WELDING PROCEDURE SUMMARY

Procedure	Process	Joint Type	Pipe Grade	Outside Diameter	Wall Thickness
WP-B-1	SMAW	Butt Weld	≤ Grade B	< 2.375"	< 0.188"
WP-B-2	SMAW	Fillet Weld	≤ Grade B	< 2.375"	< 0.188"
WP-42-3	SMAW	Butt Weld	≤ X42	2.375" – 12.750"	0.154" – 0.750"
WP-42-4	SMAW	Fillet Weld	≤ X42	2.375" – 12.750"	0.154" – 0.750"
WP-42-5	SMAW	Butt Weld	≤ X42	> 12.750"	0.188" – 0.750"
WP-42-6	SMAW	Fillet Weld	≤ X42	> 12.750"	0.188" – 0.750"
WP-60-3	SMAW	Butt Weld	X42 < Grade < X65	2.375" – 12.750"	0.154" – 0.750"
WP-60-4	SMAW	Fillet Weld	X42 < Grade < X65	2.375" – 12.750"	0.154" – 0.750"
WP-60-5	SMAW	Butt Weld	X42 < Grade < X65	> 12.750"	0.188" – 0.750"
WP-60-6	SMAW	Fillet Weld	X42 < Grade < X65	> 12.750"	0.188" – 0.750"
WP-65-3	SMAW	Butt Weld	X65	2.375" – 12.750"	0.154" – 0.750"
WP-65-4	SMAW	Fillet Weld	X65	2.375" – 12.750"	0.154" – 0.750"
WP-65-5	SMAW	Butt Weld	X65	> 12.750"	0.188" – 0.750"
WP-65-6	SMAW	Fillet Weld	X65	> 12.750"	0.188" – 0.750"
WP-70-3	SMAW	Butt Weld	X70	2.375" – 12.750"	0.154" – 0.750"
WP-70-4	SMAW	Fillet Weld	X70	2.375" – 12.750"	0.154" – 0.750"
WP-70-5	SMAW	Butt Weld	X70	> 12.750"	0.188" – 0.750"
WP-70-6	SMAW	Fillet Weld	X70	> 12.750"	0.188" – 0.750"
WP-B42-1	SMAW	Fillet Weld	Grade B on X42	< 2.375"	< 0.188"
WP-B52-1	SMAW	Fillet Weld	Grade B on X52	< 2.375"	< 0.188"
WP-B60-1	SMAW	Fillet Weld	Grade B on X60	< 2.375"	< 0.188"
WP-B65-1	SMAW	Fillet Weld	Grade B on X65	< 2.375"	< 0.188"
WP-B70-1	SMAW	Fillet Weld	Grade B on X70	< 2.375"	< 0.188"
WP-IS	In-Service SMAW	Butt/Fillet	≤ X65	All	All

Procedure included in standard UTI Welding Manual.

Procedure not included in standard UTI Welding Manual.

REVISION HISTORY

Date	Version	Description
5/5/2014	2014.00	UTI procedures revised to accommodate updated groupings (diameter, wall thickness, grade) and welding parameters (rod size, rod type, amperage range, voltage range, travel speed).
10/1/2014	2014.01	Added procedures WP-70-5, WP-70-6, & WP-B70-1. Clarified diameter ranges on all procedures. Added general welding requirements to make the welding manual a standalone document.
12/2/2014	2014.02	Revised lineup clamp requirements for all branch/fillet weld procedures.
4/16/2015	2015.01	Add section to Chapter 5 regarding arc burns.
5/15/2015	2015.02	Added procedures WP-70-3 & WP-70-4. Fixed typos, clarified pre-heat and post-heat requirements.
9/25/15	2015.03	Revised in-service welder qualification test parameters in 3.1.2. Revised language in 5.7, Completion of Weld; 5.9, Weather Conditions; and 5.10, Permissible Wall Thickness Mismatch. Deleted Table 5.8-1 and replaced with actual required parameters in 5.10.

FORWARD

The following is a combination of general requirements and welding procedures for various types of pipe materials and sizes used in the pipeline industry. If a situation is encountered in which any of the variables or parameters are outside what is listed in this manual, all welding should be stopped and UTI shall be contacted immediately.

Utility Technologies International
4700 Homer Ohio Lane
Groveport, OH 43125
P: 614-482-8080
www.uti-corp.com

Utility Technologies International
Welding Manual

1. GENERAL

This manual includes the welding specifications and procedures to be used for the construction, fabrication and maintenance of pipeline facilities. All personnel performing welding under this manual shall follow the specifications and procedures herein. This manual details the requirements associated with the following items:

- Welding Procedure Qualification
- Welder Qualification
- 3rd Party Fabricator Welding Procedure Acceptance
- General Welding Guidelines
- Weld Inspection
- Weld Repair

Specific SMAW fixed position butt, branch and fillet weld procedures have been developed and qualified. These procedures are included in this manual and cover welding of pipe and fittings up to and included specified minimum yield strength (SMYS) of 70,000, on all diameters, and all thicknesses up to 0.750". An "in-service" procedure is also included. All provided procedures have been qualified under API 1104, 20th edition.

For the purposes of this manual, the term "COMPANY" shall refer to any company that is utilizing this manual for their welding requirements.

2. WELDING PROCEDURE QUALIFICATION

Before welding may be permitted to begin, the qualification of the appropriate procedure or combination of procedures is required. The procedure shall be qualified to demonstrate that welds with suitable mechanical properties (such as strength, ductility, hardness, etc.) can be made using each developed welding procedure.

The welding procedure can be in text form or can be summarized on a form similar to the attached "Procedure Specification Sheet". The procedure qualification test must be performed and destructively tested in accordance with the respective governing code (API 1104 or Section IX of the ASME Boiler and Pressure Vessel Code). Each welding procedure must be recorded in detail, including the results of the qualifying tests. These records shall be retained and followed whenever the procedures are used. UTI procedure qualification records are available for audit review.

All procedure qualification tests must be within the specified allowable ranges of materials, pipeline parameters, and welding parameters listed in the procedure. Upon successful completion of the

required testing, the procedure is then deemed qualified on all materials, pipeline parameters, and welding parameters within the ranges specified in the procedure.

A new procedure qualification is required whenever a variance in any of the provided essential variables, outside of the qualified ranges is anticipated. All UTI developed procedures are per API 1104, 20th edition, which lists the following essential variables for procedures qualifications:

(1) Welding Process or Method of Application
(2) Base Material
(3) Joint Design
(4) Position
(5) Wall Thickness
(6) Filler Metal
(7) Electrical Characteristics
(8) Time Between Passes
(9) Direction of Welding
(10) Shielding Gas & Flow Rate
(11) Shielding Flux
(12) Speed of Travel
(13) Pre-Heat
(14) Post-Weld Heat Treatment

3. WELDER QUALIFICATION

Before being permitted to begin welding under this manual, the welder must be qualified in accordance with the governing code being used in the procedure (API 1104 or Section IX of the ASME BPVC). Additionally, the welder must pass the destructive testing requirements associated with the respective code. Non-destructive testing for welder qualifications is not permitted.

3.1. API 1104 Welder Qualification

3.1.1. Multiple Qualification Test

Unless welding is limited to a specific project where only a single qualification test is required, the welder shall be qualified by the multiple qualification method on 12" nominal diameter pipe, as specified in Section 6, API 1104, 20th edition, which includes the following:

(1) One (1) 12.750" nominal diameter butt weld in the 45° fixed position with a wall thickness greater than or equal to 0.250"
(2) Layout, fit, cut, and weld one (1) 12" x 12" full-sized branch on pipe connection. A full-size hole shall be cut in the run pipe. The weld shall be made with the run-pipe axis in the horizontal position and the branch-pipe axis extending vertically downward from the run. The finished weld shall exhibit a neat, uniform workman-like appearance.

A welder who has successfully completed the multiple test listed above shall be qualified to weld in all positions; on all wall thicknesses, joint design, and fittings; on all pipe diameters. Additionally, welders shall be required to perform the qualification test on the pipe grades listed in the table below:

Table 3.1.1-1
Welder Qualification Test Pipe Grade Requirements

Qualification Test Performed on:	Welder Qualified to Weld on:
Grade B	≤ X42
X42	≤ X42
X52	≤ X60
X60	≤ X60
X65	≤ X70
X70	≤ X70

3.1.2. In-Service Qualification Test

When conditions of high flow and/or pressures exist that could induce hydrogen cracking, the in-service welding procedure must be used and the welder must be qualified. After completing the multiple qualification test listed above, the welder shall be permitted to perform the in-service qualification tests (per Appendix B, API 1104, 20th edition). The welder shall be qualified for the in-service procedure by welding on Grade B or higher pipe, containing flowing water. The recommended test is as follows:

(1) The welder shall weld a split sleeve onto a 12" nominal diameter pipe with a wall thickness equal to 0.250", containing water flowing at a rate of 1-3 GPM. The pipe shall be fixed at a 45° angle.
(2) The welder will weld a 12" nominal diameter, standard wall thickness tee onto a 12" nominal diameter pipe with a wall thickness equal to 0.250", containing water flowing at a rate of 1-3 GPM. The pipe and tee shall be in the fixed horizontal position.

Successful completion of this test, in conjunction with the 12" multiple test, shall qualify the welder for in-service welding on all pipe grades up to the welder's maximum qualified grade (per Table 3.1.1-1, above), all pipe diameters, and all wall thicknesses up to 0.750".

3.2. ASME Section IX BPVC Welder Qualification

If an ASME Section IX BPVC procedure is used, the welder must perform the qualification weld and meet the destructive testing requirements, as specified in the code.

3.3. Welder Requalification Requirements

Welders shall be required to maintain the qualification by completing a weld of the same process, which has been destructively or non-destructively tested in accordance with 49 CFR 192.229 & API 1104 requirements twice each calendar year, not to exceed 7½ months. One requalification test is sufficient for each welding process (e.g. SMAW). Destructive testing shall be required for all bi-annual requalification tests for all welders who will be welding on compressor stations. Welders that miss the requalification deadline shall be required to perform the multiple qualification test again, and pass the destructive testing requirements as outlined above.

4. 3RD PARTY FABRICATOR WELDING PROCEDURE ACCEPTANCE

COMPANY may elect to utilize fabrication shops to perform welding on various pipeline related facilities. These shops typically have their own qualified procedures (API 1104 and/or Section IX ASME BPVC), which can be used in lieu of the UTI qualified procedures. Acceptance criteria for 3rd party procedures shall be as follows:

(1) Fabricator shall supply COMPANY (or its agent) with all Welding Procedure Specifications, Procedure Qualification Records, and Welder Qualification Records (including requalification records)
(2) COMPANY (or its agent) shall review the documentation provided by fabricator for compliance with the governing code (API 1104 or Section IX ASME BPVC)
(3) After determination that the documentation provided is complete and meets all code requirements, COMPANY (or its agent) shall issue an approval to the fabricator for use of the procedures on the specified project.
(4) WPS, PQR, & WQR records shall be included in the as-built report documentation for the pipeline facility.

5. GENERAL WELDING GUIDELINES

5.1. Alignment

The alignment of the abutting ends shall minimize the offset between surfaces. For pipe ends of the same nominal wall thickness, the offset shall not exceed 1/16". If a larger offset is caused by dimensional variations, it shall be equally distributed around the circumference of the pipe. Hammering of the pipe to obtain proper lineup should be kept to a minimum.

5.2. Bevel

All mill bevels on pipe ends shall conform to the joint design used in the specific procedure. Field bevels should be made by machine tool, machine oxygen, or machine plasma cutting. Manual oxygen cutting may be used. The beveled ends should be relatively smooth and uniform. Dimensions shall be in accordance with the procedure used.

5.3. Clearance

When the pipe is welded above ground, the working clearance around the pipe at the weld should not be less than 16 inches. When the pipe is welded in a trench, the bell hole shall be large enough to provide the welder or welders with ready access to the joint.

5.4. Electrodes

Welding electrodes shall be selected as outlined in the procedure being used. Electrodes shall be kept dry (especially important for E7016 and E7018 low-hydrogen rods) and protected from any mechanical damage or deterioration. They shall not be used if found or suspected to be defective.

5.5. Minimum Distance Between Welds

The minimum distances between the edges of welds shall be:

(1) Two inches (2") between adjacent fillet welds.
(2) Two inches (2") between a fillet weld and a butt weld.
(3) Twelve inches (12") or one pipe diameter, whichever is smaller, between parallel butt welds.
    (a) For shop fabrication or completely unrestrained conditions, four inches (4") or one pipe diameter, whichever is smaller, shall be allowed between parallel butt welds.
(4) Factory made steel welding elbows or transverse segments cut therefrom may be used for changes in direction, provided that the arc length measured along the crotch is at least one inch (1").

5.6. Longitudinal Seams

Longitudinal seams shall be located in the following positions:

(1) Straight Pipe:
    (a) Longitudinal seams shall be located in the top quarter of the pipe, preferably in the 10:30 or 1:30 position.
(2) Straight Sags & Overbends:
    (a) Longitudinal seams shall be located at the 9:00 or 3:00 position.
(3) Straight Sidebends:
    (a) Longitudinal seams shall be located in the top quarter of the pipe.
(4) Combination Pipe Bends:
    (a) Longitudinal seams shall be located in the top half of the pipe.
(5) Adjacent Seams:
    (a) Adjacent longitudinal seams shall be alternated on each side of the pipe (based on the above locations), wherever possible. Where this is impractical, adjacent seams shall not be located any closer than 3" on the pipe circumference (for $\geq$ 4" pipe). The contractor shall make every effort to maximize the spacing of adjacent seams.

5.7. Completion of Weld

Maximum time between the root/stringer, hot pass, and first filler pass are given in each individual welding procedure. All other passes shall begin within 10 minutes after completion of the previous pass, unless half the groove has been filled. If this time has been exceeded, the weld must be preheated again according to the requirements of the welding procedure.If half the groove has been filled, the maximum time allowed for completion of the weld shall be 48 hours, unless further limited by the specific welding procedure

All tie-in welds must be welded to completion at the time of the tie-in. Any weld which has or will exceed the maximum time interval specified shall be cut out and re-welded at the expense of the contractor.

5.8. Pressurized Pipe

Before in-service welding, welders should consider operating pressure, flow conditions, and wall thickness. The areas to be welded should be ultrasonically inspected to ensure that pipe wall defects (e.g. laminations) are not present and that the wall thickness is adequate to prevent burn through.

In-service welding shall be done at times of low flow or no flow conditions. This will minimize the effects of cooling of the weld joint by flowing gas that may create a cracking problem. If welding on high pressure or high flow pipelines, an in-service welding procedure should be considered.

5.9. Weather Conditions

Welding shall not be done when the quality of the completed weld would be impaired by the prevailing weather conditions, including but not limited to airborne moisture, blowing dirt or sand, or high winds. Windshields may be used when practical.

5.10. Permissible Wall Thickness Mismatch for Butt Welds

Welding of pipe segments with different wall thickness shall be allowed, without special end preparation, per the following rules:

(1) $\leq$ 0.250" Wall Pipe – A maximum of 3/64" difference in wall thicknesses may be welded together without special end preparation.
(2) > 0.250" Wall Pipe – A maximum of 3/32" difference in wall thicknesses may be welded together without special end preparation.

When welding of pipe segments with wall thickness difference greater than listed above, the thicker section shall be tapered (1 on 4) to meet the thinner section.

5.11. Arc Burns

Arc burns shall not be permitted on new pipe ends. These imperfections shall be cut out. The remaining pipe ends shall be properly re-beveled.

6. WELD INSPECTION

6.1. General

Visual inspection of welding shall be conducted to assure that welding is performed in accordance with the appropriate welding procedure and that the welding is acceptable under the standards of acceptability in API 1104, 20th edition. Welding defects are shown in Figures 6-1 through 6-4. Welds shall be rejected if they contain defects that exceed the standards of acceptability for visual inspection in Tables 6-1 and 6-2. These figures and tables are included, as a reference, at the end of this section.

6.2. Responsibility

COMPANY shall be responsible to ensure all inspectors are qualified by appropriate training and experience to inspect welding operations. The inspector assigned to each project is responsible for the quality of welding and for the acceptance and rejection of welds.

COMPANY (or its agent) shall be the sole judge of what constitutes an acceptable weld and shall determine the disposition of defective welds. The contractor shall remove and replace, at their cost, welds or partial welds that are deemed unsatisfactory.

6.3. Welding Inspection Check List

The inspector shall perform the following inspection checks to ensure welding is performed in accordance with the qualified procedures.

6.3.1. General Conditions

The inspector shall check the following:

(1) Weather conditions for need for protection from precipitation and wind.
(2) Equipment to insure that it is capable of holding the pipe in a fixed position during welding.
(3) Condition and capacity of welding machines.
(4) Fittings for bevels, wall thickness, grade and mismatch (Exhibit A).
(5) Type of lineup clamps -- external or internal clamps.
(6) Preheating requirements.
(7) Welder's qualification -- process, position, grade, diameter, and wall thickness.

6.3.2. Prior to Welding

The inspector shall verify the following:

(1) Bevels are machine cut and smooth.
(2) Pipe ends are free of rust, scale, primer, oil, and other foreign material.
(3) Root opening spacing. (Critical for electric arc welding.)
(4) Size and type of welding electrodes or rods.

6.3.3. During Welding

The inspector shall check for the following:

(1) Dry welding electrodes.
(2) Grinding marks and/or arc marks (burns) on pipe next to weld or grounding connection. Neither is permitted.
(3) How grounding connection is made. Welding to pipe or fittings is not permitted.
(4) Whether slag, blowholes, windows, knots, and overlaps have been removed after each pass.
(5) First pass (root/stringer bead) proper penetration and fusion.
(6) Whether second pass (hot pass) was started within required time after completion of first pass.

6.3.4. Completed Weld Check

The inspector shall check for the following:

(1) External undercut.
(2) Cracks.
(3) Surface gas pockets (bug holes).
(4) Correct weld profile and size.
(5) Weld spatter.
(6) Welder's identification number if more than one welder is on job

6.4. Radiographic Inspection

Any time radiographic inspections are required, these inspection procedures should be reviewed with the radiographic inspection company.

The radiographic contractor shall have written procedures and personnel who have been trained and qualified in the established procedures and with the equipment employed in testing. These procedures and qualifications shall be in accordance with API 1104, 20th edition. The procedures and equipment should be reviewed by COMPANY (or its agent) prior to acceptance.

Radiography shall take place before the weld is coated. Any welds determined to be unsatisfactory shall be repaired or removed. Welding defects are shown in Figures 6-1 through 6-4. Additionally, welds shall be rejected if they contain defects that exceed the standards of acceptability for radiographic inspection defined in API 1104, 20th edition,and included in this manual in Table 6-2.

6.4.1. Pipe Systems Requiring Non-destructive Testing

Piping systems designed to operate at 20% or more of the specified minimum yield strength (SMYS) shall be non-destructive tested in accordance with 49 CFR 192.241 & 192.243. Listed below are the minimum required percentages of each day's field butt welds, selected at random by COMPANY, that must be non-destructively tested over their entire circumference. COMPANY reserves the right to require more stringent standards than those listed below for any given project:

- In Class 1 locations, except offshore, at least ten percent 10%.
- In Class 2 locations, at least 15%.
- In Class 3 and Class 4 locations, at crossings of major or navigable rivers, offshore, and within railroad or public highway rights-of-way, including tunnels, bridges, and overhead road crossings, 100% unless impracticable, in which case at least 90%. Non-destructive testing must be impracticable for each girth weld not tested.
- At pipeline tie-ins, including tie-ins of replacement sections, 100 percent.
- Additionally, except for a welder whose work is isolated from the principal welding activity, a sample of each welder's work for each day must be non-destructively tested, when working on facilities to operate in excess of 20% SMYS.

For these circumstances each operator must retain, for the life of the pipeline, a record showing by milepost, engineering station, or by geographic feature, the number of girth welds made, the number non-destructively tested, the number rejected, and the disposition of the rejects.

Repaired welds, or weld joints which have been completely replaced, shall be radiographed.

Non-destructive testing of welds must be performed by any process, other than trepanning, that will clearly indicate defects that may affect the integrity of the weld.

Film viewing illuminators provided by the contractor shall produce sufficient light so that all portions of the radiograph can be clearly viewed.

Figure 6-1

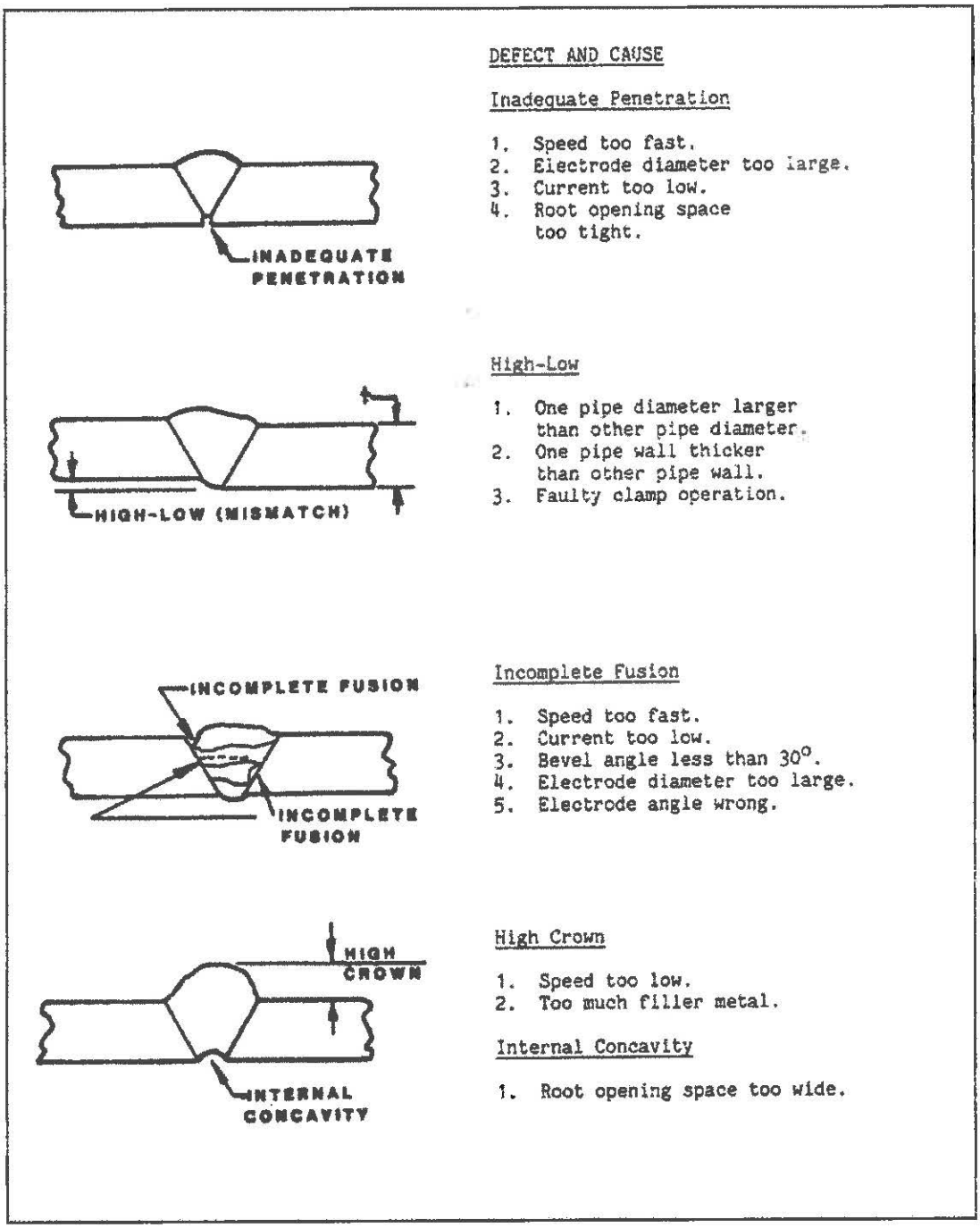
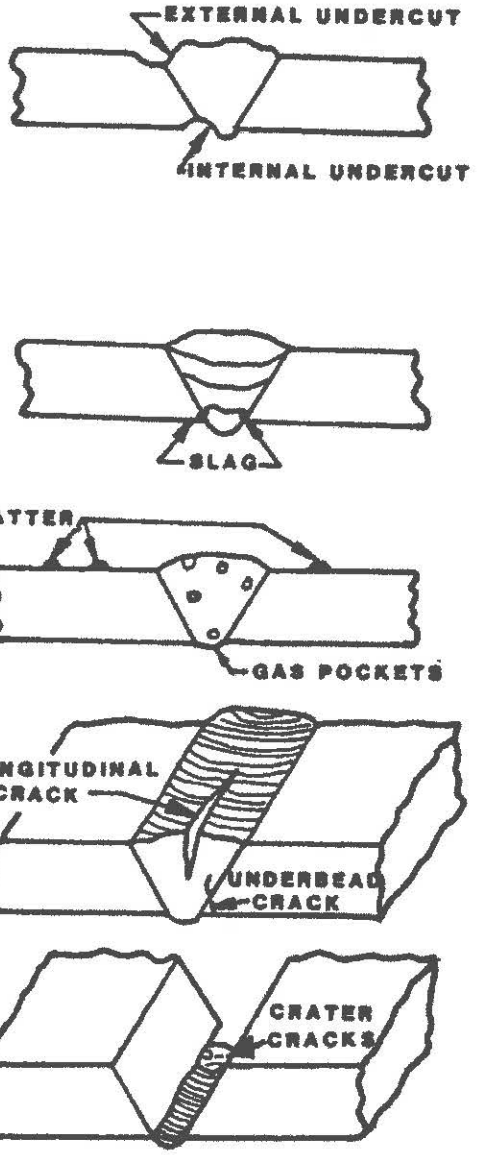

DEFECT AND CAUSE
Inadequate Penetration
1. Speed too fast.
2. Electrode diameter too large.
3. Current too low.
4. Root opening space too tight.
INADEQUATE PENETRATION
High-Low
1. One pipe diameter larger than other pipe diameter.
2. One pipe wall thicker than other pipe wall.
3. Faulty clamp operation.
HIGH-LOW (MISMATCH)
Incomplete Fusion
1. Speed too fast.
2. Current too low.
3. Bevel angle less than 30°.
4. Electrode diameter too large.
5. Electrode angle wrong.
INCOMPLETE FUSION
INCOMPLETE FUSION
High Crown
1. Speed too low.
2. Too much filler metal.
HIGH CROWN
Internal Concavity
1. Root opening space too wide.
INTERNAL CONCAVITY

Figure 6-2



DEFECT AND CAUSE

External Undercut
1. Moved electrode from edge of puddle too fast.
2. Current too high.
3. Too large of electrode diameter.
4. Speed too fast.

Internal Undercut
1. Open circuit voltage too low.
2. Dirty bevels
3. Root opening too wide.

Slag Lines
1. Bead profile too convex.
2. Improper electrode manipulation on hotpass.
3. Improper grinding.

Spatter
1. High current.
2. High voltage.

Gas Pockets
1. Impurities on pipe bevels.
2. Arc length too short.
3. Speed too fast.
4. Wet electrodes.

Longitudinal Crack
1. Rigid joint.

Underbead Crack
1. Moisture
2. Temperatures below 32° F.

Crater (Star) Crack
1. Remove electrode from puddle too fast.

Figure 6-3

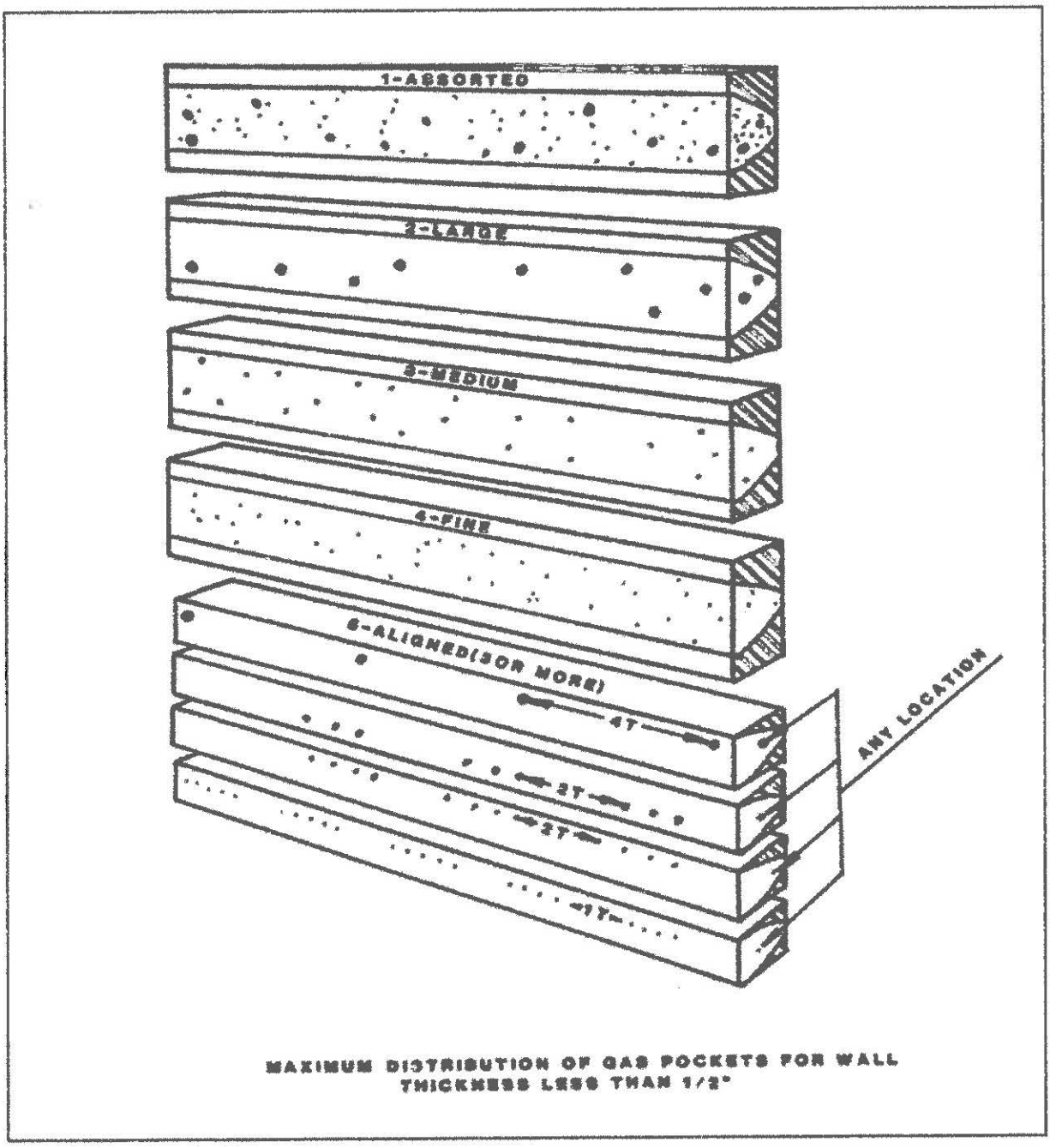
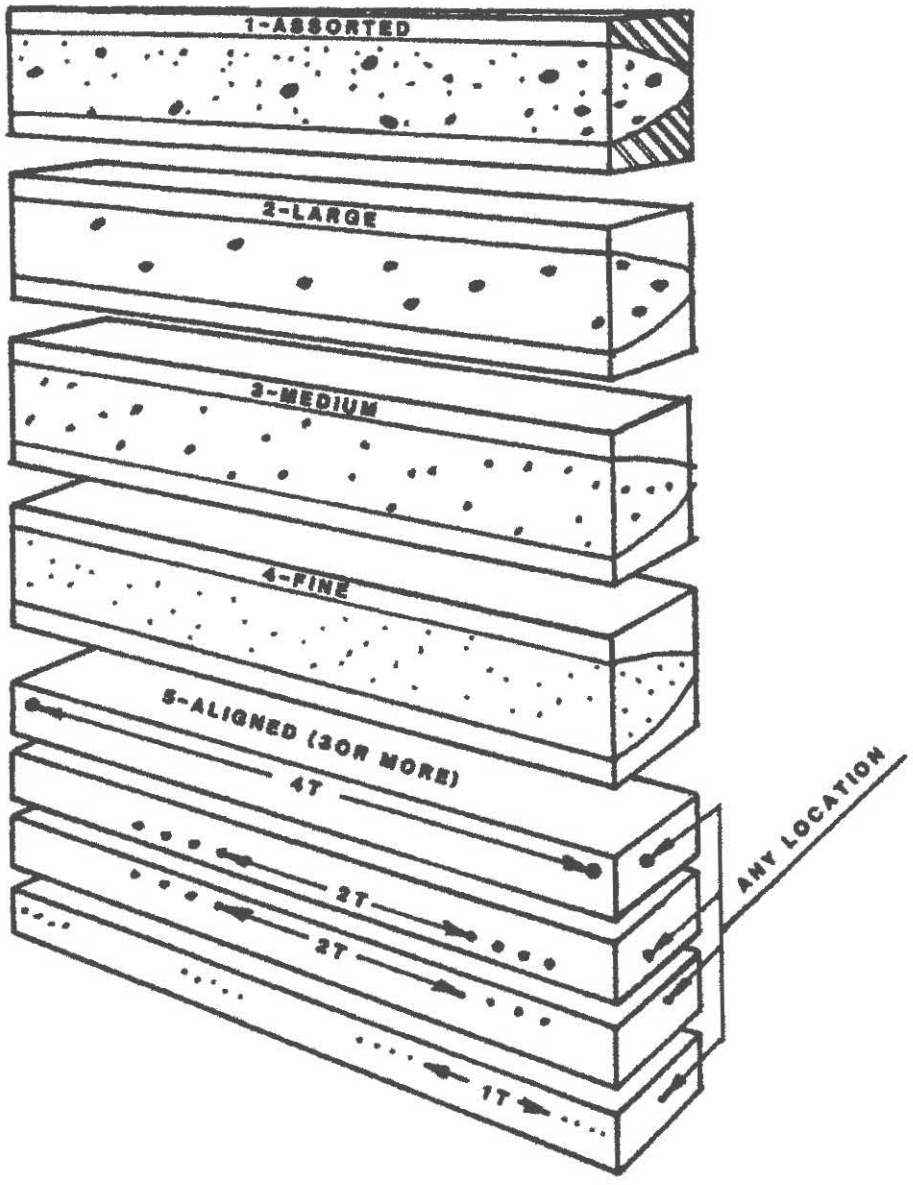

1-ASSORTED
2-LARGE
3-MEDIUM
4-FINE
5-ALIGNED(5 OR MORE)
4T
2T
2T
1T
ANY LOCATION
MAXIMUM DISTRIBUTION OF GAS POCKETS FOR WALL THICKNESS LESS THAN 1/2"

Figure 6-4



MAXIMUM DISTRIBUTION OF GAS POCKETS FOR WALL THICKNESS 1/2" TO 1-1/4"

Table 6-1
Visual Standards of Acceptability

DISCONTINUITY	BUTT WELDS	FILLET WELDS
Cracks	None permitted	None permitted
Inadequate Penetration	None permitted	None permitted
Burn Through	None permitted	N/A
Weld Reinforcement (where the thinner component is ½" and under)	1/8" maximum (1/16" desired)	Meet design spec.
Weld Reinforcement (where the thinner component is above ½")	3/16" maximum (1/16" desired)	Meet design spec.
Overlap	1/16" minimum - 1/8" maximum	N/A
Internal Concavity	Shall not reduce the total thickness of the joint, including reinforcement, to less than the thickness of the thinner component	N/A
Arc Strikes (Burns)	None permitted	None permitted
Low Cap/Cover	None permitted	Meet design spec.
Internal Buildup	3/32" maximum	N/A
Porosity	None permitted	None permitted
Undercutting Butt Weld (EU & IU) Fillet Weld (EU Only)	IF THE DEPTH IS: Over 1/32" or over 12.5% of wall thickness Over 1/64" or over 6% of wall thickness, but not over 1/32" or 12.5% of wall thickness 1/64" or less and 6% or less of wall thickness	LENGTH None acceptable Total of IU plus EU shall not exceed 2" in any 12" length or 1/6 the weld length EU is acceptable. Consider only IU.

Note: Welds must have a neat appearance.

Table 6-2
Standards of Acceptability for Radiograph Tested Welds

Field Symbols	Type of Defect	Individual Defects	Aggregate Defect Length per Weld Length	Pipe Less than 2-3/8"O.D.
1P	Inadequate Penetration	Shall not exceed 1" in length	Shall not exceed 1" in 12" length[1]	
IPD	Inadequate Penetration Due to High-Low	Shall not exceed 2" in length	Shall not exceed 3" in 12" length	
ICP	Inadequate Cross Penetration	Shall not exceed 2" in length	Shall not exceed 2" in 12" length	
1F	Incomplete Fusion	Shall not exceed 1" in length	Shall not exceed 1" in 12" length[1]	
IFD	Incomplete Fusion Due to Cold Lap	Shall not exceed 2" in length	Shall not exceed 2" in 12" length[2]	
IC	Internal Concavity[3]	Radiographic density of bead shall not exceed that of t		
BT	Burn Through	Shall not exceed t nor 1/4" in any dimension	Sum of maximum dimensions shall not exceed 1/2" in lesser of 12" or total length	Only one burn-through is acceptable and shall not exceed t or 1/4"
ESI	Elongated Slag Inclusion[4]	Shall not exceed 2" in length or 1/16" in width	Shall not exceed 2" in 12" length[2]	Individual defects shall not exceed 1/16" in width or 3 t in length[2]
ISI	Isolated Slag Inclusion	Shall not exceed 1/8" in width	Shall not be more than 4 indications with max width of 1/8", aggregate exceeding 1/2" in 12" length[2]	Individual defects shall not exceed 1/2 t in width or 2 t in length[2]
P	Individual or Scattered Porosity[5]	Shall not exceed 1/8" nor 1/4 t in diameter (If wormhole porosity use maximum dimension.) Maximum distribution per pp 3&4, Exh C.		
CP	Cluster Porosity	Diameter of cluster shall not exceed 1/2"	Shall not exceed 1/2" in 12" weld length	
HB	Hollow Bead Porosity	Shall not exceed 1/2" in length	Shall not exceed 2" in 12" weld. Defects exceeding 1/4" in length shall be separated by 2" of sound weld metal[2].	
C	Cracks	None unless shallow crater or star crack		
CC	Shallow Crater or Star Cracks	Shall not exceed 5/32" in length		
EU, IU	External, Internal Undercut		Shall not exceed 2" in 12" weld length. Shall not exceed 1/6 of total weld length	
	Accumulation of Imperfections[6]		Shall not exceed 2" in 12" weld length[2]	

(1) The total length of such conditions shall not exceed 8% of weld less than 12".
(2) The total length of such conditions shall not exceed 8% of total weld length.
(3) Indicated by appreciable difference of density.
(4) Parallel ESI indications separated by approximately the width of the root bead (wagon tracks) considered a single indication unless the width of either of them exceeds 1/32". In that event, they are considered separate indications.
(5) If piping (wormhole) porosity use maximum dimension.
(6) Excluding incomplete penetration due to high-low and undercutting.

Note: "t" is the nominal wall thickness of the thinnest wall pipe.

7. WELD REPAIR

Visually detected cracked welds, regardless of when detected, length, or location, are unacceptable and shall be cut out and the section replaced.

Non-destructive testing (NDT) detected cracked welds with crack lengths greater than 8% of the weld length are unacceptable and shall be cut out and the section replaced.

Other defects in a weld discovered prior to acceptance may be repaired by welding at the discretion of the Welding Inspector.

Each weld that is repaired shall have the defect removed down to sound metal and the segment to be repaired, if it has cooled, must be pre-heated as outlined in the specific procedure.

Welding repairs shall be performed in accordance with the welding procedure that was used to make the initial weld. Repair methods must ensure that the minimum mechanical properties specified in the original procedure are still intact upon completion of the repair process.

Repairs shall be re-inspected by the same method previously used to assure its acceptability. Additional inspection methods may also be used at the discretion of the Welding Inspector. If the repair is found to be unacceptable, the weld shall be cut out and the pipe ends re-beveled.

Utility Technologies International
4700 Homer Ohio Lane
Groveport, OH 43125
P: 614-482-8080
www.uti-corp.com

Welding Procedure WP-B-1
API 1104, 20th Edition
SMAW Fixed Butt Joint
≤ Grade B, Diameter < 2.375", Wall Thickness < 0.188"

1. PROCESS

Shielded Metal Arc Welding (SMAW)

2. MATERIALS

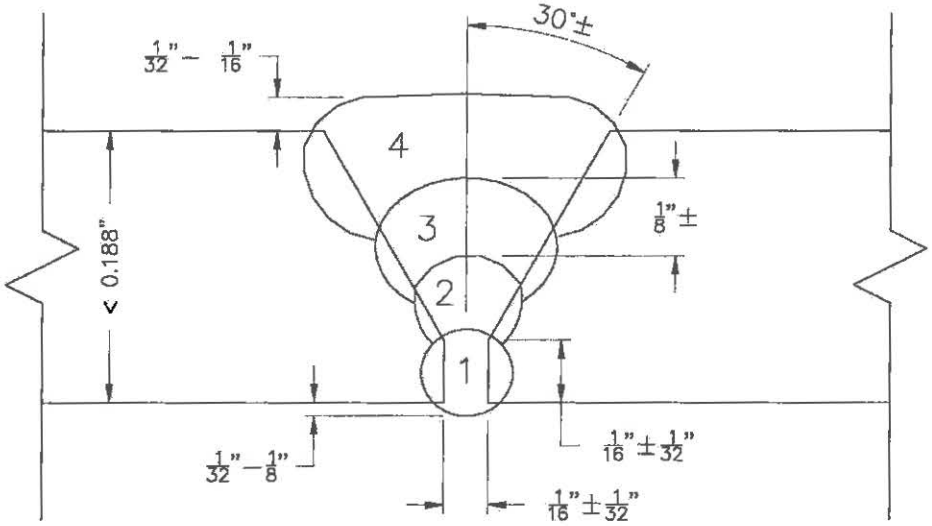
This procedure describes the welding of fixed position butt joints in pipe manufactured to API 5L specifications with a specified minimum yield strength of 35,000 psig or less and equivalent materials with similar chemical and physical properties (such as ASTM A106).

3. DIAMETERS & WALL THICKNESSES

Nominal Outside Diameters: < 2.375"
Nominal Wall Thicknesses: < 0.188"

4. JOINT DESIGN

The following figure depicts the joint design that shall be used for this procedure:



TYPICAL BUTT WELD

5. FILLER METAL & NUMBER OF BEADS

The following electrodes are approved for use with this procedure. The electrode sizes listed in the table below are the maximum diameter electrodes that shall be used. The total number of passes is the minimum number that shall be deposited.

Material Grade	Material Thickness	Rod Type	Rod Size				Minimum Passes
			Root Pass	Hot Pass	Filler Pass(s)	Cap Pass	
≤ X42	< 0.188	E6010	3/32	1/8			3

Tack welds are considered part of the stringer/root bead and shall be deposited with the pipe in the fixed position. Tacks welds shall be of sufficient number and length to maintain the stringer/root opening and pipe alignment. If a tack weld, or any part of the stringer/root bead, cracks or breaks, the weld shall be cut out, as a cylinder, and the pipe or fittings re-beveled. Tacks of excessive thickness shall be cut down with a power grinder, diamond point or round nosed chisel, with the power grinder being the preferred method. The use of an oxy-fuel cutting torch or a welding electrode for removing excess weld metal is prohibited.

6. ELECTRICAL CHARACTERISTICS & TRAVEL SPEED

A Direct Current Reverse Polarity (DCRP), electrode positive, shall be used. The table below depicts the ranges that must be maintained throughout the procedure:

Rod Size	Rod Type	Amperage	Voltage	Travel Speed
3/32"	E6010	40-70	20-35	4-14
1/8"	E6010	65-130	20-35	4-14

7. FLAME CHARACTERISTICS

Not applicable.

8. POSITION

The pipe shall be fixed throughout the welding process.

9. DIRECTION OF WELDING

The direction of the welding shall be downhill.

10. TIME BETWEEN PASSES

The maximum time interval between the completion of the stringer/root bead (first pass) and the beginning of the hot pass (second pass) is five (5) minutes. The maximum interval between the hot pass (second pass) and the next filler (third pass) shall not exceed ten (10) minutes. If for any reason the weld is not completed in a timely manner, and the weld has cooled below the temperatures outlined in Section 13 of this procedure (below), the weld shall be re-heated to the

required pre-heat temperature before welding may be resumed. Additionally, the following rules shall apply:

a) Each pass shall be completed before the next pass is permitted to begin.
b) Two successive passes shall not begin at the same point.
c) A stripper or short bead shall be used to build up low areas

11. LINEUP CLAMPS

The pipe shall be supported so that there is no strain on the stringer/root bead throughout the welding process. Line up clamps shall be external. Stringer/root bead (first pass) segments shall be uniformly spaced around the circumference with an aggregate length of at least 50% before the clamp is removed. However, where 50% of the root bead cannot be completed in equal segments on opposite sides of the joint without repositioning the clamp, tack welds can be used for alignment. Four tack welds shall be used, equally spaced around the circumference. Tack welds shall be at least three times the wall thickness in length.

The use of backing rings is prohibited.

12. CLEANING/GRINDING

All scale/slag, knots of filler metal (excessive metal on starts), and similar defects shall be removed with a power grinder. A combination of hand and power tools may be utilized to clean the weld metal and weld joint.

All coal tar coating shall be removed a minimum of 6" back from the beveled surface prior to welding. All remaining coatings shall be removed 4" back.

All moisture, rust, scale/slag, oil, paint, primer, coating, or other materials which may be detrimental to the finished weld shall be removed from the welding surface.

Where possible, beveling shall be performed with a machine tool or machine cutting device (oxy-acetylene torch, beveling machine). Flame cut surfaces should be smooth and regular. Power brushes shall be used for cleaning all beveled surfaces. If the beveled surface cannot be satisfactorily cleaned of foreign materials utilizing power brushes, then power sanding discs (60 grit or higher), grit blasting, or approved safety solvents may be utilized. Prior to welding, all residue left from the use of safety solvents shall be removed.

13. PRE-HEATING

Pre-heating of plain carbon steels is required under any of the following conditions:

a) When the ambient temperature is below 50°F and at the discretion of the welding inspector when the ambient temperature is above 50°F.
b) When the pipe is wet or damp for the purposes of drying the pipe prior to welding.
c) When the carbon content exceeds 0.28% (ladle analysis) or the carbon equivalent (CE) is 0.45% or greater.
d) When the percent of alloying elements will adversely affect weldability.

e) When pre-heating will alleviate existing conditions that would limit the welding technique or tend to adversely affect the quality of the weld.

During the pre-heat process, the temperature shall be maintained above 250°F and shall not exceed 375°F. Pre-heating may be achieved by the use of a gas ring, induction coil, resistance heater, or propane torch. Welding shall not begin until the required pre-heat temperature is achieved. A temperature indicating crayon, or other suitable method, shall be used to determine or verify when the required pre-heat temperature has been achieved.

The welding of a joint shall be continuous, with no interruptions, until half the depth of the welding groove has been filled. The pre-heat temperature shall be maintained until the welding is completed. If welding is interrupted, the joint shall be re-heated to the original pre-heat temperature before welding is resumed.

The minimum width of the pre-heat area on each side of the weld shall be equal to three times the pipe wall thickness or 2", whichever is greater.

There shall be no accelerated cooling of the weld joint.

14. POST-WELD HEAT TREATMENT

Not applicable.

15. GROUNDING

The ground clamp shall be designed to prevent arc burns on the pipeline. Welding of the ground clamp to the pipe is prohibited.

16. SHIELDING GAS & FLOW RATE

Not applicable.

17. SHIELDING FLUX

Not applicable.

Utility Technologies International
4700 Homer Ohio Lane
Groveport, OH 43125
P: 614-482-8080
www.uti-corp.com

Welding Procedure WP-B-2
API 1104, 20th Edition
SMAW Branch Connections & Fillet Welds
≤ Grade B, Diameter < 2.375", Wall Thickness < 0.188"

1. PROCESS

Shielded Metal Arc Welding (SMAW)

2. MATERIALS

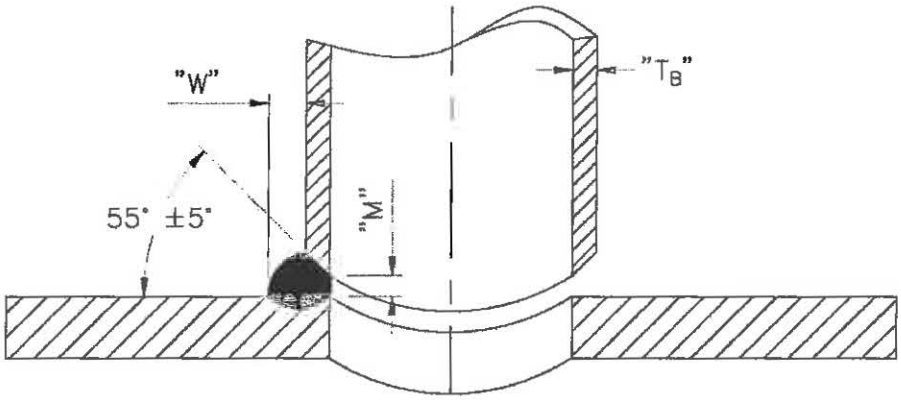
This procedure describes the welding of branch connections and fillet welds in pipe manufactured to API 5L specifications with a specified minimum yield strength of 35,000 psig or less and equivalent materials with similar chemical and physical properties (such as ASTM A106).

3. DIAMETERS & WALL THICKNESSES

Nominal Outside Diameters: < 2.375"
Nominal Wall Thicknesses: < 0.188"

4. JOINT DESIGN

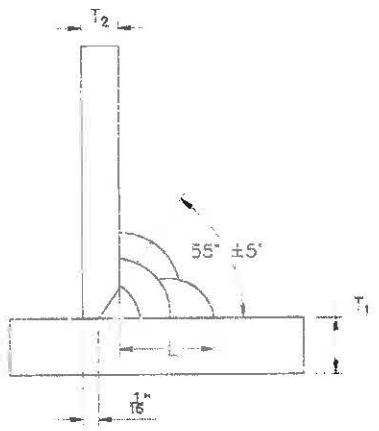
The following figures depict the joint design that shall be used for this procedure:



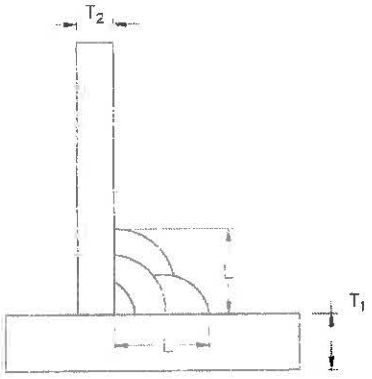
$W = \frac{3}{8}" * T_B$ ($\frac{1}{4}"$ MIN)
$M = \frac{1}{16}"$ (MIN) – $\frac{3}{16}"$ (MAX)

TYPICAL BRANCH CONNECTION

For fillet joints, the maximum dimension of L is 1.25 x T_1 or 1.25 x T_2, whichever is smaller:



TYPICAL BRANCH WELD



TYPICAL FILLET WELD

5. FILLER METAL & NUMBER OF BEADS

The following electrodes are approved for use with this procedure. The electrode sizes listed in the table below are the maximum diameter electrodes that shall be used. The total number of passes is the minimum number that shall be deposited. The number of passes depends upon the size of the fillet weld. The size of the fillet weld is the length of a side of the largest inscribed right triangle having two equal sides.

Material Grade	Material Thickness	Rod Type	Rod Size				Minimum Passes
			Root Pass	Hot Pass	Filler Pass(s)	Cap Pass	
≤ X42	< 0.188	E6010	3/32	1/8			3

Tack welds are considered part of the stringer/root bead and shall be deposited with the pipe in the fixed position. Tacks welds shall be of sufficient number and length to maintain the stringer/root opening and pipe alignment. If a tack weld, or any part of the stringer/root bead, cracks or breaks, the weld shall be cut out, as a cylinder, and the pipe or fittings re-beveled. Tacks of excessive thickness shall be cut down with a power grinder, diamond point or round nosed chisel, with the power grinder being the preferred method. The use of an oxy-fuel cutting torch or a welding electrode for removing excess weld metal is prohibited.

6. ELECTRICAL CHARACTERISTICS & TRAVEL SPEED

A Direct Current Reverse Polarity (DCRP), electrode positive, shall be used. The table below depicts the ranges that must be maintained throughout the procedure:

Rod Size	Rod Type	Amperage	Voltage	Travel Speed
3/32"	E6010	40-70	20-35	4-14
1/8"	E6010	65-130	20-35	4-14

7. FLAME CHARACTERISTICS

Not applicable

8. POSITION

The welding shall be performed with the pipe or assembly held stationary.

9. DIRECTION OF WELDING

The direction of the welding shall be downhill.

10. TIME BETWEEN PASSES

The maximum time interval between the completion of the stringer/root bead (first pass) and the beginning of the hot pass (second pass) is five (5) minutes. The maximum interval between the hot pass (second pass) and the next filler (third pass) shall not exceed ten (10) minutes. If for any reason the weld is not completed in a timely manner, and the weld has cooled below the temperatures outlined in Section 13 of this procedure (below), the weld shall be re-heated to the required pre-heat temperature before welding may be resumed. Additionally, the following rules shall apply:

a) Each pass shall be completed before the next pass is permitted to begin.
b) Two successive passes shall not begin at the same point.
c) A stripper or short bead shall be used to build up low areas

11. LINEUP CLAMPS

The pipe shall be supported so that there is no strain on the stringer/root bead throughout the welding process. When an external fixturing or support device is used, it shall remain in place until a maximum practical amount of the root pass is completed (a minimum of 50% of the root pass). However, where 50% of the root bead cannot be completed in equal segments on opposite sides of the joint without repositioning the fixturing/support device, tack welds can be used for alignment. Four tack welds shall be used, equally spaced around the circumference. Tack welds shall be at least three times the wall thickness in length.

12. CLEANING/GRINDING

All scale/slag, knots of filler metal (excessive metal on starts), and similar defects shall be removed with a power grinder. A combination of hand and power tools may be utilized to clean the weld metal and weld joint.

All coal tar coating shall be removed a minimum of 6" back from the beveled surface prior to welding. All remaining coatings shall be removed 4" back.

All moisture, rust, scale/slag, oil, paint, primer, coating, or other materials which may be detrimental to the finished weld shall be removed from the welding surface.

Where possible, beveling shall be performed with a machine tool or machine cutting device (oxy-acetylene torch, beveling machine). Flame cut surfaces should be smooth and regular. Power brushes shall be used for cleaning all beveled surfaces. If the beveled surface cannot be satisfactorily cleaned of foreign materials utilizing power brushes, then power sanding discs (60 grit or higher), grit blasting, or approved safety solvents may be utilized. Prior to welding, all residue left from the use of safety solvents shall be removed.

13. PRE-HEATING

Pre-heating of plain carbon steels is required under any of the following conditions:

a) When the ambient temperature is below 50°F and at the discretion of the welding inspector when the ambient temperature is above 50°F.
b) When the pipe is wet or damp for the purposes of drying the pipe prior to welding.
c) When the carbon content exceeds 0.28% (ladle analysis) or the carbon equivalent (CE) is 0.45% or greater.
d) When the percent of alloying elements will adversely affect weldability.
e) When pre-heating will alleviate existing conditions that would limit the welding technique or tend to adversely affect the quality of the weld.

During the pre-heat process, the temperature shall be maintained above 250°F and shall not exceed 375°F. Pre-heating may be achieved by the use of a gas ring, induction coil, resistance heater, or propane torch. Welding shall not begin until the required pre-heat temperature is achieved. A temperature indicating crayon, or other suitable method, shall be used to determine or verify when the required pre-heat temperature has been achieved.

The welding of a joint shall be continuous, with no interruptions, until half the depth of the welding groove has been filled. The pre-heat temperature shall be maintained until the welding is completed. If welding is interrupted, the joint shall be re-heated to the original pre-heat temperature before welding is resumed.

The minimum width of the pre-heat area on each side of the weld shall be equal to three times the pipe wall thickness or 2", whichever is greater.

There shall be no accelerated cooling of the weld joint.

Utility Technologies International
4700 Homer Ohio Lane
Groveport, OH 43125
P: 614-482-8080
www.uti-corp.com

Welding Procedure WP-42-3
API 1104, 20th Edition
SMAW Fixed Butt Joint
Grade ≤ X42, Diameter 2.375" – 12.750", Wall Thickness 0.154" – 0.750"

1. PROCESS

Shielded Metal Arc Welding (SMAW)

2. MATERIALS

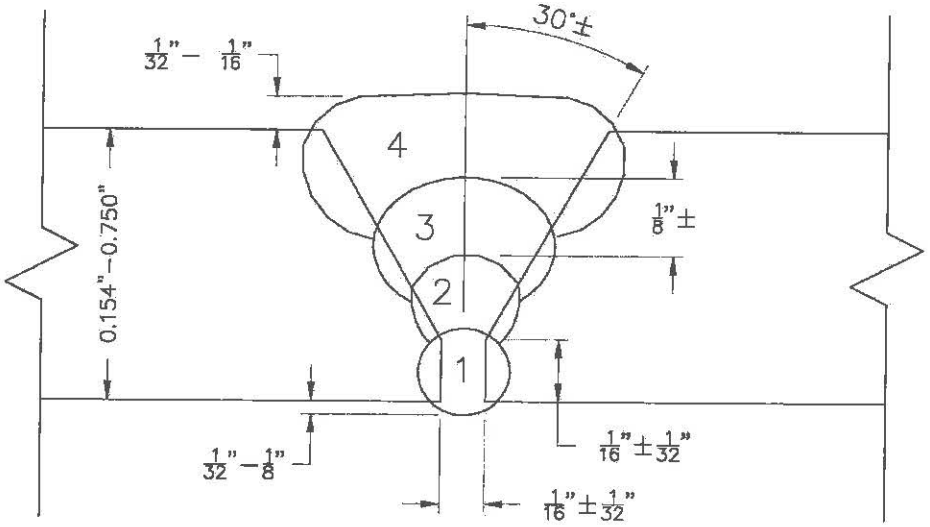
This procedure describes the welding of fixed position butt joints in pipe manufactured to API 5L specifications with a specified minimum yield strength of 42,000 psig or less and equivalent materials with similar chemical and physical properties (such as ASTM A106).

3. DIAMETERS & WALL THICKNESSES

Nominal Outside Diameters: 2.375" – 12.750"
Nominal Wall Thicknesses: 0.154" – 0.750"

4. JOINT DESIGN

The following figure depicts the joint design that shall be used for this procedure:



TYPICAL BUTT WELD

5. FILLER METAL & NUMBER OF BEADS

The following electrodes are approved for use with this procedure. The electrode sizes listed in the table below are the maximum diameter electrodes that shall be used. The total number of passes is the minimum number that shall be deposited.

Material Grade	Material Thickness	Rod Type	Rod Size				Minimum Passes
			Root Pass	Hot Pass	Filler Pass(s)	Cap Pass	
≤ X42	0.154 - 0.187	E6010	3/32	1/8			3
	0.188 - 0.250	E6010 E7010	1/8	5/32			3
	0.251 - 0.375	E6010 E7010	5/32				4
	0.376 - 0.500	E6010 E7010	5/32		3/16		5
	0.501 - 0.625	E6010 E7010	5/32		3/16		6
	0.626 - 0.750	E6010 E7010	5/32		3/16		7

Tack welds are considered part of the stringer/root bead and shall be deposited with the pipe in the fixed position. Tacks welds shall be of sufficient number and length to maintain the stringer/root opening and pipe alignment. If a tack weld, or any part of the stringer/root bead, cracks or breaks, the weld shall be cut out, as a cylinder, and the pipe or fittings re-beveled. Tacks of excessive thickness shall be cut down with a power grinder, diamond point or round nosed chisel, with the power grinder being the preferred method. The use of an oxy-fuel cutting torch or a welding electrode for removing excess weld metal is prohibited.

6. ELECTRICAL CHARACTERISTICS & TRAVEL SPEED

A Direct Current Reverse Polarity (DCRP), electrode positive, shall be used. The table below depicts the ranges that must be maintained throughout the procedure:

Rod Size	Rod Type	Amperage	Voltage	Travel Speed
3/32"	E6010	40-70	20-35	4-14
1/8"	E6010	65-130	20-35	4-14
	E7010	75-130		
5/32"	E6010 E7010	90-185	20-35	4-14
3/16"	E6010 E7010	140-225	25-35	4-14

7. FLAME CHARACTERISTICS

Not applicable

8. POSITION

The pipe shall be fixed throughout the welding process.

9. DIRECTION OF WELDING

The direction of the welding shall be downhill.

10. TIME BETWEEN PASSES

The maximum time interval between the completion of the stringer/root bead (first pass) and the beginning of the hot pass (second pass) is five (5) minutes. The maximum interval between the hot pass (second pass) and the next filler (third pass) shall not exceed ten (10) minutes. If for any reason the weld is not completed in a timely manner, and the weld has cooled below the temperatures outlined in Section 13 of this procedure (below), the weld shall be re-heated to the required pre-heat temperature before welding may be resumed. Additionally, the following rules shall apply:

a) Each pass shall be completed before the next pass is permitted to begin.
b) Two successive passes shall not begin at the same point.
c) A stripper or short bead shall be used to build up low areas

11. LINEUP CLAMPS

The pipe shall be supported so that there is no strain on the stringer/root bead throughout the welding process. Line up clamps shall be external. Stringer/root bead (first pass) segments shall be uniformly spaced around the circumference with an aggregate length of at least 50% before the clamp is removed.

The use of backing rings is prohibited.

12. CLEANING/GRINDING

All scale/slag, knots of filler metal (excessive metal on starts), and similar defects shall be removed with a power grinder. A combination of hand and power tools may be utilized to clean the weld metal and weld joint.

All coal tar coating shall be removed a minimum of 6" back from the beveled surface prior to welding. All remaining coatings shall be removed 4" back.

All moisture, rust, scale/slag, oil, paint, primer, coating, or other materials which may be detrimental to the finished weld shall be removed from the welding surface.

Where possible, beveling shall be performed with a machine tool or machine cutting device (oxy-acetylene torch, beveling machine). Flame cut surfaces should be smooth and regular. Power brushes shall be used for cleaning all beveled surfaces. If the beveled surface cannot be satisfactorily cleaned of foreign materials utilizing power brushes, then power sanding discs (60

grit or higher), grit blasting, or approved safety solvents may be utilized. Prior to welding, all residue left from the use of safety solvents shall be removed.

13. PRE-HEATING

Pre-heating of plain carbon steels is required under any of the following conditions:

a) When the ambient temperature is below 50°F and at the discretion of the welding inspector when the ambient temperature is above 50°F.
b) When the pipe is wet or damp for the purposes of drying the pipe prior to welding.
c) When the carbon content exceeds 0.28% (ladle analysis) or the carbon equivalent (CE) is 0.45% or greater.
d) When the percent of alloying elements will adversely affect weldability.
e) When pre-heating will alleviate existing conditions that would limit the welding technique or tend to adversely affect the quality of the weld.

During the pre-heat process, the temperature shall be maintained above 250°F and shall not exceed 375°F. Pre-heating may be achieved by the use of a gas ring, induction coil, resistance heater, or propane torch. Welding shall not begin until the required pre-heat temperature is achieved. A temperature indicating crayon, or other suitable method, shall be used to determine or verify when the required pre-heat temperature has been achieved.

The welding of a joint shall be continuous, with no interruptions, until half the depth of the welding groove has been filled. The pre-heat temperature shall be maintained until the welding is completed. If welding is interrupted, the joint shall be re-heated to the original pre-heat temperature before welding is resumed.
The minimum width of the pre-heat area on each side of the weld shall be equal to three times the pipe wall thickness or 2", whichever is greater.

There shall be no accelerated cooling of the weld joint.

14. POST-WELD HEAT TREATMENT

Not applicable.

15. GROUNDING

The ground clamp shall be designed to prevent arc burns on the pipeline. Welding of the ground clamp to the pipe is prohibited.

16. SHIELDING GAS & FLOW RATE

Not applicable.

17. SHIELDING FLUX

Not applicable.

Utility Technologies International
4700 Homer Ohio Lane
Groveport, OH 43125
P: 614-482-8080
www.uti-corp.com

Welding Procedure WP-42-4
API 1104, 20th Edition
SMAW Branch Connections & Fillet Welds
Grade ≤ X42, Diameter 2.375" – 12.750", Wall Thickness 0.154" – 0.750"

1. PROCESS

Shielded Metal Arc Welding (SMAW)

2. MATERIALS

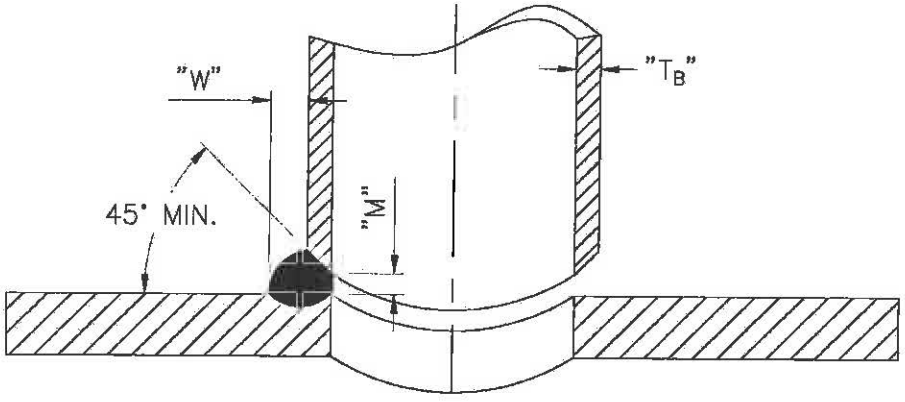
This procedure describes the welding of branch connections and fillet welds in pipe manufactured to API 5L specifications with a specified minimum yield strength of 42,000 psig or less and equivalent materials with similar chemical and physical properties (such as ASTM A106).

3. DIAMETERS & WALL THICKNESSES

Nominal Outside Diameters: 2.375" – 12.750"
Nominal Wall Thicknesses: 0.154" – 0.750"

4. JOINT DESIGN

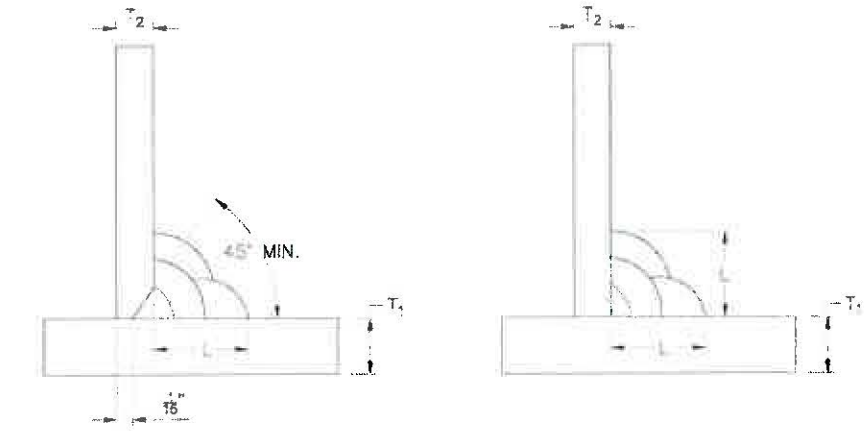
The following figures depict the joint design that shall be used for this procedure:



$W = \frac{3}{8}" * T_B$ ($\frac{1}{4}"$ MIN)
$M = \frac{1}{16}"$ (MIN) – $\frac{3}{16}"$ (MAX)

TYPICAL BRANCH CONNECTION

For fillet joints, the maximum dimension of L is 1.25 x T_1 or 1.25 x T_2, whichever is smaller:



TYPICAL BRANCH WELD TYPICAL FILLET WELD

5. FILLER METAL & NUMBER OF BEADS

The following electrodes are approved for use with this procedure. The electrode sizes listed in the table below are the maximum diameter electrodes that shall be used. The total number of passes is the minimum number that shall be deposited. The number of passes depends upon the size of the fillet weld. The size of the fillet weld is the length of a side of the largest inscribed right triangle having two equal sides.

Material Grade	Material Thickness	Rod Type	Rod Size				Minimum Passes
			Root Pass	Hot Pass	Filler Pass(s)	Cap Pass	
≤ X42	0.154 - 0.187	E6010	3/32	1/8			3
	0.188 - 0.250	E6010 E7010	1/8	5/32			3
	0.251 - 0.375	E6010 E7010	5/32				4
	0.376 - 0.500	E6010 E7010	5/32		3/16		5
	0.501 - 0.625	E6010 E7010	5/32		3/16		6
	0.626 - 0.750	E6010 E7010	5/32		3/16		7

Tack welds are considered part of the stringer/root bead and shall be deposited with the pipe in the fixed position. Tacks welds shall be of sufficient number and length to maintain the stringer/root opening and pipe alignment. If a tack weld, or any part of the stringer/root bead, cracks or breaks, the weld shall be cut out, as a cylinder, and the pipe or fittings re-beveled. Tacks of excessive thickness shall be cut down with a power grinder, diamond point or round nosed chisel, with the

Summary: Testimony of Darryl Knight on behalf of Ohio Rural Natural Gas Co-op (Part 5-Exhibits Continued) electronically filed by Mr. Richard R Parsons on behalf of Ohio Rural Natural Gas Co-op