1.0 SCOPE

1.1 This standard shall be included as a part of all Welding Procedure Specifications used on natural gas facilities governed by CPUC GO 112 (latest revision), Subpart E and the edition of API Standard 1104 code referenced in Appendix A of GO 112.

1.2 Material to be welded by procedures given in this standard includes the following:

1.2.1 Pipe: API 5L, Gr.B & A-25
API 5LX, Gr.X-42 up to and including X-65
ASTM A-53, Gr.B
ASTM A-106, Gr.B

1.2.2 Fittings: ASTM A-516, Gr.70
ASTM A-242
ASTM A-441
ASTM A-633, Gr.E
ASTM A-234, Gr.WPB
ASTM A-105

Any exceptions shall be noted in the particular welding procedure specification.

1.3 All welding on pipe and fittings that are not under pressure shall be done using detailed procedure specifications established, qualified, and recorded in accordance with GO-112 and the API 1104 code.

1.4 Changes to these welding standards shall be approved by the Gas Systems Design Department.

2.0 WELDING SPECIFICATIONS

2.1 Process

2.1.1 All piping and fittings designed to operate at 20% or more of SMYS, regardless of size, shall be welded by using one or a combination of the following processes:

2.1.1.1 Shielded metal arc welding (SMAW);

2.1.1.2 Gas metal arc welding (GMAW);

REGISTERED PROFESSIONAL ENGINEER
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No. 10689
MECHANICAL
STATE OF CALIFORNIA

APPROVED BY										
LWH	RLH	2	8-10-84	Revised entire standard						
PAL	JAF	1	6-80	Rev'd Par. 2.7.2, 2.7.3 & 2.8.2 Added 2.12.2						
PEL	RCB	0	1-20-77	Issued for use						
TET	PEH	REV.	DATE	DESCRIPTION	GM	DWN.	CHKD.	SUPV.	APVD.	

GM CJT	PIPING - DATA SHEET	B/M	
SUPV.	ARC WELDING PROCEDURE	DWG. LIST	
DSGN.	ALL STRESS LEVELS	SUPSDS	
DWN.	GAS STANDARD	SUPSD BY	
CHKD.		SHEET NO. 1 of 9 SHEETS	
O.K.		086432	REV. 2
DATE 9-13-76 / SCALE	PACIFIC GAS AND ELECTRIC COMPANY SAN FRANCISCO, CALIFORNIA	MICROFILM	

62-1804 Rev 7-75

2.1.1.3 Flux cored arc welding (FCAW);

2.1.1.4 Gas Tungsten arc welding (GTAW); or

2.1.1.5 Submerged arc welding (SAW).

2.1.2 Piping 2" nominal diameter and smaller with a maximum wall thickness of 0.154" and designed to operate at stress levels over 20% of SMYS may be oxyacetylene welded in accordance with Gas Standard D-20.

2.1.3 Piping 4" nominal diameter and smaller with a maximum wall thickness of 0.188" and designed to operate at stress levels under 20% may also be oxyacetylene welded in accordance with Gas Standard D-20.

2.1.4 Shielded metal arc welding of high-pressure piping shall be performed according to drawings 284361 (Weld Design with Cellulose Type Electrode) and 284364 (Weld Design with Low Hydrogen Electrode) of this standard.

2.1.5 Piping designed to operate at less than 20% SMYS may be welded using any of the above methods.

2.2 Weld Preparation

2.2.1 Welding electrodes shall conform to AWS Specification A-5.1 and A-5.5. Refer to drawings 284361 and 284364.

2.2.2 All tools and equipment used for welding shall be of a capacity suited to the work to be performed.

2.2.3 The welding operation must be protected (shielded) from weather conditions (rain, snow, ice, or high winds) that would impair the quality of the completed weld.

2.2.4 Prior to welding, the weld groove and the adjacent surfaces 1" from it shall be cleaned and kept free of all dirt, paint, rust, scale, moisture, oil, grease, or other foreign material harmful to welding. Clean by filing, hand or power wire brushing or grinding, and approved solvents. Acceptable solvents for cleaning and drying are alcohol (methanol or ethanol) or acetone. Do not expose these solvents or their fumes to open flame, arcs, or hot surfaces.

2.2.5 Before sections of pipe and fittings are assembled for welding, all rust, scale, slag, dirt, liquids, or other foreign matter shall be removed from the inside surface of the pipe by swabbing with clean rags or by other acceptable methods. Responsible person(s) on the job shall insure compliance with this requirement.

2.2.6 Pipe and/or fittings joined by welding shall be aligned to minimize any offset (high-low) of pipe wall surfaces around the circumference of the pipe. For joining pipe and/or fittings of the same nominal wall thickness, the internal offset shall not exceed 1/16". If the pipe or fitting ends are defective or damaged (scratches, gouges, dents, etc.), the ends shall be rebeveled. For joining pipe of unequal wall thickness, the internal offset shall not exceed 3/32". If this value is exceeded refer to drawing 084033 of this standard. External offset shall be limited to the out-of-roundness and pipe and fitting end diameter tolerances given in the material specifications.

2.2.7 All hammers used for aligning pipe and fittings must be bronze or brass faced. Care should be exercised to avoid denting, gouging, or scratching the pipe and/or fittings.

2.2.8 When aligning abutting lengths of pipe for welding, the longitudinal seams shall be staggered, (no closer than 3") within the top quadrant (10 to 2 o'clock).

2.2.9 A lineup clamp shall be used on pipe with a diameter 3" and larger. The lineup clamp shall be left in place until the stringer bead is at least 50% completed and equally deposited around the weld groove. No stress (movement) should be placed on the weld groove until the stringer bead is completed.

2.2.10 The minimum separation between any two circumferential welds, wherever possible, shall be:

2.2.10.1 One pipe diameter for welds on pipelines other than station piping but never less than 3 inches (except as allowed by paragraph 2.2.10.3 below).

2.2.10.2 Six inch for station piping or fabricated assemblies 6" nominal O.D. and larger; one pipe diameter for piping smaller than 6" nominal O.D.

2.2.10.3 One inch, as measured along the inside arc radius of any welding elbow and transverse segments of these elbows 2" or more in nominal diameter (GO 112, latest revision, paragraph 192.313 (c)).

2.2.11 Adequate working clearance shall be provided and maintained around the pipe and/or fittings at all points to be welded so that the work can be performed safely.

2.3 Preheating

2.3.1 A preheat of 200°F minimum to 400°F maximum must be achieved and maintained until completion of welding when any of the following conditions exist:

2.3.1.1 When pipe or fitting wall thickness (regardless of pipe grade) is greater than 0.500".

2.3.1.2 When the pipe or fitting surface temperature at the weld area is less than 50°F.

2.3.1.3 When carbon content heat analysis exceeds 0.32%.

2.3.1.4 When carbon equivalent, C.E. (C.E.% = carbon % + 1/4 manganese %), exceeds 0.65%.

Note: Pipe material meeting API 5L, 5LX and ASTM A-53 or A-106, Gr.B specifications does not exceed the above chemical limits required for preheat. Certain fitting materials may exceed the limits and therefore would require preheat.

2.3.1.5 When weld defects are being repaired.

2.3.2 The preheated area shall be at least six inches wide, centered about the weld, and shall extend around the entire circumference of the pipe or fitting.

2.3.3 Preheat temperature shall be checked with temperature sensitive crayons, such as "Tempilstick," or contact pyrometer , at the weld area, outside of the weld groove.

2.3.4 If welding is interrupted, the weld area shall be preheated before welding is resumed.

2.3.5 Interpass temperature is the temperature of the weld area between depositing weld beads. Minimum interpass temperature shall comply with minimum preheat temperature requirements given in 2.3.1 above.

2.4 Stress Relieving

2.4.1 Stress relieving shall be required under the following conditions:

2.4.1.1 When the carbon content of the pipe or fitting material by heat analysis exceeds 0.32% or the carbon equivalent (C + $\frac{1}{4}$Mn) exceeds 0.65% (Pipe meeting API specifications 5L or 5LX and ASTM A-53 or A-106, Gr.B does not exceed these limits. Certain fitting materials may exceed these limits and therefore would require stress relieving.)

2.4.1.2 When the wall thickness of the pipe or fitting being welded is 0.750" or greater, unless approved by Gas System Design Department. Mandatory for all thickness 1-1/4" or greater.

2.4.1.3 When couplings, weldolets, or socket-weld fittings larger than 2" are welded to a header wall with a thickness 0.750" or greater, unless approved by Gas System Design Department.

2.4.2 Stress Relieving Temperature

2.4.2.1 For welding being performed under API specifications as in this standard, heating to stress relieving temperatures shall be done uniformly at a rate suitable to the type of equipment being used. For welds to ASME specifications, heat uniformly at a rate not to exceed 600°F per hour below 600°F, and not to exceed 400°F per hour above 600°F.

2.4.2.2 The weld being stress relieved shall be held in the range of 1100°F - 1200°F for a period of one hour per inch of wall thickness, but in no case less than 45 minutes.

2.4.2.3 After stress relieving is completed, the weld shall be cooled to 600°F at a cooling rate not to exceed 500°F per hour. From 600°F, the weld may be cooled in still air. Accelerated cooling is not allowed.

2.4.2.4 The minimum width of the area to be stress relieved on each side of the weld shall be equal to four times the wall thickness, or two inches, whichever is greater.

2.4.3 Equipment for Local Stress Relieving

Stress relieving may be accomplished by electric induction, electric resistance, oxyfuel-fired ring burners, exothermic chemical reactions, or other suitable means of heating in compliance with paragraph 2.4.2 of this standard.

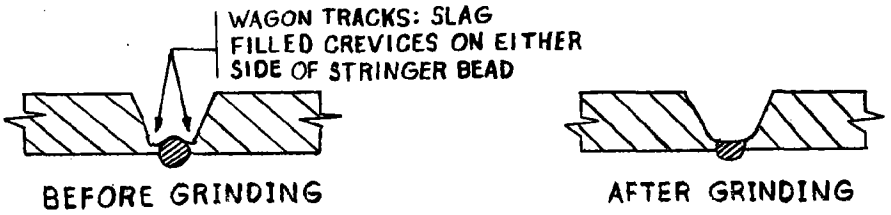
2.5 Horizontal and Vertical Fixed Position Welding - Cellulose-Type Electrode

Horizontal and vertical fixed position shielded metal-arc welding with cellulose-covered electrodes (AWS E6010, E7010, or E8010) shall be performed by the "downhill" method. Refer to drawing 284361 for the proper electrode to use with specific materials.

2.5.1 Depositing Stringer Bead and Hot Pass

The amount of root opening (gap) will usually equal the dimension of the root face (nose), but should suit the preference of the welder responsible for the integrity of

the stringer bead. During alignment and tacking, the joint is held together by a lineup clamp. Care must be taken during joint alignment and preparation to ensure full penetration and complete fusion during stringer bead (root pass) deposit. Strike the arc in the weld groove only. The stringer bead is made using a drag technique (electrode coating resting on the bevel as the electrode is dragged downhill). Thoroughly clean the stringer bead before applying hot pass (second bead). Disc grinding is used to remove bumpy starts and slag, improve bead contour, or remove excessive wagon tracks before applying the hot pass.



Applying the hot pass with sufficient heat (amperage) will melt out shallow wagon tracks and float any remaining slag to the surface. Use a slight up and down whipping motion. Start the hot pass immediately after completion of the stringer bead - within five minutes.

2.5.2 Filler and Cover Passes

A side-to-side weave motion is used when applying the filler passes. Before applying the cover pass, it is sometimes necessary to add filler metal to the concave portion of the filler passes. On heavy wall pipe and fittings where the welding groove is wide, more than one bead per layer shall be used for filling and capping in the "downhill" direction (does not apply to low hydrogen electrodes - see Section 2.6.8.2). Exceptionally wide "downhill" wash passes shall not be permitted. Two beads shall not be started at the same location. The face of the completed weld should be approximately 1/8 to 3/16 inch greater than the width of the original groove. At no point shall the crown surface be below the outside surface of the pipe, nor should it be raised above the parent metal more than 3/32 inch. The completed weld shall be thoroughly brushed and cleaned.

2.6 Horizontal and Vertical Fixed Position Welding - Low-Hydrogen Electrodes

2.6.1 To perform properly, low-hydrogen electrodes must be stored and handled in a manner which will prevent absorption of moisture. These electrodes shall either be stored in their manufacturer's unopened containers, or once opened, in holding ovens. Electrodes in unopened sealed containers remain dry indefinitely under good storage conditions. The storage area should be enclosed, clean, dry and have adequate facilities for safe storage to prevent deterioration.

2.6.2 If used immediately, low-hydrogen electrodes may be issued for use directly from freshly opened hermetically sealed containers. The remaining electrodes shall be removed from their containers and placed in a electric holding oven or portable rod warmer and held at a temperature of 250°F to 350°F.

2.6.3 Electrodes shall be withdrawn from the holding oven or portable rod warmer in small quantities and used immediately.

2.6.4 The electric holding oven or portable rod warmer shall be powered by a reliable electric source.

2.6.5 Electrodes shall not be exposed to moisture. They shall not be used after having been removed from their sealed containers or holding oven for a period exceeding four hours. If the low-hydrogen electrode container is punctured and exposed to air for a few days, or stored sealed for long periods of time in areas of high humidity, weld quality will be adversely affected.

2.6.6 Electrodes subjected to the conditions described in paragraph 2.6.5 must be dried or discarded. Electrodes are dried by baking them in an electric oven at 700°F to 800°F for a minimum of one hour. They should then be transferred to a holding oven and held there until used. Discard any electrodes whose coating becomes fragile and flakes or breaks off while welding or that develops a noticeable difference in handling or arc characteristics.

2.6.7 All welders who become qualified to use low-hydrogen electrodes shall be thoroughly instructed in storage and handling requirements and be equipped with an electric heater or portable electrode warmer. Low-hydrogen electrodes shall always be issued in portable rod warmers, or the electrodes shall be returned to the heated storage oven within the time specified in par. 2.6.5.

2.6.8 Welding Technique with Low-Hydrogen Electrodes. (Refer to Drawing 284364)

2.6.8.1 The stringer bead and hot pass shall be made using shielded metal-arc welding with E6010(5P) E7010 (HYP) or E8010 (70+) downhill.

2.6.8.2 Filler and cover passes are made using E7016 or E7018, welding uphill, on horizontally fixed pipe or fittings. On heavy wall pipe or fittings (greater than Schedule 40) where the weld groove is wider than normal, more than one pass per layer shall be used. If the weave motion is used, it shall be no wider than three times the diameter of the low hydrogen electrode used. On pipe or fittings in the vertical fixed position, each weld layer shall be deposited with multiple passes in the horizontal plane. Wash passes shall not be permitted.

2.7 Roll Welding

Roll or flat welding is where the welding arc is struck on the top of the pipe or fitting and held there to deposit the bead as the pipe or fitting is steadily revolved. When applicable, roll welding will be permitted, provided alignment and support is maintained by roll-type positioners.

2.8 Fillet Weld

The bead shape of all fillet welds shall be flat or slightly convex with the length of each weld leg equal. All attachments using fillet welds shall be in accordance with drawing 283263 sheet 2 of 2 of this standard.

2.8.1 When welding slip-on flanges to pipe, the inside weld joining the pipe end to the flange's inside diameter bore surface shall be completed first, followed by the weld at the outside of the flange to the outside circumference of the pipe as shown on drawing 283263, sheet 2 of 2.

2.8.2 Fillet welds attaching supports and other non-pressure attachments to pressure piping are limited to piping and fitting materials with less than 46,000 psi SMYS operating under 50% of SMYS and shall not exceed 3/8" leg size and 2" in weld length.

2.9 Back-welding When Joining Unequal Wall Thicknesses

2.9.1 Back-welding and end preparation when joining unequal wall thicknesses shall be performed as specified on drawing 084033 of this standard. Before back-welding, disc grind or wire buff loose scale from the backside of the weld groove.

2.9.2 Back-welding shall be done using SMAW welding with E6010, E7010, or E8010 electrodes. Use a small weave to penetrate and fuse the backside of the weld groove. Back-weld bead width and height should exceed minimum requirements shown on drawing 084033 by as small a margin as practical. If a second fill pass is needed, this pass should form a smooth transition from one side of the pipe to the other. Do Not Overweld.

2.9.3 When valves and fittings are welded to each other or to pipe, the joint shall have a two pass weld on the inside in addition to the outside weld. This requirement applies to all welds on pipe 16" diameter and larger and to smaller diameters when practical.

2.10 Repair or Removal of Defects and Cracks

2.10.1 With the exception of shallow crater cracks, no weld containing cracks, regardless of size or location shall be acceptable. All welds containing cracks and other unacceptable defects that are detected during or after welding shall be repaired or removed. A weld must be removed if it has a crack that is more than two inches long or that penetrates either the root or second bead. Oxy-fuel gas gouging (flame gouging) and air carbon-arc gouging, grinding, chipping, or machining are acceptable methods for removing cracks and other defects. The repair cavity shall be finished by grinding, filing or machining to bright clean base metal. After removing defect(s), other than cracks, the area shall be examined visually to verify that the defect(s) have been completely removed. Crack(s) that are removed require that the repair groove be examined by a magnetic particle or dye penetrant test to assure complete removal of the crack(s).

2.10.2 Prior to welding, the surfaces to be welded shall be cleaned using the procedures given in Par. 2.2.4.

2.10.3 Preheating of the segment(s) to be repaired is required per Par 2.3. Post-weld heat treatment, and nondestructive examination shall be the same as required for the original weld joint. If the repair is not acceptable, the weld must be removed.

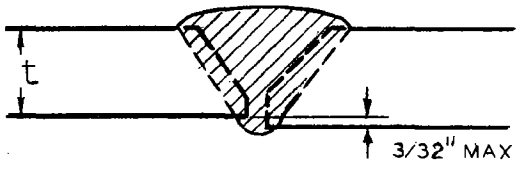
2.11 Identification of Welds

Where the number of welders makes identifying a welder's work difficult, the welder shall identify his work by marking it with his assigned number or initials using soapstone, yellow lumber crayon or other suitable marker.

D-22

PAGE 10

THIS JOINT DESIGN NOT FOR USE WHERE THICKER PIPE WALL HAS LOWER YIELD STRENGTH. A JOINT OF THIS TYPE COULD BE USED WHERE LOCATION CLASS CHANGES.



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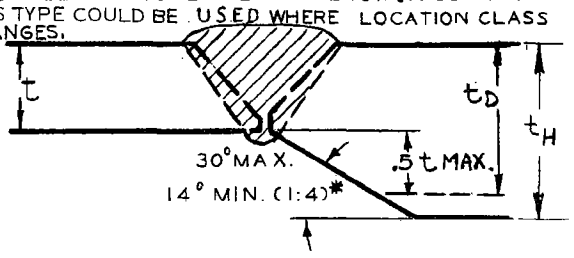

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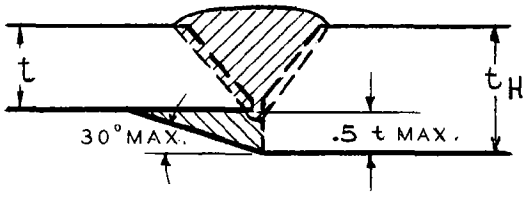

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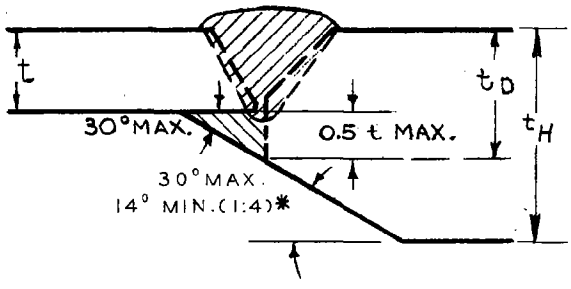

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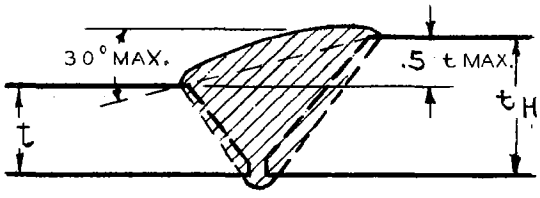

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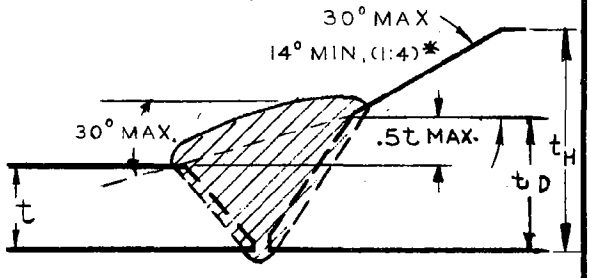

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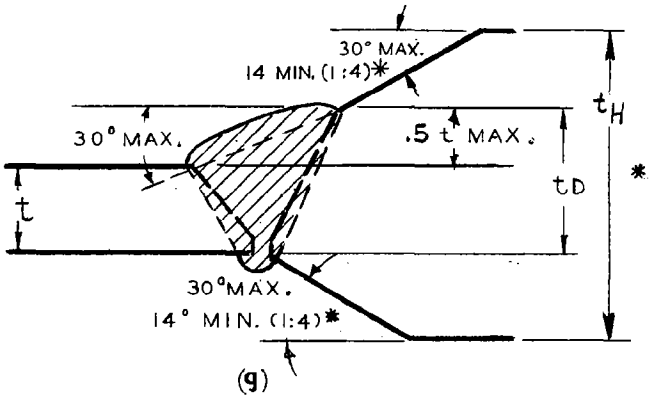


(g)

t_D = WALL THICKNESS REQUIRED FOR DESIGN PURPOSES FOR HEAVY WALL PIPE WHICH IS BEING JOINED TO THINNER PIPE. t_D MAY NOT EXCEED 1.5t.

t_H = ACTUAL WALL THICKNESS OF HEAVIER WALL PIPE.

* NO MIN. WHEN MATERIALS JOINED HAVE EQUAL YIELD STRENGTH

NOTE:

1. IF MATERIALS BEING JOINED HAVE DIFFERENT YIELD STRENGTHS, RATIO OF HIGHER YIELD TO LOWER MUST NOT EXCEED 1.5. A TRANSITION PIECE OF INTERMEDIATE YIELD STRENGTH MAY BE USED. WELDING ELECTRODES MUST BE SUITABLE FOR HIGHEST YIELD IN EACH JOINT.

APPROVED BY	CHG.	DATE	DESCRIPTION	GM	BY	CH.	APPD.
	4	8-10-84	CHANGED PAGE NO. FROM 8 TO 10				
	3	12-20-76	REVISED TITLE, TRANSFERED FROM D-31; ADDED t_H		C.A.	HF	
	2	3-10-71	CHANGED PAGE NO TO 36				
	1	4-28-66	CODE ADDITION- ADD t_D				

SUPV. BY
DSGN.
DR.
CH.
O.K.
DATE 1-13-65
SCALE NONE

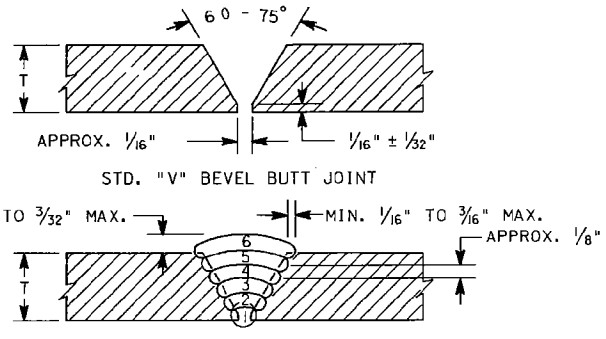
PIPING-DATA SHEET
END PREPARATIONS FOR JOINING UNEQUAL WALL THICKNESSES
GAS STANDARD

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

DRAWING LIST
SUPERSEDES
SUPERSEDED BY
SHEET NO. SHEETS
DRAWING NUMBER 084033
CHANGE 4

PRINTED ON DIEPO NO. 1000H CLEARPRINT

WELD DESIGN



SEQUENCE OF BEADS (NUMBER WILL VARY WITH CHANGE IN WALL THICKNESS, ETC)

WELD DETAIL

WELD LAYER	METHOD		ELECTRODE		RECOMMENDED	
	HORIZONTAL FIXED POSITION	* VERTICAL FIXED POSITION	CLASS	SIZE	AMPS	VOLTS
FIRST PASS	DOWNHILL	BEAD	TABLE I	ALL	100-170	26-28
HOT PASS (SEE NOTE 3)	DOWNHILL	BEAD	TABLE I	1/8" OR 5/32"	120-160	24-28
FILLER PASSES	DOWNHILL ▼	BEAD	TABLE I	ALL	140-180	24-28
COVER PASS	DOWNHILL ▼	BEAD	TABLE I	ALL	140-180	24-28

* WASH PASSES SHALL NOT BE ACCEPTABLE IN VERTICAL FIXED POSITION.
▼ EXCEPTIONALLY WIDE DOWNHILL WASH PASSES SHALL NOT BE PERMITTED.

TABLE I
SUITABLE ELECTRODES FOR WELDING VARIOUS MATERIALS

MATERIAL	ELECTRODE (AWS)
PIPE (SEE NOTE 4)	
API 5L, GR. B & A-25	E 6010
API 5LX, GR. X-42 THRU X-48	E 6010
API 5LX, GR. X-52 THRU X-60	E 7010
API 5LX, GR. X-65	E 8010
ASTM A-53, GR. B	E 6010
ASTM A-106, GR. B	E 6010
FITTINGS	
ASTM A-105	E 6010
ASTM A-234, GR. WPB	E 6010
ASTM A-242 & A-441	E 6010
ASTM A-516, GR. 70	E 6010
ASTM A-633, GR. E	E 7010

WHERE FITTINGS ARE TO BE WELDED IN PIPELINES, AND THE SUITABLE ELECTRODES AS GIVEN IN TABLE I ARE DIFFERENT, USE THE HIGHER STRENGTH ELECTRODES (I.E. E 7010 INSTEAD OF E 6010 OR E 8010 INSTEAD OF E 7010).

NOTES:

1. ALL CURRENT SHALL BE D.C. REVERSE POLARITY.
2. ELECTRODES:

	PG&E CODE NO.
3/32"E 6010 FLEETWELD 5P OR EQUAL	15-9252
1/8" E 6010 FLEETWELD 5P OR EQUAL	15-9026
5/32"E 6010 FLEETWELD 5P OR EQUAL	15-9027
3/16" E 6010 FLEETWELD 5P OR EQUAL	15-9028
1/8" E 7010 SHIELD ARC HYP OR EQUAL	15-9285
5/32"E 7010 SHIELD ARC HYP OR EQUAL	15-9286
3/16"E 7010 SHIELD ARC HYP OR EQUAL	15-9287
1/8" E 8010 SHIELD ARC 70+ OR EQUAL	15-9405
5/32"E 8010 SHIELD ARC 70+ OR EQUAL	15-9406
3/16" E 8010 SHIELD ARC 70+ OR EQUAL	15-9407

3. IF BACKWELDING, USE "HOT PASS" TECHNIQUES FOR (FIRST) BACKWELD PASS. USE CONVENTIONAL FILLER AND COVER TECHNIQUES, IF MULTIPLE PASSES ARE REQUIRED.
4. IN SOME OLDER PIPELINE INSTALLATIONS "PG&E SPECIFIED" PIPE WAS INSTALLED. THIS PIPE DOES NOT NECESSARILY COMPLY WITH API, ASTM OR ANY OTHER PIPELINE STANDARD. BEFORE WELDING ON "PG&E SPECIFIED" PIPE, CONSULT GAS SYSTEM DESIGN FOR THE PROPER WELDING PROCEDURES AND ELECTRODE(S) TO USE.

[270,170]841168.G24 8-3-84 BB

APPROVED BY							
EFO							
	1	8-3-84	ISSUE FOR USE-SUPERSEDED DWG. 084022; DEL'TD. NOTE 2 & RENUM'D; ADDED E8010 ELECTRODE TO NEW				
			NOTE 2; ADDED NOTE 4 & TABLE I.				
	REV	DATE	DESCRIPTION	DWN	CHKD	APVD	

REGISTERED PROFESSIONAL ENGINEER CHARLES J. TAYLOGIAN No. 10689 MECHANICAL STATE OF CALIFORNIA

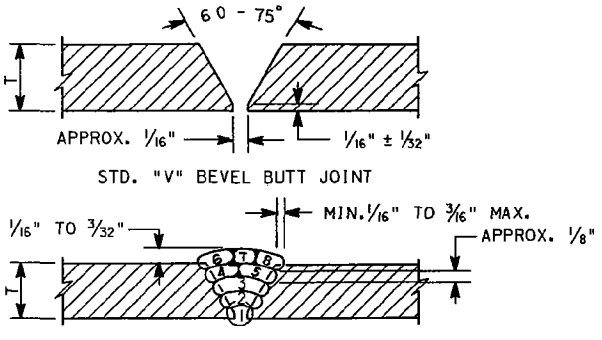
GM	
SUPV	
DSGN	
DWN	
CHKD	
O K	
DATE 8-3-84	SCALE NONE

PIPING-DATA SHEET
WELD DESIGN WITH CELLULOSE COATED ELECTRODES
GAS STANDARD
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO CALIFORNIA

SUPERSEDES	
SUPERSEDED BY	084022
SHEET NO. 1 OF 1 SHEETS	
DRAWING NUMBER	REV
284361	1
MICROFILM	

61-4345 REV. 7-75

WELD DESIGN



SEQUENCE OF BEADS (NUMBER AND POSITION WILL VARY WITH CHANGE IN WALL THICKNESS, ETC)

WELD DETAIL

WELD LAYER	METHOD		ELECTRODE		RECOMMENDED	
	HORIZONTAL FIXED POSITION	* VERTICAL FIXED POSITION	CLASS	SIZE	AMPS	VOLTS
FIRST PASS	DOWNHILL	BEAD	NOTE 5	ALL	100-170	26-28
HOT PASS ◪	DOWNHILL	BEAD	NOTE 5	1/8" OR 5/32"	120-160	24-28
FILLER PASSES	UPHILL	BEAD	E 7016 OR E 7018	1/8"	100-150	22-25
COVER PASS	UPHILL	BEAD	E 7016 OR E 7018	1/8"	100-150	22-25

* WASH PASSES SHALL NOT BE ACCEPTABLE IN VERTICAL FIXED POSITION.

◪ IF BACKWELDING, USE "HOT PASS" TECHNIQUES FOR (FIRST) BACKWELD PASS. USE CONVENTIONAL FILLER AND COVER TECHNIQUES, IF MULTIPLE PASSES ARE REQUIRED.

NOTES:

1. ALL CURRENT SHALL BE D.C. REVERSE POLARITY.
2. ELECTRODES SPECIFIED ARE SUITABLE FOR ALL A.P.I. GRADES THROUGH X-60.
3. HANDLING INSTRUCTIONS AND WELD TECHNIQUE IN SECTION 2.6 MUST BE FOLLOWED.
4. LOW HYDROGEN ELECTRODE IS RECOMMENDED ONLY FOR HIGH YIELD, HEAVY WALL PIPE FOR STATION PIPING, RIVER CROSSINGS OR OTHER LOCATIONS WHERE VIBRATION OR EXTERNAL LOADING MAY OCCUR. IT PRODUCES A MORE DUCTILE HIGH STRENGTH WELD WHICH GIVES SUPERIOR NOTCH STRENGTH. HOWEVER, THE LOW-HYDROGEN ELECTRODE (E-7016 OR E-7018) IS MORE TIME CONSUMING THAN THE CONVENTIONAL CELLULOSE ELECTRODE (E-6010, E-7010 OR E-8010) AND SHOULD BE USED ONLY WHERE SPECIFIED BY THE PROJECT ENGINEER. CONTACT THE GAS SYSTEM DESIGN DEPT. IF MORE INFORMATION IS REQUIRED.
5. FOR FIRST PASS AND HOT PASS, USE ELECTRODES AS SHOWN ON DWG. 284361.
6. LOW-HYDROGEN ELECTRODES: 1/8" E 7018 (ALT: E 7016) HOBART, AIRCO, ALLOY RODS, OR LINCOLN USE CODE 15-9194.

[270,170]841369.G24 8-9-84 RES

APPROVED BY							
BFO							
KDB							
RJD		1	8-9-84	SUPERSEDES DWG 086462			
		REV	DATE	DESCRIPTION	DWN	CHKD	APVD

REGISTERED PROFESSIONAL ENGINEER CHARLES J. TATEOSIAN No. 10639 MECHANICAL STATE OF CALIFORNIA

GM	
SUPV	
DSGN	
DWN	
CHKD	
O K	
DATE	8-9-84
SCALE	NONE

PIPING-DATA SHEET

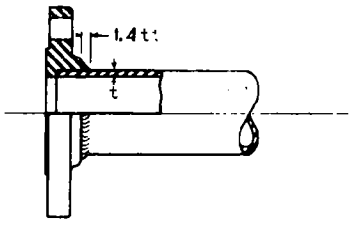
WELD DESIGN WITH LOW-HYDROGEN ELECTRODES

GAS STANDARD

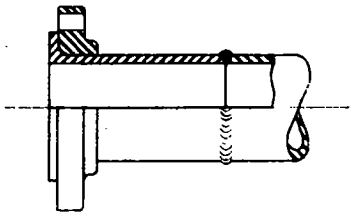
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO CALIFORNIA

SUPERSEDES	086462
SUPERSEDED BY	
SHEET NO. 1 OF 1 SHEETS	
DRAWING NUMBER	REV
284363	1
MICROFILM	

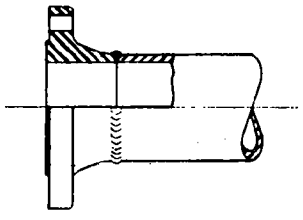
61-4345 REV. 7-75



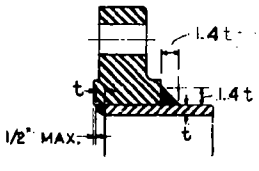
SOCKET WELDING FLANGE



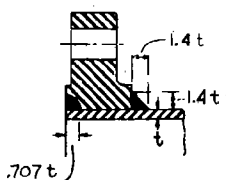
LAP JOINT FLANGE



BUTT WELDING FLANGE

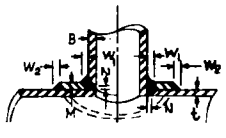


FRONT AND BACK WELD



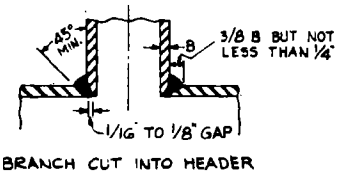
FACE AND BACK WELD

SLIP ON FLANGES

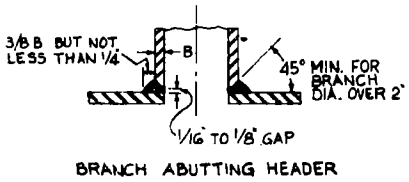


W_1(MIN.) = 3/8 B BUT NOT LESS THAN 1/4"
W_2(MIN.) = 1/2 M BUT NOT LESS THAN 1/4" OR t WHICHEVER IS SMALLER
N = 1/16"(MIN.), 1/8"(MAX.)

PAD TYPE REINFORCEMENT

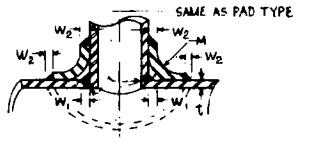


BRANCH CUT INTO HEADER



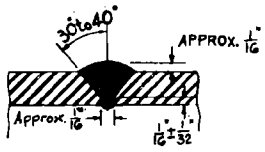
BRANCH ABUTTING HEADER

WELDING OF BRANCH CONNECTIONS JOINT DESIGN



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.)

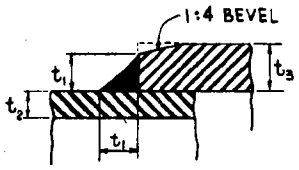
SADDLE TYPE REINFORCEMENT



BUTTJOINT WELD

C MINIMUM = 1¼t, BUT NOT LESS THAN 5/32"

SOCKET WELDING ONLY



SLEEVE ATTACHMENTS
$t_1 = 1.42t_2$

FOR ARC WELDING NATURAL GAS PIPELINES

APPROVED	5	11-29-76	Changed 1.4t to 1.2t-1/16"; transfered from D-31.	H.F.			
	4	4-20-73	Sleeve Attachment Revised From $t_1 \cong t_2$; Title Revised.	A.C.	A.N.K.		
	3	1-71	Added Saddle Type Reinforcement and new sheet	D.C.M.			
	2	6-70	Up dated and removed fitting joint design				
	6	8-10-64	CHANGED PAGE NO. FROM 11 TO 13; REVISED WELD DETAIL FOR SO & SW FLGS. & SLEEVE ATTACH'TS				
	CHG.	DATE	DESCRIPTION	BY	CH.	APPRD.	

REGISTERED PROFESSIONAL ENGINEER CHARLES I. TATEOSIAN No. 10689 MECHANICAL STATE OF CALIFORNIA

SUPERV. BY DEPT. OF G.O.		SUPERSEDES 083718	
DSGN.		SUPERSEDED BY	
DR.		SHEET NO. 2 OF 2 SHEETS	
CH.		DRAWING NUMBER	CHANGE
O.K.		283263	6
DATE 12-17-34	SCALE NONE		

PIPING-DETAILS

ATTACHMENT USING BUTT OR FILLET WELDS

GAS STANDARD

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA