HDPE DUAL CONTAINMENT PIPING SYSTEMS SIMULTANEOUS BUTT FUSION WELDING PROCEDURE

1. INTRODUCTION

ISCO Dual Contained Pipe is a simultaneously fused dual containment HDPE piping system. HDPE is a thermoplastic material joined through thermoplastic heat butt fusion welding. A weld results when HDPE is "squeezed" together with heat and pressure. The weld zone must be clean and dry, and the material must be properly aligned. The standard for butt fusion welding is ASTM F2620 and PPI TR-33.

"High points" of the Simultaneous Butt Fusion Welding procedure.

- Simultaneously welded systems install very much like single wall piping. This provides a system that contractors can install without a steep learning curve. ISCO dual contained pipe and fittings are designed for simultaneous butt fusion welding where both pipes are welded at the same time.
- The ISCO Simultaneous Butt Fusion Welding Procedure follows the visual practice for single wall butt fusion welding as identified in ASTM F2620 "Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings" and PPI TR-33.
- The ISCO Simultaneous Butt Fusion Welding Procedure is highly reliable. As defined in ASTM F2620 and PPI TR-33, this procedure produces a double wall joint that is as easy to visually verify as a good weld in single wall HDPE pipe.
- Simultaneously welded dual contained pipe systems eliminate the expensive, time-consuming closures and end terminations that other piping profiles require.

II. WELDING PROCEDURE

1. Begin by setting the fusion parameters for your pipe and fittings for the fusion equipment. Fusion temperature for standard HDPE material[1] is 400°F to 450°F, with 425°F considered optimum. The fusion pressure for the ISCO Dual Contained Pipe is the higher fusion pressure value of carrier or the containment pipe, adding any compensation for drag as typically done for single wall pipe. This will typically be the containment pipe pressure for many dual containment systems. The individual fusion pressure for the carrier pipe and containment pipe are determined using the same formulas and guides as standard single wall pipe fusion based on the equipment. Fusion equipment gauge pressure will vary depending on the pipe DRs, the carrier and containment pipe diameters, and the equipment model/manufacturer. Refer to the manufacturers operating instructions to understand all the features, benefits, and warnings for the butt fusion equipment. For example, a McElroy hydraulic fusion machine (a #28 machine and larger) with the hydraulic manifold must have the fusion pressure set, the heat soak pressure

set, and the facing pressure set. The understanding and use of the manifold shifting sequence is essential to a good weld. A detailed explanation of butt fusion procedure for single wall pipe, including hydraulic machines, is available in the ISCO Fusion Manual.

2. ISCO Dual Contained pipe and fittings are designed for simultaneous butt fusion welding. Both carrier and containment pipes are joined at the same time.

3. End centralizers are welded to the carrier and containment pipes to prevent any movement of the carrier pipe. In this process, pressure can be applied evenly to both pipe ends. Centralizers are the pipe support and guidance system for the carrier pipe. Centralizers also provide for the carrier pipe's alignment.

4. Check the fit of the heater in the fusion machine and check the heater surface condition. Plug in the heater and the fusion machine itself. Check the equipment for proper operation and sufficient power. Make sure that the heater is hot enough per the specific fusion parameters for your pipe and fittings before beginning the welding process. Wipe off the heater face with a clean, dry cotton cloth (synthetics will melt) before each weld with no exceptions.

5. The carrier extends past the end of the containment on all pipe and fabricated fittings. This is key to the ISCO Dual Contained pipe simultaneous welding procedure. The extended carrier pipe provides for 4 quality control (Q.C.) checks during the fusion procedure following ASTM F2620 and PPI TR-33. With the pipe and/or fittings clamped in the fusion equipment, apply pressure equal up to 1.5 times the fusion joining pressure only to the carrier pipe ends ensuring that the carrier will not move relative to the containment. This allows pressure to be evenly applied to both dual contained pipe ends, once the pipe has been faced. This is our first Q.C. check. Alignment for the carrier pipe ends should be checked at this time as the second Q.C. check.

6. The next step is called "facing the pipe". The facer is a rotary planer that "shaves" the pipe ends to provide clean, parallel pipe ends. Proper facing is critical in any butt-fusion procedure. Once facing is complete all four pipe ends, both carrier and containment, will be smooth, clean and parallel. Remove pipe shavings and use a clean, dry cotton cloth to wipe the pipe ends if the pipe is touched accidentally.

7. After facing the pipe ends, remove facer and check alignment of the containment pipe by bringing the pipe ends together. This is our third Q.C. check. Normally the containment pipe will fall within 10% alignment; however, some variance may be acceptable. It is not abnormal to see some variance of toe-in, especially near the vertical port openings of the centralizers.

8. Separate the pipe ends so the heater can be placed in the fusion unit. Wipe off the heater face with a clean, dry cotton cloth (synthetics will melt) before each weld with no exceptions. Place the heater in the fusion unit. Bring the pipe ends in direct contact with the heater plate. Check to make sure that the containment pipe ends are in full contact with the heater on both sides. DO NOT apply pressure at this time. This is the heat soak cycle. The pipe material absorbs heat before fusion pressure is applied. A bead of material will form as the pipe heats up and "flares" outward from the expansion of the pipe end. Observe the weld bead formation, which indicates when the pipe is melting. A weld bead of approximately 1/8" on pipe up to 4" nominal OD, 3/16" on pipe up to 8" nominal OD and 1/4" on pipe 10" nominal OD and larger is the necessary size. The weld bead should be uniform around the pipe OD. Correct weld bead formation and size indicates sufficient heat soak.

9. Once the proper weld bead forms evenly around the pipe ends, remove the heater.

10. The fourth Q.C. check is performed when the heater is removed. The appearance of the pipe ends are quickly inspected. The weld bead will have formed on the ID as well as the observed bead on the OD of the containment pipe and on both the OD and ID of the carrier pipe. Each pipe end itself should be flat or slightly convex with the bead flaring away from the pipe ends. A concave profile on the end of any heated pipe is not acceptable.

11. Bring the pipe ends together at this time using fusion pressure as explained in step 1. As fusion pressure is applied, the weld bead rollback forms.

12. At this point, the fusion weld is nearly complete. Keep the fusion joint under fusion pressure until the joint is cool. This time will vary with pipe sizes, wall thicknesses, heater plate temperature setting and environmental conditions. There are a couple of methods to determine proper cooling has taken place.

- Use a pyrometer to measure the temperature of the weld bead and compare it to the temperature of the containment pipe or fitting near the fusion joint, typically one pipe diameter away. If the temperatures are the same, the cooling requirement has been met.
- Allow the weld to cool to the touch. Caution, if using this method, do not place hand or fingers in between equipment jaws. The joint has pressure applied and the jaws could slip at this point. Use a tool like a long handled screwdriver that can be used to probe the weld bead. If the tool makes an impression in the weld bead, the weld bead is soft and has not cooled enough.

TO RECAP: Simultaneous butt-fusion is a reliable process based on accepted butt-fusion procedures (ASTM F2620 and PPI TR-33) with the addition of 4 extra quality assurance steps. Verify the alignment of the carrier pipe. Verify the alignment of the containment. By observing the pipe ends after heat soak and checking the weld bead formation on the carrier as well as the containment, we verify that the pipe is hot enough. The ability of the carrier pipe to accept fusion pressure was verified by checking for any relative movement between the carrier and containment. After facing, the carrier and containment pipe ends are both parallel, which insures that pressure is applied evenly to both pipe ends. Verify that the heater and fusion pressures meet all the parameters for a sound butt-fusion. As pressure is applied squeezing the pipe ends together, the rollback of the weld bead is observed. A properly "rolled-back" weld bead indicates a sound, leak free simultaneous butt-fusion weld.

[1] These parameters are true for all HDPE resins that are classified PE 3608 and 4710 per ASTM D3350. Other versions or unique HDPE materials are available worldwide that may have different heat and pressure requirements for a successful weld. Please contact ISCO Fusion Hotline regarding any questions with this procedure.

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