. Fuse the fitting to the pipe.
    - Socket fusion is often a two person job. See Table 1 for personnel requirements when doing socket fusions.
        - On 15 mm and 26 mm socket fusions, the assistant holds and removes the tool. The fuser must have one hand on the pipe and the other hand on the fitting.
        - Start the socket fitting on the heater before the pipe, start the pipe once the fitting is 2/3 of the way on the heating tool
    - Push the fitting and the pipe end onto the heating tool using steady force.
        - Do not twist or bend the fitting or the pipe out of alignment.
    - When the heating cycle is complete:
        - Quickly snap the fitting from the heating tool without twisting or bending it.
        - Snap the tool from the pipe without twisting or bending it.
    - Place the tool in the heater bag (Clean heater faces with a dry, clean lint free wipe after every fusion
        - Push the fitting squarely on to the pipe end. Do not twist the fitting when pushing the hot components together.
        - This operation must take no more than three (3) seconds.
    - Hold the fitting to the pipe end as outlined in Table 2 (see above).
        - If released too soon, the fitting will creep off the pipe end, creating an imperfect joint.
    - Do not stress, twist, or bend the fitting or the pipe.
    - Remove the cold ring after Additional Cooling Time is complete as per Table 2.

9. Inspect the fused joint.
    - Confirm that the pipe and fitting are aligned, that there is an even bead around the entire circumference at the pipe-to-fitting interface, and that there are no gaps or voids in the fusion area.
    - The quality of the fused joints depends on:
        - Pipe preparation
        - Correct heating durations
        - Correct heat on the tool
        - Proper removal and installation techniques

Acceptable Fusions

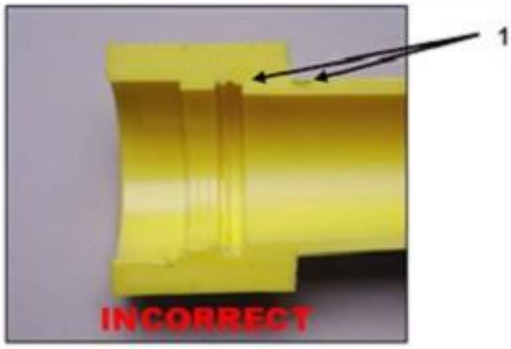


1. Melt bead flattened by cold ring
2. No gaps or voids

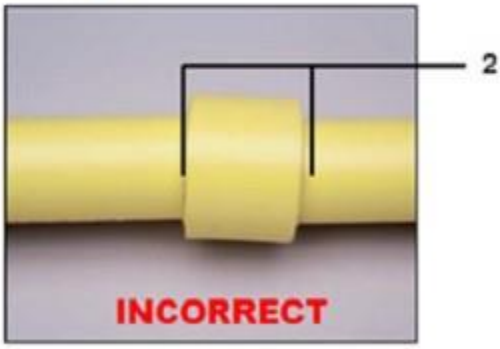


3. No gap or voids
4. Proper insertion depth
5. Acceptable internal fusion bead
6. Complete internal melt bead

Unacceptable Fusions



1. Improper insertion depth/short stab depth



2. Misalignment

- If the socket fusion looks deficient in any way, or the operator knows of any faulty technique or procedure, **or is in doubt**, the fusion **must** be cut out and redone.

NOTE: Upon completion of a fusion that has been determined to be acceptable, the PE Fusers identification number (Man number), date and time of day and cooling time of fusion completion must be permanently marked on the pipe adjacent to the fusion. This will ensure proper cooling time has finished and documentation of employee who completed fusion.

Document fusion information in your PE Log Book

10. Clean the heating tool faces.
    - After the fusion has been made, use a clean, lint free dry wipe to remove any residual PE material from the heat faces.
    - Do **not** use synthetic cloth or 99.9% Isopropyl alcohol to clean heater faces.
    - Do **not** use a metallic tool for cleaning.
        - This may scratch or damage the Teflon coating on the heating tool faces making them unusable.

11. Continue with the next fusion.
    - Wait 5 minutes after completion of the last socket fusion before stressing that joint, as per Table 2(see above)
    - To join two sections of pipe with a socket fitting, use the preceding fusion procedure.
    - The same procedure also holds for all socket fittings such as elbows, tees, or caps.

    NOTE: DO NOT put any socket joints under stress by excessive bending force. Utilize shear sleeves when putting and bending force near a socket fusion fitting

12. Pressure test the assembly after 5 minutes of cooling as per Table 2.
    - Refer to **CRL #1403** *Testing Services.*

    - Upon completion of a fusion that has been determined to be acceptable, the PE Fuser's identification number (Man #), date and time of day, and cooling time of fusion completion, must be permanently marked on the pipe adjacent to the fusion. This will ensure proper cooling time has finished and documentation of employee who completed the fusion.

    - All completed fusions performed in the field must be reviewed (when practicable), with the reviewer permanently marking their identification number (Man #) on the pipe adjacent to the fusion. Acceptable reviewers include Operations Supervisor, Managers, Trades Trainers, Crew Leaders/Foremen, Distribution Service Agents (DSAs) or another Certified Fuser.
    - **All Fusions must be entered in PE fusers log book.**