WELDER QUALIFICATION AND CONSTRUCTION STANDARD FOR FIELD WELDING NATURAL GAS PIPELINES DESIGNED TO OPERATE AT 20% OR MORE OF THE SPECIFIED MINIMUM YIELD STRENGTH

1. SCOPE

1.1 The intent of this standard is to establish the welding procedure, the welder qualification, and the tests and inspection and procedures for welding all API 5L and 5LX grades of pipe material up to and including X60 on all natural gas lines operating at stress levels of 20% or more of the specified minimum yield strength to comply with California Public Utilities Commission General Order 112, Section 206.

1.2 Definitions pertaining to welding in this standard conform to the standard definitions contained in API Standard 1104, ~~7th Edition.~~ 10th

1.3 All procedures covered in this standard have been established and qualified in accordance with API Standard 1104, ~~7th Edition.~~ 10th

1.4 Any deviations from this welding standard shall be governed by the "Essential Variables" of API Standard 1104, ~~7th Edition,~~ and shall 10th be subject to approval by the Gas System Design Department.

2. WELDING PROCEDURE

2.1 Process

2.1.1 All butt welds in pipe shall be made by the shielded metal arc welding process. Piping in sizes 2" and under may be oxy-acetylene welded in accordance with procedure SP 1600.

2.1.2 Welding may be performed by semi-automatic or automatic processes providing the process is in compliance with a qualified and approved procedure.

2.2 Method

Shielded metal arc welding of high pressure piping shall be performed by the downhill method in accordance with Drawing 083466, Sheet 4.

2.3 Materials and Equipment

2.3.1 Welding electrodes shall conform to ASTM Specification A-233-58T Classification E-6010 for welding all API grades through X46 and E-7010 (See Drawing 083466 -1 Sheet 4) for all above X46 up to and including X60.

2.3.2 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.

2.3.3 Suitable wind guards and welders' platforms shall be provided for use when conditions require.

2.4 Weld Preparation

2.4.1 Prior to welding, all dirt, paint, rust, scale, grease, or other substance detrimental to welding shall be removed from the beveled ends of the pipe to be welded. In cleaning the beveled ends prior to welding, power driven grinders with abrasive fibre discs shall be used, and all paint shall be removed back from the beveled end for a distance of two inches.

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 by swabbing. The lineup foreman shall visually inspect the inside of each pipe section before the pipe is aligned to insure compliance with this requirement.

2.4.3 The weld design for welding shall be in accordance with Drawing 083466, Sheet 4.

2.4.4 For pipe of the same nominal wall thickness, the maximum offset or misalignment of the abutting pipe ends shall not exceed 1/16 inch. If the pipe ends are damaged or dented beyond these acceptable limits, they shall be cut off and rebeveled except minimum straightening of dented ends is permissible on pipe below grades X52. All hammers used for this purpose shall be faced with bronze or brass and due care shall be exercised to avoid abrasions.

2.4.5 When unequal thicknesses are joined by welding, 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 one-to-four taper.

2.4.6 A line-up clamp shall be used on pipe sizes 12" and greater. Line-up clamp shall be left in place until first pass or stringer bead is complete.

2.4.7 Adequate working clearance shall be provided around the pipe at all joints to be welded.

2.4.8 Where pipe is of the longitudinal-seam-weld type, the pipe welds shall be staggered within the top quadrant at least 3" apart where practicable.

2.5 Preheating

2.5.1 All welding on pipe having a wall thickness greater than 0.500 inch shall be preheated to between 200° F and 400° F prior to and during welding.

2.5.2 All grades shall be preheated to 200° F - 400° F when the pipe temperature is less than 50° F.

2.5.3 Preheating shall be done with an approved torch system or with electric equipment which will provide uniform heating.

2.5.4 The preheat area shall be at least six inches wide, centered about the weld and shall extend around the entire circumference of the pipe.

2.5.5 Preheat temperatures shall be checked with temperature-sensitive crayons, such as "Tempilstik", or by other approved methods.

2.5.6 If a weld requires preheating, the same temperature requirements shall be maintained for each succeeding pass.

2.6 Stress-Relieving

2.6.1 Stress-relieving shall be required under the following conditions:

2.6.1.1 When the carbon content of the pipe material by ladle analysis exceeds 0.32 percent or the carbon equivalent (C + 1/4 Mn) exceeds 0.65 percent.

2.6.1.2 When the wall thickness of the pipe being welded is 0.750 inch or greater.

2.6.1.3 When couplings, weldolets, or socket-weld-type fittings larger than two-inch pipe size are welded to a header with a wall thickness 0.750 inch or greater.

2.6.2 Stress-Relieving Temperature

2.6.2.1 Heating to stress-relieving temperature range shall be done uniformly at a rate not to exceed 600°F per hour. Above 600°F, the rate of heating shall not exceed 400° per hour.

2.6.2.2 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.

2.6.2.3 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.

2.6.2.4 The minimum width of the area to be heated on each side of the weld shall be equal to four times the wall thickness or three inches, whichever is greater.

2.6.3 Equipment for Local Stress-Relieving.

2.6.3.1 Stress-relieving may be accomplished by electric induction, electric resistance, fuel-fired ring burners, exothermic chemical reactions, or other suitable means of heating, provided that a uniform temperature is obtained and maintained during the stress-relieving.

2.6.3.2 The stress-relieving temperature shall be checked and recorded by the use of recording thermocouple pyrometers or other suitable equipment to insure that the proper stress-relieving cycle has been accomplished.

2.7 Welding Technique

2.7.1 Horizontal Roll Welds

When shielded metal arc welds are made in the horizontal rolled position, the first or stringer pass shall be deposited by the "downhill" method of welding while the pipe remains in a horizontal fixed position. Alternately, the joint may be adequately tack welded and the root pass may be made by roll welding.

For all remaining passes, the pipe may be horizontally rolled as the weld metal is deposited in the approximate top quadrant of the weld groove. The pipe shall be adequately supported and alignment maintained during welding.

2.7.2 Horizontal Fixed Welds (Position Welding)

2.7.2.1 When shielded metal arc welds are made with the pipe in the horizontal fixed position, all passes shall be deposited by the "downhill" method of welding. The cover passes may be deposited in beads or by a laced technique.

2.7.2.2 The first or stringer pass and the second or hot pass shall be completed before ending a day's work. Successive passes shall not be started at the same point.

2.7.3 Vertical Welds

When shielded metal arc welds are made with the pipe in an approximately vertical position, the deposition of weld metal shall be in successive passes deposited as beads in an approximately horizontal plane. The cover passes may be deposited as beads or by a laced technique.

2.7.4 Fillet Welds

2.7.4.1 When slip-on flanges are welded to pipe, the inside weld shall be made first, followed by the weld at the reverse or back side of the flange.

2.7.4.2 When coupling and socket-weld-type fittings are welded to piping, the weld leg size shall be 1.4 times the lesser ~~pipe~~ wall thickness.

2.7.4.3 All fillet welds shall be slightly concave and the length of each leg approximately equal.

2.7.4.4 Fillet welds attaching supports and other-non-pressure attachments to pressure piping when permitted shall not exceed 3/8 inch leg x 2 inches long weld size.

2.7.5 Treatment of Underside of Weld

2.7.5.3 Back welding the root bead shall be required on all welds on piping and fittings of different wall thickness that are accessible for inside welding. The root of the weld shall be ground to sound metal on the inside of the pipe and two passes shall be deposited. Inside weld passes shall be made by the "downhill" method of welding, using E-6010 electrodes.

2.8 Weld Identification

For quality control during construction each finished weld shall be clearly marked to identify the portion made by each welder. Die Stamping will not be permitted.

3. OPERATOR QUALIFICATION

3.1 Qualification Procedure

The procedure for making test welds shall be the same as specified in Section 2 of this standard.

3.2 Test Welds Required

The following test weld is required to qualify a welder:

Metal arc welders shall make one test weld in the horizontal fixed position, Paragraph 2.7.2, in accordance with drawing 083466, sheet 4. Qualification under this procedure shall also qualify a welder to make metal arc welds on all pipelines operating at stress levels less than 20% of specified minimum yield strength.

3.3 The testing spools shall be 8" or 16" pipe size in accordance with drawing 083466, sheet 5.

3.3.1 Qualification tests for shielded metal arc welding shall be performed on

a.) 8-5/8" O.D. x .375" Wall API-5LX Grd. X 42

Qualification under group (a) will qualify a welder in all pipe sizes up to and including 12-3/4" O.D. x .375" wall using pipe materials up to and including API -5LX Grd. X 42.

b.) 16" O.D. x .500" Wall API-5LX Grd. X 52

Qualification under group (b) will qualify a welder for all pipe sizes up to and including 36" O.D. x .500" wall and pipe materials up to and including API-5LX-Grd X 52

c.) Tests required for work on materials and thicknesses exceeding (b) above will be established by the Department of Gas System Design.

3.4 Test Specimens

3.4.1 Test specimens shall be cut from the test weld, as shown on drawing 083466, sheet 3.

3.4.2 Test specimens shall be prepared as shown on Drawing 083466, Sheet 2.

3.5 Testing

3.5.1 Visual Examination

A test weld with a non-uniform appearance or containing numerous visible surface defects may be rejected without mechanical testing.

3.5.2 Guided-Bend and Side-Bend Tests

Guided-Bend and Side-Bend specimens, with weld reinforcement removed, shall be tested in a guided-bend jig meeting the requirements of Drawing 083466, sheet 8.

The specimen shall be placed on the die of the testjig with the weld at mid-span. The face-bend specimen shall be placed with the face of the weld directed toward the gap and the root-bend specimen shall be placed with the root of the weld directed toward the gap. The plunger of the jig shall be forced into the gap until the curvature of the specimen is approximately U-shaped. The bend test shall be considered acceptable if no crack or other defect exceeding 1/8 inch in any direction is present in the weld metal or between the weld and the pipe material after bending. Each specimen subjected to the bend test shall meet the above requirements. Cracks which originate along the edges of the specimen during testing and which are less than 1/4 inch measured in any direction shall not be considered.

Side-bend test specimens shall be tested in the same jig. The specimen shall be placed on the die with the weld at mid-span and with the face of the weld at 90 degrees to the gap. The plunger shall be forced into the gap until the curvature of the specimen is approximately U-shaped. The results of the side-bend test shall be considered acceptable if no crack or other defect exceeding 1/8 inch in any direction is present in the weld metal or between

the weld and pipe material after bending. Each specimen shall meet the above requirements. Cracks which originate along the edges of the specimen during testing which are less than 1/8 inch shall not be considered.

3.5.3 Nick-Break Tests

Nick-break specimens with weld reinforcement intact shall be nicked through the center of the weld on both edges, in accordance with Drawing 083466, sheet 2, broken by pulling or hammer blows at the center or one end and examined visually.

The exposed surface of the specimen shall show not more than six gas pockets per square inch, with the greatest dimension not to exceed 1/16 inch. Slag inclusions shall not be greater than 1/32 inch in depth or 1/8 inch in width, and shall be separated by at least 1/2 inch of sound weld metal. Each specimen subjected to the nick-break test shall meet the above requirements.

3.5.4 Tensile Tests

Tensile-test specimens shall be approximately 1 inch wide and shall be prepared in accordance with Drawing 083466, Sheet 2. The weld reinforcements, both at the face and at the root of the weld, shall not be removed. Specimens may be oxygen-cut and no additional machining or preparation will be necessary, provided the sides are parallel and free from notches or unevenness which may adversely affect the test results.

Tensile test specimens shall be ruptured under tensile load. The tensile strength shall be computed by dividing the maximum load at failure by the least cross-sectional area of the specimen, as measured before load is applied. The tensile strength of each such specimen shall be equal to, or greater than, the minimum specified tensile strength of the pipe material. If the specimen breaks in the pipe metal outside of the weld or fusion line, the test shall be accepted as meeting the requirements.

3.5.5 Extra Test

If only one specimen is unacceptable, another specimen may be removed adjacent to the one that failed. Should this specimen also be unacceptable, the welder will be disqualified.

3.6 Qualification Retests

3.6.1 A welder who has been previously qualified and fails to meet the requirements for the re-qualification tests may be retested immediately.

3.6.2 A man who has not previously demonstrated his ability to weld and who fails to meet the requirements shall be required to have further training or practice before being retested.

3.6.3 The work of each welder shall be tested by requalification at intervals not exceeding one year. Welding requalification test shall also be required if there is some specific reason to question the welder's ability or the welder has not engaged in electric arc welding for a period of at least three months.

3.6.3.1 The welder may satisfy the above yearly requalification requirement provided his production welds have passed the radiographic examination prescribed herein once during the year.

3.7 Records

The pipeline welder qualification or requalification test, Form No. 75-292, Physical Test or Form No. 75-306, Radiographic Examination Test, shall be filled out for each welder and retained in either the Division Office or the Manager of Gas Construction files for two years. Each welder must pass the qualification test at intervals not to exceed 12 months.

4. FIELD INSPECTION

One or more of the following inspection methods must be used to establish quality control and insure adherence to welding procedures. Any weld not meeting the requirements of this specification may be either rejected or repaired.

4.1 Nondestructive Testing

Weld quality shall be checked by radiographic inspection. Defects located by radiography shall not exceed the limits of the "Standards of Acceptability" as outlined in Paragraph 5. All welds in piping systems operating at stress levels of more than 20% of the specified minimum yield

strength shall be inspected as follows:

4.1.1. On pipe sizes up to and including 10" nominal diameter, spot checking, using radiographic inspection procedures outlined in Paragraph 6 shall be used for up to 10% of the welds. For small extensions, or where the magnitude of work is such that it would be uneconomical to bring X-ray equipment to the job site, visual inspection will suffice.

4.1.2. On pipe sizes larger than nominal 10" diameter, spot-checking of 10% to 20% of the welds using radiographic procedures as outlined in paragraph 6 shall be employed.

4.1.3. On all pipe sizes designed to operate at a stress level of 60% or more of the specified minimum yield strength, the minimum inspection requirements for welds will be supplied by the Gas System Design Department.

4.1.4. Particular attention is directed to amount of inspection required by Paragraphs 828.2 and 206.1 of General Order 112. The total number of radiographic examinations should include the requirements of the above paragraphs with respect to tie-ins, tap lines, repaired areas and highway, river and railroad crossings.

4.2 Visual Inspection

Visual inspection of welds made in lieu of, or augmenting, radio-

graphic examinations in order to comply with the total requirements of paragraph 828.2 and 206.1 shall consist of:

4.2.1. Careful observation of the deposition of weld metal. Particular attention shall be directed to the first two passes, the cleaning between passes, and the finished appearance of the weld.

4.2.2. The dimension of the finished weld shall comply with drawing 083466, sheet 4.

The weld must be free of cracks, inadequate penetration, burning through and other defects, and it must present a neat workman-like appearance. Undercutting adjacent to the final bead on the outside of the pipe shall not exceed 1/32 in. in depth and there shall not be more than 2" of undercutting in 12 in. length of weld.

4.3 Additional Inspections

4.3.1. In addition to the foregoing requirements, additional finished welds shall be examined as an aid to quality control.

4.4 Record of Inspection

4.4.1. A record shall be made of the results of the test and type of inspection employed, for each new pipeline facility built in accordance with the conditions set forth in this Standard Practice.

4.4.2. All the information required herein shall be set forth

in Form No. 75-307.

4.4.3 This report shall be transmitted to the Plant Accounting Department and kept with the permanent plant records for the life of said pipeline facility.

5. STANDARDS OF ACCEPTABILITY

5.1 Pipe Defects

Laminations, split ends, or other defects in the pipe shall normally be cropped, repaired, or removed from the line. Should it be considered advisable to repair a defect approval shall be obtained from the inspector or supervisor before any repair is made.

5.2 Limitation of Discontinuities

5.2.1 Introduction

The standards of acceptability are applicable primarily to determination of size and type of defects located by radiography or other nondestructive test methods.

These standards may also be applied to determination of size and type of defects located by visual inspection.

5.2.2 Measurement of Defects

For the purpose of this specification, all measurement shall be taken clockwise, from the top center of the pipe, looking to the direction of gas flow. The term "in 12-inch lengths" means in succeeding 12-inch lengths measured from the top center of the pipe. The length of a defect is measured along the circumferential weld.

5.2.3 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 defined as the lack of bond between beads or between the weld metal and the pipe metal. Any individual defect due to inadequate penetration or incomplete fusion shall not exceed 1 in. in length. The total length of such defects in any 12-in. length of weld shall not exceed 1 in. The total length of such defects in any two succeeding 12-in. lengths shall not exceed 2 in. and individual defects shall be separated by at least 6 in. of sound weld metal.

5.2.4 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 individual burn-through area shall not exceed 1/2 in. in length. The total length of burn-through area in any 12-in. length of weld shall not exceed 1 in. The total length of burn-through area in any two succeeding 12-in. lengths shall not exceed 2 in., and individual defects shall be separated by at least 6 in. of sound weld metal.

5.2.5 Slag Inclusions

A slag inclusion is a non-metallic solid entrapped in weld metal, or between the weld metal and the pipe metal. Elongated slag inclusions are usually found

at the fusion zone. Isolated slag inclusions are irregularly shaped inclusions and may be located anywhere in the weld.

5.2.3.1 Elongated Slag Inclusions (Wagon Tracks)

Any elongated slag inclusions shall not exceed 2 in. in length or 1/16 in. in width. The total length of elongated slag inclusions in any 12-in. length of weld shall not exceed 2 in. and the total length of elongated slag inclusions in any two succeeding 12-in. lengths shall not exceed 4 in. Adjacent elongated slag inclusions shall be separated by at least 6 in. of sound weld metal. Parallel slag lines shall be considered as individual defects if their individual width is greater than 1/32 in.

5.2.3.2. Isolated Slag Inclusions

The maximum width of any isolated slag inclusion shall not exceed 1/8 in. The total length of isolated slag inclusions in any 12-in. length of the weld shall not exceed 1/2 in., nor shall there be more than four isolated slag inclusions of the maximum width of 1/8 in. in this length. The total length

of isolated slag inclusions in any 24-in. length of weld shall not exceed 1 in. Adjacent isolated slag inclusions shall be separated by 2 in. of sound weld metal.

5.2.4 Porosity or Gas Pockets

Porosity or gas pockets are voids occurring in the weld metal and are usually spherically shaped. The maximum dimension of any individual gas pocket shall not exceed 1/16 inch. Maximum distribution of gas pockets shall not exceed that shown in Drawings 083466, sheets 6 and 7.

5.2.5 Cracks

No weld containing cracks, regardless of size or location, shall be acceptable except as provided for in Paragraph 5.3.

5.2.6 Accumulation of Discontinuities

Any accumulation of discontinuities having a total length of more than 2 inches in a weld length of 12 inches is unacceptable. Any accumulation of discontinuities which total more than 10 per cent of the weld length of a joint is unacceptable.

5.2.7 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 and where it is fused to the surface of the pipe.

Undercutting adjacent to the cover bead on the outside of the pipe shall not exceed 1/32 in. in depth and 2 in. in length. Undercutting adjacent to the root bead on the inside of the pipe shall not exceed 2 in. in length.

5.3 Repair or Removal of Defects

5.3.1 Authorization and Definitions

Repairs of defects in the root and filler beads may be authorized but any weld that shows evidence of repair work without authorization may be rejected. Minor cracks in surface and filler beads may be repaired when so authorized. Any crack penetrating the root bead or the second bead shall be cause for complete rejection of the weld and the entire weld shall be cut from the line. Minor cracks shall be defined as cracks not more than 2 inches in length.

Repairs may be made to pin holes and undercuts in the final bead without authorization.

5.3.2 Procedures

Before repairs are made, injurious defects shall be entirely removed by chipping, grinding, or arc-gouging to clean metal. Defects not exceeding five per cent of the weld length may be removed by grinding, chipping, or

arc-gouging and re-welded in accordance with these procedures.

When defects are ground out and the weld repaired, the entire weld shall be preheated to a temperature of 250° F prior to welding.

6. Nondestructive Procedure (Radiograph or Sonic)

6.1 Until other arrangements are made, divisions are requested to arrange with the Gas Construction Department to handle all radiographic or sonic testing.

7. Low Hydrogen Electrode

The additional procedure and welder qualification tests using low hydrogen electrodes are included here for operators who may be required to use them for repair welding in accordance with SP 1603.

7.1 Welding rod

7.11 Welding rod shall conform to A.W.S. classification E6016 and/or E7016 electrode. The diameter of these electrodes should not exceed 5/32 inch.

7.12 E7016 low hydrogen iron powder electrode may be substituted for conventional low hydrogen electrode.

7.13 Low hydrogen electrodes shall be stored and handled in a manner to prevent absorption of moisture.

7.14 Proper storage facilities shall be provided for electrodes removed from sealed moisture proof containers. The following methods of storage are recommended.

7.141 A storage cabinet and/or drying oven shall be provided, centrally located within the group area. Such a storage cabinet would contain Silica-Gel, or a similar material, to absorb excess moisture.

7.142 A suitable electric drying oven or a small storage tube, made of 4" pipe and containing Silica-Gel shall be standard equipment with all welding units for overnight storage of opened unused low hydrogen electrodes.

7.15 Electrodes can be purchased in the usual manner and distributed to the welders in 10 pound sealed moisture proof packets.

7.16 Electrodes left overnight without the proper protection shall not be used without first being reprocessed in a drying oven.

7.17 Electrodes shall not be exposed to moisture by the welder.

7.18 All welders qualified to use this type electrode will be thoroughly instructed in their storage and handling requirements.

7.2 Welding Technique

7.21 The uphill method of depositing weld metal shall be used.

7.22 Strike arc ahead of the starting point and bring the arc back to starting point. (Welding should then proceed over the point where the arc was struck.)

7.23 The weld passes should be beaded rather than weaved with particular care not to whip the electrode.

7.24 Clean each beading thoroughly.(Low hydrogen electrode is not deep penetrating, any slag or foreign matter may be

entrapped and will not burn out when depositing subsequent beads.)

7.25 Low hydrogen Electrode Classification, size and current required for fillet weld:

Bead	AWS Electrode Classification	Rod Size	Ampere	Volts
Stringer	E6016	1/8"	80-120	22-24
Hot Pass	E7016	1/8"	80-120	22-24
Subsequent Passes	E7016	5/32"	150-190	22-24

*One size smaller electrode may be used when using Iron Powder electrode.

7.3 Welder Qualification

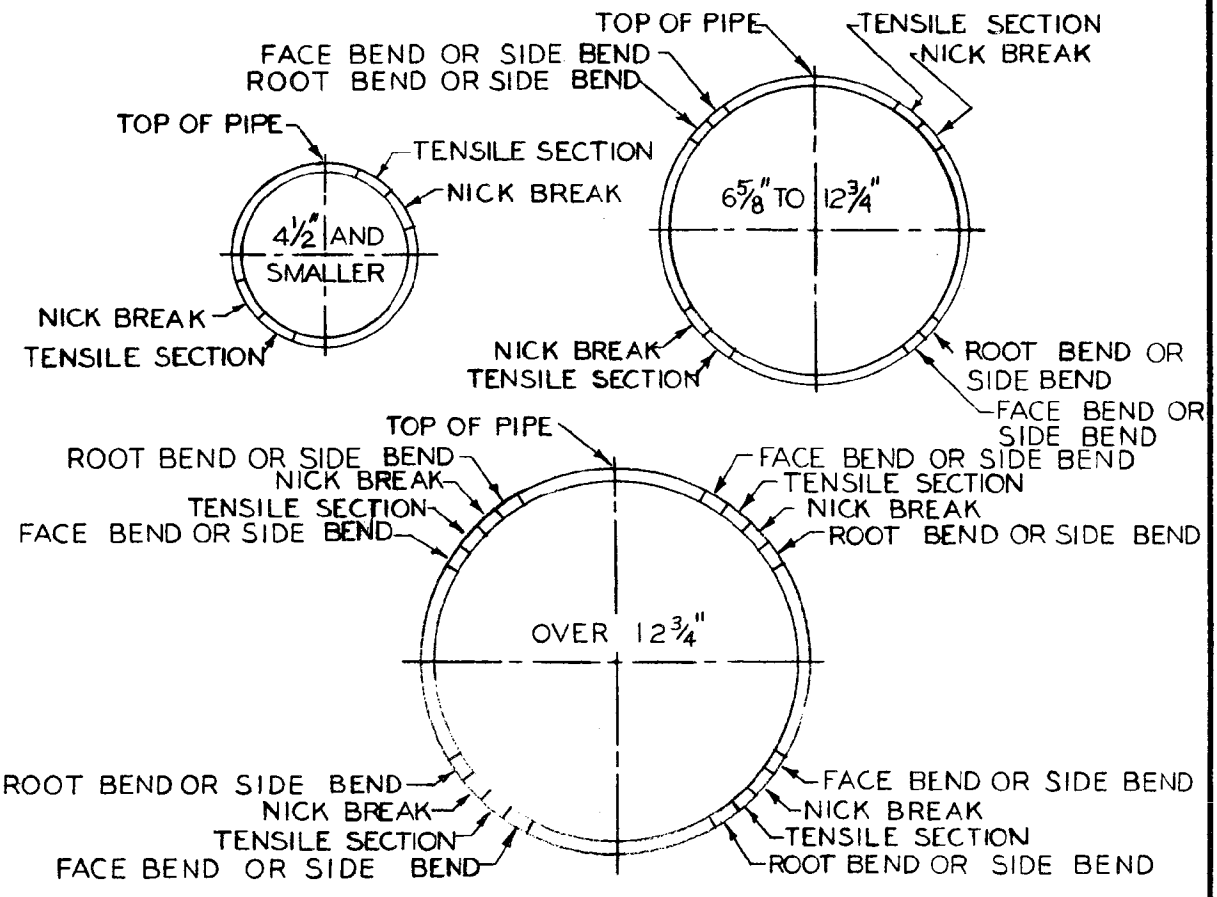
7.31 Welder shall be qualified, in accordance with Par. 3.0, to weld on API 5L and 5LX grade pipe.

7.32 Welder in addition to the standard test set forth in Par. 3.0 shall qualify himself to use low hydrogen electrode by completing a test weld using the welding technique described in Par. 7.2 above and outlined in Drawing 083466, Sheet 10, of this Standard Procedure.

APPROVED [redacted]

DATE 5/63

VICE PRESIDENT, GAS OPERATIONS



PIPE SIZE OUTSIDE DIAMETER GROUP	TOTAL # OF SPECIMENS	TENSILE	NICK BREAK	BENDS ROOT	BENDS FACE	BENDS *SIDE
4½" & SMALLER	4	2	2	0	0	0
6⅝" - 12¾" INCLUSIVE	8	2	2	2	2	4
OVER 12¾"	16	4	4	4	4	8

* USE IN LIEU OF ROOT AND FACE BENDS ON PIPE OF WALL THICKNESS GREATER THAN 1/2".

WALL THICKNESS GROUP

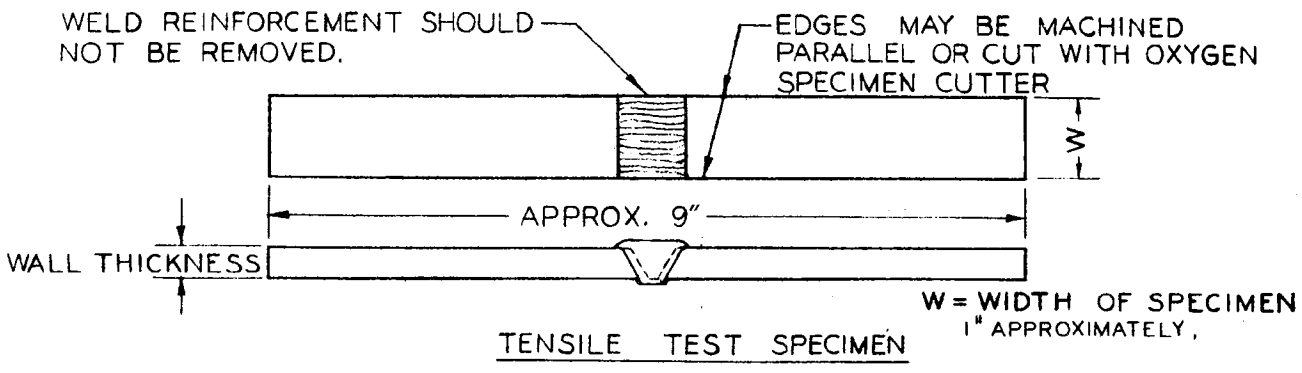
1. LESS THAN 3/16".
2. 3/16" TO 3/4" INCLUSIVE.
3. OVER 3/4".

PROCEDURE QUALIFICATION TEST FOR PIPING SYSTEMS OPERATING AT HOOP STRESSES OF 20% OR MORE OF SPECIFIED MINIMUM YIELD STRENGTH AS PER C.P.U.C. GENERAL ORDER NO. 112.

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

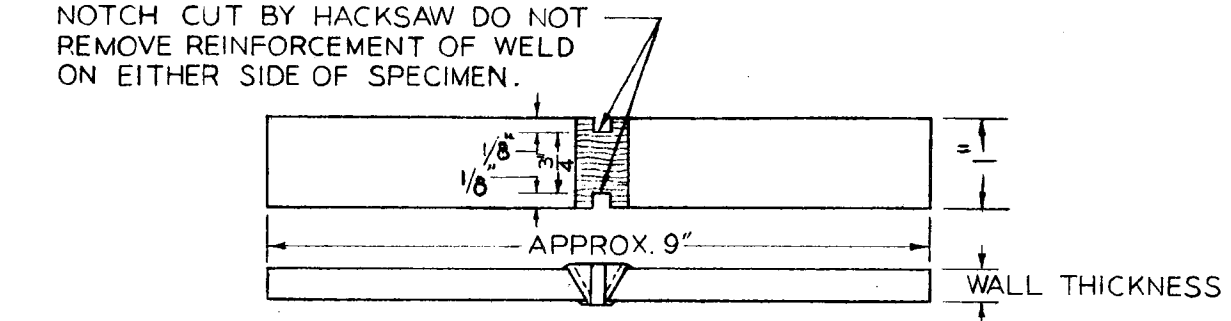
APPROVED

BY G.S.D.D.	GAS STANDARD	SUPERSEDES	
DSGN.	LOCATION OF TEST SPECIMENS	SUPERSEDED BY	
DR [redacted]	PROCEDURE QUALIFICATION TEST WELD	SHEET No. 1 OF 10 SHEETS	
CH.	PACIFIC GAS AND ELECTRIC COMPANY	DRAWING NUMBER	CHANGE
O.K.	SAN FRANCISCO, CAL.	083466	
DATE 8-4-61	SCALE NONE		

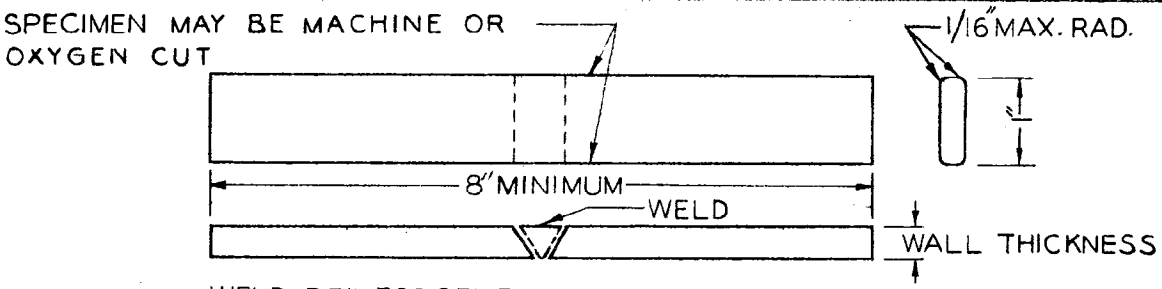


W = WIDTH OF SPECIMEN 1" APPROXIMATELY.

TENSILE TEST SPECIMEN

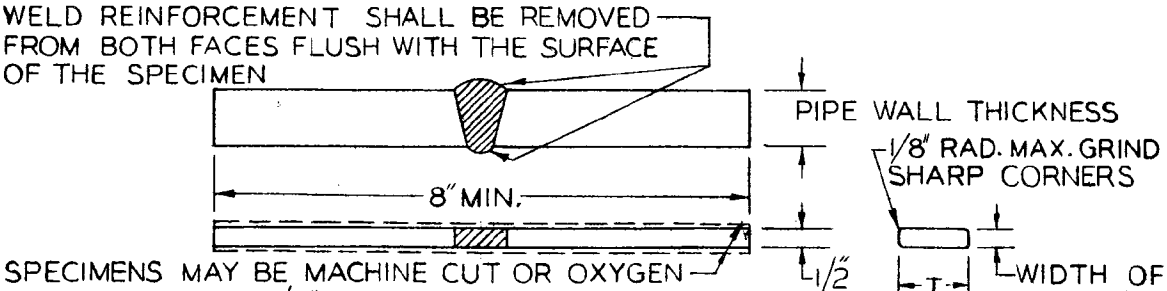


NICK-BREAK TEST SPECIMEN



WELD REINFORCEMENT SHALL BE REMOVED FROM BOTH FACES FLUSH WITH THE SURFACE OF THE SPECIMEN.

GUIDED-BEND TEST SPECIMEN



SPECIMENS MAY BE MACHINE CUT OR OXYGEN CUT TO APPROX. 5/8" WIDTH. THE CUT SURFACES SHALL THEN BE GROUND SMOOTH TO 1/2" WIDTH. THESE SURFACES SHALL BE PARALLEL.

SIDE BEND TEST SPECIMEN

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.
1	12-19-62	CHG'D. WIDTH TO 1" APPROX.					

APPROVED

BY G.S.D.D.
DSGN.
DR. G.S.LIM
CH.
O.K.
DATE 10-11-61
SCALE NONE

GAS STANDARD

PREPARATION OF TEST SPECIMENS

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET NO. 2 OF 10 SHEETS
DRAWING NUMBER 083466
CHANGE 1

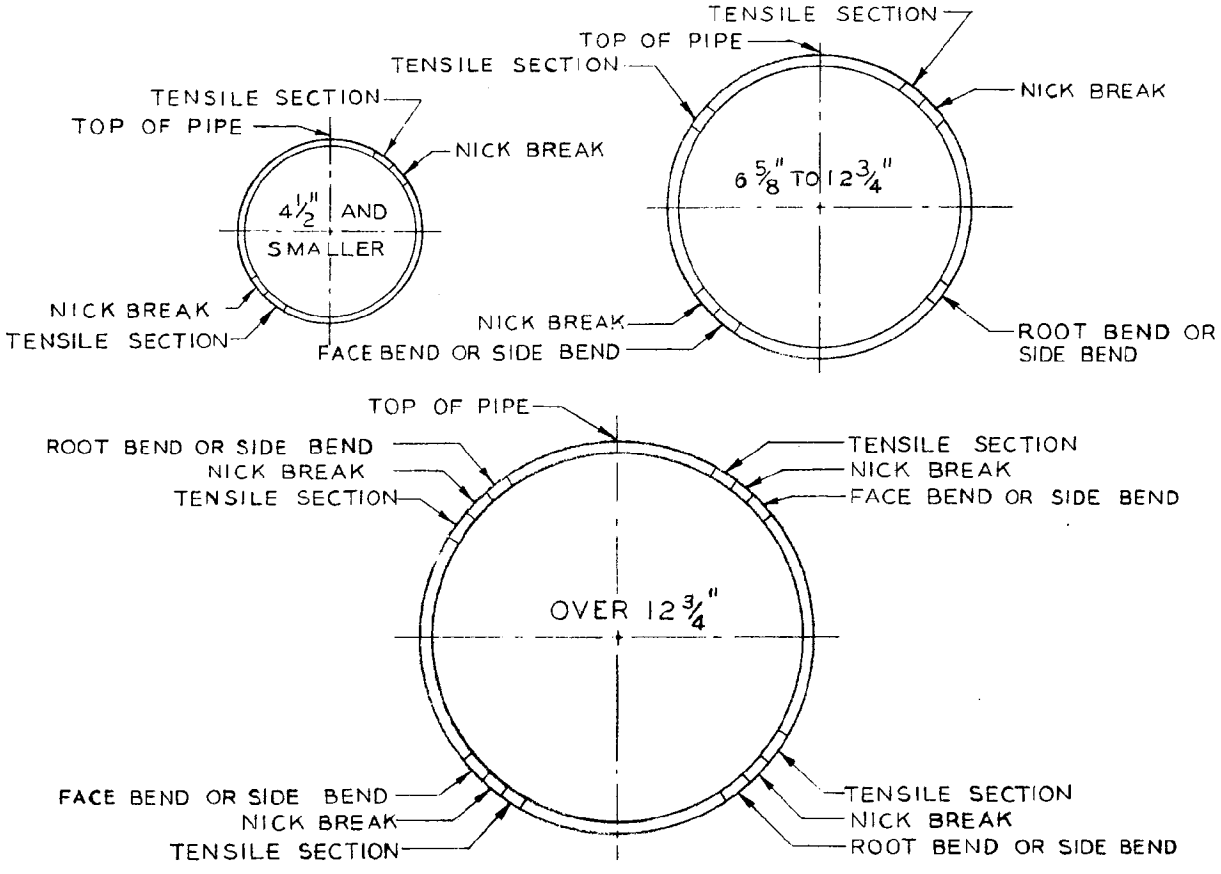
ARC WELDER QUALIFICATION TEST FOR PIPING SYSTEMS OPERATING AT HOOP STRESSES OF 20% OR MORE OF SPECIFIED MINIMUM YIELD STRENGTH AS PER C.P.U.C. GENERAL ORDER NO. 112.

PIPE SIZE OUTSIDE DIAMETER GROUP	TOTAL # OF SPECIMENS	TENSILE	NICK BREAK	BENDS		
				ROOT	FACE	* SIDE
4 1/2" & SMALLER	4	2	2	0	0	0
6 5/8" - 12 3/4" INCLUSIVE	6	2	2	2	0	2
OVER 12 3/4"	12	4	4	2	2	4

* USE IN LIEU OF ROOT AND FACE BENDS ON PIPE OF WALL THICKNESS GREATER THAN 1/2".

WALL THICKNESS GROUP

1. LESS THAN 3/16".
2. 3/16" TO 3/4" INCLUSIVE.
3. OVER 3/4".



CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED [illegible]

BY G.S.D.D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE 8-31-61
SCALE NONE

GAS STANDARD

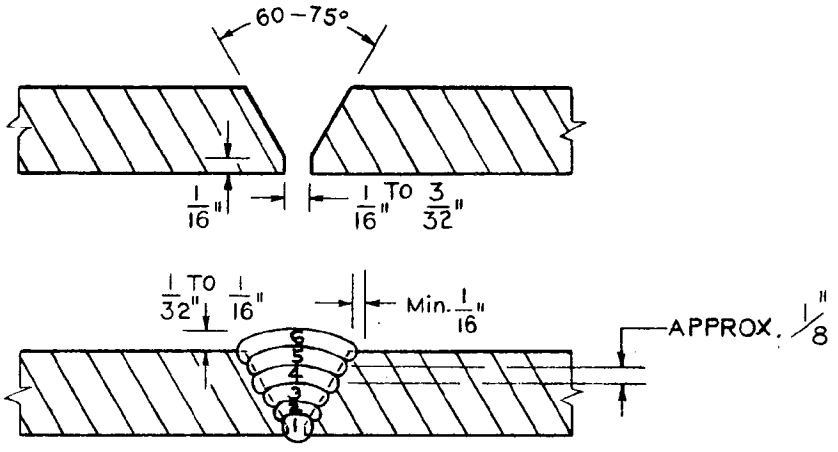
LOCATION OF TEST SPECIMENS FOR ARC WELDERS QUALIFICATION TEST WELD

PACIFIC GAS AND ELECTRIC COMPANY

SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET NO. 3 OF 10 SHEETS
DRAWING NUMBER C83466
CHANGE

WELD DESIGN



WELD DETAIL

WELD LAYER	METHOD		ELECTRODE		RECOMMENDED	
	HORIZONTAL FIXED POSITION	VERTICAL FIXED POSITION	CLASS	SIZE	AMPS	VOLTS
FIRST PASS	DOWNHILL	BEAD	E-6010	5/32"	150-190	26-28
FILLER PASSES	DOWNHILL	BEAD	NOTE 3	5/32"	140-180	24-26
COVER PASS	DOWNHILL	BEAD OR LACED	E-7010 OR E-6010	5/32" OR 3/16"	140-180	24-26

NOTES:

1. ALL CURRENT SHALL BE D.C. REVERSE POLARITY.
2. WHEN PIPE WALL THICKNESS 0.250 INCH OR LESS, 1/8 INCH ELECTRODES MAY BE USED FOR FIRST PASS ONLY.
3. E 6010 FOR ALL API GRADES UP TO AND INCLUDING X46 AND E7010 FOR ALL GRADES ABOVE X46 UP TO AND INCLUDING X60.

WELDING PROCEDURE FOR FIELD WELDING PIPELINES OPERATING OVER 20% OF SPECIFIED MINIMUM YIELD POINT.

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED

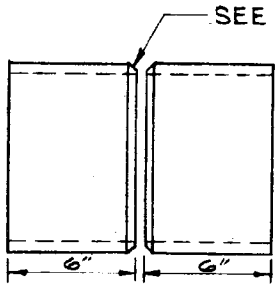
BY G.S.D.D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE 8-21-61
SCALE None

GAS STANDARD

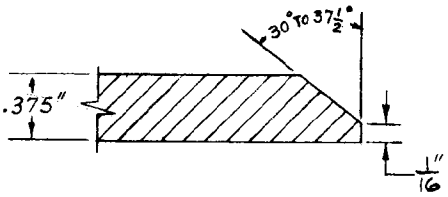
WELD DESIGN

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET No. 4 OF 10 SHEETS
DRAWING NUMBER 083466
CHANGE

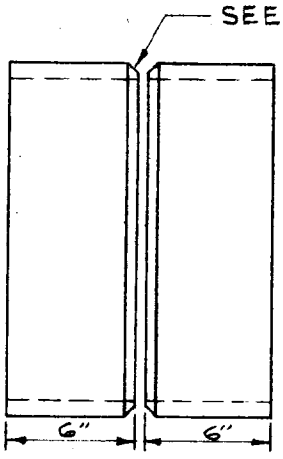


TYPE 1

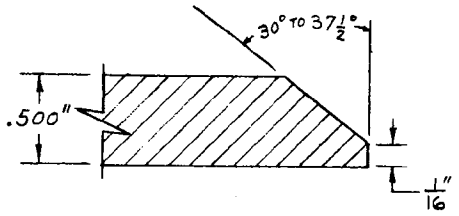


DETAIL OF BEVEL

$6\frac{5}{8}$" OR $8\frac{5}{8}$" O.D. X .188"-.375" WALL API-5LX, GRADE X42 CODE 02-2582.



TYPE 2



DETAIL OF BEVEL

16" O.D. X .219"-.500" WALL API-5LX, GRADE X52 CODE 02-2583

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.
2	2-67	CHANGED NOTES TO PROVIDE RANGE	[redacted]				
1	1-65	SUPERSEDED					

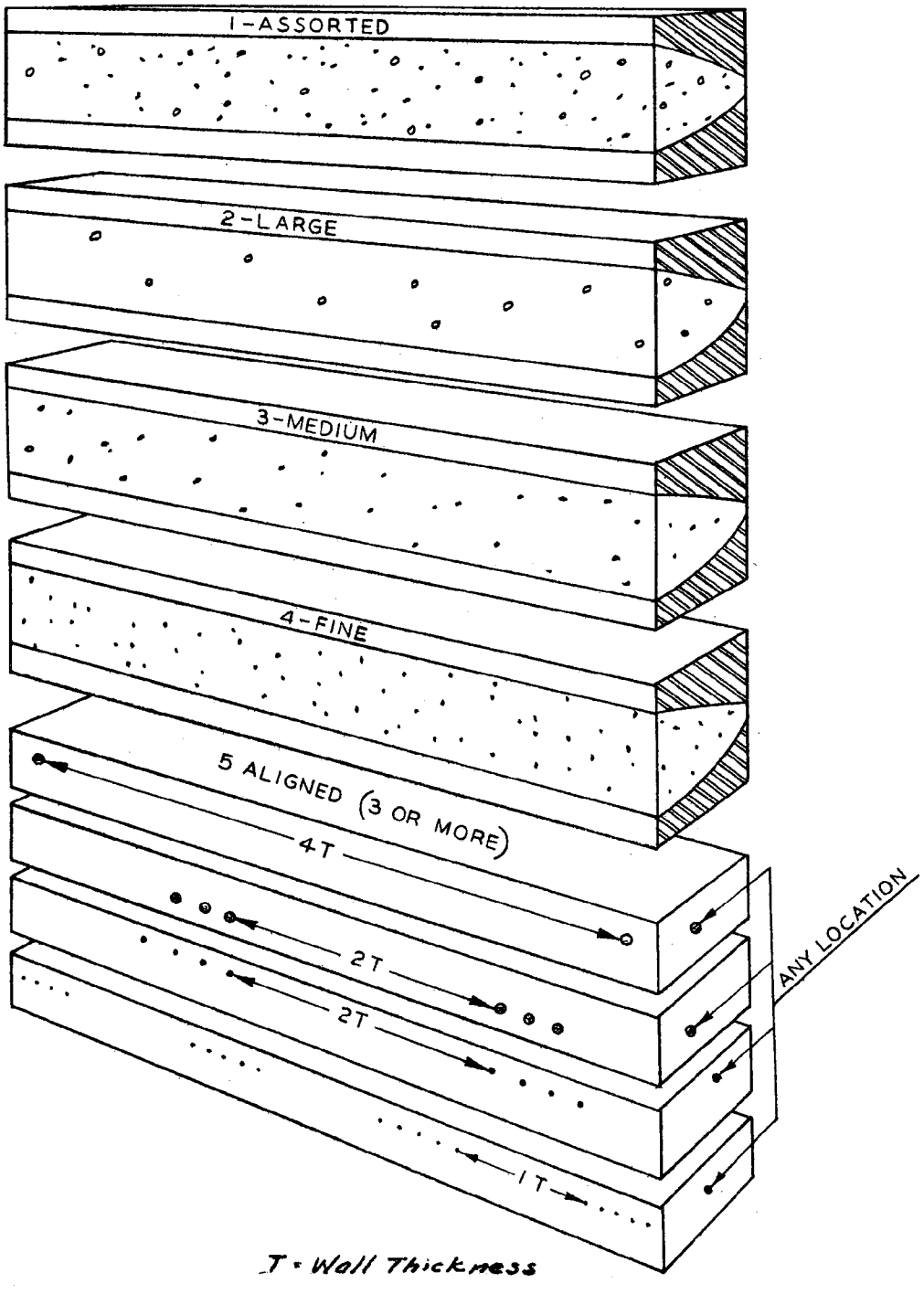
APPROVED [redacted]

BY G. S. D. D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE 1-22-62
SCALE NONE

GAS STANDARD
WELD TEST SPOOLS FOR WELDERS WORKING ON PIPE LINES OPERATING AT HOOP STRESSES OF MORE THAN 20% OF THE SPECIFIED MINIMUM YIELD
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY 084023
SHEET NO. 5 OF 10 SHEETS
DRAWING NUMBER 083466
CHANGE 2

PRINTED ON DIEPO NO. 1000H CLEARPRINT



CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED

BY G.S.D.D.

DSGN.

DR. [redacted]

CH.

O.K.

DATE 9-1-61

SCALE NONE

GAS STANDARD
MAXIMUM DISTRIBUTION OF GAS POCKETS
WALL THICKNESS OVER $\frac{1}{2}$" TO $1\frac{1}{4}$"

PACIFIC GAS AND ELECTRIC COMPANY

SAN FRANCISCO, CAL.

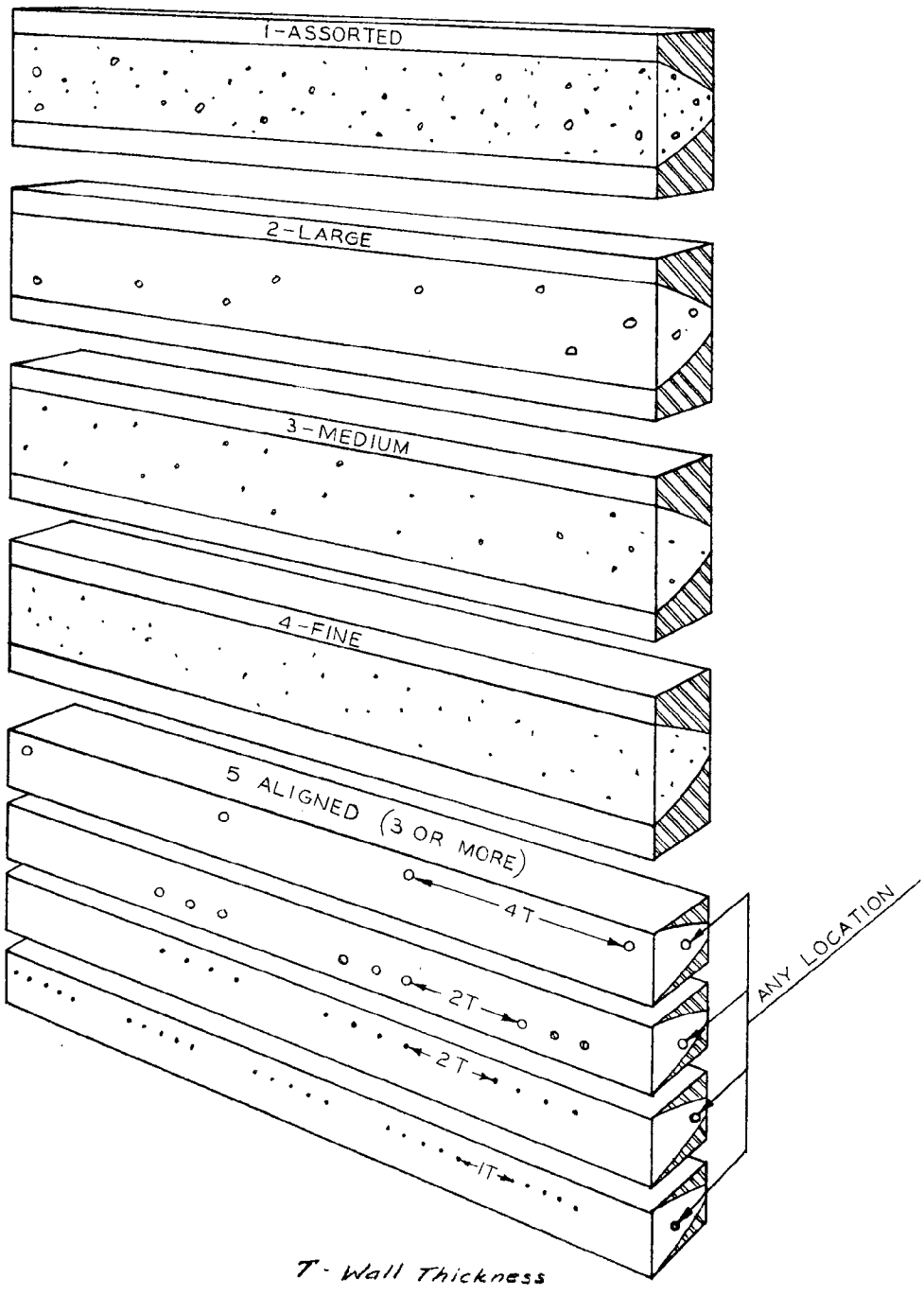
SUPERSEDES

SUPERSEDED BY

SHEET No. 6 of 10 SHEETS

DRAWING NUMBER 083466

CHANGE



CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

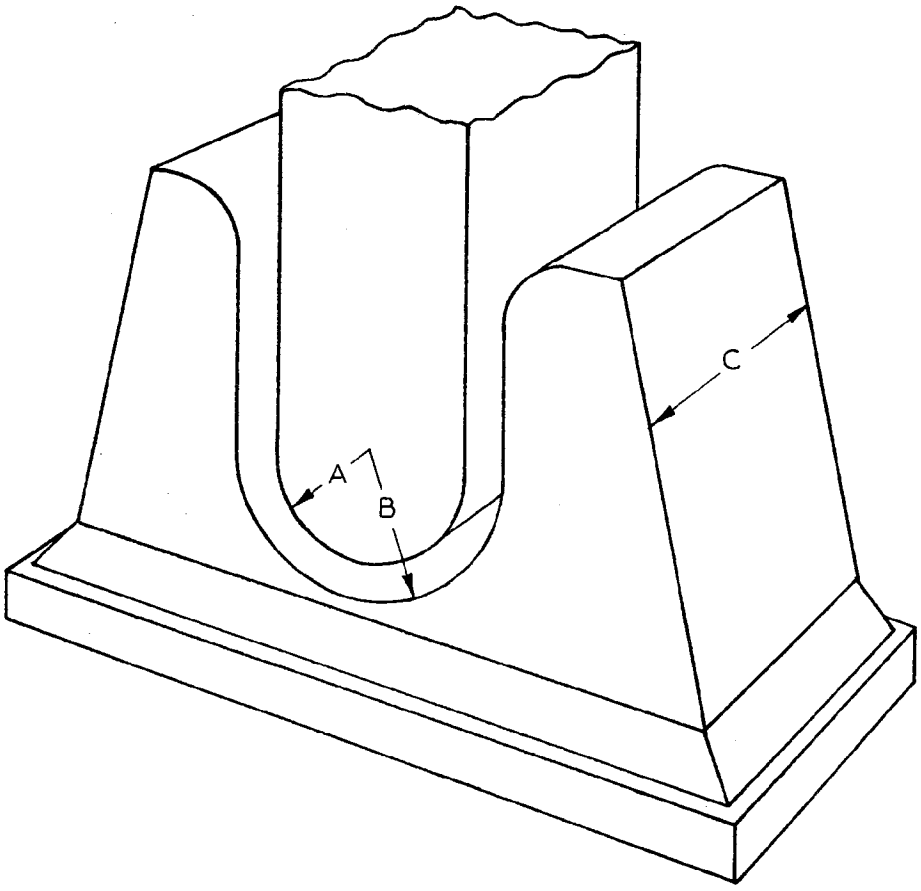
APPROVED [illegible] 11-29-61

BY G. S. D. D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE 9-1-61
SCALE NONE

GAS STANDARD
MAXIMUM DISTRIBUTION OF GAS POCKETS
WALL THICKNESS OVER $\frac{1}{4}$" TO $\frac{1}{2}$"

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET No. 7 of 10 SHEETS
DRAWING NUMBER 083466
CHANGE



RADIUS OF PLUNGER A = $1\frac{3}{4}$ INCHES

RADIUS OF DIE. B = $2\frac{5}{16}$ INCHES

WIDTH OF DIE C = 2 INCHES

Note: Alternate jig MS 10001, Drawing 282074 may be used.

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED

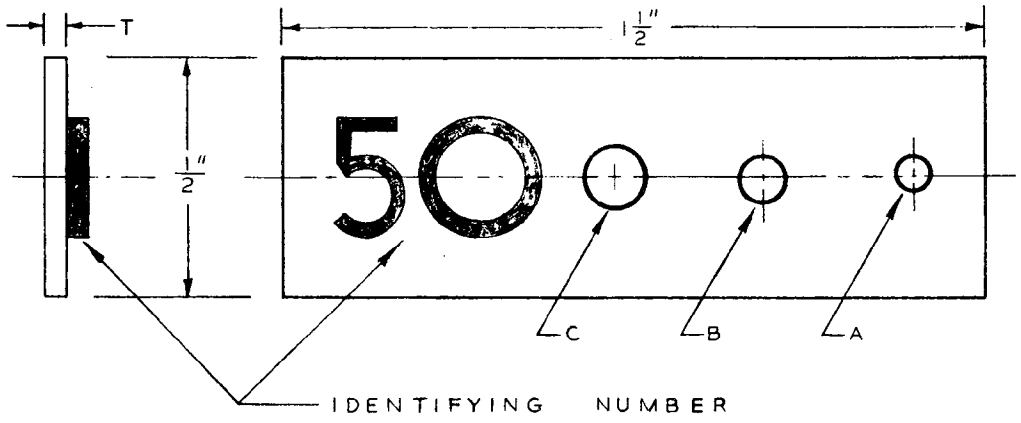
BY G S D D
DSGN.
DR. [redacted]
CH.
O.K.
DATE 9-12-61
SCALE NONE

GAS STANDARD

JIG FOR GUIDED BEND TEST

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET No. 8 of 10 SHEETS
DRAWING NUMBER 083466
CHANGE



T = SPECIFIED PERCENT OF PIPE WALL THICKNESS
A DIAMETER = (2)(T)
B DIAMETER = (3)(T)
C DIAMETER = (4)(T)

THIS RELATIONSHIP TO PENETRAMETER THICKNESS IS CONSTANT FOR EITHER 2 PERCENT OR 4 PERCENT PENETRAMETERS. THE DIAMETER NEED NOT BE LESS THAN 1/16 INCH.

HOLES SHALL BE ROUND AND DRILLED PERPENDICULAR TO THE SURFACE.

HOLES SHALL BE FREE OF BURRS BUT EDGES SHALL NOT BE CHAMFERED.

EACH PENETRAMETER SHALL CARRY A LEAD IDENTIFICATION NUMBER REPRESENTING, TO 2 SIGNIFICANT FIGURES, THE MINIMUM THICKNESS OF THE PLATE FOR WHICH IT MAY BE USED.

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED [redacted]

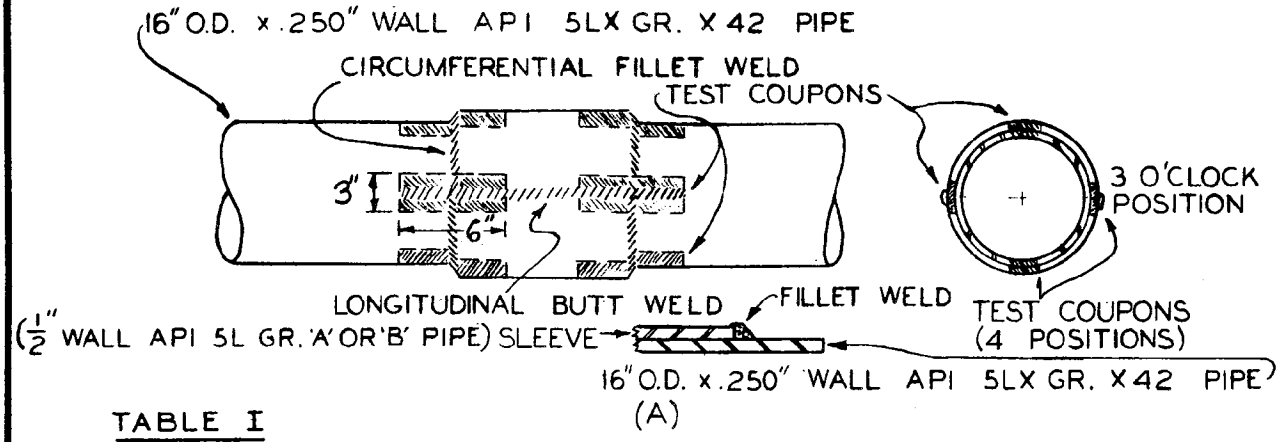
BY G. S. D. D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE | SCALE

GAS STANDARD

STANDARD PENETRAMETER

PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET No. 9 of 10 SHEETS
DRAWING NUMBER 083466
CHANGE



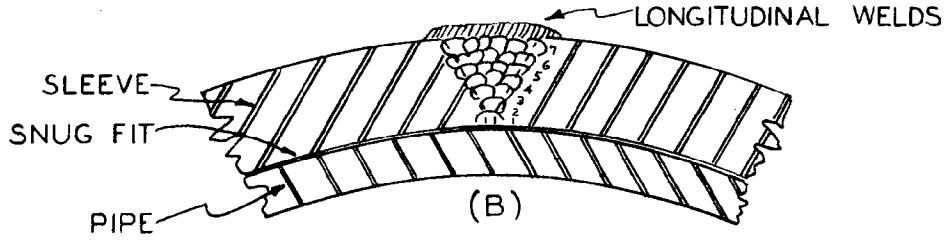
(A)

TABLE I

PROCEDURE FOR 1/2" WALL THICK SLEEVE

FILLET WELD	STRINGER	1F	2F	3F	4F	5F	COVER
ELECTRODE SIZE 1 METHOD	1/8" UPHILL	1/8" OR 5/32" UP	1/8" OR 5/32" UP	1/8" OR 5/32" UP	5/32" UP	5/32" UP	5/32" UP
BUTT WELD	1 ST. LAYER	2 ND. L.	3 RD. L.	4 TH. L.	5 TH. L.	6 TH. L.	COVER
NO. OF PASSES/LAYER ELECTRODE SIZE	1 1/8"	1 1/8"	2 1/8"	3 1/8"	4 1/8"	5 1/8"	1 1/8" OR 5/32"

(1) ONE SIZE SMALLER MAY BE USED FOR IRON POWDER ELECTRODES.



(B)

NOTE:

1. **In welding the sleeve to the pipe, the two longitudinal butt welds shall be made first, followed by the two circumferential fillet welds. The sleeve shall be placed so that the longitudinal seam welds are made in the 3 o'clock and 9 o'clock positions. The recommended number of passes and the sizes of electrodes to be used are shown in Table I above.**

2. **Eight nick break test coupons, four from each fillet weld, shall be removed as shown in Figure A.**

CHG.	DATE	DESCRIPTION	APPRD.	CHG.	DATE	DESCRIPTION	APPRD.

APPROVED
BY G.S.D.D.
DSGN.
DR. [redacted]
CH.
O.K.
DATE APR. 24, '63
SCALE NONE

GAS STANDARD
WELDERS QUALIFICATION USING LOW HYDROGEN ELECTRODE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CAL.

SUPERSEDES
SUPERSEDED BY
SHEET No. 10 of 10 SHEETS
DRAWING NUMBER 083466
CHANGE