



P1-AT-Lh-f

Power & Industrial Division By <u><i>H. H. ...</i></u> Manager of Engineering	BECHTEL CORPORATION WELDING STANDARD Procedure Specification P1-AT-Lh-f Revision 3	Metallurgy & Welding Section Date: 2/23/65 Prepared by <u><i>A. Johnson</i></u> Checked by <u><i>G. M. Beowell</i></u> Approved <u><i>G. B. Grable</i></u> G. B. Grable
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Authorized for use only when signed by the Manager of Engineering of the Division.

1.0 SCOPE

- 1.1 This procedure specification is to be used for welding Carbon Steel piping materials in thicknesses up to and including 4 inches without consumable insert rings.
- 1.2 This procedure has been qualified under Section IX of the ASME Code and the ASA Code for Pressure Piping, B31.1 and B31.3.

2.0 PROCESS

- 2.1 Welding under this procedure specification shall be done with the combination Gas Tungsten-Arc and Shielded Metal-Arc process using a flux protective backing for the root pass.

3.0 BASE MATERIAL

- 3.1 This procedure specification shall be used only in welding the carbon steel materials shown in Table 1, Drawing P1-AT-Lh-f-1.

4.0 WELD MATERIAL

- 4.1 The filler metal shall conform to the A-1 weld metal analysis number and F4 and F6 grouping numbers shown in Section IX of the ASME Code.

3 4.2 Coated electrodes and bare filler rod shall conform to ASTM A233, Mild Steel Arc-Welding Electrodes, Classification EXX16, or EXX18; and ASTM A251 Iron and Steel Gas-Welding Rods, Classification GAXX, respectively.

3 4.2.1 Carbon steel materials with a specified minimum tensile strength greater than 60,000 psi shall be welded with E7016 or E7018 coated electrodes and GA65 bare filler rod, Drawing No. P1-AT-Lh-f-1.

3 4.2.2 Carbon steel materials with a specified minimum tensile strength equal to or less than 60,000 psi, or not specified, shall be welded with E6016 or E6018 coated electrodes, and GA60 or GA65 bare filler rod, Drawing No. P1-AT-Lh-f-1.

4.3 Electrodes that have wet or damaged coatings shall not be used.

4.4 All coated low hydrogen electrodes shall be purchased in sealed containers. Low hydrogen electrodes removed from sealed containers shall be used within four hours. Electrodes not used within four hours shall be stored in electrode storage ovens at 250-300°F or as otherwise recommended by the electrode manufacturer.

5.0 WELDING

5.1 Position

This procedure specification covers welding that may be done in any position.

5.2 Preparation of Base Material

5.2.1 Field beveling for butt welds shall be done by machining, grinding, or flame cutting and grinding.

5.2.2 The method of base metal preparation used shall leave the welding groove with reasonably smooth surfaces free from notches or other harmful irregularities.

3

5.2.3 The angle of bevel, spacing, and other details shall be in accordance with weld end preparation drawings included in the job specifications. If not included with job specifications, the angle of bevel, spacing, and other details shall be essentially in accordance with Drawing No. P1-AT-Lh-f-2.

5.2.4 Prior to fit-up and welding, the beveled edges, root land and back side of each weld end shall be cleaned of all grease, oil, rust, scale, or other foreign material to bright, clean metal by filing, power brushing or power grinding. Approved proprietary protective coatings such as "Deoxaluminite" need not be removed prior to welding.

### 5.3 Electrical Characteristics

5.3.1 Gas tungsten-arc welding shall be done using a one or two percent thoriated tungsten electrode with direct current, electrode negative (straight polarity).

5.3.2 Metal-arc welding shall be done using direct current electrode positive (reverse polarity).

5.3.3 Recommended values for amps and volts are shown on Drawing No. P1-AT-Lh-f-2.

### 5.4 Gas Shielding and Flux Backing

5.4.1 The shielding gas shall be argon at 12-15 cfh through the welding torch.

5.4.2 After cleaning, and before fit-up, the back side of each weld bevel shall be given a coat of "Solar Flux" Type B for a distance of one-half inch from the end. No flux shall be applied to the face of the land or to the outside surface of the weld groove.

5.4.3 The "Solar Flux" must be thoroughly mixed with methyl alcohol to a thin paste consistency, in accordance with the manufacturer's instructions, and be allowed to stand five minutes before use. The flux shall be applied so as

5.4.3 (Cont.) to accomplish an even and smooth coat. Only quantities to coat four to six welds should be mixed at any one time and this should be kept in a small sealed jar or container. Flux once mixed and allowed to dry shall not be used. Keep container tightly closed on unmixed flux. As a precaution, always weld in a ventilated space.

## 5.5 Technique

- 5.5.1 No welding shall be done when surfaces to be welded are wet or covered with ice, when rain or snow is falling, or during periods of high wind; unless the work is properly protected.
- 5.5.2 Alignment and fit-up of the weld joint shall be made without a consumable insert ring. The abutting edges of the land of each weld joint shall be brought together so that the gap at any location does not exceed 1/32 inch.
- 5.5.3 Clamps, welded clips, tack welds or other appropriate means shall be used to properly align the joint for welding. Tack welds shall be welded in full compliance with this procedure specification and if not removed shall be inspected visually for defects prior to starting the continuous weld.
- 5.5.4 Following the fit-up and alignment, three 1/8-inch diameter holes shall be drilled through the center of the root at the twelve, four and eight o'clock positions. These holes are provided for observation during deposition of the gas tungsten-arc root pass.
- 5.5.5 The job welding technician or a qualified welder designated by the technician shall observe the deposition of the gas tungsten-arc root pass to inform the welder performing the work that the proper fusion and penetration is taking place. During gas tungsten-arc welding 1/16-inch diameter carbon steel bare rod shall be used, as necessary, for filler material.

- 5.5.6 Upon completion of the first gas tungsten-arc root pass and prior to any shielded metal-arc welding, closure of the observation holes shall be carefully performed by gas tungsten-arc welding. The holes at the four and eight o'clock positions shall be closed first, observing from the twelve o'clock hole. The twelve o'clock hole may then be closed. Care must be exercised in making the first shielded metal-arc pass using 3/32-inch diameter electrodes to avoid burning through. For the second shielded metal-arc pass, 1/8-inch diameter electrodes shall be used. Subsequent welding may be completed using 1/8 or 5/32-inch diameter electrodes.
- 5.5.7 Each bead of welding shall be cleaned free of slag, flux or other foreign material before depositing the next successive bead. Each layer of welding shall be free of irregularities of deposit such as high spots, deep crevices, undercuts and porosity.
- 5.5.8 The progress of welding shall be upward for vertical welding. For horizontal welding the weld metal shall be deposited in multiple passes of beads. Each layer of welding shall be completed around the entire circumference of the weld groove before the succeeding weld passes are deposited.
- 5.5.9 Welding shall not be interrupted until at least one-third of the weld thickness is completed.

5.6 Appearance of Weld

- 5.6.1 The appearance of welding layers shall be essentially as shown on Drawing No. P1-AT-Lh-f-2.
- 5.6.2 The width of the welding pass in vertical, flat and overhead positions should not exceed the width of four diameters of the electrode being used and the thickness of the layer should not exceed one-eighth inch.

- 5.6.3 The cover pass shall be slightly convex and shall fuse into the surface of the base metal in such a manner as to tie in the edge of the groove on each side of the weld a minimum of 1/16 inch and a maximum of 1/8 inch.

5.7 Repair of Defects

- 5.7.1 Cracks that occur during welding shall be removed by grinding, chipping, arc or flame gouging. Before welding is resumed, dye penetrant or magnetic particle inspection shall be used to determine that the cracks have been totally removed.
- 5.7.2 After welding has been completed, defects in excess of the applicable standards of acceptance detected by the inspection techniques required in the job specifications shall be removed by grinding, chipping, arc or flame gouging and rewelded in full compliance with this procedure specification.

6.0 PREHEAT AND INTERPASS TEMPERATURE

- 6.1 A preheat and interpass temperature of 200°F minimum shall be maintained when any one of the following conditions exists:
  - 6.1.1 When the ambient temperature is 32°F or lower.
  - 6.1.2 When the wall thickness exceeds one inch.
  - 6.1.3 For materials in Table I with a specified minimum tensile strength of 65,000 psi or greater, refer to Drawing No. Pl-AT-Lh-f-1.
  - 6.1.4 For materials in Table I with a specified carbon content in excess of 0.30 percent, refer to Drawing No. Pl-AT-Lh-f-1.
- 6.2 The specified preheat and interpass temperature shall be maintained during all welding. If the welding operation is interrupted, the joint shall be brought up to the required preheat temperature before welding is resumed.

- 6.3 The width of the preheat area on each side of the weld shall be at least three times the pipe or plate thickness, or two inches, whichever is greater.
- 6.4 Preheating may be done using electrical resistance or induction units, liquid petroleum gas (LPG) heating torches, or other torches which will provide uniform heating over the entire pre-heat area.
- 6.5 Preheat temperatures shall be checked with temperature-indicating crayons.

## 7.0 POSTWELD HEAT TREATMENT

The requirements for postweld heat treatment (stress relieving) shall be as specified in Bechtel Engineering Standard PHT-500 for P-1 materials or as otherwise required by the applicable job specifications and drawings. When required, the postweld heat treatment shall be performed in accordance with the applicable code requirements, as follows:

### 7.1 ASME Code Section I and ASA Code for Pressure Piping B31.1 and B31.3

7.1.2 The weldment shall be heated slowly and uniformly to the specified postweld heat treatment temperature, held at that temperature for the specified time, and then slowly cooled under insulation to a temperature not exceeding 600°F. Below 600°F the weldment may be allowed to cool in still air without insulation.

7.1.3 The minimum width of the heated circumference for welding joints in pipes, tubes, and headers shall be the larger of:

7.1.3.1 Three times the width of the widest part of the welding groove.

7.1.3.2 The width of the weld reinforcement, plus 1/4 inches.

7.1.4 Branches or other welded attachments shall be postweld heat treated by heating a circumferential band around the pipe or header on which the branch or attachment is welded with the branch or attachment at the middle of the heated band. The width of the band shall be the larger of:

7.1.4.1 Three times the nominal wall thickness of the header plus the diameter of the weld joining the branch or other attachment to the header.

7.1.4.2 Two inches greater than the diameter of the weld joining the branch or other attachment to the header.

7.2 ASME Code Section VIII

7.2.1 Heating of vessels or parts of vessels to the postweld heat treatment temperature shall be accomplished in such a manner that above 600°F the rate of heating shall be not more than 400°F per hour divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 400°F per hour.

7.2.2 Cooling of vessels or parts of vessels from the postweld heat treatment temperature shall be accomplished in such a manner that above 600°F cooling shall be at a rate not greater than 500°F per hour divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 500°F per hour. From 600°F, cooling may be done in still air.

7.2.3 The width on each side of the center line of circumferential joints in pipe or tubing to be heated to the postweld heat treatment temperature shall be at least three times the greatest width of the finished weld.

7.2.4 In addition to the foregoing, postweld heat treatment of vessels or parts of vessels shall be in accordance with the requirements of paragraphs UW 40 and UCS 56 of Section VIII of the ASME Boiler and Pressure Vessel Code.



7.3 Heat Treatment Temperature and Time

7.3.1 The postweld heat treatment for piping and vessels fabricated under Sections I and VIII of the ASME Code shall be 1100° - 1200°F for one hour per inch of thickness.

7.3.2 When it is impractical to postweld heat treat at the temperature specified in 7.3.1 above, it is permissible, under Sections I and VIII of the ASME Code, to postweld heat treat at lower temperatures for longer periods of time in accordance with the following tabulation:

<u>Minimum Holding Temperature, °F</u>	<u>Minimum Holding Time, Hours/Inch of Thickness</u>
1050	2
1000	3
950	5
900	10

7.3.3 The postweld heat treatment for piping fabricated under the ASA Code for Pressure Piping, B31.1 and B31.3, shall be 1100° - 1200°F for one hour per inch of thickness, but not less than one hour.

7.4 Equipment

7.4.1 Postweld heat treatment may be done using one of the following methods or a combination thereof:

7.4.1.1 Shop or field-erected heat treating furnace.

7.4.1.2 Localized heating using electrical resistance or induction coils.

7.4.1.3 Liquid petroleum gas (LPG), fuel oil or other heating torch units which will provide uniform heating over the entire area to be postweld heat treated.

- 7.4.2 Under the ASA Code for Petroleum Refinery Piping, B31.3, an annealing heat treatment using exothermic chemical reaction may be substituted for the above described equipment. When the exothermic annealing heat treatment is used, the instructions furnished with the exothermic materials shall be carefully followed to insure the proper exothermic charge and insulation are used.
- 7.4.3 Postweld heat treatment temperatures attained by use of the equipment described in 7.4.1.1 and 7.4.1.2 shall be checked by the use of thermocouples and recording potentiometers. At least two thermocouples (one a spare) shall be attached to the pipe or vessel being heat treated. The number and location of thermocouples shall be such as to indicate accurately the temperature of the area being heat treated.
- 7.4.4 Postweld heat treatment temperatures attained by use of the equipment described in 7.4.1.3 shall be checked by the use of temperature-indicating crayons.

8.0 WELDER PERFORMANCE QUALIFICATION

Welders who are required to use this procedure shall be qualified in accordance with Bechtel Corporation's WELDING STANDARD WQ-F-1, Performance Specification.

3	2/23/65	Revised Title Page, 2.1, 4.1, 4.2, 4.2.1, 4.2.2, 5.2.3., 7.3.3 and Table I	WRJ
2	7/19/63	Completely revised format	DRJ
0	6/9/62	Issued for field construction as P-1B-S	BMM
No.	Date		By

TABLE I  
CARBON STEEL P -1 GROUPING

<u>ASTM</u> <u>Designation</u>	<u>Tensile Strength</u> <u>Psi-Min</u>	<u>Type of Material</u>	
A 53	Open Hearth	45, 000	Furnace welded pipe
	Grade A	48, 000	Seamless or welded pipe
	Grade B	60, 000	Seamless or welded pipe
A 53	Acid Bessemer	50, 000	Furnace welded pipe
A 83	Grade A	Not specified	Seamless tubes
	Grade B	Not specified	Seamless tubes
	Alternate B	Not specified	Seamless tubes
A 105	Grade I*	60, 000	Flanges and fittings
	Grade II*	70, 000	Flanges and fittings
A 106	Grade A	48, 000	Seamless pipe
	Grade B	60, 000	Seamless pipe
	Grade C*	70, 000	Seamless pipe
A 120		Not specified	Seamless or welded pipe
A 135	Grade A	48, 000	Resistance welded pipe
	Grade B	60, 000	Resistance welded pipe
A 139	Grade A	48, 000	Welded pipe
	Grade B	60, 000	Welded pipe
A 155	Grade C 45	45, 000	Welded pipe
	Grade C 50	50, 000	Welded pipe
	Grade C 55	55, 000	Welded pipe
	Grade KC 55	55, 000	Welded pipe
	Grade KC 60	60, 000	Welded pipe
	Grade KC 65*	65, 000	Welded pipe
	Grade KC 70*	70, 000	Welded pipe
A 161	Carbon Steel	47, 000	Seamless tubes
A 178	Grades A, B, C*	Not specified	Resistance welded tubes
A 179		Not specified	Seamless tubes
A 181	Grade I*	60, 000	Flanges and fittings
	Grade II*	70, 000	Flanges and fittings
A 192		Not specified	Seamless tubes
A 210		60, 000	Seamless tubes

\* Specified carbon content exceeds 0.30 per cent.

WELDING STANDARD

P -1 Base Materials

Drawing No.

P1-AT-Lh-f-1

Rev.

1

Page 1 of 2

<u>ASTM Designation</u>	<u>Tensile Strength Psi-Min</u>	<u>Type of Material</u>
A 211	Not specified	Spiral welded pipe
A 214	Not specified	Welded tubes
A 216 Grade WCA	60,000	Castings
Grade WCB	70,000	Castings
A 226	47,000	Welded tubes
A 234 Grade WPA	48,000	Seamless and welded fittings
Grade WPB	60,000	Seamless and welded fittings
Grade WPC*	70,000	Seamless and welded fittings
A 266 Class I*	60,000	Seamless drum forgings
Class II*	70,000	Seamless drum forgings
A 333 Grade C	55,000	Seamless and welded pipe
A 334 Grade C	55,000	Seamless and welded pipe
A 350 Grade LF1	60,000	Seamless fittings
A 352 Grade LCB	65,000	Castings
A 420 Grade WPLC	55,000	Seamless and welded fittings

API  
Designation

API		
5L Grade A	48,000	Seamless and welded pipe
Grade B	60,000	Seamless and welded pipe
OH Iron	42,000	Seamless and welded pipe
Electric Furnace	45,000	Butt welded pipe
Class I	45,000	Butt welded pipe
Class II	48,000	Butt welded pipe
Bessemer	50,000	Butt welded pipe

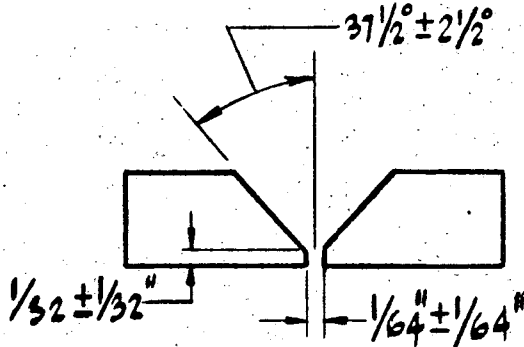
\* Specified carbon content exceeds 0.30 per cent.

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BEVEL DETAILS

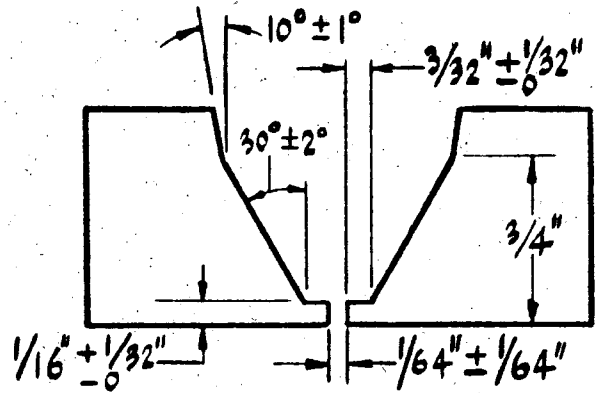
**VEE GROOVE**

Thicknesses 3/8" and less



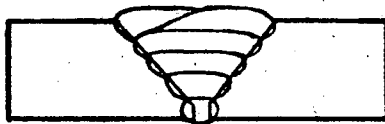
**VEE GROOVE  
EXTENDED LAND**

Thicknesses over 3/8"



LAYER DETAILS

(Illustrative only)



Weld - Flat, vertical, and overhead



Weld - Horizontal

TUNGSTEN			EXX 16			EXX 18		
Electrode Diameter	Filler Rod Diameter	Amps	Diam.	Amps	Volts	Diam.	Amps	Volts
1/16	1/16	60-150	3/32	70-100	20-22	3/32	80-100	20-22
3/32	1/16	150-250	1/8	80-120	22-24	1/8	100-160	22-24
1/8	1/16	250-350	5/32	150-190	22-24	5/32	160-220	22-24

**NOTE:**

- (1) The first pass shall be made by the gas tungsten-arc process. The second and successive passes shall be made by the shielded metal-arc process.

△								
△								
△		Issued for field construction				AMC	RRJ	
NO.	DATE	REVISIONS			DR.	SUPVR.	ENG.	ENG. CLIENT



**WELDING STANDARD**

Weld Bevel and Layer Details for Welding Pipe

JOB No. STANDARD

DRAWING No.

P1-AT-Lh-f-2

REV.

0

Enclosure 4

BPC Welding Procedure Qualification Records

PQR TEST VS. BASE METAL TENSILE STRENGTH

TENSILE STRENGTH (PSI)

<u>WELD PROCEDURE</u>	<u>PQR TEST</u>	<u>BASE METAL</u>
P1-A-c	62,700	60,000 (A-106, Gr B)
P1-A-c-d	67,500	60,000 (A-106, Gr B)
P-1A	58,700	48,000 (API-5L, Gr A)
P1-A-c	72,500	60,000 (SA-53, Gr B)
P1-A-c	62,700	60,000 (SA-106, Gr B)
P1-A-c	69,700	60,000 (SA-333)
P1-A-Lh	69,250	60,000 (SA-106, Gr B)
P1-A-Lh	65,300	60,000 (SA-106, Gr B)
P1-AT-Lh	64,795	60,000 (SA-106, Gr B)
P1-AT-Lh	63,450	60,000 (SA-106, Gr B)
P8-A	89,800	75,000 (A-182, Gr F304)
P8-AT-Ag	79,900	75,000 (A-376, Type 316)
P8-T-Ag	83,350	75,000 (SA-312, Type 304)
P8, P1-A	65,980	60,000 (SA-53, GR B)
P8-AT-Ag	86,900	75,000 (SA-358, GR 347)
P1-A-c-d	67,500	60,000 (SA-106, GR B)
P1-A-c-Lh	74,300	60,000 (SA-106, GR B)



BECHTEL CORPORATION  
San Francisco, California

WELDING PROCEDURE QUALIFICATION RECORD PQR No. 2

PROCEDURE SPECIFICATION NO. Pl-A-c Date February 23, 1955  
WELDING PROCESS Shielded Metal-Arc Location Union Oil Co.  
Santa Maria, Ca.

PARENT MATERIAL QUALIFIED ON:

ASTM Spec. A 106 Grade B ASME P-No. 1  
Chemical Carbon Steel Shape Pipe  
Thickness Range Qualified 3/16-inch thru 0.874-inch Thickness 0.437"

ELECTRODE OR FILLER METAL:

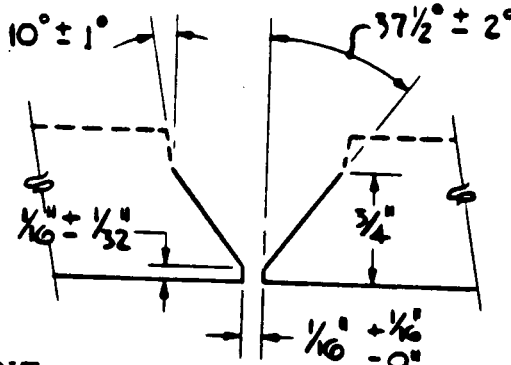
AWS Spec. A 5.1 AWS Classification E 6010 F-No. 3 A-No. 1

Filler Metal Chemistry (if not included in Table Q11.2) ---

Manufacturer, Trade Name and Wire Size Lincoln Fleetweld 5

Flux or Shielding Gas N.A. Flow Rate ---

JOINT DESIGN:



Weld Direction 5G Uphill  
Backing Strips None  
Consumable Insert ---  
Internal Purge ---  
Flow Rate ---  
Welding Current DCRP  
Multiple pass per side yes

HEAT TREATMENT:

Preheat Temp. Min. None Postweld Heat Treatment Temp. None  
Interpass Temp. Max. --- P. H. T. Time ---

TEST RESULTS		2G	POSITION 2G	5G	POSITION 5G
Reduced Section Tensile	Tensile Strength, psi	64,300	63,669	62,700	64,100
Bend	Root	180°OK	180°OK	180°OK	180°OK
Bend	Face	180°OK	180°OK	180°OK	180°OK
Other					

Mechanical Testing by Pittsburgh Testing Lab. S.F Lab No. ---  
Welders Name Harry C. Whisenant Symbol S  
Test Conducted by J. N. Taylor

We certify that the statements in this record are correct and that the tests welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

BECHTEL CORPORATION





BECHTEL CORPORATION  
San Francisco, California

WELDING PROCEDURE QUALIFICATION RECORD PQR No. 4

PROCEDURE SPECIFICATION NO. Pl-A-c-d Date April 19, 1962  
WELDING PROCESS Manual Shielded Metal-Arc Location San Francisco  
California

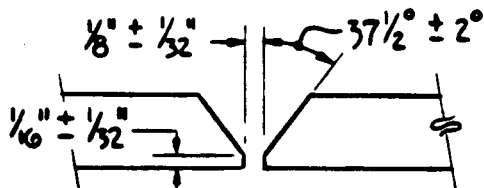
PARENT MATERIAL QUALIFIED ON:

ASTM Spec. A 106 Grade B ASME P-No. 1  
Chemical Carbon Steel Shape 12-inch XS pipe  
Thickness Range Qualified 3/16-inch thru 1-inch Thickness 0.500 inch

ELECTRODE OR FILLER METAL:

AWS Spec. A 5.1 AWS Classification E 6010 F-No. 3 A-No. 1  
A 5.5 AWS Classification E 7010 F-No. 3 A-No. 2  
Filler Metal Chemistry (if not included in Table Q1.2) ---  
Manufacturer, Trade Name and Wire Size Lincoln Fleetweld 5  
Lincoln Fleetweld 85  
Flux or Shielding Gas --- Flow Rate ---

JOINT DESIGN:



Weld Direction Downhill  
Backing Strips None  
Consumable Insert None  
Internal Purge ---  
Flow Rate ---  
Welding Current DCRP  
Multiple pass per side yes

HEAT TREATMENT:

Preheat Temp. Min. 60°F Postweld Heat Treatment Temp. None  
Interpass Temp. Max. --- P. H. T. Time ---

TEST RESULTS		5G POSITION	5G POSITION
Reduced Section Tensile	Tensile Strength, psi	67,500	68,950
Bend	Side	180°OK	180°OK
	Side	180°OK	180°OK
Other			

Mechanical Testing by Bechtel Lab Lab No. ---  
Welders Name Gene Blalock Symbol B  
Test Conducted by A. M. Croswell

We certify that the statements in this record are correct and that the tests welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

BECHTEL CORPORATION

*A M Croswell*

PROCEDURE QUALIFICATION RECORD

Procedure Specification No. P-1A Date 4/9/53  
Welding Process Manual Metallic-Arc Location San Francisco, Calif.

Name Paul Cady Symbol C  
Test Conducted by R. G. Rhoades

Parent Material Qualified On:

Chemical Carbon-Steel Spec. API 5-L Grade "A"  
P-No. 1 Shape 20" Pipe  
Thickness 13/16" Wall

Electrode or Filler Material Used:

AWS Class. E-6010 ASTM Spec. A233

F-No. 3 A-No. 1  
Manufacturer and Trade Name Lincoln Fleet-Weld 5

Joint Design Per:

Bevel Angle 37 1/2° Single or Double Single Backing Strips Used No

Heat Treatment

Preheat None Stress Relieve Temp. None Stress relieve Time None

Radiographic Results Satisfactory

Physical Testing Pittsburgh Testing Laboratory, San Francisco, Calif.

SPECIMEN	Pipe	POSITION: Axis Vertical		POSITION: Axis Horizontal	
		RESULTS		RESULTS	
Reduced Section	Yield Strength psi	36,750	35,640	35,551	34,898
	Tensile Strength psi	58,700	59,200	59,459	58,953
Tensile	Elongation, % in 2"	--	--	--	--
Bend	Free %	--	--	--	--
Bend	Side or root	180°OK	180°OK	180°OK	180°OK
Bend	Side or face	180°OK	180°OK	180°OK	180°OK

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

BECHTEL CORPORATION

Date 4/14/53

By A. M. Brownell

**BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE (4)  
Sheet 4 of 17  
PQR NO. 1

Procedure Specification Pl-A-c Date December 19, 1969  
 Welding Process(es) Shielded Metal Arc Location San Francisco, California

Material Specification SA-53, Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 12 inches O.D. Range Qualified All  
 Thickness 1/4 inch Thickness Range Qualified 1/16 through 1/2 inch

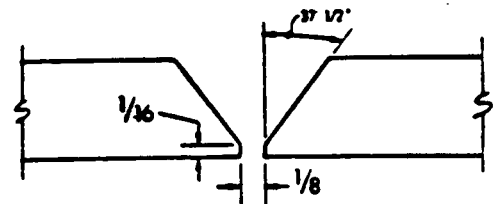
Filler Metal Specifications:  
 ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---

Electrode Dia. 1/8 inch Wire Dia. ---  
 Consumable Insert --- Trade Names Lincoln Fleetweld 5P  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---

Position of Groove 2G & 5G  
 Welding Direction 5G uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage 115  
 Voltage 30  
 Single or Multiple Arc Single  
 Travel Speed 7 ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Minimum Interpass Temperature Not recorded  
 Oscillation width --- inches, and dwell --- sec.

JOINT DESIGN



HEAT TREATMENT: Temp. None Time ---

Reduced Section	[Specimen No.]	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
Tensile Tests	2G A	0.748 in.	0.246 in.	0.184	13,652	74,200	B.M.
	2G B	0.747 in.	0.252 in.	0.188	13,705	72,900	B.M.
	5G A	0.748 in.	0.240 in.	0.180	13,392	74,400	B.M.
	5G B	0.747 in.	0.244 in.	0.182	13,195	72,500	B.M.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Root - 2G	180 degrees - OK	2 Root - 5G	180 degrees - OK
	2 Face - 2G	180 degrees - OK	2 Face - 2G	180 degrees - OK

Mechanical Testing By Anamet and Bechtel Laboratories Lab. No. 1269.251  
 Welder's Name H. J. Mantle and K. Foster LAO-435, 6280  
 Test Conducted By L. A. Oscarson

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

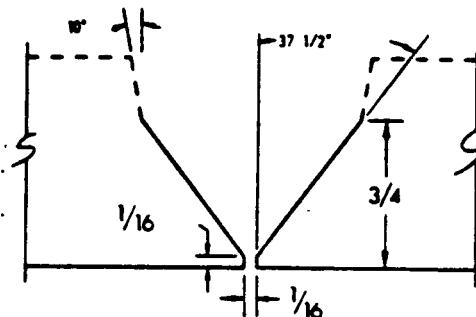
Recorded on New Form March 19, 1979 Reviewed By J. J. [Signature]  
 Original Designation Pl-A-c Approved By B. M. MacLeod  
 Other Designations --- Materials and Quality Services  
 Department, Research and Engineering

**BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE(4)  
SHEET 5 of 17  
PQR NO. 2

Procedure Specification Pl-A-c Date February 23, 1955  
 Welding Process(es) Shielded Metal Arc Location Union Oil Company,  
Santa Maria, Calif.  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 6 inches O.D. Range Qualified All  
 Thickness 0.437 inch Thickness Range Qualified 3/16 through 0.874 inch  
 Filler Metal Specifications:  
 ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. Not recorded Wire Dia. ---  
 Consumable Insert --- Trade Names Lincoln Fleetweld 5  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G  
 Welding Direction Uphill for 5G  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature Not recorded  
 Oscillation width --- inches, and dwell --- sec.

JOINT DESIGN



HEAT TREATMENT: Temp. None Time ---

Reduced Section	[Specimen No.]	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
Tensile Tests	[ 2G ]	[ N.R. in. ]	[ N.R. in. ]	[ N.R. ]	[ N.R. ]	[ 64,300 ]	[ N.R. ]
	[ 2G ]	[ N.R. in. ]	[ N.R. in. ]	[ N.R. ]	[ N.R. ]	[ 63,669 ]	[ N.R. ]
	[ 5G ]	[ N.R. in. ]	[ N.R. in. ]	[ N.R. ]	[ N.R. ]	[ 62,700 ]	[ N.R. ]
	[ 5G ]	[ N.R. in. ]	[ N.R. in. ]	[ N.R. ]	[ N.R. ]	[ 64,100 ]	[ N.R. ]

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	[ 2 Root - 2G ]	[ 180 degrees - OK ]	[ 2 Face - 2G ]	[ 180 degrees - OK ]
	[ 2 Root - 5G ]	[ 180 degrees - OK ]	[ 2 Face - 5G ]	[ 180 degrees - OK ]
Other	N.R. = not recorded			

Mechanical Testing By Pittsburgh Testing Lab. S.F. Lab. No. Not recorded  
 Welder's Name Harry C. Whisenant  
 Test Conducted By J. N. Taylor

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form March 19, 1979  
 Original Designation P-1A  
 Other Designations ---

BECHTEL POWER CORPORATION  
 Reviewed By J. B. ...  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Department, Research and Engineering

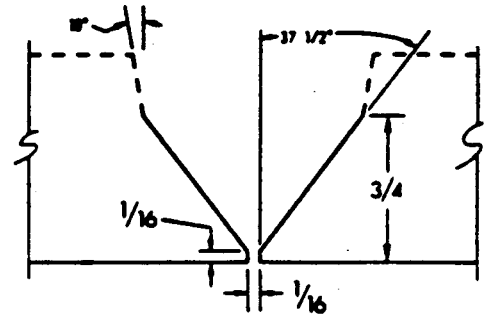
**BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE (4)  
SHEET 6 of 17  
PQR NO. 3

Procedure Specification Pl-A-c Date August 8, 1963  
 Welding Process(es) Shielded Metal-Arc Location San Francisco, California  
 Material Specification SA-333 to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 6-5/8 inches O.D. Range Qualified All  
 Thickness 0.864 inch Thickness Range Qualified 3/16 thru 1.728 inches

**Filler Metal Specifications:**

ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. N.R. Wire Dia. ---  
 Consumable Insert --- Trade Names Fleetweld 5  
 Tungsten Type ---  
 Shielding Gas --- Flow Rate ---  
 Purge Gas --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G JOINT DESIGN  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Heat Temperature Minimum 50F  
 Maximum Interpass Temperature N.R.  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. 1150F Time 1 hour

Reduced Section	[Specimen No.]	Width	Thick. or Dia.]	Area Sq. In.]	Load Lbs.]	UTS psi	Remarks
	[ 2G - 1 ]	[ 0.750 in.]	[ 0.747 in.]	[ 0.560 ]	[ 39,350 ]	[ 70,300 ]	[ Weld ]
	[ 2G - 2 ]	[ 0.743 in.]	[ 0.755 in.]	[ 0.561 ]	[ 39,100 ]	[ 69,700 ]	[ Weld ]
Tensile Tests	[ 5G - 1 ]	[ 0.722 in.]	[ 0.701 in.]	[ 0.506 ]	[ 36,250 ]	[ 71,600 ]	[ Weld ]
	[ 5G - 2 ]	[ 0.732 in.]	[ 0.748 in.]	[ 0.548 ]	[ 39,700 ]	[ 72,500 ]	[ Weld ]

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	[ 4 Side - 2G ]	[ 180 Degrees - OK ]	[ 4 Side - 5G ]	[ 180 Degrees - OK ]
Other				

Mechanical Testing By Testing Engineers Inc. & Bechtel Lab. No. N.R.  
 Welder's Name Burl Blalock OL5-2276  
 Test Conducted By E. H. Belter

I certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

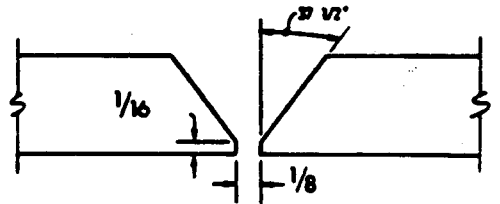
Recorded on New Form October 15, 1979  
 Original Designation Pl-A-c  
 Other Designations ---

Reviewed By J. Buisson  
 Approved By B. M. MacLeod  
 Materials and Quality Services  
 Research and Engineering

BECHTEL INCORPORATED  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 9

Procedure Specification PI-A-Lh Date August 8, 1963  
 Welding Process(es) Shielded Metal Arc Location San Francisco, California  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 10-3/4 inches O.D. Range Qualified All  
 Thickness 0.365 inch Thickness Range Qualified 1/16 through 0.730 inch  
 Filler Metal Specifications:  
 ASME SPA-5.1 AWS Classification E7018 F-No. 4 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. Not recorded Wire Dia. ---  
 Consumable Insert --- Trade Names P & H 170LA  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G JOINT DESIGN  
 Welding Direction 5G uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature Not recorded  
 Oscillation width --- inches, and dwell --- sec.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
	2G - 1	0.747 in.	0.323 in.	0.241	16,960	70,370	B.M.
	2G - 2	0.747 in.	0.302 in.	0.226	15,650	69,250	B.M.
	5G - 1	0.750 in.	0.336 in.	0.252	17,530	69,560	B.M.
	5G - 2	0.749 in.	0.313 in.	0.234	16,250	69,440	B.M.

Guided Tests	Type & Position	Result	Type & Position	Result
Bend	2 Root - 2G	180 degrees - OK	2 Root - 5G	180 degrees - OK
Tests	2 Face - 2G	180 degrees - OK	2 Face - 5G	180 degrees - OK
Other				

Mechanical Testing By Testing Engineers and Bechtel Lab. Lab. No. OL5-2276  
 Welder's Name B. Bialock  
 Test Conducted By E. H. Belter

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form March 19, 1979  
 Original Designation PI-A-Lh  
 Other Designations ---

BECHTEL INCORPORATED  
 Reviewed By W. H. Borten  
 Approved By B. M. MacLeod  
 Materials and Quality Services  
 Department, Research and Engineering

**BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE (4)  
SHEET 8 of 17  
PQR NO. 10

Procedure Specification Pl-A-Lh Date March 3, 1965  
 Welding Process(es) Shielded Metal Arc Location San Francisco, California

Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 10-3/4 inches O.D. Range Qualified All  
 Thickness 2.00 inches Thickness Range Qualified 3/16 through 4.0 inches

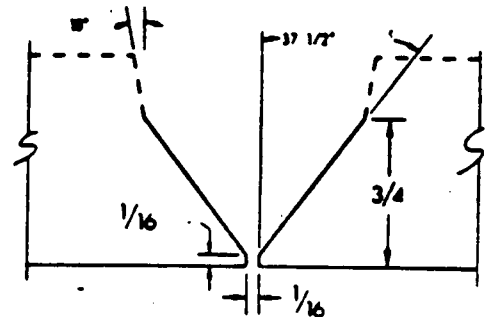
Filler Metal Specifications:  
 ASME SFA-5.1 AWS Classification E7016 F-No. 4 A-No. 1  
 ASME SFA-5.1 AWS Classification E7018 F-No. 4 A-No. 1

Filler Metal Chemistry ---

Electrode Dia. Not recorded Wire Dia. ---  
 Consumable Insert --- Trade Names Arcos 7016  
Atom Arc 7018  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---

Position of Groove 2G & 5G  
 Welding Direction 5G uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 200F  
 Maximum Interpass Temperature Not recorded  
 Oscillation width --- inches, and dwell --- sec.

JOINT DESIGN



HEAT TREATMENT: Temp. 1150F Time 2 hours

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
	2G	N.R. in.	N.R. in.	N.R.	N.R.	65,300	None
Tensile Tests	2G	N.R. in.	N.R. in.	N.R.	N.R.	68,400	None
	5G	N.R. in.	N.R. in.	N.R.	N.R.	68,300	None
	5G	N.R. in.	N.R. in.	N.R.	N.R.	65,300	None

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 side - 2G	180 degrees - OK	4 side - 5G	180 degrees - OK
Other	N.R. = not recorded			

Mechanical Testing By Pittsburgh Testing Lab & Bechtel Lab. Lab. No. Not recorded  
 Welder's Name W. B. Keyser  
 Test Conducted By W. B. Keyser

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Revised on New Form March 19, 1979  
 Original Designation Pl-A-Lh  
 Other Designations ---

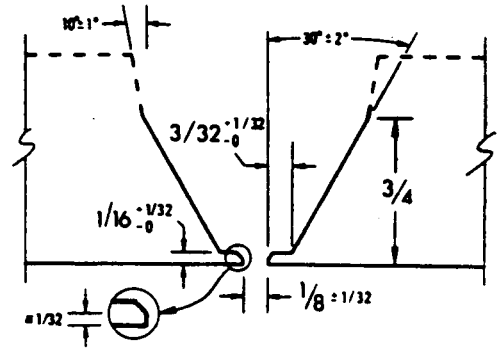
BECHTEL POWER CORPORATION  
 Reviewed By J. B. [Signature]  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Department, Research and Engineering

BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 17

Procedure Specification Pl-AT-Lh Date March 3, 1965  
 Welding Process(es) Gas Tungsten Arc and Shielded Metal Arc Location San Francisco, California  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 10-3/4 in. O.D. Range Qualified All  
 Thickness 2.0 in. Thickness Range Qualified 3/16 thru 4.0 in.  
 Filler Metal Specifications:  
 ASME SFA-5.18 AWS Classification E70S-2 F-No. 6 A-No. 1  
 ASME SFA-5.1 AWS Classification E7016 & E7018 F-No. 4 A-No. 1  
 Filler Metal Chemistry ---  
 Electrode Dia. 7016 3/32 in; 7018 1/8 & 5/32 in. Wire Dia. 1/8 in.  
 Consumable Insert None Trade Names Linde Oxweld 65  
 Tungsten Type Not recorded Arcos 7016, Atom Arc 7018  
 Shielding Gas: Argon Flow Rate 20 cfh  
 Purge Gas: None Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity GTAW-DCSP/ SMAW-DCRP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 200F  
 Maximum Interpass Temperature None

JOINT DESIGN



HEAT TREATMENT: Temp. 1125 to 1175F Time Two Hours

Reduced Section	Position	UTS psi	Remarks	Position	UTS psi	Remarks
	2G	64,796	None	5G	68,877	None
Tensile Tests	2G	68,877	None	5G	64,795	None

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 degs. OK	4 Side - 5G	180 degs. OK

Mechanical Testing By PTL and Bechtel Labs Lab. No. Not recorded  
 Welder's Name W. B. Keyser  
 Test Conducted By W. B. Keyser

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form December 10, 1975  
 Original Designation ---  
 Other Designations ---

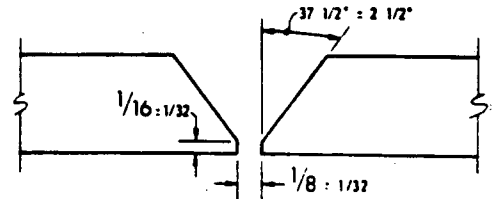
Reviewed By F. C. Heister  
 Approved By B. M. MacLeod  
 Materials and Quality Services Department



BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 18

Procedure Specification Pl-AT-Lh Date May 6, 1965  
 Welding Process(es) Gas Tungsten Arc and Shielded Metal Arc Location San Francisco, California  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 8-5/8 in. O.D. Range Qualified All  
 Thickness 0.375 in. Thickness Range Qualified 1/16 thru 0.750 in.  
 Filler Metal Specifications:  
 ASME SFA-5.18 AWS Classification E70S-2 F-No. 6 A-No. 1  
 ASME SFA-5.1 AWS Classification E7018 F-No. 4 A-No. 1  
 Filler Metal Chemistry ---  
 Electrode Dia. 7018 1/8 in. & 5/32 in. Wire Dia. 1/8 in.  
 Consumable Insert None Trade Names Linde Oxweld 65  
 Tungsten Type Not recorded Arcos 7018  
 Shielding Gas: Argon Flow Rate 20 cfh  
 Purge Gas: none Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G and 5G JOINT DESIGN  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity GTAW-DCSP/SMAW-DCRP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum None  
 Maximum Interpass Temperature None



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Position	UTS psi	Remarks	Position	UTS psi	Remarks
	2G	63,900	None	5G	63,800	None
Tensile Tests	2G	63,700	None	5G	63,450	None

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Root - 2G	180 degs. OK	2 Root - 5G	180 degs. OK
	2 Face - 2G	180 degs. OK	2 Face - 5G	180 degs. OK

Mechanical Testing By Bechtel Lab. Lab. No. None  
 Welder's Name B. Blalock  
 Test Conducted By W. B. Keyser

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form December 10, 1975  
 Original Designation Pl-BS  
 Other Designations ---

Reviewed By J. C. Newman  
 Approved By B. M. Macleod  
 Materials and Quality Services Department

**BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE(4)  
SHEET 11 of 17  
PQR NO. 46

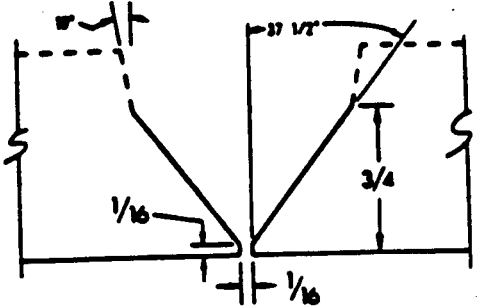
Procedure Specification P8-A Date April 24, 1970  
 Welding Process(es) Shielded Metal Arc Location San Francisco, California

Material Specification A182 Grade F304 to Itself  
 ASME P-No. 8 to P-No. 8 O.D. 12-3/4 inches O.D. Range Qualified All  
 Thickness 1-1/4 inches Thickness Range Qualified 3/16 thru 2-1/2 inches

Filler Metal Specifications:  
 ASME SFA-5.4 AWS Classification E308-16 F-No. 5 A-No. 8  
 ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---  
 Electrode Dia. 3/32 and 1/8 inch Wire Dia. ---  
 Consumable Insert --- Trade Names McKay E308-16  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---

**JOINT DESIGN**



Position of Groove 2G & 5G  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage 85-110  
 Voltage 22-24  
 Single or Multiple Arc Single  
 Travel Speed 2-8 ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature 350F  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.

HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
	2G - 1	---	0.506 in.	0.201	18,592	92,500	Weld
	2G - 2	---	0.506 in.	0.201	18,592	92,500	Weld
Tensile Tests	5G - 1	---	0.506 in.	0.201	18,049	89,800	Weld
	5G - 2	---	0.506 in.	0.201	18,291	91,000	Weld

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 Degrees - OK		
	4 Side - 5G	180 Degrees - OK		

Other \_\_\_\_\_

Mechanical Testing By Anamet Laboratories Lab. No. N.R.  
 Welder's Name L. A. Oscarson LAO-031 470.434  
 Test Conducted By H. J. Mantle

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code \_\_\_\_\_

Recorded on New Form July 3, 1980  
 Original WPS, Rev., Entity P8-A/N.R./N.R.

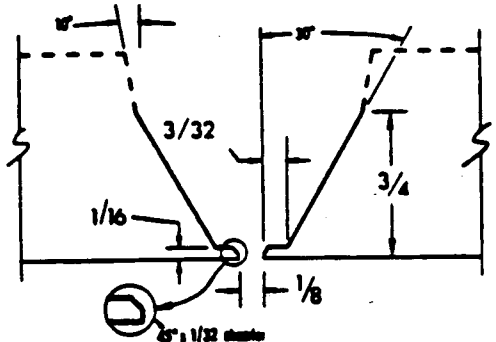
Reviewed By A. K. Bordina  
 Approved By B. M. MacLeod  
 Materials and Quality Services  
 Research and Engineering

Other Designations ---

**BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE (4)  
SHEET 12 of 17,  
PQR NO. 47

Procedure Specification P8-AT-Ag Date August 22, 1968  
 Welding Process(es) Gas Tungsten Arc and Shielded Metal Arc Location San Francisco, California  
 Material Specification A376 Type 316 to Itself  
 ASME P-No. 8 to P-No. 8 O.D. 34 inches O.D. Range Qualified All  
 Thickness 2 inches; GTAW 3/32, SMAW 1-29/32 Thickness Range Qualified 3/16 thru 4 inches  
 Filler Metal Specifications: GTAW 1/16 thru 3/16; SMAW 3/16 thru 3-13/16  
 ASME SFA-5.9 AWS Classification ER316 F-No. 6 A-No. 8  
 ASME SFA-5.4 AWS Classification E316-15 & 16 F-No. 5 A-No. 8  
 Filler Metal Chemistry ---  
 Electrode Dia. 1/8 and 5/32 inch Wire Dia. 1/8 inch  
 Consumable Insert None Trade Names McKay ER316  
 Tungsten Type N.R. McKay E316-15, E316-16  
 Shielding Gas: Argon Flow Rate 20 cfh  
 Purge Gas: Argon Flow Rate 20 cfh  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G JOINT DESIGN  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity GTAW DCSP; SMAW DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Interpass Temperature N.R.  
 Penetration Width N.R. inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. None Time ---

Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
Tensile Tests	2G	---	N.R.	N.R.	N.R.	81,300	N.R.
	2G	---	N.R.	N.R.	N.R.	79,900	N.R.
Tensile Tests	5G	---	N.R.	N.R.	N.R.	82,900	N.R.
	5G	---	N.R.	N.R.	N.R.	83,800	N.R.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
Bend Tests	4 Side - 2G	180 Degrees - OK		
	4 Side - 5G	180 Degrees - OK		
Other				

Mechanical Testing By Anamet Laboratories Lab. No. BLN 568-1  
 Welder's Name W. B. Keyser and L. Thompson  
 Test Conducted By B. M. Macleod

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Revised on New Form November 7, 1980  
 Original WPS, Rev., Entity P8-AT-Ag/NR./N.R.

Reviewed By [Signature]  
 Approved By [Signature]  
 Materials and Quality Services  
 Research and Engineering

Other Designations ---

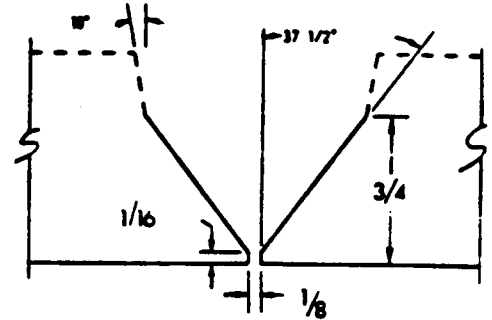
**BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE(4)  
SHEET 13 of 17  
PQR NO. 54

Procedure Specification P8-T-Ag Date March 24, 1958  
 Welding Process(es) Gas Tungsten Arc Location Morris, Illinois  
 Material Specification SA-312 Type 304 to Itself  
 ASME P-No. 8 to P-No. 8 O.D. 6 inches O.D. Range Qualified All  
 Thickness 0.432 inch Thickness Range Qualified 3/16 through 0.864 inch

Filler Metal Specifications:  
 ASME SFA-5.9 AWS Classification ER308 F-No. 6 A-No. 8  
 ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---  
 Electrode Dia. Not recorded Wire Dia. Not recorded  
 Consumable Insert None Trade Names Alloy Rods, Draw alloy 308  
 Tungsten Type Not recorded  
 Shielding Gas: Argon Flow Rate 20 cfh  
 Purge Gas: Not recorded Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G **JOINT DESIGN**  
 Welding Direction 5G uphill  
 Backing Strip None  
 Current and Polarity DCSP  
 Amperage Not recorded  
 Voltage Not recorded  
 Single or Multiple Arc Single  
 Travel Speed Not recorded ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature Not recorded  
 Oscillation width --- inches, and dwell --- sec.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
	2G	---	in.	Not recorded	Not recorded	87,600	Not recorded
Tensile Tests	2G	---	in.	Not recorded	Not recorded	87,160	Not recorded
	5G	---	in.	Not recorded	Not recorded	83,350	Not recorded
	5G	---	in.	Not recorded	Not recorded	86,540	Not recorded

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Face - 2G	180 degrees - OK	2 Root - 2G	180 degrees - OK
	2 Face - 5G	180 degrees - OK	2 Root - 5G	180 degrees - OK

Mechanical Testing By W. H. Flood Laboratories Lab. No. Not recorded  
 Welder's Name H. Belt  
 Test Conducted By J. Matsko

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Revised on New Form March 20, 1979  
 Original Designation P-8C  
 Other Designations P-8T, P8-T-g

BECHTEL POWER CORPORATION  
 Reviewed By Johann Meisner  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Department, Research and Engineering

**BECHTEL**  
**WELDING PROCEDURE QUALIFICATION RECORD**

ENCLOSURE (4)  
SHEET 14 of 17  
PQR NO. 78

Procedure Specification P8, P1-A Date July 16, 1958  
 Welding Process(es) Shielded Metal Arc Location Dresden  
Illinois  
 Material Specification SA-312 Grade TP304 to SA-53 Grade 4  
 ASME P-No. 8 to P-No. 1 O.D. 6-5/8 inches O.D. Range Qualified All  
 Thickness 7/8 inch Thickness Range Qualified 3/16 thru 1-3/4 inches

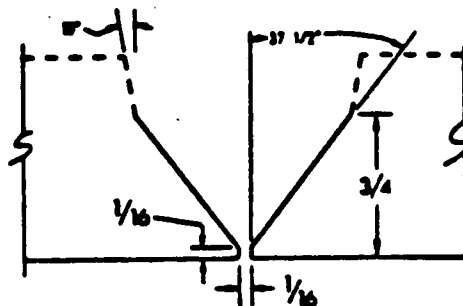
**Filler Metal Specifications:**

ASME SFA-5.4 AWS Classification E312-16 F-No. 5 A-No. 8  
 ASME --- AWS Classification --- F-No. --- A-No. ---

**Filler Metal Chemistry**

Electrode Dia. N.R. Wire Dia. ---  
 Consumable Insert None Trade Names Arcalloy 312 (Alloy Rods Co.)  
 Tungsten Type ---  
 Shielding Gas --- Flow Rate ---  
 Purge Gas --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G and 5G  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 200F  
 Maximum Interpass Temperature N.R.  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.

JOINT DESIGN



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
Tensile Tests	2G-1	N.R. in.	N.R. in.	N.R.	N.R.	66,140	N.R.
	2G-2	N.R. in.	N.R. in.	N.R.	N.R.	67,000	N.R.
	5G-1	N.R. in.	N.R. in.	N.R.	N.R.	65,980	N.R.
	5G-2	N.R. in.	N.R. in.	N.R.	N.R.	67,850	N.R.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 Degrees - OK		
	4 Side - 5G	180 Degrees - OK		

Other Radiography recorded as satisfactory

Mechanical Testing By Pittsburgh Testing Lab. Lab. No. N.R.  
 Welder's Name H. Belt (Symbol L)  
 Test Conducted By J. Matsko

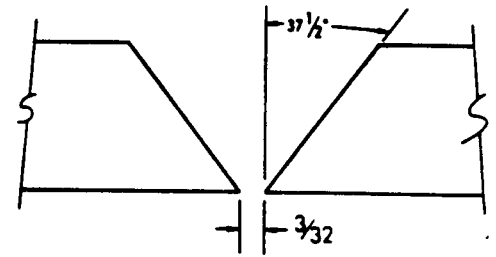
We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form December 4, 1980 Reviewed By J. B. Buisson  
 Original WPS, Rev., Entity P8-P1, Rev 12-30-55 Approved By J. M. MacLeod  
 BC-R&C Div, 2-30-55  
 Other Designations P8A, P1A and P8, P1-A Materials and Quality Services  
 Research and Engineering

BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 90

Procedure Specification P8-AT-Ag Date June 27, 1965  
 Welding Process(es) Gas Tungsten Arc and Location Richmond,  
Shielded Metal Arc California  
 Material Specification SA-358 Grade 347 to Itself  
 ASME P-No. 8 to P-No. 8 O.D. 8-5/8 inches O.D. Range Qualified All  
 Thickness 0.908 inch; GTAW 3/16; SMAW 0.721 Thickness Range Qualified 3/16 through 1.816 inches  
 Filler Metal Specifications: GTAW 1/16 through 3/8; SMAW 3/16 through 1.442 inches  
 ASME SFA-5.9 AWS Classification ER347 F-No. 6 A-No. 8  
 ASME SFA-5.4 AWS Classification E347-15, E308-15 F-No. 5 A-No. 8  
 Filler Metal Chemistry ---  
 Electrode Dia. GTA Not recorded; 3/32 inch E347; Wire Dia. 1/16 inch ER347  
1/8 and 5/32 E308  
 Consumable Insert None Trade Names Chromenar 19/9 Cb  
 Tungsten Type Not recorded Chromend 19/9 Cb and 19/9  
 Shielding Gas: Argon Flow Rate 12-15 cfh  
 Purge Gas: Argon Flow Rate 25 cfh - 10 cfh  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G and 5G JOINT DESIGN  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity GTAW DCSP; SMAW DCRP  
 Amperage GTAW 70-250; SMAW 70-130  
 Voltage GTAW 16-20; SMAW 23-26  
 Single or Multiple Arc Single  
 Travel Speed Not recorded  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50 F  
 Maximum Interpass Temperature 350 F



HEAT TREATMENT: Temp. 1575 F Time 1-3/4 hours

Reduced Section	Position	UTS psi	Remarks	Position	UTS psi	Remarks
	2G	89,800	Failed in BM	5G	86,900	Failed in BM
Tensile Tests	2G	89,000	Failed in BM	5G	88,300	Failed in BM

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 degrees-OK		
	4 Side - 5G	180 degrees-OK		
Other	2G and 5G nick breaks satisfactory. Calculated ferrite 5 - 7 percent. For impact test results and thickness range qualified see page 2.			

Mechanical Testing By Anamet Laboratories Lab. No. Not recorded  
 Welder's Name W. Mourer 665.309, 665.309A  
 Test Conducted By R. B. Setterlund

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form January 28, 1977 Reviewed By J. B. Miller  
 Original Designation P8-AT-g Approved By B. M. Mackard  
 Other Designations P8-AT-g (347) Materials and Quality Services Department

**BECHTEL POWER CORPORATION  
WELDING PROCEDURE QUALIFICATION RECORD**

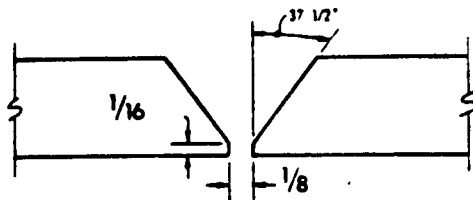
ENCLOSURE (4)  
SHEET 16 of 17  
WQR NO. 4

Procedure Specification Pl-A-c-d Date April 19, 1962  
 Welding Process(es) Shielded Metal-Arc Location San Francisco  
California  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 12-3/4 inches O.D. Range Qualified All  
 Thickness 1/2 inch Thickness Range Qualified 3/16 thru 1 inch

**Filler Metal Specifications:**

ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME SFA-5.5 AWS Classification E7010-A1 F-No. 3 A-No. 2

Filler Metal Chemistry ---  
 Electrode Dia. N.R. Wire Dia. ---  
 Consumable Insert None Trade Names Fleetweld 5  
Shield-Arc 85  
 Tungsten Type --- Flow Rate ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flux Name ---  
 Flux Classification --- JOINT DESIGN  
 Position of Groove 5G  
 Welding Direction 5G Downhill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 70F  
 Minimum Interpass Temperature ---  
 Maximum Heat Input N.R. Joules/inch  
 Oscill. Width --- inch(es), Dwell --- sec., Frequency --- cpm.



HEAT TREATMENT: Temp. --- Time ---

Reduced Section	[Specimen No.]	Width	[Thick. or Dia.]	Area	Sq. In.]	Load	Lbs.]	UTS	psi	Remarks
Tensile	[5G-1]	N.R. in.]	N.R. in.]	N.R.	N.R.]	N.R.	N.R.]	67,500	N.R.]	N.R.
Tensile	[5G-2]	N.R. in.]	N.R. in.]	N.R.	N.R.]	N.R.	N.R.]	68,950	N.R.]	N.R.
Tests	[---	--- in.]	--- in.]	---	---	---	---	---	---	---
Tests	[---	--- in.]	--- in.]	---	---	---	---	---	---	---

Guided Bend Tests	Type & Position	Result	Type & Position	Result
Bend	[4 Side - 5G Down	180 Degrees - OK	---	---
Tests	[---	---	---	---
Other				

Mechanical Testing By PTL and Bechtel Labs. Lab. No. N.R.  
 Welder's Name G. Blalock  
 Test Conducted By A. M. Crowell

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Recorded on New Form May 9, 1979  
 Original Designation Pl-A-c-d  
 Other Designations ---

BECHTEL POWER CORPORATION  
 Reviewed By J. B. ...  
 Approved By B. M. MacLeod  
 Materials and Quality Services  
 Research and Engineering

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

WPS NO. 6

Procedure Specification PI-A-c-Lh Date March 31, 1969  
Welding Process(es) Shielded Metal-Arc Location San Francisco, California

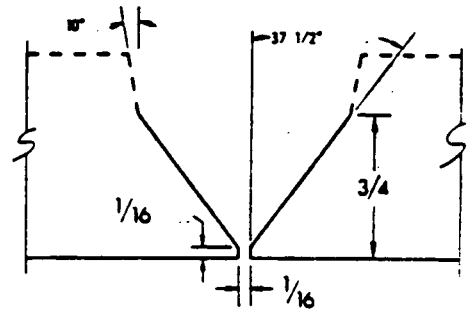
Material Specification SA-106 Grade B to Itself  
ASME P-No. 1 to P-No. 1 O.D. 12-3/4 inches O.D. Range Qualified All  
Thickness 1.0 inch Thickness Range Qualified 3/16 thru 2.0 inches

Filler Metal Specifications:

ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
ASME SFA-5.1 AWS Classification E7018 F-No. 4 A-No. 1

Filler Metal Chemistry ---  
Electrode Dia. N.R. Wire Dia. ---  
Consumable Insert --- Trade Names N.R.  
Tungsten Type ---  
Shielding Gas --- Flow Rate ---  
Purge Gas --- Flow Rate ---  
Flux Classification --- Flux Name ---

Position of Groove 2G JOINT DESIGN  
Welding Direction ---  
Backing Strip None  
Current and Polarity DCRP  
Amperage N.R.  
Voltage N.R.  
Single or Multiple Arc Single  
Travel Speed N.R. ipm.  
Multiple Pass Per Side Yes  
Preheat Temperature Minimum 50F  
Maximum Interpass Temperature N.R.  
Oscillation Width --- inch(es), Dwell --- sec.  
Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. 1150-1200F Time 1 hour

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
	2G-1	N.R. in.	N.R. in.	N.R.	N.R.	74,300	N.R.
Tensile Tests	2G-2	N.R. in.	N.R. in.	N.R.	N.R.	75,000	N.R.
		in.	in.				
		in.	in.				

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 Degrees - OK		
Other				

Mechanical Testing By Anamet Lab Lab. No. N.R.  
Welder's Name J. Miller  
Test Conducted By J. D. Bert and L. A. Oscarson

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Recorded on New Form October 15, 1979  
Original Designation PI-A-c-Lh  
Other Designations ---

Reviewed By J. B. ...  
Approved By B. M. Macleod  
Materials and Quality Services  
Research and Engineering



Enclosure 5

BPC Welding Procedure Qualification Record

SMAW and GTAW Processes

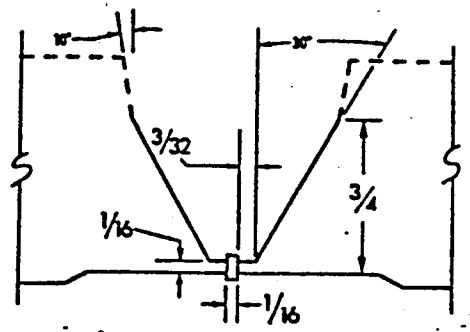
BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 50

Procedure Specification P8-AT-Ag-I Date August 19, 1965  
 Welding Process(es) Gas Tungsten Arc and Shielded Metal Arc Location San Onofre, California  
 Material Specification SA-430 Grade FP304 to Itself  
 ASME P-No. 8 to P-No. 8 O.D. 14 inches O.D. Range Qualified All  
 Thickness 1-3/4 inches; GTAW 3/16; SMAW 1-9/16 Thickness Range Qualified 3/16 thru 3-1/2 inches, GTAW 1/16 thru 3/8; SMAW 3/16 thru 3-1/8 inches

Filler Metal Specifications:  
 ASME SFA-5.9 AWS Classification ER308L F-No. 6 A-No. 8  
 ASME SFA-5.4 AWS Classification E308L F-No. 5 A-No. 8  
 Filler Metal Chemistry \_\_\_\_\_  
 Electrode Dia. GTAW N.R., SMAW 1/8 inch Wire Dia. 3/32 inch  
 Consumable Insert Yes, Type & Size N.R. Trade Names Linde ER308L  
 Tungsten Type N.R. Alloy Rods, Atom Arc E308L  
 Shielding Gas Argon Flow Rate 20 cfh  
 Purge Gas Argon Flow Rate N.R.  
 Flux Classification \_\_\_\_\_ Flux Name \_\_\_\_\_  
 Position of Groove 2G & 5G  
 Welding Direction 5G Uphill  
 Backing Strip None  
 Current and Polarity GTAW, DCSP; SMAW, DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature N.R.  
 Groove Width \_\_\_\_\_ inch(es), Dwell \_\_\_\_\_ sec.  
 Groove Frequency \_\_\_\_\_ cpm.

JOINT DESIGN



HEAT TREATMENT: Temp. None Time \_\_\_\_\_

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area	Sq. In.	Load	Lbs.	UTS	psi	Remarks
	2G-1	N.R. in.	N.R. in.		N.R.		N.R.	83,100		N.R.
	2G-2	N.R. in.	N.R. in.		N.R.		N.R.	80,900		N.R.
	5G-1	N.R. in.	N.R. in.		N.R.		N.R.	83,100		N.R.
	5G-2	N.R. in.	N.R. in.		N.R.		N.R.	83,600		N.R.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	4 Side - 2G	180 Degrees - OK	4 Side - 5G	180 Degrees - OK

Mechanical Testing By Advance Tests and Inspections Lab. No. N.R.  
 Welder's Name E. Estis  
 Test Conducted By B. Boyd Lab. No. N.R.

I certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Revision on New Form December 13, 1979  
 Designation P8-AT-g  
 Other Designations P8-AT-Ag-I

Reviewed By A. K. Bordin  
 Approved By J. M. MacLeod  
 Materials and Quality Services  
 Research and Engineering

Enclosure 6

AWS D1.0-63

Welding in Building Construction

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R. F. Dudley

San Onofre 1 Project Manager

June 26, 1986

Enclosure 7

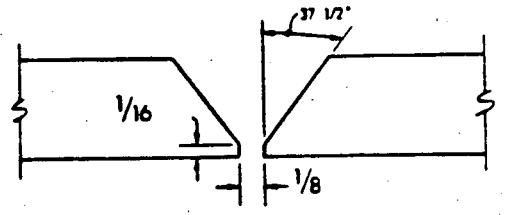
BPC Welding Procedure Qualification Records

Structural

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. D9

Procedure Specification Pl-A-Lh (Structural) Date August 8, 1963  
 Welding Process(es) Shielded Metal-Arc Location San Francisco, California  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 10-3/4 inches O.D. Range Qualified 10 and over  
 Thickness 0.365 inch Thickness Range Qualified 0.1825 thru 0.730 inch  
 Filler Metal Specifications:  
 ASME SFA-5.1 AWS Classification E7018 F-No. 4 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. N.R. Wire Dia. ---  
 Consumable Insert --- Trade Names P & H 170LA  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G JOINT DESIGN  
 Welding Direction 5G uphill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature N.R.  
 Oscillation width --- inches, and dwell --- sec.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area, Sq. In.	Load, Lbs.	UTS psi	Remarks
	2G - 1	0.747 in.	0.323 in.	0.241	16,960	70,370	B.M.
	2G - 2	0.747 in.	0.302 in.	0.226	15,650	69,250	B.M.
Tests	5G - 1	0.750 in.	0.336 in.	0.252	17,530	69,560	B.M.
	5G - 2	0.749 in.	0.313 in.	0.234	16,250	69,440	B.M.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Root - 2G	180 Degrees - OK	2 Root - 5G	180 Degrees - OK
	2 Face - 2G	180 Degrees - OK	2 Face - 5G	180 Degrees - OK

Mechanical Testing By Testing Engineers and Bechtel Lab. Lab. No. OL5-2276  
 Welder's Name B. Blalock  
 Test Conducted By E. H. Belter

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code and AWS D1.1

Recorded on New Form September 26, 1979  
 Final Designation Pl-A-Lh  
 Other Designations ---

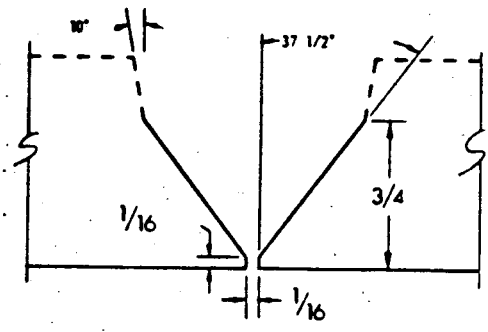
Reviewed By J. Buiniewicz  
 Approved By B. M. MacLeod  
 Materials and Quality Services  
 Department, Research and Engineering

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. D2

Procedure Specification Pl-A-c (Structural) Date February 23, 1955  
 Welding Process(es) Shielded Metal-Arc Location Union Oil Company, Santa Maria, Calif.  
 Material Specification SA-106 Grade B to Itself  
 ASME P-No. 1 to P-No. 1 O.D. 6 inches O.D. Range Qualified 4 and over  
 Thickness 0.437 inch (Sch. 80) Thickness Range Qualified 3/16 through any  
 Filler Metal Specifications:  
 ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. N.R. Wire Dia. ---  
 Consumable Insert --- Trade Names Lincoln Fleetweld 5  
 Tungsten Type ---  
 Shielding Gas: --- Flow Rate ---  
 Purge Gas: --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 2G & 5G  
 Welding Direction Uphill for 5G  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm. Oscillation --- cpm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 50F  
 Maximum Interpass Temperature N.R.  
 Oscillation width --- inches, and dwell --- sec.  
 HEAT TREATMENT: Temp. None Time ---

JOINT DESIGN



Reduced Section	Specimen No.]	Width ]	Thick. or Dia.]	Area, Sq. In.]	Load, Lbs.]	UTS psi ]	Remarks ]
Tensile Tests	[ 2G ]	[ N.R. in.]	[ N.R. in.]	[ N.R. ]	[ N.R. ]	[ 64,300 ]	[ N.R. ]
	[ 2G ]	[ N.R. in.]	[ N.R. in.]	[ N.R. ]	[ N.R. ]	[ 63,669 ]	[ N.R. ]
	[ 5G ]	[ N.R. in.]	[ N.R. in.]	[ N.R. ]	[ N.R. ]	[ 62,700 ]	[ N.R. ]
	[ 5G ]	[ N.R. in.]	[ N.R. in.]	[ N.R. ]	[ N.R. ]	[ 64,100 ]	[ N.R. ]

Guided Bend Tests	Type & Position ]	Result ]	Type & Position ]	Result ]
	[ 2 Root - 2G ]	[ 180 Degrees - OK ]	[ 2 Face - 2G ]	[ 180 Degrees - OK ]
	[ 2 Root - 5G ]	[ 180 Degrees - OK ]	[ 2 Face - 5G ]	[ 180 Degrees - OK ]
Other	[ N.R. = not recorded ]			

Mechanical Testing By Pittsburgh Testing Lab. S.F. Lab. No. N.R.  
 Welder's Name Harry C. Whisenant  
 Test Conducted By J. N. Taylor

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code and AWS D1.1

Recorded on New Form September 26, 1979  
 Original Designation P-1A  
 Other Designations ---

Reviewed By J. B. Brummitt  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Department, Research and Engineering

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 184

Procedure Specification Pl-A-c-d (Structural) Date April 9, 1971  
 Welding Process(es) Shielded Metal Arc Location San Francisco, California  
 Material Specification SA-285 Grade C to Itself  
 ASME P-No. 1 to P-No. 1 O.D. Plate O.D. Range Qualified All  
 Thickness 1/4 inch Thickness Range Qualified 1/16 thru 1/2 inch

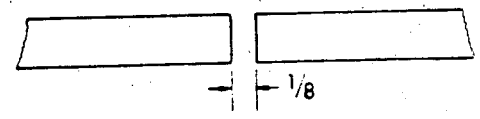
Filler Metal Specifications:

ASME SFA-5.1 AWS Classification E6010 F-No. 3 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---  
 Electrode Dia. 5/32 inch Wire Dia. ---  
 Consumable Insert --- Trade Names Fleetweld 5  
 Tungsten Type ---  
 Shielding Gas --- Flow Rate ---  
 Purge Gas --- Flow Rate ---  
 Flux Classification --- Flux Name ---

JOINT DESIGN

Position of Groove 2G and 3G  
 Welding Direction 3G Downhill  
 Backing Strip None  
 Current and Polarity DCRP  
 Amperage 120-140  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Single pass each side  
 Preheat Temperature Minimum 60F  
 Maximum Interpass Temperature N.R.  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
	2G-1	N.R. in.	N.R. in.	N.R.	N.R.	63,800	N.R.
	2G-2	N.R. in.	N.R. in.	N.R.	N.R.	61,800	N.R.
Tensile Tests	3G-1	N.R. in.	N.R. in.	N.R.	N.R.	67,000	N.R.
	3G-2	N.R. in.	N.R. in.	N.R.	N.R.	65,000	N.R.

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Face - 2G	180 Degrees - OK	2 Face - 3G	180 Degrees - OK
	2 Root - 2G	180 Degrees - OK	2 Root - 3G	180 Degrees - OK

Mechanical Testing By Bechtel Lab Lab. No. N.R.  
 Welder's Name W. Drumm  
 Test Conducted By B. M. Macleod

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Redacted on New Form November 6, 1979  
 Original Designation Pl-A-c-d (Structural)  
 Other Designations ---

Reviewed By J. Beiermeister  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Research and Engineering

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

WQR NO. 254

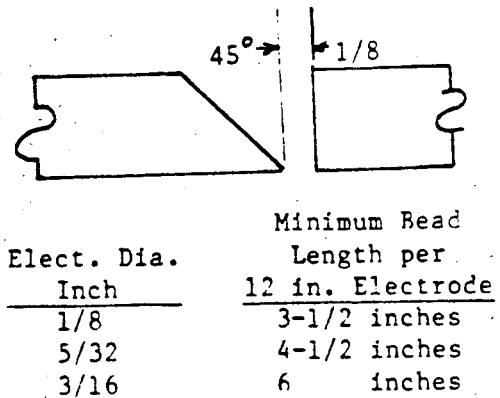
Procedure Specification P11, P1 -A-Lh (Structural) Date June 12, 1968  
Welding Process(es) Shielded Metal Arc Location San Francisco, California

Material Specification A514 (T-1 Steel) to A441  
ASME P-No. 11B\* to P-No. 1\* O.D. Plate O.D. Range Qualified All  
Thickness 1.0 inch Thickness Range Qualified 3/16 thru 2 inches ASME, unlimited AWS

Filler Metal Specifications:

ASME SFA-5.1 AWS Classification E7018 F-No. 4 A-No. 1  
ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---  
Electrode Dia. N.R. Wire Dia. ---  
Consumable Insert --- Trade Names N.R.  
Tungsten Type ---  
Shielding Gas --- Flow Rate ---  
Purge Gas --- Flow Rate ---  
Flux Classification --- Flux Name ---  
Position of Groove 3G JOINT DESIGN  
Welding Direction Uphill  
Backing Strip None  
Current and Polarity DCRP  
Amperage N.R.  
Voltage N.R.  
Single or Multiple Arc Single  
Travel Speed N.R. ipm.  
Multiple Pass Per Side Yes  
Preheat Temperature Minimum 200F  
Maximum Interpass Temperature 400F  
Welding Cycle Duration Width --- inch(es), Dwell --- sec.  
Welding Cycle Frequency --- cpm.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
	3G-1	0.997 in.	0.956 in.	0.953	81,800	85,800	BM (N.R.)
	3G-2	0.998 in.	0.935 in.	0.933	79,400	85,100	BM (N.R.)
Tests		in.	in.				
		in.	in.				

Guided Bend Tests [ Type & Position ] [ Result ] [ Type & Position ] [ Result ]  
Bend [ 4 Side - 3G ] [ 180 Degrees - OK ] [ ] [ ]  
Other [ 2 free bend tests 3G-1, 27 percent; 3G-2, 29 percent elongation. Both satisfactory. ]  
\*Similar to ASME P numbers 11B and 1.

Mechanical Testing By N.R. Lab. No. N.R.  
Welder's Name W. B. Keyser  
Test Conducted By W. B. Keyser

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code and AWS D1.0-68

Recorded on New Form November 30, 1979  
Original Designation P11, P1-A-Lh (Structural)  
Other Designations ---

Reviewed By [Signature]  
Approved By [Signature]  
Materials and Quality Services  
Research and Engineering



BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

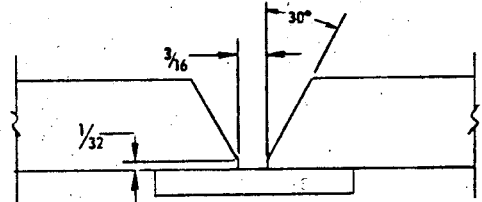
ENCLOSURE (4)  
SHEET 5 of 6  
PQR NO. 344

Procedure Specification Pl-F (CO2) (Structural) Date December 19, 1973  
 Welding Process(es) Flux Cored Arc Location Midland, Michigan  
 Material Specification SA-36 to Itself  
 ASME P-No. 1 to P-No. 1 O.D. Plate O.D. Range Qualified All  
 Thickness 3/8 inch Thickness Range Qualified 1/16 thru 3/4 inch

Filler Metal Specifications:

ASME SFA-5.20 AWS Classification E-70T-1 F-No. 6 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---

Filler Metal Chemistry ---  
 Electrode Dia. 1/16 inch Wire Dia. ---  
 Consumable Insert --- Trade Names Airco Super Cor  
 Tungsten Type ---  
 Shielding Gas CO2 Flow Rate 40 cfh  
 Purge Gas None Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 1G JOINT DESIGN  
 Welding Direction ---  
 Backing Strip Yes, Carbon Steel  
 Current and Polarity DCRP  
 Amperage 210-250  
 Voltage 25-28  
 Single or Multiple Arc Single  
 Travel Speed 6-10 ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 60F  
 Maximum Interpass Temperature N.R.  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
	1G - 1	1.499 in.	0.324 in.	0.486	33,100	68,100	BM
	1G - 2	1.504 in.	0.305 in.	0.459	32,500	70,800	BM
Tensile Tests		in.	in.				
		in.	in.				

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Face - 1G	180 Degrees - OK		
	2 Root - 1G	180 Degrees - OK		
Other	Radiography to RT-XG-1, acceptable to UW-51.			

Mechanical Testing By Bechtel Lab. No. BLN 1273-17  
 Welder's Name Jay Bowling 007  
 Test Conducted By R. L. Henke

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code

Revised on New Form January 8, 1980  
 Original Designation Pl-F (G) Structural  
 Other Designations Pl-F (CO2)(Structural)

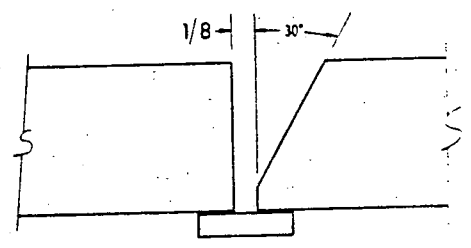
Reviewed By A. K. Bordin  
 Approved By B. M. Madson  
 Materials and Quality Services  
 Research and Engineering

BECHTEL  
WELDING PROCEDURE QUALIFICATION RECORD

PQR NO. 225

Procedure Specification Pl-F (Structural) Date August 21, 1967  
 Welding Process(es) Flux Cored Arc Location Bellingham, Washington  
 Material Specification SA-36 to Itself  
 ASME P-No. 1 to P-No. 1 O.D. Plate --- O.D. Range Qualified ---  
 Thickness 3/8 inch Thickness Range Qualified 1/16 thru 3/4 inch

Filler Metal Specifications:  
 ASME SFA-5.20 AWS Classification E70T-2 F-No. 6 A-No. 1  
 ASME --- AWS Classification --- F-No. --- A-No. ---  
 Filler Metal Chemistry ---  
 Electrode Dia. 5/64 inch Wire Dia. ---  
 Consumable Insert None Trade Names Airco Fluxcor 1  
 Tungsten Type ---  
 Shielding Gas CO2 Flow Rate 40 cfh  
 Purge Gas --- Flow Rate ---  
 Flux Classification --- Flux Name ---  
 Position of Groove 1G **JOINT DESIGN**  
 Welding Direction ---  
 Backing Strip Yes - Carbon Steel  
 Current and Polarity DCRP  
 Amperage N.R.  
 Voltage N.R.  
 Single or Multiple Arc Single  
 Travel Speed N.R. ipm.  
 Multiple Pass Per Side Yes  
 Preheat Temperature Minimum 60F  
 Maximum Interpass Temperature N.R.  
 Oscillation Width --- inch(es), Dwell --- sec.  
 Oscillation Frequency --- cpm.



HEAT TREATMENT: Temp. None Time ---

Reduced Section	Specimen No.	Width	Thick. or Dia.	Area Sq. In.	Load Lbs.	UTS psi	Remarks
	1G-1	N.R. in.	N.R. in.	N.R.	N.R.	72,860	N.R.
	1G-2	N.R. in.	N.R. in.	N.R.	N.R.	71,280	N.R.
Tensile Tests		in.	in.				
		in.	in.				

Guided Bend Tests	Type & Position	Result	Type & Position	Result
	2 Face - 1G	180 Degrees - OK		
	2 Root - 1G	180 Degrees - OK		
Other				

Mechanical Testing By Coast Eldridge Test Lab Lab. No. N.R.  
 Welder's Name N.R.  
 Test Conducted By J. Ghiselli

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code AWS D1.0 and AWS D2.0

Revised on New Form November 15, 1979  
 Original Designation Pl-M (Structural)  
 Other Designations Pl-F (G) (Structural)

Reviewed By AK Bordine  
 Approved By B. M. Macleod  
 Materials and Quality Services  
 Research and Engineering

Enclosure 8

BPC Field Weld Check-Off List

FIELD WELD CHECK-OFF LIST

Job No. \_\_\_\_\_ Unit No. \_\_\_\_\_

<u>GENERAL INFORMATION</u>	Bechtel W. E.		Authorized Code Insp.	
	Initials	Date	Signature	Date
System _____				
Iso. No. _____				
Weld No. _____				
Material _____				
Diameter _____ Wall Thickness _____				
Welding Procedure _____				
Filler Metal: Root _____				
Filler Passes _____				
Preheat _____				
Proper Joint Preparation and Fit-Up _____				
_____ used for Welding _____				
Welders Name & Symbol _____				
Welders Name & Symbol _____				
<u>WELD INSPECTION DATA</u>				
Visual Inspection _____				
Post Heat Temp. _____ Time _____				
Liquid Penetrant: Root _____				
Cover _____				
Magnetic Particle _____				
Radiographed _____				
Radiography Results: Accepted _____				
Rejected _____				

CERTIFIED CORRECT

Bechtel Welding Engineer \_\_\_\_\_ Date \_\_\_\_\_  
 Signature



FIELD WELDING CHECK LIST

EXHIBIT 8

GENERAL INFORMATION

- ② System or component \_\_\_\_\_
- ③ Engineering Specification No. \_\_\_\_\_
- ④ Iso or Drawing No. \_\_\_\_\_
- ⑤ ASTM Material  
Type & grade \_\_\_\_\_
- ⑥ Welding procedure and  
Revision number \_\_\_\_\_
- ⑦ Welder Qualification \_\_\_\_\_

- ⑧ Weld number \_\_\_\_\_  
Original  Repair No. \_\_\_\_\_
- Original WR-5 S.N. \_\_\_\_\_
- ⑨ Pipe diameter \_\_\_\_\_
- ⑩ Joint thickness \_\_\_\_\_
- ⑪ Backing rings required   
Inserts required

WELD REQUIREMENTS

- ⑫ Purge required  Gas type \_\_\_\_\_
- ⑬ Preheat temp. °F \_\_\_\_\_
- ⑭ Interpass temp. °F \_\_\_\_\_
- ⑮ PWHT temp. °F \_\_\_\_\_ Hold time \_\_\_\_\_

WELD INSPECTION

- ⑯ Cleanliness, bevel, alignment,  
spacing, etc. \_\_\_\_\_ **REQUIRED**
- ⑰ Release for welding \_\_\_\_\_ **REQUIRED**
- ⑱ Weld completed \_\_\_\_\_ **REQUIRED**
- ⑲ Visually examined \_\_\_\_\_ **REQUIRED**
- ⑳ Release for NDT required

NONDESTRUCTIVE EXAMINATION

- ⑳ Radiography
- ㉑ Liquid penetrant exam.
- ㉒ Magnetic particle exam.
- ㉓ Other \_\_\_\_\_

FILLER METAL

- ㉔ Coated  ㉕ Bare
- E7018  E 70S-2
- E6010  ER 308L
- E308L-16  ER 309
- E309-16
- Other \_\_\_\_\_ Other \_\_\_\_\_

㉖ Above REQUIREMENTS CERTIFIED CORRECT

Field Welding Engineer (FWE) \_\_\_\_\_ Date \_\_\_\_\_

㉗ Code Inspector Hold Points  
Item No. \_\_\_\_\_

Code Inspection, Item(s) No. \_\_\_\_\_  
Inspected by: \_\_\_\_\_

Authorized Code Inspector \_\_\_\_\_ Date \_\_\_\_\_

FOR FIELD USE ONLY

RECORDED RESULTS      FWE      Date

	RECORDED RESULTS	FWE	Date
⑫ Gas type	_____		
⑬ Temp. °F	_____		
⑭ Temp. °F	_____		
⑮ Temp. °F      Hold time	_____		
Chart No.      Curve No.	_____		
⑯ Cleanliness, bevel, alignment, spacing, etc.	_____		
⑰ Release for welding	_____		
⑱ Weld completed	_____		
⑲ Visually examined	_____		
⑳ Purge dam removed	_____		
㉑ Released for NDT	_____		
㉒ Performed by subcontractor	_____		
㉓ Acceptable	_____		
Rejected	_____		
㉔ Accepted	_____		
Accepted	_____		
Accepted	_____		
㉕ Type: Control Designation(s)	_____		
E7018	_____		
E6010	_____		
E308L-16	_____		
E309-16	_____		
Other	_____		
㉖ E 70S-2	_____		
ER308L	_____		
ER 309	_____		
Other	_____		

㉗ Welder's name(s) & symbol \_\_\_\_\_ Date \_\_\_\_\_

㉘ Above RESULTS CERTIFIED CORRECT:

Field Welding Engineer (FWE) \_\_\_\_\_ Date \_\_\_\_\_