

**Generic Saddle Fusion  
Joining Procedure for  
Polyethylene Gas Piping  
TR-41/2002**



1825 Connecticut Ave., NW Suite 680 Washington, DC 20009-P: 202-462-9607-F: 202-462-9779-[www.plasticpipe.org](http://www.plasticpipe.org)

---

# FOREWARD

This report was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute, Inc.). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The purpose of this technical report is to provide important information available to PPI on a particular aspect of polyethylene pipe saddle fusion to engineers, users, contractors, code officials, and other interested parties. More detailed information on its purpose and use is provided in the document itself.

This report has been prepared by PPI as a service of the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered without any warranty, expressed or implied, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Consult the manufacturer for more detailed information about the particular joining procedures to be used with its piping products. Any reference to or testing of a particular proprietary product should not be construed as an endorsement by PPI, which does not endorse the proprietary products or processes of any manufacturer. Industry members in fulfilling their own compliance responsibilities offer the information in this report for consideration. PPI assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this report from time to time, in response to comments and suggestions from users of the report. Please send suggestions of improvements to the address below. Contacting PPI directly or visiting the web site can obtain information on other publications.

The Plastics Pipe Institute, Inc.  
Toll Free: (888) 314-6774  
<http://www.plasticpipe.org>

October 2002

## **I. Introduction**

In 1994, representatives of the U.S. Department of Transportation (DOT), Office of Pipeline Safety requested that the Plastics Pipe Institute assist in promoting greater uniformity in the joining procedures utilized by gas utilities in the butt and saddle fusion of polyethylene (PE) gas piping products. DOT reported that it had encountered a proliferation of similar but slightly varying joining procedures from individual PE pipe producers. The slight differences in the various procedures made it more difficult for pipeline operators to qualify persons with appropriate training and experience in the use of these procedures, and more difficult for DOT to enforce the joining requirements in 49 C.F.R. § Part 192.285 (Plastic pipe; qualifying persons making joints) of the Code of Federal Regulations.

In response to DOT's request, PPI established a task group to review the fusion procedures currently used and develop a more uniform, or "generic" joining procedure that could be qualified by pipeline operators. This joining procedure would bring greater consistency to this aspect of gas pipeline installation, facilitate the pipeline operator's efforts to qualify the procedure, reduce costs, and simplify DOT's enforcement duties.

## **II. Scope**

The program undertaken by the PPI Task Group for the testing of representative materials under a generic set of conditions was designed to reflect the fusion conditions and parameters specified in most joining procedures recommended by pipe producers and qualified by pipeline operators. It produced a PPI Technical Report (TR-33/99) that reflects a Generic Butt Fusion Procedure that most of the Polyethylene Gas Pipe manufacturer's recommend. At the conclusion of the butt fusion phase of the program, the task group started its testing to develop a Generic Saddle Fusion Procedure that is based on common interfacial pressures and heater adapter surface temperatures. In anticipation of a change in the Maximum Allowable Operating Pressure (MAOP) and the design factor from .32 to .40, it was felt that this procedure was needed to insure safety in saddle fusion on live gas mains. It was intended to provide a technical basis for the development of a proposed generic saddle fusion procedure (see Appendix A) that can be offered to the industry for use with selected PE piping products. The procedure would be available for use by pipeline operators who would determine whether the procedure is appropriate for their use with the PE piping products they employ. Pipeline operators may consider recommendations and testing performed by others in their efforts to comply with the fusion procedure qualification requirements of 49 C.F.R. § Part 192.283 (Plastic pipe; qualifying joining procedures).

It is important to emphasize that the testing performed by the PPI Task Group was intended only to establish a technical basis for developing and proposing a generic fusion joining procedure that may be qualified and used by pipeline operators with a broad range of PE piping products. The testing was not intended to qualify the procedure for use with any particular pipe product, and PPI offers no opinion on whether the procedure is properly qualified for use with any particular PE pipe product. PE pipe producers remain solely responsible for any representations that they may make about the use of this generic procedure or any other joining procedure with their proprietary PE piping products. Pipeline operators remain solely responsible for compliance with the requirements of 49 C.F.R. § Part 192.283 (Plastic pipe; qualifying joining procedures) when qualifying any procedure for use with the products they select for their pipelines.

PPI hopes that the inherent value of greater uniformity will provide an incentive for manufacturers and pipeline operators to evaluate the proposed generic procedure in Appendix A as a first option for saddle fusion joining of PE piping products. Use of this procedure is not mandatory, and each PE pipe producer and pipeline operator retains the option of developing different procedures for its particular products and pipelines. However, PPI believes that its work in developing this procedure will promote the use of effective, qualified procedures for saddle fusion joining of PE pipe.

### **III. Testing Program to Evaluate Use of PPI-Proposed Generic Saddle Fusion Joining Procedure with Polyethylene Gas Piping Products**

The PPI Task Group consisted of representatives from the following equipment, fitting, and pipe manufacturers: Performance Pipe, Rinker PolyPipe, Central Plastics, Uponor, Charter Plastics, North American Pipe, KWH Pipe, Rahn Plastics, McElroy Manufacturing, and T.D. Williamson.

The Task Group collected and examined a large number of diverse procedures now in use by gas pipeline operators or recommended by pipe producers for specific PE piping products. It then identified those conditions and fusion parameters that were common to the majority of those procedures. The Task Group proposed the following saddle fusion parameters as representative of the conditions in the individual procedures that they reviewed:

Heater Adapter Surface Temperature	500° ± 10°F
Initial Interfacial Pressure	80 PSI
Heat Soak Interfacial Pressure	0 PSI
Fusion Interfacial Pressure	40 PSI

Note: "Interfacial pressure" is the force per unit area applied between the fitting saddle base and the main pipe. Most saddle fusion equipment provides a gauge reading that is the actual force applied in pounds (Newtons). To determine the applied force for a

particular saddle fitting design, multiply the interfacial pressure by the saddle fitting base area.

From its review of the different procedures collected from PE gas pipe producers, the Task Group further developed the “generic” joining procedure set out in Appendix A, based on its assessment of the common elements in the individual procedures. It was agreed that proprietary products such as Uponor’s Aldyl A MDPE products and Phillips Driscopipe’s 8000 HDPE piping products (both of which have been discontinued) were sufficiently different from the remainder of the materials being discussed that they were not included in the test program. The manufacturers should be contacted for more information on particular joining procedures for those products.

Using these proposed parameter ranges and procedures, the Task Group initiated a testing program to evaluate whether a representative cross-section of marketed PE gas piping products would qualify under the qualification requirements of Part 192 when joined in accordance with this “generic” joining procedure. The evaluation was conducted using pipe and fittings from MDPE and HDPE materials deemed suitable for fuel gas applications per ASTM D 2513. These materials have a grade designation, in accordance with ASTM D3350, of PE24 and PE34, respectively.

Grade	Density (grams/cc)	Melt Index (grams/10min.)	Pipe Marking
PE24	.926/.940	.15 to .40	PE2406
PE34	.941/.955	.05 to .15	PE3408

After saddle fusion of the fittings onto pressurized gas main pipe, destructive tests were conducted in accordance with the requirements of DOT and ASTM. The results of the test program are described in the following sections. PPI’s Conclusions and Recommendations, based on the Task Group’s work, are noted at the end of the testing report. Test data are maintained at PPI headquarters.

**Part 1 - Saddle Fusion and Testing - (Like Materials) By an independent lab.**

Part 1 of this project was to evaluate the generic procedure for use in fusing PE pipe fittings to the same pipe main material (e.g., MDPE to MDPE) using different heating times. An independent lab was used to saddle fuse the samples using the proposed interfacial pressure combinations and different heating times at both 32° F and 120 °F temperature conditions. The following parameters were used to make samples that were destructively tested and evaluated by the independent lab to narrow down the proposed fusion procedure and parameters for saddle fusing different fittings on ASTM D 2513 gas mains. The Task Group members supplied 2" SDR 11 pipe samples and tapping tee fittings for this saddle fusion testing. All

fusions were made on pipe mains under 0.40 design factor pressures - that is, MDPE -100 psig and HDPE -125 psig to observe any leakage or blowout problems (Note - the 73°F HDB may be used only for temperatures below 100°F; for 100°F and above, elevated temperature ratings must be used). The Task Group agreed to use these same fusion parameters for both the MDPE and HDPE (shown in Appendix A). Approximately (210) saddle fusion joints were made and evaluated by visual inspection, quick burst testing per ASTM D1599, knock off testing per ASTM F905 and Section/bend testing per ASTM D 2657. From this, the task group decided to use the same parameters shown above and ask each pipe manufacturer to do the next round of testing by varying the heating times and keeping the heater temperature and interfacial pressures the same.

**Part 2 - Saddle Fusion and Testing - (Like Materials) By Pipe Manufacturers**

Part 2 of this project was to evaluate the proposed generic saddle fusion procedure on 2"IPS main pipe and larger using the same parameters as in Part 1 but varying the heating times. Each pipe manufacturer saddle fused tapping tees onto 2" IPS straight and coiled 2" IPS DR11 main pipe using both serrated and smooth heater adapters at 73°F. All fusions were made on pipe mains under 0.40 design factor pressures (that is, MDPE -100 psig and HDPE -125 psig at 73°F) to observe any leakage or blowout problems. The Task Group agreed to use these same fusion parameters for both the MDPE and HDPE (shown in Appendix A). Again, the saddle fusion joints were made and evaluated by visual inspection, quick burst testing per ASTM D1599, knock off testing per ASTM F905 and Section/bend testing per ASTM D 2657. The results were very encouraging the fusion parameters and heating times were narrowed as shown below:

Heater Adapter Surface Temperature	500° ± 10° F
Initial Interfacial Pressure	60 PSI
Heat Soak Interfacial Pressure	0 PSI
Fusion Interfacial Pressure	30 PSI
Total Heating Times	20,30 and 40 seconds

(Note: Total heating times include the time required for initial heating and heat soak. During initial heating, the main is observed and when an indication of melt is visible on the crown of the main, the pressure is reduced for the heat soak time. Typically, initial heating takes from 3 to 5 seconds.)

**Part 3 - Saddle Fusion and Testing - 2" IPS DR11 (Like Materials)**

Part 3 of this project was to evaluate the proposed generic saddle fusion procedure on 2"IPS and larger main pipes using the same parameters from Part 2 and varying the heating times. Each pipe manufacturer saddle fused tapping tees onto 2" IPS straight and coiled 2" IPS DR11 main pipe using both serrated and smooth heater adapters at 73°F. All fusions were made on pipe mains under 0.40 design factor pressures (that is, MDPE -100 psig and HDPE -125 psig at 73°F) to observe any leakage or blowout problems. The Task Group agreed to use these same fusion parameters for both the MDPE and HDPE (shown in Appendix A). Again, the saddle fusion joints were made and evaluated by visual inspection, quick burst testing per ASTM D1599, knock off testing per ASTM F905 and Section/bend testing per ASTM D 2657. The task group member reported no failures using a 25-35 second total heating time, 60 psi Initial Heat interfacial pressure and 30 psi Fusion Interfacial Pressure. The Task Group therefore decided to do cross fusion testing of HDPE fittings on MDPE mains and different manufacturer's fittings on other manufacturer's pipe. A test matrix was developed for (186) samples to be made and tested as in earlier parts.

Heater Adapter Surface Temperature	500° ± 10° F
Pre-Heat Interfacial Pressure	60 PSI
Soak Interfacial Pressure	0 PSI
Fusion Interfacial Pressure	30 PSI
Heating time	25-35 seconds

**Part 4 - Saddle Fusion and Testing - (Unlike Materials)**

Part 4 of this project was to evaluate the proposed generic saddle fusion parameters shown in Part 3 above and the generic saddle fusion procedure shown in Appendix A on different combinations of "standard" tapping tee fittings and pipe manufacturer's pipe (brands and material types). Each pipe manufacturer saddle fused "standard" tapping tees onto 2" IPS DR11 straight and 2" IPS DR11 coiled main pipe using both serrated and smooth heater adapters at 73°F. All fusions were made on pipe mains under 0.40 design factor pressures (that is, MDPE -100 psig and HDPE -125 psig at 73°F) to observe any leakage or blowout problems. The Task Group agreed to use these same fusion parameters for both the MDPE and HDPE (shown in Appendix A). Again, the saddle fusion joints were made and evaluated by visual inspection, quick burst testing per ASTM D1599, knock off testing per ASTM F905 and Section/bend testing per ASTM D 2657. Approximately (186) samples were made and tested with no blowouts, failures or unsatisfactory results under any of the DOT or ASTM test conditions.

**IV. Conclusions and Recommendations**

The results of this study indicate that there is a single fusion procedure, with defined ranges of acceptable heater adapter surface temperature, heating times and interfacial pressures, that can be used for saddle fusing most of the PE fittings and

pipes on the market today. The PE main pipes used in these tests were 2" IPS and larger selected PE2406 and PE3408 materials which were deemed suitable for fuel gas applications (per ASTM D 2513) and which have a grade designation, in accordance with ASTM D3350, of PE24 and PE34, respectively, excluding Uponor's Aldyl A MDPE and Phillip's Driscopipe 8000 HDPE (which have been discontinued). The pipe and fitting materials used in this study had a nominal melt index range of .07 - .20 g/10 min. Both straight and coiled 2" IPS DR11 pipes were used as the main pipe in these studies.

Note: 1 1/2" IPS main pipes were not tested in this study but the procedure was qualified for this main size by the pipe and fitting manufacturers at a later date. (Pipe manufacturers should be consulted for recommendations on smaller main sizes).

The results of this study further indicate that there is a strong likelihood that the generic saddle fusion procedure used in this testing (see Appendix A) can be qualified by gas pipeline operators under DOT's regulations in Part 192 for use with these PE gas piping products. The Plastics Pipe Institute hopes that the proposed generic saddle fusion procedure in Appendix A will be qualified by more and more gas pipeline operators for use with PE pipe products in the marketplace, thus moving the industry toward DOT's objective of greater uniformity, efficiency, and simplicity in the area of fusion procedures.

Endorsement letters for this generic saddle fusion procedure from PPI member companies are in Appendix B.



## Appendix A

### **Generic Saddle Fusion Joining Procedure of PE (Polyethylene) Pipe Mains 1 1/4" IPS and Larger**

This Appendix is for use only in conjunction with PPI's Technical Report TR-41, which more fully explains the background, scope and purposes of the PPI generic saddle fusion procedure. This procedure has not been qualified for use with any particular piping product or any combination of piping products and must be qualified for use in accordance with DOT 49 CFR Part 192.283 prior to its use in field joining of PE gas pipe. Photographs describing the steps of this procedure along with photos of acceptable and unacceptable fusions are in Appendix C.

Notice: This procedure may be copied or reproduced provided notice and the reference to the accompanying PPI TR-41 are included. Any other copying or reproduction is a violation of the copyright.

This procedure can be used for PE fuel gas pipe and fittings that meet ASTM D 2513 and have a grade designation (in accordance with ASTM D3350) of PE24 and PE34, excluding Uponor's Aldyl A MDPE and Phillip's Driscopipe 8000 HDPE (both of which have been discontinued). The pipe and fitting nominal melt index range would be .07-.20 g/10 min. This procedure is intended only as a guide because heating times can vary under different ambient conditions.

#### Generic Saddle Fusion Parameters

Heater Adapter Surface Temperature	500°±10°F
Initial Interfacial Pressure	60±6 psi
Heat Soak Interfacial Pressure	0 psi
Fusion Interfacial Pressure	30±3 psi
Total Heating Time on Main—1 _" IPS Pressure Main	15 seconds max.
Total Heating Time on Main-- 2" IPS Pressure Main	25-35 seconds max.
Total Heating Time on non-pressure 1 _" IPS, 2" IPS mains, and on pressure or non-pressure 3" IPS and larger mains.	Look for a 1/16" bead around the fitting base

Note: Look in the lower right hand corner of the fitting label for the forces required for that fitting (Initial Heat Force / Heat Soak Force / Fusion Force) (example 180/0/90)

## Definitions

Initial Heat (Bead-up) – The heating step used to develop an initial melt bead on the main pipe.

Initial Heat Force (Bead-up force)—The force (pounds) applied to establish an initial melt pattern on the main pipe. The Initial Heat Force is determined by multiplying the fitting base area (sq. inches) by the initial interfacial pressure (pounds per square inch)

Heat Soak Force—The force (pounds) applied after an initial melt pattern is established on the main pipe. The Heat Soak Force is the minimum force (essentially zero pounds) that ensures that the fitting, heater and main stay in contact with each other.

Fusion Force—The force (pounds) applied to establish the fusion bond between the fitting and the pipe. The Fusion Force is determined by multiplying the fitting base area (square inches) by the fusion interfacial pressure (pounds per square inch).

Total Heat Time—A time that starts when the heater is placed on the main pipe and initial heat force is applied and ends when the heater is removed.

Cool Time—The time required to cool the joint to approximately 120°F (49°C). The fusion force must be maintained for 5 minutes on 1 \_" IPS or 10 minutes for all other main sizes, after which the saddle fusion equipment can be removed. The joint must be allowed to cool undisturbed for an additional 30 minutes before tapping the main or joining to the branch outlet.

Interfacial Area for rectangular base fittings-- The major width times the major length of the saddle base, without taking into account the curvature of the base or sides, minus the area of the hole in the center of the base.

Interfacial Area for round base fittings-- The radius of the saddle base squared times  $\pi$  (3.1416), without taking into account the curvature of the base or sides, minus the area of the hole in the center of the base.

Fitting Label—The initial heat force, heat soak force and the fusion force will be listed in the lower right hand corner of the fitting label for all saddle fusion fittings, This will eliminate the need to calculate the fusion forces in the field. (example: 180/0/90)

# Generic Saddle Fusion Procedure

## Preparation

This procedure requires the use of a Saddle Fusion Tool. This tool must be capable of holding and supporting the main, rounding the main for good alignment between the pipe and fitting, holding the fitting, and applying and indicating the proper force during the fusion process.

1. Install the Saddle Fusion Tool on the main according to the manufacturer's instructions. The tool should be centered over a clean, dry location where the fitting will be fused. Secure the tool to the main. A main bolster or support is recommended under the pipe on 6" IPS and smaller main pipe sizes.
2. Abrade the main, where the fitting will be joined, with a 50-60 grit utility cloth until a thin layer of the pipe surface is removed. The abraded area must be larger than the area covered by the fitting base. After abrading, brush residue away with a clean, dry cloth.
3. Abrade the fusion surface of the fitting with 50 to 60 grit utility cloth; remove all dust and residue. Insert the fitting in the Saddle Fusion Tool loosely. Using the Saddle Fusion Tool, move the fitting base against the main pipe and apply about 100 pounds-force to seat the fitting. Secure the fitting in the Saddle Fusion Tool.

## Heating

4. The heater must be fitted with the correct heater adapters. The temperature of the heater adapter fusion surfaces must be 490-510°F.
5. Place the heating tool on the main centered beneath the fitting base. Immediately move the fitting against the heater faces, apply the Initial Heat Force (see fitting label), and start the heat time. Apply the Initial Heat Force until melt is first observed on the crown of the pipe main (Initial Heat is the term used to describe the initial heating (bead-up) step to develop a melt bead on the main pipe and usually is 3-5 seconds) and then reduce the force to the Heat Soak Force (Bead-up force) (see fitting label). Maintain the Heat Soak Force until the Total Heat Time is complete.
6. At the end of the Total Heat Time, remove the fitting from the heater and the heater from the main with a quick snapping action. Quickly check for an even melt pattern on the pipe main and fitting heated surfaces (no unheated areas). Total Heat Time ends:
  - a. When the Total Heating Time expires for a pressurized 1 \_" IPS or 2" IPS main, or
  - b. When a melt bead of about 1/16" is visible all around the fitting base for a 1 1/4 " IPS or 2" IPS non-pressurized main, or a larger pressurized or non-pressurized main.

## **Fusion and Cooling**

7. Whether or not the melt patterns are satisfactory, press the fitting onto the main pipe very quickly (within 3 seconds) after removing the heater and apply the Fusion Force (see the fitting label). Maintain the Fusion Force on the assembly for 5 minutes on 1 \_" IPS and for 10 minutes on all larger sizes, after which the saddle fusion equipment may be removed. (Fusion Force adjustment may be required during Cool Time, but never reduce the Fusion Force during cooling.)
8. Cool the assembly for an additional 30 minutes before rough handling or tapping the main. (If step 7 melt patterns were not satisfactory or if the fusion bead is unacceptable, cut off the saddle fitting above the base to prevent use, relocate to a new section of main, and make a new saddle fusion using a new fitting.)

### **NOTE:**

These procedures are based on tests conducted under controlled ambient temperature conditions. Environmental conditions on a job site could affect heating and cooling times. Regardless of job site conditions or ambient temperature, the prescribed heating tool temperature is required. Do not increase or decrease the heating tool temperature.

## Appendix B

### LETTERS OF ENDORSEMENT FROM PPI MEMBER COMPANIES

#### CHARTER PLASTICS, INC. POLYETHYLENE PIPE PRODUCTS

##### Letter of Approval PPI Generic Saddle Fusion Joining Procedure

October 4, 2002

This letter is to certify that Charter Plastics, Inc. approves the PPI generic saddle fusion joining procedure shown in Appendix A of PPI Technical Report TR-41. This testing procedure was performed in accordance with DOT 49 CFR 192.283 to qualify joining procedures. Testing included visual inspection, long-term 80°C 1000-hour testing using 580-psi hoop stress, knock-off testing per ASTM F905, and section/bending testing.

All these tests were conducted using the revised MAOP of 125 psig for SDR 11 PE 3408 materials and 100 psig for SDR 11 PE 2406 materials – based on the proposed new design factor of 0.40 (revised from 0.32) for the gas pipe mains.

Based on these tests and previous testing performed by the task group to validate these procedures, Charter Plastics, Inc. approves the use of the PPI generic saddle fusion joining procedure in saddle fusing Charter Plastics, Inc. PE 2406 and PE 3408 saddle fittings onto PE 2406 and PE 3408 pipe (not including Uponor's Aldyl A MDPE products and Phillips Driscopipe's 8000 HDPE piping products).

While procedures now specified in our company's literature can also be used, the use of the PPI generic saddle fusion joining procedure is intended to help DOT expedite the qualification of gas pipeline operators and add some uniformity to the industry.

If we deviate from the particular thermoplastic piping material formulations or make any other change, which is not specifically allowed by an appropriate policy in PPI Technical Report TR-3, then we will re-qualify the fusions.

Sincerely,

*Donna Stoughton*

Charter Plastics, Inc.  
P.O. BOX 770  
Titusville, PA 16354



October 3, 2002

## Letter of Approval

### PPI Generic Saddle Fusion Joining Procedure

This letter is to certify that KWH Pipe has conducted saddle fusion testing using the PPI generic saddle fusion joining procedure shown in Appendix A of PPI Technical Report TR-41. This testing was performed in accordance with DOT 49 CFR 192.283 to qualify joining procedures. Testing included visual inspection, long-term 80°C 1000-hour testing using 580-psi hoop stress, knock-off testing per ASTM F905, and section/bending testing.

All these tests were conducted using the revised MAOP of 125 psig for SDR 11 PE 3408 materials and 100 psig for SDR 11 PE 2406 materials – based on the proposed new design factor of 0.40 (revised from 0.32) for the gas pipe mains.

These results were shared with the PPI saddle fusion task group. Based on these tests and previous testing performed by the task group to validate these procedures, KWH Pipe approves the use of the PPI generic saddle fusion joining procedure in saddle fusing PE 2406 and PE 3408 saddle fittings onto KWH Pipe's Wehogas PE 2406 and PE 3408 pipe.

While procedures now specified in our company's literature can also be used, the use of the PPI generic saddle fusion joining procedure is intended to help DOT expedite the qualification of gas pipeline operators and add some uniformity to the industry.

If we deviate from the particular thermoplastic piping material formulations or make any other change, which is not specifically allowed by an appropriate policy in PPI Technical Report TR-3, then we will re-qualify the fusions.

Sincerely,

**KWH PIPE (CANADA) LTD.**

*D. Fuerth*

David Fuerth, P.Eng.  
Sales and Marketing Manager

KWH Pipe (Canada) Ltd., 6507 Mississauga Rd. Mississauga, Ontario, Canada L5N 1A6

*Phone: 713-840-7473*

*FAX: 713-552-0087*

# **North American Pipe Corporation**

---

---

2801 Post Oak Boulevard

*Houston, Texas 77056*

## **Letter of Approval**

### **PPI Generic Saddle Fusion Joining Procedure**

October 3, 2002

This letter is to certify that North American Pipe Corporation has conducted saddle fusion testing using the PPI generic saddle fusion joining procedure shown in Appendix A of PPI Technical Report TR-41. This testing was performed in accordance with DOT 49 CFR 192.283 to qualify joining procedures. Testing included visual inspection, long-term 80°C 1000-hour testing using 580-psi hoop stress, knock-off testing per ASTM F905, and section/bending testing.

All these tests were conducted using the revised MAOP of 125 psig for SDR 11 PE 3408 materials and 100 psig for SDR 11 PE 2406 materials – based on the proposed new design factor of 0.40 (revised from 0.32) for the gas pipe mains.

These results were shared with the PPI saddle fusion task group. Based on these tests and previous testing performed by the task group to validate these procedures, North American Pipe Corporation approves the use of the PPI generic saddle fusion joining procedure in saddle fusing PE 2406 and PE 3408 saddle fittings onto AmeriFlow PE 2406 and PE 3408 pipe (not including Uponor's Aldyl A MDPE products and Phillips Driscopipe's 8000 HDPE piping products).

While procedures now specified in our company's literature can also be used, the use of the PPI generic saddle fusion joining procedure is intended to help DOT expedite the qualification of gas pipeline operators and add some uniformity to the industry.

If we deviate from the particular thermoplastic piping material formulations or make any other change, which is not specifically allowed by an appropriate policy in PPI Technical Report TR-3, then we will re-qualify the fusions.

Sincerely,

*Danny W. McDonald*

North American Pipe Corporation  
2801 Post Oak Blvd. Suite 600  
Houston, TX 77056



## PERFORMANCE PIPE

A DIVISION OF CHEVRON PHILLIPS CHEMICAL COMPANY LP  
5085 W PARK BLVD, STE 500 (75093)  
PO BOX 269006  
PLANO, TX 75026-9006  
TEL: (972) 599-6600  
<http://www.performancepipe.com>

Plastics Pipe Institute  
1825 Connecticut Ave., NW  
Suite 680  
Washington, DC 20009

Subject: **PPI Generic Saddle Fusion Joining Procedure**

October 3, 2002

This letter is to certify that Performance Pipe, a Division of Chevron Phillips Chemical Company LP has conducted saddle fusion testing using the PPI generic saddle fusion joining procedure shown in Appendix A of PPI Technical Report TR-41. This testing was performed in accordance with DOT 49 CFR 192.283 to qualify joining procedures. Testing included visual inspection, long-term 80°C 1000-hour testing using 580-psi hoop stress, knock-off testing per ASTM F905, and section/bending testing.

All these tests were conducted using the revised MAOP of 125 psig for SDR 11 PE 3408 pipe products and 100 psig for SDR 11 PE 2406 pipe products – based on the proposed new design factor of 0.40 (revised from 0.32) for the gas pipe mains.

These results were shared with the PPI saddle fusion task group. Based on these tests and previous testing performed by the task group to validate these procedures, Performance Pipe, a Division of Chevron Phillips Chemical Company LP concurs with the use of the PPI generic saddle fusion joining procedure in saddle fusing Performance Pipe's PE 2406 and PE 3408 saddle fittings onto PE 2406 and PE 3408 pipe (not including Uponor's Aldyl A MDPE products and Phillips Driscopipe's 8000 HDPE piping products).

While procedures now specified in our company's literature can also be used, the use of the PPI generic saddle fusion joining procedure is intended to help DOT expedite the qualification of gas pipeline operators and add some uniformity to the industry.

If we deviate from the particular thermoplastic piping material formulations or make any other change, which is not specifically allowed by an appropriate policy in PPI Technical Report TR-3, then we will re-qualify the fusions.

Sincerely,

**Michael F. Byrne**  
Technical Manager

P.O. Box 390  
Gainesville, TX 76241-0390  
Phone: 940-665-1721  
FAX: 940-668-8612



# PolyPipe®

---

March 1, 2009

Subject: PPI TR-41 GENERIC SADDLE FUSION PROCEDURE / LETTER OF APPROVAL

This letter is to verify that PolyPipe, Inc. has conducted saddle fusion testing using the PPI Generic Saddle Fusion Joining procedure as shown in Appendix A of PPI Technical Report TR-41. This testing was conducted in accordance with DOT 49 CFR 192.283 and consisted of visual inspection, knock-off testing per ASTM F905, section/bending testing and sustained pressure 80C testing. Initial testing and qualification was performed by a PPI task group as reflected in the TR-41/2002 report. PolyPipe Inc has completed additional qualification to these same procedures and test protocol for its bi-modal PE2708 and PE4710 products for gas distribution. PolyPipe Inc approves the use of the PPI Generic Saddle Fusion procedures for the joining of these bimodal products to eachother and to the products previously tested in earlier qualifications.

While procedures now specified in PolyPipe Inc product literature can also be used, the use of the PPI Generic Saddle Fusion Joining Procedures is intended to help the DOT expedite the qualification of gas pipeline operators and to add some uniformity to the industry.

These procedures apply to the following PolyPipe Inc products for gas distribution service:

- PolyPipe® GDY20
- PolyPipe® GDB30
- PolyPipe® GDB50

Sincerely,



Allison Crabtree, P.E.  
Engineering Manager

**PolyPipe, Inc.**

P.O. Box 390 | Gainesville, TX | 940.665.1721 | 940.668.8612



## Letter of Approval

### PPI Generic Saddle Fusion Joining Procedure

October 3, 2002

This letter is to certify that Uponor Aldyl Company has conducted saddle fusion testing using the PPI generic saddle fusion joining procedure shown in Appendix A of PPI Technical Report TR-41. This testing was performed in accordance with DOT 49 CFR 192.283 to qualify joining procedures. Testing included visual inspection, long-term 80°C 1000-hour testing using 580-psi hoop stress, knock-off testing per ASTM F905, and section/bending testing.

All these tests were conducted using the revised MAOP of 125 psig for SDR 11 PE 3408 materials and 100 psig for SDR 11 PE 2406 materials – based on the proposed new design factor of 0.40 (revised from 0.32) for the gas pipe mains.

These results were shared with the PPI saddle fusion task group. Based on these tests and previous testing performed by the task group to validate these procedures, Uponor Aldyl Company approves the use of the PPI generic saddle fusion joining procedure in saddle fusing PE 2406 and PE 3408 saddle fittings onto Uponor Aldyl Company PE 2406 and PE 3408 pipe (not including Uponor's Aldyl A MDPE products and Phillips Driscopipe's 8000 HDPE piping products).

While procedures now specified in our company's literature can also be used, the use of the PPI generic saddle fusion joining procedure is intended to help DOT expedite the qualification of gas pipeline operators and add some uniformity to the industry.

If we deviate from the particular thermoplastic piping material formulations or make any other change, which is not specifically allowed by an appropriate policy in PPI Technical Report TR-3, then we will re-qualify the fusions or notify participating member companies that the new formulation is not qualified per TR-41.

Sincerely,

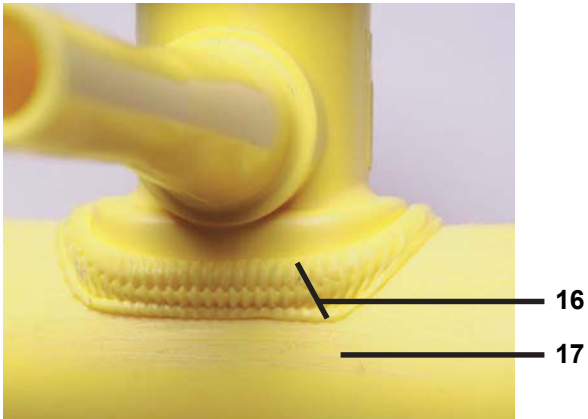
Larry Shelton

Larry Shelton

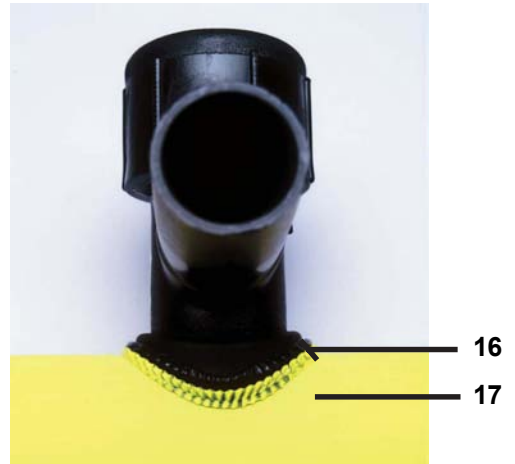
Technical Supervisor

Uponor Aldyl Company

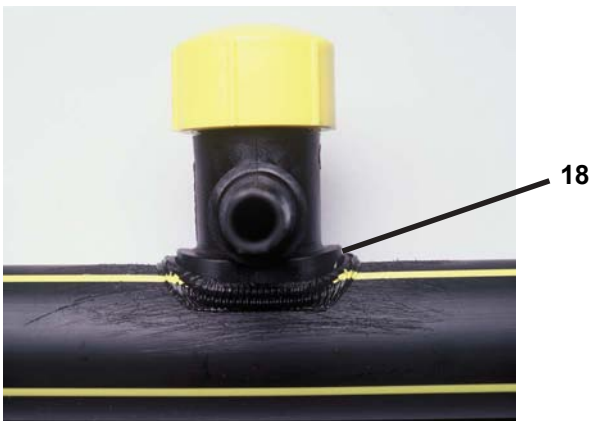
# ACCEPTABLE FUSIONS



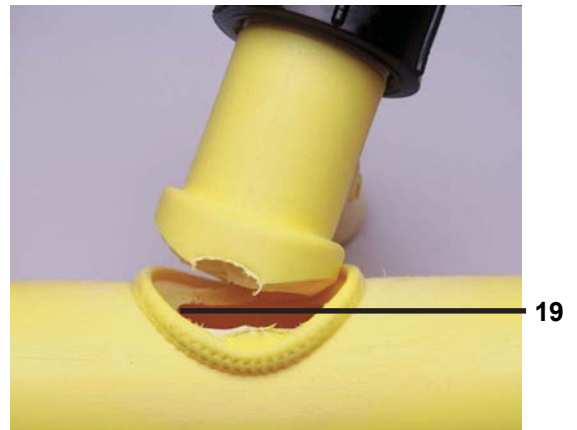
16. Proper alignment, force and melt  
17. Proper pipe surface preparation



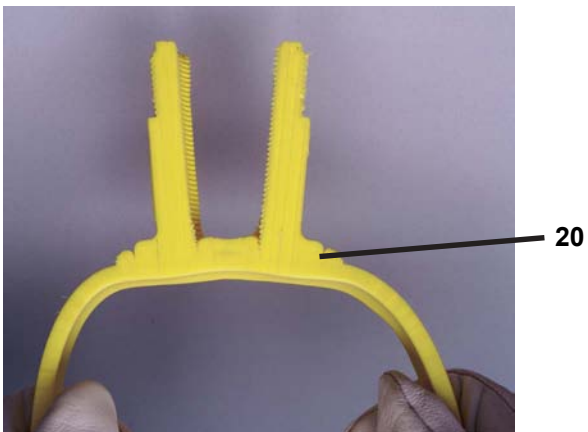
16. Proper alignment, force and melt  
17. Proper pipe surface preparation



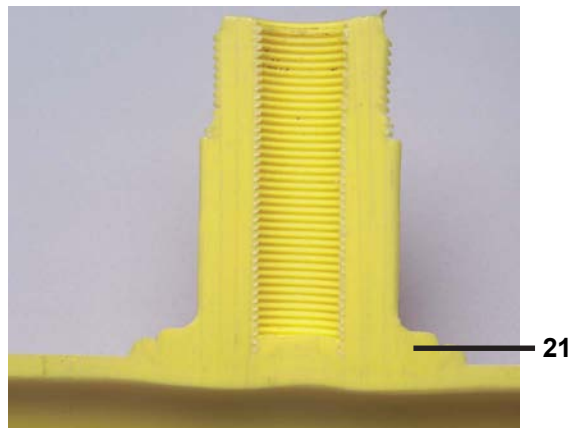
18. Melt bead below or parallel with  
top of fitting base



19. Material pulled from pipe when  
impact tested

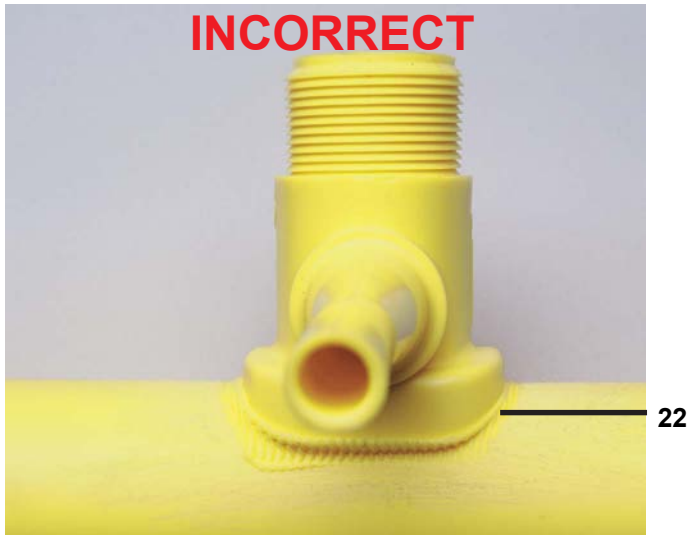


20. No gap or voids when bent

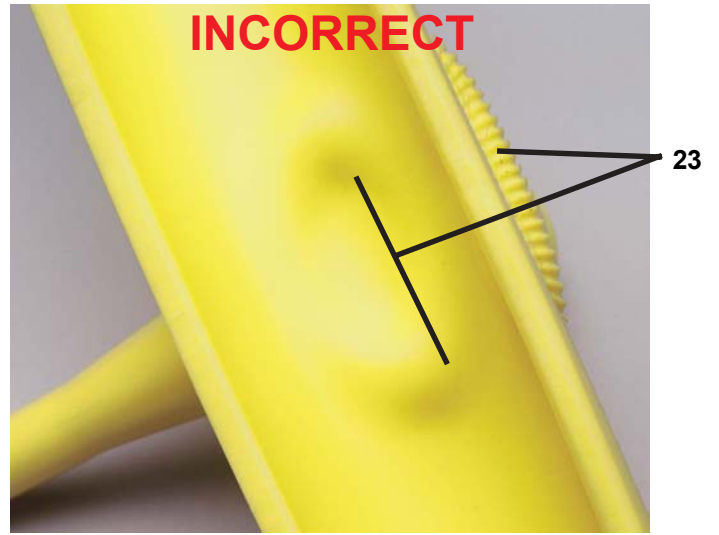


21. No gap or voids at fusion interface

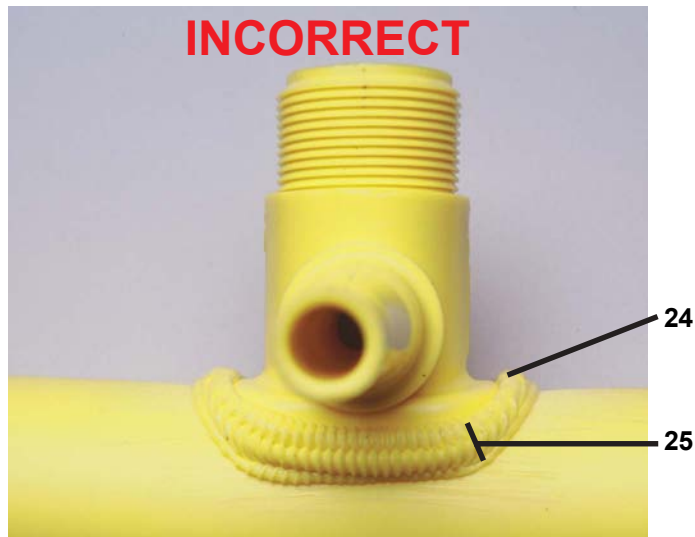
# UNACCEPTABLE FUSIONS



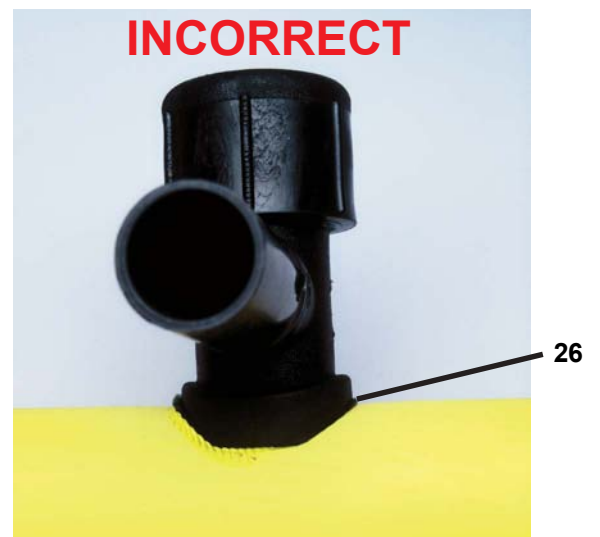
22. Insufficient melt and misaligned



23. Excessive melt and force



24. Bead above base of fitting  
25. Excessive melt and force



26. Insufficient melt

### Prepare Fusion Machine

This procedure requires the use of a Saddle Fusion Tool. This tool must be capable of holding and supporting the main, rounding the main for good alignment between the pipe and fitting, holding the fitting, applying and indicating the proper force during the fusion process.



PH02220-7-16-01

Install the Saddle Fusion Tool on the main according to the manufacturer's instructions. The tool should be centered over a clean, dry location where the fitting will be fused. Secure the tool to the main. A main bolster or support is recommended under the pipe on 6" IPS and smaller main pipe sizes.



PH02201-7-16-01

Abrade the fusion surface of the main with a 50-60 grit utility cloth. The abraded area must be larger than the area covered by the fitting base. After abrading, brush residue away with a clean, dry cloth.



PH02207-7-16-01

Abrade the fusion surface of the fitting with 50 to 60 grit utility cloth; remove all dust and residue.



PH02204-7-16-01



Insert the fitting in the Saddle Fusion Tool loosely.



PH02205-7-16-01

Using the Saddle Fusion Tool, move the fitting base against the main pipe and apply about 100 pounds-force to seat the fitting. Secure the fitting in the Saddle Fusion Tool.



PH02260-7-16-01

### Heating

The heater must be fitted with the correct heater adapters. The temperature of the heater adapter fusion surfaces must be 490-510° F.



PH02207-7-16-01

Place the heating tool on the main centered beneath the fitting base. Immediately move the fitting against the heater faces, apply the Initial Heat Force (see fitting label), and start the heat time.



PH02210-7-16-01

Apply the Initial Heat Force until melt is first observed on the crown of the pipe main (Initial Heat is the term used to describe the initial heating (bead-up) step to develop a melt bead on the main pipe and usually is 3-5 seconds) and then reduce the force to the Heat Soak Force (Bead-up force) (see fitting label). Maintain the Heat Soak Force until the Total Heat Time is complete.

At the end of the Total Heat Time, remove the fitting from the heater and the heater from the main with a quick snapping action. Quickly check the melt pattern on the pipe main and fitting heated surfaces for an even melt pattern (no unheated areas). Total Heat Time ends:

- a) When the Total Heating Time expires for a pressurized 1¼" IPS or 2" IPS main.

or

- b) When a melt bead of about 1/16" is visible all around the fitting base for a 1¼" IPS or 2" IPS non-pressurized main, or a larger pressurized or non-pressurized main.



PH02214-7-16-01

### Fusion and Cooling

Whether or not the melt patterns are satisfactory, press the fitting onto the main pipe very quickly (within 3 seconds) after removing the heater and apply the Fusion Force (See the Fitting Label). Maintain the Fusion Force on the assembly for 5 minutes on 1¼" IPS and for 10 minutes on all larger sizes, after which the saddle fusion equipment may be removed. (Fusion Force adjustment may be required during Cool Time, but never reduce the Fusion Force during the cooling.)



PH02218-7-16-01

The assembly should cool for an additional 30 minutes before rough handling or tapping the main. (If step 7 melt patterns were not satisfactory or if the fusion bead is unacceptable, cut off the saddle fitting above the base to prevent use, relocate to a new section of main, and make a new saddle fusion using a new fitting.)

**NOTE:** These procedures are based on tests conducted under controlled ambient temperature conditions. Environmental conditions on a job site could affect heating and cooling times. Regardless of job site conditions or ambient temperature, the prescribed heating tool temperature is required. Do not increase or decrease the heating tool temperature.



PH02221-7-16-01