SADDLE FUSION

SADDLE FUSION TO A PRESSURIZED MAIN (HOT TAPPING)

As identified in the Introduction, this saddle fusion procedure applies to field fusion of Performance Pipe service saddles, tapping tees and branch saddles.

WARNING: The possibility of gas main blowout increases when internal pressure is higher, when the pipe wall is thinner (higher DR) and when the temperature of the main is elevated.

When saddle fusing to a pressurized gas main, gas main internal pressure must not exceed pressure limits specified in Federal regulations (MAOP).

- *For Federally regulated gas applications in the United States, main pressure must be reduced for elevated temperature when the main temperature exceeds 100°F (38°C).*
- *For Federally regulated gas applications in Canada, main pressure must be reduced for elevated temperature when the main temperature exceeds 23°C (73°F).*

Saddle fusion to pressurized gas mains is not recommended for 3" IPS (89mm) mains with DR's above 13.5 and 4" IPS (110 mm) and larger mains with DR's above 17.

REQUIRED EQUIPMENT

- ✓ A saddle fusion machine (application tool/unit) with appropriate clamps for the main pipe and saddle fitting. Use a main bolster or support for 6" IPS (160 mm) and smaller main pipes.
- ✓ **When saddle fusing to a pressurized main, the saddle fusion machine must have a gauge or mechanism that indicates the force applied when the saddle base is pressed against the heating tool or the main.**
- ✓ A heating tool with faces contoured and correctly sized for the main pipe and the fitting base. Both serrated and smooth heater faces will produce quality saddle fusions with the serrated heater faces being preferred.
- ✓ 50-60 grit utility cloth.
- ✓ Timing equipment such as a stopwatch or watch with a sweep second hand when fusing to 2" IPS and smaller mains.

WARNING: Using improper or faulty equipment or failing to follow correct saddle fusion procedure during saddle fusion to a pressurized main can result in death, serious injury or property damage.

Important: Saddle fusion machines, tools and equipment from different manufacturers will operate differently. Follow the machine manufacturer's instructions for proper use and operation of the equipment.

SET-UP PARAMETERS

- ✓ Heating tool surface temperature – **minimum 490°F (255°C); maximum 510°F (265°C)**
- ✓ ***Low heating tool temperature can lead to a blowout during saddle fusion to a pressurized main.*** Before you begin, all points on both heating tool surfaces must be within the prescribed

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minimum and maximum temperatures where the heating tool surfaces will contact the main or the fitting. Heating tool surfaces must be clean.

SADDLE FUSION PARAMETERS

Saddle fusion bead-up force, heating force and joining force are printed on the fitting label.

Figure 4 Example Fitting Label

Bead-Up Force. During bead-up, force is applied to form an initial melt pattern on the main and the fitting base. Bead-up ends when melt is visible at the top center of the main on both sides of the heating tool. Bead-up force is usually applied for 3 – 5 seconds, but no more than about 1/3 of the total heating time. The bead-up force in pounds is the first number on the fitting label.[3] See Figure 4.

Heating Force. The heating force is always zero. During heating, the fitting, heating tool and main are held together, but without applying force. The heating force is the second number on the fitting label (as depicted in Figure 4 as "0").[3]

Joining Force. Joining force is applied to the fitting against the main immediately after the heating tool is removed. Joining force is half the bead-up force. The joining force is the third number on the fitting label.[3] See Figure 4. Joining force must be maintained for the duration of the first cooling time period. ***Caution – Never reduce joining force during the first cooling time period. Reducing joining force during the first cooling time period may result in blowout during hot tapping.*** If the saddle fusion machine force gauge reading rises during the minimum cooling time period, allow it to do so. See Table 3 for Minimum Cooling Time.

Maximum Heating Time. Heating time starts when the heating tool is first applied to the main. Heating time ends when the heating tool is removed from in-between the main and the fitting. When hot tapping 2" IPS and smaller mains, a timing device such as a stopwatch or watch with a sweep second hand is necessary for measuring heating time. See Table 3 for Maximum Heating Time.

WARNING – When saddle fusing to a pressurized main, blowout may occur if maximum heating time is exceeded.

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[3] When using hydraulic combination units for saddle fusion, Bead-Up, Heating or Joining Force (lbs) may be converted to hydraulic gauge pressure (psi) by dividing Bead-Up, Heating or Joining Force by the carriage cylinder piston area. Obtain the carriage cylinder piston area from the combination unit manufacturer.

In accordance with PPI TR-41 recommendations for generic saddle fusion, this saddle fusion procedure uses 54-66 psi interface pressure for bead-up force, zero psi interface for heating force, and 27-33 psi interface pressure for joining force. The recommended force is calculated by multiplying the area of the fitting base by the interface pressure. Fitting base area information is available upon request

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Minimum Cooling Time. Cooling time is two successive cooling time periods. During the first cooling time period, joining force is applied with the saddle fusion equipment. ***WARNING -- Never reduce joining force during the first cooling time period, even if joining force increases on its own.*** At the end of the first cooling time period, the application tool may be removed. During the second time period, the joint must be allowed to cool undisturbed. After the second cooling time, the tap tee can be tapped and pressure tested. See Table 3 for Minimum Cooling Time.

Table 3 Maximum Heating Time and Minimum Cooling Time

Main Size	*Maximum Heating Time*	*Minimum Cooling Time*
1-1/4" IPS DR 11	Stop heating when about 1/16" bead is visible all around fitting base. ***Do not exceed 15 sec when hot tapping.†***	5 min◊ + 30 min∆
2" IPS DR 11	Stop heating when about 1/16" bead is visible all around fitting base. ***Do not exceed 35 sec when hot tapping.†***	10 min◊ + 30 min∆
3" IPS and larger	Stop heating when about 1/16" bead is visible all around fitting base.	10 min◊ + 30 min∆
1" IPS and larger	ypically stop heating when 1/8" bead is visible. On large addle fittings the melt bead may be larger.	10 min◊ + 30 min∆

Warning -- During saddle fusion to a pressurized main, blowout may occur if maximum heating time is exceeded.
Warning -- Never reduce joining pressure during the first cooling time period -- Main blowout may occur.
Tapping or pressure tests may be conducted after the second cooling time period. Larger base fittings may require additional cooling time.

PROCEDURE

1. Preparation

Determine saddle fitting location – The area of the main pipe where the saddle fusion machine and the fitting will be located must be clean, dry, and free of deleterious nicks, gouges, or cuts[4]. The application tool must fit on the main pipe without interference or restriction from components or appurtenances, fusion beads or the like. Remove dirt and foreign materials from the main pipe surface. If below grade, the excavation must be large enough to install and operate the Saddle Fusion Machine. The main pipe must not be curved tighter than 100 pipe diameters bending radius.

WARNING: Observe all applicable codes, regulations and safety precautions when working in trenches or other excavations and when working with pressurized gas lines.

a) Install the saddle application tool on the main pipe according to the tool manufacturer's instructions. The saddle application tool should be centered at the location where the fitting will be fused.

b) Abrade the fusion surface of the fitting base, and the mating fusion surface of the main pipe with 50-60 grit utility cloth. On the main surface, abrade a surface area that is the size of the fitting base plus about 1/2-in (13 mm) per side all around. It is necessary to completely remove a thin layer of material from both surfaces. After abrading, brush the residue away with a clean, dry cloth. *Do not touch abraded and cleaned surfaces with your hands.*

[4] If used, alcohol wipes are used only before abrading the surface, never after abrading the surface. The surface should be wiped dry with a clean, dry non-synthetic (cotton) cloth or paper towel after using the alcohol wipe.

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Regular replacement of the Utility Cloth is necessary. Worn or dirty utility cloth will not abrade the surface properly. Poor surface preparation can cause poor fusion quality.

c) Install and lightly clamp the fitting in the saddle application tool. (Tapping tee caps may need tightening.) Move the fitting base against the main pipe, and apply moderate force (around 100 lbs) to seat the fitting against the main pipe and in the application tool. It may be necessary to wiggle the fitting a little to be sure it is completely seated and squarely aligned against the main. While maintaining force, secure the fitting in the saddle application tool. Move the fitting away from the main pipe.

2. Heating

WARNING: Heating and fusing must be performed accurately and quickly, especially when saddle fusing to a pressurized main pipe. Overheating or excessive time between actions can cause a blowout.

WARNING: Do not interrupt heating to inspect the melt pattern on the main pipe. When fusing to a pressurized main, this can overheat the main pipe and cause a blowout.

✓ Determine saddle fusion forces from the fitting label.

✓ Verify that the heating tool is maintaining 490-510°F (255-265°C) surface temperature.

✓ Check that heating tool surfaces are clean.

d) ***In a quick, continuous operation***, center the heating tool beneath the fitting base, place the heating tool on the main, move the fitting against the heating tool, apply the Bead-up Force and begin timing. *This operation should take less than 5 seconds.*

e) At the first visual indication of main pipe melt at the curved center of the heating tool face on the main (at the crown of the main), reduce Bead-Up Force to Heating Force. Continue timing.

3. Fusion and Cooling

f) When the heating time ends, ***QUICKLY*** separate the heating tool from the fitting and the main pipe, and remove the heating tool.

- Saddle fusion machines from different manufacturers may require particular techniques for separating the heating tool from the fitting and the main pipe without disturbing the melt. See the saddle fusion machine manufacturer's instructions.
- A melt bead of about 1/16" (1.5 mm) or more should be visible around the fitting.

g) ***QUICKLY*** inspect the melt on the main pipe and the melt around the fitting base, and (within 3 seconds) move the fitting against the main pipe, and apply Joining Force. Maintain Joining Force for the first cooling time period.

- *The surfaces of the main and the fitting base should be completely melted.*
- ***Regardless of the main pipe or fitting melt condition, QUICKLY join the fitting to the pipe, and apply and maintain Fusion Joining Force for the first cooling time period.***

WARNING: Blowout – Always join the fitting to a pressurized main pipe after heating. If the fitting is not joined to the main pipe immediately after heating, the pressurized main pipe may rupture.

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- ***After Fusion Joining Force has been applied, NEVER reduce Fusion Joining Force until the first cooling time period has ended.*** Do not reduce the application tool Joining Force setting if the value on the application tool gauge rises.
- The saddle fusion machine may be removed after the first cooling time period has ended.

j) Cool undisturbed for an additional 30 minutes (the second cooling time period). During this time, avoid pressure testing, rough handling and tapping.
Do not try to shorten cooling time by applying water, wet cloths or the like.

4. Inspect

- *If the melt on the main pipe or the fitting base was unacceptable, the saddle fusion should not be placed in service.* To prevent use, the fitting should be cut off near the fitting base. Do not attempt to remove the saddle-fitting base. Leave it in place to reinforce the main pipe. Move to a new location on the main pipe, and install a new saddle fitting. Follow the complete saddle fusion procedure when installing the new saddle fitting in the new location.

k) Visually check the fusion bead around the entire fitting base at the main pipe. The fusion bead should be uniformly sized all around the fitting base, and should have a characteristic "three-bead" shape. The first bead is the fitting base melt bead. The second or outermost bead is produced by the edge of the heating tool face on the main. The third or center bead is the main pipe melt bead. The first and third beads should be about the same size all around the fitting base. The second bead is usually smaller, but should also be uniformly sized around the fitting base.

Table 4 Saddle Fusion Bead Troubleshooting Guide

Observed Condition	*Possible Cause*
Non-uniform bead size around fitting base	Misalignment; Defective heating tool; Loose or contaminated heating tool saddle faces; Worn equipment; Fitting not secured in application tool; Heating tool faces not within specified temperature
One bead larger than the other	Misalignment; Component slipped in clamp; Worn equipment; Defective heating tool; Loose or contaminated heating tool saddle faces; Heating tool faces not within specified temperature
Beads too small	Insufficient heating; Insufficient joining force
Beads too large	Excessive heating time; excessive force
No second bead (or outermost bead)	Incorrect pipe main heating tool face
Serrated bead appearance	Normal for serrated heating tool faces
Smooth bead appearance	Normal for smooth heating tool faces
Pressurized main pipe blowout (beside base or through fitting center)	Overheating; Incorrect heating tool faces; Heating tool faces not within specified temperature; Taking too much time to start heating (Step 2e), or to remove the heating tool and join the fitting to the main pipe (Step 3g);
Rough, sandpaper-like, bubbly, or pockmarked melt bead surface	Hydrocarbon contamination
No third (or center) bead	Insufficient joining force

Saddle Fusion Qualifying Procedure

1. Prepare at least two sample joints. The main pipe length should not be less than 2' (610 mm) or seven times the maximum saddle fitting base dimension, whichever is greater. Center the fitting on

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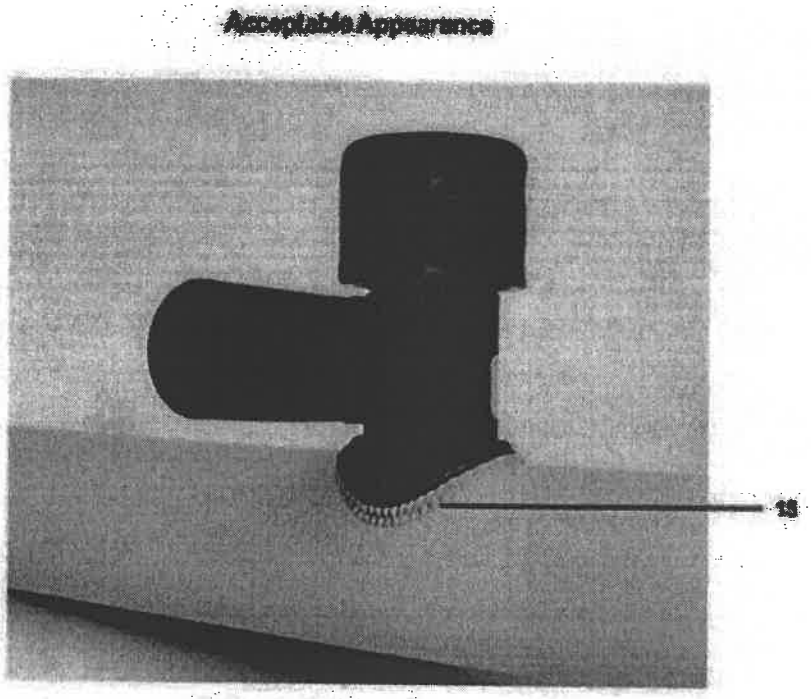
the main pipe length. Observe the joining process to determine that the correct procedure is being followed.

2. Visually inspect the sample joints and compare them to a sample or picture of an acceptable joint.
3. Allow the sample joints to cool for no less than one hour. Do not tap (pierce) the main through the saddle fitting center hole.
4. Cut one sample joint lengthwise along the main pipe and through the saddle fitting to prepare a strap. The cuts should be made near the edge of the fitting center hole so the resulting strap is not quite as wide as the center hole.
5. Visually inspect the cut surface at the joint and compare to a sample or picture of an acceptable joint. There should be no gaps, voids, misalignment, or unbonded areas.
6. Bend the strap 180° until the ends touch.
7. If flaws are observed in the sample joints, compare appearance with pictures of unacceptable joints. Prepare new sample joints using correct joining procedure, and repeat the qualifying procedure.

Alternate Saddle Fusion Qualifying Procedure

1. Test a sample joint by impact against the saddle fitting. Failure must occur by tearing the fitting or bending the fitting at least 45° or removing a section of wall from the main pipe. Failure along the fusion bond line is not acceptable. (Federal regulations require impact tests for procedure qualification, but not for individual qualification.) Refer to ASTM F905.



15. Proper alignment, force and melt

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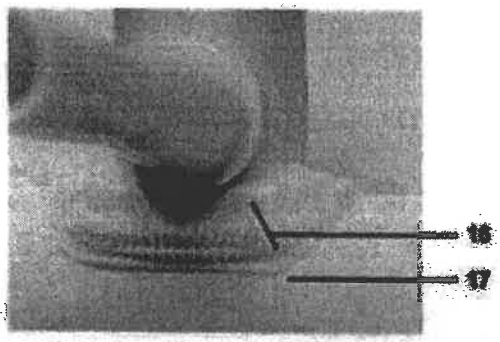
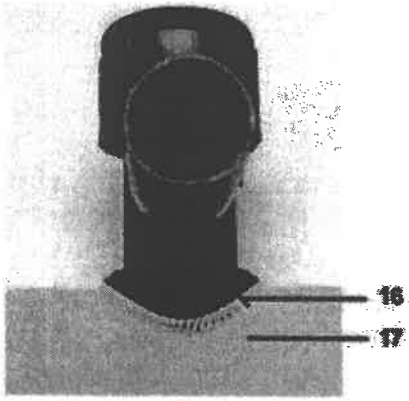
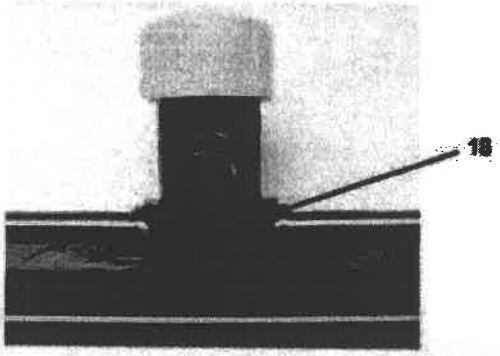
ACCEPTABLE FUSIONS



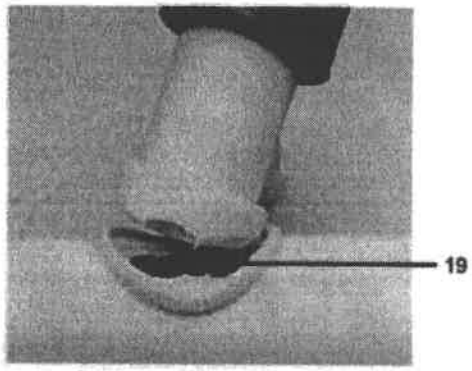
16. Proper alignment, force and melt
17. Proper pipe surface preparation



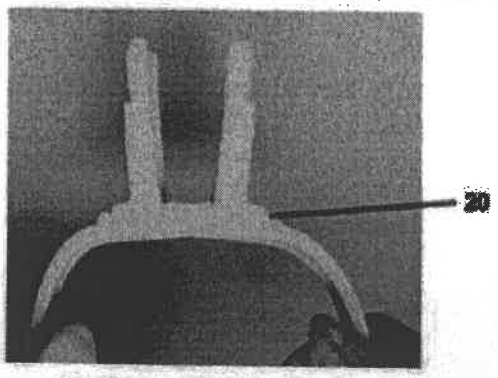
16. Proper alignment, force and melt
17. Proper pipe surface preparation



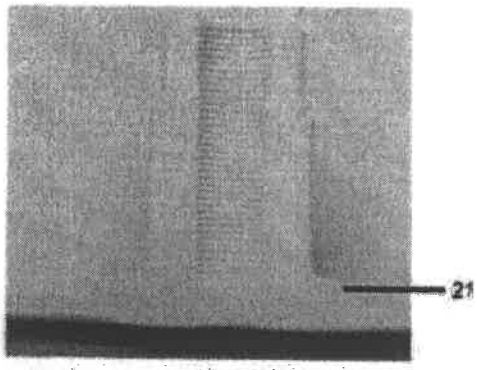
18. Melt bead below or parallel with top of fitting base



19. Material pulled from pipe when impact tested



20. No gap or voids when bent



21. No gap or voids at fusion interface

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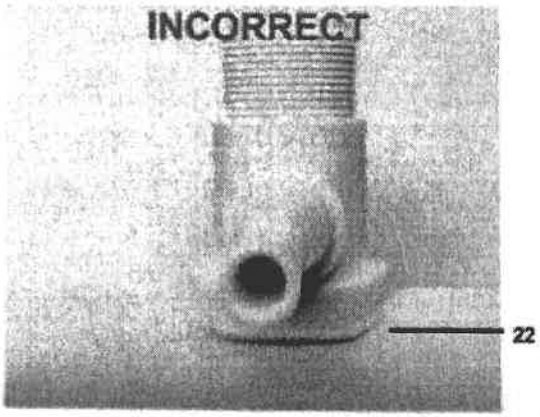
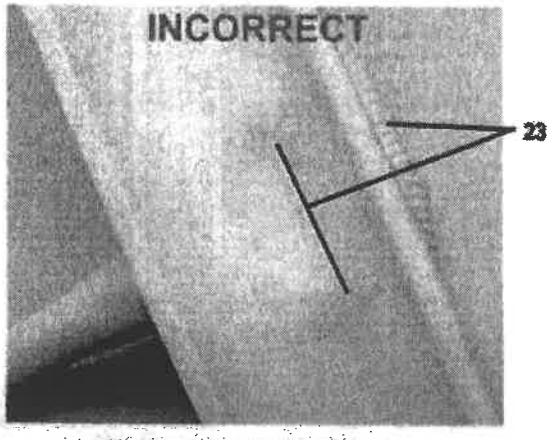
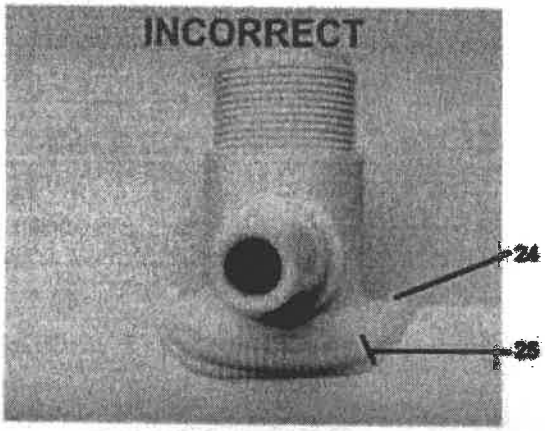
UNACCEPTABLE FUSIONS



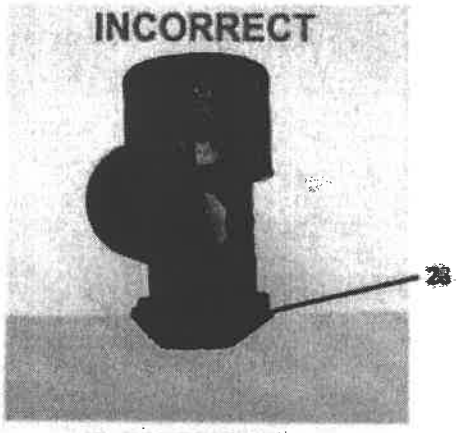
22. Insufficient melt and misaligned



23. Excessive melt and force



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



26. Insufficient melt

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C. Remove surface damage at pipe ends that could compromise the joining surfaces or interfere with fusion tools or equipment.

D. Be sure all required tools and equipment are on site, in proper working order and fueled up. The pipe and fitting surfaces where tools and equipment are fitted must be clean and dry. Use clean, dry, non-synthetic (cotton) cloths or paper towels to remove dirt, snow, water and other contamination.

E. Shield heated fusion equipment and surfaces from inclement weather and winds. A temporary shelter over fusion equipment and the fusion operation may be required.

F. When joining coiled pipe, making an S curve between pipe coils can relieve tension. In some cases, it may be necessary to allow pipe to equalize to the temperature of its surroundings. Allow pulled-in pipes to relax for several hours to recover from tensile stresses.

G. Pipes must be correctly aligned before making connections.

CAUTION – Impact Hazard – Do not bend pipe into alignment against open butt fusion clamps. The pipe may spring out and cause injury or damage. Pipe must be aligned **before placing it into butt fusion equipment.**

H. A trial fusion can verify fusion procedure and equipment settings for the actual jobsite conditions. They can also be used to verify the skill and knowledge of the fusion technician.

BUTT FUSION PROCEDURE

Set-Up Parameters – Temperature and Pressure

A. Heating Tool Surface Temperature

Minimum 400°F – Maximum 450°F (204 – 232°C)

Heating tool surfaces must be up to temperature before you begin. All points on both heating tool surfaces where the heating tool surfaces will contact the pipe or fitting ends must be within the prescribed minimum and maximum temperatures and the maximum temperature difference between any two points on the heating tool fusion surfaces must not exceed 20°F (11°C) for equipment for pipe smaller than 18-in. (450 mm) diameter or 35°F (19°C) for larger equipment. Heating tool surfaces must be clean.

B. Interface Pressure

Minimum 60 psi – Maximum 90 psi (414 – 621 kPa; 4.14 – 6.21 bar)

When the properly heated mating surfaces are brought together, the force required to make the joint is the force that is necessary to roll the fusion melt beads over to the pipe surface. This is a visual determination.

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Interface pressure is used to calculate a fusion joining pressure value for hydraulic butt fusion machines or manual machines equipped with a torque wrench. The same interface pressure is used for all pipe sizes and all butt fusion machines. However, fusion joining pressure settings for the butt fusion machine are calculated for each pipe OD and DR.

***CAUTION:* Interface pressure and fusion machine hydraulic fusion joining pressure gauge settings are not the same!**

For hydraulic machines, the interface pressure, the fusion surface area, the machine's carriage cylinder size and internal drag pressure, and if necessary, the pressure needed to overcome external drag resistance, are used to calculate hydraulic fusion joining pressure gauge settings. The equipment manufacturer's instructions are used to calculate this value.

C. Step-by-Step Procedure

i) **SECURE.** Clean the inside and outside of the component (pipe or fitting) ends by wiping with a clean, dry, lint-free cloth or paper towel. Remove all foreign matter. Align the components with the machine, place them in the clamps and then close the clamps. *Do not force pipes into alignment against open fusion machine clamps.* (When working with coiled pipe, if possible, "S" the pipes on each side of the machine to compensate for coil curvature and make it easier to join.) Component ends should protrude past the clamps enough so that facing will be complete. Bring the ends together and check high-low alignment. Adjust alignment as necessary by tightening the high side down.

ii) **FACE.** Place the facing tool between the component ends and face them to establish smooth, clean, parallel mating surfaces. Complete facing produces continuous circumferential shavings from both ends. Face until there is a minimal distance between the fixed and moveable clamps. Some machines have facing stops. If stops are present, face down to the stops. Remove the facing tool, and clear all shavings and pipe chips from the component ends. *Do not touch the component ends with your hands after facing.*

iii) **ALIGN.** Bring the component ends together, check alignment and check for slippage against fusion pressure. Look for complete contact all around both ends with no detectable gaps, and outside diameters in high-low alignment. If necessary, adjust the high side by tightening the high side clamp. Do not loosen the low side clamp because components may slip during fusion. Re-face if high-low alignment is adjusted.

iv) **MELT.** Verify that the heating tool is maintaining the correct temperature.

- Place the heating tool between the component ends and move the ends against the heating tool. The initial contact should be under moderate pressure to ensure full contact. Hold contact pressure *very briefly* then release pressure without breaking contact. Pressure must be reduced to contact pressure at the first indication of melt around the pipe ends.

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***Note**: On large pipe sizes (14 inches and larger) hold fusion pressure until a slight melt is observed around the circumference of the pipe or fitting before reducing pressure. This normally varies from about 10 seconds on 14 inch pipe and smaller and could be greater than 2 minutes on 36 inch and larger pipe sizes.*

- Hold the ends against the heating tool ***without force.*** Beads of melted polyethylene will form against the heating tool at the component ends. When the proper melt bead size is formed, quickly separate the ends, and remove the heating tool.

  ***Note:** On larger pipe sizes (14 inches and larger) maintain the heat soak for a minimum of 4.5 minutes for every inch (25.4 mm) of pipe wall thickness. (Example: minimum heat soak time for a pipe with .50 in. (12.7mm) wall would be 2 minutes 15 seconds). Continue heating the pipe ends until the melt bead size has developed against the heater face per Table 1 below.*

- During heating, the melt bead will expand out flush to the heating tool surface, or may curl slightly away from the surface. If the melt bead curls significantly away from the heating tool surface, unacceptable pressure during heating may be indicated.

Table 1
Approximate Melt Bead Size

Pipe Size	Approximate Melt Bead Size
1-1/4" and smaller (40 mm and smaller)	1/32" – 1/16" (1 – 2 mm)
Above 1-1/4" through 3" (above 40 mm through 90 mm)	About 1/16" (2 mm)
Above 3" through 8" (above 90 mm through 225 mm)	1/8" – 3/16" (3 – 5 mm)
Above 8" through 12" (above 225 mm through 315 mm)	3/16" – 1/4" (5 – 6 mm)
Above 12" through 24" (above 315 mm through 630 mm)	1/4" – 7/16" (6 – 11 mm)
Above 24" through 36" (above 630 mm through 915 mm)	About 7/16"
Above 36" through 54" (above 915 mm through 1300 mm)	About 9/16"

v) **JOIN.** Immediately after heating tool removal, **quickly** inspect the melted ends, which should be flat, smooth, and completely melted. If the melt surfaces are acceptable, immediately and in a continuous motion, bring the ends together and apply the correct joining force. **Do Not Slam.** Apply enough joining force to roll both melt beads over to the pipe surface if performing manually. If using a hydraulic machine, the calculated fusion force as determined by the pipe size, DR and the machine being used is applied. ***See the butt fusion welding equipment manufacturer for the specific calculation of the theoretical joining force using the chosen equipment.*** A concave melt surface is unacceptable; it indicates pressure during heating. (See Figure 1).

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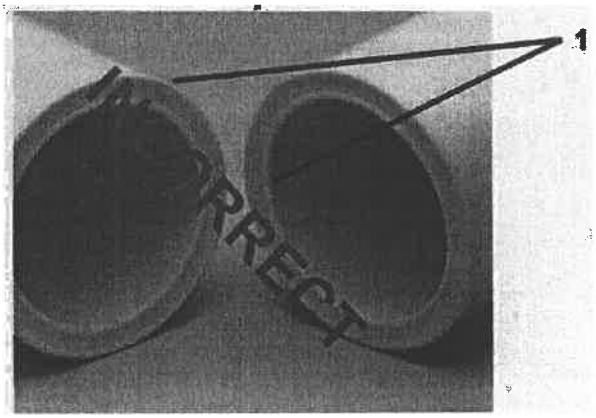
Do Not Continue. Allow the component ends to cool and start over at section C (Step-by-Step Procedure).

Figure 1 Unacceptable Concave Melt Appearance



1. Unacceptable concave melt appearance

- The correct joining force will form a double bead that is rolled over to the surface on both ends.

vi) **HOLD.** Hold joining force against the ends until the joint is cool. The joint is cool enough for *GENTLE* handling when the double bead is cool to the touch. Cool for about 30-90 seconds per inch of pipe diameter. *Do not try to shorten cooling time by applying water, wet cloths, etc.*

- Gentle handling allows the pipe to be removed from the fusion equipment.
- Avoid pulling, installation, pressure testing and rough handling for at least an additional 30 minutes.
- Allow 10 minutes additional cooling time for 1" IPS and smaller pipes before rough handling.
- Heavier wall thickness pipes require longer cooling times.

vii) **VISUALLY INSPECT.** On both sides, the double bead should be rolled over to the surface, and be uniformly rounded and consistent in size all around the joint. As illustrated in Figure 3, the double bead width should be 2 to 2-1/2 times its height above the surface, and the v-groove depth between the beads should not be more than half the bead height.

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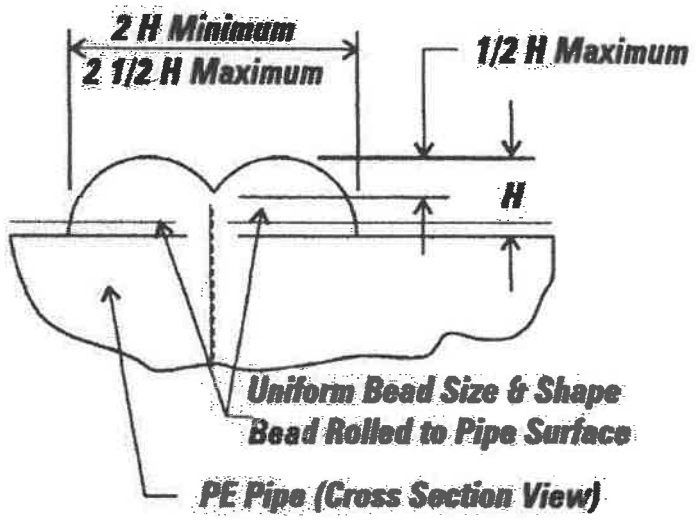
Figure 1 Butt Fusion Bead Proportions



- When butt fusing to molded fittings, the fitting side bead may have an irregular appearance. This is acceptable provided the pipe side bead is correct.
- It is not necessary for the internal bead to roll over to the inside surface of the pipe.

Table 2
Butt Fusion Bead Troubleshooting Guide

Observed Condition	Possible Cause
Excessive double bead width	Overheating; Excessive joining force
Double bead v-groove too deep	Excessive joining force: Insufficient heating; Pressure during heating
Flat top on bead	Excessive joining force; Overheating
Non-uniform bead size around pipe	Misalignment; Defective heating tool; Worn equipment; Incomplete facing
One bead larger than the other	Misalignment; Component slipped in clamp; Worn equipment; Defective heating tool; Incomplete facing; Dissimilar material – see note above
Beads too small	Insufficient heating; Insufficient joining force
Bead not rolled over to surface	*Shallow v-groove* – Insufficient heating & insufficient joining force; *Deep v-groove* – Insufficient heating & excessive joining force
Beads too large	Excessive heating time
Squared outer bead edge	Pressure during heating
Rough, sandpaper-like, bubbly, or pockmarked melt bead surface	Contamination of heater plate or hydrocarbon absorption in the PE pipe.

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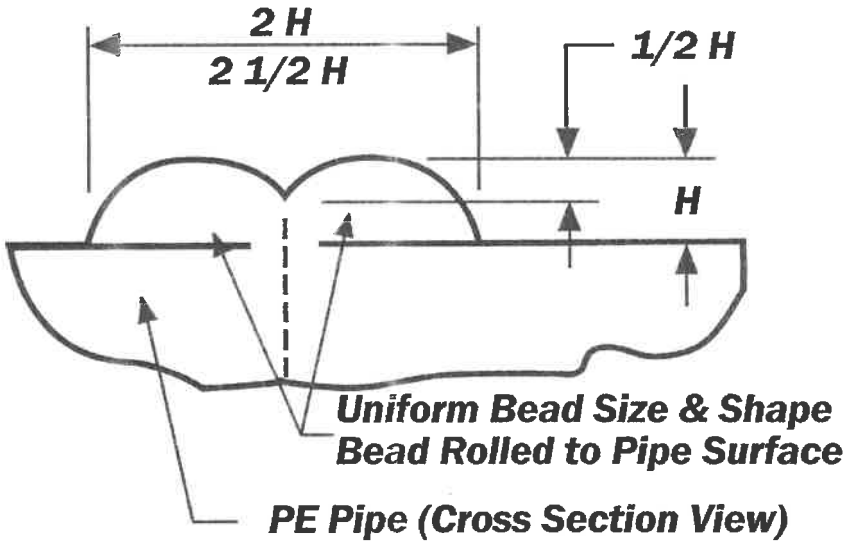
ILLUSTRATION OF A PROPERLY MADE BUTT FUSION JOINT



Note: When butt fusing to molded fittings, the fitting side bead may have an irregular appearance. This is acceptable provided the pipe side bead is correct.

This bead configuration DOES NOT apply to joints made with Dupont Aldyl A MDPE, Uponor Aldyl A MDPE or Phillips Driscopipe 7000 and 8000 HDPE.

Prepare Fusion Machine

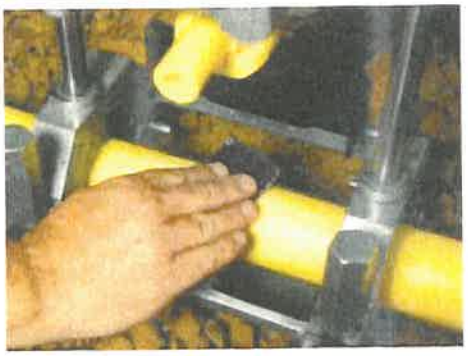
This procedure requires the use of a Saddle Fusion Tool. This tool must be capable of holding and supporting the main, rounding the main for good alignment between the pipe and fitting, holding the fitting, applying and indicating the proper force during the fusion process.


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

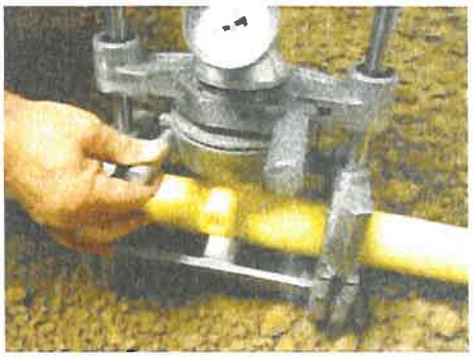
Abrade the fusion surface of the main with a 50-60 grit utility cloth. The abraded area must be larger than the area covered by the fitting base. After abrading, brush residue away with a clean, dry cloth.


PH02207-7-16-01

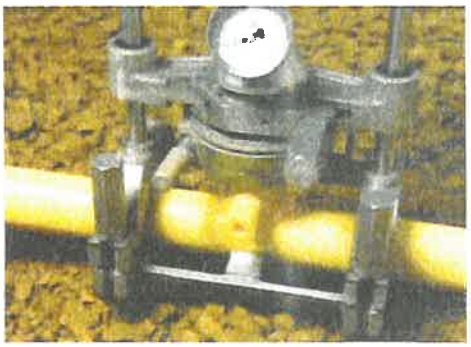
Abrade the fusion surface of the fitting with 50 to 60 grit utility cloth; remove all dust and residue.


PH02204-7-16-01

Insert the fitting in the Saddle Fusion Tool loosely.

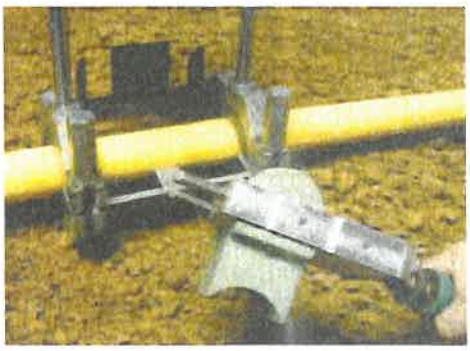

PH02205-7-16-01

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.

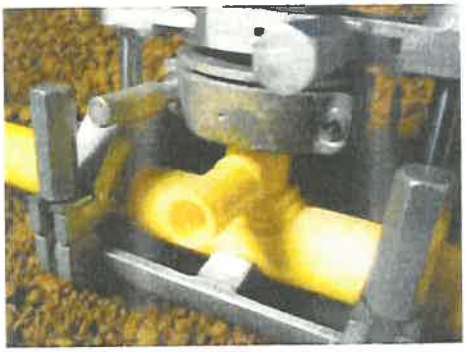
or

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.)

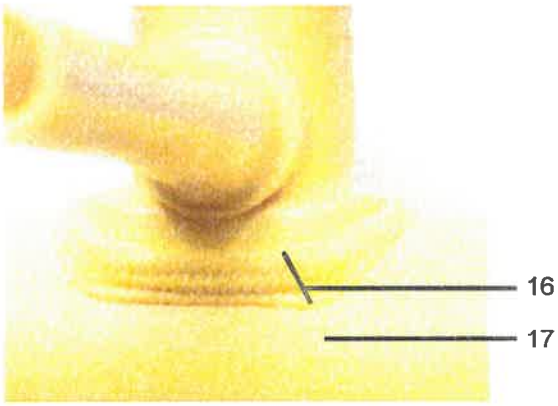

PH02218-7-16-01

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.)

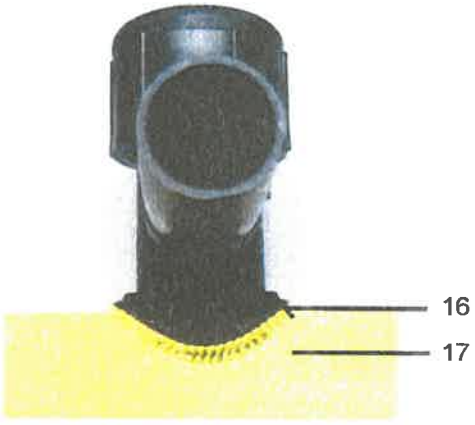
NOTE: These procedures are based on tests conducted under controlled ambient temperature conditions. Environmental conditions on a job site could affect heating and cooling times. Regardless of job site conditions or ambient temperature, the prescribed heating tool temperature is required. Do not increase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


PH02221-7-16-01

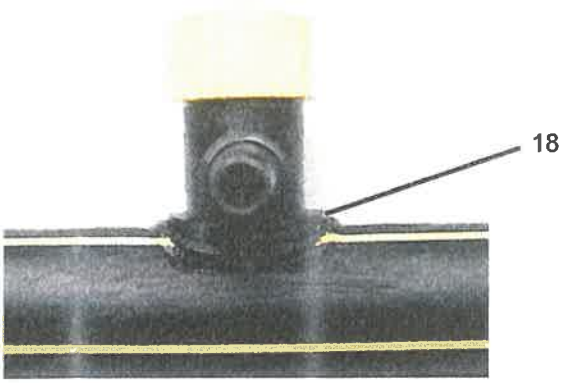
ACCEPTABLE FUSIONS



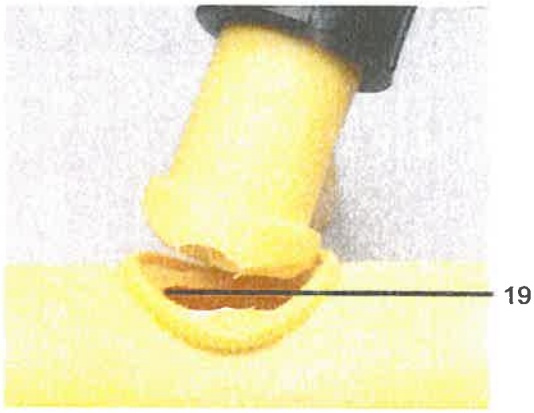
16. Proper alignment, force and melt
17. Proper pipe surface preparation



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

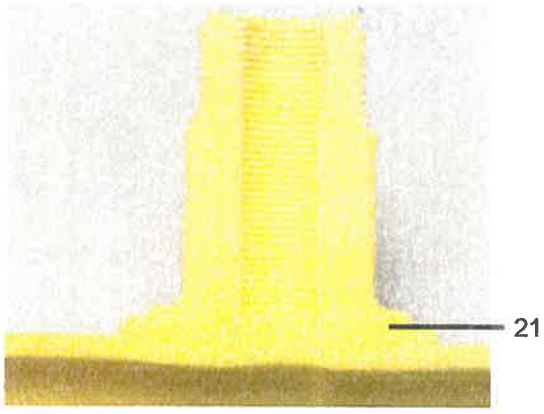


18. Melt bead below or parallel with top of fitting base



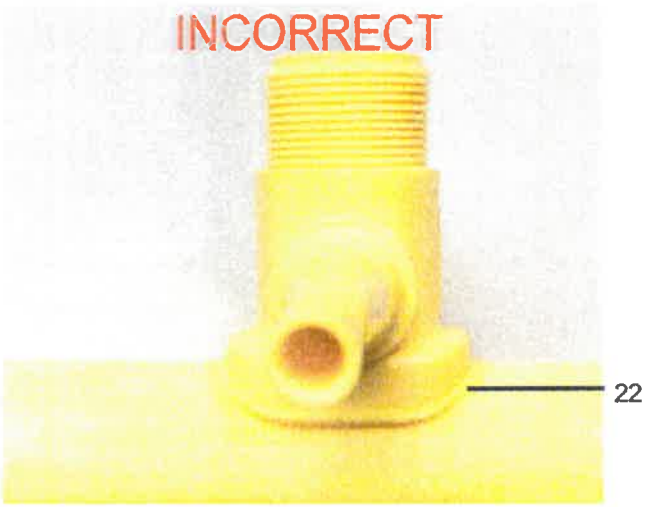
19. Material pulled from pipe when impact tested

20. No gap or voids when bent

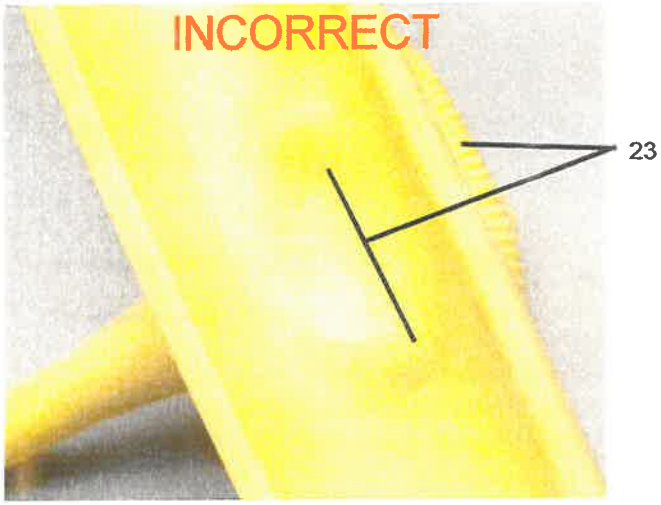


21. No gap or voids at fusion interface

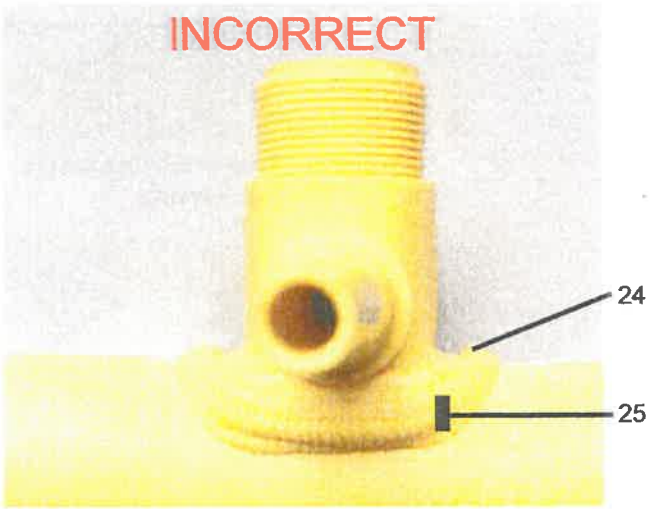
UNACCEPTABLE FUSIONS



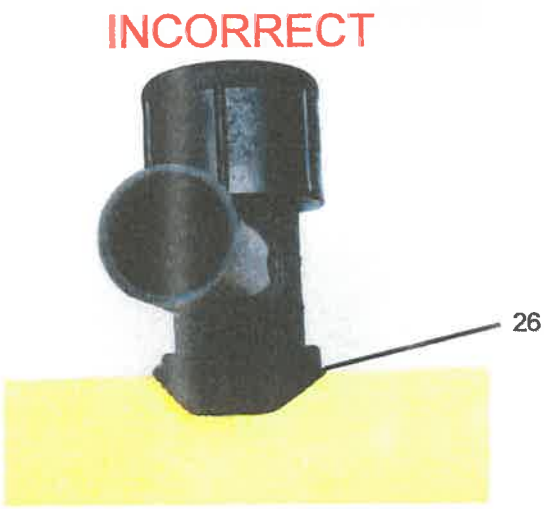
22. Insufficient melt and misaligned



23. Excessive melt and force



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



26. Insufficient melt

XXI. DESIGN PRESSURES FOR API-5L PIPE

API-5L T = 1.00
125 E = .60
S = 28,000

SIZE	WEIGHT	PRESSURE AT 100% SMYS	DESIGN PRESSURE CLASS 2 F = .6	CLASS 3 F = .5	CLASS 4 F = .4
	.113	5062	3037	2531	2024
1"	.133	4468	2680	2234	1787
1-1/4"	.140	3763	2258	1882	1505
1-1/2"	.145	3248	1948	1624	1299
2"	.154	2587	1552	1293	1034
3"	.216	2419	1451	1209	967
4"	.237	1991	1194	995	796

API-5L T = 1.00
Grade B E = 1.00
Sch. 40 S = 35,000
Seamless or E.W.

SIZE	WEIGHT	PRESSURE AT 100% SMYS	DESIGN PRESSURE CLASS 2 F = .6	CLASS 3 F = .5	CLASS 4 F = .4
3/4"	.113	10546	6327	5273	4218
1"	.133	9310	5586	4655	3724
1-1/4"	.140	7840	4704	3920	3136
1-1/2"	.145	6767	4060	3383	2706
2"	.154	5390	3234	2695	2156
3"	.216	5040	3024	2520	2016
4"	.237	4147	2488	2074	1658
6"	.280	3266	1960	1633	1306
8"	.322	2817	1690	1408	1126
10"	.365	2555	1533	1277	1022
12"	.406	2368	1420	1184	947

DESIGN PRESSURES FOR API-5L PIPE

API-5LX42
ELECTRIC WELD

T = 1.00
E = 1.00
S = 42,000 PSI (MIN.)

NOMINAL SIZE	WALL	PRESSURE AT 100% SMYS	PRESSURE* AT 40% SMYS	PRESSURE** AT 20% SMYS
3"	.188	5264	2106	1053
4"	.188	3948	1578	789
6"	.188	2632	1051	526
8"	.250	2626	1050	525

***Highest test pressure that can be applied with air or nitrogen.**
****Pressure limitation for high pressure distribution line.**

ALL PRESSURES IN PSIG

API-5LX52
ELECTRIC WELD

T = 1.00
E = 1.00
S = 52,000 PSI (MIN.)

NOMINAL SIZE	WALL	PRESSURE AT 100% SMYS	PRESSURE* AT 40% SMYS	PRESSURE** AT 20% SMYS
8"	.250	33250	1300	650
12"	.312	2704	1080	540

***Highest test pressure that can be applied with air or nitrogen.**
****Pressure limitation for high pressure distribution line.**

ALL PRESSURES IN PSIG