Flying W Plastics

Recommended Butt Fusion Procedure

The following is general instructions recommended by FWP and is not intended to replace or supersede the specific instructions furnished by fusion equipment manufacturer. FWP recommends an interfacial pressure of 75 psi +/- 10% and a heater plate temperature of 425° F +/- 25 degrees. It is necessary to consult the particular machine manufacturer's instructions regarding machine settings to achieve this condition. 75 PSI interfacial pressure IS NOT the hydraulic gauge pressure on the fusion machine. It is critical that the operator has a full understanding of the particular machine involved and should be trained by the fusion equipment manufacturer or his representative.

1. Load the pipe in the fusion machine. Insure the pipe ends are clean (utilize a clean, lint free cotton cloth if required). Make sure the clamps are properly tightened to avoid any pipe slippage through the fusion operation.

2. Face the ends of the pipe to the machine stops. After facing if there is any debris present it should be removed with a lint free cotton cloth. At this point, lack of contamination is critical. Make sure anything in contact with the pipe ends is free of contamination. Any cloth used must be free of contaminants, cleaning solvents, etc. Do not touch with bare hand as the oil from your skin can be a contaminant. Make sure your facer blades on the fusion equipment are free of contaminants. A residue free material like isopropyl alcohol can be used to clean equipment facer blades if necessary.

3. Check for high/low alignment. Misalignment should not exceed 10% of the wall thickness. If misalignment exist clamps can be readjusted, pipe rotated, etc. Re-face pipe as required.

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4. Check the heater plate temperature. (425° F +/- 25 deg.) Allowance may be made for extreme conditions. (Example: a sub-zero condition would benefit from heater plate temperature on the high side of the range)

5. Insert the heater plate between the ends of the pipe and bring ends firmly in contact with the ends of the pipe. Fusion pressure is not applied at this point. Apply only enough pressure to ensure full contact with the ends of the pipe and watch for the proper melt bead.

   Approximate Melt Bead Size / Wall Thickness

1/16”	Less than .3” wall
1/8” – 3/16”	.3” wall - .75” wall
1/4” – 5/16”	.75’ wall – 1.5” wall

6. After the proper melt bead has been achieved, move the pipe ends away from the heater plate, remove the heater plate, and quickly move the pipe ends together and apply the proper fusion pressure. Do not slam the ends together. Fusion pressure is applied to form a double roll-back bead and pressure is held through the cool down time.

   Note: When fusing two long pieces of pipe make sure the drag factor is taken into account. Drag factor will affect the hydraulic gauge pressure.

7. Allow the joint to cool until your finger can remain comfortably on the fusion bead. *(Below 110° F)* ***Do not touch hot molten plastic!*** A straight blade screwdriver can be used to test the bead to insure it has hardened and has substantially cooled. Typical cool down time is one minute per inch diameter but will vary with wall thickness and ambient temperature.

   Do not pressure test, install, or rough handle for an additional 30 minutes.

Flying W Plastics

Recommended Socket Fusion Procedure

The following is general instructions recommended by FWP and is not intended to replace or supersede the specific instructions furnished by manufacturer of the socket fusion equipment.

1. Preheat heating tool to (490 – 510) Deg. F. Surface temperature should be checked and adjusted with a surface pyrometer.

2. Chamfer pipe ends and clean pipe ends with a clean rag.

3. Place cold ring on the pipe and utilize depth gauge to set stab depth.

4. Push fitting on the heater and push pipe in the heater socket keeping both in place for the prescribed heating cycle. Insure both are fully inserted.

5. At the completion of the heat cycle, "briskly" pull the pipe & fitting from the tool; do not twist.

6. Push the fitting on the pipe until the cold ring is flush with the fitting. Push smoothly and straight, do not twist. Melt bead must be pressed evenly against a minimum of 50% of the fitting face. Push smoothly and straight; do not twist.

7. Hold together for the prescribed cool down time.

Socket Fusion Time Cycles

Pipe Size	Heating Time	Cold Weather Time	Cooling time	Cooling Time to Tie-in
1/2"	10 seconds	12 seconds	30 seconds	10 minutes
3/4"	13 seconds	16 seconds	30 seconds	10 minutes
1'"	15 seconds	18 seconds	30 seconds	10 minutes
1-1/4"	18 seconds	21 seconds	60 seconds	15 minutes
1-1/2"	18 seconds	21 seconds	60 seconds	15 minutes
2"	24 seconds	28 seconds	60 seconds	15 minutes

FOR CTS REDUCE BY 10%

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Quality Assurance and Field Testing
Leak Testing – Considerations (1)

Flying W Plastics recommends hydrostatic pressure leak test of pressure piping systems be conducted in accordance with ASTM F2164(2). The preferred hydrostatic testing liquid is clean water. Flying W Plastics does not recommend air or compressed air testing for any of our product line.

The intent of leak testing is to find unacceptable joint leakage in pressure piping systems. If leaks exist, they may manifest themselves by leakage or rupture. Leak tests of pressure systems generally involve filling the system or a section of the system with liquid and applying internal pressure to determine resistance to leakage. Safety is of paramount importance when conducting pressurized internal fluid leak tests. The following are general guidelines and considerations:

• Even at relatively low internal pressures, leak testing with a pressurized internal fluid can generate very high forces that can be dangerous or even fatal if suddenly released by the failure of a joint or system component or a testing component.

• Always take safety precautions when conducting pressurized fluid leak tests.

• Restrain pipe, components and test equipment against movement in the event of failure. Joints may be exposed for leakage inspection provided that restraint is maintained.

• Keep persons not involved in testing a safe distance away while testing is being conducted.

• Liquids such as water are preferred as test fluids because less energy is released if something in the test section fails catastrophically. During a pressure leak test, energy (internal pressure) is applied to stress the test section. If the test fluid is an incompressible liquid such as water, the energy applied to pressurize the liquid transfers primarily to the pipe and components in the test section.

• Maximum leak test pressure is temperature dependent. If possible, test fluid and test section temperatures should be less than 80°F (27°C). At temperatures equal to or greater than 80°F (27°C), reduced test pressure is required. Sunlight heating of exposed PE pipe, especially black PE pipe, can result in high pipe temperature.

• Before applying test pressure, allow time for the test fluid and the test section to temperature equalize. Hydrostatic leak tests typically use cooler liquids so the liquid-filled test section will tend to equalize to a lower temperature near test liquid temperature.

• Leak Test Pressure and Duration – The maximum allowable leak test pressure and leak test time including initial expansion, and time at leak test pressure should be in accordance with the following equation and Tables 1 and 2.

$$P_{(T)} = \frac{2 \times HDS \times F(t) \times H(T)}{(DR - 1)}$$

Where: $P_{(T)}$ = Leak Test Pressure, psig, for Leak Test Time, T (from Table 1)
T = Leak Test Time, hours
HDS = PE material hydrostatic design stress for water at 73°F (23°C), psi (from Table 2)
F(t) = PE material elevated temperature reduction factor (from Table 3)
H(T) = Leak test duration factor for leak test time, T
DR = Pipe dimension ratio

Table 1: Leak Test Duration Factor, H_T

Leak Test Pressure $P_{(T)}$ (psig)	Leak Test Time T (hours)	Leak Duration Factor H_T
$P_{(8)}$	≤ 8	1.5
$P_{(48)}$	≤ 48	1.25
$P_{(120)}$	≤ 120	1.00

Table 2: PE Material Hydrostatic Design Stress (HDS)

PE Material Designation Code	HDS for Water at 73°F (psi)
PE2708	800
PE3608	800
PE3710	1000
PE4710	1000

Table 3: Temperature Compensating Multipliers for Determination of the Apparent Modulus of Elasticity at Temperatures Other than at 73°F (23°C) Equally Applicable to All Stress-Rated PE's
(e.g., All PE2xxx's, All PE3xxx's and All PE4xxx's)

Maximum Sustained Temperature of the Pipe °F (°C)	**Compensating Multiplier**
-20 (-29)	2.54
-10 (-23)	2.36
0 (-18)	2.18
10 (-12)	2.00
20 (-7)	1.81
30 (-1)	1.65
40 (4)	1.49
50 (10)	1.32
60 (16)	1.18
73.4 (23)	1.00
80 (27)	0.93
90 (32)	0.82
100 (38)	0.73
110 (43)	0.64
120 (49)	0.58
130 (54)	0.50
140 (60)	0.43

• The testing equipment capacity and the pipeline test section should be such that the test section can be pressurized and examined for leaks within test duration time limits. Lower capacity testing and pressurizing equipment may require a shorter test section.

• Test equipment and the pipeline test section should be examined before pressure is applied to ensure that connections are tight, necessary restraints are in place and secure, and components that should be isolated or disconnected are isolated or disconnected. All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.

For pressure piping systems where test pressure limiting components or devices have been isolated, or removed, or are not present in the test section, the maximum allowable test pressure for a leak test duration of 8 hours or less is 1.5 times the system design pressure at the lowest elevation in the section under test. If lower pressure rated components cannot be removed or isolated from the test section, the maximum test pressure is the pressure rating of the lowest pressure rated component that cannot be isolated from the test section. Test pressure is temperature dependent and must be reduced at elevated temperatures.

• The test section should be completely filled with the test liquid, taking care to bleed off any trapped air. Venting at high points may be required to purge air pockets while the test section is filling. Venting may be provided by bleed valves or equipment vents.

• The test procedure consists of initial expansion, and test phases. For the initial expansion phase, the test section is pressurized to test pressure and make-up test liquid is added as required to maintain maximum test pressure for four (4) hours. For the test phase, the test pressure is reduced by 10 psi. This is the target test pressure. If the pressure remains steady (within 5% of the target test pressure) for an hour, leakage is not indicated.

• If leaks are discovered, depressurize the test section before repairing leaks. Correctly made fusion joints do not leak. *Leakage at a butt fusion joint may indicate imminent catastrophic rupture. Depressurize the test section immediately if butt fusion leakage is discovered.* Leaks at fusion joints require the fusion joint to be cut out and redone.

• If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.

Non-Testable Systems

Some systems may not be suitable for pressure leak testing. These systems may contain non-isolatable components, or temporary closures may not be practical. Such systems should be carefully inspected during and after installation. Inspections such as visual examination of joint appearance, mechanical checks of bolt or joint tightness, and other relevant examinations should be performed.

References

1. PPI Post Installation Leak Testing, Chapter 2, Plastic Pipe Institute, Irving, TX.
2. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure, West Conshohocken, PA.