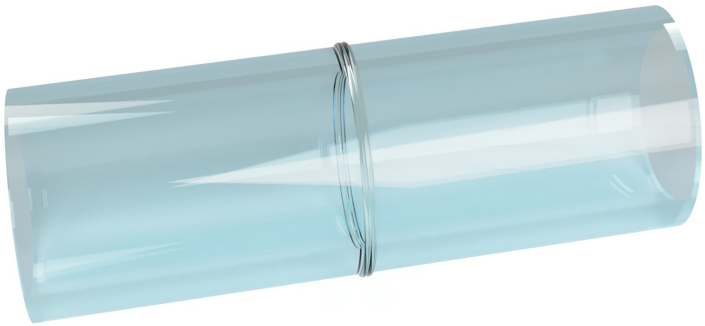
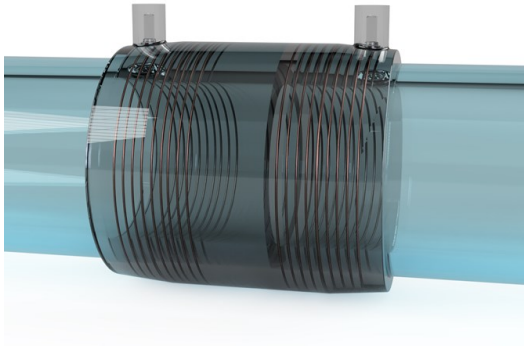
PolyPedia®

PE Pipe Welders Reference Guide

This reference guide is based on information gathered from pipe and fitting manufacturers and numerous international welding standards.
Please confirm information with your local PEWeldBank re-seller or authorities.



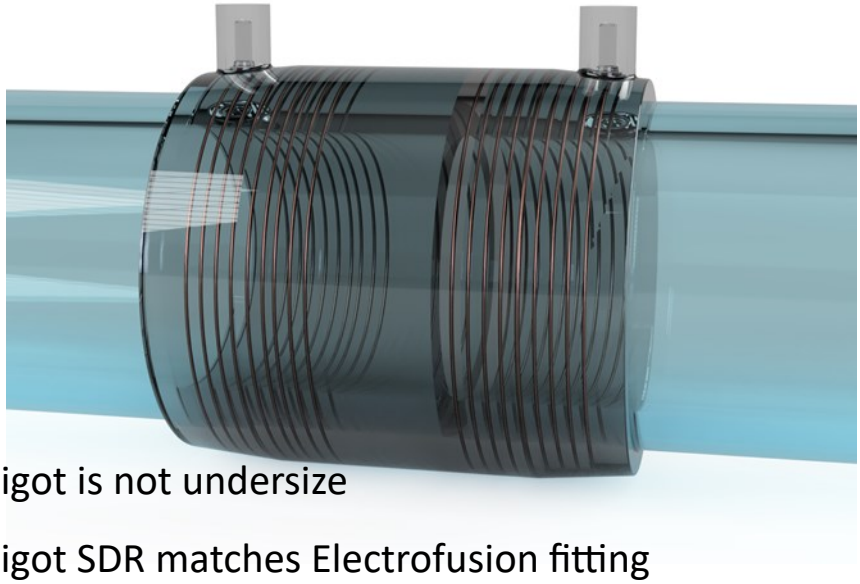


Contents

PolyPedia uses information available from industry and manufacturers of pipe and fittings, If you would like extra information added or have questions or suggestions please do not hesitate contacting:

info@peweldbank.com

Basic Electrofusion Procedure

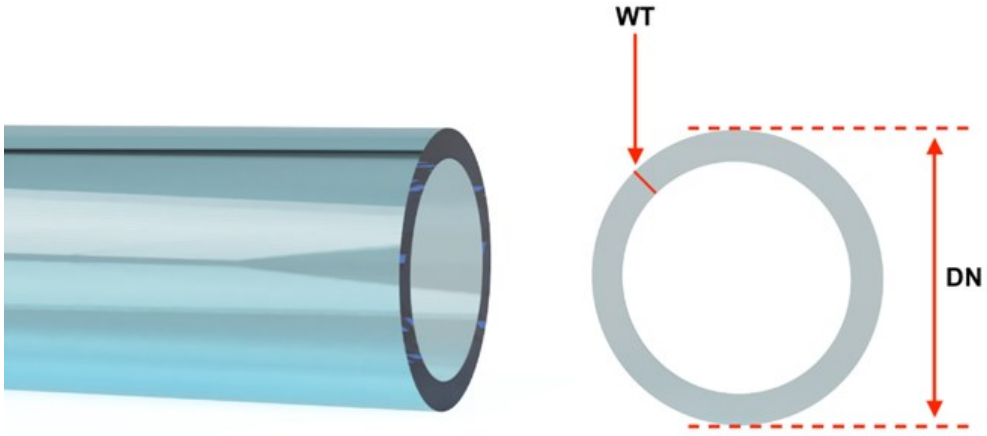


1. Check spigot is not undersize
2. Check spigot SDR matches Electrofusion fitting
3. Check spigot ovality is within range
4. Check spigot ends are straight
5. Check spigot end reversion
6. Witness mark end
7. Peel spigot
8. Wipe spigot with approved cleaning agent (allow to dry)
9. Check that electrofusion fitting is clean
10. Insert spigot into electrofusion fitting (check witness mark)
11. Repeat steps 1-10 with 2nd spigot where applicable
12. Secure assembly in restraint / alignment / rounding tool
13. Cover open ends to prevent air movement
14. Attach welding leads
15. Follow electrofusion control unit instructions
16. Note some couplings are Bifilar which require welding of each end and some may require preheating
17. Allow completion of welding time
18. Allow full cooling time while assembly is still restrained

- N.B. pipe or fitting end is referred to as spigot

Minimum Pipe Size & “SDR” Standard Dimension Ratio

Dimension Nominal (DN) (mm) also refers to minimum OD
16
20
25
32
40
50
63
75
90
110
125
140
160
180
200
225
250
280
315
355
400
450
500
560
630
710
800
900
1000
1200



DN marked on pipe also refers to the minimum allowable pipe OD.

1. Pipe DN must be measured with a Pi tape before peeling.
2. Pipe must be rejected if less than this size.

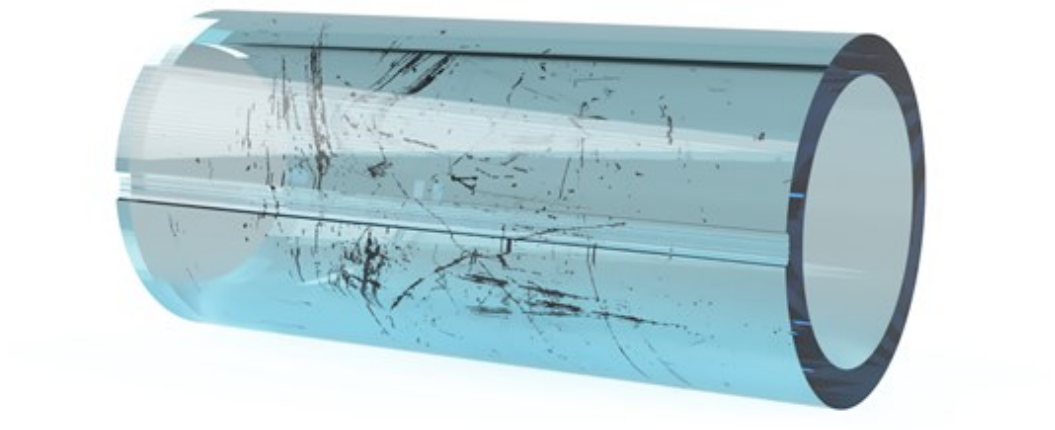
If the pipe or spigot is undersize it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

SDR
Standard Dimension Ratio

DN/ WT = SDR
DN / SDR = WT

(In some countries “SDR” is referred to as “DR”)

Removal of Pipe Surface Damage



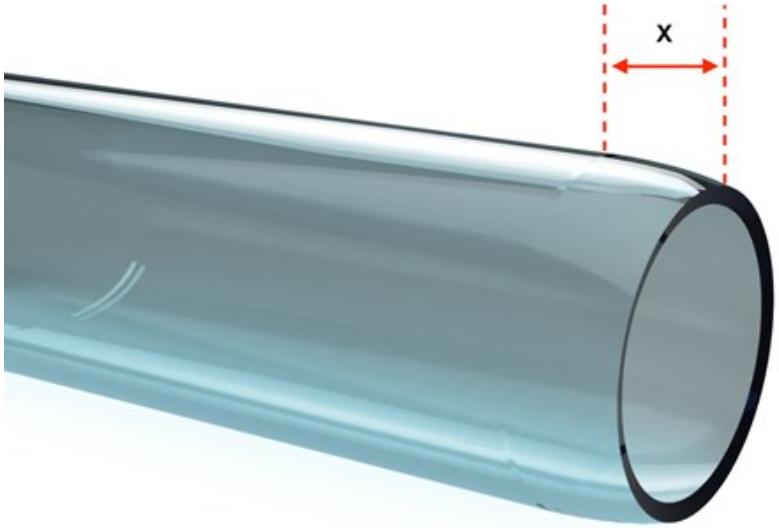
1. After mechanical peeling, visually inspect the pipe surface prior to assembly of the electrofusion joint.
2. Examine for scores or deep gouges that weren't removed by peeling.
3. If gouges remain on the surface - peel again to remove them, ensuring the pipe diameter complies with Minimum allowable pipe size after peeling. (refer page 9)
4. Where gouges cannot be removed by peeling don't proceed with the assembly of the electrofusion joint.

Remaining surface irregularities can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Also pipe surface damage outside weld zone must not exceed 10% of wall thickness.

Reversion or Toe-in

Dimension Nominal (DN) (mm)	Distance to measure for toe in, from pipe end (mm) "X"
16	0.8
20	1
25	1.25
32	1.6
40	2
50	2.5
63	3.15
75	3.75
90	4.5
110	5.5
125	6.25
140	7
160	8
180	9
200	10
225	11.25
250	12.5
280	14
315	15.75
355	17.75
400	20
450	22.5
500	25
560	28
630	31.5
710	35.5
800	40
900	45
1000	50
1200	60

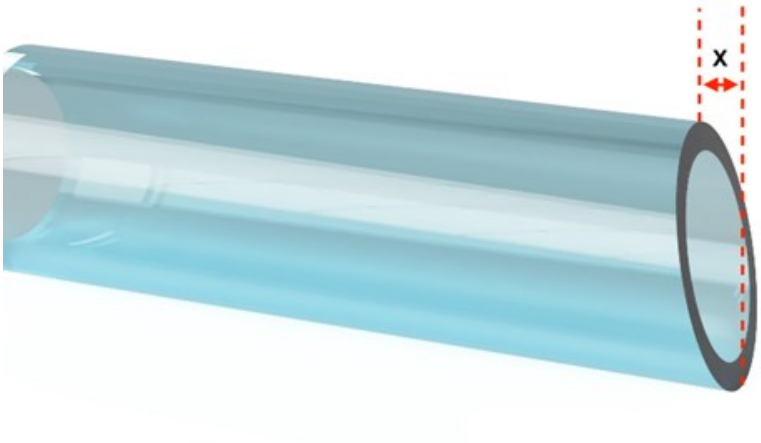


1. Measure “X” distance from end of pipe.
2. At this point the pipe must not be less than the DN.
3. If it is you must trim the end off.

If the end of pipe or spigot is undersize it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Maximum allowable cut angle

Dimension Nominal (DN) (mm)	Maximum allowable cut angle (mm) "X"
16	0.8
20	1
25	1.25
32	1.6
40	2
50	2.5
63	3.15
75	3.75
90	4.5
110	5.5
125	6.25
140	7
160	8
180	9
200	10
225	11.25
250	12.5
280	14
315	15.75
355	17.75
400	20
450	20
500	20
560	20
630	20
710	20
800	20
900	20
1000	20
1200	20

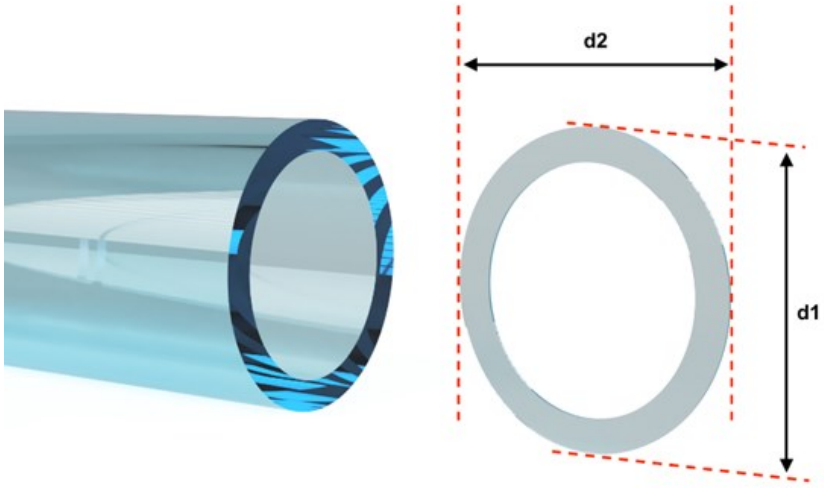


1. Ends of pipes must be cut straight, or within the allowable cut angle. "X"

If the end of pipe or spigot is not straight it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Ovality

Dimension Nominal (DN) (mm)	Allowable ovality (d1-d2) ≤ (mm) "X"
16	0.24
20	0.30
25	0.38
32	0.48
40	0.60
50	0.75
63	0.95
75	1.13
90	1.35
110	1.65
125	1.88
140	2.10
160	2.40
180	2.70
200	3.00
225	3.00
250	3.00
280	3.00
315	3.15
355	3.55
400	4.00
450	4.50
500	5.00
560	5.00
630	5.00
710	5.00
800	5.00
900	5.00
1000	5.00
1200	5.00



1. If ovality exceeds measurements, a rounding tool must be used.
2. d1 - d2 must be ≤ “X”

If the end of pipe or spigot is outside this allowance it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Peeling / Oxidisation removal

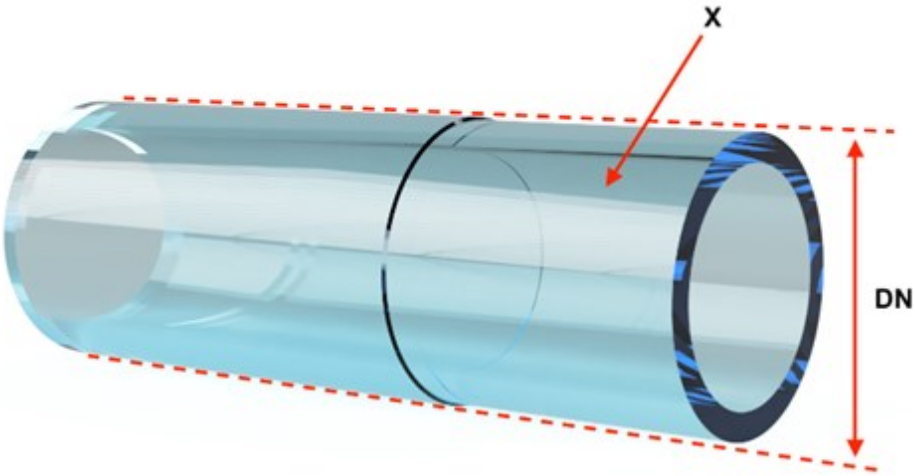
Dimension Nominal (DN) (mm)	Minimum Thickness to be removed (mm)
16	0.2
20	0.2
25	0.2
32	0.2
40	0.2
50	0.2
63	0.2
75	0.2
90	0.2
110	0.2
125	0.2
140	0.2
160	0.2
180	0.2
200	0.2
225	0.2
250	0.3
280	0.3
315	0.3
355	0.3
400	0.3
450	0.3
500	0.3
560	0.3
630	0.3
710	0.3
800	0.3
900	0.3
1000	0.3
1200	0.3

1. Peeling must only be done using a mechanical peeler, manual scrapers are not permitted.
2. Peeling must extend at least 20mm past insertion depth.
3. Ensure pipe / spigot is clean before peeling.
4. Measure peel strip thickness with a vernier / calliper.

Failure to fully remove oxidisation layer will create a barrier between surfaces to be welded.

Minimum Allowable pipe size after Peeling

Dimension Nominal (DN) (mm)	Minimum allowable pipe diameter after peeling (mm) "X"
16	15.6
20	19.6
25	24.6
32	31.5
40	39.5
50	49.5
63	62.5
75	74.4
90	89.4
110	109.4
125	124.4
140	139.4
160	159.4
180	179.4
200	199.4
225	224.4
250	249.3
280	279.3
315	314.3
355	354.2
400	399.2
450	449.2
500	499.2
560	559.2
630	629.2
710	709.2
800	799.2
900	899.2
1000	999.2
1200	1199.2



1. Measure with Pi tape after peeling.
2. If pipe or spigot is undersize do not proceed.

If the pipe or spigot is undersize after peeling it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).


Pi tape

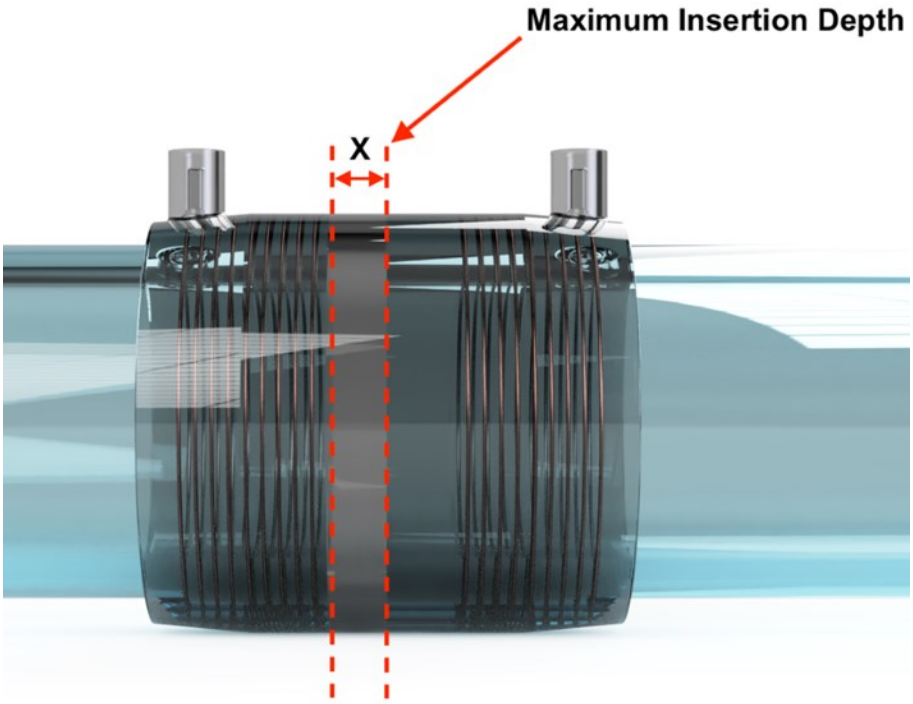
Cleaning

1. Pipe / spigot end must be cleaned with an approved cleaning agent before welding, Isopropyl alcohol wipes are generally used.
2. Do not contaminate wipes or wipe past the peeled area.
3. Ensure pipe / spigot is dry before inserting into fitting or attaching saddle.
4. Do not use dirty fittings
5. Do not touch the pipe / spigot or inside electrofusion fitting.
6. If electrofusion fitting cannot be cleaned to original condition do not proceed.

Failure to fully remove any contaminate can create voids and a possible barrier between surfaces to be welded.

Short Insertion

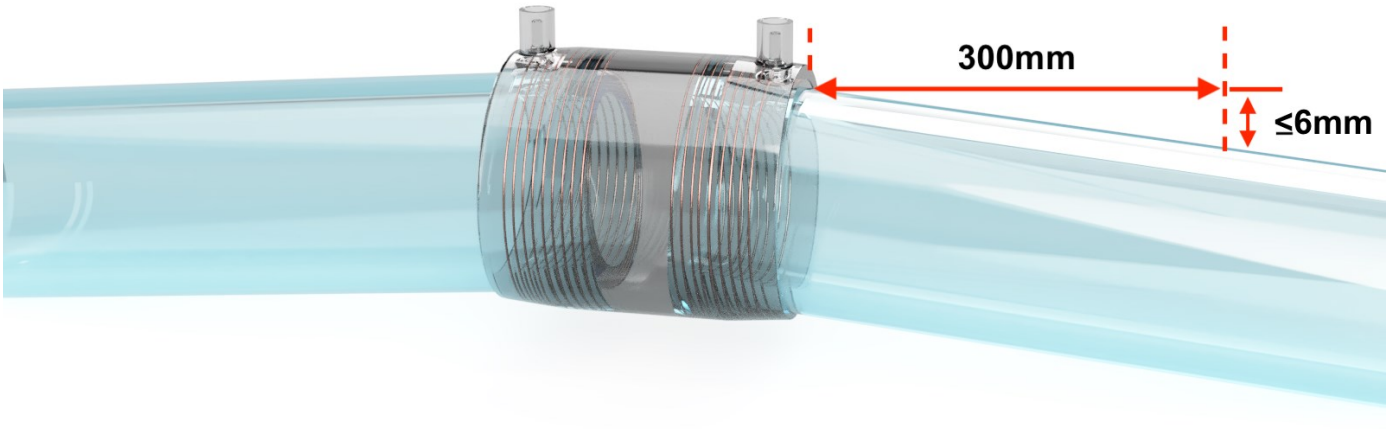
Dimension Nominal (DN) (mm)	Maximum allowable short insertion (mm) "X"
16	0.8
20	1
25	1.25
32	1.6
40	2
50	2.5
63	3.15
75	3.75
90	4.5
110	5.5
125	6.25
140	7
160	8
180	9
200	10
225	11.25
250	12.5
280	14
315	15.75
355	17.75
400	20
450	20
500	20
560	20
630	20
710	20
800	20
900	20
1000	20
1200	20



1. Pipe / spigot end distance from maximum insertion depth of electrofusion fitting, must not exceed 5% of DN for pipes up to 400mm DN and for pipes ≥ 400mm DN distance must not exceed 20mm.

If the pipe or spigot is not inserted correctly, it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Alignment and Restraint

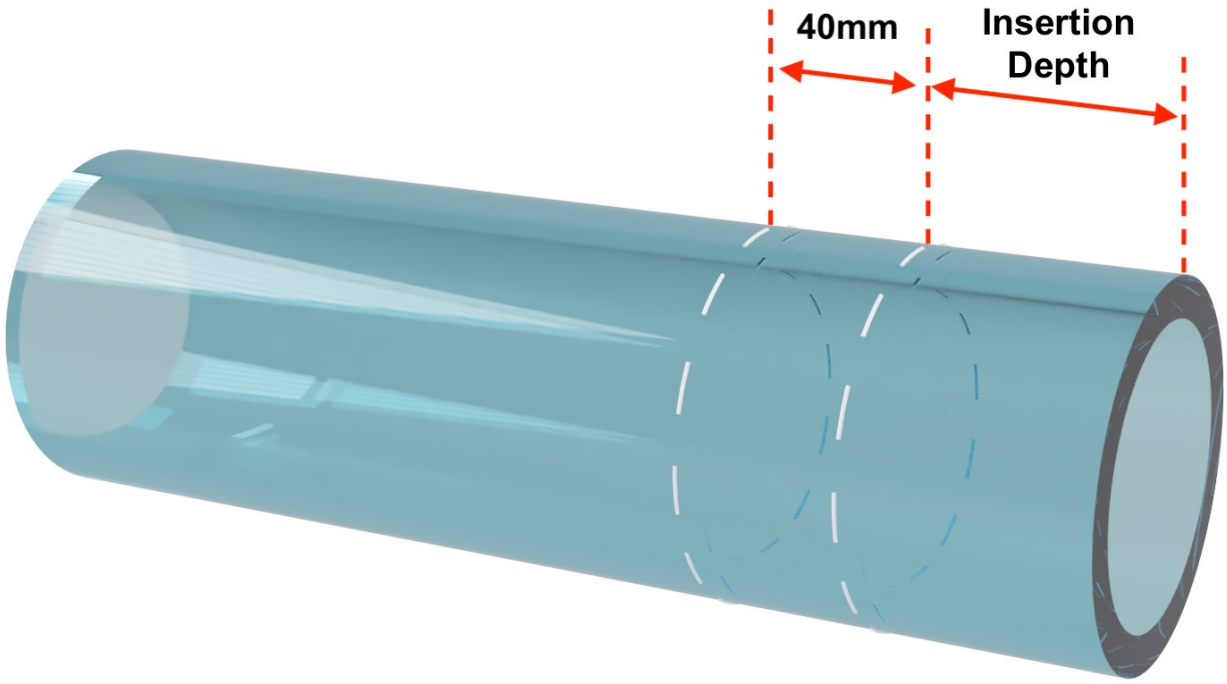


Alignment:
Maximum allowable misalignment is ≤ 6mm at 300mm from coupling (or 2˚) this applies to all pipe sizes.

Restraint:
Pipes and fittings must be restrained from movement during welding and cooling cycles, extra attention must be given to alignment and restraint of coiled pipe.

If the end of pipe or spigot is outside this allowance it can cause problems in the electrofusion heat zone (i.e., melt pressure imbalance during welding, electrical short circuit, incomplete welds, or voids in the fusion zone).

Witness Marking



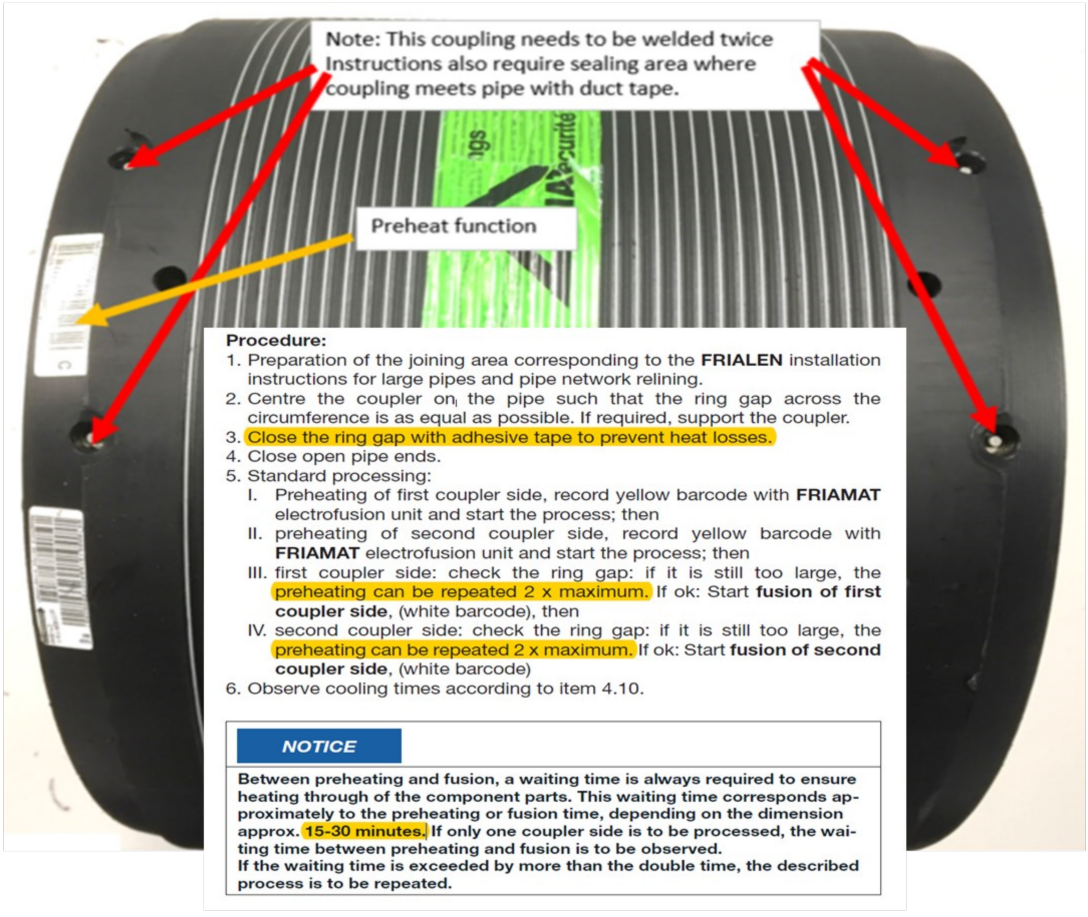
Clear witness marks are required to ensure correct insertion of pipe into fitting.
Measure the insertion depth of the fitting and mark this on the pipe, then place another mark 40mm past this.
Now you have a clear mark to measure to, before and after welding.

This will need to be adjusted when using a socket as a slip socket.

Bifilar Fittings &
Fittings that require Pre Heating

Bifilar basically means that the fitting has 2 independent welding filaments or coils.

Many medium to large diameter fittings may be Bifilar fittings where Each end needs to be welded separately. Some of these fittings may require pre heating.



1. Bifilar electrofusion fittings need to be welded independently each end. Numerous manufacturers design their larger fittings in this way.
2. Some manufactures also provide a preheat function to assist with welding.
3. Follow manufactures instructions carefully when using these fittings.
4. PEWeldBank makes allowance for these fittings, make Bifilar and preheat selection when entering fitting detail.

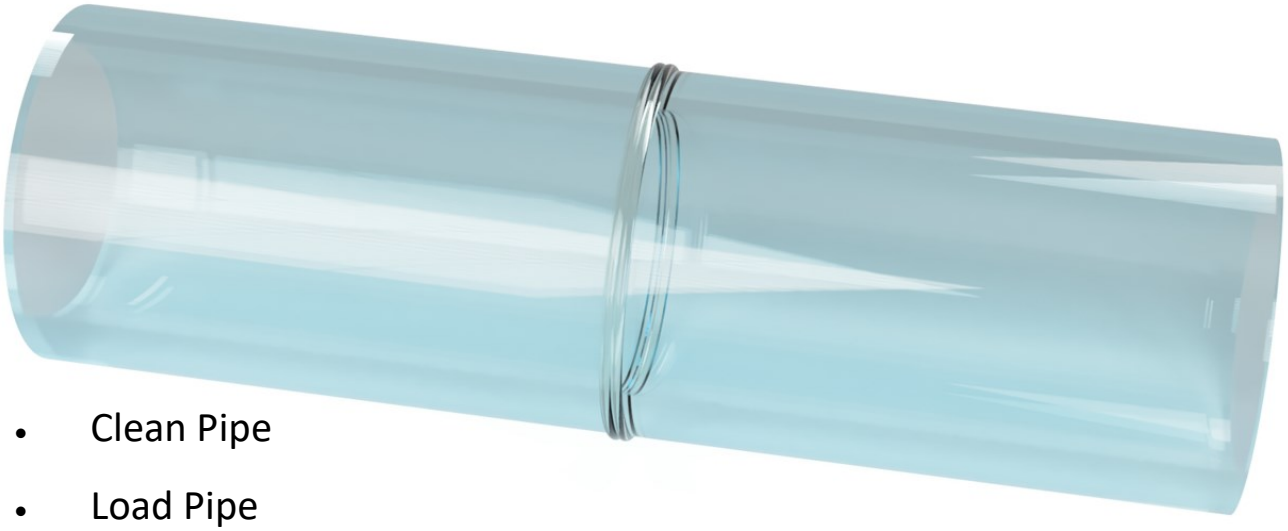
Butt welding Standards included in PEWeldBank

The process of Butt Welding is very similar with each standard, however the times and pressures vary depending on local requirements.

PEWeldBank includes many Butt Welding standards from around the world, others may be added, please contact info@peweldbank.com

Standard Name	Origin
ASTM F2620	This standard uses Imperial measurements not Metric and is common in North America
DVS 2207-1 PE	Germany, commonly used in many countries.
DVS 2207-11 PP	Germany for PP, commonly used in many countries
ISO 21307-17 Single High Pressure	Australia
ISO 21307-17 Single Low Pressure	Australia
Custom	Developed for Scandinavia
Others	Subject to request

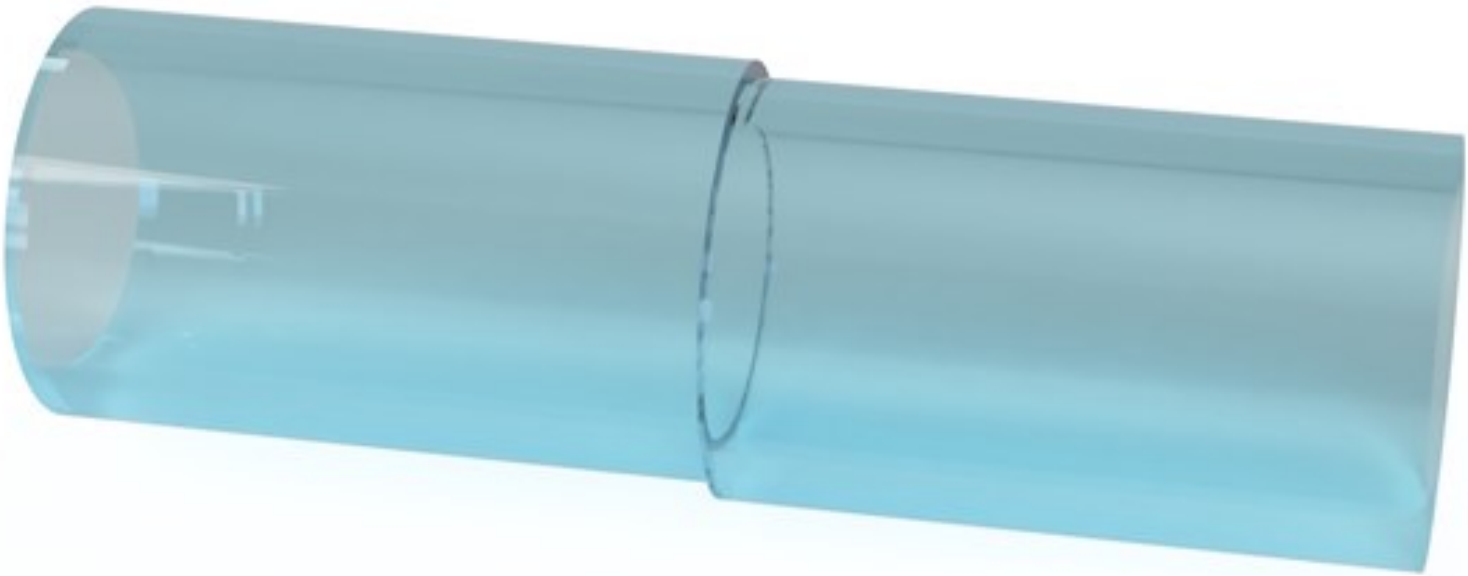
Basic Butt Weld Procedure



- Clean Pipe
- Load Pipe
- Cover ends
- Face ends
- Remove swarf
- Clean faces (Iso wipe)
- Measure drag P2
- Set welding pressure P1
- Check for slippage (clamps tight enough?)
- Check alignment
- Insert heater plate
- Bring up to weld pressure P1
- Wait for evidence or bead up size t1
- Drop to between 0- drag P2
- Start timer t2
- Remove heater plate t3/4
- Bring up to weld pressure P3
- Wait for cooling time t5
- Extended cooling time (if required) t6

Allowable Axial Misalignment before Butt Welding

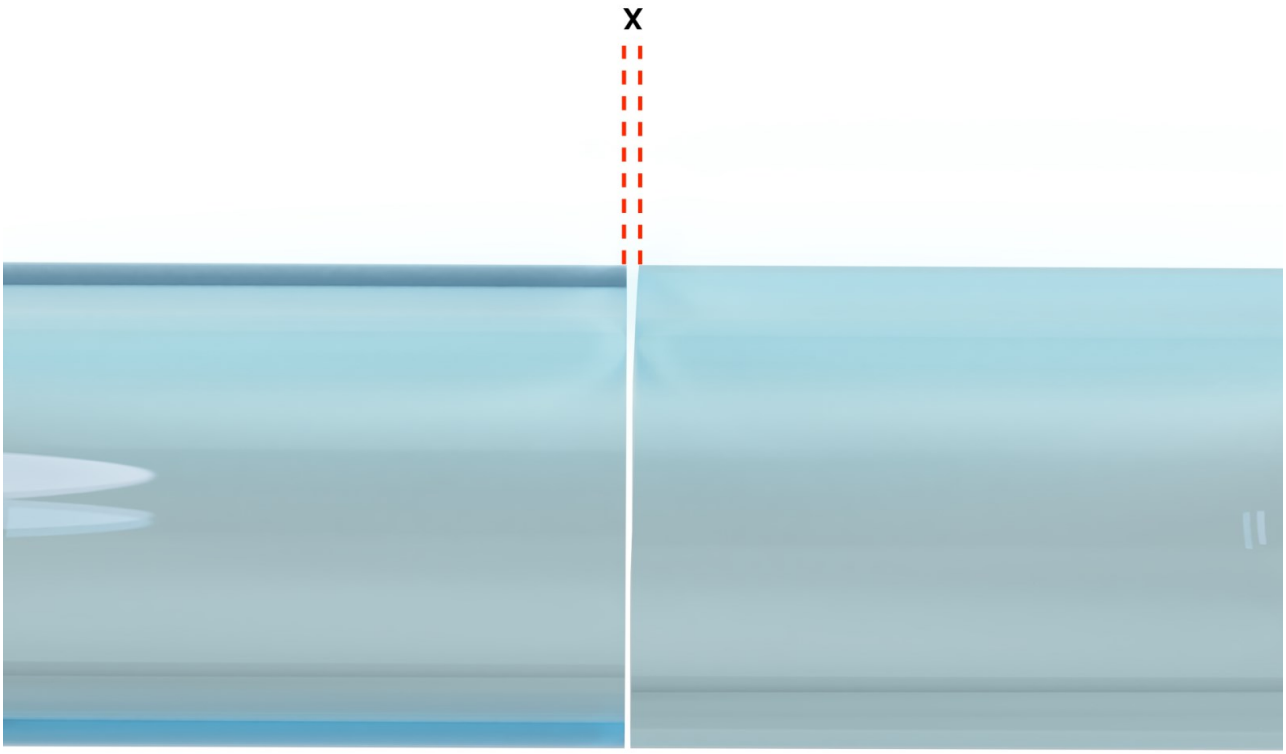
Axial Misalignment must not exceed 10% of wall thickness



Possible Cause:

1. Poor support of pipes and / or fittings.
2. Pipe or fittings not clamped in machine correctly.
3. Toe in / Reversion (see page 5)

Allowable Facial Misalignment before Butt Welding

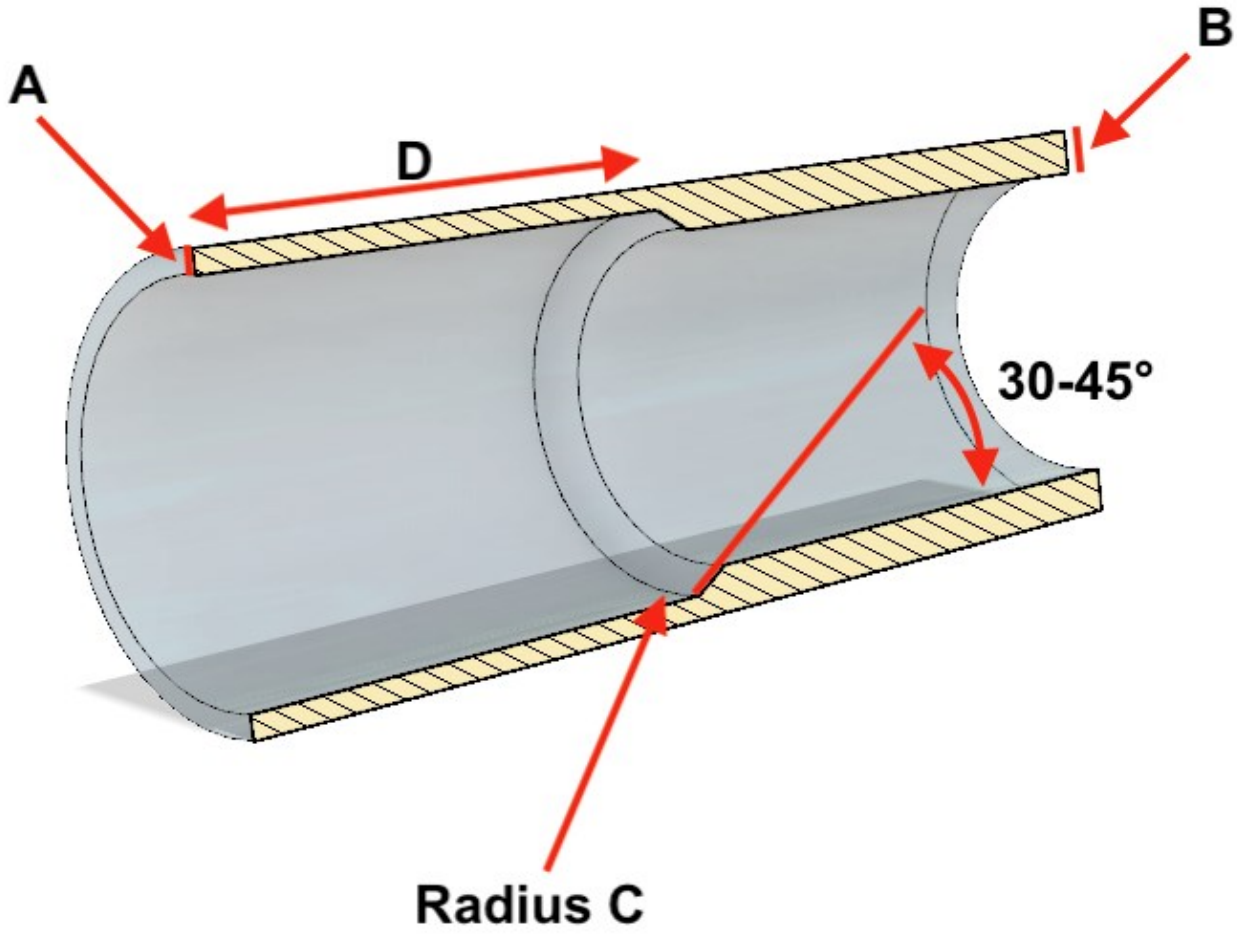


Dimension Nominal (DN) (mm)	Maximum gap (mm) "X"
≤ 355	0.5
400 to ≤ 630	1
630 to ≤ 800	1.3
800 to ≤ 1000	1.5
>1000	2

Possible Cause:

1. Poor support of pipes and / or fittings.
2. Poor facing.
3. Pipe or fittings not clamped in machine correctly.

SDR Transitions



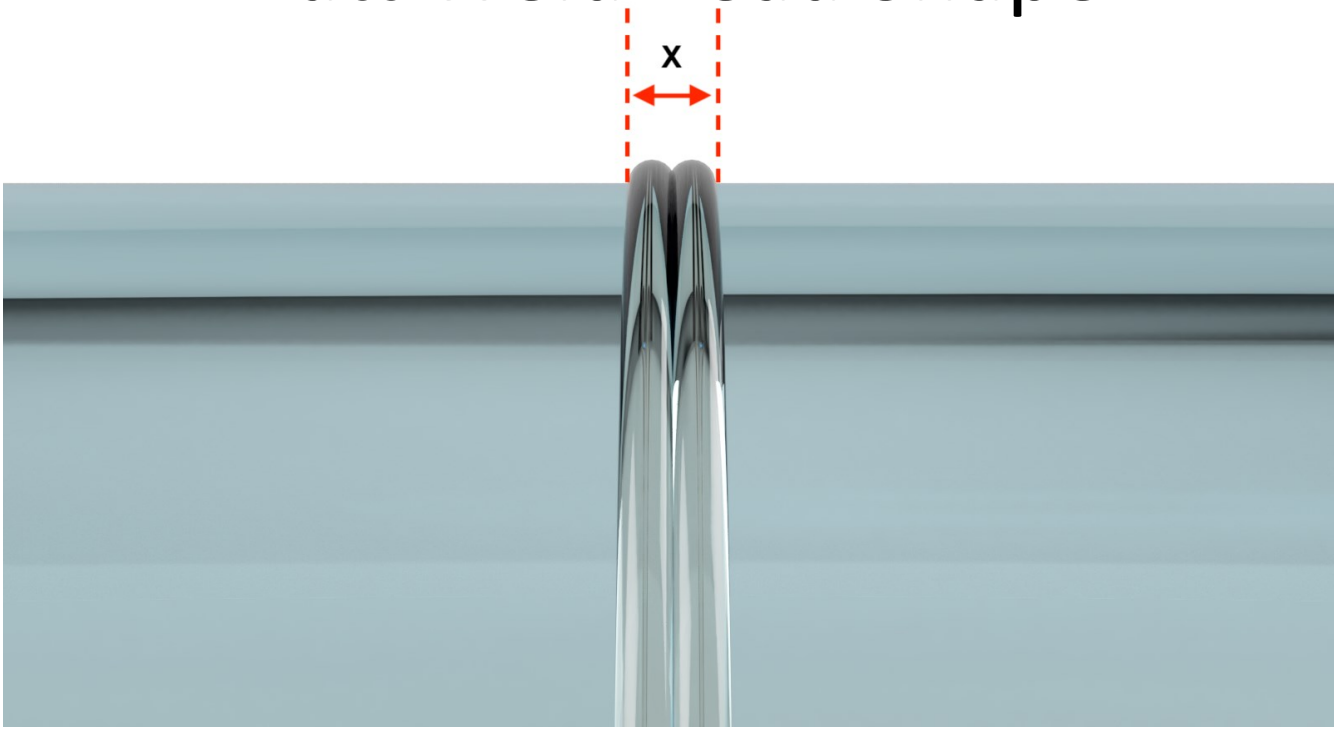
When butt welding pipes of different Wall thickness a transition piece must be used.

A = Nominal wall thickness of thinner pipe.
B = Nominal wall thickness of thicker pipe.
C = 0.15A
D = not less than 50mm or 2A

Pipes or fittings of different SDR may also be joined together using an electrofusion coupling (check SDR range).

If WT difference is < 10% a transition piece is not required.

Butt Weld Bead Shape



Butt weld joints must have a smooth even shaped bead around the entire pipe circumference.

The size and shape of a bead can often indicate an error in the welding procedure.

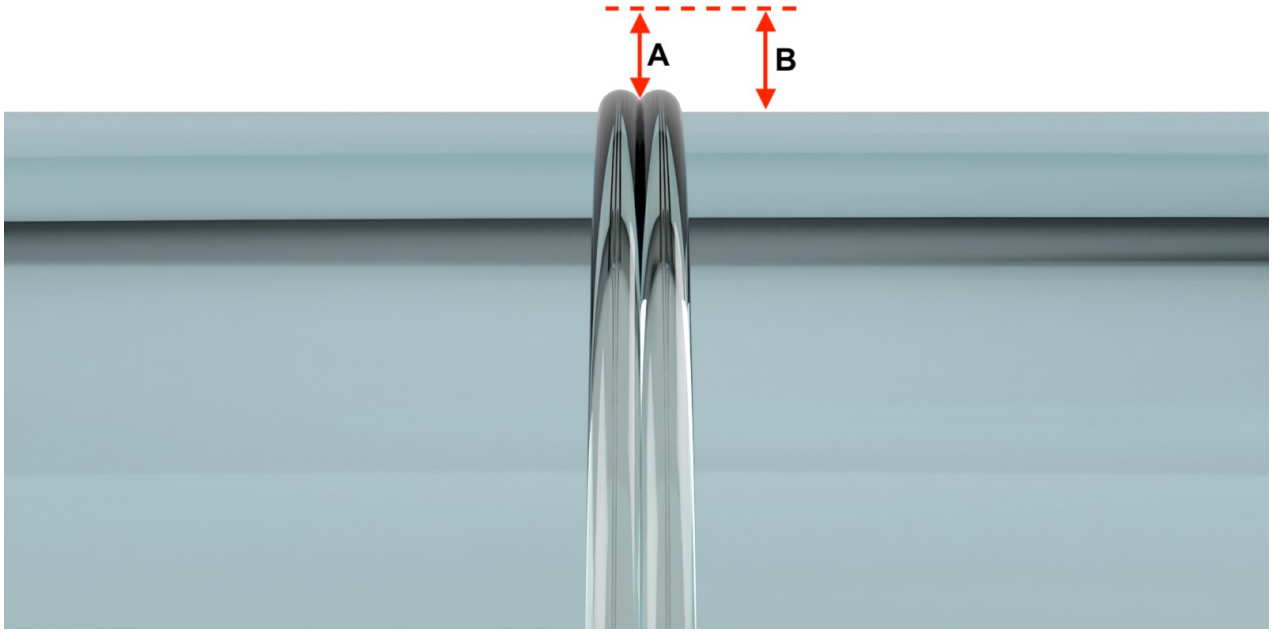
Possible Cause:

1. Incorrect pressure and or times.
2. Incorrect heater plate temperature.
3. Too slow during heater plate removal phase.
4. Environmental conditions.

One method of determining an acceptable bead width (X) is experimentally using pipes and a butt welding machine operating at the specific parameters. The mean value is determined from several joints made under these conditions. The measured bead should not exceed ± 20% of average size.

A previous guideline used was to check that the width of the bead (X) shall be greater than wt x 0.5+3mm and not to exceed wt x 0.75+5mm However this will vary depending on material, ambient temperature and weld pressure.

Butt Weld Bead Shape



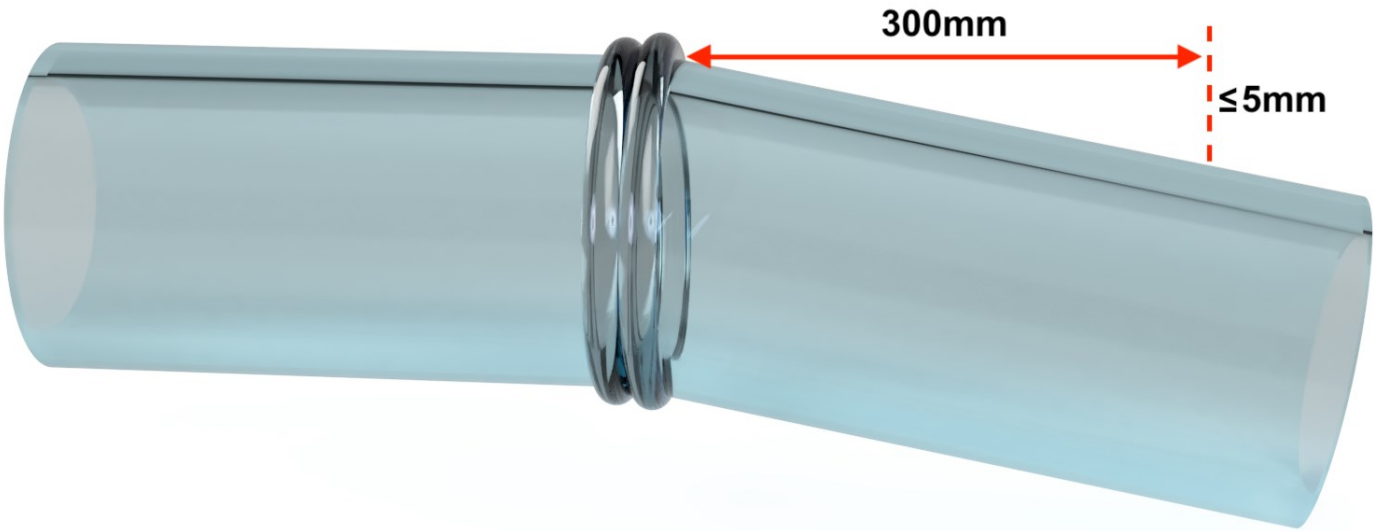
The depth of the bead depression must not extend into the wall thickness of the pipe.
For example: A must always be less than B.

External Beads can be removed and bent back to help assess weld quality

Possible Cause:

1. Incorrect pressure.
2. Heater plate too cool.
3. Too slow during heater plate removal phase.
4. Environmental conditions.

Alignment

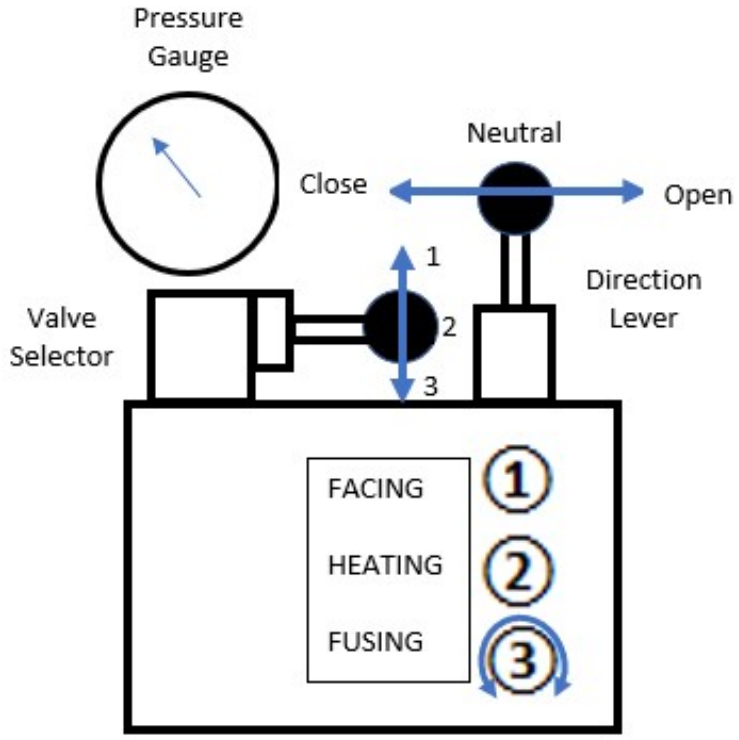


1. Allowable misalignment for a Butt welded joint is ≤ 5mm at 300mm from butt weld. This applies to all pipe sizes.

Possible Cause:

1. Poor support of pipes and / or fittings.
2. Pipe or fittings not clamped in machine correctly.

Valve Control Sequence when using PEWeldBank (Continual flow)



After Facing, cleaning, alignment and setting Heating / Drag pressure.

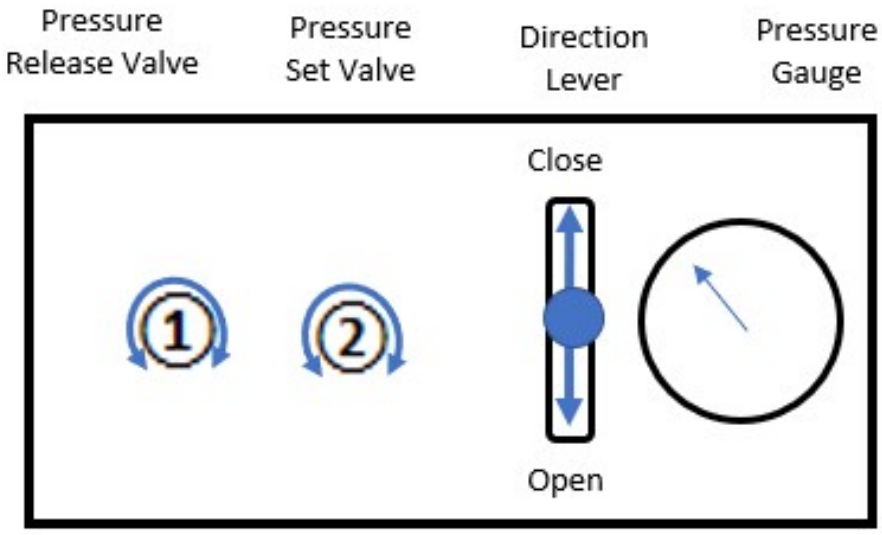
1. Close carriage and set Fusing pressure valve ③ to XX bar
2. Press [NEXT] on PEWeldBank
3. Open carriage ALL THE WAY this will drop pressure to drag or less.
4. Insert Heater Plate
5. Bring Pipe up to heater plate to XX bar pressure
6. When you have bead up size
7. Reduce to 0-Drag

To do this correctly you must move "Valve Selector" to 2 position and wait for pressure to drop to below drag, then move "Direction Lever" to neutral. And Wait for Heat Soak Time

8. Open Carriage:, move "Valve Selector" down to Fusion Position 3, move "Direction Lever" to the right, just enough to remove heater plate.
9. Remove Heater Plate and Close carriage.
10. To avoid pressure spike, slow carriage speed just before closure.

(Continual flow:- Hydraulic pump runs continually,
On demand flow :- Hydraulic pump only runs when lever activated)

Hydraulic Valve Control Sequence when using PEWeldBank (On de-mand flow)



Generic Pressure control unit. Most basic units run similarly but valves may be arranged differently.

After Facing, cleaning, alignment and Recording Drag pressure

1. Close Pressure Release Valve ①
2. Close carriage and set Pressure Set Valve ② to XX bar
3. Press **[NEXT]** on PEWeldBank.
4. Open carriage this will drop pressure to drag or less.
5. Insert Heater Plate.
6. Bring Pipe up to heater plate to XX bar pressure and hold Direction Lever for several seconds.
7. When you have bead up size
8. Reduce to 0-Drag Using Pressure Release Valve ①
   And Wait for Heat Soak Time.
8. Open Carriage: Just enough to remove heater plate.
9. Remove Heater Plate and Close carriage, hold Direction Lever for several seconds.

(Continual flow:- Hydraulic pump runs continually,
On demand flow :- Hydraulic pump only runs when lever activated)

Protection from Environmental conditions

The Butt Welding and Electrofusion process is sensitive to weather and climatic conditions. The Butt Welding or Electrofusion process needs to be carried out in a clean, dry and draft free condition.
To manage this the following is advised.

1. Where necessary a shelter or cover must be used to keep moisture and dust away for weld surfaces.
2. Electrofusion is not recommended below -5°C or above 45°C
3. Butt Welding is not recommended below -5°C or above 45°C
4. Cover the remote ends of open pipe to prevent air flow.
5. In some instances tape must be used to close gap between EF fitting and pipe OD.

Notes, Abbreviations & symbols

DN	Dimension Nominal
OD	Outside Diameter
EN	Wall Thickness Nominal
WT	Wall Thickness
SDR	Standard Dimension Ratio
PN	Pressure Nominal
IFP	Inter Facial Pressure
mm	Millimetre
kPa	Kilopascal
Bar	Bar
MPa	Megapascal
≤	Less than or equal to
≥	Greater than or equal to
Pressure	
1 MPA = 10 Bar = 1000 kPa	

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PE Pipe Welders Reference

Disclaimer

PolyPedia
Is an informative guide for electrofusion and Butt welding specifications.

The information and content in the tables is based on information gathered from pipe and fitting manufacturers and numerous welding standards internationally and therefore is general in nature.
References:
PIPA POP001 & POP003
DVS 2207
ISO 21307
APGA CSG CoP
AS NZS 4130

Please confirm information with your local authorities.

This is a fluid document and will be updated as required, please do not hesitate sending comments or suggestions or requesting further information to be included.

Contact:
info@peweldbank.com