Prepared by: JZB1

QUALIFICATIONS FOR JOINING PLASTIC PIPE D-34

Asset Type: Gas Transmission and Distribution **Function:** Design

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Rev. #04: This document replaces Revision #03. For a description of the changes, see Page 8.

This document also appears in the following manuals:

- *Gas Applicant Design Manual*

Purpose and Scope

This numbered document provides the qualifications required for Company employees, Company contractors, and QC/Ss to perform plastic fusion, electrofusion, and mechanical connections on plastic facilities.

Acronyms

CTS:	copper tubing size
EF:	electrofusion
GSR:	gas service representative
GT&D:	Gas Transmission and Distribution
IPS:	iron pipe size
PE:	polyethylene
PVC:	polyvinyl chloride
QC/Ss:	qualified contractors/subcontractors
SR:	self-regulated

References

	Document
Piping Design and Test Requirements	A-34
Polyethylene Pipe Specifications and Design Considerations	A-93
Plastic Gas Distribution System Construction and Maintenance	A-93.1
Excess Flow Valves	A-93.3
Compression Couplings	B-54
Plastic System Socket and Butt Fusion Fittings	B-90
Plastic System Saddle Fittings	B-90.1
Plastic System Accessories	B-90.2
Electrofusion Fittings and Tapping Tees	B-90.3
Mechanical Transition Fittings for Plastic Systems	B-91
Plastic System Mechanical Fittings	B-91.1
Cast Iron to Polyethylene Transition Fittings	B-91.5
Polyethylene Electrofusion Coupling and Saddle Connections	Utility Work Procedure WP4170-07
Polyethylene Mechanical Fitting Connections	Utility Work Procedure WP4170-08
Joining of Materials Other Than by Welding, Plastic Pipe	49 CFR 192.281
Joining of Materials Other Than by Welding, Plastic Pipe: Qualifying Joining Procedures	49 CFR 192.283
Joining of Materials Other Than by Welding, Plastic Pipe: Qualifying Persons to Make Joints	49 CFR 192.285
Joining of Materials Other Than by Welding, Plastic Pipe: Inspection of Joints	49 CFR 192.287
Gas Main Extensions	Gas Rule 15
Gas Service Extensions	Gas Rule 16
Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings	ASTM D-2513
Standard Terminology Relating to Plastic Piping Systems	ASTM F-412

Qualifications for Joining Plastic Pipe

Definitions

For the purposes of this numbered document, the following definitions apply:

- Annual verification – A visual evaluation conducted annually to determine an individual's proficiency with Company-approved joining procedures.
- Applicant – The developer or party entering into a contract with the Company to install gas and/or electric facilities or to convert existing underground or overhead electric facilities.
- Company – Pacific Gas and Electric Company.
- Company contractors – Individuals working on Company-owned gas facilities pursuant to an executed Company contract.
- Connections – Joints produced by the approved methods listed in this numbered document.
- Designated Company representative – A person trained and authorized by GT&D to perform qualifications and annual verifications.
- Electrofusion – A heat-fusion joining process where the heat source is an integral part of the fitting. When an electric current is applied, heat is produced that melts and joins the plastics. This can be achieved in SR or universal modes.
    - SR electrofusion – A heat-fusion joining process that uses self-regulating well-rupture technology to determine when a fusion is complete. This process is specific to Innogaz fittings.
    - Universal electrofusion – A heat-fusion joining process that uses bar code technology. A bar code label attached to each fitting contains the fusion parameters. When the bar code reader is moved over the bar code, the processor identifies the brand, type, size, fusion time, and automatically adjusts to ambient temperature.
- Fusion interface – The surface that bonds together when plastic materials are joined by the heat-fusion process.
- Fusion zone – The total length of the melted material in a cross section of the joint.
- Heat fusion – Creating a connection by heating the mating surfaces of pipe components and pressing them together until they fuse into essentially one piece.
- Heat iron fusion – Heat iron fusion connections are made by heating mating surfaces to a melting condition, bringing the surfaces into contact, and allowing the mating surfaces to cool to form a connection.
- Joining – The process of connecting plastic pipe and/or fittings through the methods specified in 49 CFR Part 192, Subpart F, except for solvent cement or adhesive joints, which, per this numbered document, shall not be made.
- Mechanical connections – Connections between piping components that require physical force to develop a seal or to align the components.
- QC/S – An applicant's contractor or subcontractor who meets the current requirements of Gas Rule 15.
- Qualification test – Visual and destructive evaluation of an individual's connections to determine proficiency of performing joining in accordance with the requirements specified in 49 CFR Part 192, Subpart F.

General Information

1. Unless qualified as defined by this numbered document, no person shall make connections to Company-owned plastic distribution facilities or plastic distribution facilities that will be deeded to the Company under Gas Rules 15 or 16.
2. Any person required to make connections must be qualified by the procedure outlined in this numbered document. Individuals are qualified to make only those types of connections for which they have been trained and have successfully demonstrated proficiency per the requirements of this numbered document to a designated Company representative.
3. Each person who has been qualified to make connections shall be issued a Plastic Connection Qualification Test Report (see Attachment A). The report indicates the procedures for which the person is qualified. It must be completed and signed off by a designated Company representative who is qualified to evaluate the test assembly.
    A. The Plastic Connection Qualification Test Report shall be kept for a period of 5 years from the last date entered on the report.
    B. The Plastic Connection Qualification Test Reports of QC/Ss shall remain with the job file for the particular Company job for which they were qualified.

4. Company contractors and QC/Ss must meet the same qualifications as Company employees to perform connections. Under no circumstances, shall individuals perform work for which they are not qualified or have been disqualified. Company contractors and QC/Ss shall be qualified for only the specific connections for the particular job to which they are assigned. There will be no minimum socket and saddle fusion assembly test requirements unless the Company contractor or QC/S will be performing those particular fusions on the job to which they have been assigned. A Plastic Connection Qualification Test Report shall be kept on file for each individual job as provided in Item 3B above.
5. QC/Ss are not required to obtain qualification or show proficiency for hot tapping, tie-in work, or installing leak-repair clamps or PVC support clamps. QC/Ss shall not perform heat fusion or electrofusion, or install any mechanical connections, on gas piping that is filled with natural gas.
6. QC/Ss shall obtain qualification to perform Company-approved mechanical connections for leak testing with air or nitrogen when the connection will remain as part of the distribution system. Refer to Numbered Document A-34 and Numbered Document A-93.1 for the leak-testing requirements.
7. An individual's connection qualifications may be terminated at any point when it becomes apparent that the individual lacks the skills necessary to produce satisfactory connections or in the Company's opinion it is not necessary to maintain an individual's qualification.
8. Individuals who will be performing connections must receive qualification testing under any of the following circumstances:
   A. The individual has not previously passed a qualification test.
   B. In the past 12 months, the individual has not prepared a specific type of connection for which qualification is required.
   C. Three connections or 3% of all connections made by this individual, whichever is greater, for a specific procedure have been found unacceptable per qualification testing performed under the provisions of this numbered document.
   D. There is reason to question the individual's ability to make sound connections.
   E. The individual has made three production connections or 3% of any one type that have leaked or failed within any 12-month period, as determined by a leak test, visual inspection, or laboratory analysis.
   F. A substantial change in joining procedures has been authorized. Examples of a substantial change include a change in the design of the fusion interface of a fitting, the resin material, the equipment, or the manufacturer's recommended procedures. Requalification is not required for changes in technique.

   When a connection leaks or fails during a pressure test, forward the type of failure, the type of connection, and the name of the person who made the connection to the location where the person's test report is kept on file. The failure shall be recorded on the person's test report.
9. Company employees performing connections to plastic facilities shall receive annual verification for those connections they are required to make. The annual verification consists of:
   A. The proper use and maintenance of tools and equipment.
   B. A demonstration of the appropriate procedures for the type of connection being made. The individual shall prepare a test assembly for each installation, except that the actual fusion of electrofusion fittings does not have to be performed.
   C. Any connections made must meet acceptable visual criteria.
   D. Destructive testing of the annual verification test assembly may be performed, if requested by the local distribution supervisor.

   Document the annual verification on the Plastic Connection Qualification Test Report.
10. If a connection fails any of the required tests specified in this numbered document, the individual is not qualified in that specific type of connection, but may be qualified for other type(s) of connection(s) if the person passed the required tests. However, if the failure occurred in the socket and saddle fusion assembly, the individual is not qualified for any heat fusion joining.
11. An individual who fails a qualification test may be retested immediately. The person must prepare two additional samples of each connection type that failed, and both of these samples must pass the required tests.

12. A Company employee or Company contractor who fails a qualification test and an immediate retest may be given another qualification test after 1 month, following additional training and practice. If this test is failed, the person may be given a qualification test after 1 more month and will remain unqualified until an additional qualification test is passed. If the person fails the additional qualification test, this person must wait 12 months before attempting another qualification test.
13. A Company employee who fails an annual verification may be retested immediately. The person must prepare two additional samples of each connection type that failed, and both of these samples must pass the required visual tests.
14. A Company employee who fails an annual verification and an immediate retest may be qualified only under the provisions of Item 12 of this numbered document after 1 month of additional training and practice.

Test Assemblies for Heat Iron Fusion Qualification (Except Electrofusion)

15. Each individual seeking qualification shall prepare a standard test assembly under the observation of the designated Company representative. The test assembly may be made either in the field or in a shop.
16. Company employees seeking qualification to perform heat iron fusion connections shall first qualify to perform the socket and saddle-type fusions described in Item 17A. Then the individual may, at the option of his/her supervisor, attempt to qualify to perform any of the following three heat iron fusion connections:
    A. Branch saddle fusion.
    B. 2" through 4" butt fusion with mechanical equipment.
    C. 4" through 8" butt fusion with hydraulic equipment.

    A separate qualification test is required for each of these three types of connections.

    Successful completion of the socket and saddle fusion test qualifies a person to make the socket and saddle fusion connections on all sizes of PE 2406/2708 pipe and tubing.
17. A test assembly must be prepared for each type of qualification, as specified below and in Figures 1 through 4 on Page 7. See Table 1 on Page 8 for assembly materials.
    A. Socket and Saddle Fusion Assembly

    The required test assembly for socket and saddle-type fusion connections consists of using Company-approved tools and procedures to fuse two sections of PE pipe, a PE coupling, and a PE service saddle or tapping tee. See the typical setup in Figure 1 on Page 7.
    Note: 2" IPS is the minimum size to ensure socket coupon strap width.

    B. Branch Saddle Fusion Assembly

    The required test assembly for branch-type fusion connections consists of using Company-approved tools and procedures to fuse a branch saddle fitting onto an 18" long section of PE pipe. See the typical setup in Figure 2 on Page 7.

    C. 2" Through 4" Butt Fusion Assembly

    The required test assembly for butt-type fusion connections consists of using a Company-approved butt-fusion machine, with Company-approved tools and procedures, to face and butt fuse together two 9" PE nipples of PE pipe. See the typical setup in Figure 3 on Page 7.

    D. 6" Through 8" Butt Fusion Assembly

    The required test assembly for 6" or 8" butt-type fusion connections consists of using a Company-approved butt-fusion machine, with Company-approved tools and procedures, to face and butt fuse together two 12" PE nipples of 6" or 8" PE pipe. See the typical setup in Figure 4 on Page 7.
18. For purposes of qualification, evaluate each assembly as follows:
    A. Visually examine it during and after fabricating and joining. The test assembly must have the same appearance as either an actual connection or photographs of a connection that is acceptable along the entire fusion zone. If unacceptable, an individual must retest per Item 11 on Page 3.
    B. Cut into at least three longitudinal straps approximately 1" wide, and:
        (1) Visually examine each strap. There must not be any voids or discontinuities on the cut surfaces of the connection area.

(2) Manually bend the connection into a "U" shape. The connection is unsatisfactory if it fails at the fusion interface.

Test Assembly for Electrofusion Qualification

19. Individuals seeking qualification or annual verification for electrofusion shall prepare a test assembly under the observation of the designated Company representative. The test assembly may be made either in the field or in a shop. Only Company-approved electrofusion processors in universal or SR mode may be used. A separate qualification shall be required for each of the approved electrofusion modes. The individual must be proficient with applying the appropriate cleaning and scraping method as required for each PE saddle fitting. Annual verification of electrofusion connections does not require the fitting to be fused, however, the process leading up to start of the fusion cycle shall be observed by a designated Company representative. Successful completion of the electrofusion test qualifies a person to make electrofusion connections on all sizes of PE 2406/2708 pipe and tubing. This also qualifies Company employees to install Aldyl-A electrofusion overcap kits to the procedure shown in Utility Work Procedure WP4170-07.

20. For the purposes of qualification, fabricate and test each assembly as follows:

    A. Prepare a test assembly, as depicted in Figure 1 on Page 7, except substitute an electrofusion tapping tee and electrofusion coupling for the heat-fusion saddle and coupling. See Table 1 on Page 8 for the typical test assembly materials.

    B. Visually inspect the installation process. Check that the individual correctly operates the electrofusion processor, knows and understands the installation procedures, and observes the proper fusion and cooling times.

        (1) The connection must be completely fused within the fusion interface and be installed at the proper depth.

        (2) The connection must have the same appearance as either an actual connection or photographs of a connection that is acceptable along the entire fusion zone.

        (3) The tee must be completely fused within the fusion interface. Check that it cannot be manually pulled apart after cooling.

    C. If the connection is not visually acceptable, refer to Item 11 on Page 3.

    D. If the connection is visually acceptable and met the required fusion time parameters, cut it into at least three longitudinal straps minimum 1" wide, and:

        (1) Visually examine each strap. There must not be any voids or discontinuities on the cut surfaces of the connection area.

        (2) Manually bend the connection into a "U" shape. The connection is unsatisfactory if it fails at the fusion interface.

Test Assembly for Mechanical Connection Qualification

21. There are three types of mechanical connections: (1) stab, (2) compression, and (3) bolt-on. An individual seeking a basic qualification for mechanical connections must:

    A. Properly install a Perfection or Continental stab-type fitting.

    B. Properly install a Met-fit or Continental compression-type fitting.

    C. Properly install a Perfection or Continental bolt-on type fitting.

    One or more of each type of connection may be made. It is not necessary to connect every fitting within the group. The connections must be made in accordance with Numbered Documents B-54, B-90.1, B-91.1, and B-91.5, Utility Work Procedure WP4170-08, and the manufacturer's instructions.

22. Individuals seeking qualification shall prepare a test assembly or separate specimen of the proper type of fitting under the observation of the designated Company representative. The assembly may be made either in the field or in a shop. Fabricate and test the assembly as follows:

    A. Prepare a test assembly as shown in Figure 1 on Page 7, except substitute a 2" Met-fit compression coupling and 2" bolt-on tapping tee for the heat-fusion coupling and saddle. Install a 9" section of tubing from the tee outlet and attach a stab-type mechanical fitting to the end of the tubing. See Table 1 on Page 8 for typical test assembly materials.

B. Visually inspect all the connections. Check that the individual correctly operates the tooling and equipment and understands the installation procedures.

(1) The connection must be sealed within the connection interface and be installed at the proper depth.

(2) The connection must have the same appearance as either an actual, acceptable connection or photographs of an acceptable connection.

(3) The tee must be completely sealed within the connection interface. Check that it cannot be manually pulled apart and that it does not slide on the pipe when tightened.

Note: Destructive testing is not required on mechanical connections.

23. Company GSRs who perform mechanical connections must be qualified to install:

A. 1/2" CTS stab-type blind-end couplings or compression (Met-fit) caps.

B. 1" CTS stab-type blind-end couplings or compression (Met-fit) caps.

See Numbered Document B-91.1 for the approved blind-end couplings and compression caps. GSRs shall not install any fittings other than the fittings listed above.

GSRs may be qualified to install either the stab-type fitting, the compression fitting, or both. GSRs only need to demonstrate a proficiency with one size of the fitting to be qualified to install.

24. Document the GSR's qualification on a Plastic Connection Qualification Test Report. Copies of the test report shall be kept by the employee's supervisor and be made available for inspection on request.

25. GSRs that have not installed mechanical connections in the past 12 months must requalify in accordance with the provisions of this section. The GSR's supervisor shall note the anniversary of the qualification date and document it on the Plastic Connection Qualification Test Report whether or not the employee made any mechanical connections in the previous 12 months.

26. GSRs must receive an annual verification to install mechanical connections. See Item 9 on Page 3 for a description of the verification process. The GSR's supervisor may conduct the verification if he/she is qualified to make the connections specified in Item 22 on Page 5.

Qualifications for Joining Plastic Pipe

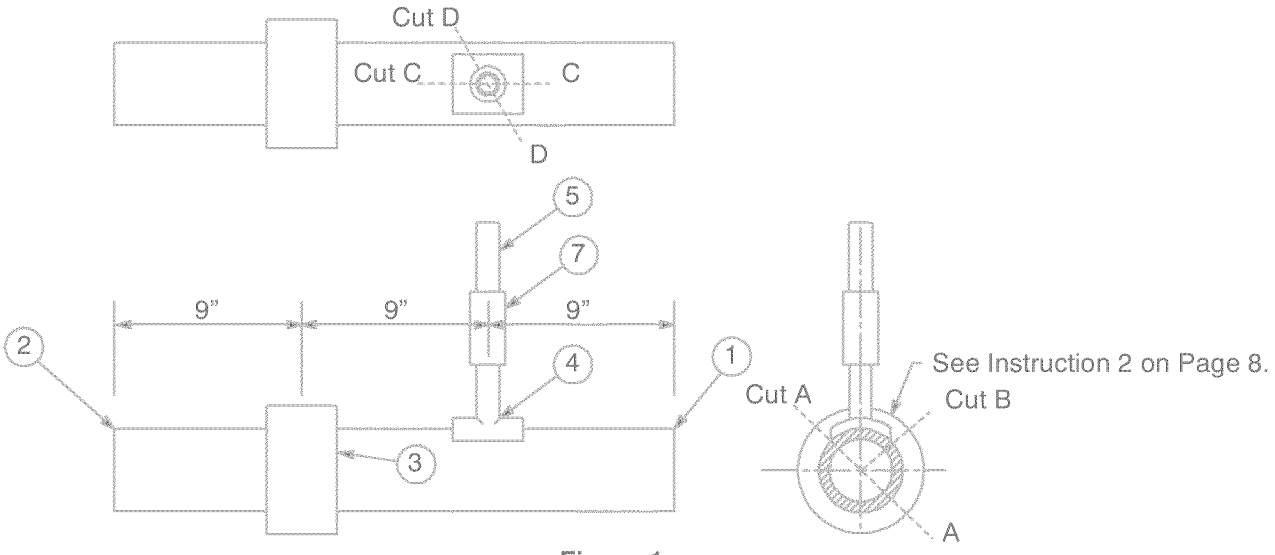

Figure 1
Socket and Saddle Fusion Specimen

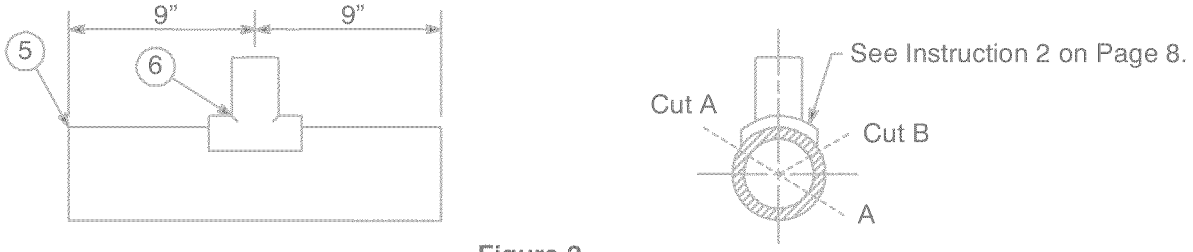

Figure 2
Branch Saddle Fusion Specimen

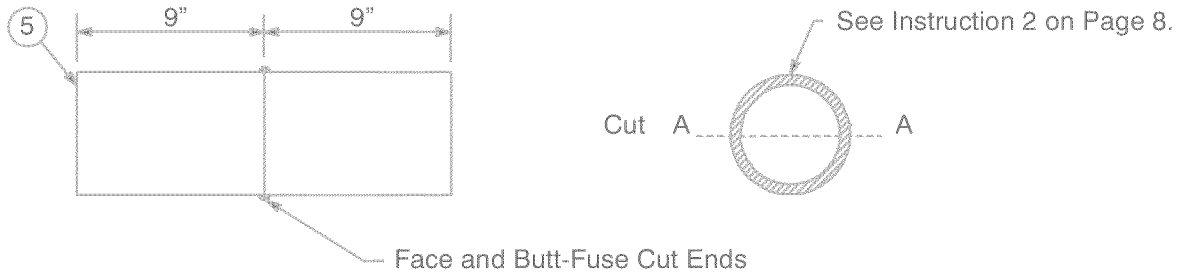

Figure 3
2" Through 4" Butt Fusion Specimen

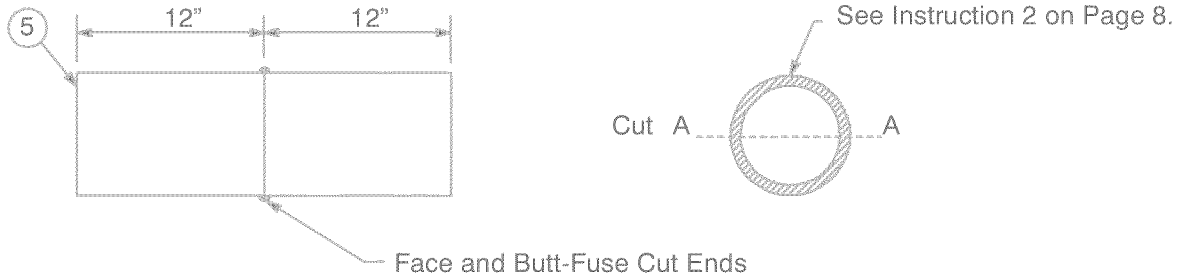

Figure 4
6" Through 8" Butt Fusion Specimen

Qualifications for Joining Plastic Pipe

Instructions:

1. After the saddle fittings are assembled, the stacks may be cut off.
2. Cut three longitudinal coupons (straps) approximately 1" wide from the segment indicated.
3. Test the coupons according to the procedures in this numbered document. Record the test results on Form FD-34-A, "Plastic Connection Qualification Test Report."

Table 1 List of Materials

Component	Description	Acceptable Diameters for Assembly (Inches)	Typical (Inches)	Reference Document
1	Branching Nipples (or Pipe Cut to Suit)	2 – 3	2 x 18 Long	B-90.1 Table 4
2	Branching Nipples (or Pipe Cut to Suit)	2 – 3	2 x 9 Long	B-90.1 Table 4
3	Heat-Fusion Coupling Electrofusion Coupling Mechanical Coupling	2 – 3 2 – 8 2 Only	2 2 2	B-90 Table 1 B-90.3 Table 1 B-91.1 Table 1
4	Heat-Fusion Service Saddle Without Sleeve Heat-Fusion Tapping Tee Electrofusion Tapping Tee Mechanical Bolt-On Tee	— 2 – 8 2 – 8 2 – 4	2 x 1/2 2 x 1/2 2 x 1/2 2 x 1/2	B-90.1 Table 2 B-90.1 Table 6 B-90.3 Table 3 B-90.1 Table 9
5	PE Tubing PE Pipe	1/2 – 1 CTS Tubing 2 – 8 IPS Pipe	As Required	A-93 Table 1 A-93 Table 1
6	Heat-Fusion Branch Saddles	2 – 4	2 x 2 3 x 2 4 x 2	B-90.1 Table 3 B-90.1 Table 3 B-90.1 Table 3
7	Mechanical Fittings – Uponor Met-fit – Perfection Permasert – Continental ConStab	1/2 – 2 IPS	As Required	B-91.1 Table 1 B-91.1 Table 3 B-91.1 Table 6

Attachments

Attachment A . . . Form FD-34-A, "Plastic Connection Qualification Test Report"

Revision Notes

Revision 04 has the following changes:

1. Added new Item 7 in the "General Information" section on Page 3.