

Welding Procedure - Oxy-Acetylene Welding

Test Report Nos. WPQ-01 & WPQ-02

Supersedes: 12/15/03

**A. General**

The welding shall be done by the manual oxy-acetylene process for welding of butt welded joints and fillet welded joints on steel pipe. All flanges, service tees and fabricated branch connection shall be electric arc welded.

\*\* **B. Pipe Metals**

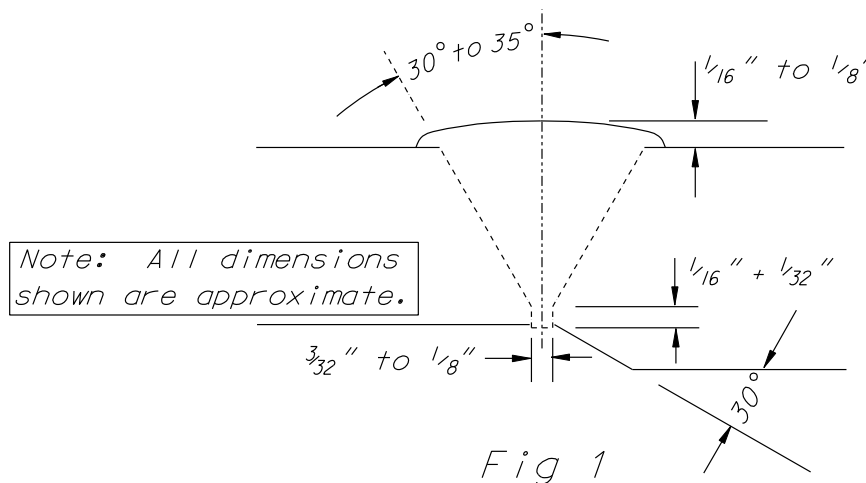
The pipe material shall conform to one of the following specifications: ASTM Specification A-53 or API Specification 5L Grade "A", Grade "B", or Grade X-42.

\*\* **C. Diameter and Wall Thickness**

These procedures apply to pipe in the following groups:

Group 1 Under 2-3/8" outside diameter with wall thickness less than 0.188"

Group II 2-3/8" outside diameter with wall thickness less than 0.188"



\*\* **D. Joint Design**

**1. Butt Joint**

The welding ends shall be beveled to an angle of approximately  $30^\circ$  to  $35^\circ$  with a root face of  $1/16'' + 1/32''$ . The bevel shall form a "V" groove with an included angle of  $60^\circ$  to  $70^\circ$ . The root opening shall be  $3/32''$  to  $1/8''$ . Field bevels shall be made by machining or by gas cutting and grinding. Preparation of ends having unequal wall thickness shall comply with Fig 1. All pipe of 1-1/4" nominal diameter or less may have the welding ends cut square.

\*\* Essential Variable

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**2. Fillet Joints**

Fillet welds may be concave to slightly convex. The size of a fillet weld is defined as the length of the shorter of the two perpendicular sides of the largest inscribed right triangle. See Figure 2.

The size of the fillet weld shall be not less than the thickness of the smaller nominal wall thickness (T) of the two pieces being joined.

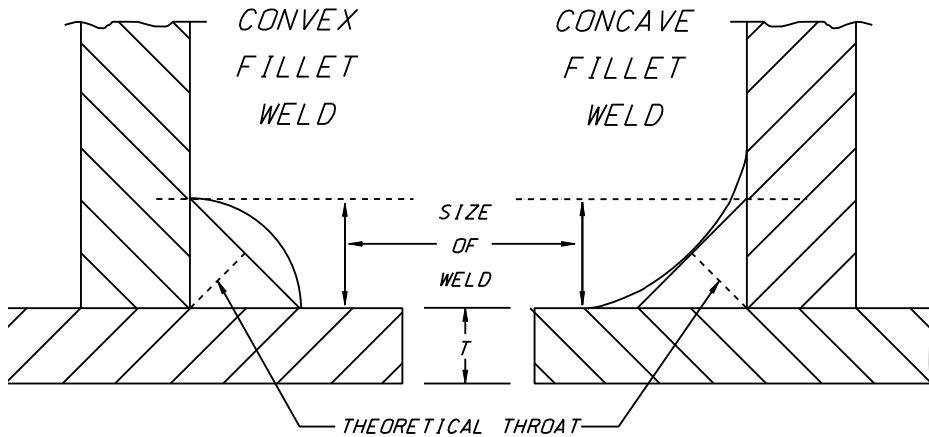


Fig 2

\*\* **E. Filler Metal**

The welding puddle shall take up the entire width and depth of the groove or gap, as it is carried around the joint, so that the entire weld is completed with a single layer of filler metal.

The final configuration of a butt weld shall completely fill the groove with a slightly convex section rising from 1/16" to 1/8" above the surface of the adjacent base metal. The final configuration of a fillet welded joint shall be concave to slightly convex as shown in Figure 2.

<u>Pipe Wall Thickness</u>	<u>Rod AWS No.</u>	<u>Rod Size</u>
.109 to .125	RG 60	1/8"
.126 to .218	RG 60	1/8", 5/32", or 3/16"

\*\* Essential Variable

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**F. Flame Characteristics**

The flame used for welding shall be neutral or have a slight excess of oxygen, depending on the type of rod used. The size of the welding tip and the gas pressure shall be that recommended by the torch manufacturer.

**G. Storage of Welding Rods**

Welding rods shall be stored in unopened containers whenever possible to prevent deterioration. Rods which show signs of deterioration or damage shall not be used.

\*\* **H. Position**

The welding shall be done with the axis of the pipe deviating not more than 30° from the horizontal position. Roll welding is permitted as described in the current edition of API Standard 1104. Vertical welding is permissible but shall be kept to a minimum.

\*\* **I. Direction of Welding**

The welding technique employed may be either a "backhand" or a "forehand" technique, depending on the type of work being performed and the qualifications of the welder.

The welding shall be continuous around the joint where possible so that the entire weld is completed with a single layer of filler metal. Where not possible, an uphill weld method shall be used. The advancing edge of the puddle shall be carefully controlled so as to insure thorough fusion at the sides and the bottom of the welding groove. Tack welds shall be thoroughly fused with the rest of the weld but need not be melted out during the welding operation.

**J. Number of Welders**

One welder may be used for all oxy-acetylene welding.

**K. Lineup Clamp**

An external line-up clamp shall be used on all joints. There shall be a minimum of 3 tack welds completed before the clamp is loosened or removed.

The alignment of the abutting pipe ends shall be such as to minimize the offset between pipe surfaces. For pipe of the same nominal wall thickness, the offset shall not exceed 1/16 inch. Any greater offset caused by dimensional variations shall be equally distributed around the circumference of the pipe.

\*\* Essential Variable

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**L. Finished Welds**

The finished welds shall be of sound metal thoroughly fused to the ends of the pipe. The crown surface of a butt weld shall be built up over the pipe wall surface so there is at least 1/16" but not more than 1/8" of reinforcement. The welds shall have a width equal to approximately 3 times the pipe wall thickness for square cut pipe or a width of 1/8" wider than the width of the original groove for beveled pipe. There shall be no undercutting along the edges of the weld.

**M. Cleaning**

All rust, dirt, and foreign matter shall be removed from the bevel surface or ends of pipe before welding is started. Power tools may be used.

**N. Cooling of Welds**

No artificial cooling of welds such as quenching with water shall be permitted. Welds shall cool naturally in air.

**\*\* O. Speed of Travel**

Speed of travel shall be 1 to 2 inches per minute.

**P. Inspection and Repair of Defective Welds**

\* Each weld on distribution piping must be visually inspected by the welder prior to beginning the next weld. Defective Welds must be repaired or removed from the pipeline. Injurious defects shall be removed by chipping, grinding or oxygen gouging to clean, sound metal. All slag and scale shall be removed by wire brushing. Repaired areas shall be carefully inspected and no further repairs shall be allowed in repaired areas. Welds originally done by some other method (Arc or CO<sub>2</sub>) shall not be repaired using oxy-acetylene method. The following limits shall be used in determining the acceptability of welds:

**1. Inadequate Penetration and Incomplete Fusion**

Inadequate penetration is defined as the incomplete filling of the bottom of the weld groove with weld metal. Incomplete fusion is the lack of bond between beads or between the weld metal and the base metal. Any individual defect due to inadequate penetration or incomplete fusion shall not exceed 1/2 inch in length. There shall not be more than 1 defect per weld.

\* Revised text

\*\* Essential Variable

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**2. Burn-Through Areas**

A burn-through area is that portion in the root bead where excessive penetration has caused the weld puddle to be blown into the pipe. Any unrepaired burn-through shall not exceed 1/4 inch or the thickness of the pipewall, whichever is smaller. There shall not be more than one defect per weld.

**3. Undercutting**

Undercutting is the burning away of the side walls of the welding groove at the edge of a layer of weld metal, or the reduction in the thickness of the pipe wall adjacent to the weld where it is fused to the surface of the pipe.

There shall not be no undercutting permitted.

**4. Cracks**

Welds containing cracks, regardless of size or location, shall be considered defective and must be repaired or replaced.

**5. Combination of Defects**

Any combination of defects having a total length of more than 1/2 inch in 6 inches of weld length is unacceptable. Any combination of defects which totals more than 10% of the weld length of a joint shall cause the weld to be rejected.

**Q. Equipment**

Welding equipment shall be of a size and type suitable for the work and shall be maintained in such condition as to insure acceptable welds, continuity of operation and safety of personnel.

**R. Welding During Inclement Weather**

Welding shall not be done when the quality of the complete weld would be impaired by the prevailing weather conditions including, but not limited to air-borne moisture, blowing sand or dirt, or high wind. Wind shields may be used when practical.