

PACIFIC GAS AND ELECTRIC COMPANY
GAS OPERATIONS
GAS SYSTEM DESIGN DEPARTMENT

WELDING PROCEDURE AND CONSTRUCTION STANDARD
FOR WELDING NATURAL GAS PIPELINES BY
THE OXY-ACETYLENE WELDING PROCESS

1. SCOPE

- 1.1 The purpose of this standard is to establish the requirements for, and to define the limitations of, the oxy-acetylene welding process for welding on all natural gas piping systems. Included in this standard are instructions applicable to welding procedure, preparation for materials and work methods, welding technique, design of welded joints, and qualification of operators.

This standard complies with Paragraph 824 of CPUC General Order 112.

- 1.2 No deviations shall be made from this welding standard except as may be authorized by the Manager of the Gas System Design Department.

2. WELDING PROCEDURE

2.1 Process

Pipe 6" and smaller designed to operate at stress levels under 20% may be welded by the oxy-acetylene process. Larger sizes shall normally be arc-welded in accordance with a procedure generally following the methods outlined by SP 1602.

2.2 Method

Oxy-acetylene welding of piping may be performed by either the fore-hand or backhand method.

2.3 Materials and Equipment

- 2.3.1 The welding rod type shall meet the requirements of AWS Class GA60. Sizes shall be as specified in Paragraph 2.6.
- 2.3.2 This process is limited to use on pipe manufactured to API-5L, 5LX, and ASTM-A-106 specifications, and fittings manufactured from ASTM-A-106 Grade A and B seamless pipe materials.
- 2.3.3 This process shall be limited to use on wall thicknesses not to exceed 0.375".
- 2.3.4 Welding torch tip size shall be used as specified in Paragraph 2.6.
- 2.3.5 Only approved oxygen and acetylene regulators shall be used.

- 2.3.5.1 Acetylene shall not be utilized at a pressure in excess of 15 psi gauge pressure.
- 2.3.5.2 Oxygen and acetylene regulator settings for welding should have equal pressure settings unless manufacturer's recommendations specify otherwise.
- 2.3.6 Flame characteristics should be neutral to slightly carburizing.
- 2.3.7 All tools and equipment used in welding operations shall be in first-class operating condition and shall be of a capacity suited to the work for which they are employed.
- 2.3.8 Suitable wind guards and welders' platforms shall be provided for use where conditions require.

2.4 Weld Preparation

- 2.4.1 All oxides and foreign matter shall be removed prior to welding. The surfaces shall be smooth, uniform, and free of materials which might adversely affect the welding operation.
- 2.4.2 Before the lengths of pipe are welded together, all loose rust, debris, and dirt shall be removed from the inside of the pipe.
- 2.4.3 The weld design requirements for end bevels, fillet welds, fitting joints, and branch connections are specified by Drawing 083718 (Page 4). All end treatments shall be prepared in conformance with these design requirements.
- 2.4.4 When unequal wall thickness are joined, the external offset shall not exceed 1/8 inch, and internal offset shall not exceed 3/32 inch. If these values are exceeded, the excess thickness of the heavier end shall be machined or ground back from the bevel on a four-to-one taper.
- 2.4.5 Use of a line-up clamp is optional. Two-inch and three-inch pipe shall be tack welded at a minimum of two points and welding commenced at a third point. Four- and six-inch pipe shall be tack welded at a minimum of three points and welding commenced at a fourth point.
- 2.4.6 Adequate working clearance shall be provided around the pipe at all joints to be welded.

2.5 Welding Technique

2.5.1 Horizontal Welds (Position Butt Welds)

Horizontal welds shall be completed by the forehand process. Roll welds may be made where conditions allow the practice. The pipe shall be adequately supported and alignment maintained during welding.

2.5.2 Vertical Welds

Vertical welds may be completed by the forehand or backhand process. The pipe shall be adequately supported and alignment maintained during welding.

2.5.3 Fillet Welds

2.5.3.1 The shape and dimensions for fillet welds shall be as shown on Drawing 083718 (Page 4).

2.5.3.2 The weld design requirements prescribed by Drawing 083718 (Page 4) shall be used for all fillet welds, including those used to attach flanges, fittings, sleeves, patches, and branch connections.

2.5.4 Stress-relief

Stress-relief is not required.

2.5.5 Cooling

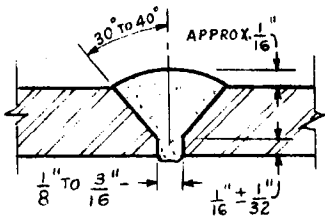
There shall be no accelerated cooling of the weld joint until the temperature of the joint is below 600°F.

2.6 Table 1

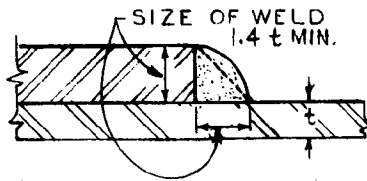
Table 1 gives the tabulation of welding tip orifice size, weld rod size, and pipe bevel recommended for each range of pipe diameters.

TABLE 1

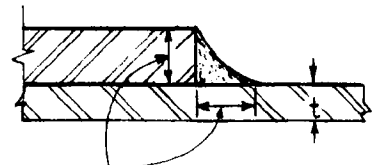
Type of Weld	Pipe Size	Welding Tip Orifice Size	Size of Welding Rod	Pipe Bevel	Flame Characteristics
BUTT WELDS	3/4" thru 2"	56 - 51	1/8"	30°-40° ↓	Neutral or Slightly Carburizing ↓
	3"	51 - 46	1/8" or 3/16"		
	4" thru 12"	51 - 43	1/8" or 3/16"		
VERTICAL WELDS	3/4" thru 2"	56 - 51	1/8"	↓	↓
	3"	51 - 46	1/8" or 3/16"		
	4" thru 12"	51 - 43	1/8" or 3/16"		
FILLET	2"	53-- 46	1/8" or 3/16"	45° ↓	↓
	3" thru 12"	49 - 43	1/8" or 3/16"		
BRANCH CONNECTION	3/4" thru 1"	56 - 51	1/8"	↓	↓
	2"	51 - 46	1/8" or 3/16"		
	3" thru 12"	49 - 43	1/8" or 3/16"		



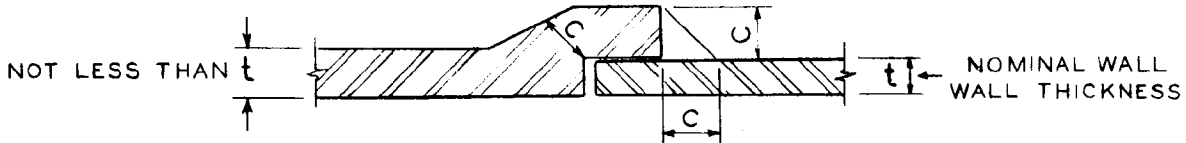
BUTT JOINT WELD



CONVEX FILLET WELD

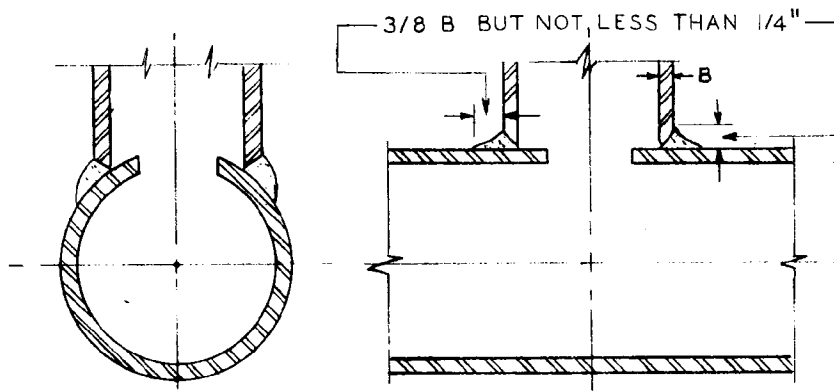


CONCAVE FILLET WELD

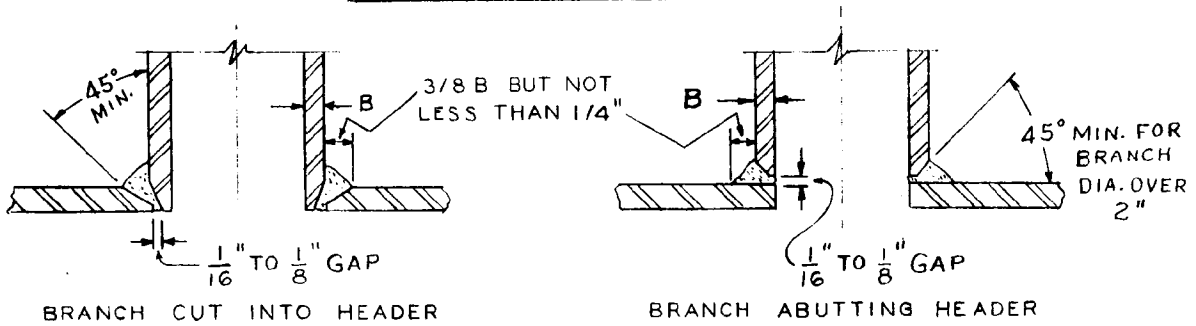


C = MINIMUM = $1.4t$ BUT NOT LESS THAN $\frac{5}{32}$ "

SOCKET WELDING ONLY

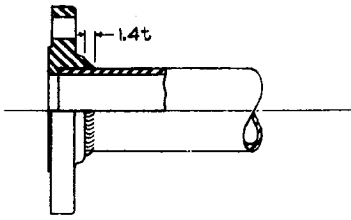


FITTING JOINT DESIGN

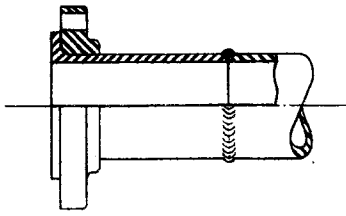


WELDING OF BRANCH CONNECTIONS JOINT DESIGN

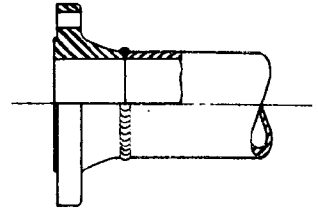
CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.
<p>APPROVED BY G.S.D.D. DR. CH. O.K. DATE 3-8-63 SCALE None</p> <p style="text-align: center;">GAS STANDARD WELD DESIGN</p> <p style="text-align: center;">PACIFIC GAS AND ELECTRIC COMPANY SAN FRANCISCO, CAL.</p> <p style="text-align: right;">SUPERSEDES SUPERSEDED BY SHEET No. 083718 SHEETS DRAWING NUMBER CHANGE</p>							



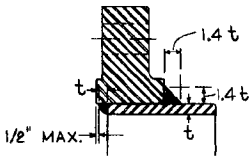
SOCKET WELDING FLANGE



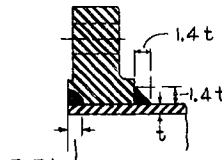
LAP JOINT FLANGE



BUTT WELDING FLANGE

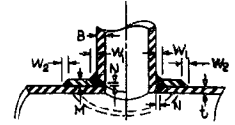


FRONT AND BACK WELD



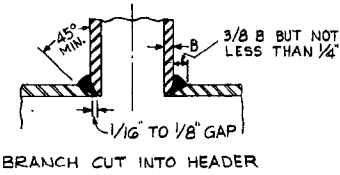
FACE AND BACK WELD

SLIP ON FLANGES

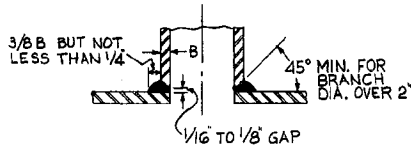


W_1 (MIN.) = $3/8 B$ BUT NOT LESS THAN $1/4$ "
 W_2 (MIN.) = $1/2 M$ BUT NOT LESS THAN $1/4$ "
 OR t WHICHEVER IS SMALLER
 $N = 1/16$ (MIN.), $1/8$ (MAX.)

PAD TYPE REINFORCEMENT

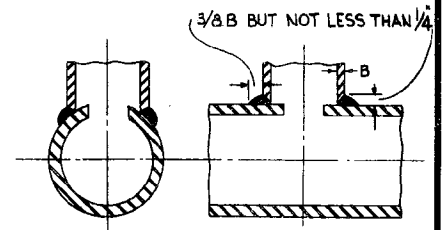


BRANCH CUT INTO HEADER

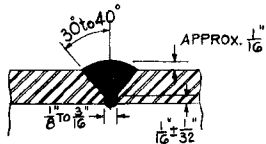


BRANCH ABUTTING HEADER

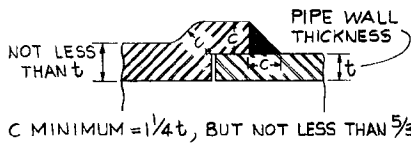
WELDING OF BRANCH CONNECTIONS JOINT DESIGN



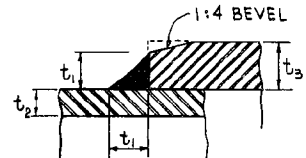
FITTING JOINT DESIGN



BUTTJOINT WELD



PIPE WALL THICKNESS
 C MINIMUM = $1/4 t$, BUT NOT LESS THAN $5/32$ "
 SOCKET WELDING ONLY



SLEEVE ATTACHMENTS
 t_1 SHALL NOT BE GREATER THAN $1.4 t_2$.
 IF t_3 EXCEEDS t_2 BY MORE THAN 1.4, THE
 EDGE SHALL BE BEVELED ON A 1:4 TAPER.

APPROVED									
CHG.	DATE	DESCRIPTION				BY	CH.	APPROD.	

SUPERV. BY DEPT. OF G.O.	
DRGN.	
DR.	
CH.	
O.K.	
DATE	SCALE
12-17-64	NONE

GAS STANDARD
**ATTACHMENT DETAILS
 USING BUTT OR FILLET WELDS**

PACIFIC GAS AND ELECTRIC COMPANY
 SAN FRANCISCO, CALIFORNIA

SUPERSEDES 083718	
SUPERSEDED BY	
SHEET NO.	SHEETS
DRAWING NUMBER	CHANGE
283263	

3. OPERATOR QUALIFICATIONS

3.1 Procedure

The procedure for making welds shall be as specified in Paragraph 2 of this standard.

3.2 Qualification

The requirements for qualifying test welds and keeping of records of operator qualification are specified by SP 1601.

APPROVED



DATE 8/12/63


Vice-President - Gas Operations