ATTACHMENT 1

AFFIDAVIT

My name is Steven Lockert. I am making this statement freely, without any threats or inducements, to Tom Devine, who is an attorney working with the Government Accountability Project.

I am making this statement because the evidence that was available to me indicates that the Pacific Gas and Electric Company was not responsible to the requirements of the Code of Federal Regulations regarding the reporting of defects and non-compliances. Further, that the M.W. Kellogg Company made false statements regarding a weld that failed in 1977 on the steam generator 1-2 nozzle indicating that the crack in the nozzle weld was not a generic problem; when in fact, there was documented evidence to the contrary on the steam generator 1-1 nozzle.

I contend that there was problems with the Kellogg Welding Procedure Specification # 200 (deviation from ANSI B31.1 preheat requirements for P3 materials of 175°F before welding,) problems with the 1-1 nozzle weld (Field Weld 197 welded without preheat prior to 12/3/74 and again on 12/24/74,) and that there were problems with the Quality Assurance Program at the time because the nonconformance report that should of been generated apparently did not get reported per 10 CFR 21.21. Also, I contend that in 1977 after a crack in nozzle 1-2 was discovered re-examination of nozzle 1-1 revealed a similar crack that apparently did not get reported per 10 CFR 21.21 either.

Response to PG&E Report 411-77.55

Subject: Failure Analysis of Cracked Field Weld No. 212, Diablo Canyon Unit 1, Steam Generator 1-2, Nozzle-To-Pipe Weld.

After review of the failure analysis report on F. W. 212 performed by PG&E's Department of Engineering Research, I have concluded that the report was put together with gross negligence or that a coverup activity is in progress to hide generic problems associated with the steam generator nozzle to feedwater pipe welded connections. F. W. 212 was performed by Pullman Power Products Corporation (M. W. Kellog Company at that time) in May of 1974 and it is believed that the remaining welds on the other steam generator nozzles in Unit 1 was performed that same year. The history of the problems with these welds has extended from 1974 to 1977 to 1982 to today. PG&E's failure analysis of F. W. 212 has not put the matter to bed but has raised more questions about the acceptability of these weldments, the ethics of Pullman Power Products, and the ability of the licensee to meet the requirements of the Code of Federal Regulations for construction and operation of Nuclear Power Plants.

Problems with the failure analysis report are:

1.) The Pullman welding procedure specification (WPS) supplied for the report has a revision date of 6/16/76. This is obviously not the WPS that was used for the actual weld performed in May of 1974.

2.) Pullman WPS 200 has an original date of 11/14/73, the date at which time the WPS was legally in effect. However, the accompanying Procedure Qualification Record (PQR) was performed on 12/28/73 over a month later. The WPS requires a PQR before the WPS can be written or used in the field.

3.) The nozzle material ASME SA-508 Class 2 is a P3 classified material under ASME Boiler & Pressure Vessel Code, Section IX requirements. Pullman's WPS 200 and accompanying PQR (P12b-P1-K1-F4-SMAW-6G) are for welds between P12b and P1 classified materials. The WPS for the nozzle welds would have had to be for P3 to P1 materials only.

4.) Pullman WPS 200 states that the preheat is only required for the SMAW portion of the weld. This procedure allows the tack and root welding to be performed without the benefit of a preheat. This procedure has an ANSI B31.1 Power Piping Code non-compliance written into it because the very definition of a preheat means "heating the base metal before

SI

a welding or cutting operation"(see paragraph 100.2,definitions, of ANSI B31.1 1977 edition.)

5.) Page 2 of WPS 200 has significant data on weld joint preparation written in so small that the data is illegiable.

6.) Copies of the original Certificate of Analysis for the three electrode lots of E 8018-C3 show that one of the original lots L416F3AC was not even shipped until 2/20/75 nine months after the weld was performed.

7.) Figure 5 showing the crack in a macroexamination has the pipe and nozzle identifications reversed.

8.) The Certificate of Analysis for the E 70S-2 filler metal and E 70S-2 insert have not been provided.

9.) The Laboratory Sample 577.329 has been mistakenly labeled P12B material. Note that there is no P12B material listed under QW 422 of the ASME Code, Sec. IX (see page 27 of the PG&E report.)

10.) Table 1 of PG&E's report shows a preheat being performed on May 18, 1974 when the Pullman Swindell report specifically states that the preheat was only from May 22, 23, and 24 of 1974 (Table 1 is on page 9 of report.)

I believe that this is just more than sloppy report writing and a full understanding of how bad the welds really are can be

attempted only after the data appropriate for PG&E's report is found for the period of time that the weld was made. It is true that F. W. 212 no longer exists because it has been replaced but that leaves the seven other nozzle to pipe welds that were performed with the same WPS that the original F. W. 212 was welded to.

Steam Generator 1-1 nozzle to pipe weld also has an interesting history. F.W. 197 was first performed prior to a Dec 3rd meeting between Mr. J. W. Ryan and Mr. P. J. Carosella, the then Pullman Construction Manager and Senior Safety Engineer for the Department of Industrial Relations of the State of CA, respectfully. Mr. Carosella makes mention of the fact that F. W. 197 had experienced a crack extending the circumference of the pipe because Pullman production had welded with out the use of preheat. The process sheet for the second try at F.W. 197, which by the way is not marked RI, is shown with the process sheet for F. W. 212 provided on page 33 of PG&E's report. Note that the preheat for the second try is not signed of by the MWK inspector and there is no reference to a preheat chart. Also note the inconsistencies in the inspection coverage between the two welds; the ANI checked for visual inspection but not the root pass on F.W. 197 but did just the opposite for F.W. 212. I think that the DR that covers why F.W. 197 was welded without preheat

before Dec. 3 should be examined to make sure that the corrective action called for by Mr. Carosella in his Dec. 18th letter addressed to J. P. Runyan, W. M. Kellog's QA/QC Manager was adaquately established. Also, some explanation for the lack of preheat data available for the second attempt at F. W. 197 during Dec. 23 to Dec. 30 of 1974 must be provided. It occurs to me that both of these mistakes appear to be reportable per 10 C F R 50, paragraph 50.55e.

F. W. 197 was subsequently radiographed and the film read by an individual named Ken Beck on 1/28/75. Mr Beck noted that tungsten inclusions were distributed through about 75% of the weld. Mr. Beck did not note a drop thru that also had linearly oriented voids. Apparently, someone requested another radiograph because the weld was reradiographed but with wider film to include a repair made to the nozzle. Again the weld was accepted but this time with recognition of the burn thru on 2/11/75 by Mr. Shore.

The time frame for documentation of events now shifts to March 17, 1977 when the leak was discovered in F.W. 212. These events are documented in the M.W. Kellogg QA Report by J. P. Runyan dated 4/12/77. The radiograph for F.W. 197 was again reviewed at this time and a decision was reached to now remove the drop thru present on the inside of the pipe. The repair was made per DR 3370 and consisted of cutting a hole in the pipe

and grinding out the burn thru. I think that it should be noted that the R. P. Runyan noted DR 3370 in his report dated 4/12/77 but that the letter addressed to Mr. R. H. Engelken of the USNRC Office of Inspection and Enforcement, Region V, written by a Mr. Philip A. Crane, Jr. makes no mention that a condition requiring repair had been found, in fact, Mr. Crane reported that PG&E's examinations revealed no rejectable indications for any of the four main steam and three feedwater welds as of 4/15/77.

In DR 3370 Mr. R. P. Runyan had noted that when he had reviewed Mr. Ken Beck's record for radiographic interpretation it was found that Mr. Beck had hired in on 1/2/74 but that he had not certified to the M. W. Kellogg radiographic Level II position until 8/9/74 and that he had accepted radiographs before he was certified to do so. However, instead of reporting the non-conformance via the QA system and notifying the licencee Mr Runyan attributed the QA breakdown to an administrative error. A problem with Mr. Beck's work was apparent as early as 4/5/77 as evidenced by the interoffice corrrespondence from S. L. Engler to R. P. Runyan where Mr. Engler states that some of the welds must be repaired.

Although PG&E could find no rejectable indications in the steam generator nozzle to pipe welds as of 4/15/77 all four of the nozzle to pipe welds were reworked from the inside of the pipe during the period from 8/31/77 to 11/28/77. Cracks were found

SF

on the inside surface of F.W. 197, a grind and polish method was used to chase the cracks. One of the cracks was 5 3/8" long and required grinding below the minimum wall thickness before a liquid penetrant test would yeild positive results. Of course after the minimum wall thickness had been violated a weld repair was in order. The grinding out of the cracks and the weld repair to F. W. 197 was apparently done to an interoffice correspondence initiated by a Mr. Don Geske instead of the direction of PG&E as indicated in step nine of DR 3484. The welding, of course, would have required a process sheet, filler metal requisitions, and the full awareness of a QC welding inspector. The DR 3484 fails to include these requirements in the recomended disposition and Mr. Don Geske was not qualified to do visual welding inspections.

Three cracks were found that required violation of minimum wall thickness before they could be successfully removed. Removal of the first crack left a groove 10" long that required grinding through about half of the pipes thickness before the crack on the nozzle side of the root pass was removed. I am not suprized that no one recognized that this crack was similar to the one that occured on F.W. 212 because that would indicate a generic problem. In fact, the people involved were very carefull not to refer to the defect as a crack, it was a

linear indication right up to and even after the weld repair. The game is over because linear indications do not require weld repairs but cracks do.

A defect had been found, a crack extending 10" long and approximately half way through the thickness of the pipe. The crack originated on the nozzle side of the root pass under a roll over where the reentrant angle was probably less than 90 . Other cracks had been observed in the land surfaces of the nozzle and pipe counterbores. Lets compare the above to a quote from PG&E's report 411-77.55 "It is believed that small cracks initiated on the I. D. of the nozzle, weld, and pipe during the thermal cycling that occured during preheating. These smallcracks originated at convenient stressrisers such as grinding scratches and regions of lack of fusion and weld bead rollover." Mr. Runyan could not see the similarities between the two because he had already made up his mind about the failure of F. W. 212 back in April. Mr. Runyan said in his summary to his QA Report on F.W. 2.. "It is my believe that the crack was peculiar to F.W. 212 only and not of a generic nature. Therefore, at this time we are assuming that no further repair will be required and that when the disposition of D. R. 3370 is completed the subject will be closed."

Defects had been found in steam generator nozzle to pipe welds that had been fully inspected and accepted. F.W. 197 and

SL

F.W. 244 revealed cracks on the nozzle side of the root similar to the crack that initiated the failure of F.W. 212. These cracks are defects which, if they were left uncorrected could have adversely affected the safety of the plant. The defects should have been reported to the Commission. I believe that a break down in Quality Assurance of construction has occured because the welds had been accepted and had been put in service with out discovering the defects. Additionally, after the failure of F. W. 212 when a 100% reinspection of radiographs on Class 1 welds had revealed problems in previous interpretations, when F.W. 197 required repair in April, and when extensive repairs had been made to all the nozzle to pipe welds in Unit 1 the NRC had not been notified as required by 10 CFR 21 and/or 10 CFR 50.55e. I believe that PG&E's failure analysis of F.W. 212 is shoddy work, I believe that there has been an attempt to fix the mistakes on the sly and that there has been purposefull withholding of information from the commission.

I have read the above 10 page statement and it is correct and true to the best of my knowledge and belief.

Steven Lockert

Steven Lockert

TATE OF CALIFORNIA
OUNTY OF SAN LUIS OBISPO ss.

n 4/10/84 before me, the undersigned, a Notary Public in and for
id State, personally appeared STEVEN LOCKERT

ersonally known to me (or proved to me on the basis of satisctory evidence) to be the person(s) whose name(s) is/are subcribed to the within instrument and acknowledged to me that e/she/they executed the same.

ITNESS my hand and official seal.

ignature Lisa P. Wenter

OFFICIAL SEAL
LISA P. WENTER
NOTARY PUBLIC - CALIFORNIA
SAN LUIS OBISPO COUNTY
My Comm. Expires May 9, 1986

(This area for official notarial seal)

LIST OF REFERENCED MATERIAL

ITEM	DATE	SUBJECT
1.	12/18/74	Crack in F.W. 197.
2.	3/23/77	D.R. 3370 (Review of Radiographs Resulting from Crack in F.W. 212.
3.	4/5/77	Letter from S. Engler to P. Runyan regarding K. Beck.
4.	4/12/77	M.W. Kellogg QA Report on Crack in F.W. 212.
5.	4/15/77	Letter from P. Crane to NRC, Office of IE.
6.	8/26/77	PG&E Failure Analysis of F.W. 212.
7.	6/23/77	Pullman Swindell Metallurgical Exam of F.W. 212
8.	8/26/77	D. R. 3453 Internal Inspection and Weld Repair of F.W. 244.
9.	10/7/77	D.R. 3484 Internal Inspection and Weld Repair of F.W. 197.
10.	11/8/82	D.R. 4662 Failure to have a PQR for MT Examination of F.W. 197 and F.W. 244
11.	10/6/75	Personnel Testing Record of Mr. D. R. Geske showing no examination scores for Magnetic Particle Testing

PARTMENT OF INDUSTRIAL RELATIONS
SION OF INDUSTRIAL SAFETY
GOLDEN GATE AVENUE, SAN FRANCISCO

December 18, 1974

Address reply to:

EXHIBIT 1 TO
ATTACHMENT 1

The M. W. Kellogg Company
P. O. Box 367
Avila Beach, CA 93242

Attention J. P. Runyan, QA/QC Manager

Subject: Quality Assurance at Diablo Canyon
Nuclear Plant Construction site

Gentlemen

On December 3rd I discussed with you and Mr. J. W. Ryan the recent removal by your Production Personnel of the thermowells from the Reactor Coolant Loop, which had to be removed because they had been improperly installed by your Company. A Hold Tag had been applied at each location and Deficiency Report 2437 had been issued which outlined the corrective work and also clearly stated that the Quality Assurance Manager was to be notified before beginning any corrective work. Production failed to notify you and failed to follow the D. R. In doing so they violated the Non-Conformance Section of your Quality Assurance Manual. KFR-10 of your QA Manual assigns to you the responsibility to assure that its provisions are adhered to.

You will recall that at the same time the repair of Steam Generator 1-1 feedwater nozzle was taking place. A crack extending circumferentially 360° had been caused by your welders when they welded without the use of preheat. The welders had been assigned to the job by their supervision before you were in possession of a qualified welding procedure for P 1 to P 12-B Materials.

The installer in possession of the proper ASME symbol stamp and Certificate of Authorization is required to operate under a controlled system by NA 4451 of Section III of the Code. We would therefore request that measures be taken to assure that conditions that caused the violations will be promptly identified and corrected to preclude repetition. It is also requested that, in accordance with NA 4800, the identification and cause of failures affecting quality and the corrective action be documented.

Very truly yours

P. J. Carosella
Senior Safety Engineer

/aa
cc J. W. Ryan, Construction Manager
J. S. Guyler

EXHIBIT 2 TO ATTACHMENT 1 Page 1 of 3

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

DISCREPANCY REPORT

D.R. NO. 3370 Rev II Rev I
ISO. NO. 500146
UNIT NO. 1
CODE NO. N/A

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J. P. Runyan

DISCREPANT ITEM: F.W. #197, Line K16-554-16-IV, Steam Generator 1-1 Nozzle to pipe

EXPLANATION OF DISCREPANCY:

As the result of a crack in F.W. #212 at the Feedwater nozzle on Steam Generator 1-2 (Ref. D.R. 3366), a review of the radiographs of the same welds on the remaining three (3) generators was performed by the N.R.C. In addition, the nozzle to pipe welds on the main steam leads were reviewed.

The review revealed a questionable indication in F.W. #197 on the feedwater lead to Steam Generator 1-1. The indication appears to be a burn through which contains linearly oriented voids. The accompanying radiographic report accepted the weld but did not indicate the presence of the burn through. Further investigation revealed that a second set of radiographs, shot at a later date, exist. This set also shows the burn through which was recorded on the radiographic report as acceptable (see copies attached).

(Continued on Page 2)

RECOMMENDED DISPOSITION:

See Page 2

Approved By: M.W.K. Field Q.A. Mgr. J P Runyan Date 3/23/77 Customer R.D Etzler REF. PGE DR 286 Date 3/23/77

FINAL DISPOSITION: ☐ In Accordance With Above
Work Completed Insp: _____ Date: _____

☐ Other (explanation and approval required)) 6/22/77 JPR
Work Completed Insp: JPR Date: 6/22/77

EXPLANATION (IF NECESSARY):

Revision I See page 3
Revision II See page 3

M.W.K. Field Q.A. Manager J P Runyan Date 6/20/77 Customer R.D Etzler DVR Date 6/20/77

M.W.K. Field Q.A. Manager D L Wolfe Date 3-30-77 Customer R. D. Etzler. DVR Date 3/31/77

STEPS TO PREVENT RECURRENCE ☐ Not Applicable

To be provided after further review.

⚠ See Page 3

Field Q.A. Manager JPR

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other _____
☒ Customer ☐ Receiving ☐ Field Inspector (_____)

ATTACH SKETCH IF NECESSARY

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3370 Rev II Rev I
ISO. NO. 500146
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J. P. Runyan

DISCREPANT ITEM: F.W. #197, Line K16-554-16-IV, Steam Generator 1-1 Nozzle to pipe

Explanation Of Discrepancy:

To determine the severity of the indications in the burn through, we have made additional radiographs of the burn through area. These radiographs indicate that the voids are probably contained within the burn through and do not extend into the weld. There is no indication of propagation of the indications.

U.T. of the weld by P.G.&E. does not indicate any indication within the weld which is outside the acceptance criteria.

Attachments 1, 2 & 3

Recommended Disposition:

To eliminate the possibility of a potential problem at a later date, it is recommended that the burn through be removed.

The following procedure is to be followed for removal and reinspection:

1. Weld a 2" threaded coupling to the pipe as shown on the attached sketch using weld procedure 88/89 or 92/93. (FW # 827)
2. M.T. per ESD-209.
3. Post weld heat treat the weld - ESD-218.
4. Perform a hydrotest on the weld prior to drilling into the pipe.
5. Following satisfactory completion of the hydrotest, cut the hole through the pipe wall with a hole saw (Ref. ESD-230) NOTE: Additional reinforcement of 2" opening is not required per P.G.& E. calculations
6. Using an extended shaft grinder with a cone shaped rock, grind the burn through flush with the pipe surface.
7. Radiograph the area to assure complete removal of unacceptable indications.
8. Install threaded plug and seal weld (F.W. #828).

This installation is to be made in accordance with the National Board Inspection Code and ASME Section I

Reviewed by A.N.I. R.L. Sanderson 3/24/77

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☒ Customer ☐ Receiving ☐ Field Inspector ( )

ATTACH SKETCH IF NECESSARY

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

Rev II

D.R. NO. 3370 Rev I
ISO. NO. 500146
UNIT NO. ONP
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J.P. Runyan

DISCREPANT ITEM: F.W. #197, Line K16-554-16-IV, Steam Generator 1-1 Nozzle ot pipe

REVISION I

The following action was taken.

Add to "Recommended Disposition" the following steps.

A. To determine if there exists an ambiguity with other welds accepted by the M.K. Kellogg film interpreter who accepted F.W. 197, the following action was taken:

1. Review qualification records of this individual to assure compliance with SNT-TC-1A.
2. Review all radiographs which were accepted by the individual.

NOTE: The findings of the review will be reported as a separate report and attached to this D.R. before the D.R. is closed. No revision will be required to the D.R.

SUMMARY
STEPS TO PREVENT RECURRENCE

In addition to the above action it has been determined that a random review of accepted film from all other M. W. Kellogg interpreters was required. Twenty sets of film were reviewed from each of seven other interpreters. No rejectable indications were noted (See Q.A. report of film and documentation review dated 4-22-77 Attached).

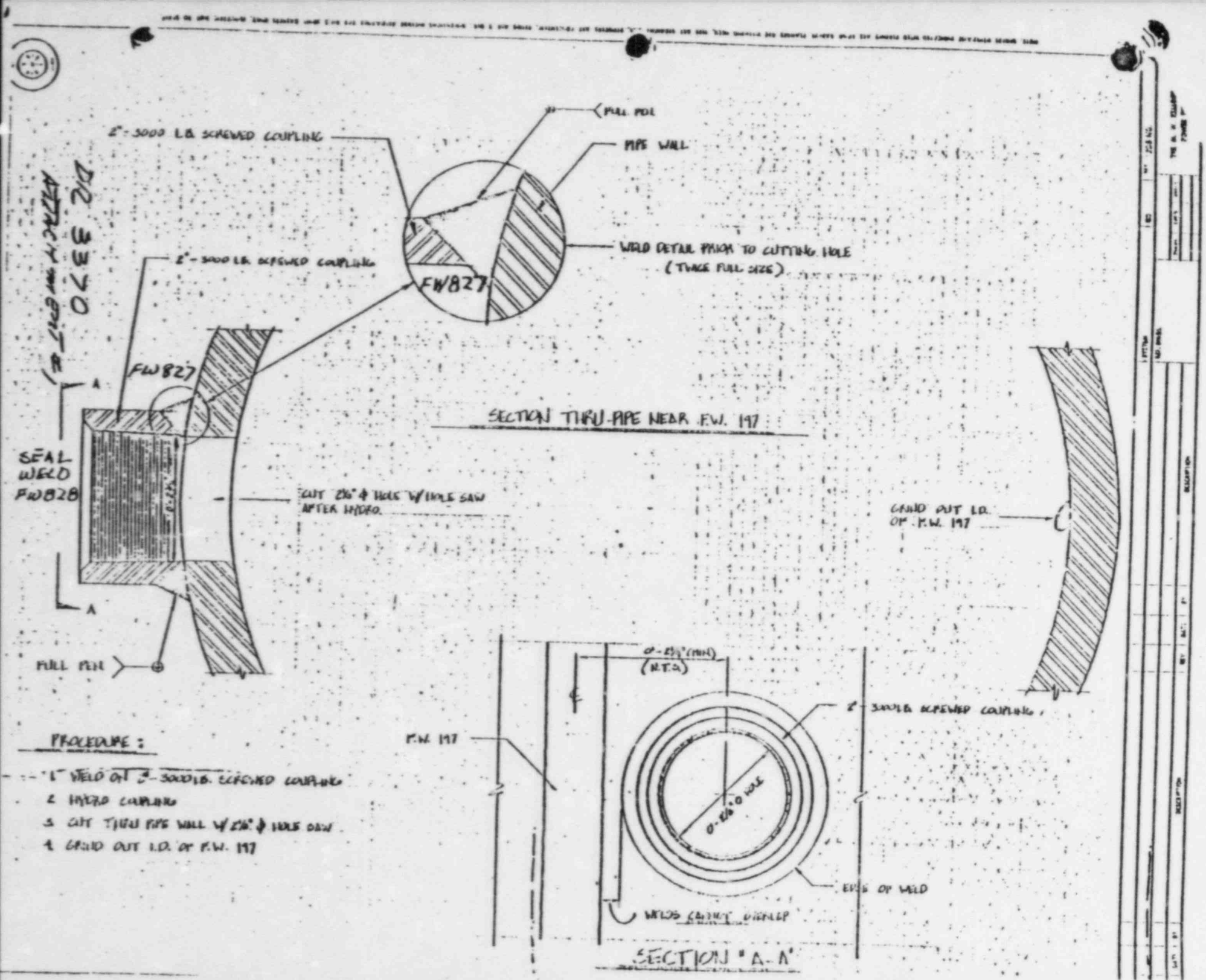
Subsequent to the above a review of additional Unit I film was performed while investigating the accept/reject rate of welders. Another rejectable indication was noted in F.W. 346 Iso 1-4-500139 (Ref. D.R.3396). At this time P.G.& E. requested that a 100% film review be performed of all design class I radiographs in Unit I and II. This will be performed and documented in accordance with D.R. 3400 Rev. I for Unit I and D.R. 3409 for Unit II.

To further assure that all welds radiographed subsequent to this date are properly interpreted; each set of film will be interpreted and then reviewed by a second qualified film reader. Reference Q.A. instruction 101 Rev. I.

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector ( )

ATTACH SKETCH IF NECESSARY

ATTACHMENT 2
DR 3370



P. G. & E.

844 Tp.	16	B31.7	3-1 S…6 FEEDWATER SYS		
IR 192	10 x 10	55	40"	90 SEC	ESD-206 KRT-2
				------	MM
					4½ x 17
					HAND TANK @ 68°
					KIMMICK
					BUTT

FITTING, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS
FW 197	0-1-2	20F	X														
V GX	2-3-4	|	X			W/k										1/29/75	
E	4-5-6	|	X		W/k	W/k										|	
L	6-7-0	|	X			W/k										|	
D																	
E																	
R																	

(SINGLE VIEWING)

APPROVED BY,

	CUST.	AUTH. INS.
[initials] 1/28/75		2-4-75 [initials]

DR 3370
ATTACHMENT #2

RADIOGRAPHIC INSPECTION REPORT

Job No. 7172 — [ ] Shop [X] Field

Date 2/ — KIS-S

P. G. & E.

1-03-500146 FEEDWATER

L-SG-TU ELD	16"	B 31.1	ESD-207 KRT-	BUTT		
IR 192	.10x.10	86 ci.	16.5	8 min.	--------	M
7X17	[ ] SINGLE	HAND TANK @ 68°	SEARS	ASNT Level		

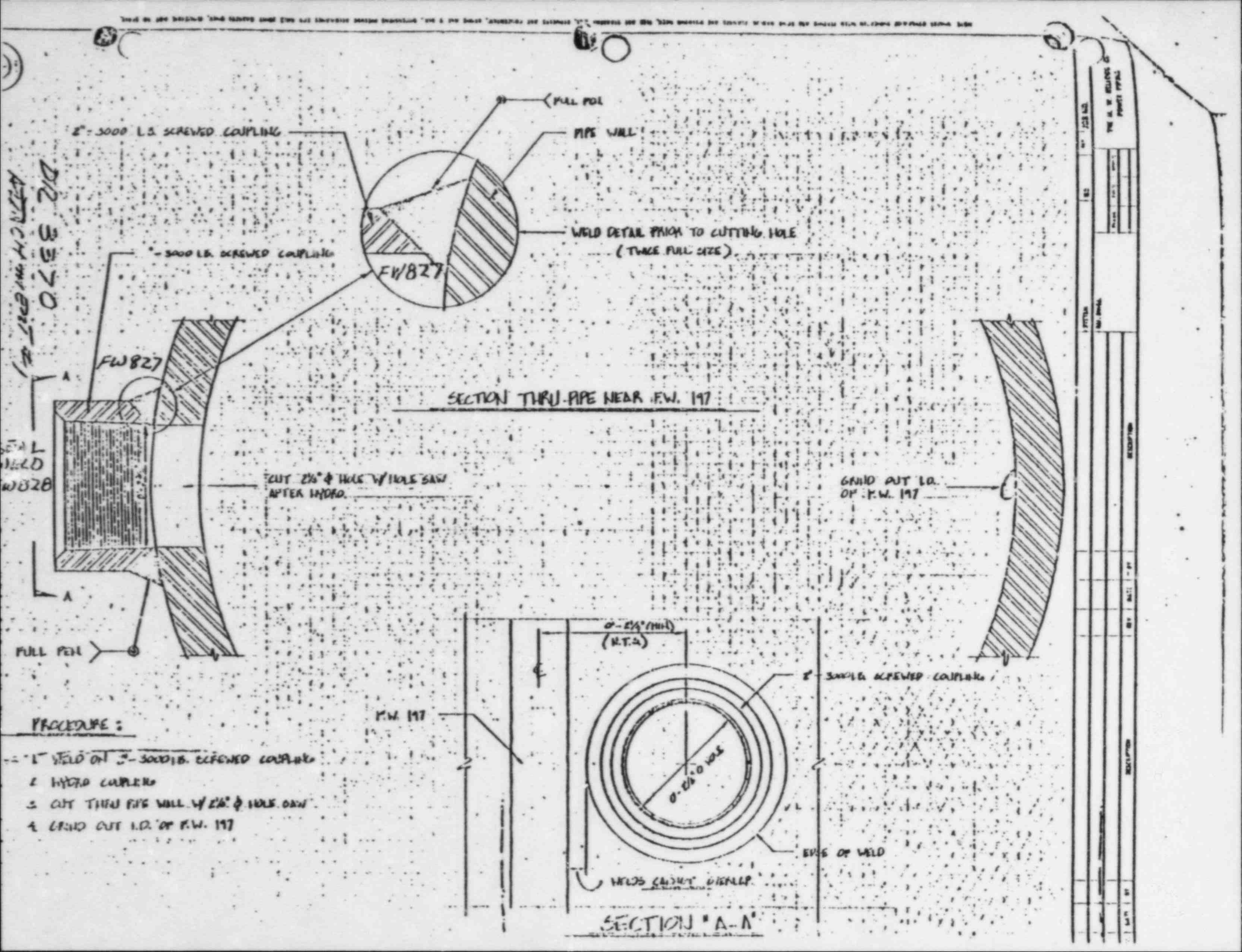
FITTING, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS	FILM INTERPRETATION BY
FW 197	0-1-2	ASME 17/2C	X							✓						2/10/75	Dropthru	
W	2-3-4	(	X			w/c				✓						|		H. Shore
E 6-X	4-5-6	(	X			w/c				✓						|	tung. incl. w/c	ASNT II
L	6-7-0	(	X			w/c				✓						|		2/11/75
D																		|
E			— Single Viewing —															
R																	NOTE: STA. #2 MISSING ON	
																	(0-1-2) BUT OVERLAP ON	
	NOTE:	THIS SIZE FILM WAS USED															(2-3-4) IS GOOD. [illegible]	
		SO WE COULD COVER REPAIR																
		AREA OF STEAM GENERATOR																
		NOZZLE.																
		[illegible]																

APPROVED BY:

MFR.	CUST.	AUTH. INS.
[illegible] 2/11/75	[illegible] 2/11/75	2-11-75 [illegible]

DR 3370

ATTACHMENT 3


2"-3000 L.B. SCREWED COUPLING
FULL PEN
PIPE WALL
WELD DETAIL PRIOR TO CUTTING HOLE
(THICK FULL SIZE)
FW827
SECTION THRU PIPE NEAR F.W. 197
CUT 2½" ϕ HOLE W/ HOLE SAW
AFTER HYDRO.
GRIND OUT I.D.
OF F.W. 197
FULL PEN
PROCEDURE:
1. WELD ON 2"-3000 LB. SCREWED COUPLING
2. HYDRO COUPLING
3. CUT THRU PIPE WALL W/ 2½" ϕ HOLE SAW
4. GRIND OUT I.D. OF F.W. 197
F.W. 197
2"-3000 LB. SCREWED COUPLING
EDGE OF WELD
WELDS CLOSEST OVERLAP
SECTION "A-A"

Customer: G. & E. | [X] FIELD | DATE 1/2?/75

Customer: G. & E.		Description: 3-S9014-6 FEEDWATER SYS		Material: K16 554	
Material type: .844 r.p.	Material diameter: 16	Acceptance standard: B31.7	Governing specification: ESD-206 KRT-2	Type seam: BUTT	
Source: IR 192	Size: 10 x 10	Curies: 55	Distance: 63"	Time: 90 SEC	Total thickness: ------
Film type: HH	Film size: 4½x17	Film technique: [ ] SINGLE [X] DOUBLE			
Film processing: HAND TANK @ 68°	Radiographer: KIMMICK	ASNT Level II			

FITTING, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS	FILM INTERPRETATION BY
FW 197	0-1-2	20F	X													1/29/75		K. Bec[illegible]
GX	2-3-4	|	X			w/c										|		ASNT I[illegible]
	4-5-6	|	X		w/c	i/c										|		
	6-7-0	|	X			w/c										|		

(SINGLE VIEWING)

APPROVED BY,		
[illegible]	COST.	AUTH. INS.
[initials]		2-4-75
1/28/75		[signature]

DR 3370

Attachment #2

CUSTOMER: P. G. & E.

LAB FIELD

MATERIAL: 1-5C-TU ELD	MATERIAL DIAMETER: 16"	ACCEPTANCE STANDARD: B 31.1	1-C-500146 FEEDWATER			DATE: 2/11/75; KIS 554
SOURCE: IR 192	.10x.10	CURIES: 86 ci.	DISTANCE: 16.5	TIME: 8 min.	FILM TYPE: M	FILM SIZE: 7X17
					FILM PROCESSING: HAND TANK @ 68°	RADIOGRAPHER: SEARS
					PROCEDURE SPECIFICATION: ESD-207 KRT-	TYPE SEAM: BUTT
					FILM TECHNIQUE: ☐ SINGLE ☒ DOUBLE	ASNT Level II

FITTING, SEAM OR TOTAL NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS	FILM INTERPRETATION BY
EX 197	0-1-2	ASME 17/2C	X							✓						2/10/75	Drop thru	H. Shor
W	2-3-4	(	X			w/c				✓								ASNT II
E GX	4-5-6	(	X			w/c				✓							tung. incl. w/c	2/11/75
L	6-7-C	(	X			w/c				✓								/
D																		
E			- single wall -															
R																	NOTE: STA.#2 MISSING ON (0-1-2) BUT OVERLAP ON (2-3-4) IS GOOD. [illegible]	

NOTE: THIS SIZE FILM WAS USED SO WE COULD COVER REPAIR AREA OF STEAM GENERATOR NOZZLE.

APPROVED BY:

LWR.	CUST.	AUTH. INS.
2/11/75	2/11/75	2-11-75

AR 3370

Attachment 3

DIABLO CANYON NUCLEAR PROJECT
JOB #7177
SPEC #8711

QUALITY ASSURANCE REPORT
OF
ACCOMPLISHED JOB TASKS
(Ref: DR 3370)

THE M. W. KELLOGG COMPANY
AVILA BEACH, CA

PREPARED BY Donald R. Geske
D. Geske
NDE Supervisor

APPROVED BY J. P. Runyan
J. P. Runyan
Field QA/QC Manager

QUALITY ASSURANCE REPORT
OF
ACCOMPLISHED JOB TASKS
(Ref: DR 3 70)

PURPOSE

To document all job tasks performed as result of deficiencies noted during review of radiographic film required by DR 3370, steps to prevent recurrence.

SCOPE

This report is restricted to those items listed in our letter to the customer dated April [illegible], 1977 (see Attachment #1), and supplements our previous report by J[illegible] Runya[illegible] dated 4-22-77, Subject: Quality Assurance Report of Documentation and Radiographic Film Review.

FILM REVIEWED

K. BECK	UNI/SYST/ISO	FW
	[illegible]68	803
	1-4-150	1051
	1-7-1	*201, 204R1
	1-7-4	19, 243
	1-7-5	27
	1-7-6	28, 31A, 32, 283
	1-7-8	39A, 41R2
	1-7-14	64
	1-7-15	65, 66, 68, 69, 70, 71, 84A
	1-7-16	72, 73
	1-7-21	98, 101, 132
	1-7-22	*106, 107, 108, 109, 113
	1-7-23	116, 117, 120
	1-7-24	122, 123
	1-7-25	166, *170
	1-7-29	183
	1-8-1	15, 15A, 516, 2222
	1-8-41	274, 275
	1-8-56	499, 500, 372R1
	1-8-61	533, 535
	1-8-71	547
	1-8-72	550, 552, 554, 2352B
	1-8-349	1312R1
	1-8-705	1830
	1-9-2	17
	1-9-3	190A, 290, 293, 322, *338, 345, 348
	1-9-16	*279
	1-9-18	*123, 126R1, 127

1-9-19	141, 145R1
1-9-21	*155, 158R1
1-9-23	173, 267, 268
1-9-25	182, 183
1-9-37	280, 281
1-9-40	283R1
1-9-42	250
1-9-61	533, 536
1-9-209	104
1-9-216	157
1-9-23	102, 20R1
1-04-500136	253R1
1-04-500137	279R1
1-03-500146	228
1-03-500146	229
2-03-75	532
2-04-2	15, 22, *28, 29
2-04-4	41, 54, 55
2-08-8	49
2-08-17	*111
2-08-25	*185C, 185D
2-08-31	222, 233
2-08-32	*243
2-08-33	249, 249A, 2486, 2487, *390
2-08-35	266, 267, 270
2-08-36	272
2-08-548	1479
2-10-10	78, 385
2-10-12	110
2-14-63	*532R2
2-04-501014	351

R. BARBER	UNIT/SYST/ISO	FW
	1-7-1	1, 2
	1-7-10	5R2
	1-7-2	7
	1-7-17	78, 79
	1-7-18	80
	1-7-15	68
	1-14-81	564, 568A, 568, 579
	1-9-38	230, 231
	1-9-5	48, 47, 45, 46R1
	1-9-20	150, 151

M. SHORE	UNIT/SYST/ISO	FW
	1-7-5	25, 24, 295, 26, 23
	1-7-8	22
	1-7-21	100, 102, 103, 104, 105, *99
	1-7-16	74, 75
	1-9-18	124
	1-9-19	138, 137, 142
	1-7-29	*188, 189

R. SEARS	UNIT/SYST/ISO	FW
	2-3-14	165
	2-4-12	138
	2-4-501016	323.
	2-8-61	445A
	2-8-480	848
	2-9-15	117
	2-9-32	196, 197
	2-12-8	91
	2-12-11	119
	2-14-62	520, 814, 843, 861

M. COSTLEY	UNIT/SYST/ISO	FW
	1-7-1	209, 211, 215, 213, 4
	1-7-8	39, 40, 242
	1-7-24	126, 129, 124
	1-7-28	180
	1-8-1	13
	1-10-5	56E, 56F
	1-14-35	181
	1-14-81	691, 574, 583A, 576

J. RUNYAN	UNIT/SYST/ISO	FW
	2-3-19	232, 237, 427
	2-3-501023	333
	2-4-27	294
	2-4-501018	158
	2-7-15	106, 115
	2-8-9	55, 56, 57, 567, 569
	2-8-16	105, 576, 577
	2-8-63	451
	2-8-65	650
	2-14-62	512

E. MARTINDALE	UNIT/SYST/ISO	FW
	1-3-500146	499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509
	1-3-6	349, 348
	1-7-14	62, 63
	1-7-15	67
	1-7-17	77, 76
	1-7-19	82, 83
	2-4-47	*501
	2-8-60	437A
	2-9-32	302
	2-14-62	505, 517, 818

*Review required job tasks.

FILM RESHOT FOR QUALITY/CLARITY

UNIT/SYST/ISO		FW	COMMENT
1-04-500136	SG 1-1	255	Compared to original film - no defect noted.
1-04-500137	SG 1-2	282	Compared to original film - no defect noted.
1-04-500138	SG 1-3	320	Compared to original film - no defect noted.
1-04-500139	SG 1-4	348	Compared to original film - geometric difference noted, see DR 3423.
1-07-1		201	Drop thru shot in cross-section and determined to be within code after customer review 5-19-77.
1-07-21		99	Reshot for lighter density - no defect noted 5-27-77.
1-07-22		106	Reshot view 3-4. Original film missing - no defects noted 5-27-77.
1-07-25		170	Reshot due to rough surface - FW ground for inservice - no defect noted 5-18-77.
1-07-29		188	Reshot view 2-3-4 for full coverage - no defect noted 5-16-77.
1-09-3		388	Unconsumed insert noted during film review. Repair included with DR 3400.
1-09-16		279	Reshot view 0-1-2 to verify root fusion - no defect noted 5-25-77.
1-09-18		123	Reshot view 8-9-0 to verify root fusion - no defect noted 5-25-77.
1-09-21		155	Reshot view 4-5-6 to verify removal of surface condition - no defects noted 5-26-77.
2-04-501013		347	Compared to original film - no defects noted.
2-04-501014		364	Compared to original film - no defects noted.
2-04-501015		379	Compared to original film - no defects noted.
2-04-501016		329	Compared to original film - no defects noted.
2-04-47		501	Reshot view adjacent to repair area - no defects noted 5-13-77.
2-08-17		111	Repair completed and accepted 5-13-77.
2-08-25		185C	Repair completed and accepted - DR 3383, 5-20-77, hydro open.
2-08-32		243	Repair completed and accepted - DR 3385, 5-26-77, hydro open.
2-08-33		390	Repair completed and accepted - DR 3384, 6-3-77, hydro open.

2-14-63	532	Repair completed and accepted - DR 3382, 6-3-77, hydro open.

OTHER JOB TASKS

UNIT/SYST/ISO	FW	COMMENT
1-03-500146	828	Penetrant tested seal weld at coupling installed to repair FW 197.
2-04-2	28	Visual inspection verified surface condition within code.

CONCLUSION

The above data reflects all actions completed as result of film review required per DR 3370 and constitutes final action as indicated. Defects discovered during film review generated the requirement for 100% radiographic film review. DR 3400 documents review of Unit I and DR 3409 concerns Unit II.

1 Attachment

File

INTEROFFICE CORRESPONDENCE

TO J. HOLLEY DATE APRIL 22, 1977

FROM J. P. RUNYAN

SUBJECT PROPOSED JOB TASKS - D.R. 3370

As result of Radiographic Film Review, conducted per D.R. 3370, the attached lists present our proposed action.

Request your review and comments at the earliest possible date.

J. P. Runyan
Field Q.A./Q.C. Manager

JPR/mk

Attachments

NDE WORK D.R. 3370

UNIT II

UT - SYSTEM ISO	F.W.	WORK REQUIRED	PREPARATION REQUIRED
2-04-501013	347	Reshoot Mainsteam	1. Scaffold at top of steam generator. 2. Not insulated.
	NOTE:	Recommend R.T. from inside of steam generator and P.T. of I.D. of welds.	
2-04-501014	364	Reshoot Mainsteam	1. Scaffold at top of steam generator. 2. Not insulated.
	NOTE:	Recommend R.T. from inside of steam generator and P.T. of I.D. of welds.	
2-04-501015	379	Reshoot Mainsteam	1. Scaffold at top of steam generator. 2. Pull insulation.
	NOTE:	Recommend R.T. from inside of steam generator and P.T. of I.D. of welds.	
2-04-501016	329	Reshoot Mainsteam	1. Scaffold at top of steam generator. 2. Pull insulation.
	NOTE:	Recommend R.T. from inside of steam generator and P.T. of I.D. of welds.	
2-04-2	28	Visual for surface Linear	1. Scaffold or ladder. 2. Pull insulation. 3. Match linear or; 4. Reshoot.
2-04-47	501	Reshoot adjacent view to repair area.	1. Modify existing scaffold.
2-08-17	111	U.T. for lack of Penetration.	1. None
2-08-25	185C	Repair gas holes	1. None
2-08-32	243	Repair gas holes	1. Erect scaffold on top of liquid hold-up tank 2-1.
2-08-33	390	Repair unconsumed ring	1. None.
2-14-63	532	Repair porosity	1. Scaffold platform for access.

NDE WORK D.R. 3370

UNIT I

UNIT - SYSTEM ISO	F.W.	WORK REQUIRED	PREPARATION REQUIRED
1-04-500136	255	Reshoot Mainsteam	1. Erect scaffold on top of steam generator. 2. Pull temporary insulation.
SG 1-1			
	NOTE:	Recommend R.T. from inside of Steam Generator and P.T. of I.D. of welds.	
1-04-500137	282	Reshoot Mainsteam	1. Erect scaffold on top of steam generator. 2. Pull temporary insulation.
	NOTE:	Recommend R.T. from inside of Steam Generator and P.T. of I.D. of welds.	
1-04-500138	320	Reshoot Mainsteam	1. Erect scaffold on top of steam generator. 2. Pull temporary insulation.
	NOTE:	Recommend R.T. from inside of Steam Generator and P.T. of I.D. of welds.	
1-04-500139	348	Reshoot Mainsteam	1. Erect scaffold on top of steam generator. 2. Pull temporary insulation.
SG 1-4			
	NOTE:	Recommend R.T. from inside of Steam Generator and P.T. of I.D. of welds.	
1-03-500146	828	Penetrant Test A.I. Witness	1. Scaffold in place 2. Pull temporary insulation. 3. Power bruth to clean.
1-07-1	201	R.T. Drop-Thru at view 3-4	1. No scaffold required. 2. Pull insulation.
1-07-21	99	Reshoot - Original Density 4.0+	1. Scaffold for access. 2. Pull insulation.
1-07-22	106	Reshoot - Original view 3-4 missing	1. Scaffold for access. 2. Pull insulation.
1-07-25	170	Reshoot - Original Rough surface	1. No scaffold required. 2. Pull insulation.
1-07-29	188	Reshoot - Original 2-3-4 missed weld.	1. No scaffold required 2. Pull insulation.
1-9-3	338	Repair insert	1. No scaffold required. 2. Not insulated 3. R.T. repaired area.

NDE WORK D.R. 3370

UNIT I

UNIT - SYSTEM ISO	F.W.	WORK REQUIRED	PREPARATION REQUIRED
1-09-16	279	U.T. for possible lack of fusion	1. No scaffold required. 2. Not insulated.
1-09-18	123	U.T. for possible lack of fusion	1. Scaffold in place. 2. Not insulated.
1-09-21	155	Reshoot - Original with possible slag	1. No scaffold required. 2. Pull insulation.

DIABLO CANYON NUCLEAR PROJECT

JOB# 7177

SPEC.# 8711

QUALITY ASSURANCE REPORT

OF

DOCUMENTATION AND RADIOGRAPHIC FILM REVIEW

(REF. D.R. 3370)

THE M. W. KELLOGG COMPANY

AVILA BEACH, CA.

PREPARED BY: J. P. Runyan

J. P. RUNYAN
FIELD Q.A./Q.C. MANAGER

DATE 4/22/77

QUALITY ASSURANCE REPORT

OF

DOCUMENTATION AND RADIOGRAPHIC FILM REVIEW

(REF. D.R. 3370)

PURPOSE

To perform a comprehensive review of radiographic film and documentation related to field weld 212 and other similar welds.

SCOPE

To review the weld procedure, welder qualification records, heat treatment records, material certifications, nondestructive examination personnel qualification and N.D.E. results of the above mentioned welds.

DISCUSSION

Because of the crack in F.W. 212 it was determined that a complete review of the history of the weld, including inspection and tests records, was in order. In addition, other welds of the same configuration and material combination should be reviewed to determine, if possible, if there exists a generic type problem. The result of that review is as follows.

WELD HISTORY REVIEW

Field weld 212 was fit-up and tack welded on Friday May 18, 1974. On Monday May 21, 1974 the tack welds and insert were removed. A new insert was installed on May 22, 1974. It is not documented as to why the original insert was removed, however, discussions with field inspectors who were on site at the time indicate that surface rust may have occurred over the weekend and the insert was removed to reclean the weld prep and install a new insert prior to consuming the ring.

The root pass was made on May 22, and accepted visually May 23, 1974. Welding proceeded following Q.C. acceptance and was completed on May 24, 1974.

The weld surface was ground and final visual inspection completed on May 28, 1974.

Other than replacing the insert no unusual or out of the ordinary circumstances were recorded.

PREHEAT AND POSTHEAT

A review of the heat charts on F.W. 212 indicate that the weld area was preheated to 200° F. min. prior to tack welding and subsequent welding.

The weld was preheated on May 22, 23, and 24. The heat was turned off at the end of each shift allowing the weld to cool.

DR 3370

Ref: Matl No Qualif

5/27/77

UNIT I FEEDWATER		WELD No.	WELDER	FITTER	INSPECTO.
500146	S.G 1-1	FW 197	GX	926 117 - GRIND ONLY	BILL GUEST
500146	S.G 1-2	FW 212	LB	671 415 - GRIND 117 PRE-HEAT	" "
500146	S.G 1-3	FW 229	SI	58 214 - PREHEAT	" "
500146	S.G 1-4	FW 244	SI	671 1339 816	" "
		FW 244 R1	EF	434	A. CUBBAG BILL GUEST

UNIT I MAIN STEAM		WELD No.	WELDER	FITTER	INSPECTOR
500136	S.G 1-1	FW 255	SI	58 415	BILL GUEST
500137	S.G 1-2	FW 282	SI & GX	55 415	" "
500138	S.G 1-3	FW 320	SI & GX	58 929 1113	" "
500139	S.G 1-4	FW 348	SI & GX	58	" "
		FW 348 R-1	EF	55	" "

WELDER'S

GX (411) D. KING = STILL HERE

LB (422) K. STALKER - TERMINATED 11/2/74

SI (896) HERRING " 6/19/75

EF (84) R. CHAPMAN " 7/9/76

FITTER'S

926 - EVANS TERMINATED 3/19/76

671 SCAMIOT " 11/8/74

58 LOGUE " 6/3/75

214 HARDISON " 4/16/74

816 WOLTMAN " 8/27/74

1339 GERDES " 11/8/74

434 BUCHANAN " 11/8/74

117 TILTON STILL HERE

415 GOTT STILL HERE

929 ERNE 6/28/74

1113 ADDED AFTER MEETING 6/14/76

Following completion of the weld on May 24, the weld was allowed to cool and no further heating was performed until post weld heat treatment on June 24, 1974.

Preheat and post heat records from other welds of the same type indicate a similar history. NOTE: Other welds reviewed were the remaining three feedwater nozzle to pipe and all four main steam nozzle to pipe welds in Unit I and the main steam nozzle to pipe welds in Unit II. The feedwater nozzle to pipe welds are not welded in Unit II.

WELDING PROCEDURE AND WELDER PERFORMANCE QUALIFICATION RECORDS

Field Weld 212 was made using weld procedure number 200. The procedure was reviewed to assure compliance with ASME Section IX. No deviations were noted. The results of the procedure qualification tests were evaluated. Included were bend test's, tension test's, and Charpy V Notch test's. All results were acceptable.

Welder performance qualification records were reviewed. The records were in order and the welder was found to be properly qualified. In addition, records of other welds performed by the same welder were reviewed. It was determined that his performance record was good. There was no reason to suspect that welders capability or performance was below standard.

MATERIAL CERTIFICATIONS

Material Certifications of the weld material and pipe-side base material was reviewed for compliance with material specifications and job specifications, including supplementary requirements. All were found to be in compliance. The nozzle base material certifications were not available for review by M.W. Kellogg.

NONDESTRUCTIVE EXAMINATION PERSONNEL, PROCEDURES AND REPORTS

The original radiographs of F.W. 212 were reviewed. There was an area along the nozzle side of the root with greater density than other areas of the weld. This area is typical of other similar welds. The higher density is caused by the nozzle counterbore which is approximately ¼" wide. There was no evidence of linear indications in the area where the crack occurred.

Review of the radiographs of other similar welds did not show evidence of linear or crack-like indications. However, the radiographs of F.W. 197, which is the feedwater nozzle to pipe weld on steam generator number 1-1, indicated a drop thru which appeared to have linearly oriented voids contained within the drop thru. There were two sets of radiographs of F.W. 197. The reader sheet for one set listed the drop thru as acceptable. The other reader sheet accepted the weld but did not indicate that the drop thru was present.

To assure the soundness of the weld it was determined that the drop thru should be removed. This was accomplished in accordance with D.R. 3370. (Attached)

To further assure that the film interpreter, which had accepted the weld with the drop thru without entering it on the reader sheet, had not overlooked other similar or more serious indications, a complete review of all the film read by him was made. His qualification records were also reviewed. The results are as follows.

Mr. Ken Beck was employed by the M.W. Kellogg Company from January 2, 1974 to March 28, 1975. His resume and personnel records indicates he had sufficient past experience and training to qualify him as a Level II radiographer capable of film interpretation. He completed M. W. Kellogg R.T. exams and was certified to Level II on August 9, 1974.

A review of the films which were read by him indicated that he had reviewed and accepted film prior to August 9, 1974. It is assumed that this was an administrative error. To assure that the film were properly interpreted and accepted by a qualified reader, all of Beck's film was re-interpreted.

In general, the findings revealed that he frequently did not record all indications on the reader sheet. We found that he had reviewed one hundred twenty-two (122) sets of film, eight had indications which in our opinion should be repaired. These repairs will be performed as soon as the systems are made available. NOTE: Four of the repairs are in Unit I, Four are in Unit II. To further confirm our findings, the Q.A. Manager and Level III N.D.E. examiner from our Paramount plant was asked to review the film which we had reviewed. His review confirmed our interpretation, a copy of his report is attached.

In light of the fact that Beck had accepted welds with rejectable indications, it was determined that other film which had been accepted by other M.W. Kellogg interpreters should be reviewed.

Seven people, other than Beck, had reviewed film. Twenty sets of radiographs interpreted by each of the seven were selected randomly and reviewed. Of the one hundred forty (140) film reviewed no rejectable indications were noted. It was noted that occasionally acceptable minor indications were not recorded on the reader sheet. However all significant acceptable indications were apparently evaluated and recorded.

Other N.D.E. reports, (i.e. M.T. and P.T.) were reviewed and found acceptable. This included a review of personnel and procedure qualification records.

CONCLUSION

It is the writers opinion that the review as recorded above has covered all potential areas for problems in welding, heat treatment and N.D.E. related to the crack in F.W. 212.

It revealed a discrepancy in the interpretation of radiographs which has been corrected. Procedures are in effect to prevent recurrance of similar problems.

No further action is anticipated at this time.

Copy to Pullman Kellogg

DISCREPANCY REPORT

No. [illegible] To: RLLorenz From: DDay Page 1 of 1

Comp. Pullman Kellogg Cont./Comm. I.D. No. D.R. 3370 PCAR No. 225

INSPECTION SECTION

Discrepant Item: Unit 1, System 3, Steam Generator 1-1 Feedwater Nozzle Field Weld No. 167.

Explanation of Discrepancy: Radiography Review revealed "drop through" with questionable indications. This was found after the radiograph and weld had been final accepted. For further details, see attached Pullman Kellogg D.R. No. 3370.

[signature] Field Engr./Inspector 3-23-77 Date

CLASSIFICATION & DISPOSITION

Minor Variation ☐ Deviation ☒

Disposition: Reject. Repair in field in accordance with P-K D.R. 3370.

The following members of the Material Review Board concur with the above Disposition: (For Minor Variations, only Resident Engineer's signature required.)

[signature] Name [illegible] Date

[signature] Resident Engineer 3-23-77 Date

[signature] Name [illegible] Date

[signature] Name 3/24/77 Date

Responsible Engineer

[signature] Name 3/24/77 Date

Supervising Engineer

DISPOSITION ACCOMPLISHED

Remarks:

Field Engineer/Inspector Date

STEPS TO PREVENT RECURRENCE (Deviations Only)

Responsible Engineer Date

Copies: Attachments: Report Completed:

Mgr. of C. Dept. Mgr. of A. Chief Engr.

INTEROFFICE CORRESPONDENCE

EXHIBIT 3 TO ATTACHMENT 1

TO P. RUNYAN

DATE APRIL 5, 1977

FROM S. L. ENGLER

SUBJECT INTERPRETATION OF RADIOGRAPHS PREVIOUSLY INTERPRETED BY K. BECK (PULLMAN KELLOGG)

Reviewed 24 seams that were previously accepted by K. Beck. These seams were reviewed by other Pullman Kellogg personnel before I arrived. They broke them into two groups: Acceptable and Questionable.

During my review of the Questionable Radiographs I found a lack of understanding by the film interpreter of the governing acceptance standards, such as:

A. Acceptable inclusions not noted on inspection report.

B. Acceptable surface indications not marked on inspection report.

C. Inclusions and surface conditions where accepted that should have been rejected.

In my opinion some of the seams will have to be repaired or at least re-radiographed. Some film can be accepted by comparison with the surface of the weld.

My review of the films interpreted by K. Beck that were re-reviewed by Pullman Kellogg personnel, and determined to be acceptable, consisted of a random sample. In the process of that review no rejectable film were found.

During the inspection I found that all other aspects of the program such as: Contrast, Sensitivity, Density and Processing were acceptable.

If you have any questions on the above report please contact me.

Stephen L. Engler

SLE/mk

cc: E. B. Curcio
J. W. Ryan
S. Handler

EXHIBIT 4 TO
ATTACHMENT 1

DIABLO CANYON NUCLEAR PROJECT
JOB # 7177
SPEC # 8711

QUALITY ASSURANCE REPORT

OF

Crack in Steam Generator Feedwater
Nozzle to pipe weld
(Generator No. 1-2)

THE M.W. KELLOGG CO.
Avila Beach, Ca.

PREPARED BY J. P. Runyan
J. P. RUNYAN
Field Q.A./Q.C. Manager

DATE April 12, 1977

QUALITY ASSURANCE REPORT

OF

CRACK IN STEAM GENERATOR FEEDWATER NOZZLE
TO PIPE WELD (GENERATOR NO. 1-2)

PURPOSE

To document events from the time of discovery of the leak until the completion of the repair.

SCOPE

This report covers the on site findings, the review of documentation including preheat and postheat charts, radiographs from the defective weld, the subsequent procedures for removing the defective area and performing the repair.

FINDINGS

On Thursday, March 17, 1977 a leak was observed in field weld 212, line K16-555, by P.G.& E. We were advised of the leak on that date.

The weld in question is where the 16" feedwater pipe ties into nozzle #4 on Steam Gererator 1-2.

Visual observation revealed a weep type leak which occasionally sprayed a fine stream of water. When observed with a 10X magnifing glass there appeared to be a small intermittant linear indication approxiately 3/8" in length in the center of the weld running around the pipe. Magnetic particle examination of the area with a D.C. converted yoke did not show evidence of a linear defect.

P.G.& E. requested that we grind the area. As grinding proceeded, the indication opened to reveal a linear defect approximately 2" long when the weld crown was flush with the pipe surface. At this point the grinding was stopped. We were requested to perform an Ultrasonic examination to determine the extent of the indication. The pipe temperature was approximately 180° F which made it impossible to perform U.T. with the standard transducers on site.

We were then instructed to "hold" until P.G.& E. Engineering Research arrived with their U.T. equipment and high temperature transducers. The weld was radiographed at this time. The radiograph revealed evidence of a linear indication which appeared to be approximately 6" in length.

On Friday, March 18, 1977 P.G.& E. Engineering Research arrived and performed Ultrasonic examination of the weld. They reported that there was a crack which appeared to extend approximately 2/3 of the distance around the weld. Based on there findings it was determined that the weld would be cut out and replaced.

WELD REMOVAL

The weld was cut by grinding approximately 1/2" from the center line on the nozzle side and at F.W. 503 on the pipe side. The end of the pipe was then cut to remove a ring which included most of the weld and approximately 4" of pipe.

The piece was examined visually and by liquid penetrant on the O.D. and I.D. and a sketch made to reflect the observations. (Sketch Attached)

The piece was shipped to P.G.& E. research lab on March 20 for analysis.

REPAIR

A piece of 16" pipe was removed from stores to replace the piece which was cut out. The pipe end preps, gamma hole and vent were machined in the P.G.& E. machine shop on March 19, 1977. The nozzle end prep at F.W. 212 and pipe end at F.W. 503 were ground in place on March 20. A liquid Penetrant examination was performed at that time to assure complete removal of any indications.

The new piece was moved into place and fit up on March 20. Preheat was applied prior to tack-up,(Ref. Chart # 547). After the fit up was approved by M.W. Kellogg Q.C. both roots were welded. Magnetic particle inspection was performed. Following magnetic particle acceptance two additional passes were welded in each weld.

Radiography was performed on March 21, 1977. The radiographs of F.W. 503 pipe to pipe wereacceptable. F.W. 212, pipe to nozzle, had excessive porosity at the window closures. These areas were ground, rewelded and re-radiographed. One area had excessive porosity, the other had a linear indication approximately 1/2" long and an area which appeared to be suck back.

At this time, March 21, 1977, P.G.& E. Q.A. placed a "hold" on all work until their Engineering could review the total program and process appropriate paperwork. "This hold was not because of the difficulty in welding the window closures".

No work was performed on March 22, 1977.

On March 23, 1977 an on site meeting was held to review findings, work to date, and procedures for completion of the repair. Attending the meeting were representatives from P.G.& E. Engineering, Q.A., General Construction, Division, Westinghouse, M.W. Kellogg site Manager, Corporate Q.A. Manager, and the writer.

A. It was determined that the procedure as outlined by D.R. 3366 was acceptable except that the preheat would be raised to 300° Min. for completion of the welding.

B. The problem of making an acceptable closure weld was discussed. It was determined that the positive pressure maintained in the system was to high and that water remaining in the generator caused vapor to be carried out the window openings.

C. P.G.& E. Division agreed to drain the generator and reduce the purge pressure until the closure welds could be made.

On March 24, 1977 the defective areas at the closures were ground out and Magnetic particle performed to assure complete removal. No welding was performed since P.G.& E. had not removed the Hold. Preheat was being maintained through the "hold" period.

On March 25, 1977 the hold was released. The windows were closed and radiograph made. Both areas were acceptable and welding continued. The weld was completed on the afternoon of the 25th. Radiographs were shot in the hot as welded condition. No rejectable indications were noted. Post weld heat treatment was then performed.

On March 26, 1977 following post weld heat treatment, the weld was ground, re-radiographed, liquid penetrant inspected and ultrasonically examined. No rejectable indications were noted. The vent line and gamma plug were completed, inspected and the system turned over to division for resumption of testing.

SUBSEQUENT INVESTIGATION

Because of the unknown origin of the crack it was determined that other welds of the same type and welded using the same procedure should be reviewed to determine if the defect could be a generic nature.

Each of the remaining three feedwater nozzle welds and the four Main Steam nozzle welds were ultrasonically examined. The original radiographs were reviewed and the feedwater nozzle welds were re-radiographed. There was no evidence of like indications in any of the welds and no evidence of change in any of the noted, acceptable, indications since the original inspections.

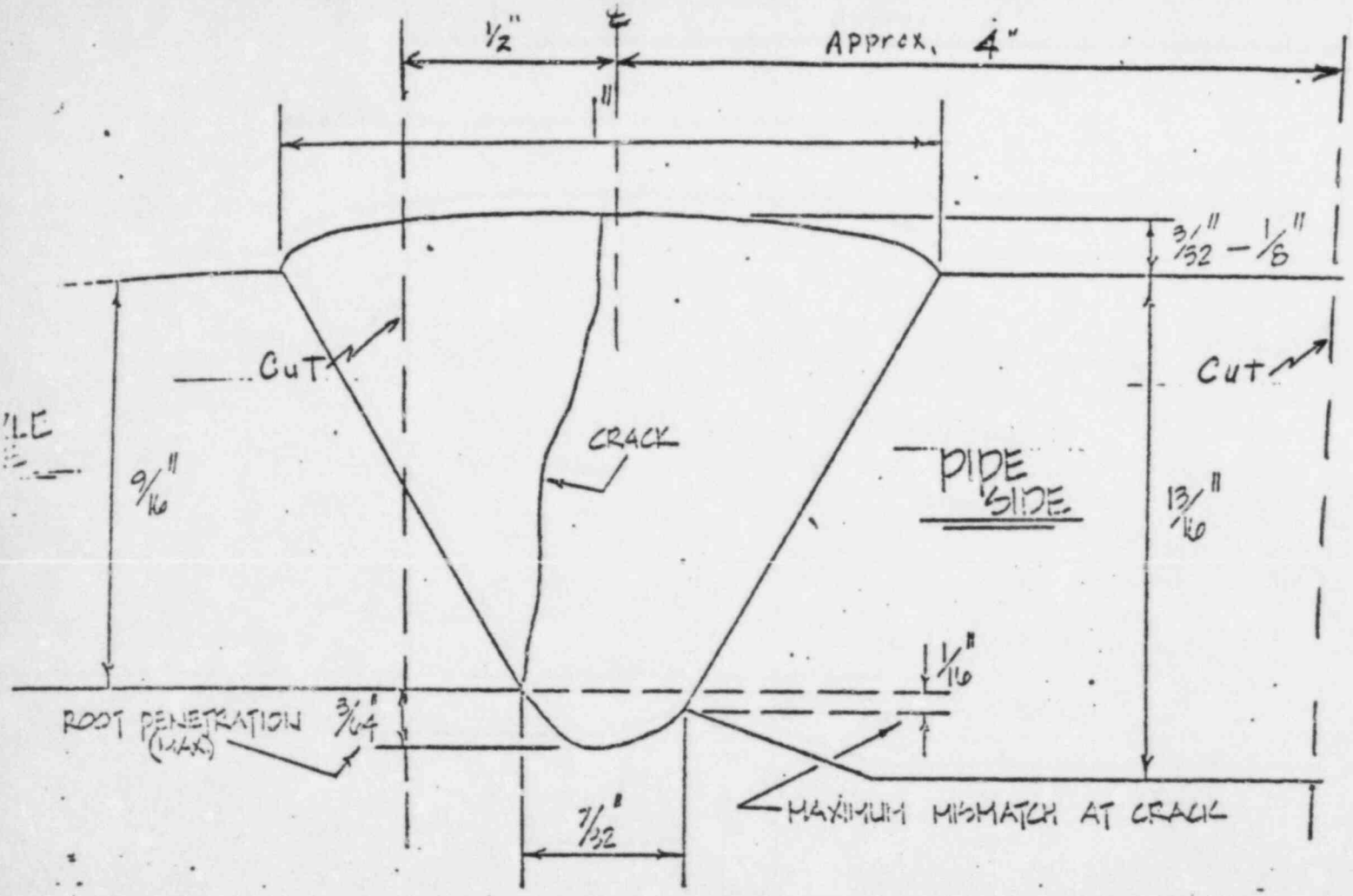
There was, however, an indication noted in F.W. 197 on generator 1-1. The indication was present on the original radiographs but had not been noted on the radiographs report. A second set of radiographs were on file for F.W. 197. This set also exhibited the same indication, however, the radiographic report did reflect the condition as being a drop thru. The indication had apparently been evaluated and determined acceptable at the time.

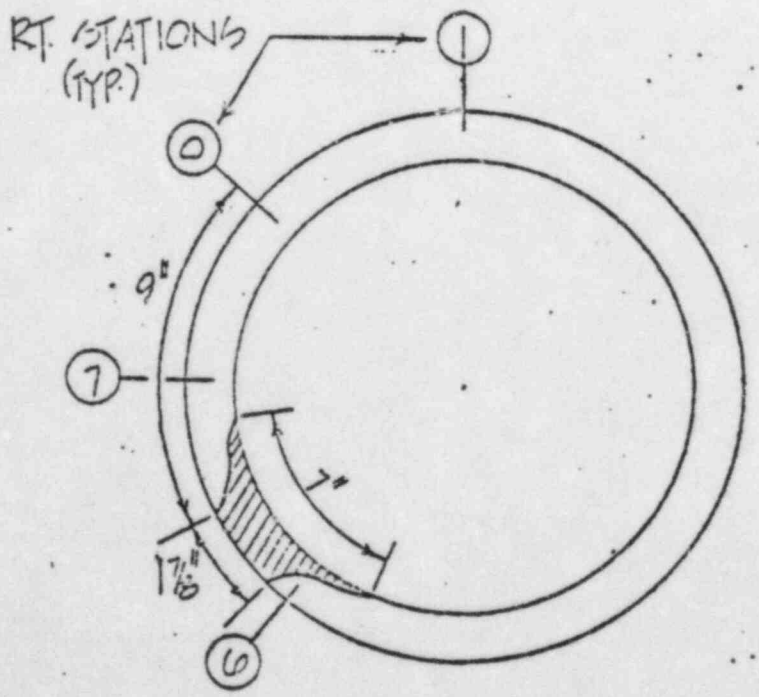
Because of the problem with F.W. 212 it was determined that any questionable situation should be resolved. It was therefore determined that the drop thru should be removed. A D.R. was initiated and the repair was made. The indication was removed by grinding. No welding was required. (See D.R. 3370 Attached)

SUMMARY

To date the metallurgical analysis has not been completed of the crack sample. We had requested, from P.G.& E., a piece of the defective material for our own analysis. This was received on Thursday, April 7, 1977 and forwarded to E. F. Gerwin in Williamsport.

It is my belief that the crack was peculiar to F.W. 212 only and not of a generic nature. Therefore, at this time we are assuming that no further repair will be required and that when the disposition of D.R. 3370 is completed the subject will be closed.





NOTE:

1. WALL THICKNESS MEASR. ARE APPROXIMATE
2. REF. TO DR. 33166 REV. A
3. STEAM GENERATOR 1-2
   F.W. # 212
   P.O. 500146
   LINE # K16-555-16IV

DR 3366 Rev. 1

ATTACHMENT # 2

THE M.W. KELLOGG COMPANY

REWRITTEN 3-21-77 Rev. II

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3366 Rev. 1
ISO. NO. 500146
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

OWNER Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/21/77
PROJECT Diablo Canyon JOB NO.: 7177 INSPECTOR: J. P. Runyan

DISCREPANT ITEM: F.W. #212, Line K16-555-16-IV, Steam Generator 1-2, Nozzle to pipe

EXPLANATION OF DISCREPANCY:

A leak was detected by P.G.&E. in F.W. #212 (Pipe--Steam Gen. 1-2 Nozzle).

Leak occurred during Hot Functional Testing March 17, 1977. Line pressure was approximately 90psi, temperature approximately 330°F.

See Attachments 1, 2 and 3.

RECOMMENDED DISPOSITION:

A. Cut out weld and reweld.

B. Prior to weld cut-out:
   1. Map weld area with U.T. to determine size and location of indication.
   2. X-ray for an analysis.
   3. Remove weld material with indication for further analysis.
   4. Cut out spool 58D (F.W. #503 to 212).

C. Reweld procedure: (Rewritten)
   1. Weld F.W. #503 using procedure 4/5 and 88/89
   2. Weld F.W. #212 using procedure 200 or 204 (See Attached Sheet #2 for additional requirements).
   3. Install soc-o-let on new spool using F.W. #411 so vent can be reinstalled.

Approved By: M.W.K. Field Q.A. Mgr [signature] Date 3/13/77 Customer PG&E MWR M-3369 Date 3-18-77

FINAL DISPOSITION: ☐ In Accordance With Above
Work Completed Insp: ____ Date: ____

☐ Other (Explanation and approval required))
Work Completed Insp: [signature] Date: 3/31/77

EXPLANATION (IF NECESSARY):

Revision I - D.R. rewritten for clarity.
Revision II See page 2

M.W.K. Field Q.A. Manager [signature] Date 3/29/77 Customer PG&E NO REVISION TO MWR REQ'D Date 3-29-77

M.W.K. Field Q.A. Manager [signature] Date 3/23/77 Customer PG&E NO REVISION OF MWR REQ'D Date 3-23-77

STEPS TO PREVENT RECURRENCE ☐ Not Applicable

1) Maintain preheat as indicated on Sheet 2.
2) Perform Post Weld Heat Treat immediately following completion of weld.

Field Q.A. Manager [signature]

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other ____
☒ Customer ☐ Receiving ☐ Field Inspector ( )

ATTACH SKETCH IF NECESSARY

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

REWRITTEN Rev II

D.R. NO. 3366 Rev. 1
ISO. NO. 500146
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER Pacific Gas & Electric SPEC. NO. 8711 DATE 3/21/77
JOB Diablo Canyon JOB NO. 7177 INSPECTOR J. P. Runyan

PLANT ITEM: F.W. #212, Line K16-555-16-IV, Steam Generator 1-2, Nozzle to pipe

Recommended Disposition:

4. Drill and tap X-ray port in new spool. Install X-ray plug using seal weld F.W. #298.
5. Add all information to Iso and Process Sheets.

Additional Requirements for F.W. #212 (See Paragraph C-2):

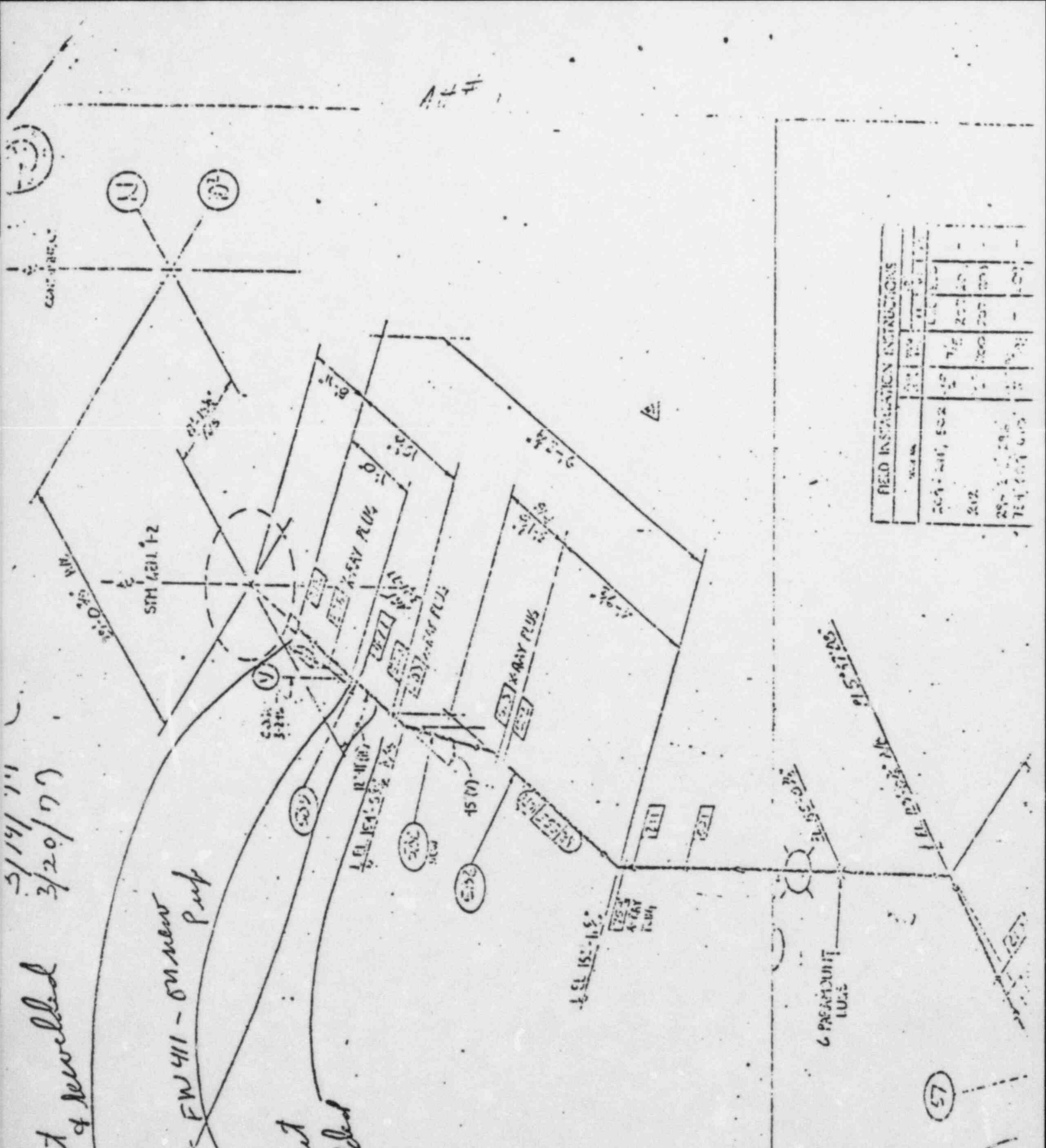
1. Preheat to 250°F minimum.
2. Maintain interpass at 250°F minimum, 500°F maximum until weld is complete and post weld heat treatment begins.
3. M.T. root pass; Esd-250.
4. R.T. after root and 2 layers weld added ESD-207. Repair if required and re-R.T. before completing weld.
5. Post weld heat treat at 1100°F minimum, 1150° maximum hold for 1 hour minimum, AT temperature..
6. Following post weld heat treatment, perform R.T.; ESD-207 and M.T.; ESD-209.
7. P.G.&E. will perform U.T. of final weld and maintain records.
8. Δ

Revision II

Change para B , sub I to read "U.T. of weld performed by P.G.& E. personnel".

Add line 8 to additional Requirements. " M.W.Kellogg will perform U.T. of final weld and incorporate results into Iso package".

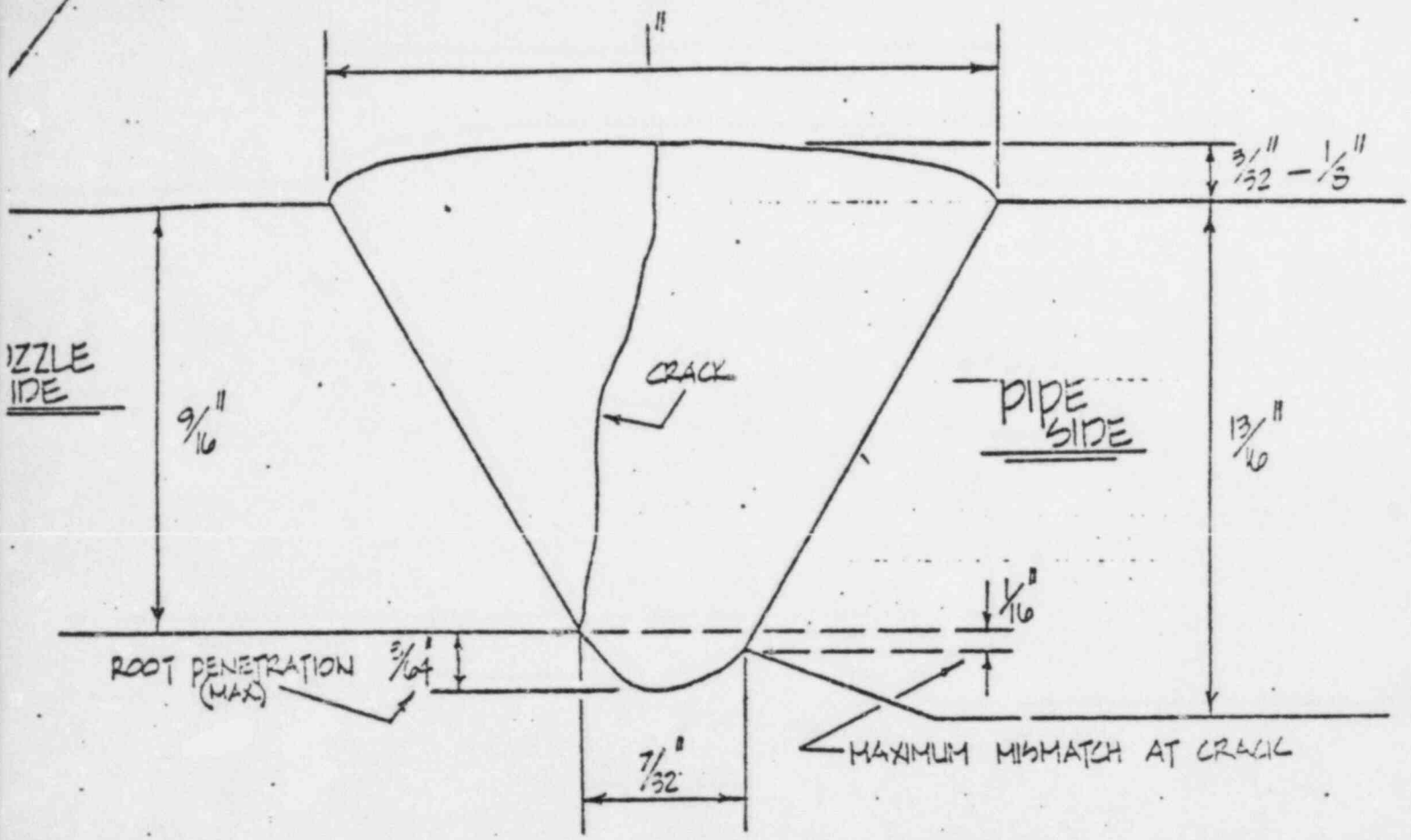
DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector

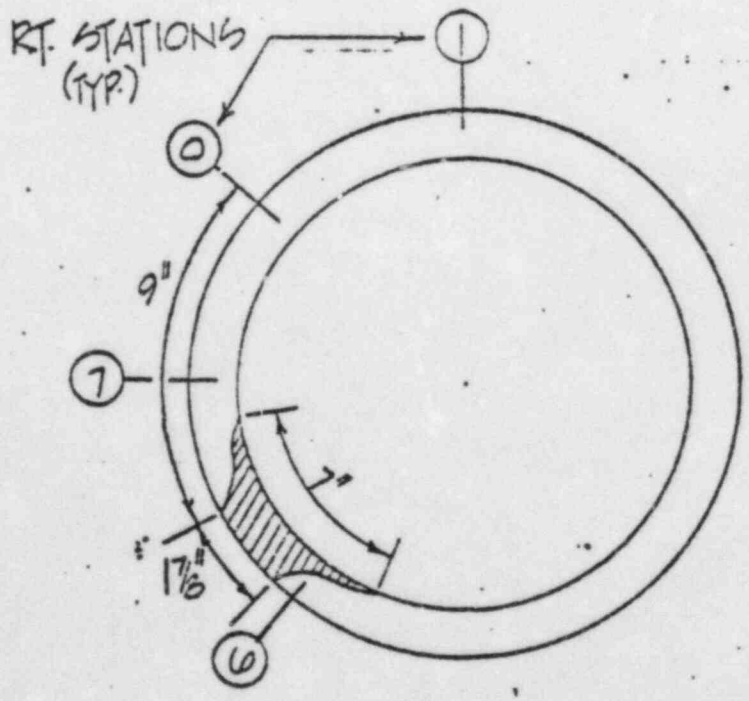


DR3366 Rev I

Attachment #1

DWG 500146





NOTE:

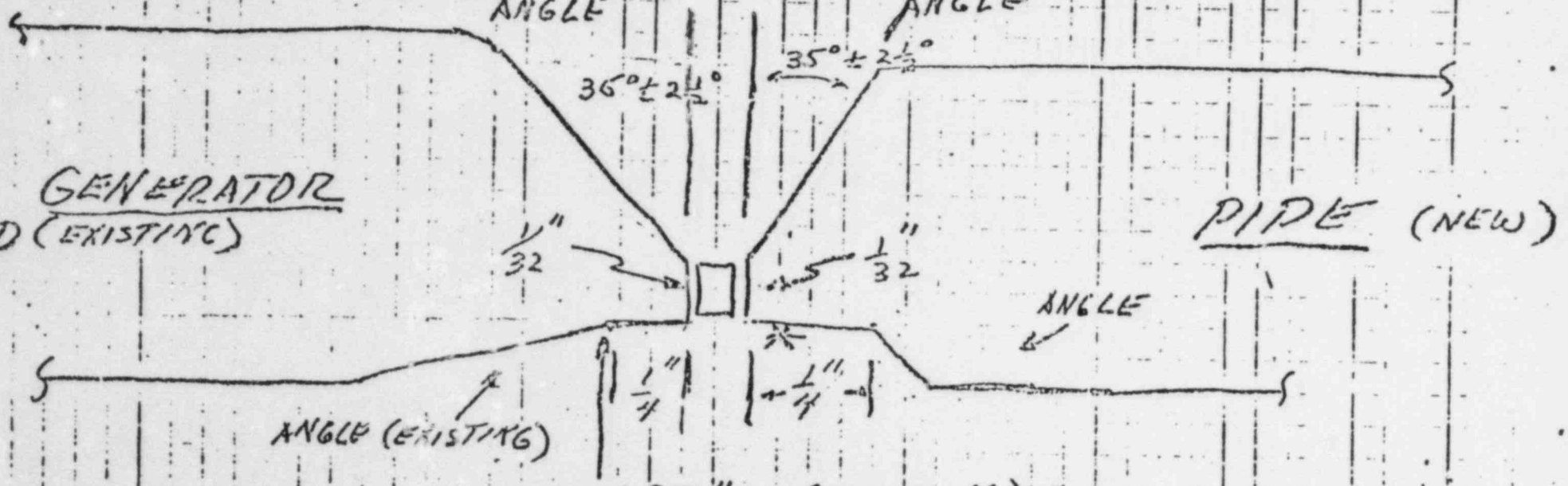
1. WALL THICKNESS MEASR. ARE APPROXIMATE
2. REF. TO D.R. 3366 REV. A
3. STEAM GENERATOR 1-2
   F.W. # 212
   W.O. 5001.40
   -LINE # K10-553-16IV

DR 3366 Rev I
ATTACHMENT # 2

DJD 3-21-77

NOT TO SCALE

(JOINT DETAIL)
FOR RE-WELD
OF FW 212



DR 3366
ATTACHMENT #3

* ID OF PIPE MACHINED TO FIT NOZZLE

DR 3366 Rev 1

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

DISCREPANCY REPORT

D.R. NO. 3370 Rev I
ISO. NO. 500145
UNIT NO. 1
CODE NO. N/A

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J. P. Runyan

DISCREPANT ITEM: F.W. #197, Line K16-554-16-1V, Steam Generator 1-1 Nozzle to pipe

EXPLANATION OF DISCREPANCY:

As the result of a crack in F.W. #212 at the Feedwater nozzle on Steam Generator 1-2 (Ref. D.R. 3366), a review of the radiographs of the same welds on the remaining three (3) generators was performed by the N.R.C. In addition, the nozzle to pipe welds on the main steam leads were reviewed:

The review revealed a questionable indication in F.W. #197 on the feedwater lead to Steam Generator 1-1. The indication appears to be a burn through which contains linearly oriented voids. The accompanying radiographic report accepted the weld but did not indicate the presence of the burn through. Further investigation revealed that a second set of radiographs, shot at a later date, exist. This set also shows the burn through which was recorded on the radiographic report as acceptable (see copies attached).

(Continued on Page 2)

RECOMMENDED DISPOSITION:

See Page 2

Approved By: M.W.K. Field Q.A. Mgr. [signature] Date 3/23/77 Customer REF. PGE DR 286 R.D. Etzler Date 3/23/77

FINAL DISPOSITION: ☐ In Accordance With Above
Work Completed Insp: _____ Date: _____

☐ Other (explanation and approval required))
Work Completed Insp: _____ Date: _____

EXPLANATION (IF NECESSARY):

Revision I See page 3

M.W.K. Field Q.A. Manager D.L. Wolfe Date 3-30-77 Customer R.D. Etzler Date 3/31/77

STEPS TO PREVENT RECURRENCE ☐ Not Applicable

To be provided after further review.

⚠ See Page 3

Field Q.A. Manager [signature]

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other _____
☒ Customer ☐ Receiving ☐ Field Inspector (_____

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3370 Rev I
ISO. NO. 500146
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

TOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
JECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J. P. Runyan

REPANT ITEM: F.W. #197, Line K16-554-16-IV, Steam Generator 1-1 Nozzle to pipe

lanation Of Discrepancy:

To determine the severity of the indications in the burn through, we have made additional radiographs of the burn through area. These radiographs indicate that the voids are probably contained within the burn through and do not extend into the weld. There is no indication of propagation of the indications.

U.T. of the weld by P.G.&E. does not indicate any indication within the weld which is outside the acceptance criteria.

Attachments 1, 2 & 3

mmended Disposition:

To eliminate the possibility of a potential problem at a later date, it is recommended that the burn through be removed.

The following procedure is to be followed for removal and reinspection:

1. Weld a 2" threaded coupling to the pipe as shown on the attached sketch using weld procedure 88/89 or 92/93. (FW # 827).
2. M.T. per ESD-209.
3. Post weld heat treat the weld - ESD-218.
4. Perform a hydrotest on the weld prior to drilling into the pipe.
5. Following satisfactory completion of the hydrotest, cut the hole through the pipe wall with a hole saw (Ref. ESD-230) NOTE: Additional reinforcement of 2" opening is not required per P.G.& E. calculations
6. Using an extended shaft grinder with a cone shaped rock, grind the burn through flush with the pipe surface.
7. Radiograph the area to assure complete removal of unacceptable indications.
8. Install threaded plug and seal weld (F.W. #828).

This installation is to be made in accordance with the National Board Inspection Code and ASME Section I

Reviewed by A.N.I. R.L. Sanderson 5/24/77

BUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3370
ISO. NO. 500146
UNIT NO. ONE
CODE NO. N/A

DISCREPANCY REPORT

STOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 3/23/77
OJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: J.P. Runyan

SCREPANT ITEM: F.W. Ø197, Line K16-554-16-IV, Steam Generator 1-1 Nozzle ot pipe

REVISION I

The following action was taken.

Add to "Recommended Disposition" the following steps.

A. To determine if there exists an ambiguity with other welds accepted by the M.K. Kellogg film interpreter who accepted F.W. 197, the following action was taken:

1. Review qualification records of this individual to assure compliance with SNT-TC-1A.
2. Review all radiographs which were accepted by the individual.

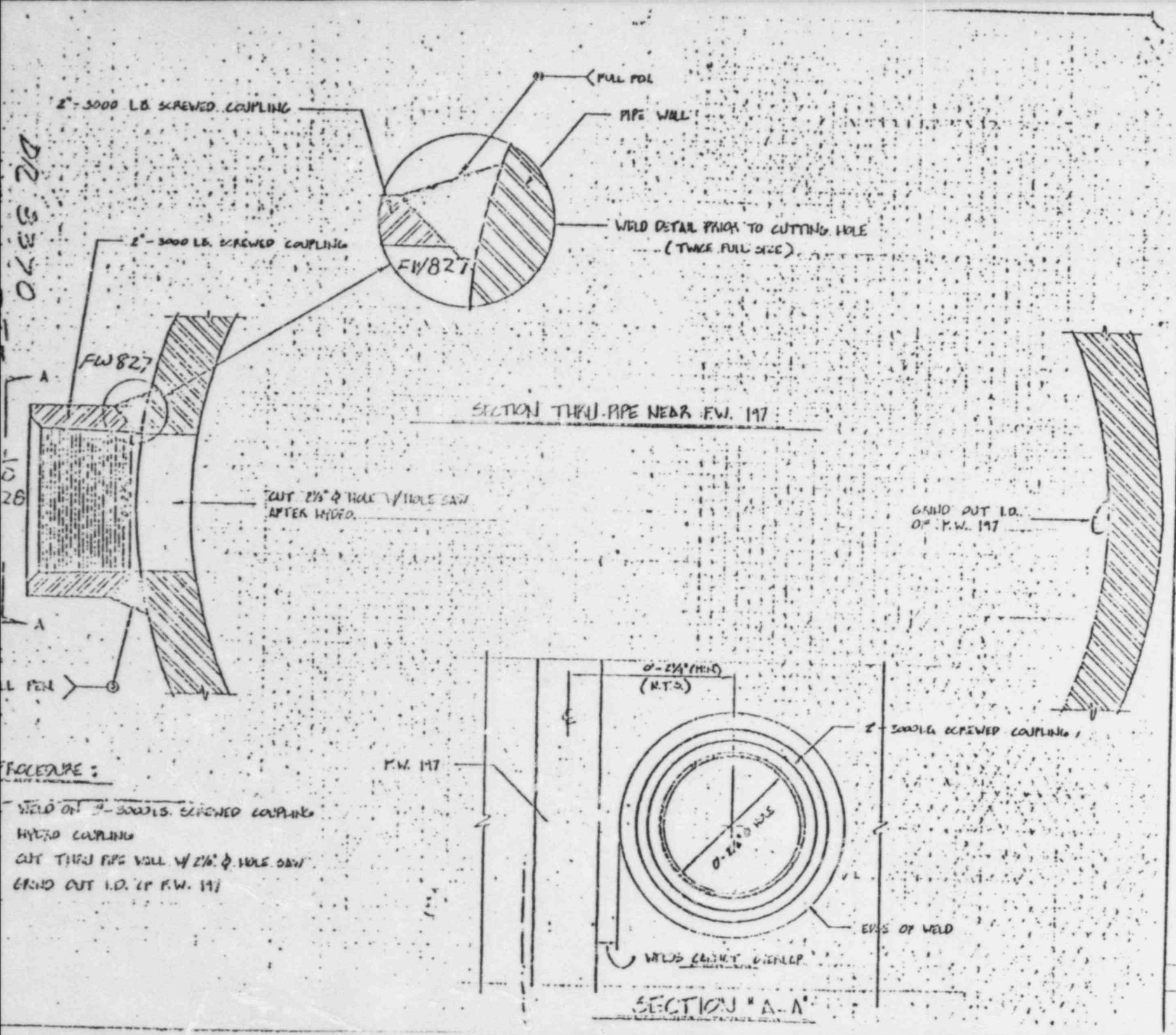
NOTE: The findings of the review will be reported as a separate report and attached to this D.R. before the D.R. is closed. No revision will be required to the D.R.

Summary:

Steps to prevent recurrence:

It has been determined that no further steps are required to avoid recurrence of a similar nature. The interpretation of radiographs is always subject to be questioned after the fact. The review as required above will assure that if any problimatic questions with existing installations are present, they will be corrected.

NOTE: The individual mentioned above is no longer employed by M. W. Kellogg.


2"-3000 LB. SCREWED COUPLING
FULL PEN
PIPE WALL
WELD DETAIL PRIOR TO CUTTING HOLE
(TWICE FULL SIZE)
FW827
2"-3000 LB. SCREWED COUPLING
FW827
A
A
CUT 2⅛" ϕ HOLE W/HOLE SAW
AFTER WELDED.
SECTION THRU PIPE NEAR F.W. 197
GRIND OUT I.D.
OF F.W. 197
0'-2½" (MIN.)
(N.T.S.)
2"-3000 LB. SCREWED COUPLING
F.W. 197
0'-2⅛" ϕ HOLE
EDGE OF WELD
WELD CREST OVERLAP
SECTION "A-A"
PROCEDURE:
WELD ON 2"-3000 LB. SCREWED COUPLING
HYDRO COUPLING
CUT THRU PIPE WALL W/ 2⅛" ϕ HOLE SAW
GRIND OUT I.D. OF F.W. 197

P. G. & E.

3-500146 FEEDWATER SYS

.844	16	B31.7	ESD-206 KRT-2	BUTT	K16-554
IR 192	10 x 10	55	90 SEC	MM	4½X17
				HAND TANK @ 68°	KIMMICK ASNT Level II

Film technique: ☐ SINGLE ☒ DOUBLE

FITTINGS, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS	FILM INTERPRE-TATION BY
197	0-1-2	20F	X															
GX	2-3-4	|	X			W/C										1/29/75		K. Beck
	4-5-6	|	X		W/C	W/C										|		ASNT II
	6-7-0	|	X			W/C										|		
		(SINGLE VIEWING)																

APPROVED BY:

	COST.	AUTH. INS.
KB		
1/28/75		2-4-75

DR3370

P. G. & E.

1-03-500146 FEEDWATER				Date [illegible]
[illegible]: 6SC-TU ELD	[illegible]: 16"	B 31.1		KIS-554-
IR 192	.10x.10	86 ci.	16.5	8 min.
ESD-207 KRT-	BUTT			
Film type: M	Film size: 7X17	☐ SINGLE ☒ DOUBLE		
HAND TANK @ 68°	SEARS	ASNT Level II		

FITTINGS, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS	FILM INTERPRETATION BY
EX 197	0-1-2	ASME 17/20	X							✓								
W	2-3-4	(	X			1/4				✓						2/10/75	Dropthru	H. Shore
E GX	4-5-6	(	X			1/4				✓								ASNT II
L	6-7-8	(	X			1/4				✓							tung. incl. 1/4	2/11/75
D										✓								
E																		
R				Single wall [illegible]														

NOTE: STA. #2 MISSING ON (0-1-2) BUT OVERLAP ON (2-3-4) IS GOOD. [illegible]

NOTE: THIS SIZE FILM WAS USED SO WE COULD COVER REPAIR AREA OF STEAM GENERATOR NOZZLE.

[illegible]

APPROVED BY:		
MFR.	CUST.	AUTH. INS.
[illegible] 2/11/75	[illegible] 2/11/75	2-11-75 [illegible]

DISCREPANCY REPORT

To: [illegible] From: [illegible]

COPY TO [illegible]

No. [illegible]

Page 1 of 1

Cont./Supp. Pullman Kellogg Cont./Supp. I.D. No. D.R. 3370 [illegible] No. 225

INSPECTION SECTION

Discrepant Item: Unit 1, System 3, Steam Generator 1-1 Feedwater [illegible] Field Weld No. 137.

Explanation of Discrepancy: Radiography Review revealed "drop through" with questionable indications. This was found after the radiograph and weld had been final accepted. For further details, see attached Pullman Kellogg D.R. No. 3370.

[signature] Field Engr./Inspector — 3-23-77 Date

CLASSIFICATION & DISPOSITION

Minor Variation ☐ Deviation ☒

Disposition: Reject. Repair in field in accordance with P-K D.R. 3370.

The following members of the Material Review Board concur with the above Disposition: (For Minor Variations, only Resident Engineer's signature required.)

[signature] Resident Engineer — 3-23-77 Date

[signature] Name — [illegible] Date

[signature] Name — [illegible] Date

Name — Date

[signature] Responsible Engineer — 3/24/77 Date

Name — Date

[signature] Supervising Engineer — 3/24/77 Date

DISPOSITION ACCOMPLISHED

Remarks:

Field Engineer/Inspector — Date

STEPS TO PREVENT RECURRENCE (Deviations Only)

Resident Engineer — Date

[illegible]ction Attachments Report Completed

(1) JK cc MRT - 1 + others
(2) EISB
RECD 4/15/77 AT 1700 HRS

April 15, 1977

EXHIBIT 5 TO ATTACHMENT 1

Mr. R. H. Engelken, Director
Office of Inspection and Enforcement
Region V
U.S. Nuclear Regulatory Commission
1990 N. California Boulevard
Suite 202
Walnut Creek, California 94596

Docket No. 50-275
Unit I
Diablo Canyon Site

Dear Mr. Engelken:

On March 18, 1977 we notified the Office of Inspection and Enforcement, Region V, of a defect in a pipe discovered during testing at Diablo Canyon, which is reportable under Paragraph (e)(iii) of 10 CFR 50.55. This letter is a preliminary written report of the situation.

On March 17, 1977, during heatup for hot functional testing, a small leak was discovered in the weld joining steam generator 1-2 feedwater nozzle to the feedwater pipe. Testing was stopped to investigate the cause and to repair the leak.

The area of the leak was examined by nondestructive methods which revealed that there was a through-the-wall crack and that it was confined to the leakage area. A 16" long piece of pipe, which included that portion of the steam generator nozzle weld containing the crack, was removed from the line. A 4 1/2" long section containing the crack was cut from this pipe and delivered to PGandE's Department of Engineering Research to be analyzed to determine the failure mechanism. The investigation is still in progress.

A comprehensive review of the weld history has been performed including the weld procedure, welder qualifications, heat treatment

records, material certifications, nondestructive examinations, and water chemistry associated with the functional testing of this equipment. The results of these investigations are still under analysis.

Repair of the feedwater pipe was made by replacing a 16" length of pipe having the same specification and physical properties as the original piece. The original weld procedure was used with minor changes to preheat and postheat requirements.

Ultrasonic examinations conforming to ASME Section XI were performed on the four main steam and the other three feedwater to steam generator nozzle welds. These examinations revealed that there were no rejectable indications.

We will submit, as soon as possible, a final report documenting the failure mechanism and our intended corrective action if such action is determined to be necessary.

Very truly yours,

Philip A. Crane, Jr.

PAC/

cc: (3) Director of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

EXHIBIT 6 TO
ATTACHMENT 1

PG and E
Pacific Gas and Electric Company

FAILURE ANALYSIS OF CRACKED FIELD WELD NO. 212
DIABLO CANYON UNIT 1, STEAM GENERATOR 1-2
NOZZLE-TO-PIPE WELD

RECEIVED W/LTR DTD 9-1-77

DEPARTMENT OF ENGINEERING RESEARCH

[redacted]

INSPECTION FILE

[redacted]

RECEIVED
[redacted]
DOCUMENTS SECTION
CAL POLY [redacted]

7725700 78

Report Issued: AUG 2 6 1977

Report 411-77.55

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

FAILURE ANALYSIS OF CRACKED FIELD WELD NO. 212 DIABLO CANYON UNIT 1, STEAM GENERATOR 1-2 NOZZLE-TO-PIPE WELD

Prepared By:

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SCOPE

This report covers the metallurgical investigation of a crack found in the pipe-to-nozzle weld of feedwater line of Steam Generator 1-2 at Diablo Canyon Power Plant. Based on the findings of this investigation, recommendations are made for modification of the welding procedures, fabrication practices, and inspection of future welds made in P-3 nozzle materials.

INTRODUCTION

On March 17, 1977, during heat-up for hot functional testing of Unit 1, a leak was discovered in the nozzle-to-pipe butt weld joining the 16-inch diameter feedwater pipe to the No. 4 nozzle of Steam Generator 1-2 (Field Weld No. 212, Line K16-555-16IV). The line temperature and pressure at this time was approximately 300°F and 90 psi, respectively. Visual observation at this time revealed an intermittent linear indication approximately 3/8-inch long running in the circumferential direction near the center of the weld. During grinding of the weld crown flush with the pipe surface the length of this linear indication increased to approximately two inches. Subsequent nondestructive examination by radiography and ultrasonics revealed a crack with a total length of approximately six inches.

As a result of the above findings, a spool piece containing a major portion of the weld, a small section of the nozzle I.D. adjacent to the weld root, and several inches of pipe were removed for analysis. Figure 1 is a sketch of the spool piece received for analysis; included is the crack path and a sketch of the shape of the crack.

FABRICATION AND SERVICE HISTORY

Material Specifications

The steam generator nozzle is fabricated of ASME SA508 Class 2 material. A copy of the original Material Test Report and a chemical analysis performed on the nozzle material adjacent to the crack are included in Appendix I. The chemical and physical properties for this material are within the limits for SA508 Class 2 material.

The feedwater line piping is fabricated from ASTM A106 Grade B material. A copy of the chemical analysis performed on this material adjacent to the crack are included in Appendix I. This analysis shows that the pipe material meets the chemical requirements of ASTM A106 Grade B.

Welding was performed using E8018 C-3 electrode. A copy of the original Certificate of Analysis for the three electrode lots used and a check analysis taken adjacent to the crack are included in Appendix I. These analyses show the material to within the chemical requirements of E8018 C-3.

Welding and Heat Treating History

Welding on Field Weld 212 was done in accordance with M. W. Kellogg Procedure 200. The weld traveller and other Q.C. documents were checked along with the temperature records for preheating and postweld heat treatment for compliance with this procedure; no deviations were noted. The weld root was placed using the tungsten inert gas method (TIG) with a consumable insert and inert gas backing. Two TIG fill passes were put in and the weld was completed using shielded metal arc weld. The weld

preparation was preheated to 200°F prior to welding. Welding on FW 212 was done over a time period of several weeks; Table 1 is an outline of this welding history.

Postweld heat treatment was performed at 1150°F; metal temperatures were monitored on both the pipe and nozzle sides of the weld with a thermocouple placed several inches from the centerline of the weld. The temperature records were reviewed, and during heat-up there was an uneven heating rate between the pipe and the nozzle, resulting in a maximum temperature differential of 260°F, where the pipe was at a temperature of 680°F when the nozzle was at 420°F. This temperature differential was rectified and no further problems were encountered throughout the postweld heat treatment.

Radiography of this weld was performed after completion of welding but prior to postweld heat treatment, an acceptable practice under the governing construction code, USAS B31.1.0-1967. Review of the radiographs showed a slight density gradient in the region where the crack occurred, but it was not judged to be rejectable nor would it be interpreted as such now. If this indication in actuality is a crack, it is at the limit of detectability.

Service History

Prior to making FW 212, a cap was welded onto the feedwater nozzle of SG 1-2, and a hydro test of the steam generator was performed. Subsequently, the piping was attached and two more hydro test cycles were performed, followed by a hot functional test program. A second hot functional was underway when the leak occurred. This sequence of events is summarized in Table 1, the hot functional testing summary is in Appendix II.

During the period between the hydro test following weld completion, August 29, 1975, and the time the leak occurred, March 17, 1977, the system was filled with water under chemical control to limit corrosion or other damage to the piping or steam generator internals. The water chemistry records were reviewed and no abnormal conditions were noted.

RESULTS OF METALLURGICAL EXAMINATION

The surface of the main fracture was almost flat, originated along the edge of a weld bead, grew approximately perpendicular to the surface and contained markings that ran parallel to the original edge, Figures 2 and 3. These markings appeared to be "beachmarks" denoting positions of the crack during its growth. The fracture surface appeared to be oxidized and was dark in color near the origin edge. Using SEM, the main fracture surface was found to be oxidized, to exhibit some evidence of mechanical damage (rubbing) and, at a distance from the origin, to contain secondary cracks, Figure 4. The presence of the visual beachmarks and the secondary cracks indicate that cylic loading had a role in the generation of the fracture.

Examination of several polished cross-sections taken through the crack showed the fracture initiated in small regions of lack of fusion along the fusion zone and in small, up to 0.015-inch deep, cracks at the root of grinding scratches adjacent to the fusion zone on the nozzle side of the weld. The crack propagated through the heat-affected zone and then through the weld metal in the V-shaped section of the weld, Figure 5. The crack cross-section in the heat-affected zone was very flat and straight, indicating little ductility; once into the weld the crack tended to branch

and wander, indicating a material with more ductility. The heat-affected zone in both pipe and nozzle materials was tempered martensite, the pipe material away from the weld was mixed pearlite and ferrite, and the weld material was tempered martensite. Microhardness tests in these various regions, converted to Rockwell hardness values, were as follows: nozzle, away from HAZ, R_B96; nozzle HAZ, R_C 34; weld root, R_C23; pipe base material, R_B88.

Examination of the small cracks adjacent to the main fracture, Figures 6, 7, and 8, illustrated that the cracks originate in slight depressions in the surface, grew perpendicular to the surface and at an oblique angle to the rolling direction (as revealed by the inclusion stringers), were filled with oxide, were transgranular, and exhibited some crack branching. No evidence of plastic deformation was observed. EDXA microprobes verified that the material in the cracks was probably oxide, that the base metal was carbon steel, and that the inclusion stringers were manganese sulfide, Figures 10-12.

Two small cracks were opened up for examination by impacting them at liquid nitrogen temperatures (Specimens 2 and 3). The fracture surfaces had a dark layer of oxide patches along the outer edge, Figure 9, and were in close proximity to weld beads. Each crack was actually the result of the coalescence of many cracks each having its own origin. The origin edges of the fracture surfaces were covered with a relatively uniform oxide layer. The oxide layer was present all the way to the tip of the prior existing crack.

Using the plastic/carbon replica technique, the details of the main fracture surface were examined in the TEM. The surface was again found to be completely oxidized; however, in some areas, the oxide formed parallel ridges which could possibly suggest prior fatigue striations. In some areas, large block-like oxide growth was found.

Extraction replicas were examined in the TEM to obtain the diffraction pattern of the oxide. The patterns obtained were analyzed, Appendix II, and found to be composed of α-Fe_2O_3. This oxide forms at about 300°C (570°F).

CONCLUSIONS

The characteristics of the small cracks and the major fracture surface are similar in regularity, orientation, oxidation, and degree of crack branching. The oxide extended to the tip of the advancing cracks indicating that oxidation and/or corrosion was an inherent part of the crack growth process. The characteristics of the fracture process; i.e., transgranular, oxidized, no plastic deformation, with some crack branching, indicated that the crack growth mode was either corrosion fatigue or thermal fatigue.

The oxide resulting from corrosion fatigue would probably be hydrated and a lower temperature form than found on the crack surfaces in this study. Based on this and the closely regulated water purity, it is believed that it is more likely that the cracks in the feedwater line of Diablo Canyon Unit 1 steam generator resulted from thermal fatigue. The cracks initiated in elongated depressions in the surface of the steel which are believed to be grinding marks, and apparently acted as local stress risers, and at minor regions of lack of fusion in the weld root.

It is believed that small cracks initiated on the I.D. of the nozzle, weld, and pipe during the thermal cycling that occurred during preheating. These small cracks originated at convenient stress risers such as grinding scratches and regions of lack of fusion and weld bead, rollover. At the time of acceptance radiography, prior to postweld heat treatment, these cracks were below the limits of detectability for radiography. Upon heat-up for the postweld heat treatment thermal stresses from the uneven heat-up between the pipe side and nozzle side of the weld caused several of these small cracks to link up and grow to some substantial size, most likely through the heat-affected zone (HAZ) and into the weld metal. The HAZ at this time, prior to postweld heat treatment (PWHT), would have consisted of untempered martensite, and have a hardness of about R_c45. The HAZ would have quite low ductility in this condition and easily propagate an existing crack when subjected to differential thermal stresses. Once this crack had propagated to a substantial size during PWHT it propagated to failure by fatigue as a result of subsequent hydro test and hot functional test stresses.

Since postweld heat treatment of the weld has tempered the heat-affected zone, this high hardness, low ductility condition no longer exists. The heat affected-zone now has a hardness of R_c 30-35, and would not be expected to be subject to the rapid crack growth that is believed to have occurred during PWHT.

RECOMMENDATIONS

Based on the findings of this investigation, following recommendations are made for future welds made in P-3 materials:

1. Specify a minimum preheat temperature of 250°F; a maximum interpass temperature of 550°F should also be specified.

2. Maintain the preheat temperature throughout the weld and until postweld heat treatment can be initiated. If a long delay during welding or between welding and PWHT is unavoidable, maintain the preheat for at least eight hours after welding stops, and then slowly cool to room temperature.

3. Care should be exercised in avoiding large temperature differentials during preheating and postweld heat treatment.

4. Final radiography should be done <u>after</u> postweld heat treatment.

TABLE 1

Fabrication and Service History (Summary)

1-14-73	Preheat to attach lugs
1-14-73	Preheat to weld cap
1-15-73	Preheat to weld cap
2-19-73	Hydro, 1356# at 106°F
4-8-74	Preheat to remove cap
4-9-74	Preheat to remove cap
5-18-74	Preheat for nozzle-pipe weld
5-21-74	Preheat for nozzle-pipe weld
5-22-74	Preheat for nozzle-pipe weld
5-23-74	Preheat for nozzle-pipe weld
5-24-74	Preheat for nozzle-pipe weld
6-15-74	Radiograph finished weld
6-24-74	PWHT weld
~8-74	PWHT adjacent weld (15" away)
8-29-75	Second hydro, 1320# at 88°F
8-29-75	Third hydro, 1356 at 88°F
12-13-75 to 2-10-76	First hot functional
3-16-77	Second hot functional

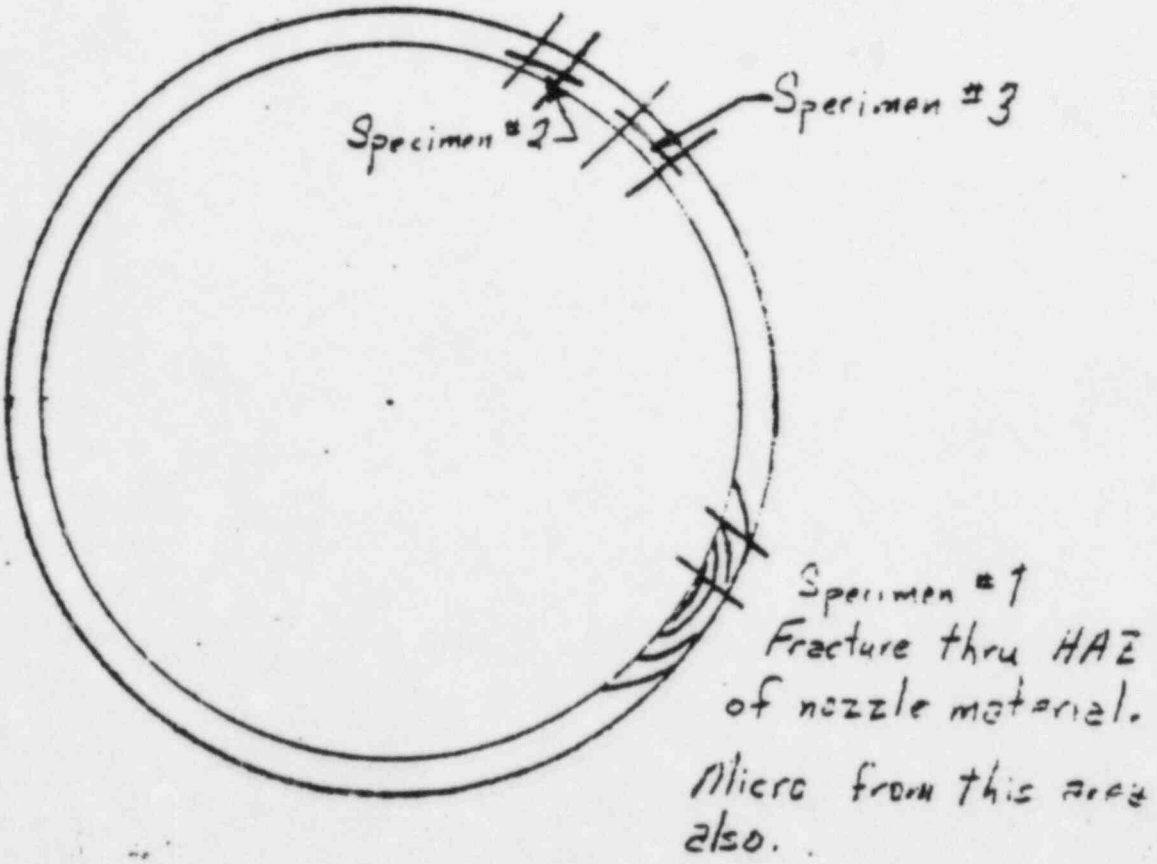
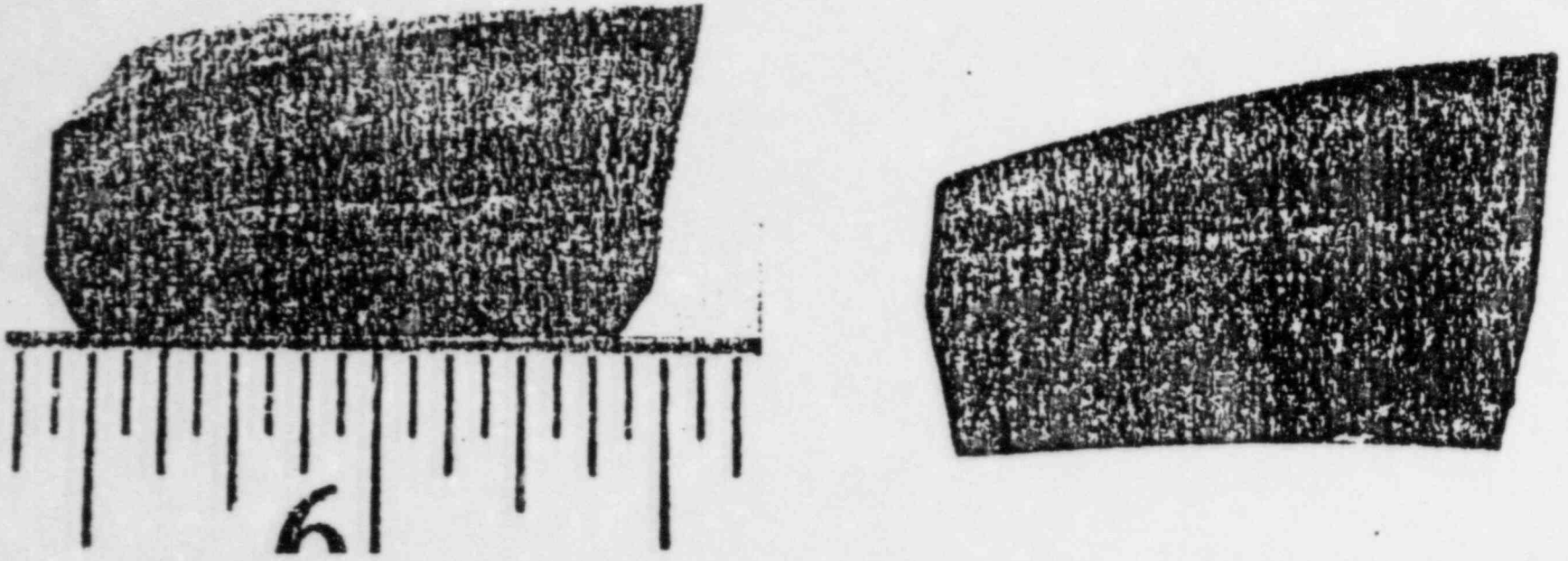


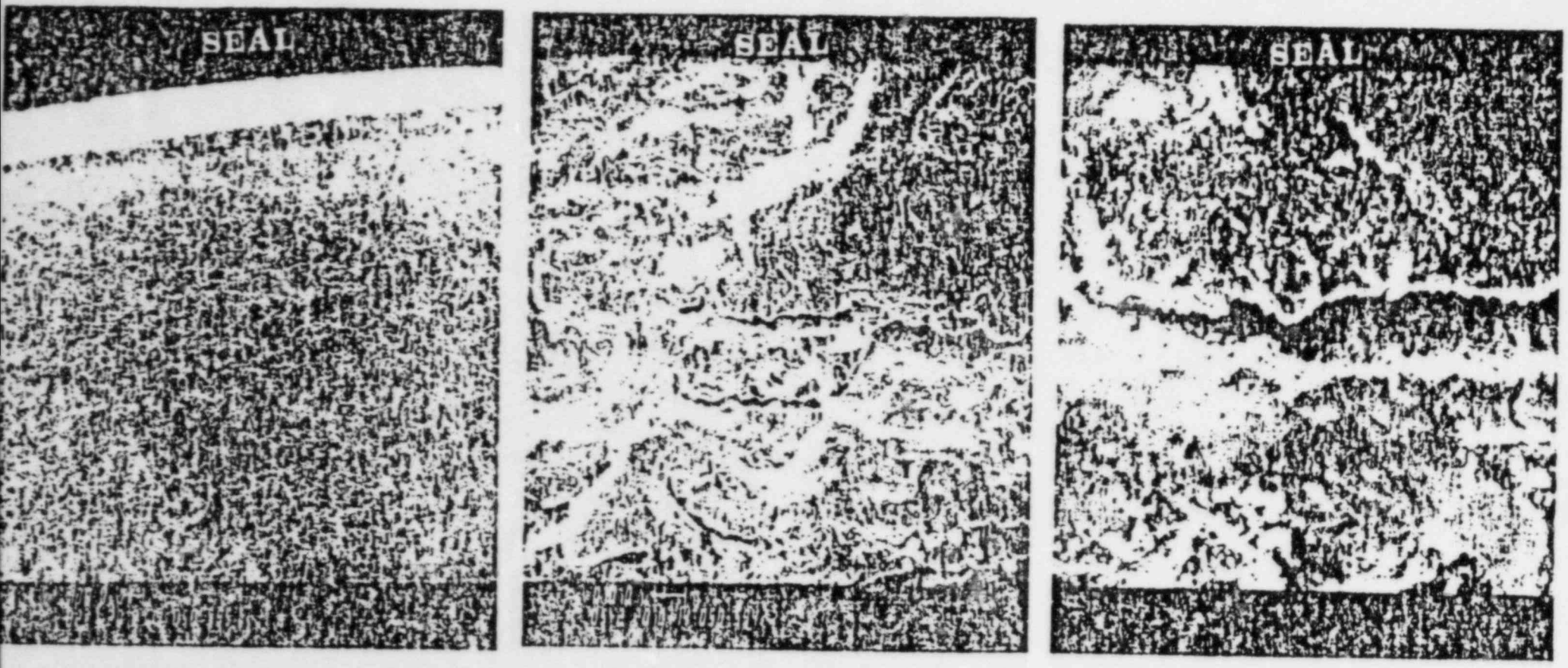
Figure 1. Schematic diagram of failed nozzle illustrating the locations from which samples were removed.

Figure 2. Overall view of fracture surface.



a. b.

Figure 3 Specimen #1, showing fracture surface with parallel markings originating along one side of weld bead; 3X.



a. b. c.

Figure 4. Surface of main fracture which was in the heat affected zone (HAZ) of the nozzle, Specimen #1, showing oxidized surface with crack branching. a. 20X (50595). b. 500X (50594). c. 2000X.

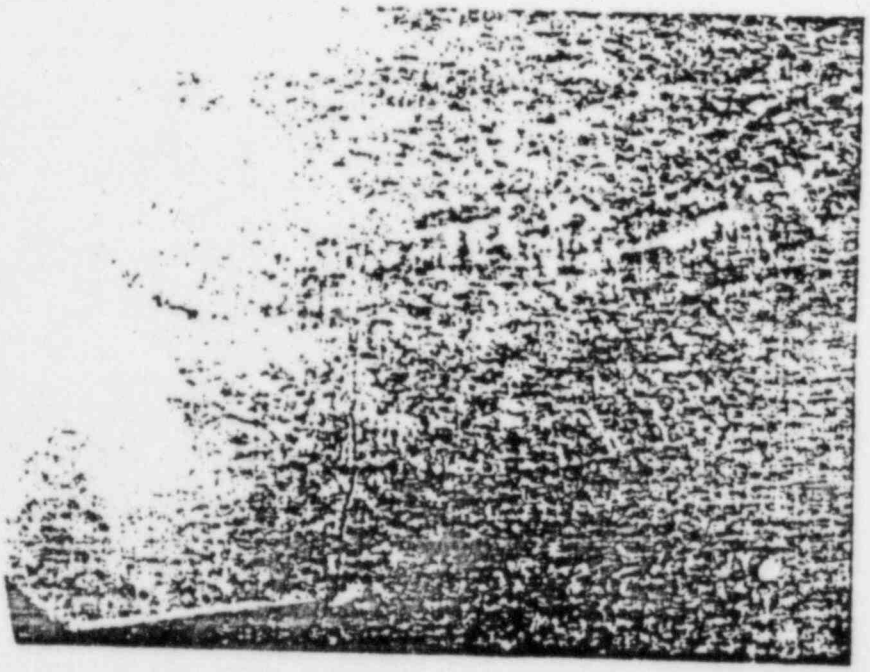
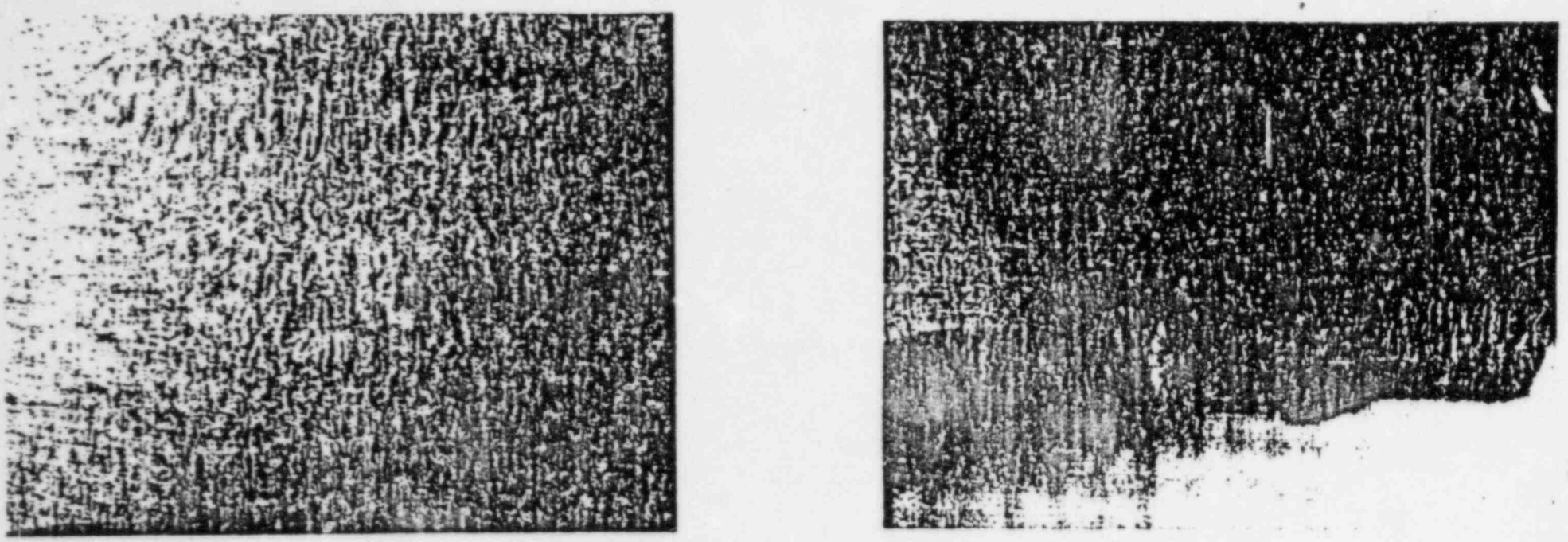


Figure 5. Polished cross section of the main fracture. The pipe is on the bottom left, the weld root is bottom center and the nozzle is bottom right. The bottom of the picture is the pipe I.D. The small bright dots are micro hardness indentations. 7 x magnification.



a. b.

Figure 6. Cross section of Specimen #3, Figure 1, which shows small secondary cracks similar to those noted adjacent to the main fracture. The tilted view shows the coincidence of the cracks with grinding marks on the pipe and nozzle I. D., as well as in the unground weld.

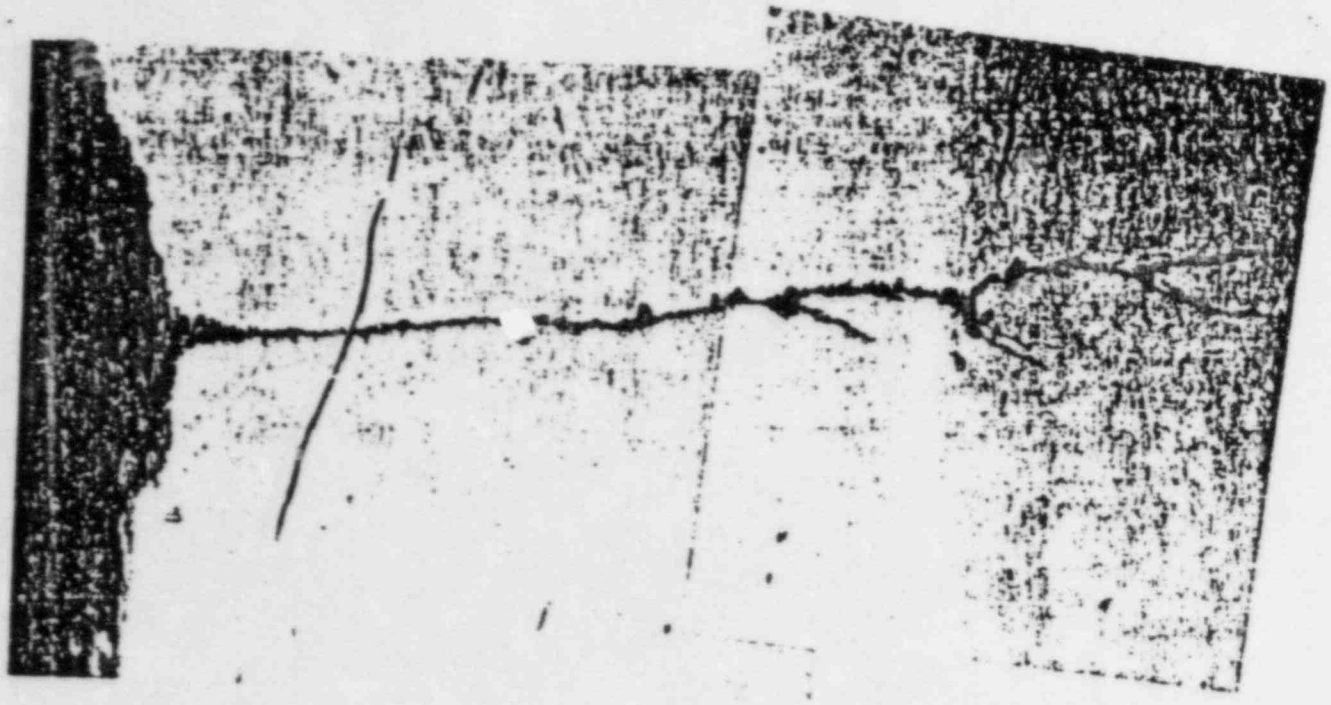
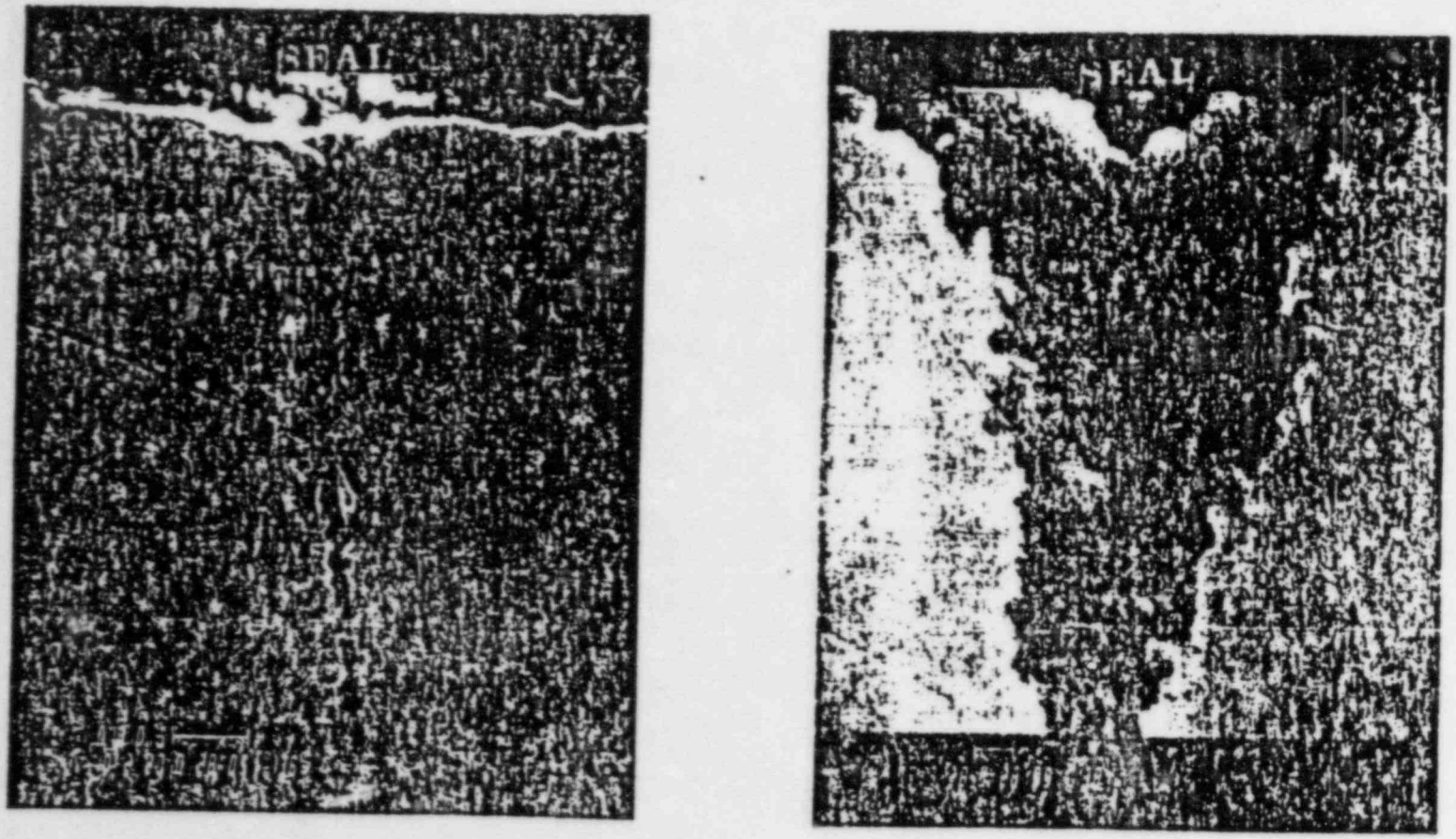


Figure 7. Polished cross section from main fracture area showing a crack, filled with oxide, with crack branching and sulfide inclusion stringers; 450X.



a. b.

Figure 8. Details of polished cross section shown in Figure 7 a. 1000X. (51136). b. 5000X (51138).

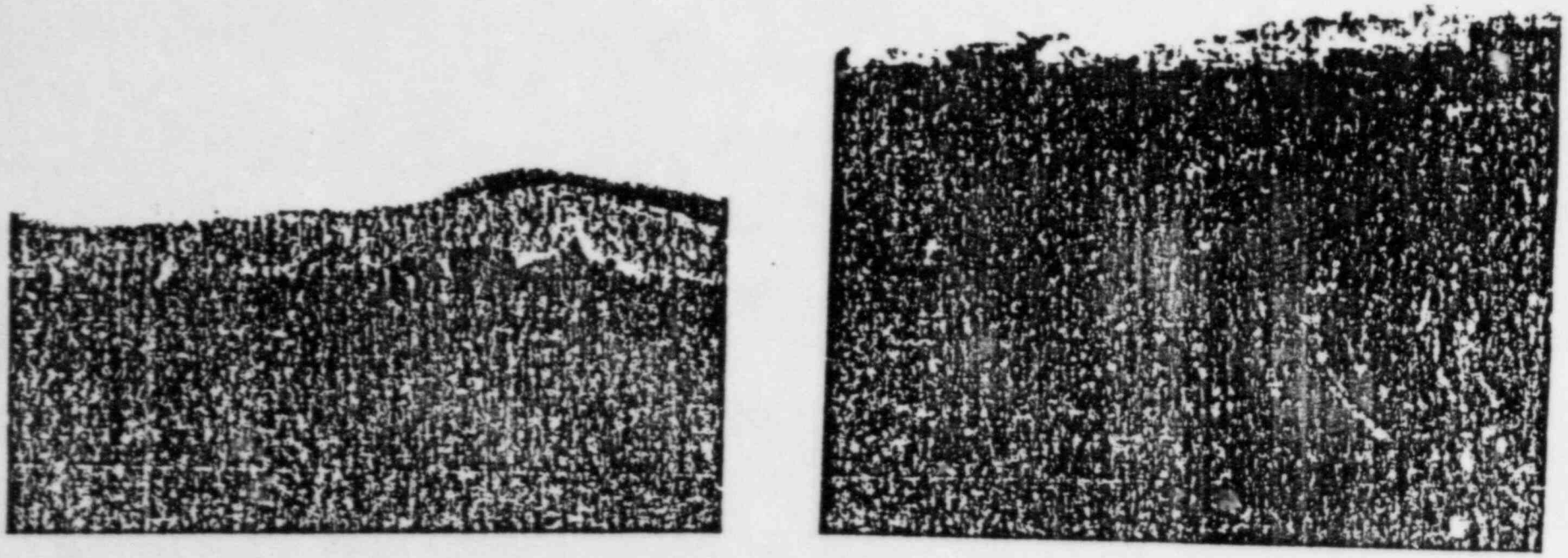


Figure 9. Opened crack along weldment on Specimen 2 showing several fracture plateaus indicative of multiple cracks and multiple origins. a. 3X. b. 12X.

Figure 10. EDXA microprobr spectrum obtained from steel matrix in Figure 8.

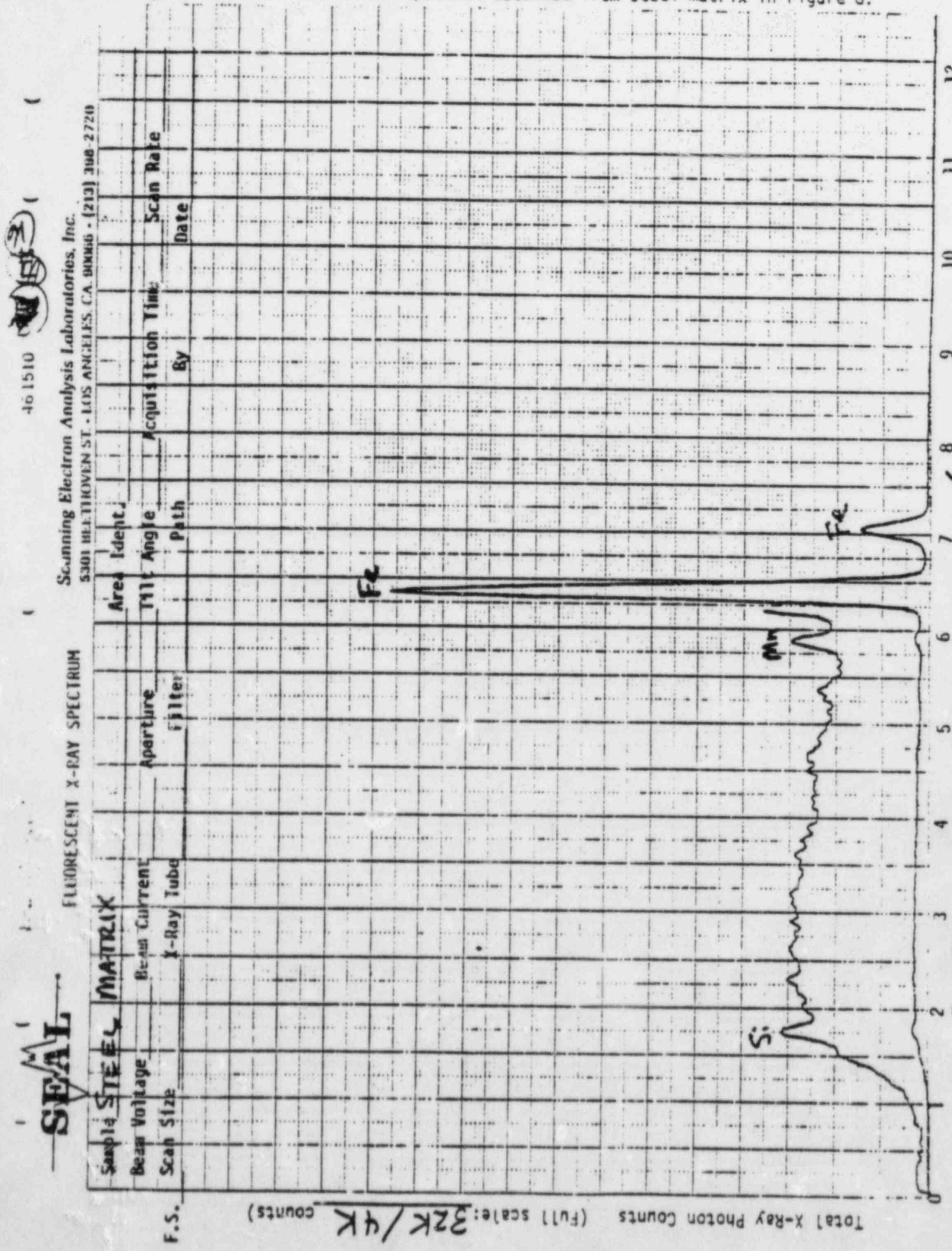


Figure 11. EDXA microprobe spectrum obtained from oxide in crack in Figure 8.

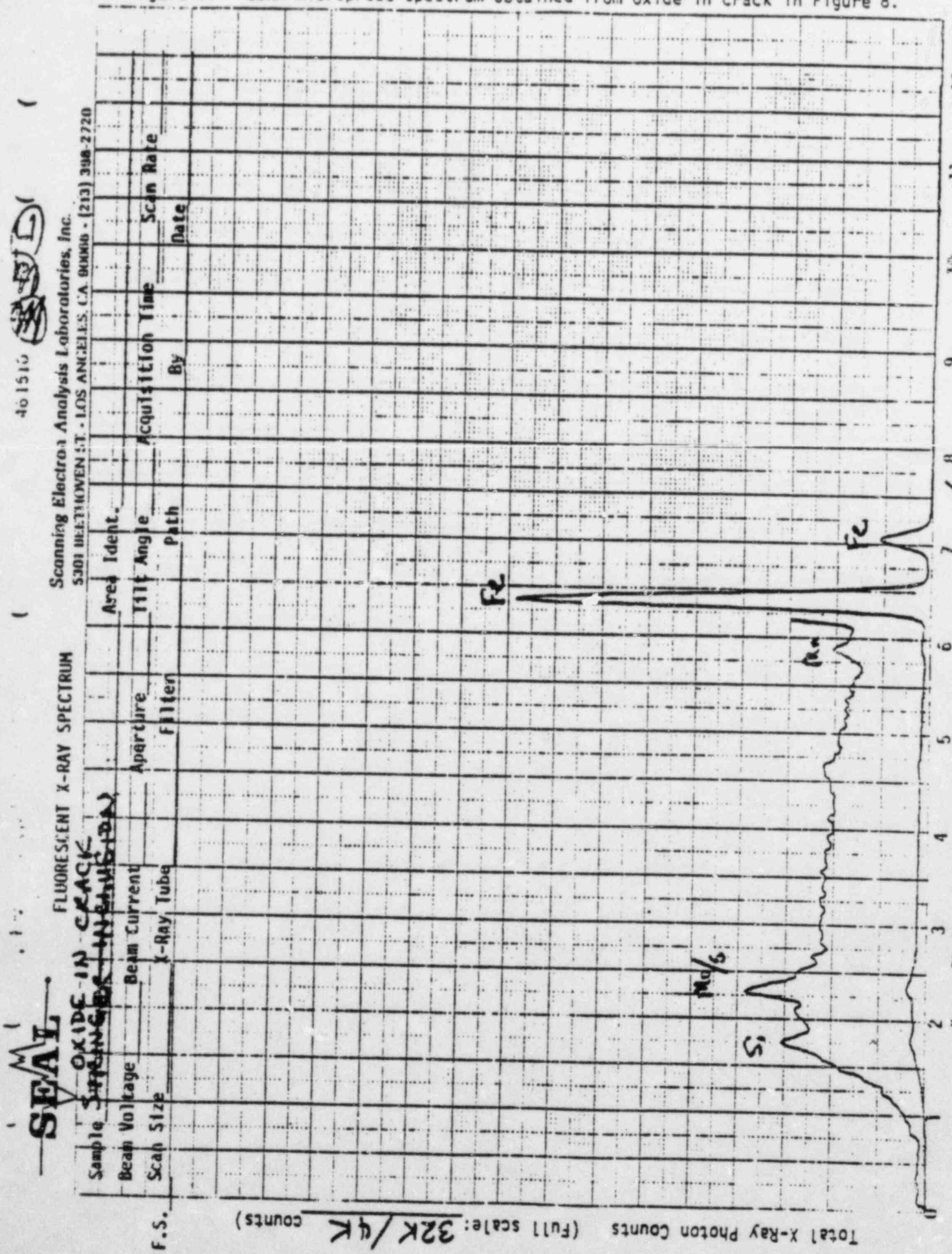
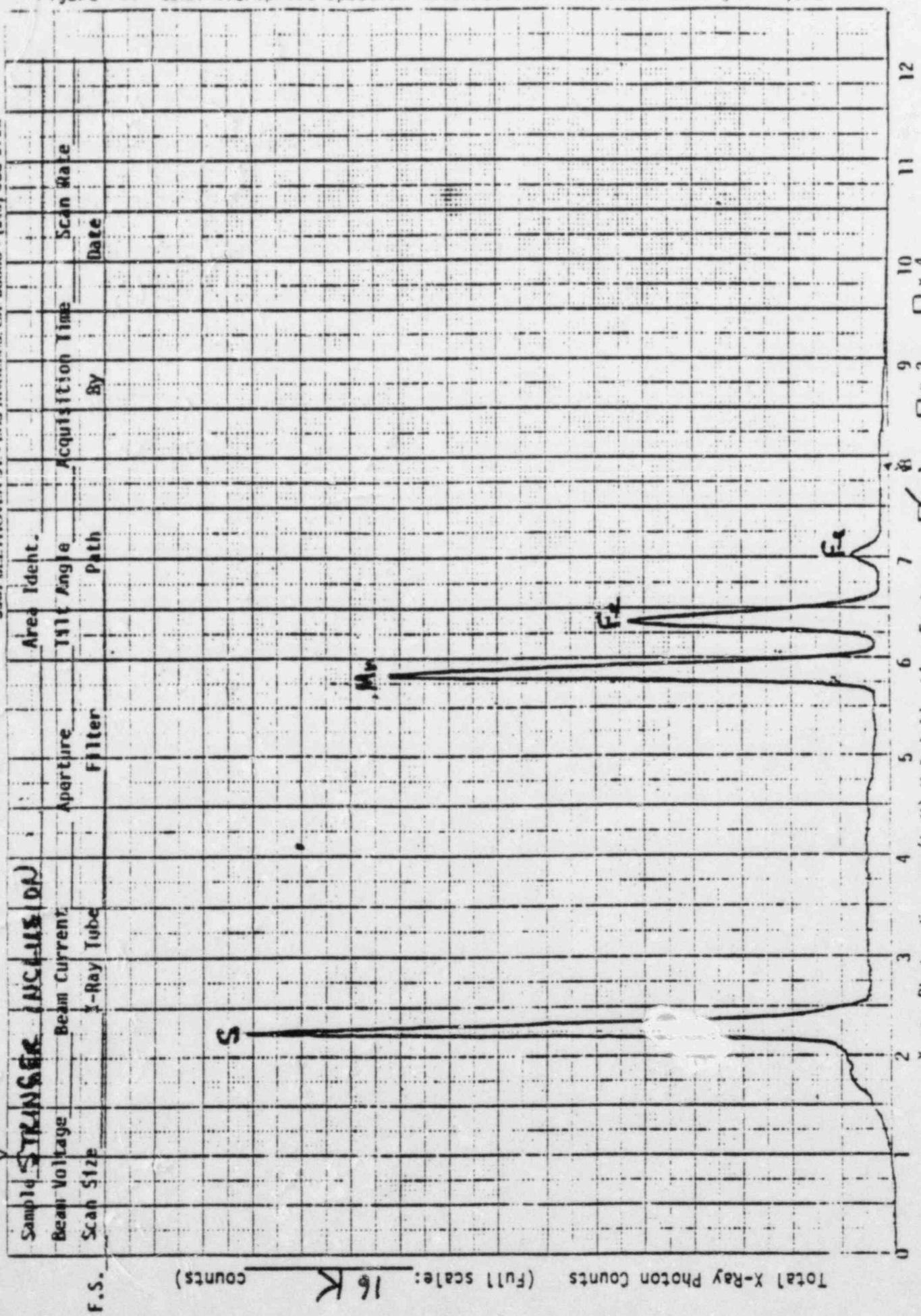


Figure 12. EDXA microprobe spectrum obtained from inclusion stringer Figure 8.



APPENDIX I

Material Specifications and Welding Procedure

Report 411-77.5E

CHICAGO FORGE DIVISION

Borg-Warner Forge & Foundry Inc.

MATERIAL TEST REPORT

S.O. No. _____ DATE June 30, 1969 E

Purchaser Westinghouse Electric Corp. Purchaser's Order No. 54-5-1042-890

Distributor C.I. Crain Co, Inc. Distributor's Order No. _____

8E59

ITEM NO.	QTY.	PRODUCT	SPEC.	HEAT OR CODE NO.	FORGING NO.	HEAT TREATMENT	FCE. CHARTS ATTACHED YES	FCE. CHARTS ATTACHED NO
1	1	14.75" I.D. Insert Stud Feedwater Nozzles per/Dwg. 870C217 T-00784	SA508-2	Q203VW	L01R4	1650°F± 25°F.1Hr/in Air Cooled. 1560°F± 25°F.1Hr/in Water Quench 1290°F± 25°F.1Hr/in Air Cooled. 1560°F± 25°F.1Hr/in Water Quench 1290°F± 25°F.1Hr/in Air Cooled. Tests Stress Relieved At: 1125°F± 25°F. For 20 Hours.		X

CHEMICAL ANALYSIS AND MECHANICAL PROPERTIES

FORGING NO.	HEAT NO.	C	MN	P	S	SI	CR	NI	MO	V			NDT REPORTS ATTACHED U.T.	M.P.	D.P.	REMARKS
L01R4	Q203VW	.21	.79	.012	.012	.27	.34	.80	.68	.05	Ladle		X	X		
		.209	.79	.005	.015	.29	.37	.80	.57	.04	Check					

FORGING NO.	HEAT NO.	TEST TEMP.	TENSILE PSI x 1000	YIELD PSI x 1000	ELONG. % in 2"	R.A. %	B.H.N.	(V-Notch at + 10° F.) IMPACT TESTS (Keyhole ●) ENERGY (ft-lbs.)	LATERAL EXP. (in.)	% SHEAR
L01R4	Q203VW	Room Temp.								
		0°	93.000	72.500	21.5	64.9		92-109-114	.067-.078-.080	80-90-90
		180°	93.100	73.400	21.5	60.9		108-104-103	.074-.076-.073	85-90-85

Chief de la Rigaudiere

We hereby certify the above results to be correct as contained in the records of the Company

Report 411-77.55

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

Certificate of Analysis

447

M. W. Kellogg Co.
c/o Pacific Gas & Elect. Co.
Daiblo Canyon Power Plant
Avila Beach, California 93424

Customer Order No. N/A

Order No. 62853

Shipped 6-6-73

This material conforms to Specification AWS A 5.5-69

Test No. 415
X-Ray Satisfactory
F-7177-1269 Item 4

Type E 8018 C-3

Trade Name:	Atom Arc 8018
Diameter Size:	1/8"
	1,000 lb.
Lot Number:	C315C3AD
Heat Number:	402K9921
Carbon	.05
Manganese	1.01
Chromium	Nil
Nickel	.96
Silicon	.58
Columbium	
Tantulum	
Molybdenum	.12
Tungsten	
Copper	
Titanium	
Phosphorus	.017
Sulphur	.018
Vanadium	.02
Iron	
Ferrite	

Moisture @ 1800°F. 0.2%

Concentricity 3%

Type Steel A-285

Test No.	Full	Split	Volts	Amps
Tensile & Impacts	1	6	22	140

Test Results:	AS Welded
Yield	76,400
Tensile	87,500
Elongation	31%
Red. of Area	76.7%

Charpy V-Notch Impacts Tested @ -40°F.

Impacts	79
Impacts	84
Impacts	87

APPROVED
M. W. KELLOGG
Q. A.
P.G.&E. Diablo Canyon Project
TW 6-27-73
INITIALS

State of Penna.)
County of York) SS

Subscribed and sworn to before me this 22nd day of June 19 73

Notary Public

My commission expires: 4-12-76

The undersigned certifies that this report is correct and that no significant change has been made in any of the elements described in the qualification approval.

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

BY R. J. Stallman
R. J. Stallman

Report 411-77.55

520

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

Certificate of Analysis

M. W. Kellogg Company
c/o Pacific Gas & Electric
Power Plant
7 Miles N. of Avila Beach
Avila Beach, California 93424
7177-1505

Customer Order No. 6520

Order No. 65365

Shipped 9-21-73

This material conforms to Specification AWS A 5.5-69
Test No. 650
X-Ray Satisfactory
Type E 8018-C3

Trade Name:	Atom Arc 8018
Diameter Size:	1/8"
	400 lb.
Lot Number:	B328C3AD
Heat Number:	627233
Carbon	.05
Manganese	.93
Chromium	.05
Nickel	1.07
Silicon	.40
Columbium	
Tantalum	
Molybdenum	.15
Tungsten	
Copper	
Titanium	
Phosphorus	.014
Sulphur	.022
Vanadium	.02
Iron	
Ferrite	

Moisture @ 1800°F. 0.2%
Concentricity 3%
Type Steel A-285

Test No.	Full	Split	Volts	Amps
Tensile & Impacts	1	6	22	130

Test Results:	AS Welded
Yield	72,400
Tensile	86,000
Elongation	31%
Red. of Area	75.0%

Charpy V-Notch Impacts Tested @ -40°F.

Impacts	76
Impacts	77
Impacts	78

Fillets: OK Vertical 1 Overhead 1

APPROVED
M. W. KELLOGG
Q. A.
P.G.&E. Diablo Canyon Project
MW 10-3-73
INITIALS

State of Penna.)
County of York) SS

Subscribed and sworn to before me this 25th day of Sept. 1973

SEAL

Notary Public

My commission expires: 4-12-76

The undersigned certifies that this report is correct and that no significant change has been made in any of the elements described in the qualification approval.

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

BY

Report 411-77.55

979

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

Certificate of Analysis

M. W. Kellogg Co.
c/o Pacific Gas & Electric
Diablo Canyon Power Plant
Mark: PO F7177-2373
7 Miles North of
Avila Beach, California

Customer Order No. F 7177-2373

Order No. 78322

Shipped 2-20-75

This material conforms to Specification AWS A 5.5-69 & M. W. Kellogg Spec. B31.7 SFA 5.5 Class E

Test No. 558
X-Ray Satisfactory

Type E 8018-C3

Trade Name: Atom Arc 8018

Diameter Size: 3/32"
200 lb.

Lot Number: L416F3AC
Heat Number: 640912

Carbon	.04
Manganese	.75
Chromium	.03
Nickel	.91
Silicon	.20
Columbium	
Tantalum	
Molybdenum	.04
Tungsten	
Copper	.03
Titanium	
Phosphorus	.016
Sulphur	.015
Vanadium	.02
Iron	
Ferrite	

Moisture @ 1800°F. 0.2%
Concentricity 4%
Type Steel A-285

Test No.	Full	Split	Volts	Amps
Tensiles & Impacts	1	7	21	140

Test Results:	AS Welded	Stress Relieved 8 hrs. @ 1125°F.
Yield	72,100	68,500
Tensile	84,500	82,100
Elongation	30%	32%
Red. of Area	77.5%	79%

Charpy V-Notch Impacts Tested @ -20°F.

Impacts	96-109-110-113-117	85-99-100-103-
Lat.Exp.	73-76-83-79-77	71-84-79-78-7
% Shear	90-85-90-85-90	75-70-80-80-7

Fillets: OK Vertical 1 Overhead 1

State of Penna.)
County of York) SS

Subscribed and sworn to before me this 25th day of Feb. 19 75

APPROVED
M. W. KELLOGG
Q. A.
P.G.&E. Diablo Canyon Project
Jaw 3-18-75
INITIALS

The undersigned certifies that this report is correct and that no significant change has been made in any of the elements described in the qualification approval.

CHEMETRON CORPORATION
WELDING PRODUCTS DIVISION

SEAL Notary Public

My commission expires: 8-21-78

BY R. W. Boyer
R.W. Boyer

Report 411-77.55

LABORATORY CERTIFICATE

Anamet Laboratories, Inc.

ANALYTICAL
CHEMICAL
METALLURGICAL

HIGH TEMPERATURE

May 25, 1977

LABORATORY NUMBER: 577.329 P.O. No. LO-879806

SAMPLE: One (1) Sample for Chemical Analysis

MARK: P-12 B
DCPP #1 Steam Generator
Nozzle Failure Analysis

DATE SUBMITTED: May 24, 1977

REPORT TO: Pacific Gas & Electric Company
3400 Crow Canyon Road
San Ramon, California 94583
Attn: Mr. Steve Ivy

CHEMICAL ANALYSIS

			Requirements A-508 Cl. 2 Min.	Max.
Carbon	(C)	0.23%	-	0.27%
Chromium	(Cr)	0.40%	0.25%	0.45%
Manganese	(Mn)	0.81%	0.50%	0.90%
Molybdenum	(Mo)	0.58%	0.55%	0.70%
Nickel	(Ni)	0.80%	0.50%	0.90%
Phosphorus	(P)	0.009%	-	0.025%
Silicon	(Si)	0.28%	0.15%	0.35%
Sulfur	(S)	0.012%	-	0.025%
Vanadium	(V)	0.05%	-	0.05%

Respectfully submitted,

ANAMET LABORATORIES, INC.

By _____

Siegfried Otto
Manager, Testing

3c
jm

LABORATORY CERTIFICATE

Report 4'1-77.55

Anamet Laboratories, Inc.

ANALYTICAL
CHEMICAL
METALLURGICAL

2827-7TH STREET · BERKELEY, CALIFORNIA 94710 841-5771

HIGH TEMPERATURE
APPLIED RESEARCH
PHYSICAL TESTING

May 25, 1977

LABORATORY NUMBER:	577.329 A	P.O. No. LO-8798
SAMPLE:	One (1) Sample for Chemical Analysis	
MARK:	P-1 DCPP #1 Steam Generator Nozzle Failure Analysis	
DATE SUBMITTED:	May 24, 1977	
REPORT TO:	Pacific Gas & Electric Company 3400 Crow Canyon Road San Ramon, California 94583	
Attn:	Mr. Steve Ivy	

CHEMICAL ANALYSIS

			Requirements A-106 Gr. B Min.	Max.
Aluminum	(Al)	0.03%	Information	
Carbon	(C)	0.26%	-	0.30%
Chromium	(Cr)	0.14%	Information	
Copper	(Cu)	0.10%	Information	
Manganese	(Mn)	0.90%	0.29%	1.06%
Molybdenum	(Mo)	0.04%	Information	
Nickel	(Ni)	0.07%	Information	
Phosphorus	(P)	0.015%	-	0.04%
Silicon	(Si)	0.25%	0.10%	-
Sulfur	(S)	0.033%	-	0.058
Titanium	(Ti)	0.003%	Information	
Vanadium	(V)	0.003%	Information	

Respectfully submitted,
ANAMET LABORATORIES, INC.

By _____
Siegfried Otto
Manager, Testing

3c
jm

Report 411-77.55

LABORATORY CERTIFICATE

Anamet Laboratories, Inc.

ANALYTICAL
CHEMICAL
METALLURGICAL

2827-7TH STREET · BERKELEY, CALIFORNIA 94710 · 841-9771

HIGH TEMPERATURE
APPLIED RESEARCH
PHYSICAL TESTING

May 25, 1977

LABORATORY NUMBER: 577.329 B P.O. No. LO-879806

SAMPLE: Two (2) Samples for Chemical Analysis

MARK: Weld - Side and Crown
DCPP #1 Steam Generator
Nozzle Failure Analysis

DATE SUBMITTED: May 24, 1977

REPORT TO: Pacific Gas & Electric Company
3400 Crow Canyon Road
San Ramon, California 94583
Attn: Mr. Steve Ivy

CHEMICAL ANALYSIS

		Side	Crown
Aluminum	(Al)	0.005%	0.004%
Carbon	(C)	0.08%	0.06%
Chromium	(Cr)	0.09%	0.06%
Copper	(Cu)	0.07%	0.08%
Manganese	(Mn)	1.17%	1.06%
Molybdenum	(Mo)	0.15%	0.12%
Nickel	(Ni)	1.00%	1.03%
Phosphorus	(P)	0.013%	0.012%
Silicon	(Si)	0.55%	0.60%
Sulfur	(S)	0.022%	0.022%
Titanium	(Ti)	0.01%	0.01%
Vanadium	(V)	0.03%	0.02%

Respectfully submitted,
ANAMET LABORATORIES, INC.

By _____
Siegfried Otto
Manager, Testing

3c
jm

THE M. W. KELLOGG COMPANY
A Division of Pullman Incorporated
Piping Fabrication
Williamsport, Pa. 17701

30

Page 1 of 4 Report 411-77.55
Weld Procedure Code No. 200
Spec. No. P12b-P1-K1-F4-SMAW 60
Date 11/14/73
Revision Dates 6-16-76

PROCEDURE SPECIFICATION FOR: Carbon Steel ...ng to Nickel Steel piping, insert weld- GTAW (root) and SMAW (weld out).

BASE METAL: The base metal shall conform ...ne specifications for ASME, Section IX, ...b to P-1 materials.

FILLER METAL: The filler metal shall con- ... to ASME Filler Metal Specifications Num- SFA-5.5 and SFA-5.18 for ferrous filler ...al in Group Number F-4 and F-6.

... chemical composition of the weld depos- shall fall within the limits of weld Metal ...ysis Number A-12b.

... FOR TORCH SHIELD: Nominal composition ...rgon, 99.995% minimum purity (for GTAW ...ess).

... FOR BACK-UP PURGE: Argon per Page 5 ...TAW process).

...CK WELDS FOR SET-UP: The GTAW process ... filler meta. type listed on Page 2 may ...sed with or without back-up purge in 1/16, ..., or 1/8 inch diameter.

...ITION: The welding may be done in all ...tions.

...HEAT AND INTERPASS: 200° F - 300° F pre- ...for SMAW weld out only and 200° F minimum ...rpass.

...ST HEAT TREATMENT: 1100° F - 1200° F, 1 ... per inch minimum (see job specifications ...cycle and thicknesses requiring post heat ...tment.

...ACKING STRIP: None.

...RAVEL SPEED: GTAW ½" - 6" per min.
... SMAW 3" - 8" per min.

WELDING PROCESS: The welding shall be done by the GTAW insert root and SMAW weldout processes using manual equipment. The GTAW process may be used with the filler metal type listed on Page 2 for intermittent voids, look-in holes (peep holes) in the ring, or mismatch in the root set-up. If necessary, one complete pass may be made while holding the purge. GTAW welding shall be done using a non-consumable electrode of 2% thoriated tungsten, EWTH-2.

BASE MATERIAL THICKNESS: This procedure is qualified to allow welding of material thickness between 3/16" and 1.5" (heat treated).

PREPARATION OF BASE MATERIAL: The edges or surfaces of the parts to be joined by welding shall be prepared by flame cutting, plasma arc, grinding, machining, or any combination of methods to essentially form the geometry of the weld shown on Page 2 as detailed on the attached sketches and shall be clean of all oil or grease and excessive amounts of scale or rust.

ELECTRICAL CHARACTERISTICS: The current used shall be DC: GTAW Straight Polarity
SMAW Reverse Polarity

JOINT WELDING PROCEDURE: The welding technique, such as electrode sizes, and voltages and currents for each electrode, size of the welding tip and filler rods, shall be substantially as shown on Page 2.

APPEARANCE OF WELDING LAYERS: The welding current and manner of depositing the weld metal shall be such that there shall be practically no undercutting on the side walls of the welding groove or the adjoining base material. See Job specifications for specific undercutting limitations.

CLEANING: All slag or flux remaining on any bead of welding shall be removed before laying down the next successive bead of welding.

DEFECTS: Any cracks or blow holes that appear on the surface of any bead of welding shall be removed by chipping, grinding, or gouging before depositing the next successive bead of welding.

P1-35-03

THE M. W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED
PIPING FABRICATION

RECOMMENDED FORM Q-1 MANUFACTURER'S RECORD OF WELDING PROCEDURE QUALIFICATION TESTS

★ Heat Treated

Specification No. P12b-P1-K1-F4-SMAW-6G Date 12/28/73
Welding Process GTAW & SMAW Manual or Machine Manual
Material Specification A-508-Cl2 to A-106-B of P-No. 12D to P-No. 1
Thickness (if pipe, diameter and wall thickness) 10" O.D. X 3/4" W
Thickness Range this test qualifies 3/16" thru 1½" wall thk, 3" IPS and over
Filler Metal Group No. F- 4 & 6
Weld Metal Analysis No. A- 12b
Describe Filler Metal if not included in Table Q-11.2 or QN-11.2 Root-E70S-2, weld out-E8018
For oxyacetylene welding–State if Filler Metal is silicon or aluminum killed.

FLUX OR ATMOSPHERE
Flux Trade Name or Composition None
Inert Gas Composition Argon
Trade Name --- Flow Rate 20 CFH
Is Backing Strip used? No
Preheat Temperature Range 200° F - 300° F
Interpass Temperature Range 200° F minimum
Postheat Treatment 400° F/hr from 600° to 1100° F, 1 hr at 1150° F, furnace cooled at 400° F/H to 600° A/C

WELDING PROCEDURE
Single or Multiple Pass Multiple
Single or Multiple Arc Single
Position of Groove 6G (See Para. & Figs. Q-2 & Q-3, or QN-2 & QN-3 (Flat, horizontal, vertical, or overhead; if vertical, state whether upward or downward)

FOR INFORMATION ONLY
Filler Wire–Diameter 1/8 x 5/32, 3/32, 1/8, 5/32
Trade Name ---
Type of Backing Argon
Forehand or Backhand ---

WELDING TECHNIQUES
Joint Dimensions Accord with See Sheet 2
amps -- volts -- inches per min.
Current D.C. Polarity GTAW Straight SMAW Reverse

REDUCED SECTION TENSILE TEST (Figs. Q-6 and QN-6)

Specimen No.	Dimensions Dia.		Area	Ultimate Total Load, lb.	Ultimate Unit Stress, psi	Character of Failure and Location
1	.498		.1948	14,000	71,900	Broke in Base Metal
2	.495		.1924	13,800	71,700	Broke in Base Metal

GUIDED BEND TESTS (Figs. Q-7.1, Q-7.2, QN-7.1, QN-7.2, QN-7.3)

Type and Figure No.	Result	Type and Figure No.	Result
1	Satisfactory	3	Satisfactory
2	Satisfactory	4	Satisfactory

Results of Fillet weld Tests, Fig. Q-9(e) N/A
Welder's Name S. Selby Clock No. 35 Stamp No. 1
Who by virtue of these tests meets welder performance requirements.
Test Conducted by Magnaflux Corp. Laboratory–Test No. MWK D-1 ★
per M. W. Kellogg

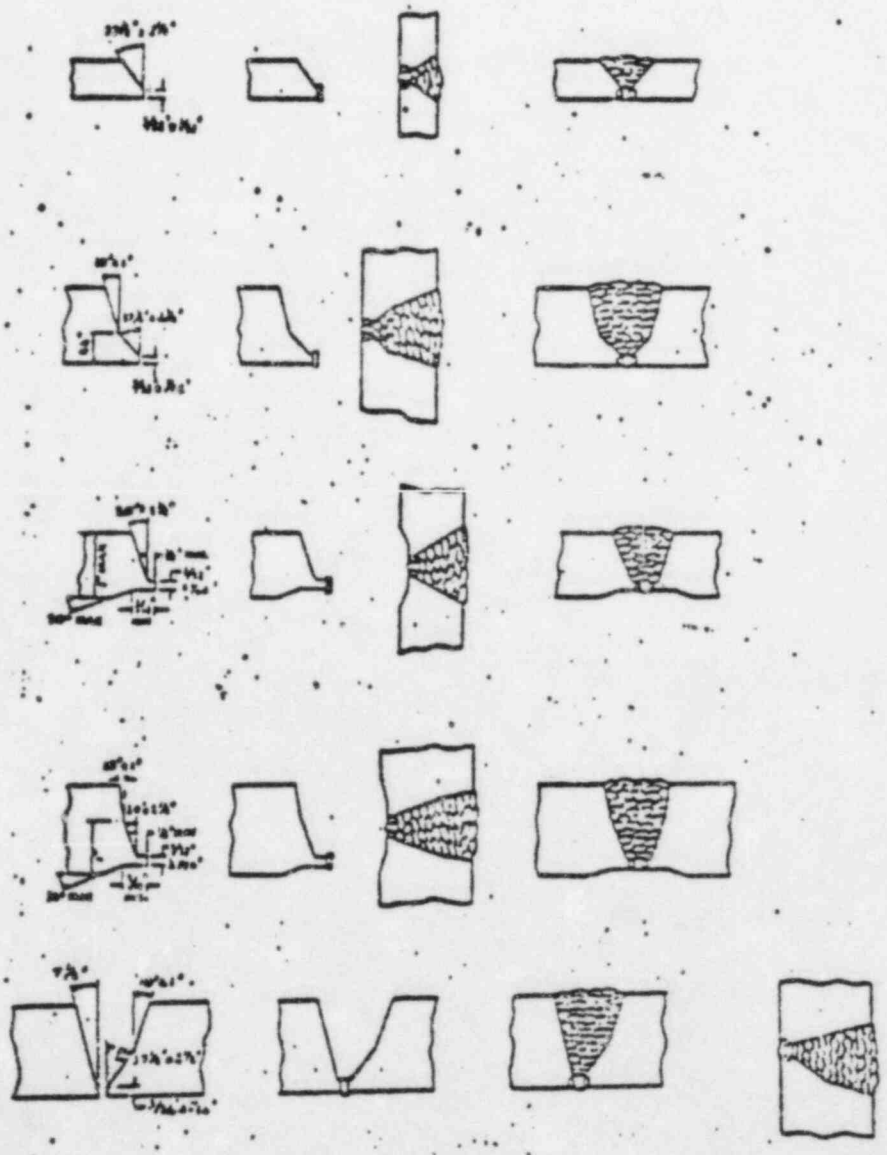
We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Signed The M. W. Kellogg Company (Manufacturer)
Date 12/28/73 By R. G. Fink

Charpy "V" Notch Test Results:
H.A.Z. P12b = 66.5, 71.0, 71.0 = 69.5
Weld = 91.0, 85.0, 99.5 = 91.8
H.A.Z. P1 = 20.0, 27.0, 32.0 = 28.0

THE M. W. KELLOGG COMPANY
A Division of Pullman Incorporated
Piping Fabrication
Williamsport, Pa. 17701

Report 411-77.55
Page 2 of 4
Weld Procedure Code No. 200
Spec. No. P12b-P1-K1-F4-SMAW-GG
Date 11/14/73
Revision Dates: 6-16-76



S NO. ND CESS	FILLER METAL TYPE OPTIONAL	FILLER METAL SIZE OPTIONAL	AMPS	MAX. VOLTS	POLARITY	TORCH SHIELD & FLO RATE (MIN.)	TUNGSTEN SIZE AND POLARITY
OT AW	E70S-2, or -6	INSERT 1/8 X 5/32	55-175	21	straight	Argon 20 CFH	1/8 or 3/32 diameter straight
CK AW	E70S-2, or -6	1/16 3/32 1/8	60-120 70-150 100-180	14 17 20	straight	Argon 20 CFH	1/8 or 3/32 diameter straight
LANCE W	E8018	3/32 1/8 5/32 3/16	65-110 100-165 140-220 180-275	27 31 34 36	reverse	—	—

*NOTE: 1/16", 3/32", or 1/8" E70S-2 or E70S-6 filler metal may be used as necessary for tacking, filling intermittent voids, look-in holes (peep holes), or mismatch in the root set-up. If necessary, one complete pass may be made while holding the purge.

FOR STEAM GENERATOR NOZZLE WELDS ONLY — THE M.W. KELLOGG COMPANY

FIELD PROCESS SHEET

N/A = NOT APPLICABLE

CUSTOMER	NO & SYSTEM	ISOMETRIC DRAWING NO.	DETAIL DRAWING NO.	SHEET NO.
P. G. & E.	#3 FEEDWATER	500146	N/A	10 of

PREPARED BY	JOB NO.	DATE	CODE	CLASS	MARK NO.
R.B.	7177	1/9/74	ASME SECTION I	SECTION I	N/A

OPER. NO.	OPERATION	HOLD FOR AUTH. INSP.	HOLD FOR MWK INSP.	PROC. NO.	OPER.	DATE COMP.	MWK INSP. & DATE	AUTH. INSP. & DATE
	FIELD WELD #T97 SEE DR-2450 ALSO Revisions							
1	CLEANING		✓	ESD 220	926	12/23/74	12/23/	
2	FIT-UP	✓	✓	ESD 215	GX/126	24 Dec 74	24 Dec 74	[illegible]
3	WELD ROOT PASS			CODE 204	GX	28 Dec 74		/
4	PREHEAT SMAW ONLY (200° - 300°) USE CHART RECORDER	[illegible]	✓	CODE 204	117	30 Dec 74		
5	WELD COMPLETE			CODE 204	GX	30 Dec 74		
6	GRIND FOR R.T.			ESD 207	117	31 Dec 74		
7	VISUAL INSPECTION	✓	✓	ESD 215	[illegible]	2 Jan 75	31 Dec 74	[illegible]
8	R.T. FINISHED WELD	✓	✓	ESD 207	K	1/25/75	1/25/75	[illegible]
	STRESS RELIEVE - SEE Chart No - 341	✓	✓	ESD 218	117	2/4/75	[illegible]	[illegible]
	M.T. FINISHED WELD		✓	ESD 209	JC	2-11-5	2-11-5	[illegible]
	REMOVE DAMS	N/A	✓	ESD 214				
	PT Finished weld	✓	✓	ESD 211	N		CLEAN DEB	
	FIELD WELD # 212 RING TACKED IN 5/21/74 — CUT OUT 5/21/74 DEB — RING TACKED OUT 5/21/74 DEB							
1	CLEANING		✓	ESD 220	[illegible]	5/ /74	[illegible]	
2	FIT-UP	✓	✓	ESD 215	LB/[illegible]	5/ /74	[illegible]	[illegible]
3	WELD ROOT PASS	✓		CODE 200	LB	[illegible]	[illegible]	[illegible]
4	PREHEAT SMAW ONLY (200° - 300°) USE CHART RECORDER		✓	CODE 200	117	5/21/74	5/ /74	/
5	WELD COMPLETE			CODE 200	LB	5/ /74		
6	GRIND FOR R.T.			ESD 207	415	5/ /		
7	VISUAL INSPECTION	N/A	✓	ESD 215	HCV	[illegible]	[illegible]	
8	R.T. FINISHED WELD	✓	✓	ESD 207	ES	[illegible]	[illegible]	[illegible]
9	STRESS RELIEVE Chart # 323	✓	✓	ESD 218	[illegible]	[illegible]	[illegible]	[illegible]
10	P.T. FINISHED WELD		✓	ESD 211	GC	5/ /	[illegible]	
11	REMOVE DAMS		✓	ESD 214	G71	5/ /	[illegible]	
	[illegible handwritten entry]				HCV	[illegible]	[illegible]	

To: Steve Friedrich
From: MRT/RD Etter

PACIFIC GAS AND ELECTRIC COMPANY
STATION CONSTRUCTION DEPARTMENT
DIABLO CANYON PROJECT

Pg. 1 of 2

HISTORY OF STEAM GENERATOR 1-2
DIABLO CANYON PROJECT

March 28, 1977

The following information is provided per your request to indicate tests and transient conditions which influenced temperature and pressure on the secondary side of steam generator 1-2:

HYDRO TESTS

2/19/74 1st hydro - 1 cycle to 1356 psig @ 106° F (main steam and feedwater nozzles capped at generator)
8/29/75 2nd hydro - 1 cycle to 1320 psig @ 88° F (RV's lifted and pressure had to be reduced)
8/29/75 With Present Piping
3rd hydro - 1 cycle to 1356 psig @ 88° F

HOT FUNCTIONAL TEST

12/13/75	RCS heatup	100° F to 150° F
12/15/75	RCS heatup	150° F to 240° F
12/23/75	RCS heatup	261° F to 340° F, 62 psig to 103 psig
12/30/75	RCS heatup	350° F to 450° F, 119 psig to 407 psig
12/31/75	RCS heatup	450° F to 511° F, 407 psig to 750 psig
1/1/76	RCS heatup	511° F to 547° F, 750 psig to 1010 psig
1/4/76	pressure dip	1000 psig - 940 - 1000 psig, ΔT < 10° F
1/4/76	pressure dip	1000 psig - 925 - 995 psig, ΔT < 10° F
1/4/76	temperature drop	545° F to 523° F, 980 psig to 810 psig
1/6/76	temperature dip	524° F - 497 - 524° F, 824 psig - 651 - 824 psig
1/7/76	temperature dip	531° F - 505 - 512° F, 900 psig - 695 - 750 psig
1/8/76	temperature increase	508° F to 545° F, 714 psig to 983 psig
1/9/76	temperature dip	545° F - 503 - 547° F, 989 psig - 677 - 1000 psig
1/10/76	temperature dip	548° F - 526 - 542° F, 1000 psig - 829 - 973 psig
1/12/76	RCS cooldown	536° F to 115° F, 908 psig to 0 psig
1/15/76	RCS heatup	139° F to 327° F, 0 to 84 psig
1/17/76	RCS heatup	327° F to 528° F, 84 psig to 860 psig
1/21/76	temperature dip	525° F - 472 - 546° F, 840 psig - 501 - 982 psig
1/23/76	turbine roll	546° F - 476 - 501° F, 1000 psig - 525 - 663 psig
1/24/76	temperature increase	501° F to 545° F, 680 psig - 985 psig
1/28/76	turbine roll	547° F to 482° F, 979 psig to 563 psig
1/28/76	RCS cooldown	482° F to 255° F, 563 psig to 20 psig
1/29/76	RCS heatup	255° F to 546° F, 20 psig to 989 psig
2/4/76	turbine roll	546° F - 477 - 546° F, 986 psig - 537 - 993 psig
2/5/76	turbine roll	546° F - 485 - 532° F, 987 psig - 595 - 857 psig

History of Steam Generator 1-2
Diablo Canyon Project

-2-

To: Spence Friedrich
From: MRT/RD Etzler
Pg. 2 of 2

HOT FUNCTIONAL TEST-continued

2/7/76	tested safeties	956 psig - 864 psig several times $\Delta T < 10°$ F
2/10/76	tested safeties (S.G.'s 1-3 and 1-4)	552° F - 531° F four times 1042 psig - 868 psig
2/10/76	RCS cooldown	549.5° F to 100° F, 1008 psig to 0 psig

NOTE: During the days not listed above, the temperature and pressure were relatively stable. A detailed picture of temperature and pressure is available at the site and a drawing of the entire hot functional program. Steam pressure shown on the drawing is downstream of the main steam isolation valves and does not always agree with steam pressure in the steam generator.

MINI-HOT FUNCTIONAL TEST

3/14/77	RCS heatup	115° F to 165° F
3/15/77	RCS heatup	165° F to 300° F, 0 psig to 52 psig
3/16/77	RCS heatup	300° F to 330° F, 52 psig to 88 psig
3/17/77	RCS cooldown	330° F to 100° F, 88 psig to 0 psig

FEEDWATER TO STEAM GENERATOR

During both Hot Functional and Mini-Hot Functional, the auxiliary feedwater system was used for makeup to the steam generator. Feedwater temperature varied from 90° F to 110° F and flow rate varied from 0 to 300 GPM. We understand you have obtained water chemistry results from the plant chemist.

THERMAL EXPANSION

During Hot Functional, thermal movement and potential component and piping interferences were closely monitored for each steam generator. Movement of steam generator 1-2 was in agreement with the movement of the remaining generators and acceptable by Engineering Department. However, insulation on the feedwater inlet line for steam generator 1-2 did come in contact with the missle barrier penetration, whereas feedwater lines on the other steam generators did not. The insulation cover was slightly indented, but not enough to induce a restriction to the movement of the feedwater line with the steam generator. Results of the thermal expansion test during Hot Functional are on file at the plant and General Office.

R. M. WOOD
Startup Department

Enclosed: None
cc File

ANALYSIS OF ELECTRON DIFFRACTION PATTERNS

Gold Calibration for Camera Constant

Ring Dia. cm	dÅ	K
2.30	2.355	5.42
2.65	2.039	5.40
3.75	1.442	5.41
4.40	1.230	5.41

K = 5.41

Pattern From Extracted Oxide

Ring Dia. cm	dÅ	Intensity*
1.3	4.15	S
1.5	3.60	W
2.0	2.70	S
2.15	2.52	M
2.40	2.25	M
2.70	2.00	W
3.10	1.74	M
3.30	1.63	W
3.50	1.55	VS
4.00	1.35	S
4.40	1.22	W
4.70	1.15	M

*VS - Very Strong
S - Strong
M - Medium
W - Weak

* αFe_2O_3 Hematite

4-0755 MAJOR CORRECTION

d	2.52	1.48	2.95	5.90	γ-Fe_2O_3
I/I1	100	53	34	2	Gamma Iron Oxide (Maghemite)

Rad. FeKα λ 1.9373 Filter [illegible]
Dia. ? Cut off Coll.
I/I1 Photometric d corr. abs.? Yes
Ref. Haul and Schoon, Z. phys. Chemie 31, 216-236 (1935)

Sys. Cubic S.G. *
a 8.350 b c A C
α β γ Z
Ref. Haul and Schoon, Z. phys. Chemie 31, 216-236 (1939)

εα nωβ εγ Sign
2V D mp Color
Ref.

a^{2} - $P4_{1}32$ or C^{7} - $P4_{3}32$
*Davies and Evans, J. Chem. Soc. 4373 (1956)
Low angle lines calculated from cell dimensions.

d Å	I/I1	hkl	d Å	I/I1	hkl
5.90	2	110	1.32	7	620
4.82	5	111	1.27	11	533
4.18	1	200	1.26	3	622
3.73	5	210	1.21	5	444
3.41	2	211	1.13	7	642
2.95	34	220	1.08	19	553,731
2.78	19	221	1.07	1	650
2.64	-	310	1.04	8	800
2.52	100	311	1.04	1	832,740
2.41	1	222	1.03	1	554,741
2.32	6	320			
2.23	.5	321			
2.08	24	400			
1.87	.3	420			
1.70	12	422			
1.61	33	511,333			
1.58	.5	432,520			
1.52	[illegible]	[illegible]			
1.48	53	440			
1.43	1	433,530			

1812

6-0502

d	2.69	2.51	1.69	3.68	α-Fe_2O_3
I/I1	100	50	60	40	Alpha Iron (III) Oxide Hematite

Rad. CoKα λ Filter Fe
Dia. 1700 Cut off Coll.
I/I1 Visual d corr. abs.?
Ref. [illegible]

Sys. Rhombohedral S.G. D_{3d}^{6} - $R\bar{3}c$
a 5.42 b c A C
α 55°17' β γ Z
Ref. Ibid.

εα nωβ εγ Sign
2V D 5.26 mp Color
Ref.

d Å	I/I1	hkl	d Å	I/I1	hkl
3.68	70	102	1.100	40	226
2.69	100	104	1.053	50	21,10
2.51	80	110	1.037	10*	
2.20	70	113	0.988	10*	
2.07	10	202			
1.837	70	204			
1.691	80	116			
1.634	10	121			
1.598	40	108			
1.484	70	214			
1.451	80	300			
1.348	20	208			
1.309	40	10,10 / 119			
1.258	30	220			
1.226	20	306			
1.208	10	223			
1.187	30	312,218			
1.160	30	20,10			
1.127	40	314			

*Superlattice lines given by Harcourt U.S. Bur. Mines [illegible], Pa., taken with FeKα.

EXHIBIT 7 TO
ATTACHMENT 1

Pullman Swindell
Division of Pullman Incorporated

441 Smithfield Street
Pittsburgh, Pennsylvania 15222
(412) 562-7000
Telex 866 500

Metallurgical Examination
Cracked Field Weld No. 212
Feed Water Pipe to Nozzle; Steam Generator 1-2.

Pacific Gas & Electric Co.
Diablo Canyon Nuclear Project

by

Pullman Power Products Co.
Williamsport, Pennsylvania

Date: 6/23/77

Prepared by: R.H. Caughey

R.H. Caughey
Chief Metallurgist

INTRODUCTION

On March 17, 1977, during hot functional testing, a water leak was discovered in the butt weld (Field Weld No. 212, line K16-555-16IV) which joined the 16 inch diameter feed water pipe to the No. 4 nozzle on steam generator 1-2. The line pressure and temperature at this time was approximately 90 p.s.i. and 300°F respectively.

Subsequent on site non-destructive testing by both ultrasonic and radiographic means (by both Kellogg and P.G. & E. representatives) led to the conclusion to cut out and totally replace this weld. A satisfactory, acceptable replacement was completed during the period March 19-25, incl. 1977.

A summary of these events are described in Kellogg's report dated April 12, 1977 prepared by J.P. Runyan, Field QA/QC Manager. A copy of this report is attached (Appendix I, pages 11-15)

Incident with this replacement a spool piece was salvaged for subsequent laboratory examination by P.G. & E. It contained a conveniently large portion of the weld deposit and a representative portion of both the nozzle and pipe components. A sketch which describes the dimension of this piece; also the crack path and the extent of the crack relative to the weld deposit is included with the Kellogg report referenced above (Appendix I).

Kellogg, for the purpose of a laboratory examination, requested P.G. & E. to furnish representative specimens cut from this spool piece. Two were received.

The report which follows covers a description of these samples and the results and conclusions determined from this investigation.

PROCEDURE & RESULTS OBTAINED

A. History

Pertinent to this investigation was a complete review of the records appertaining to field weld joint No. 212, namely; the weld procedure; welder qualification records, heat treatment; material certifications; nondestructive examination personnel qualification and N.D.E. results. The following information was gleaned from the recorded documents on file with respect to this weld:

1. WELD HISTORY REVIEW

Field weld 212 was fit-up and tack welded on Friday May 18, 1974. On Monday May 21, 1974 the tack welds and insert were removed. A new insert was installed on May 22, 1974. It is not documented as to why the original insert was removed, however, discussions with field inspectors who were on site at the time indicate that surface rust may have occurred over the weekend and the insert was removed to reclean the weld prep and install a new insert prior to consuming the ring.

The root pass was made on May 22, and accepted visually May 23, 1974. Welding proceeded following Q.C. acceptance and was completed on May 24, 1974.

The weld surface was ground and final visual inspection completed on May 28, 1974.

Other than replacing the insert no unusual or out of the ordinary circumstances were recorded.

2. PREHEAT AND POSTHEAT

A review of the heat charts on F.W. 212 indicate that the weld area was preheated to 200°F min. prior to tack welding and subsequent welding.

The weld was preheated on May 22, 23, and 24. The heat was turned off at the end of each shift allowing the weld to cool.

2. PREHEAT AND POSTHEAT (Con't)

Following completion of the weld on May 24, the weld was allowed to cool and no further heating was performed until post weld heat treatment on June 24, 1974.

Preheat and post heat records from other welds of the same type indicate a similar history. NOTE: Other welds reviewed were the remaining three feedwater nozzle to pipe and all four main steam nozzle to pipe and all four main steam nozzle to pipe welds in Unit I and the main steam nozzle to pipe welds in Unit II. The feedwater nozzle to pipe welds are not welded in Unit II.

3. WELDING PROCEDURE AND WELDER PERFORMANCE QUALIFICATION RECORDS

Field Weld 212 was made using weld procedure number 200. The procedure was reviewed to assure compliance with ASME Section IX. No deviations were noted. The results of the procedure qualification tests were evaluated. Included were bend tests, tension tests, and Charpy V Notch tests. All results were acceptable.

Welder performance qualification records were reviewed. The records were in order and the welder was found to be properly qualified. In addition, records of other welds performed by the same welder were reviewed. It was determined that his performance record was good. There was no reason to suspect that welders capability or performance was below standard.

4. MATERIAL CERTIFICATIONS

Material Certifications of the weld material and pipe-side base material was reviewed for compliance with material specifications and job specifications, including supplementary requirements. All were found to be in compliance. The nozzle base material certifications were not available for review by M.W. Kellogg.

5. NONDESTRUCTIVE EXAMINATION PERSONNEL, PROCEDURES AND REPORTS

The original radiographs of F.W. 212 were reviewed. There was an area along with nozzle side of the root with greater density than other areas of the weld. This area is typical of other similar welds. The higher density is caused by the nozzle counterbore which is approximately 1/4" wide. There was no evidence of linear indications in the area where the crack occurred. Review of the radiographs of other similar welds did not show evidence of linear or crack-like indications.

B. Metallurgical Examination

A description of the two (2) specimens received from P.G. & E. follows:

One represented by about 1/2 inch of the circumference contained the full depth, "front" face of the crack as viewed toward the pipe component. An enlarged photograph showing the "front" face is displayed in Fig. 1 Page 8. This surface had been fully protected from post atmosphere affects by the application of a lacquer. The coating was removed for photographing.

The second (also about 1/2 inch of circumference) contained the full cross section of the weld joint. It had apparently been removed from a location where cracking had not occurred. A photograph of this sample is not included. It will be discussed with relation to microscopic examinations which were conducted on both specimens.

Photomicrographs of both specimens are displayed in Fig. 2 and 3* respectively. Both represent the existing metallic structure in the locus of the weld root on the nozzle side of the weldment.

Noteable in Fig. 1, or the "front" face of the crack cross section is the distinct, variously "shaded" areas. There appears to be four in number as illustrated in the accompaning sketch.

* Figure 2, Page 9
Figure 3, Page 10

DISCUSSION

Fractured or cracked areas showing these distinctions are typically associated with fatique failures caused by the imposition of cyclic stress.

From this photograph the clear indication is that crack initiation took place in the root of the weld in the forged nozzle and ultimately propagated to failure through the weld deposit in at least 3 stages as shown in the sketch. (The cycling involved could have resulted either from multiple hydrotesting or from cyclic exposure during hot functional testing. These facts were not contained in the reported history cited above).

In such cases the causual phenomenon is usually a preexisting discontinuity which may be either an inherent metallurgical plane of weakness or a physical crack like defect.

In the photograph of the fractured surfaces (Fig. 1) the first distinct area is the root of the weld joint. Close visual examination by macroscopic means showed sporadic small areas (light areas in the photograph) which were relatively bright or "shined".

Fig. 2 is a photomicrograph of the metallic structure which was found to exist in one of these areas. The indication is that these are associated with remanent, weld bevel "land" material of the forged nozzle component. The suggestion is that, crack initiation stemmed from this locus; also that the initiating defects were localized, incipient root cracks through the land area.

What is not clear from this examination is the cause for the defects. In the history of the field fabrication of this particular weld (cited above) the fact that repetiture preheating and cooling was permitted to take place on four separate occassions before the weld was completed, could be one factor. Thereby inordinately high thermal stresses could have resulted in incipient cracks.

DISCUSSION (Con't)

Another contributing factor under these circumstances (which cannot be overlooked) could be the relative hardenability of the forged nozzle material the reported composition of which was a nickel, molybdenum bearing steel or A.S.T.M. A508-CL2. This is an air hardening composition. It is possible due to the noted in attention especially to cooling affects, following the root pass welding, that, air hardened, crack sensitive microstructures could have been effected and sporadic cracks on cooling promoted in the initial land area. (Microstructure affects in the specimens examined would, of course, be obscured by the subsequent stress-relief heat treatment.)

Understanding this weld (NO. 212) was one which was completed under restrained conditions (or as a closure weld) the possible circumstances i.e., in attention to preheating and cooling and metallurgical transformations, would augment the cracking tendencies.

Fig. 3 or the photomicrograph of the uncracked weld joint (localized at the root weld in nozzle forging) shows the normally expected microstructure; good penetration; and no evidence for lack of fusion or cracking. Certain evidence of small cracks are shown to exist in the I.D. surface of the forging. But there is no reason to believe these or like defects could have contributed to ultimate failure, once the weld was completed and stress relieved.

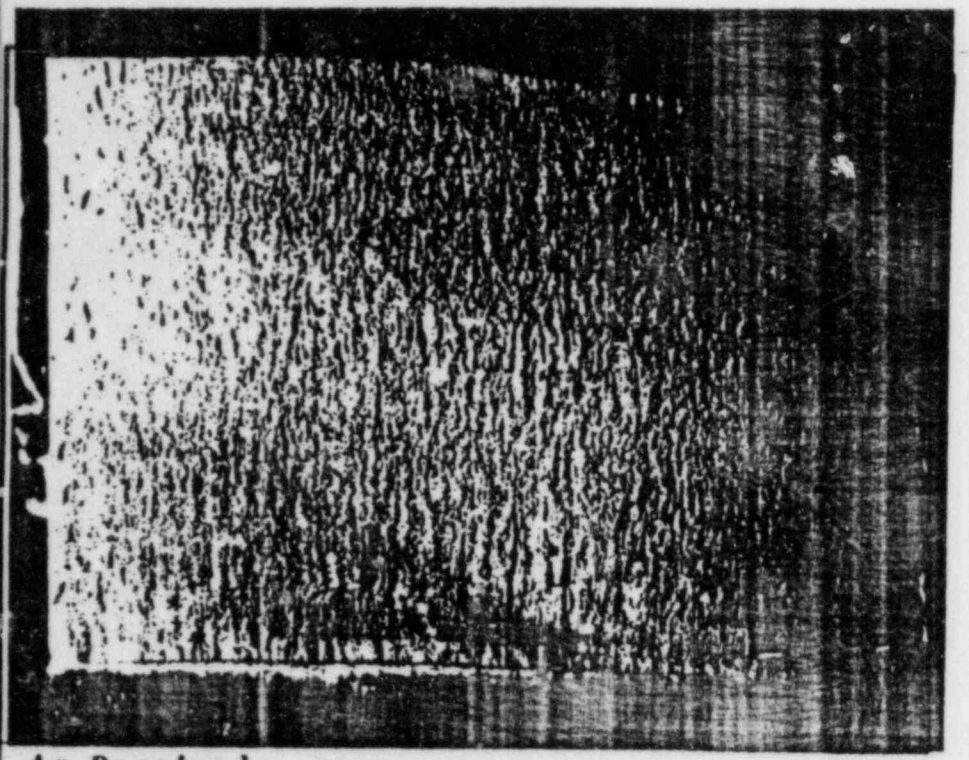
CONCLUSIONS

1. The crack failure in the FW212 resulted from crack like defects which apparently existed in the weld bevel land.

2. The cause for the crack defects is not clear. They are believed, however, to have resulted from the welding process and probably portend the affects of repetitive preheats and cooling applied before welding was completed. Imposition of high thermal stress, especially in the early stages of welding, is a plausible explanation.

3. Ultimate failure through the weld deposit was due to a cyclic fatique stress phenomenon, which it is suggested was the consequence of repetitive loading due either to preliminary hydrotesting or inherent in the hot functional testing program.

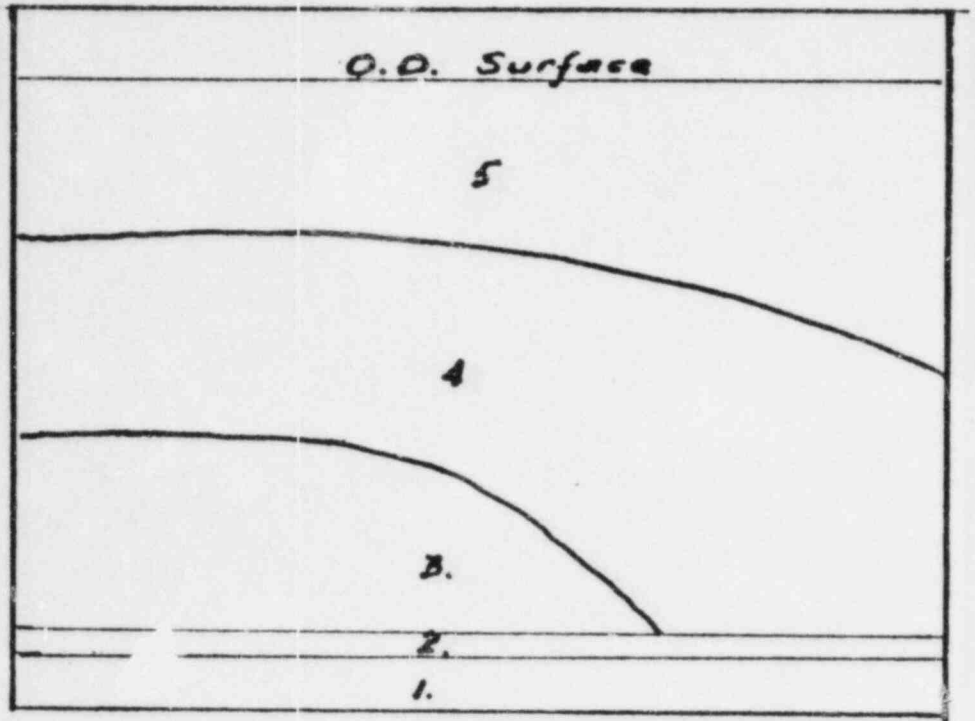
4. The fact that cracking was only discovered during the hot functional testing, and not evident from preliminary in-process inspections i.e., ultrasonic and radiography (probably due to the inherent insensitivity of these procedures to indicate small incipient cracking) the recommendation is hereby made that all like welds should be reinspected upon the completion of functional testing and before service in order to discover any evidence of crack propagation or enlargement; not withstanding the fact that in process documents failed to disclose the possibility of similar incidents.



As Received 5X

Photograph

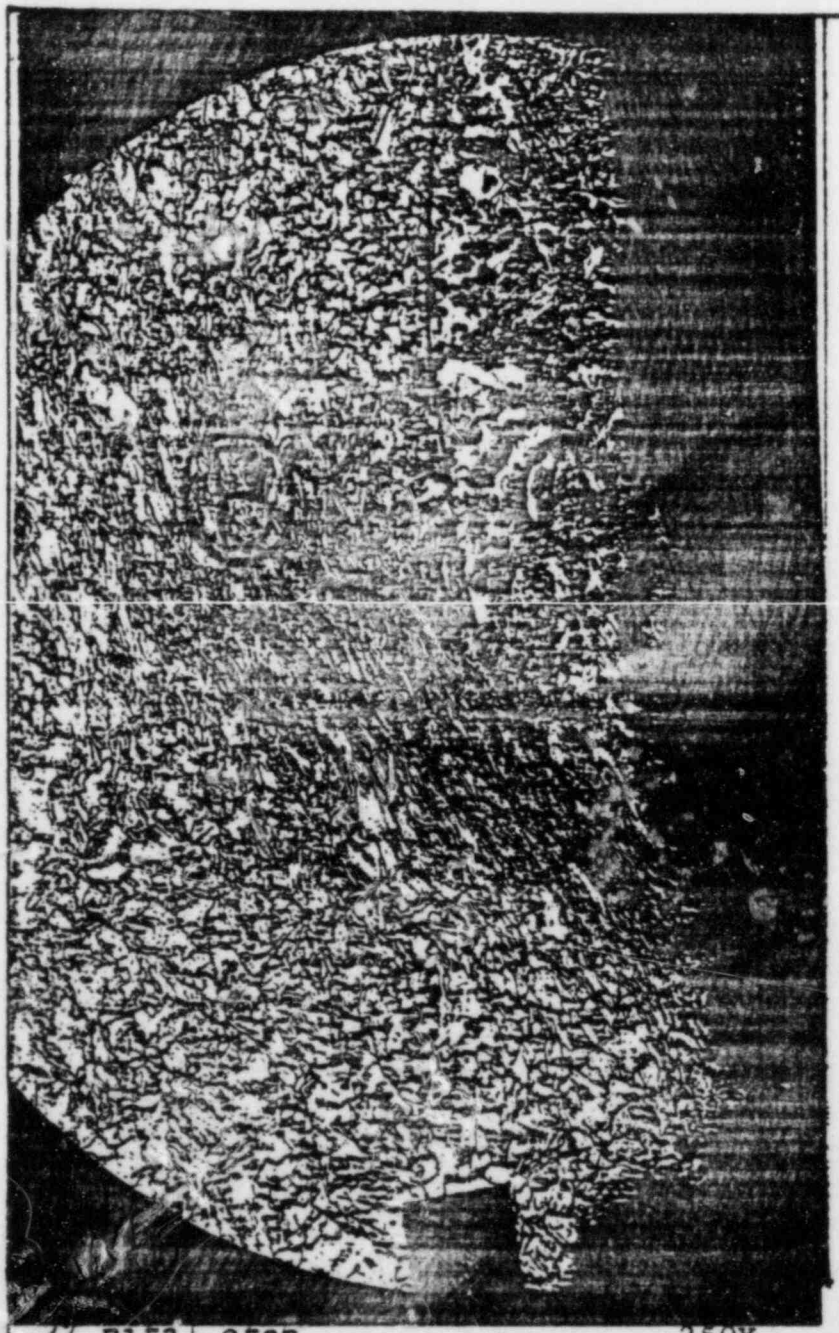
Crack "Front" Face; Viewed Toward Pipe Component.



LEGEND

1. K-insert, weld reinforcement.
2. Remanent weld bevel land; probable crack initiation region. Refer to photomicrograph, Fig. 2.
3. 2nd-crack stage.
4. 3rd-crack stage.
5. Final stage, thru wall penetration.

Fig. 1

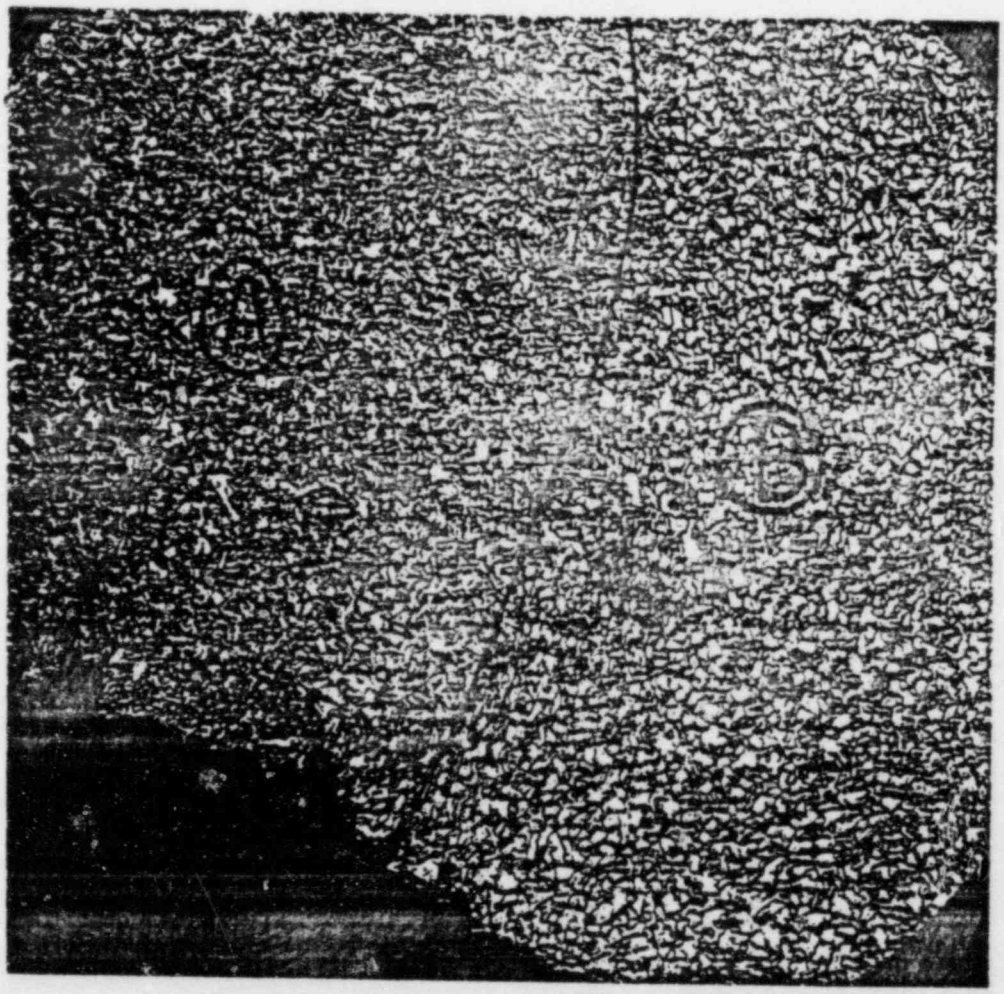


A. Remanent weld bevel land in forged nozzle.

B. K-insert, weld I.D. Reinforcement.

2% nital etch 250X

Photomicrograph
Crack Evidence in Initial Weld Bevel Land



2% Nital Etch 100X

A. Nozzle Forging

B. K-insert root weld and I.D. Reinforcement

Photomicrograph; Root Weld Nozzle Forging Component

Fig. 3

APPENDIX I

DIABLO CANYON NUCLEAR PROJECT
JOB # 7177
SPEC # 8711

QUALITY ASSURANCE REPORT

OF

Crack in Steam Generator Feedwater
Nozzle to pipe weld
(Generator No. 1-2)

THE M.W. KELLOGG CO.
Avila Beach, Ca.

PREPARED BY J. P. Runyan
J. P. RUNYAN
Field Q.A./Q.C. Manager

DATE April 12, 1977

QUALITY ASSURANCE REPORT

OF

CRACK IN STEAM GENERATOR FEEDWATER NOZZLE TO PIPE WELD (GENERATOR NO. 1-2)

PURPOSE

To document events from the time of discovery of the leak until the completion of the repair.

SCOPE

This report covers the on site findings, the review of documentation including preheat and postheat charts, radiographs from the defective weld, the subsequent procedures for removing the defective area and performing the repair.

FINDINGS

On Thursday, March 17, 1977 a leak was observed in field weld 212, line K16-555, by P.G.& E. We were advised of the leak on that date.

The weld in question is where the 16" feedwater pipe ties into nozzle #4 on Steam Gererator 1-2.

Visual observation revealed a weep type leak which occasionally sprayed a fine stream of water. When observed with a 10X magnifing glass there appeared to be a small intermittant linear indication approxiately 3/8" in length in the center of the weld running around the pipe. Magnetic particle examination of the area with a D.C. converted yoke did not show evidence of a linear defect.

P.G.& E. requested that we grind the area. As grinding proceeded, the indication opened to reveal a linear defect approximately 2" long when the weld crown was flush with the pipe surface. At this point the grinding was stopped. We were requested to perform an Ultrasonic examination to determine the extent of the indication. The pipe temperature was approximately 180° F which made it impossible to perform U.T. with the standard transducers on site.

We were then instructed to "hold" until P.G.& E. Engineering Research arrived with their U.T. equipment and high temperature transducers. The weld was radiographed at this time. The radiograph revealed evidence of a linear indication which appeared to be approximately 6" in length.

On Friday, March 18, 1977 P.G.& E. Engineering Research arrived and performed Ultrasonic examination of the weld. They reported that there was a crack which appeared to extend approximately 2/3 of the distance around the weld. Based on there findings it was determined that the weld would be cut out and replaced.

WELD REMOVAL

The weld was cut by grinding approximately 1/2" from the center line on the nozzle side and at F.W. 503 on the pipe side. The end of the pipe was then cut to remove a ring which included most of the weld and approximately 4" of pipe.

The piece was examined visually and by liquid penetrant on the O.D. and I.D. and a sketch made to reflect the observations. (Sketch Attached)

The piece was shipped to P.G.& E. research lab on March 20 for analysis.

REPAIR

A piece of 16" pipe was removed from stores to replace the piece which was cut out. The pipe end preps, gamma hole and vent were machined in the P.G.& E. machine shop on March 19, 1977. The nozzle end prep at F.W. 212 and pipe end at F.W. 503 were ground in place on March 20. A liquid Penetrant examination was performed at that time to assure complete removal of any indications.

The new piece was moved into place and fit up on March 20. Preheat was applied prior to tack-up,(Ref. Chart # 547). After the fit up was approved by M.W. Kellogg Q.C. both roots were welded. Magnetic particle inspection was performed. Following magnetic particle acceptance two additional passes were welded in each weld.

Radiography was performed on March 21, 1977. The radiographs of F.W. 503 pipe to pipe wereacceptable. F.W. 212, pipe to nozzle, had excessive porosity at the window closures. These areas were ground, rewelded and re-radiographed. One area had excessive porosity, the other had a linear indication approximately 1/2" long and an area which appeared to be suck back.

At this time, March 21, 1977, P.G.& E. Q.A. placed a "hold" on all work until their Engineering could review the total program and process appropriate paperwork. "This hold was not because of the difficulty in welding the window closures".

No work was performed on March 22, 1977.

On March 23, 1977 an on site meeting was held to review findings, work to date, and procedures for completion of the repair. Attending the meeting were representatives from P.G.& E. Engineering, Q.A., General Construction, Division, Westinghouse, M.W. Kellogg site Manager, Corporate Q.A. Manager, and the writer.

A. It was determined that the procedure as outlined by D.R. 3366 was acceptable except that the preheat would be raised to 300° Min. for completion of the welding.

B. The problem of making an acceptable closure weld was discussed. It was determined that the positive pressure maintained in the system was to high and that water remaining in the generator caused vapor to be carried out the window openings.

C. P.G.& E. Division agreed to drain the generator and reduce the purge pressure until the closure welds could be made.

On March 24, 1977 the defective areas at the closures were ground out and Magnetic particle performed to assure complete removal. No welding was performed since P.G.& E. had not removed the Hold. Preheat was being maintained through the "hold" period.

On March 25, 1977 the hold was released. The windows were closed and radiograph made. Both areas were acceptable and welding continued. The weld was completed on the afternoon of the 25th. Radiographs were shot in the hot as welded condition. No rejectable indications were noted. Post weld heat treatment was then performed.

On March 26, 1977 following post weld heat treatment, the weld was ground, re-radiographed, liquid penetrant inspected and ultrasonically examined. No rejectable indications were noted. The vent line and gamma plug were completed, inspected and the system turned over to division for resumption of testing.

SUBSEQUENT INVESTIGATION

Because of the unknown origin of the crack it was determined that other welds of the same type and welded using the same procedure should be reviewed to determine if the defect could be a generic nature.

Each of the remaining three feedwater nozzle welds and the four Main Steam nozzle welds were ultrasonically examined. The original radiographs were reviewed and the feedwater nozzle welds were re-radiographed. There was no evidence of like indications in any of the welds and no evidence of change in any of the noted, acceptable, indications since the original inspections.

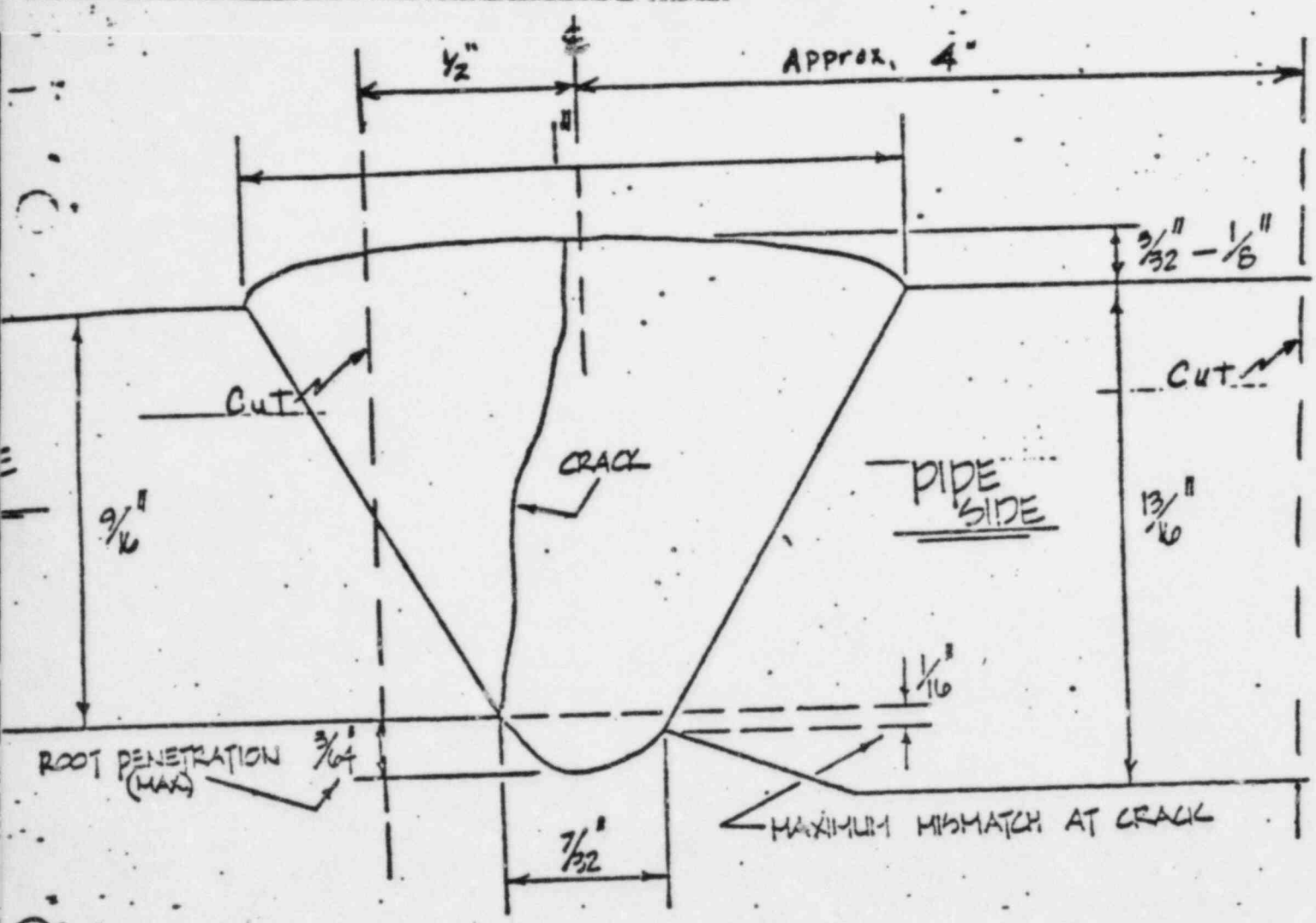
There was, however, an indication noted in F.W. 197 on generator 1-1. The indication was present on the original radiographs but had not been noted on the radiographs report. A second set of radiographs were on file for F.W. 197. This set also exhibited the same indication, however, the radiographic report did reflect the condition as being a drop thru. The indication had apparently been evaluated and determined acceptable at the time.

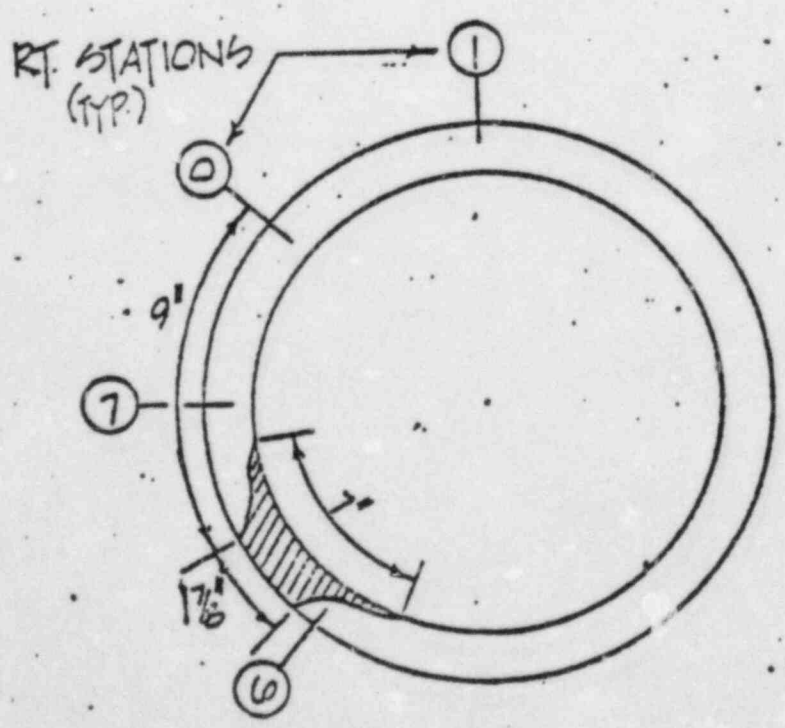
Because of the problem with F.W. 212 it was determined that any questionable situation should be resolved. It was therefore determined that the drop thru should be removed. A D.R. was initiated and the repair was made. The indication was removed by grinding. No welding was required. (See D.R. 3370 Attached)

SUMMARY

To date the metallurgical analysis has not been completed of the crack sample. We had requested, from P.G.& E., a piece of the defective material for our own analysis. This was received on Thursday, April 7, 1977 and forwarded to E. F. Gerwin in Williamsport.

It is my belief that the crack was peculiar to F.W. 212 only and not of a generic nature. Therefore, at this time we are assuming that no further repair will be required and that when the disposition of D.R. 3370 is completed the subject will be closed.





NOTE:

1. WALL THICKNESS MEASR. ARE APPROXIMATE
2. REF. TO D.R. 3366 REV. A
3. STEAM GENERATOR 1-2
   F.W. # 212
   P.O. 500146
   LINE # K16-555-16IV

DR 3366 Rev I
ATTACHMENT # 2

QPM F-114

EXHIBIT 8 TO ATTACHMENT 1

PULLMAN POWER PRODUCTS

EVALUATION OF DISCREPANCY REPORT IN RELATION TO REQUIREMENTS OF 10CFR PART 21

D.R. # 3453 Rev1, to which this page is attached and become a part of, (is not, may be) considered to be reportable to the NRC under the requirements of 10CFR Part 21.

PULLMAN POWER PRODUCTS

by _____

Pacific Gas & Electric Company (does, does not) consider this discrepancy reportable and (has reported, will not report) the above discrepancy.

This form returned to Pullman Power Products on 9/12/77
DATE

PACIFIC GAS & ELECTRIC CO.

by R.D. Tyler

FORM F-114

PULLMAN POWER PRODUCTS

EVALUATION OF DISCREPANCY REPORT IN RELATION
TO REQUIREMENTS OF 10CFR PART 21

D.R. # 3453, to which this page is attached and become a part of, (is not, may be) considered to be reportable to the NRC under the requirements of 10CFR Part 21.

PULLMAN POWER PRODUCTS

by J. P. Cunningham

Pacific Gas & Electric Company (does, does not) consider this discrepancy reportable and (has reported, will not report) the above discrepancy.

This form returned to Pullman Power Products on 8/29/77 .
DATE

PACIFIC GAS & ELECTRIC CO.

by R. D. Etzler

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 Rev. 1 Rev 2
ISO. NO. 500146 Sht. 4 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. 1

EXPLANATION OF DISCREPANCY: Reference P.G.&E. Drawing 500146, Rev. 98

Per P.G.&E.'s request, an internal inspection of F.W. 244 on Steam Generator 1-4 Feedwater Nozzle will be performed. The line entry will be made in the following manner, see Recommended Disposition.

FOR INFORMATION ONLY

RECOMMENDED DISPOSITION:

1. Measure 2" from F.W. 244 center upstream on pipe (Spool Piece 500) circumscribe the pipe using a wrap around, then prick punch the scribe line.
2. Using air-arc, cut the pipe all around maintaining less than a 40° total bevel to within approximately 1/8" from the I.D. (See Sketch #1).
3. Using a thin blade grinder, cut through the center of the bevel, then dress up both bevels (See Sketch #1).
4. Jack pipe awey from cut on upstream side per Superintendent's instruction. Install a dam in nozzle beyond F.W. 244 to prevent air from entering Steam Generator.
5. Clean and inspect F.W. 244 internally as directed by P.G.&E.

(Con't on Page 2)

Approved By: M.W.K. Field Q.A. Mgr. J.P. Runyan Date 8/26/77 Customer R.D. Etzler MVR 3553 Date 8/29/77

FINAL DISPOSITION: ☒ In Accordance With Above
Work Completed Insp: A.B. Burke Date: 11-2-77

☒ Other (explanation and approval required)
Work Completed Insp: A.B. Burke Date: 11-2-77

EXPLANATION (IF NECESSARY):
Revision 1 - Delete Step 6 in its entirety (access was achieved). Refer to Attachment #1 for results of initial inspection and recommended disposition.
Revision 2 - See Page 3 of 3 and Attachment #3. DEVIATION 244

Rev #2 J.P. Runyan 9/7/77 R.D. Etzler ~~MVR 3553~~ 9-26-77
Rev #1 J.P. Runyan
M.W.K. Field Q.A. Manager Date 8/31/77 Customer R.D. Etzler MVR 3553-A1 Date 8/31/77

STEPS TO PREVENT RECURRENCE ☒ Not Applicable

Field Q.A. Manager

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector ( )

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 Rev. 1 RE
ISO. NO. 500146 Sht. 4 of
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. I

RECOMMENDED DISPOSITION: (CON'T)

6. If access to F.W. 244 I.D. cannot be achieved, proceed with alternate instructions (See Sketch #2).
7. Upon completion of inspection, remove dam, grind bevel to facilitate fit-up as needed, clean and fit to ESD-215 and ESD-220.
8. Weld out using F.W. 549 and procedure 4/5.
9. Inspect and NDE to ESD-215 and ESD-206.
10. Add all information to process sheet and isometrics.

FOR FIELD CONSTRUCTION ONLY

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 REV 2
ISO. NO. 500146 Sht. 4 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. I

D.R. 3453, Revision 2

EXPLANATION OF DISCREPANCY:

During the performance of grinding per D.R. 3453, Revision 1, Step #5, four (4) indications of heavy drop through with roll over were removed along with all of the existing root penetration. Re-inspection revealed a linear indication 11" long on the fusion line to the Feedwater Nozzle. Further grinding, to a maximum depth of .110", removed the linear indication (see Attachment #3).

FOR INFORMATION ONLY

COMMENDED DISPOSITION:

Add the following to Step #5 and delete original Steps #7, 8, 9 and 10. Perform the following repair:

A. Grind the bevels to facilitate Fit-Up of F.W. 549.
B. M.T. I.D. of F.W. 244 using ESD-247 coil method, and clean grooved root pass at F.W. 244 per ESD-215.
C. Remove the dam from the nozzle at F.W. 244.
D. Preheat F.W. 244 to a minimum of 250°F, interpass not to exceed 550°F maximum. Maintain this preheat until stress relief begins.
E. Weld to procedure 200 (F.W. 244 R1), using E70S2 wire with the GTAW process, to conform to blended configuration of the balance of the weld. I.D. only
F. Grind and polish the added weld metal to blend with base metal surfaces.
G. Inspect and NDE to ESD-215 and PGE&E DER TO PERFORM L.P. AT PREHEAT-TEMP. & FURNISH MWK WITH COPY OF PGE&E CERT.

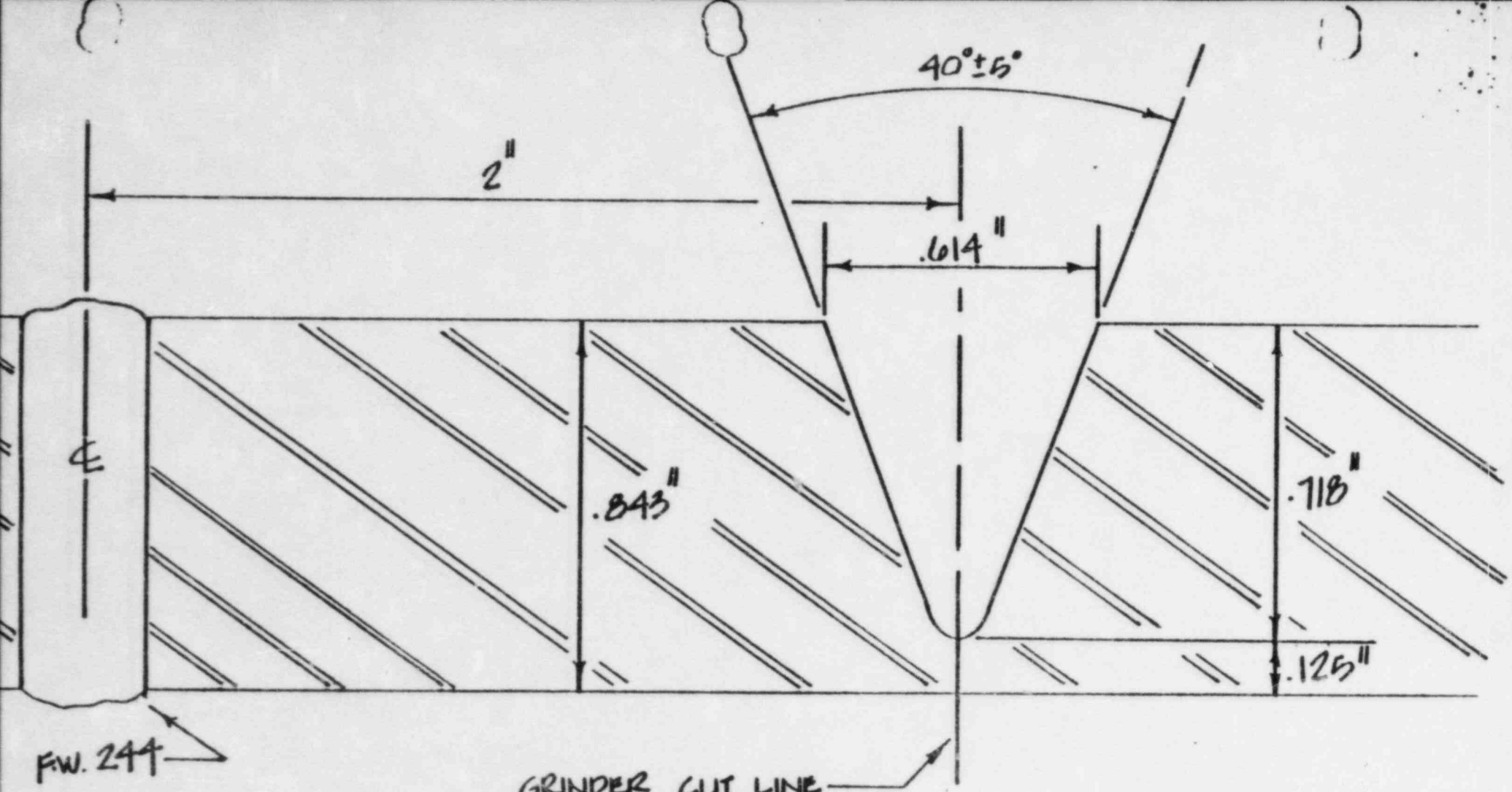
NOTE: Proceed with D.R. 3456, and X-ray weld, hot, for information only.

7. Upon completion of inspection, remove dams from F.W. 549 pipe side, clean and fit F.W. 549 to ESD-215 and ESD-220.
8. Weld out using F.W. 549 with procedure 4/5 A.O.
9. Grind F.W. 549 for X-ray.
10. Inspect and NDE F.W. 549 to ESD-215 ~~& PGE&E DER TO PERFORM L.P. AT PREHEAT-TEMP. & FURNISH MWK WITH COPY OF PGE&E CERT.~~ 9/30/77 11 AM

NOTE: X-ray weld hot for information only.

11. Stress relieve at F.W. 244 R1 and F.W. 549 1100°F to 1150°F per ESD-218.
12. NDE F.W. 244 R1 and F.W. 549 to ESD-207.
13. " " " " to ESD-211 9/30/77
14. Add information to process sheets.

(SEE ATTACHMENT #3 OF ESD 8013 C-3 SIMILAR) BY ROBERTS 9-28



3X ACTUAL SIZE

DR-#3453

SKETCH #1

ALTERNATE INSTRUCTIONS

1. Cut out F.W. 509 using air-arc and taking necessary steps to maintain the ability to bevel the 45° all side of the weld to 20° ± 2½° and a 3/32" ± 1/16" land. Also, cut out F.W. 339 shown on Iso. 3-246.

2. Requisition: 8 5/8" + of 16" Pipe, Schedule 80 A106 Gr B and a 3/4" 3000# S.W. Half Coupling or soc-o-let A105.

3. Install the 3/4" half coupling or soc-o-let four (4) inches from the end of the 16" pipe.

4. Clean and Fit to ESD-215 and ESD-220.

5. Weld out with procedure 92/93 (F.W. 831).

6. Inspect and NDE to ESD-215 and ESD-211.

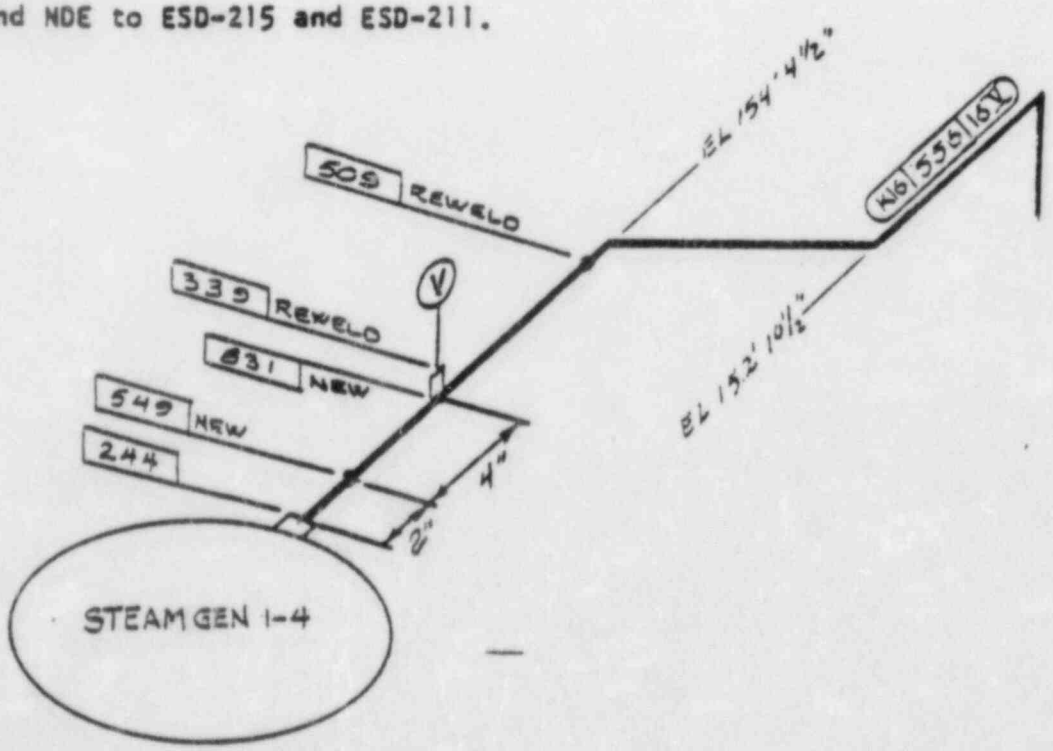
7. Upon completion of F.W. 244 I.D. inspection and P.G.&E.'s direction, fit-up 16", Schedule 80 pipe and proceed with Step 7 of attached D.R. using F.W. 549 and F.W. 509.

8. Reweld F.W. 339, as shown on Iso. 3-246, maintain original line configuration.

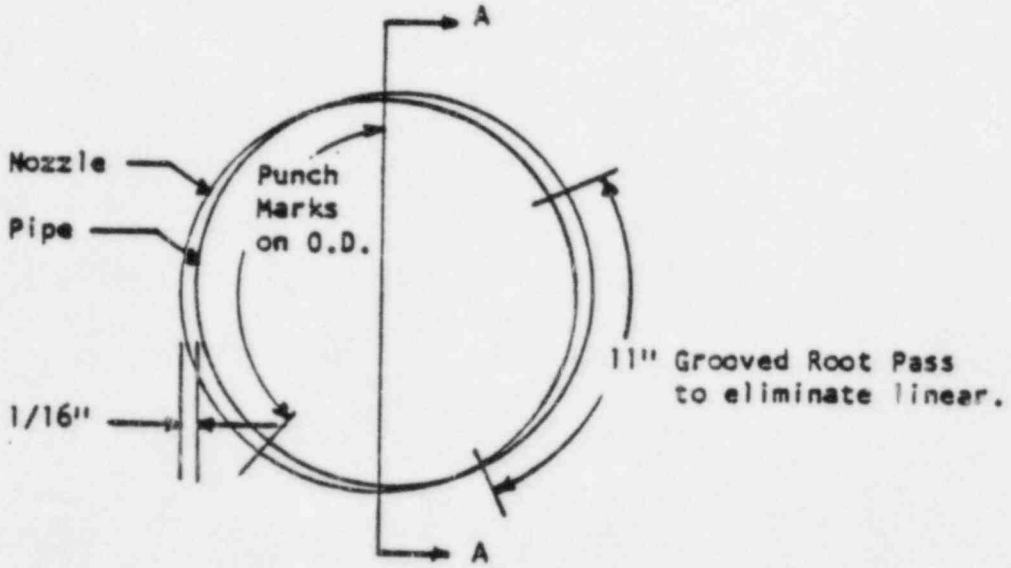
9. Clean and Fit-up to ESD-215 and ESD-220.

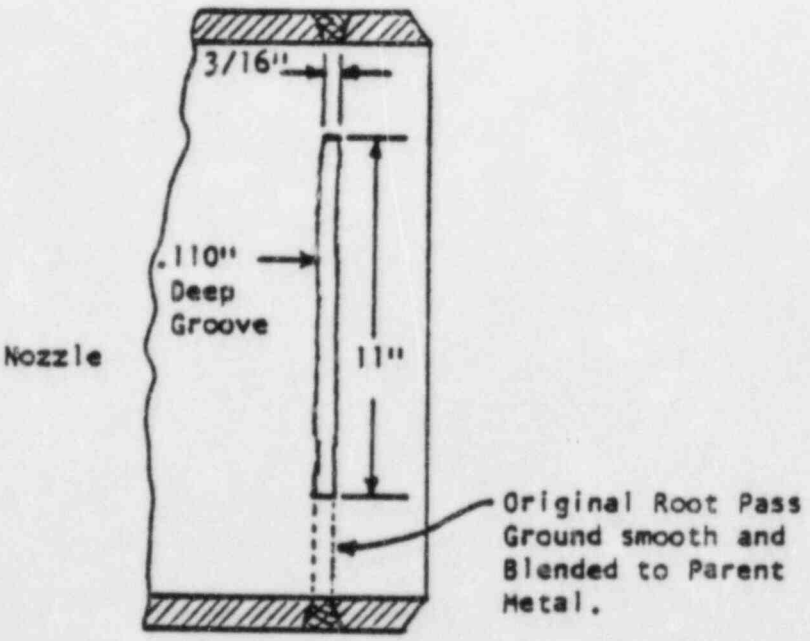
10. Weld out with procedure 92/93.

11. Inspect and NDE to ESD-215 and ESD-211.



Findings at F.W. 244





Section A-A

NOTE: Average Wall Thickness = .580" to .600"
Remaining Wall At Groove = .450"
Punch Marks On The O.D. = .047" Deep
(Punch Marks are directly on the fusion line of F.W. 244 to 1/8" inside the fusion line .047" deep.)

INTEROFFICE CORRESPONDENCE

ATTACHMENT #1
DR-3453 Rev. 1

TO J. P. RUNYAN, Q.A./Q.C. MANAGER

DATE AUGUST 31, 1977

FROM D. R. GESKE, NDE SUPERVISOR

SUBJECT LIQUID PENETRANT EXAMINATION, F.W. 244, INSIDE DIAMETER

On August 31, 1977, F.W. 244, Line K16-556, Isometric 1-03-500146, Feedwater piping to Steam Generator 1-4 Nozzle, was liquid penetrant examined on the inside diameter.

The following indications were noted:

1. 2" from top center of nozzle, a small faint transverse linear-nonrelevant due to weld geometry.
2. 7" from top center of nozzle, heavy 1" drop through with roll over.
3. 9" from top center of nozzle, heavy 2" drop through with roll over.
4. 37" from top center of nozzle, heavy 1½" drop through with roll over.
5. 39" from top center of nozzle, heavy 1/2" drop through with wire protrusion.
6. Approximately 1/16" mismatch exists from 7:00 to 9:00 facing the nozzle.

We recommend that the root pass be ground and polished to blend with base metal surfaces. Particular care should be taken to avoid the removal of base material. Then re-examine the I.D. with liquid penetrant, if acceptable, proceed to "Recommended Disposition", Step 7 of D.R. 3453, Revision 1.

Donald R Geske

Donald R. Geske
NDE Supervisor

DRG/js

DC 3455

SCHEDULE TO CUT, INSPECT & RESTORE 1-4 F/W NOZZLE

PLAN: AIR-ARC CUT PIPE ± 2" FROM NOZZLE WELD. STOP SHORT OF PIPE I.D. MAINTAINING N_2 PURGE ON S/G. REMOVE N_2 PURGE PRESSURE. FINISH CUT OF PIPE WITH THIN GRINDING DISK. PULL FOLLOWER LINE BACK FROM NOZZLE 3½" TO 4". INSERT PURGE DAM INTO THE S/G NOZZLE TO HOLD POSITIVE PRESSURE ONLY. (PURGE DAM WILL NOT HOLD PRESSURE) CONTINUE WORK BY HOLDING LINE AWAY FROM CUT A MINIMUM OF 3½". CLEAN I.D. OF NOZZLE WELD WITH SOAP AND WATER UNTIL CLEAN. PERFORM P.T. IF P.T. IS ACCEPTABLE, RESTORE WELD PREPS, ACCOMPLISH FITUP AND MAKE WELD.

ALTERNATE PLAN: IF MINIMUM OF 3½" OPENING CANNOT BE ACCOMPLISHED IT WILL BE NECESSARY TO MAKE SECOND CUT AT 45° ELL, REMOVE 8" "PUP" AND FOLLOW ABOVE STEPS.

TIME REQUIRED:

1. CUT PIPE & PULL LINE @ 2" MIN, 3" 2 MEN = 12 HRS
2. INSTALL PURGE DAM & RESTORE N2 BLANKET - 2M-2
3. CLEAN I.D. OF WELD AND PREHEAT P.T.
   2 MEN = 2 HRS = PREHEAT FOR P.T. 3 HRS
4. RESTORE WELD PREPS & FITUP = 2 MEN = 16 HRS
5. COMPLETE WELD = 3 M. = 12 HRS
6. RADIOGRAPH WELD = NIL SHIFT (NO TIME LOST)
7. STRESS RELIEVE WELD = 1 MAN = 6 HRS

ALTERNATE PLAN: 1, 2, 3 SAME AS ABOVE

4. MAKE SECOND CUT AT 45° ELL = 2 MEN = 8 HRS
5. RESTORE WELD PREPS ON ADDITIONAL WELD =
   2 MEN = 16 HRS
6. MAKE SECOND WELD = 3 MEN = 12 HRS

RADIOGRAPHY & S/R CAN BE DONE AT SAME TIME AS ABOVE

BASED ON 40 HR WK - 8 HR DAY

START WORK 8-29-77 — COMPLETE 9-7-77

ALTERNATE 9-12-77

F-114

EXHIBIT 9 TO ATTACHMENT 1

PULLMAN POWER PRODUCTS

EVALUATION OF DISCREPANCY REPORT IN RELATION TO REQUIREMENTS OF 10CFR PART 21

D.R. # 3484, to which this page is attached and become a part of (is not, may be) considered to be reportable to the NRC under the requirements of 10CFR Part 21.

PULLMAN POWER PRODUCTS

by _____

Pacific Gas & Electric Company (does, does not) consider this discrepancy reportable and (has reported, will not report) the above discrepancy.

This form returned to Pullman Power Products on 10-10-77 .
DATE

PACIFIC GAS & ELECTRIC CO.

by R.D. GETLER /

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3484 Rev. 1
ISO. NO. 500146 Sht. 1 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 10-7-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-554-16"; Piece #540; El. 154'-5"; Area F; Section I

EXPLANATION OF DISCREPANCY:

Per P.G.&E. request, an internal inspection of F.W. 197 on Steam Generator 1-1 is to be performed. The line entry will be made in the manner described below.

⚠1 Inspection conducted October 11, 1977, required by Step #9 of the Recommended Disposition, revealed conditions requiring rework. (See Attachment #3, Report of Findings.)

⚠2 Inspection conducted October 13, 1977, required by Attachment #3 revealed further rework is required. (See Attachment #4, Report of Rework).

Attachment #1 (Sketch)
Attachment #2 (Sketch)
⚠1 Attachment #3 (Report of Findings)
⚠2 Attachment #4 (Report of Rework)

RECOMMENDED DISPOSITION:

1. Remove the 2", 3000# coupling at F.W. 827 from the pipe using air-arc and grinder (do not air-arc through). Clean and NDE removal area to ESD-220 and ESD-211 on F.W. 197 side of hole in pipe. Close hole with fire retardant material (Reference Attachment #1).

2. Circumscribe the pipe using wrap around at the edge of hole in pipe nearest F.W. 197. This should be approximately 1 5/8" from the center of F.W. 197 (Reference Attachment #1).

3. Prick punch the scribe line.

4. Using air-arc, cut the pipe all around and apply a bevel of not more than 30° from O.D. of pipe to within not less than 1/8" of the I.D. of pipe directly below

(Con't on Page 2)

Approved By: M.W.K. Field Q.A. Mgr [signature] Date 10/14/77 Customer MUR M-3590 Date 10-10-77

FINAL DISPOSITION: ☒ In Accordance With Above
Work Completed Insp [signature] Date: 11-2-77

☒ Other (Explanation and approval required))
Work Completed Insp [signature] Date: 11-2-77

EXPLANATION (IF NECESSARY):

Revision 1 - Adds Attachment #3 (Report of Inspection Findings). P.G.&E. will indicate rework released on Attachment #3 under Recommended Rework. See ⚠ for other changes.

Revision 2 - See page 3 . . . (AND ATT. #4)

M.W.K. Field Q.A. Manager [signature] Date 10/14/77 Customer MUR M-3590-R1 Date 10-12-77

M.W.K. Field Q.A. Manager [signature] Date 10/14/77 Customer MUR M-3590-R2 Date 10-17-77

STEPS TO PREVENT RECURRENCE ☒ Not Applicable

Field Q.A. Manager [signature]

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

DISCREPANCY REPORT

D.R. NO. 3484 Rev. 1
ISO. NO. 500146 Sheet 1 of 5
UNIT NO. 1
CODE NO. N/A

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 10-7-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-554-16"; Piece #540; El. 154'-5"; Area F; Section 1

RECOMMENDED DISPOSITION:

scribe line (do not cut through the pipe with air-arc). Using a 1/8" blade, grind through to I.D. of pipe.

5. Locate center of F.W. 500. Using wrap around, circumscribe weld center.
6. Prick punch scribe line.
7. Cut out F.W. 500 using air-arc maintaining a maximum bevel of 30° on ell side to within not less than 1/8" of the I.D. of pipe (do not cut through with air-arc). Using a 1/8" blade, grind through to I.D. of pipe.
8. Install dam in nozzle of Steam Generator 1-1 past F.W. 197.
9. Clean and inspect F.W. 197 internally as directed by P.G.&E. Report findings of inspection before proceeding with Step #10. △1 Proceed with rework requirements as directed by P.G.&E. on Attachment #3.
10. Upon completion of inspection, remove dam, grind bevels to facilitate fit-up as needed. AFTER GRINDING IS COMPLETE. MM
11. Install new pup, fit-up and inspect to ESD-215 and ESD-220.
12. Weld out F.W. 551 and F.W. 500, as shown on Attachment #2, to process 4/5A0.
13. Inspect and NDE to ESD-215 and ESD-206.
14. Upon acceptance of R.T.'s of F.W. 551 and F.W. 500, clean and fit-up gamma plug, as shown on Attachment #2, to ESD-215 and ESD-220.
15. Weld out to process 7/8 using F.W. 832.
16. Inspect and NDE to ESD-215 and ESD-211.
17. Post weld heat treat to ESD-218 (F.W.'s 551, 500 and 832).
18. Add all information to isometric and process sheets.

Field Q.A. Manager

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector (

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

DISCREPANCY REPORT

D.R. NO. 3484 REV. 2
ISO. NO. 500146, Sht. 1 of 5
UNIT NO. 1
CODE NO. N/A

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 10-14-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell,Guest

DISCREPANT ITEM: NOTED

REVISION 2:

Adds Attachment #4 (Report of Rework). P. G. & E. will indicate rework released on Attachment #4 under Recommended Rework, adds rework to Recommended Disposition as Step 9a.

RECOMMENDED DISPOSITION:

5 3/8" Linear Removal.
A. Grind to remove the 5 3/8" linear.
B. P.T. to ESD 211 to insure complete removal.

Non-metallic Inclusion Removal.
A. Blend base material to eliminate the two non-metallic inclusions.
B. U.T. to ESD 244 to determine wall thickness remaining.

Pipe-side Rough Grind & Machining Lines.
A. Polish the pipe-side counter-bore to eliminate rough grind edges and machining lines.
B. P.T. to ESD 211 to insure complete removal.
C. Remove dam prior to Step 4.

Preheat to 250° min. 550° max. interpass; maintain pre-heat until stress relief.

Weld the 5 3/8" Grindout to original I.D. configuration using Procedure 200.

Grind 5 3/8" repair for R.T. while maintaining pre-heat.

M.T. to ESD ~~209~~ 247 or Hot P.T. by P. G. & E. D.E.R.

P. G. & E. to indicate N.D.E. to be performed (Step 7).

Weld area of inclusion removal, if needed, to original counter-bore configuration, using Procedure 4/5 AO.

Grind inclusion repair, if Step 8 is used, for R.T. while maintaining pre-heat.

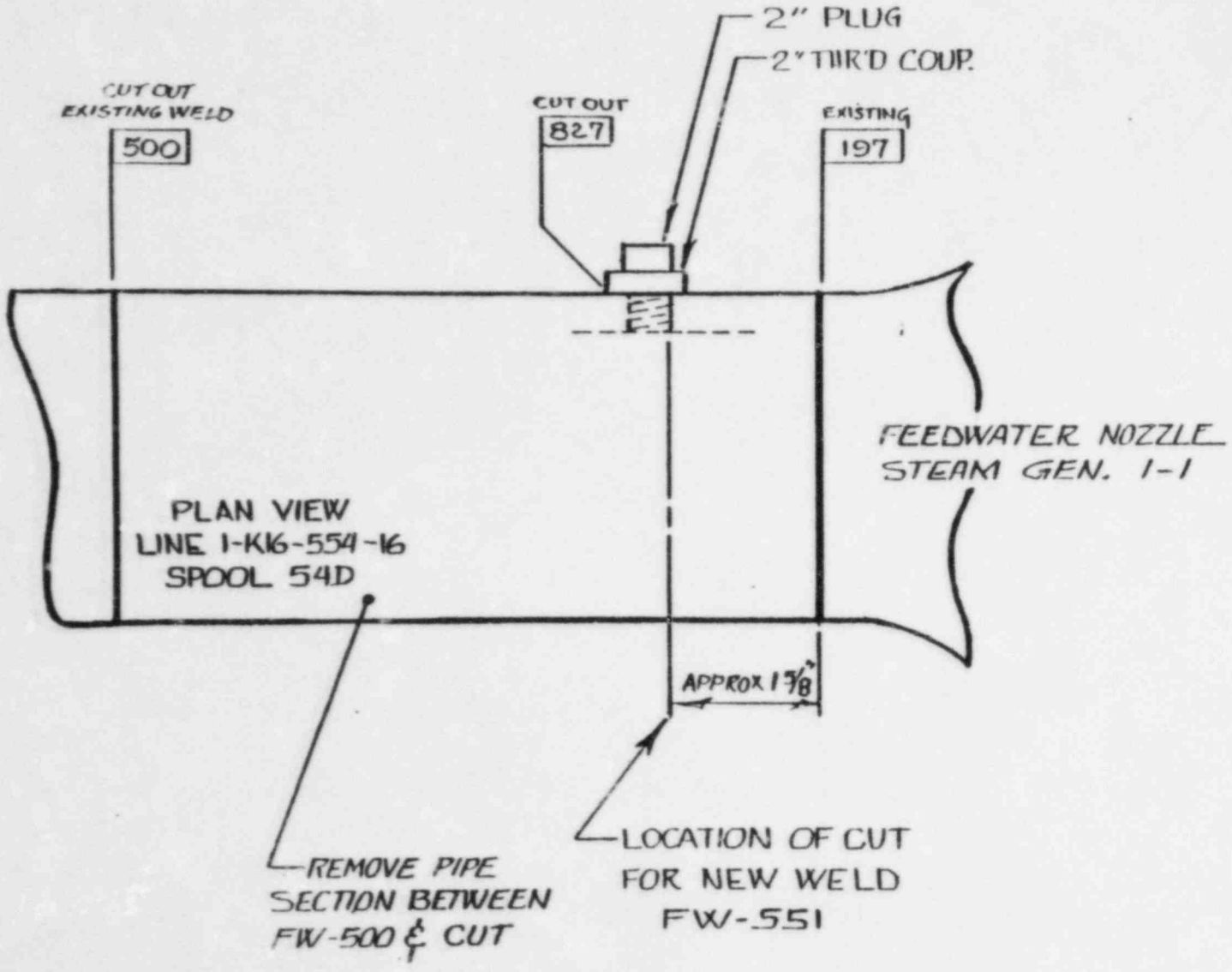
Perform Hot R.T. of repair area per ESD 207.

Proceed with Step 10 of the original D.R. 3484 Recommended Disposition.

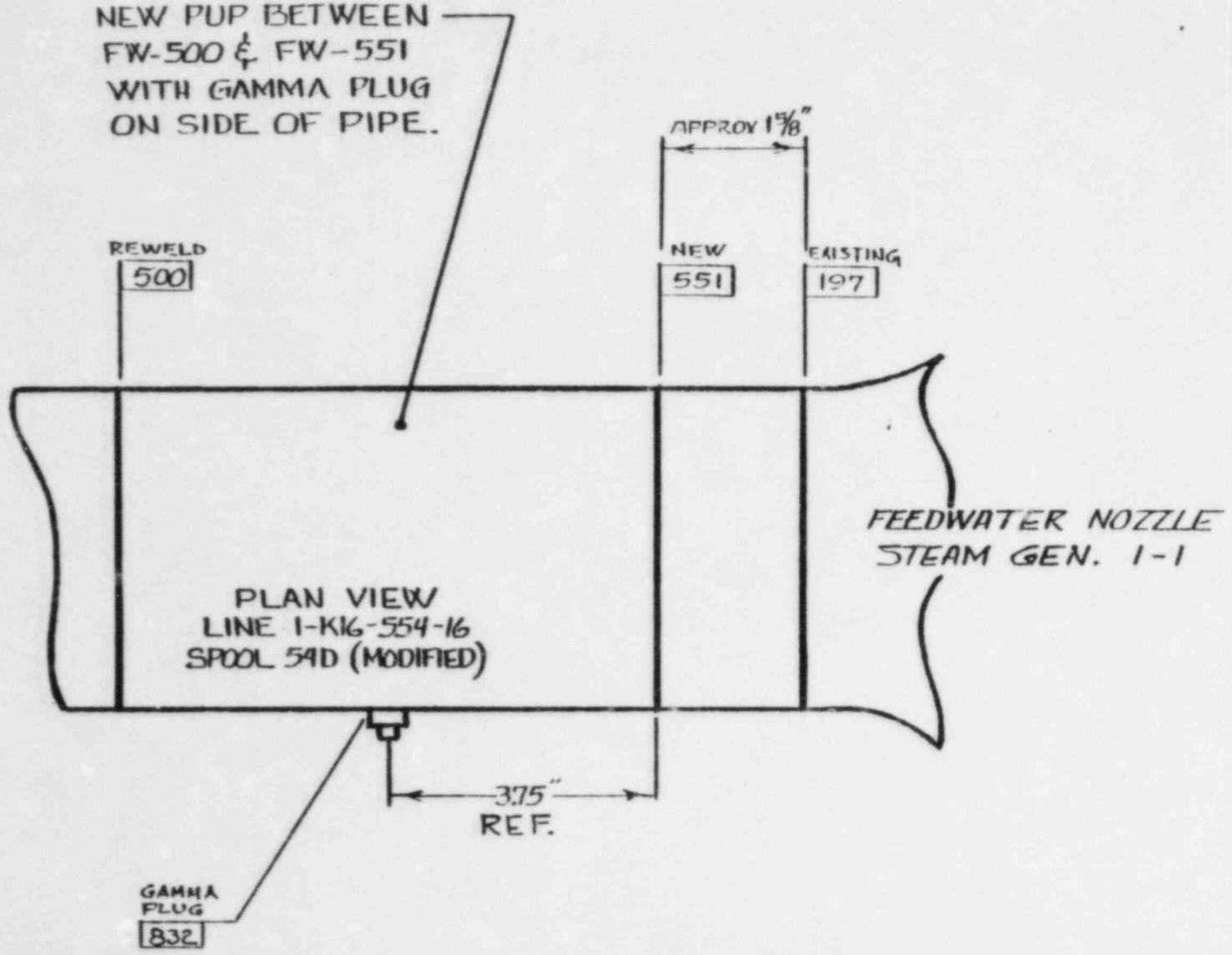
Field Q.A. Manager

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector ( )

ATTACH SKETCH IF NECESSARY



DR 3484 SKETCH 1



DR 3484 SKETCH 2

INTEROFFICE CORRESPONDENCE

TO J. P. RUNYAN, FIELD Q.A./Q.C. MANAGER DATE OCTOBER 12, 1977

FROM D. R. GESKE, N.D.E. SUPERVISOR

SUBJECT LIQUID PENETRANT EXAMINATION, F.W. 197, INSIDE DIAMETER

On October 11, 1977, the inside diameter of F.W. 197 was Liquid Penetrant examined per Step #9 of D.R. 3484. The following indications were noted. All dimensions refer to a clock-wise direction beginning at the top (12 o'clock) of the nozzle.

1. 8" clock-wise: 15" of mis-match with root pass roll over on the nozzle side.
2. 8" clock-wise: 1 3/4" of heavy roll over on the nozzle side and slight roll over on the pipe side. (Previous re-work in this area removed drop-through with voids.)
3. 16" clock-wise: 1" of undercut on the pipe side of the root pass.
4. 18" clock-wise: 1" of undercut on the pipe side of the root pass.
5. 41" clock-wise: 3/16" crack-like linear on the land surface of the counter-bore 3/16" from the root edge, pipe-side.
6. 41¼" clock-wise: 1/8" crack-like linear on the land surface of the counter-bore 5/32" from the root edge, pipe-side.
7. 41" clock-wise: 1/16" lack of penetration at the window close area.
8. 46½" clock-wise: 1 1/2" of heavy drop-through with root pass roll over on both sides of the root.
9. The entire pipe-side counter-bore has been rough ground to facilitate fit-up.

RECOMMENDED REWORK

1. Liquid Penetrant examine to redevelop the noted condition.
2. Grind and polish the root pass. Flush with the base metal from 8" clock-wise for 15", 41" clock-wise at window close, and 46½" clock-wise for 1 1/2". (Indications 1, 2, 3, 4, 7 and 8.)

ATTACHMENT #3

TO: J. P. RUNYAN, Q.A./Q.C. MANAGER DATE OCTOBER 12, 1977

SUBJECT: LIQUID PENETRANT EXAMINATION, F.W. 197, INSIDE DIAMETER

3. Grind and polish the land surface to remove the two (2) linear indications in the land area of the counter-bore. (Indications 5 and 6.) DO NOT REMOVE MORE THAN .010" OF BASE METAL.

   NOTE: If the crack-like linears join and grow, versus reduce in size and remove, suspend grinding and report the findings.

4. Polish the entire pipe-side counter-bore to eliminate rough grind edges. DO NOT remove more than .010" of base metal.

5. Liquid Penetrant examine all grind areas to redevelop indications, i.e. remaining undercut (Indications 3 and 4) and lack of penetration at the window close area (Indication 7).

6. Grind and polish to remove the remaining indications.
   DO NOT REMOVE MORE THAN .010" OF BASE METAL.
   NOTE: If the indications grow, versus reduce and remove, suspend grinding and report the findings.

7. Determine the remaining wall thickness using ultrasonic thickness measuring methods and report the findings.

8. Upon completion of rework, proceed with Step #10 of D.R. 3484 or revise D.R. 3484 to indicate further required rework.

Donald R Geske

Donald R. Geske
N.D.E. Supervisor

DRG/js

OK
GPK
10/12/77

TO: J. P. RUNYAN, Q.A./Q.C. MANAGER

DATE OCTOBER 12, 1977

SUBJECT: LIQUID PENETRANT EXAMINATION, F.W. 197, INSIDE DIAMETER

3. Grind and polish the land surface to remove the two (2) linear indications in the land area of the counter-bore. (Indications 5 and 6.) ~~DO NOT REMOVE MORE THAN TOTAL OF .010"~~ REMOVAL OF .010" DID NOT REMOVE LINEARS, CONTINUE TO GRIND FOR REMOVAL. DO NOT REMOVE BELOW MINIMUM WALL REQUIRED.
   NOTE: If the crack-like linears join and grow, versus reduce in size and remove, suspend grinding and report the findings.

4. Polish the entire pipe-side counter-bore to eliminate rough grind edges. DO NOT remove more than .010" of base metal.

5. Liquid Penetrant examine all grind areas to redevelop indications, i.e. remaining undercut (Indications 3 and 4) and lack of penetration at the window close area (Indication 7).

6. Grind and polish to remove the remaining indications.
   DO NOT REMOVE MORE THAN .010" OF BASE METAL.
   NOTE: If the indications grow, versus reduce and remove, suspend grinding and report the findings.

7. Determine the remaining wall thickness using ultrasonic thickness measuring methods and report the findings.

8. Upon completion of rework, proceed with Step #10 of D.R. 3484 or revise D.R. 3484 to indicate further required rework.

Donald R Geske

Donald R. Geske
N.D.E. Supervisor

DRG/js

OK

INTEROFFICE CORRESPONDENCE

TO J. P. Runyan, Q.A./Q.C. Manager DATE October 14, 1977

FROM D. R. Geske, N.D.E. Supervisor

SUBJECT Result of Rework, F.W. 197 Inside Diameter

On October 12, 1977, the inside diameter of F.W. 197, Steam Generator 1-1 was reworked per Attachment #3 to D.R. 3484. At the end of shift, the rework had not been completed. The following indications remained.

1. 8" clock-wise from top center of the nozzle, 10" of root pass edge fusion line with slight weld metal remaining above the weld metal.

2. 41" clock-wise from top center of the nozzle, 3/16" linear on the pipe-side counter-bore. The original indication moved 1/32" laterally away from the weld. Tentative interpretation was the open edge of a non-metallic inclusion in the pipe.

3. 41 1/4" clock-wise from top center of the nozzle, 1/8" linear on the pipe side counter-bore. The original indication moved 3/32" laterally away from the weld. Tentative interpretation was the open edge of a non-metallic inclusion in the pipe.

On October 13, 1977, the indications listed above were further reworked. Weld metal was reduced to minimum wall, .566", to eliminate the 10" root pass edge fusion line. In addition, the area of non-metallic inclusion was explored ultrasonically. The following are results of rework.

1. 41" to 41 1/4" clock-wise: two non-metallic inclusions .600" from the O.D. surface, parallel to the surface. The edge of each inclusion was exposed as a result of counter-bore machining. Total surface measures 5/8" x 3/16" with the longest dimension parallel to the weld.

2. 14 1/2" clock-wise: one linear indication 5 3/8" long, in the land surface of the nozzle, 1/16" from the original root pass weld metal. Observation, during weld metal removal and physical measurement, revealed that this indication was hidden by root pass roll over during the first penetrant examination.

3. Pipe side counter-bore surface was not reworked. Rough grind edges and machining lines remain.

ATTACHMENT #4

TO: J. P. Runyan, Q.A./Q.C. Manager DATE October 14, 1977

SUBJECT: Result of Rework, F.W. 197 Inside Diameter

Upon reaching minimum wall thickness with indication remaining, rework was suspended and a Q. A. Hold tag applied.

RECOMMENDED REWORK

1. Grind to remove the 5 3/8" linear indication 14 1/2" clock-wise from top center of the nozzle. Re-weld the ground-out to original weldment configuration.

2. Grind to remove the two non-metallic inclusions measure remaining wall thickness. Weld out to original wall thickness if required and grind to original configuration of the counter-bore.

3. Grind and polish the pipe-side counter-bore to eliminate rough grind edges and machining lines.

4. GRIND AND POLISH ROOT WELD FLUSH WITH PIPE/NOZZLE I.D. JBB 10-17-77

Donald R. Brake

Donald R. Beske
N.D.E. Supervisor

DRG/jf

OK
JPR

INTEROFFICE CORRESPONDENCE

TO J. P. RUNYAN, FIELD Q.A./Q.C. MANAGER DATE OCTOBER 19, 1977

FROM D. R. GESKE, N.D.E. SUPERVISOR

SUBJECT REWORK OF F.W. 197, INSIDE DIAMETER

D.R. 3484, dated October 7, 1977, directed entry into line K16-554-16" approximately 1 5/8" on the pipe-side of F.W. 197. Entry was required to facilitate an internal inspection of the piping to nozzle weldment, identified as F.W. 197.

Entry into the line was completed on October 11, 1977, and the initial inspection was conducted using Liquid Penetrant methods per ESD-211. The inspection revealed conditions requiring rework. These conditions were added to the D.R. by means of Revision 1.

On October 12, 1977, P.G.&E. released the recommended rework noted in Revision 1 to D.R. 3484. The rework was released with a modification "Do not remove more than .010" of base metal". Rework actions were begun. Two (2) linear indications in the pipe-side land surface of the counter-bore were not removed with removal of .010" of base material. P.G.&E. further modified Revision 1 to D.R. 3484 on October 12, 1977, by indicating "Removal of .010" did not remove linears. Continue to blend for removal. Do not remove below minimum wall requirements". At the end of shift, the rework had not been completed.

On October 13, 1977, the remaining indications were further reworked. Pipe and weld wall thickness was reduced to minimum wall (.566") and both linears in the pipe-side counter-bore were explored ultrasonically. Results of these actions were added to D.R. 3484 with Revision 2 on October 14, 1977.

Rework was continued on October 17, 1977, based upon D.R. 3484, Revision 2. Further grinding of weld metal removed all of the existing indications except the pipe-side rough grind and machine lines. Wall thickness at the 5 3/8" linear was reduced to .350" with .520" at the non-metallic inclusions. Revision 2 to D.R. 3484 was then modified by P.G.&E. to include "Grind and polish root weld flush with pipe/nozzle I.D." Rework continued until end of shift.

Liquid Penetrant examination was conducted on October 18, 1977, after preliminary grind and polish of root pass removal and pipe-side counter-bore rough grind edges and machining lines. The examination revealed the following conditions:

1. 17" from top center of the nozzle - 4 1/2" x 1/8" area of a fine network of linears on either side of the weld centerline. These two networks were located in the base metal on the face of each counter-bore.

TO: J. P. RUNYAN, FIELD Q.A./Q.C. MANAGER DATE OCTOBER 19, 1977

SUBJECT: REWORK OF F.W. 197, INSIDE DIAMETER

2. 31" from top center of the nozzle - 2 1/2" fine linear on either side of the root pass removal area.

Both conditions noted above were reported by telephone. Further rework was stopped pending review by P.G.&E.

The areas in question were examined by a representative from P.G.&E. Mechanical, P.G.&E. D.E.R. and Westinghouse on October 18, 1977. Instruction from P.G.&E. Mechanical was to remove the indications by grind and polish. Further discussion resulted in instruction to proceed under the existing revision to D.R. 3484. Rationale applied was that the two (2) linears at 31" was part of root pass removal and the network of linears at 17" was part of the rough grind clean-up action.

Rework of the inside surface continued to the end of shift. All noted indications were removed and a preliminary Liquid Penetrant examination verified removal.

Liquid Penetrant examination per ESD-211 was re-applied on October 19, 1977. Examination revealed all previously noted discontinuities were removed and rework was concluded. Ultrasonic thickness measurements of remaining wall indicated average wall in the flush grind areas is .580". Grind areas are as follows:

1. 8" clock-wise from top center of the nozzle a 10" crescent groove .350" of remaining wall.

2. 31" clock-wise from top center of the nozzle a 2 1/2" crescent groove .420" of remaining wall.

3. 41" clock-wise from top center of the nozzle a 2" rounded grind-out .520" of remaining wall.

On October 19, 1977, rework of F.W. 197 inside surface was continued per D.R. 3484, Revision 2, Step #9A, Item 4.

Donald R Geske

D. R. Geske
N.D.E. Supervisor

DRG/js

Attachment - D.R. 3484,Rev. 2

THE M.W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED

LIQUID PENETRANT EXAMINATION RECORD

DATE 10-19-77

ISO/DWG NUMBER 500146A (DR 3484, Rev 2) "F" SHEET N/A

JOINT NUMBER FW-197 (INSIDE SURFACE AFTER GRIND OUT) JOB NO. 7177

MATERIAL 16" C.S. TO STEAM GENERATOR 1-1 NOZZLE

EXAMINATION PROCEDURE KPT- 8711 ESD- 211

ACCEPTANCE STANDARDS ASME SECTION III

LIQUID PENETRANT-BRAND MAGNAFLUX DYE CHECK

LIQUID PENETRANT BATCH NUMBER CLEANER 6J004 PENETRANT 2L095 DEVELOPER SM113

☒ ACCEPTED ☐ REJECTED Donald A Burke
SIGNATURE OF INSPECTOR

MAGNETIC PARTICLE EXAMINATION RECORD

DATE

/DWG NUMBER "F" SHEET N/A

JOINT NUMBER FW- JOB NO. 7177

MATERIAL CARBON STEEL

EXAMINATION PROCEDURE KMT- 8711 ESD-

ACCEPTANCE STANDARDS ASME

MAGNETIC PARTICLE POWDER BRAND MAGNAFLUX

MAGNETIC PARTICLE POWDER COLOR RED (8A)

COLOR OF COMPONENT METALLIC

INDICATIONS
Linear
Round
Aligned

☐ ACCEPTED ☐ REJECTED

THE H. W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED
POWER PIPING

PAGE

RADIOGRAPHIC INSPECTION REPORT

JOB NO. 7177 ☐ SHOP ☑ FIELD

DATE 10-19-77

CUSTOMER	DESCRIPTION	MATERIAL SPEC.
S. C. E.	500146 A FEEDWATER	K16-554

MATERIAL THICK	MATERIAL DIAMETER	ACCEPTANCE STANDARD	WELDING SPECIFICATION	TYPE SEAM
.580	16"	B31.1	ESD 207 · KRT-2	BUTT

SOURCE	DIA. & LENGTH	CURIES	DISTANCE	TIME	INITIAL UNSHARPNESS	FILM TYPE	FILM SIZE	FILM TECHNIQUE
Ir 192	10 x 10	84	8"	20 sec.	—	T	4½ X 17	☐ SINGLE ☒

KV	MA	DISTANCE	TIME	FOCAL SPOT SIZE	FILM PROCESSING	INTERPRETED
					Hand Tank @ 68° F	GESKE ASNT Level II

FITTING, SEAM OR JOINT NUMBER	FILM INTERVAL NUMBER	PENETRAMETER	ACCEPT.	REJECT	SLAG	POROSITY	CRACK	LACK OF PEN.	LACK FUSION	UNDERCUT	SURFACE	SHRINK	HOT TEAR	SAND	CHAPLETS	DATE FILM EXPOSED	REMARKS -SINGLE VIEWING-	INT. TA
FW197	0-1-2	INFO	✓			¼c										10-19-77	PIPE HOT 300°F	DGESK
RI TZ.	2-3-4	|	✓			¼c												
	4-5-6	|	✓		¼c	¼c											CLUSTER AT #6 ACCEPTABLE.	
	6-7-0	✓	✓			¼c												

NOTE: WELDMENT SHOT WHILE AT 300°F FOR INFORMATION ONLY PER DR 3484, REV 2.

Donald R Geske
10-19-77

APPROVED BY:		
M.W.K.	CUST.	ALTD. INS.

THE M.W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED

LIQUID PENETRANT EXAMINATION RECORD

DATE _____

ISO/DWG NUMBER _____ "F" SHEET N/A

JOINT NUMBER FW- _____ JOB NO. 7177

MATERIAL _____

EXAMINATION PROCEDURE KPT- 8711 ESD-

ACCEPTANCE STANDARDS ASME

LIQUID PENETRANT BRAND MAGNAFLUX DYE CHECK

LIQUID PENETRANT BATCH NUMBER CLEANER _____ PENETRANT _____ DEVELOPER _____

☒ ACCEPTED ☐ REJECTED _____
SIGNATURE OF INSPECTOR

MAGNETIC PARTICLE EXAMINATION RECORD

DATE 10-19-77

/DWG NUMBER 500146A (DR 3484, REV 2) "F" SHEET N/A

JOINT NUMBER FW-197 (INSIDE SURFACE AFTER WELD-OUT) (300°A). JOB NO. 7177

MATERIAL CARBON STEEL

EXAMINATION PROCEDURE KMT- 8711 ESD- [redacted] 247 Dtd 10-28-77

ACCEPTANCE STANDARDS ASME SECTION I

MAGNETIC PARTICLE POWDER BRAND MAGNAFLUX

MAGNETIC PARTICLE POWDER COLOR RED (8A)

COLOR OF COMPONENT METALLIC

INDICATIONS
Linear
Round
Aligned

NOTE: COIL METHOD WAS USED.
Dtd 10-28-77

☒ ACCEPTED ☐ REJECTED Gerald R. Gates

EXHIBIT 10 TO ATTACHMENT 1 KN

10 CFR-21 (IS) or (IS NOT) ATTACHED ?/?

Pullman Power Products

DISCREPANCY REPORT

D.R. NO. 4662
ISO. NO. 500146
UNIT NO. 1
CODE NO. 8

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 11-8-82 RGK

PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: B. Hudson/MacCrae

DISCREPANT ITEM: ESD-246 and ESD-247 - Magnetic Particle Procedure/ Dry/Continuous Coil Method not per Spec 8711

EXPLANATION OF DISCREPANCY:

Internal Audit #101, A.A.R. #1, identified that there was no Procedure Qualification Record or ESD-246 and ESD-247.

Subsequent investigation has revealed that ESD-247 was used to MT examine the inside iameter of FW #197, Iso #500146, Steam Generator 1-1, DR #3484, on two occasions (see attached xamination records) ESD-247 is listed on DR #3453 as well, under Recommended Disposition and s suspected to have been used (there is no: examination record with the D.R.) to MT examine he inside diameter of FW #244, Iso #500146, Steam Generator 1-4. The welds in question are on ines K16-554-16 IV and K16-556-16 IV, both Seismic Class 1 code.

The use of ESD-247 on Seismic Class 1 pipe without a Procedure Qualification Record is a onconformance to Contract Specification 8711 Section 3 Table I and Notes to Table I, Section Paragraph 3.23, Section 5 Paragraph 1.2, Section 2 Paragraph 2.1 and Section 3 Paragraph 1.4.

--CONTINUED ON PAGE 2 OF DISCREPANCY REPORT--

ECOMMENDED DISPOSITION: INDICATE APPROVAL BY CIRCLING THE APPROPRIATE "RECOMMENDED DISPOSITION"

(1.) Accept-as-is all work examined by ESD-247

(2.) File a copy of this D.R. in the following locations:

A. Document package for Iso #500146 FW 197 and original DR 3484

B. Document package for Iso #500146 FW 244 and original D.R. 3453

C. Originals of ESD 246 and 247

OR

X 3. P.G.&E. to disposition

PG&E G.C. QUALITY CONTROL
REVIEWED T.E. Quinn
DATE 12/9/83

oroved By P.P. Field C.A. Mgr. B Kamen Date 11/29/82 Customer M.J. Angell Date 2/9/83

NAL DISPOSITION: ☒ In Accordance With Above #1 & #2 ☐ Other (explanation and approval required))

rk Completed Insp: B Kamen Date: 2/14/83 Work Completed Insp: _____ Date: _____

PLANATION (IF NECESSARY):

P.P. Field C.A. Manager _____ Date _____ Customer _____ Date _____

TO PREVENT RECURRENCE ☒ Not Applicable

A/QC Manager shall assure that N.D.E. procedures have the necessary Procedure Qualification ecords performed and included as part of the procedure prior to submitting to P.G.&E. for pproval.

Field C.A. Manager B Kamen 11/29/82

STRIBUTION: ☒ Master C.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other _____

Pullman Power Products

10 CFR-21
(IS) or (IS NOT)
ATTACHED

DISCREPANCY REPORT

D.R. NO.
ISO. NO. 50146
UNIT NO. 1
CODE NO. 1-

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 11-8-82
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: [illegible]

Generator 1-4. The weld on lines K16-554-16IV and K16-556-16IV, both Seismic Class I lines. The weld on ESF 247 on Seismic Class I pipe which is a Procedure Qualification Record is a nonconformance to Contract Specification 8711 Section 3 Table I and Notes to Table I, Section 4.3.2.3, Section 5.1.2 Section 2.2.1 and Section 3.1.4

THE M.W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED

LIQUID PENETRANT EXAMINATION RECORD

DATE _____

ISO/DWG NUMBER _____ "F" SHEET N/A

JOINT NUMBER FW- _____ JOB NO. 7177

MATERIAL _____

EXAMINATION PROCEDURE KPT- 8711 ESD-

ACCEPTANCE STANDARDS ASME

LIQUID PENETRANT BRAND MAGNAFLUX DYE CHEC

LIQUID PENETRANT BATCH NUMBER CLEANER PENETRANT DEVELOPER

☐ ACCEPTED ☐ REJECTED

SIGNATURE OF INSPECTOR

MAGNETIC PARTICLE EXAMINATION RECORD

DATE 10-19-77

/DWG NUMBER 500146A (DR 3484, REV 2) "F" SHEET N/A

JOINT NUMBER FW-197 (INSIDE SURFACE AFTER WELD-OUT) (300°A) JOB NO. 7177

MATERIAL CARBON STEEL

EXAMINATION PROCEDURE KMT- 8711 ESD- [redacted] 247 Dtd 10-28-77

ACCEPTANCE STANDARDS ASME SECTION I

MAGNETIC PARTICLE POWDER BRAND MAGNAFLUX

MAGNETIC PARTICLE POWDER COLOR RED (8A)

COLOR OF COMPONENT METALLIC

INDICATIONS
☒ Linear
☐ Round
☐ Aligned

NOTE: COIL METHOD WAS USED- Dtd 10-28-77

☒ ACCEPTED ☐ REJECTED

Donald R Lake

SIGNATURE OF INSPECTOR

THE M.W. KELLOGG COMPANY
A DIVISION OF PULLMAN INCORPORATED

LIQUID PENETRANT EXAMINATION RECORD

DATE _____

SO/DWG NUMBER _____ "F" SHEET N/A

JOINT NUMBER FW- _____ JOB NO. 7177

MATERIAL _____

EXAMINATION PROCEDURE KPT- 8711 ESD-

ACCEPTANCE STANDARDS ASME

LIQUID PENETRANT BRAND MAGNAFLUX DYE CHECK

LIQUID PENETRANT BATCH NUMBER CLEANER PENETRANT DEVELOPER

☐ ACCEPTED ☐ REJECTED _____ SIGNATURE OF INSPECTOR

MAGNETIC PARTICLE EXAMINATION RECORD

DATE 10-20-77

SO/DWG NUMBER 500146A (DR 3484) "F" SHEET N/A

JOINT NUMBER FW- 197 (INSIDE SURFACE AFTER WELD) JOB NO. 7177

MATERIAL CARBON STEEL

EXAMINATION PROCEDURE KMT- 8711 ESD- 247

ACCEPTANCE STANDARDS ASME SECTION I

MAGNETIC PARTICLE POWDER BRAND MAGNAFLUX

MAGNETIC PARTICLE POWDER COLOR RED (8A)

COLOR OF COMPONENT METALLIC

INDICATIONS
Linear
Round
Aligned

☒ ACCEPTED ☐ REJECTED Donald R Burke SIGNATURE OF INSPECTOR

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 Rev. 1 Rev.
ISO. NO. 500146 Sht. 4 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. 1

EXPLANATION OF DISCREPANCY: Reference P.G.&E. Drawing 500146, Rev. 98

Per P.G.&E.'s request, an internal inspection of F.W. 244 on Steam Generator 1-4 Feedwater Nozzle will be performed. The line entry will be made in the following manner, see Recommended Disposition.

FOR INFORMATION ONLY

RECOMMENDED DISPOSITION:

1. Measure 2" from F.W. 244 center upstream on pipe (Spool Piece 500) circumscribe the pipe using a wrap around, then prick punch the scribe line.
2. Using air-arc, cut the pipe all around maintaining less than a 40° total bevel to within approximately 1/8" from the I.D. (See Sketch #1).
3. Using a thin blade grinder, cut through the center of the bevel, then dress up both bevels (See Sketch #1).
4. Jack pipe away from cut on upstream side per Superintendent's instruction. Install a dam in nozzle beyond F.W. 244 to prevent air from entering Steam Generator.
5. Clean and inspect F.W. 244 internally as directed by P.G.&E.

(Con't on Page 2)

Approved By: M.W.K. Field Q.A. Mgr. J.P. Runyan Date 8/26/77 Customer R.D. Etzler MVIR 3553 Date 8/29/77

FINAL DISPOSITION: ☒ In Accordance With Above
Work Completed Insp. A.B. Burke Date: 11-2-77

☒ Other (explanation and approval required))
Work Completed Insp. A.B. Burke Date: 11-2-77

EXPLANATION (IF NECESSARY):
Revision 1 - Delete Step 6 in its entirety (access was achieved). Refer to Attachment #1 for results of initial inspection and recommended disposition.
Revision 2 - See Page 3 of 3 and Attachment #3.

DEVIATION 244

Rev #2 J.P. Runyan 9/7/77 R.D. Etzler 9-26-77
Rev #1
M.W.K. Field Q.A. Manager J.P. Runyan Date 8/31/77 Customer R.D. Etzler MVIR 3553-R1 Date 8/31/77

STEPS TO PREVENT RECURRENCE ☒ Not Applicable JPR

Field Q.A. Manager

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector ( )

ATTACH SKETCH IF NECESSARY

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 Rev. 1 REI
ISO. NO. 500146 Sht. 4 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. 1

RECOMMENDED DISPOSITION: (CON'T)

6. If access to F.W. 244 I.D. cannot be achieved, proceed with alternate instructions (See Sketch #2).

7. Upon completion of inspection, remove dam, grind bevel to facilitate fit-up as needed, clean and fit to ESD-215 and ESD-220.

8. Weld out using F.W. 549 and procedure 4/5.

9. Inspect and NDE to ESD-215 and ESD-206.

10. Add all information to process sheet and isometrics.

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector ( )

THE M.W. KELLOGG COMPANY

A DIVISION OF PULLMAN INCORPORATED

D.R. NO. 3453 REV 2
ISO. NO. 500146 Sht. 4 of 5
UNIT NO. 1
CODE NO. N/A

DISCREPANCY REPORT

CUSTOMER: Pacific Gas & Electric SPEC. NO: 8711 DATE: 8-26-77
PROJECT: Diablo Canyon JOB NO.: 7177 INSPECTOR: Runyan/Scannell/Guest

DISCREPANT ITEM: Line K16-556-16"; Spool Piece 500; El. 154'-4½"; Area G; Sect. 1

D.R. 3453, Revision 2

EXPLANATION OF DISCREPANCY:

During the performance of grinding per D.R. 3453, Revision 1, Step #5, four (4) indications of heavy drop through with roll over were removed along with all of the existing root penetration. Re-inspection revealed a linear indication 1" long on the fusion line to the Feedwater Nozzle. Further grinding, to a maximum depth of .110", removed the linear indication (see Attachment #3).

FOR INFORMATION ONLY

RECOMMENDED DISPOSITION:

Add the following to Step #5 and delete original Steps #7, 8, 9 and 10. Perform the following repair:

A. Grind the bevels to facilitate Fit-Up of F.W. 549.
B. M.T. I.D. of F.W. 244 using ESD-247 coil method, and clean grooved root pass at F.W. 244 per ESD-215.
C. Remove the dam from the nozzle at F.W. 244.
D. Preheat F.W. 244 to a minimum of 250°F, interpass not to exceed 550°F maximum. Maintain this preheat until stress relief begins.
E. Weld to procedure 200 (F.W. 244 R1), using E70S2 wire with the GTAW process, to conform to blended configuration of the balance of the weld. I.D. ONLY
F. Grind and polish the added weld metal to blend with base metal surfaces.
G. Inspect and NDE to ESD-215 and PGE DER TO PERFORM L.P. AT PREHEAT-TEMP., & FURNISH MWK WITH COPY OF PGE CERT.

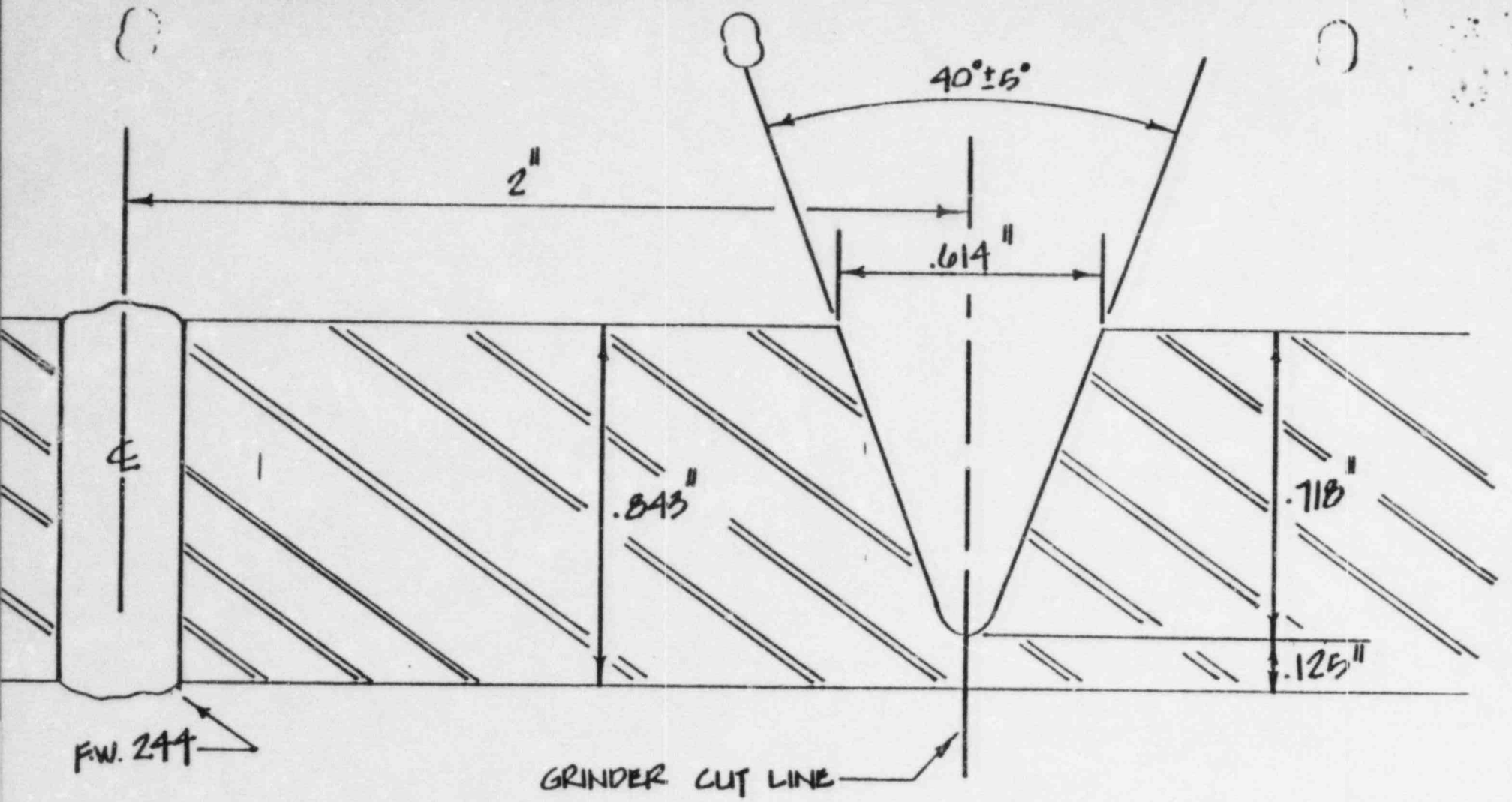
NOTE: Proceed with D.R. 3456, and X-ray weld, hot, for information only.

7. Upon completion of inspection, remove dams from F.W. 549 pipe side, clean and fit F.W. 549 to ESD-215 and ESD-220.
8. Weld out using F.W. 549 with procedure 4/5 A.O.
9. Grind F.W. 549 for X-ray.
10. Inspect and NDE F.W. 549 to ESD-215 & PGE DER TO PERFORM L.P. AT PREHEAT-TEMP., & FURNISH MWK WITH COPY OF PGE CERT. 9/30/77 11AM

NOTE: X-ray weld hot for information only.

11. Stress relieve at F.W. 244 R1 and F.W. 549 1100°F to 1150°F per ESD-218.
12. NDE F.W. 244 R1 and F.W. 549 to ESD-207.
13. " " " " to ESD-211 9/30/77
14. Add INFORMATION TO PROCESS SHEETS.

DISTRIBUTION: ☒ Master Q.A. File ☒ Auth. Insp. ☒ Engineering Dept. ☐ Other
☒ Customer ☐ Receiving ☐ Field Inspector



3X ACTUAL SIZE

DR-#3453
SKETCH #1

ALTERNATE INSTRUCTIONS

1. Cut out F.W. 509 using air-arc and taking necessary steps to maintain the ability to bevel the 45° ell side of the weld to 20° ± 2½° and a 3/32" ± 1/16" land. Also, cut out F.W. 339 shown on Iso. 3-246.

2. Requisition: 8 5/8" ± of 16" Pipe, Schedule 80 A106 Gr B and a 3/4" 3000# S.W. Half Coupling or soc-o-let A105.

3. Install the 3/4" half coupling or soc-o-let four (4) inches from the end of the 16" pipe.

4. Clean and Fit to ESD-215 and ESD-220.

5. Weld out with procedure 92/93 (F.W. 831).

6. Inspect and NDE to ESD-215 and ESD-211.

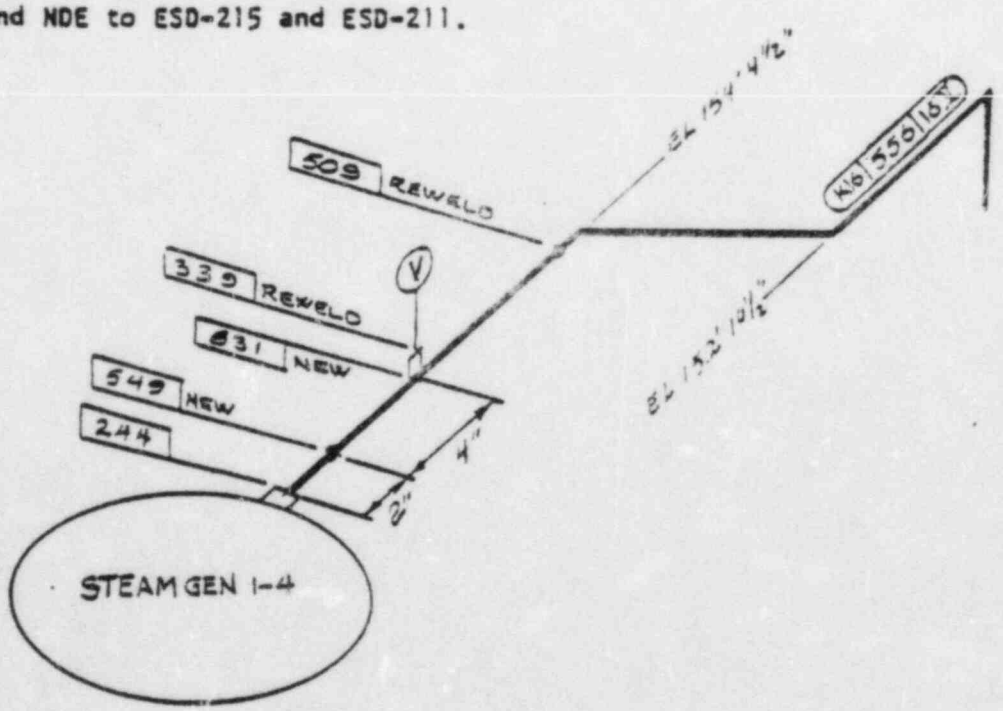
7. Upon completion of F.W. 244 I.D. inspection and P.G.&E.'s direction, fit-up 16", Schedule 80 pipe and proceed with Step 7 of attached D.R. using F.W. 549 and F.W. 509.

8. Reweld F.W. 339, as shown on Iso. 3-246, maintain original line configuration.

9. Clean and Fit-up to ESD-215 and ESD-220.

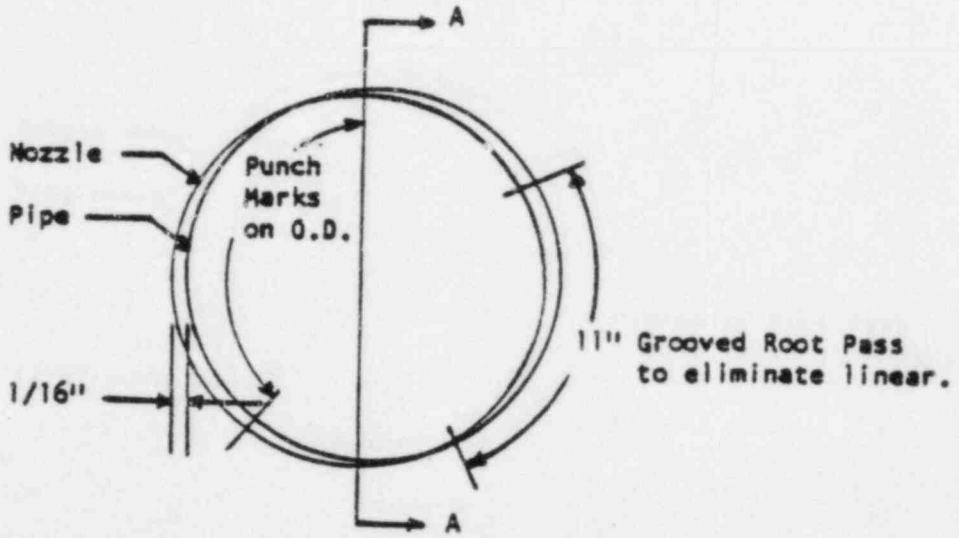
10. Weld out with procedure 92/93.

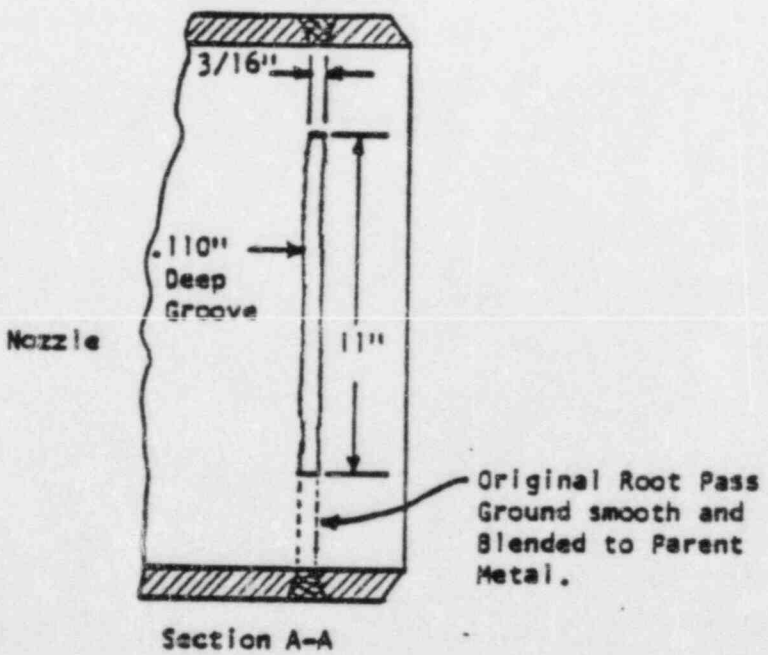
11. Inspect and NDE to ESD-215 and ESD-211.



SKETCH #2
DR 3453

Findings at F.W. 244





Section A-A

NOTE: Average Wall Thickness = .580" to .600"
Remaining Wall At Groove = .450"
Punch Marks On The O.D. = .047" Deep
(Punch Marks are directly on the fusion line of F.W. 244 to 1/8" inside the fusion line .047" deep.)

INTEROFFICE CORRESPONDENCE

ATTACHMENT #1
DR-3453 Rev. 1

TO J. P. RUNYAN, Q.A./Q.C. MANAGER

DATE AUGUST 31, 1977

FROM D. R. GESKE, NDE SUPERVISOR

SUBJECT LIQUID PENETRANT EXAMINATION, F.W. 244, INSIDE DIAMETER

On August 31, 1977, F.W. 244, Line K16-556, Isometric 1-03-500146, Feedwater piping to Steam Generator 1-4 Nozzle, was liquid penetrant examined on the inside diameter.

The following indications were noted:

1. 2" from top center of nozzle, a small faint transverse linear-nonrelevant due to weld geometry.
2. 7" from top center of nozzle, heavy 1" drop through with roll over.
3. 9" from top center of nozzle, heavy 2" drop through with roll over.
4. 37" from top center of nozzle, heavy 1½" drop through with roll over.
5. 39" from top center of nozzle, heavy 1/2" drop through with wire protrusion.
6. Approximately 1/16" mismatch exists from 7:00 to 9:00 facing the nozzle.

We recommend that the root pass be ground and polished to blend with base metal surfaces. Particular care should be taken to avoid the removal of base material. Then re-examine the I.D. with liquid penetrant, if acceptable, proceed to "Recommended Disposition", Step 7 of D.R. 3453, Revision 1.

Donald R Geske

Donald R. Geske
NDE Supervisor

DRG/js

Response to Internal Audit #101, A.A.R. #1

A procedure qualification was performed in order to qualify ESD-247 as well as ESD-246 (ref. Internal Audit #101, A.A.R. #1).

As both ESD-246 and 247 have been withdrawn from use and the equipment listed in both procedures is no longer available for use, the equipment used for these PQR's was the Magnaflux Model P-90 for the coil technique only. All other factors are the same as specified in the procedures.

As the Magnaflux Model P-90 puts out less amperage than the equipment listed in ESD-246 and ESD-247, and acceptable results were obtained (i.e; I.D. and O.D. surface and I.D. subsurface indications were located), the demonstration of this technique is deemed adequate to approve this method employed by the equipment listed in the above procedures.

A record of the procedure qualification demonstration is hereby submitted along with this response. The originals will be filed with the applicable procedures.

In the event that either or both procedures are re-activated in the future, they will be revised to incorporate the Magnaflux Model P-90 into the list of equipment. As both procedures are currently withdrawn from use, no revision is deemed necessary at this time.

Michael S. MacCrae

Michael S. MacCrae
MT Level III
11-9-82

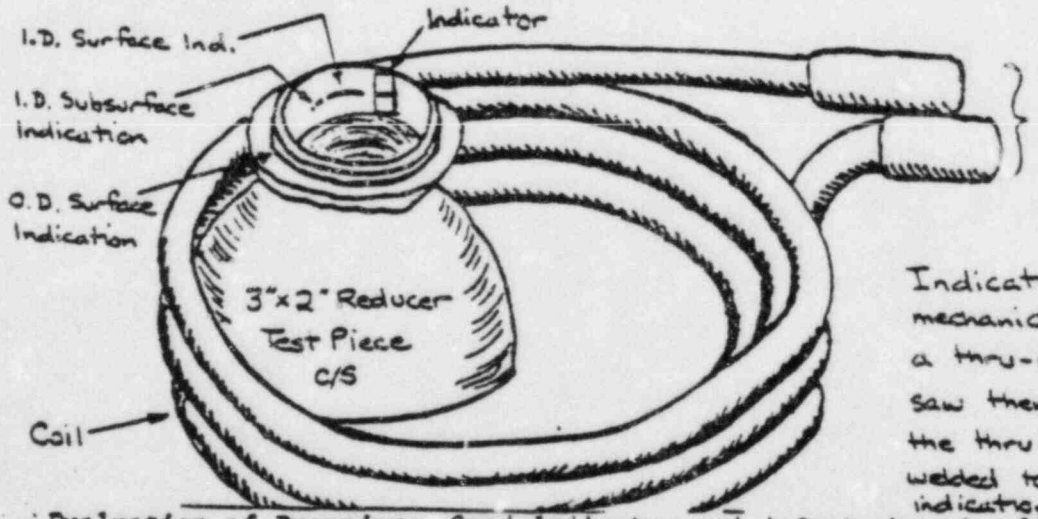
ENGINEERING | SPECIFICATION – | SPEC. NO. 8711

ENGINEERING DEPARTMENT | ES D-246

MAGNETIC PARTICLE PROCEDURE QUALIFICATION RECORD

Procedure Qualification No. MT-3

Method Dry Powder Continuous; Half Wave D.C., Coil
Equipment Manufacture Magnaflux Corp.
Brand Name Magnaflux
Model Number P-90
Magnetic Particles: Brand Magnaflux Type Dry Color 8A-Red
Magnetization Current Half Wave Rectified D.C.
Out Put Amperes 1000 Amps.
Test Piece Position Vertical
Test Material Carbon Steel
Type Test Piece 3"x2" Reducer with cut fillet weld at socket end
Surface Condition Bare Metal
Pre-Cleaning Method None
Weather 70° Dry
Base Metal Color Dark Brown and Shiny Metal
Contrast of Particles to Base Metal Good
Method of Particle Application Powder Bulb
Method of Removing Excess Particles Blowing
Demagnetization None
Prod. Spacing and Amperage: 3 Coil Loops of 5 x Pipe Diameter with 1000 Amps.



Coil plugged into Magnaflux Model P- Half-Wave Rectifie DC Current. (110 Volt

Indications are induced mechanical defects made by a thru-wall cut of a band saw then compressed. Part of the thru wall cut was back-welded to produce sub-surface indications.

Evaluation of Procedure Good-Indicator and defect showed well.

Procedure: ☐ Approved ☐ Not Approved

Test Conducted By M. MacCrae 11/9/82
M. S. MacCrae
MT Level III

PREPARED BY M. MacCrae DATE OF ISSUE 11/9/82 PAGE ___ OF ___
DATE OF REV. ___
APPROVED BY ___

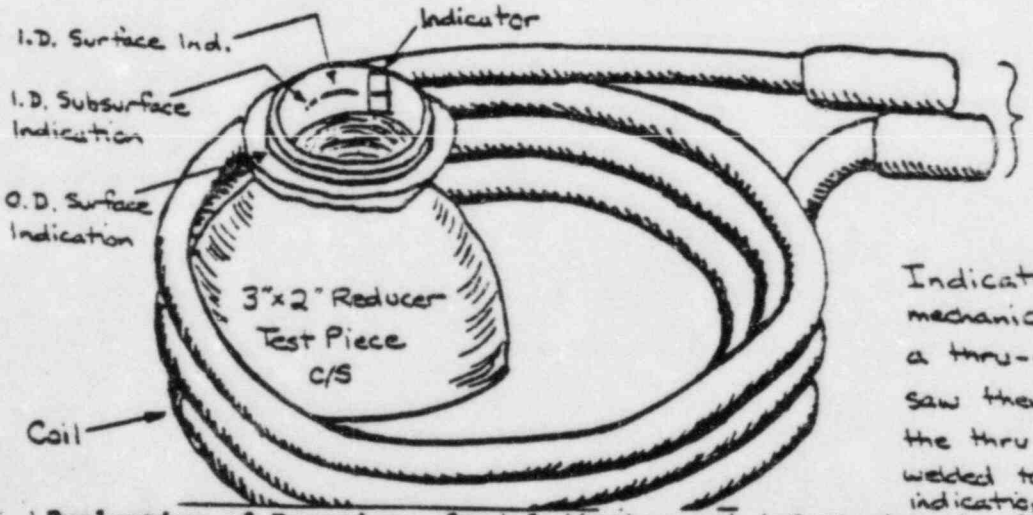
ENGINEERING | SPECIFICATION – | SPEC. NO. 8711

ENGINEERING DEPARTMENT | ES D-247

MAGNETIC PARTICLE
PROCEDURE QUALIFICATION RECORD

Procedure Qualification No. MT-3

Method Dry Powder Continuous; Half Wave D.C., Coil
Equipment Manufacture Magnaflux Corp.
Brand Name Magnaflux
Model Number P-90
Magnetic Particles: Brand Magnaflux Type Dry Color 8A-Red
Magnetization Current Half Wave Rectified D.C.
Out Put Amperes 1000 Amps.
Test Piece Position Vertical
Test Material Carbon Steel
Type Test Piece 3"x2" Reducer with cut fillet weld at socket end
Surface Condition Bare Metal
Pre-Cleaning Method None
Weather 70° Dry
Base Metal Color Dark Brown and Shiny Metal
Contrast of Particles to Base Metal Good
Method of Particle Application Powder Bulb
Method of Removing Excess Particles Blowing
Demagnetization None
Prod. Spacing and Amperage: 3 Coil Loops of 5 x Pipe Diameter with 1000 Amps.



Coil plugged into Magnaflux Model P- Half-Wave Rectifie DC Current. (110 volt

Indications are induced mechanical defects made by a thru-wall cut of a band saw then compressed. Part of the thru wall cut was back-welded to produce sub-surface indications.

Evaluation of Procedure Good-Indicator and defect showed well.

Procedure: ☐ Approved ☐ Not Approved Test Conducted By M. MacCrae 11/9/82

M. S. MacCrae
MT Level III

PREPARED BY M. MacCrae DATE OF ISSUE 11/9/82 PAGE ___ OF ___

APPROVED BY ___ DATE OF REV. ___

CONST. B-48

THE H. K. PORTER COMPANY
A DIVISION OF PULLMAN INCORPORATED

EXHIBIT II TO ATTACHMENT 1

PERSONNEL TESTING RECORD

NAME D. R. GESKE

SUBJECT	LEVEL	GRADE	DATE	EXAMINED BY	RE-EXAMINED BY	GRADE	DA
Radiography	III	92%	8-5-75	[illegible]			
Magnetic Particle	II	98%	8-23-75	[illegible]			
Liquid Penetrant	II	96.6%	10-1-75	[illegible]			
Visual Inspection	II	93.7%	10-1-75	[illegible]			
Welding Inspection	---	---	/				
Radiation Safety	---	---	/				
Ultrasonics	II	97%	11-25-75	[illegible]			
			/				

EXAMINATION GRADES IN PERCENT

SUBJECT	GENERAL EXAM	SPECIFIC EXAM	PRACTICAL EXAM	COMPOSITE
Radiography	93%	90%	P.S.	92%
Magnetic Particle	---	---	---	98%
Liquid Penetrant	100%	90%	93.75%	96.6%
Visual Inspection	100%	80%	100%	93.7%
Welding Inspection				
Radiation Safety				
Ultrasonics	90%	93%	100%	95%

PERCENTILE WEIGHT

SUBJECT	GENERAL EXAM	SPECIFIC EXAM	PRACTICAL EXAM	LEVEL
Radiography	.5	.3	.2	II
Magnetic Particle	.4	.3	.3	II
Liquid Penetrant	.4	.3	.3	II
Visual Inspection	.5	.4	.1	II
Welding Inspection	---	---	---	---
Radiation Safety	---	---	---	---
Ultrasonics	.3	.3	.4	II

ATTACHMENT
2

Affidavit

My name is Charles Stokes. I am submitting this affidavit to the Nuclear Regulatory Commission (NRC) to inform them of material false statements and other evidence of activities which could compromise the quality of the Diablo Canyon nuclear power plant, if it should be turned on. The misconduct involves welding, procedure qualification tests, and plant modifications during the hot functional tests. In my professional judgment, if these issues alone are confirmed as examples of general practices, the plant could not possibly be licensed to go critical under the NRC's legal requirements in 10 C.F.R.

In fact, the practices revealed below and others I have disclosed would even flunk Bechtel's own standards. I am enclosing as Exhibit 1 portions of Bechtel's "Field Engineer Pocket Hanger Reference," Diablo Canyon Project, Bechtel Power Corporation. Bechtel's booklet is not a bad document. Although there are a few minor errors, it describes a reasonable design control and quality assurance (QA) program.

Unfortunately it was not issued on-site before I left. I obtained a copy before distribution was stopped. I can understand why Bechtel didn't want the booklet released. The plant wasn't built at all like the system described in Bechtel's own handbook. The handbook will be discussed in more detail below.

(1) In reply to PG&E's letters no. DCL-84-067 and no. DCL-84-078 concerning welding of A-325 bolts. PG&E contends that "10 supports were identified which used welded A-325 bolt design." That is highly misleading. In reality, there are many more cases where bolts have been used.

Because of inadequate documentation, welded bolts have been used and it is impossible to say whether they are A-325 or A-307 or anything else. Even QA Personnel concedes not knowing. In two specific cases, for which I can provide the support numbers, undocumented bolts were used to connect support members to structural steel.

In my opinion, PG&E's reply is so far from complete that it does not provide accurate information to the NRC concerning the use of A-325, A-307 or other bolts. The two specific supports do not even have a weld symbol describing how they were welded on the drawings. The QA inspector was not able to visually inspect the connection.

(2) A second illustration of deficient documentation for welding bolts is inadequate material traceability. Material was not stamped for traceability back to the Certificates of Compliance as required. The significance of stamping for traceability is that without this traceability there existed no methodology to ensure that the material used in many hangers, or other seismic class one structures, complied with the requirements (e.g., proper metallurgical properties).

In ANSI B31.7 chapter 10723, entitled "Materials," it is stated that "all material shall be clearly identified" by "the applicable material specification and grade, heat number, or heat code of the material, and any additional markings required to facilitate traceability of the reports of the results of all tests and examinations performed on the material." ANSI B31.7 also states that "Certificant of Compliance with the material specifications may be provided <u>in lieu of</u> Certified Material Test Reports unless otherwise required by the design specification." (Emphasis added)

Material traceability is only one aspect of the required traceability. In ANSI B31.7 Para. 1-727.5.3 and Para. 1-727.6, weld traceability is also required. "The welder or welding operator shall identify it as his work by applying his assigned symbol for permanent record in a manner specified by his employer. As an alternative, the employer shall keep a record of the joints and of the welders working the joints." This is also true under ASME Section IX QW-301.3, entitled "Identification of Welders and Welding Operations," which states: "Eace qualified welder and welding operator shall be assigned an identifying number, letter, or symbol by the manufacturer or contractor, which shall be used to identify the work of that welder or welding operator."

In discussions with Pre-inspection Engineers, QC and QA inspectors, some of whom have worked for as long as ten years at Diablo, it is obvious that neither material nor welder traceability was maintained. All that was required was that the "Certificate of Compliance" be provided. This superficial attempt to comply with the requirements of ANSI B31.7 and ASME Section IX does not satisfy the code requirements. This is evidenced by past and present industry practice at other plants across the United States. The abuse of traceability destroys the foundation of a valid Quality Control Program -- accountability and traceability.

Since many of the pre-inspection engineers and QC, QA personnel have never before Diablo worked at a nuclear plant nor other heavy industry construction site nor read ANSI B31.1, B31.7 or ASME Section IX, they worked at Diablo under the false assumption that the work was being performed correctly, and that management was implementing all the necessary directives for them to do their work. Management did not train personnel, nor did they correct this misconception.

Having worked on other nuclear plants, I know the importance of these sections in ANSI B31.7 and ASME Section IX. At other plants almost everything in Class I systems was stamped and logged, and records were kept to insure that traceability was maintained. Per B31.7, "The marking or marking code shall be transferred to all pieces when material is cut to make more than one piece." In my experience at other plants, this was required for all Class I material except miscellaneous material, such as "gaskets, packing, seals, springs, bearings, retaining rings, washers, fluids for hangers, etc." This was not done at Diablo Canyon. The practice of using "non traceable" steel was widespread throughout the plant. At other plants shim stock was not required to be stamped, and I suppose shim stock was considered to be "etc."

B31.7 states in the case of miscellaneous items that "A list of such materials shall be furnished, and such materials do not require certified materials test reports or certificates of compliance as defined in 1-723.1.2." (Emphasis added) Management at Diablo Canyon have failed to provide the chain of documentation which is necessary under 10 C.F.R. 50 before the plant can be operational. Not only did they fail to provide an "up-to-date heat number log," but also failed to publish a list of material that did not have to meet the scrutiny of ANSI B31.7.

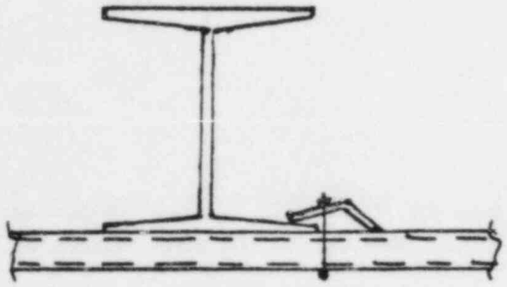
(3) Deficient training reinforced the problems, and perpetuated them. QA inspectors told me that their training consisted of reading ESD 223 for one week and being given a list of suggested reading. This list contained B31.7, B-31.1 and other codes. In one conversation, when I asked if the QC inspectors were required to read the suggested readings, his reply was "no, we only had to know what B31.7 was, not what it says." "I and others thought that these codes had been incorporated into ESD 223 by management." This was, and remains, a wrong assumption. The inspectors undoubtedly performed to the best of their

ability. However, the instruction, training, and practices necessary to adequately perform their functions were deficient. The inspectors only discovered their "wrong beliefs" through discussions with better trained, more experienced inspectors from companies other than PG&E.

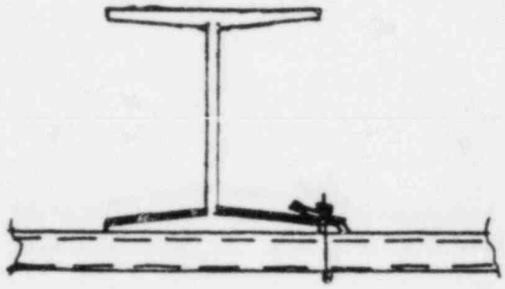
(4) In letter no. DCL-84-094, PG&E states, "Pipe support number 100-111, identified for NRC review by Mr. C. Stokes, resulted in a minor modification . . . This change was made for consistency with Project Standard Practices even though analysis showed the change was not necessary to meet acceptance criteria."

I don't know if PG&E reported other modifications performed during the hot functional testing to the NRC. I do know of at least one other support which was modified during hot functional testing. I can not give the support number here. My informant would be immediately on the "firing" line. I will supply the support number to NRC inspector Isa Yin, if the NRC supplies a list of supports to me for which they know modifications have been performed.

(5) In PG&E's answer to the intervenor's motion to reopen licensing issues on Construction Quality Assurance, "Affidavit of D.A. Rockwell, L.R. Wilson," Paragraph 3 states in part: "Since this contact is provided by the plate of the clamp to the Unistrut, the plate is not necessarily horizontal and may appear 'cockeyed.'" This statement is too incomplete to be meaningful. The use of the term "cockeyed" is not explained or supported nearly enough to support any conclusion that the clamping plates were correctly installed. If incorrectly installed, the clamp will tend to slip off the structural steel to which it is attached. See sketches below of correct installation compared to incorrect installation.



Correct. Notice Line contact at toe and heel of plate. When bolt is tongued properly, clamp should not be easily displaced.



Incorrect. Line contact but not at toe. When tongued, this tends to slip off the steel marker.

In both the examples above, the plate is "cockeyed." One is correct, and if installed correctly, should not be easily moved. On the other hand, the incorrect installation could slip easily. This fact can be checked by consulting engineering manuals from either Unistrut, Superstrut, or other brand names.

(6) In paragraph 5 as a remedy for possible slipping, PG&E states, "For support type S221, U-bolts were torqued and U-bolt nuts tack welded. For other support types, the Unistrut channel was directly welded to the beam flange." (Emphasis added) Based on my experience in the nuclear industry, the proposed fix by PG&E/Foley would do more damage than good. To my knowledge, there are no engineering documents presently available or in use that support the practice of welding Unistrut or similar material. In fact, the material type used in making "Superstrut" and similar products should not be welded In a phone call on 3/27/84 with a Superstrut Product Engineer, I was told that Superstrut is coated with an electro-plated galvanized chromate coating (an epoxy paint) which burns when welded, giving off toxic gases. Two problems result from welding it. (1) Air quality problems for the welder and (2) the joint corrodes. The Product Engineer said he would never

advise that Superstrut be welded when used as Class I supports in a nuclear plant near the ocean. He said that the material could be destroyed in one year if exposed to adverse conditions.

(7) In reply to intervenor's Petition to reopen Construction Quality Assurance, Affidavit of H.R. Arnold, F.C. Breismesiter and R.K. Rhodes Paragraph 6. "During a planned review of existing brazing procedures for copper and stainless steel by Foley QA Personnel in September 1981, it could not be verified that stainless steel tubing PBS number MD045 had been qualified in all braze flow positions (vertical-up, vertical-down, horizontal and flat) since the procedure qualitfication tests performed in 1977 did not include the vertical-up flow position. This variation was properly documented on Foley Non-Conformance Report (NCR) #8802-675 in accordance with approved procedures." (Emphasis added) The statement quoted above is in direct contradiction to the first line in Para. 1 and line, Page 1. "This allegation is completely false. The procedures in question were qualified prior to their use." (Emphasis added) To correct this problem, one worker was tested. Under ANSI B31.7 and ASME Section IX, each welder must be qualified to perform the work to which he is assigned. Foley's solution does not correct the use of the procedure from 1977 to 1981 for brazing a vertical-up joint as was originally stated in the procedure. Nor does it resolve the issue as to whether the brazers before 1977 were qualified to perform work. The test of one worker does not satisfy ASME requirements that each worker be qualified unless the worker tested was the only person on-site who was assigned the brazing work. Nor do the present tests qualify old work, since past work could be considered training thus not qualifying as acceptable work. ASME Section IX requires that the welder be qualified first before work is performed. There is a reason for this,

which is to ensure that the work is performed correctly. The other point not sufficiently covered in Foley's reply is that "Neither the ASME Code nor Foley procedures require documentation of these inspections. Therefore none were documented." Nor in the statement that "ASME Section IX recognizes the function of independent mechanical test contractors such as Central Coast Lab, and does not requre them to witness the actual brazing." (Paragraph 3, page 6 and 7) This is an example of Management 's near-sightedness. Can they say that this documentation is not required in B31.1, B31.7, ASME Section IX, AWS D1.1-79 or 10 C.F.R? From my previous experience in the nuclear industry, it has been the practice to test and document results therefrom for welders. This would certify that the weld was made by the specific welder and that the test results were for the welds performed by that individual. These logs and records were controlled and monitored by the QA. The policies at Diablo by PG&E, Pullman, and Foley are at the opposite end of the scale from what has been typical industry practice. Where documentation was in question, other plant owners considered it good engineering practice and a good policy to go ahead and provide documentation to prevent the problem of a future question. At Diablo, just the opposite is true.

(8) In a discussion with a friend, I was shown a Discrepancy Report written against Unit #2. This document listed many anchor and smaller supports which did not have acceptable full penetration welds at the stantion to pipe and were to be reworked. The problem with this work was that there had been no process sheets issued for the removal nor had the pipe been ultrasonically tested to ensure that the minimum wall remained after grinding away the old material. The new stanchions were installed without an ultrasonic test (UT) being performed. The tests were performed seven months later. Per ASME Section IX and ANSI B31.7, the ultrasonic testing should have been conducted

at the time after removal and before new stanshions were welded in place. When ultrasonically testing this type of joint, incorrect readings are possible.

A worker who was familiar with this Discrepancy Report (DR) on Unit 2 realized the same problem might have occurred on Unit 1. I was shown a copy of a Preliminary Discrepancy Report listing about 15 supports in Unit 1 which the worker had determined had the same problem as the Unit 2 problem narrated above. I can supply the DR number on Unit 2 and the author of the Unit 1 DR. This will be suppled under similar conditions listed on a previous issue to Isa Yin.

(9) In closing and as the only exhibit to this affidavit, I have a copy of a document which was scheduled to be issued to all field engineers to aid them in their work at Diablo. It was prepared by Bechtel Power Corporation. The title of this document is Field Engineer Pocket Hanger Reference. This document was sent to the field for issuing, but was recalled under the excuse that it contained errors which needed to be corrected. I and other engineers at Diablo had copies of this document. It contains valuable information to which an engineer could refer and rely upon during his work. In truth, this document represents Bechtel policy at previous jobs. Much of it is in direct contradiction to the procedures used to build Diablo. Had it been issued many problems would have surfaced in a relatively short time. Why is this true? The document puts at finger tip location contradictory guides, providing typical industry practice in many areas, to the procedures and management directives issued at Diablo. There are minor errors in this document. However, I have reviewed it and have found it to be a valuable and handy document to have when working in the field. It should have been checked, corrected, issued and used.

Enclosed are pages 1-10 and 1-11, "Notes: Pipe Insulation Chart." In reading these two pages several points are evident which were not complied with at Diablo: (1) vapor barrier requirements; and (2) the application of a double layer of insulation on high thermal lines. In PG&E's answers to the staff concerning stress walkdown, they tried to explain away interferences by local crushing of calcium silicate. Note, this is not acceptable on Page 1-10.

Also enclosed is a copy of page 1-13, "Insulation Removal Request Flow Chart" and page 1-14, "Request for Insulation Removal." I am not aware of either of these procedures being followed at Diablo.

Also enclosed is a copy of Section 7, "Welding Instruction." On page 7-2, item 15, it is stated that there are no dihedral angle limitations for skewed T-joints. I feel this policy will cause problems by design personnel failing to consider welds shown as fillet as partial penetration groove welds unless a note specifically stated that it should be considered otherwise. I personally know many engineers will assume a fully effective throat for any weld indicated as a fillet. I suggest a test at site on this point before a decision is made on how to represent a skewed T-joint.

Also on page 7-5, see "attachment I." Either I don't understand this table or no allowance was added for the throat deduction for inadequage penetration. This last conclusion was also that of a pre-inspect engineer at Diablo Canyon.

Lastly, on pages 7-7 thru 7-10, I would like to point out the concise clarification of weld symbol terminology. Had this part of the book been in effect at Diablo, many questions would have been resolved (although many

other questionable practices would have become evident to many field personnel).

I have read the above 11-page statement and it is true and correct to the best of my knowledge and belief.

Charles C. Stokes 4/12/84

Charles Stokes

SPECIFICATION/PIPE SCHEDULE CONVERSION

PIPING SPEC	CLASS 250 (IN.)	CLASS 150 (IN.)	SCH 40 (IN.)	STD. (IN.)	SCH 80 (IN.)	SCH 80 (CL)	SCH 100 (IN.)	SCH 120 (IN.)	SCH 140 (IN.)	SCH 160 (IN.)	X.S. (IN.)	SCH 10S (IN.)	SCH 40S (IN.)	SCH 80S (IN.)
D	3-10	12-24												
F			1 & >											
G			1½-10	12 & >										
G1			4-10	12 & >										
H			2½-10	12 & >		2 & <								
J			2½-10	12 & >		2 & <								
K			2½-10	12 & >		2 & <								
K2			2½-10	12 & >		2 & <								
K8			2½-3		8-24	2 & <								
K8			4-6			2½								
K12			2½-10	12-14		2 & <					16-20			
K12			16 & 24											
K13			2½-10	12 & >		2 & <								
K14			2½-3		8-24	2 & <								
K14			4-6			2½								
K15			2½-3		8-24	2 & <								
K15			4-6			2½								
K16						2 & <								
K16						2½-16	24							
K17										½-12				
S1													2 & <	
S1													2½ & >	
S2													2 & <	
S2													2½ & >	
S3													2 & <	
S3													2½ & >	
[illegible]							8-10							
[illegible]														½-2
[illegible]														2½-6
[illegible]								6	8-16	2 & <				
[illegible]										2½-3				
[illegible]										6				
[illegible]										12-16				
[illegible]												2 & <		

APPENDIX H
PIPING SPECIFICATIONS
(PG&E DWG. [illegible])

1-4

EXAMPLE OF LINE DESIGNATION—UNITS 1 AND 2 (DWG. NO. 102040—PAGE 38—DATE 10/02/72)

(1) LINE NUMBER	(2) LINE DESIGNATION	(3) PIPING SPEC.	(4) PG&E CLASS	(5) PIPE SCHD NO.	(6) PIPE SCHD COORD	(7) LINE SIZE (IN.)	(8) FLUID	(9) MAXIMUM - OPERATING: FLOW RATE	(10) G	(11) PSIA	(12) TEMP °F	(13) HT	(14) INSUL. SPEC.	(15) DC	(16) CONS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	GAS	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	GAS	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SOL	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SOL	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]		[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WTR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	-	[illegible]

1-6

LINE DESIGNATIONS (NOTES 1 THROUGH 16)

(1) LINE NUMBERS 1 THRU [illegible] LINE NUMBERS NOT CURRENTLY USED HAVE [illegible] OR ARE BLANK IN ALL COLUMN GROUPS

(2) A UNIQUE DESCRIPTION OF LINE EQUIPMENT & FUNCTIONS WITH DSGN STD [illegible] IS USED FOR ABBREVIATIONS

- 0-1: LEFT SIDE OF DASH INDICATES UNIT NUMBER; 0 INDICATES COMMON FOR UNITS 1 & 2; RIGHT SIDE OF DASH INDICATES EQUIPMENT NUMBER
- 2/1: LEFT SIDE OF SLASH INDICATES EQUIP NO FOR UNIT 1 ONLY; RIGHT SIDE OF SLASH INDICATES EQUIP NO FOR UNIT 2 ONLY

(3) PIPING SPEC IN ACCORDANCE WITH PG&E DWG NO [illegible] AND THE FOLLOWING
- * INDICATES PIPE SUPPLIED WITH ASSOCIATED EQUIPMENT. SEE PIPING SCHEMATIC FOR SPECIFIC INFORMATION
- ** INDICATES PIPE NOT SUPPLIED BY KELLOGG SPEC [illegible] OR SCOTT CO SPEC [illegible] SEE PIPING SCHEMATIC FOR SPECIFIC INFORMATION
- G INDICATES PIPE SUPPLIED BY SCOTT SPEC [illegible]
- S INDICATES PIPE SUPPLIED UNDER SPEC [illegible] ANY OTHER PIPE IS SUPPLIED BY KELLOGG SPEC [illegible]

(4) PG&E CLASS SYMBOL PER LEGEND DWG NO [illegible] INDICATES ASME BOILER & PRESSURE VESSEL CODE SECTION I, [illegible]

(5) INDICATES LAST TWO DIGITS OF DWG NO [illegible]

(6) [illegible]
DWG COORDINATE (SIDE)
DWG COORDINATE (TOP) [illegible] TIMES PAGE NO

(7) PIPE SIZE IN INCHES (NOMINAL) (SEE NOTE 7, [illegible])

(8) FLUIDS USED ARE
- AIR - COMPRESSED, ATM ETC (C)
- GAS - ANY EXCEPT AIR, H_2, N_2, Cl_2 & CO_2 (C)
- H_2 - HYDROGEN (C)
- N_2 - NITROGEN (C)
- Cl_2 - CHLORINE (C)
- CO_2 - CARBON DIOXIDE (C)
- OIL - LUBE OR FUEL (G)
- SOL - ANY LIQUID MIXTURE (G)
- STM - STEAM (P)
- WTR - COND., FW, SERVICE, FIRE, ETC (G) OR (P)

1-7

PG&E DESIGN CLASS SYMBOLS

A – DESIGN TO ANSI B31.1-1967; MATERIAL, N.D.E., FABRICATION AND ERECTION TO ANSI B31.7 CLASS I-1969 EDITION PLUS 1970 ADD., PG&E DESIGN CLASS I

B – ANSI B31.7 CLASS II, 1969 EDITION PLUS 1970 ADD., PG&E DESIGN CLASS I

C – ANSI B31.7 CLASS III, 1969 EDITION PLUS 1970 ADD., PG&E DESIGN CLASS I

E – ANSI B31.1-1967, PG&E DESIGN CLASS II

E1 – CLASS E, MODIFIED TO REQUIRE "FILE-44" – DESIGN EARTHQUAKE ANALYSIS

G – NFPA; ALSO COMPLIES WITH ANSI B31.1

G1 – NFPA STANDARDS, PG&E DESIGN CLASS II (10 CFR 50 APPENDIX B QUALITY ASSURANCE PROVISION APPLIES TO THIS PG&E DESIGN CLASS II SYSTEM)

● – DESIGN TO ANSI B31.1-1967, FABRICATION, ERECTION AND INSPECTION TO ASME BOILER AND PRESSURE VESSEL CODE SECTION 1, 1968 EDITION, PG&E DESIGN CLASS I. (EXCEPTION: LINES No. 1 THROUGH No. 12 AND No. 16 ARE DESIGNED TO THE 1955 EDITION OF ANSI B31.1 AND APPLICABLE NUCLEAR CODE CASES.)

1-5

NOTES: PIPE INSULATION CHART

Fittings and valves are normally insulated with pre-formed sections of the same material as used on the pipe. However segmental blocks are sometimes used by wiring them on the fitting or valve and filling the gaps with asbestos cement.

Many and varied types of jackets for insulation are available. Some of these are: canvas, asphalt-saturated asbestos felt, plastic-impregnated asbestos felt, thin gage sections of galvanized steel, and integral or separate jackets of aluminum alloy or stainless steel.

The selection of the type of jacket to be used should be made with due consideration given to the following: amount of abrasion and mechanical abuse to be encountered. Weather protection for outdoor installations, fire proofing, vapor barrier requirements, cost of application, and last but not least the finished appearance.

Most insulation failures are caused by water entering through breaks in the finish, such as expansion cracks, or un-flashed openings, therefore, particular attention should be given to complete detailed specifications in regard to weatherproofing.

The usual insulating materials and jackets for heated piping and equipment allow the moisture to escape in the form of vapor. However in the medium temperature range, and where shut-downs are frequent, moisture in the insulation is not driven off and water damage is most likely to occur. For these conditions, the insulation should be thoroughly dry before applying the jacket, the surface of the pipe should be primed and painted, and corrosion-restraint wire or bands used for securing the insulation. If possible, insulation should be applied to high temperature piping while heated to insure the complete dryness of the completed installation.

The layout of insulated piping and equipment should provide adequate clearances for proper application of the insulation and also safeguard against mechanical damage during normal operation and maintenance.

Thicknesses, as shown are nominal. Actual thicknesses, which are based on "simplified thicknesses," will vary slightly from nominal in that the outer diameters of the insulation approximate the diameters of iron pipe sizes in order to obtain nesting of layers.

Weights, as shown, are for actual thicknesses and are based on densities of 11 pounds per cubic foot for 85% magnesia and calcium silicate, and 21 pounds per cubic foot for diatomaceous earth (calcined diatomaceous silica and asbestos fiber). Weights for materials with different densities may be proportioned accordingly.

At temperatures above 600°F, pipe expansion is a significant factor. For best results pipe insulation should be applied in double layers with staggered joints for all operating temperatures above 600°F. This construction prevents excessive heat losses and surface temperatures at the joints, opened by pipe expansion, thus eliminating scorched or burned jackets. This construction also eliminates the potential fire hazard of exposing jackets to higher temperatures at the joint. Double-layer, staggered-joint construction also minimizes thermal stresses in the insulation by reducing the temperature differential across each layer.

The recommended thicknesses in the above table are calculated on an economic basis for heat conservation under average operating conditions for steam generation and process piping, and assure adequate temperature control. To determine the most economical thickness for any particular installation the cost of fuel, fixed charges, need for definite temperature control, or other special conditions must be considered. If necessary, insulation thickness can be increased.

Generally, pipe insulation is furnished in 3-foot half sections for pipe sizes up to 24-inch in calcium silicate and up to 14-inch pipe size for 85 percent magnesia and diatomaceous earth. Insulation for pipe sizes larger than those mentioned is usually furnished in 3-foot long segments or curved blocks.

LINE DESIGNATIONS (NOTES (1) THROUGH (16))

LINE DESIGNATIONS (ADDITIONAL NOTES)

APPENDIX E OF DCM-M9

PIPING INSULATION SPECIFICATION

THICKNESS REQUIRED				
NOM PIPE SIZE / CLASS	III	IV	V	VI
BELOW 2"	1"	1½"	1½"	2½"
2"				
2½"				
3"			2"	3"
4"				
6"				3½"
8"	1½"			
10"				
12"				
14"			2½"	
16"				
18"	2"	2"		4"
20"				
24"				
26"				
30"				
36"				

CLASS	TEMP RANGE (°F)
I	SEE NOTE 1
III	151-400 (SEE NOTE 5)
IV	401-524
V	525-675
VI	676-1100
SPL	SEE NOTE 2

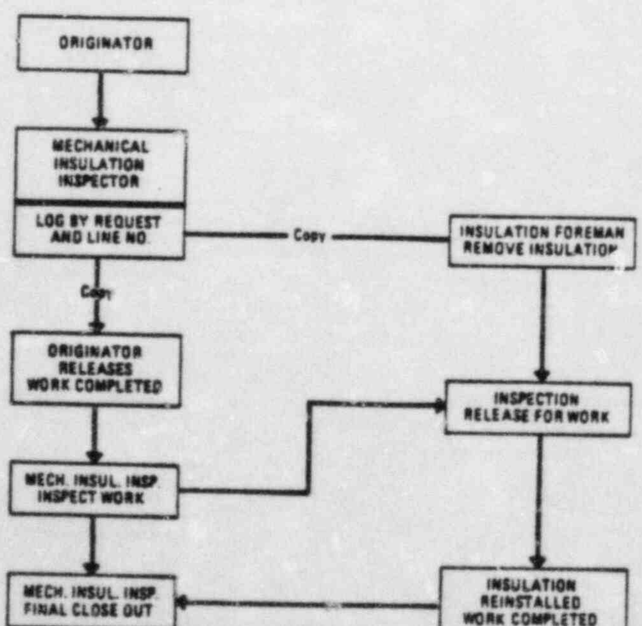
NOTES

1. FOR CLASS I, LOW TEMPERATURE INSULATION SHALL BE USED. FOR CLASSES III, IV, V, AND VI, HIGH TEMPERATURE MASS INSULATION SHALL BE USED THROUGHOUT. FOR INSULATION MATERIAL SPECIFICATION SEE PG&E SPEC 8737
2. THE USE OF SPECIAL INSULATION IS TO FACILITATE THE PERFORMANCE OF THE INSERVICE INSPECTION REQUIREMENTS OF SECTION XI OF ASME BOILER AND PRESSURE VESSEL CODE. THE EXTENT OF THE INSERVICE INSPECTION IS SHOWN ON P&I [illegible]. FOR SPECIAL INSULATION MATERIAL SPECIFICATION SEE PG&E SPEC 8740
3. FOR INDIVIDUAL PIPE INSULATION CLASS SEE DESIGNATION TABLE (DWG [illegible])
4. TYPICAL LINE DESIGNATION WITH INSULATION CLASS SYMBOLS AS SHOWN ON DWGS

   (1 -87 -153 -6III) ← INSULATION CLASS

5. CLASS III INSULATION SHOWN ON THIS ISSUE INCLUDES CLASS II INSULATION SHOWN ON PREVIOUS ISSUE OF THIS DRAWING.
6. THE LETTER "P" FOLLOWING AN INSULATION CLASS DENOTES INSULATION FOR PERSONNEL PROTECTION ONLY (i.e., IIIP, IVP, ETC.). PERSONNEL PROTECTION INSULATION SHALL BE INSTALLED ON ALL SYSTEMS WITH FLUID TEMPERATURE 151°F OR HIGHER, WHETHER OR NOT INSULATION IS REQUIRED FOR THE PRESERVATION OF HEAT, AS DETAILED BELOW
   A. HORIZONTAL RUNS: ALL PIPING 8 FT OR LESS FROM PIPE CENTER LINE TO FLOORS, DECKING, PLATFORMS, STAIRWAY OR OTHER NORMAL STANDING, WALKING OR CLIMBING LOCATIONS SHALL BE INSULATED. THE INSULATION SHALL BE RUN 3 FT FROM HAND RAIL.
   B. VERTICAL RUNS: ALL PIPING SHALL BE INSULATED TO A POINT 8 FT ABOVE THE FLOOR, DECKING, PLATFORM, STAIRWAY OR ANY OTHER NORMAL STANDING, WALKING OR CLIMBING LOCATION. THIS INCLUDES ALL PIPING WITHIN A HORIZONTAL DISTANCE OF 3 FT FROM HAND RAIL. THICKNESS OF THIS INSULATION IS ESTABLISHED ACCORDING TO LINE TEMPERATURE AS PER CLASSES SHOWN IN TABLE AT LEFT PAGE. THE SKETCH (RIGHT) SHOWS A TYPICAL SECTION AND ILLUSTRATES AREAS DESCRIBED IN PARAGRAPHS A AND B ABOVE.

INSULATION REMOVAL REQUEST FLOW CHART



REQUEST FOR INSULATION REMOVAL

REQUEST NUMBER ________

REQUEST BY ________ NAT NO ________ EXT ________ DEPT ________

DOES LINE REQUIRE RE HYDRO BECAUSE OF NEW ATTACHMENT: YES ________ NO ________

DOES LINE INVOLVE HEAT TRACING ________ CHAD NO ________ TRACE NO ________

STAINLESS STEEL PIPE: CHLORIDE AND FLUORIDE TESTING REQUIRED: YES ________ NO ________

ALL LINES REQUIRING HEAT TRACING MUST BE COORDINATED WITH ELECTRICAL DEPT

PURPOSE ________

UNIT NO ________

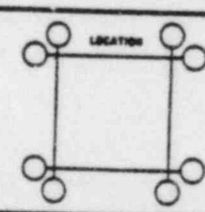
AREA ________

BUILDING ________

ELEVATION ________

LINE NO ________

HANGER NO ________



*ESTIMATED COMPLETION DATE ________

RELEASED FOR REMOVAL & LOGGED ________ DATE ________ EXT ________

ELECTRICAL HEAT TRACE COORDINATOR ________ DATE ________ EXT ________

ORIGINATOR RELEASE FOR REINSULATING ________ DATE ________ EXT ________

MECHANICAL INSULATION INSPECTOR ________ DATE ________ EXT ________

INSULATION FOREMAN COMPLETED ________ DATE ________ EXT ________

[illegible]

WELDING INSTRUCTIONS
(EXCERPTED FROM ESD-223 REV. 7)

1 WELDS SHALL NOT BE PEENED.

2 FULL PENETRATION WELDS SHALL BE FIT IN ACCORDANCE WITH THE WELD PROCEDURES DESIGNATED BY THE FIELD ENGINEER. ROOT OPENINGS USING BACKING STRAPS SHOULD BE 1/4" PLUS OR MINUS 1/16". ROOT OPENING REQUIREMENTS FOR GTAW WELD PROCEDURES ARE 1/8" PLUS OR MINUS 1/32".

3 PARTIAL PENETRATION GROOVE WELDS SHALL BE FIT IN ACCORDANCE WITH THE WELD PROCEDURE DESIGNATED BY THE FIELD ENGINEER. THE JOINT SHALL BE BROUGHT INTO AS CLOSE CONTACT AS POSSIBLE. THE GAP BETWEEN PARTS SHALL NOT EXCEED 3/16".

4 SQUARE GROOVE WELDS SHALL BE FIT IN ACCORDANCE WITH THE WELD PROCEDURE DESIGNATED BY THE FIELD ENGINEER. ROOT OPENING SHALL BE 0" TO 1/16" MAXIMUM.

5 FILLET WELDS SHALL BE FIT IN ACCORDANCE WITH THE WELD PROCEDURE DESIGNATED BY THE FIELD ENGINEER. PARTS TO BE JOINED SHALL BE BROUGHT INTO AS CLOSE CONTACT AS POSSIBLE. NO PACKING, SHIMMING, OR WELDING WILL BE PERMITTED TO CORRECT POOR FIT-UP OF JOINTS. IF THE SEPARATION IS 1/16" OR GREATER, THE LEG OF THE FILLET SHALL BE INCREASED BY THE AMOUNT OF THE SEPARATION. THE GAP SHALL NOT EXCEED 5/16".

7-1

6 ALL MEMBERS SHALL BE VISUALLY PLUMB, TRUE TO LINE, AND SUBSTANTIALLY FREE FROM BENDS, TWISTS, OR EXCESSIVE GAPS.

7 ALL WELD PREPARATION SURFACES SHALL BE FREE FROM FOUNDRY OR MILL SCALE, OIL, RUST, SAND, SLAG, PAINT, AND ANY TYPE OF SURFACE OXIDE OR DIRT.

8 WELD PREPARATION SHALL BE SMOOTH AND UNIFORM. IF WELD PREPARATIONS ARE FORMED BY FLAME CUTTING, THEY SHALL BE GROUND AND DRESSED BEFORE WELDING.

9 UNDERCUT, EXTENDING THE LENGTH OF THE WELD, SHALL NOT EXCEED 1/32" IN DEPTH. LOCAL UNDERCUT SHALL NOT EXCEED 1/16" WHEN THE LENGTH OF A LOCAL UNDERCUT AREA DOES NOT EXCEED 1/2" IN ANY 6" LENGTH OF WELD.

10 FOR GROOVE AND FILLET WELDS, THE SUM OF THE DIAMETERS OF POROSITY SHALL NOT EXCEED 3/8" IN ANY LINEAR INCH OF WELD AND SHALL NOT EXCEED 3/4" IN ANY 12" LENGTH OF WELD.

11 MINOR ARC STRIKES ON SUPPORT MEMBERS SHALL BE MINIMIZED. SERIOUS ARC STRIKES ON SUPPORT MEMBERS SHALL BE REMOVED AND/OR REPAIRED PRIOR TO QC ACCEPTANCE. NO ARC STRIKES ON PIPE SHALL BE PERMITTED. ARC STRIKES ON PIPE AND SEISMIC LIMITERS SHALL BE REPORTED ON A DEFICIENT CONDITION NOTICE FOR DISPOSITION PER ESD-268.

12 THE FILLET WELD SIZE SHALL BE AS SPECIFIED ON THE DRAWING. WHERE THE SIZE IS NOT SPECIFIED, THE FILLET SHALL BE OF THE SAME SIZE AS THE THICKNESS OF THE THINNER OF THE TWO MEMBERS BEING JOINED. AS-BUILT IS REQUIRED TO SHOW WELD SIZE.

13 OVERWELD: FOR EXISTING WELDS ANY AMOUNT OF OVERWELD IS ACCEPTABLE, PROVIDED DISTORTION IS NOT EXCESSIVE. FOR NEW WELDS THE MAXIMUM OVERWELD SHALL BE 50 PERCENT OR 1/8", WHICHEVER IS GREATER, PROVIDED THAT DISTORTION IS NOT EXCESSIVE. (SEE PARAGRAPH 6.8.2.4.A.) AS-BUILT IS NOT REQUIRED.

14 UNDERWELD: FOR EXISTING WELDS, ANY UNDERWELD IS ACCEPTABLE PROVIDED THAT THE AISC RECOMMENDED MINIMUM WELD SIZE FOR THE MATERIAL BEING WELDED IS MET. A NEW FILLET WELD IN ANY SINGULAR CONTINUOUS WELD SHALL BE PERMITTED TO UNDERRUN THE NOMINAL FILLET WELD SIZE REQUIRED BY 1/16" WITHOUT CORRECTION, PROVIDED THAT THE UNDERSIZED PORTION OF THE WELD DOES NOT EXCEED 10% OF THE LENGTH OF THE WELD.

AS-BUILT IS REQUIRED TO SHOW EXISTING WELDS WHICH ARE MORE THAN 25 PERCENT UNDERSIZED AND/OR UNDERSIZE FOR MORE THAN 20 PERCENT OF THE TOTAL LENGTH OF THE WELD.

FILLET WELD SIZE TABLE

7-2

MATERIAL THICKNESS OF THICKER PART JOINED	MINIMUM SIZE OF FILLET WELD
UP TO AND INCLUDING 1/4	1/8
OVER 1/4 THROUGH 1/2	3/16
OVER 1/2 THROUGH 3/4	1/4
OVER 3/4 THROUGH 1-1/2	5/16
OVER 1-1/2 THROUGH 2-1/4	3/8
OVER 2-1/4 THROUGH 6	1/2
OVER 6	5/8

15 FILLET WELDS ON SKEWED T-JOINTS

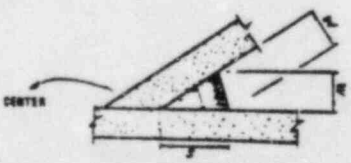
- THERE ARE NO DIHEDRAL ANGLE LIMITATIONS
- THE SIZE OF FILLET WELDS ON SKEWED T-JOINTS SHALL BE DETERMINED BY MEASURING THE NOMINAL LEG, AS FOLLOWS:

W = NOMINAL WELD LEG

NOTE: WELD SURFACES MUST BE FLAT OR CONVEX.

16 PARTIAL PENETRATION WELDS

- WHEN VERIFYING THE SIZE OF PARTIAL PENETRATION BEVEL WELDS, THE FACE MUST BE AT LEAST FLUSH WITH THE FACE OF THE BEVELED PIECE.
- QC FIT-UP INSPECTION IS REQUIRED ON PARTIAL PENETRATION GROOVE WELDS DESIGNED AT SKEWED T-JOINTS. THE SIZE OF PARTIAL PENETRATION GROOVE WELDS, WHICH HAVE BEEN DESIGNED TO BE INSTALLED AT SKEWED T-JOINTS, SHALL BE DETERMINED BY MEASURING THE FACE OF THE WELD, AS FOLLOWS:



7-3

W = NOMINAL WELD LEG

S = SPECIFIED SIZE

USE W MINIMUM IN DETERMING WELD SIZE.

THE ACCEPTABILITY OF THE WELD SIZE SHALL BE DETERMINED BY USING THE CHART IN ATTACHMENT I.

17 FLARE-BEVEL WELDS WHICH ARE FORMED BY AT LEAST ONE PIECE OF TUBE STEEL SHALL HAVE THE SIZE DETERMINED AS FOLLOWS:

- WHEN NO SIZE IS SPECIFIED ON THE DRAWING, THE FACE OF THE WELD SHALL BE AT LEAST FLUSH WITH THE FACE OF THE TUBE STEEL BEING WELDED
- WHEN THE SIZE OF THE WELD IS SPECIFIED ON THE DRAWING, THE SIZE OF THE WELD SHALL BE DETERMINED BY MEASURING THE FACE OF THE WELD AS FOLLOWS:

W = NOMINAL WELD FACE

S = SPECIFIED SIZE

THE ACCEPTABILITY OF THE WELD SIZE SHALL BE DETERMINED BY USING THE CHART IN ATTACHMENT J.

18 PREHEAT AND INTERPASS

- THE FOLLOWING PREHEAT AND INTERPASS TEMPERATURES SHALL BE USED FOR THE WELDING OF CARBON STEEL SUPPORT MEMBERS TO EXISTING STRUCTURAL STEEL AND RUPTURE RESTRAINTS (EXCLUDING INSERTS):

MATERIAL THICKNESS (INCHES)	PREHEAT (MIN) (°F)	INTERPASS (MAX) (°F)
UP TO 3/4	50*	800
OVER 3/4 - 1-1/2	150	800
OVER 1-1/2 - 2-1/2	225	800

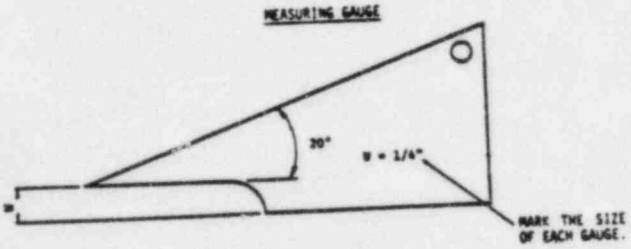
NOTE: FOR WELDING OF DISSIMILAR METALS, THE MINIMUM PREHEAT TEMPERATURE AND MAXIMUM INTERPASS TEMPERATURE SHALL BE IN ACCORDANCE WITH THE WELD PROCEDURE

*MATERIAL TO BE FLAME DRIED WHEN BELOW 70°F.

- PREHEAT REQUIREMENTS SHALL BE DETERMINED BY THE HANGER FIELD ENGINEER DURING INITIATION OF THE REQUIRED PROCESS SHEETS PRIOR TO RELEASE OF WORK. THE PREHEAT SHALL BE A QC HOLD POINT ON THE GENERAL FIELD PROCESS SHEET.

ATTACHMENT H

MEASURING GAUGE



W = 3/16"
1/4"
5/16"
3/8"
7/16"
1/2"
5/8"
3/4"
7/8"
— ONE SET

ATTACHMENT J

IF W MEASURED IS GREATER THAN OR EQUAL TO X SPECIFIED, NO MORE SIZE CHECKING IS NEEDED.

IF W MEASURED IS LESS THAN S SPECIFIED, CONSULT THE TABLES BELOW TO VERIFY THAT W MEASURED IS GREATER THAN OR EQUAL TO W REQUIRED.

IF W MEASURED IS LESS THAN W REQUIRED, WELD IS UNDERSIZE.

TUBE STEEL PERIMETERS LESS THAN OR EQUAL TO 24 INCHES
(ALL DIMENSIONS ARE IN INCHES)

S / WALL THKS	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
.188	3/16	3/16	3/16	3/8						
.188 < T ≤ .250	3/16	3/16	3/16	3/16	5/16	1/2				
.250 < T ≤ .313	3/16	3/16	3/16	3/16	3/16	1/4	3/8	5/8		
.313 < T ≤ .375	3/16	3/16	3/16	3/16	3/16	3/16	1/4	3/8	1/2	3/4
.375 < T ≤ .500	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	5/16	3/8

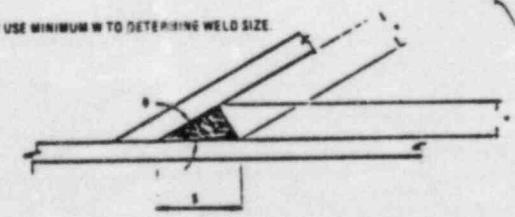
TUBE STEEL PERIMETERS GREATER THAN 24 INCHES
(ALL DIMENSIONS ARE IN INCHES)

S / WALL THKS	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
.188	3/16	3/16	3/16	3/16	5/16					
.188 < T ≤ .250	3/16	3/16	3/16	3/16	3/16	1/4	3/8	5/8		
.250 < T ≤ .313	3/16	3/16	3/16	3/16	3/16	3/16	5/16	5/16	7/16	5/16
.313 < T ≤ .375	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4	5/16	3/8
.375 < T ≤ .500	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4
.500 < T ≤ .625	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4

EQUIVALENT WELD SIZE "W" FOR FLARE BEVEL WELDS (SEE PARAGRAPH 6.8.2.6.G(2)(b))

ATTACHMENT I

* USE MINIMUM W TO DETERMINE WELD SIZE.



IF MINIMUM W MEASURED IS GREATER THAN OR EQUAL TO S SPECIFIED, NO MORE SIZE CHECKING IS NEEDED.

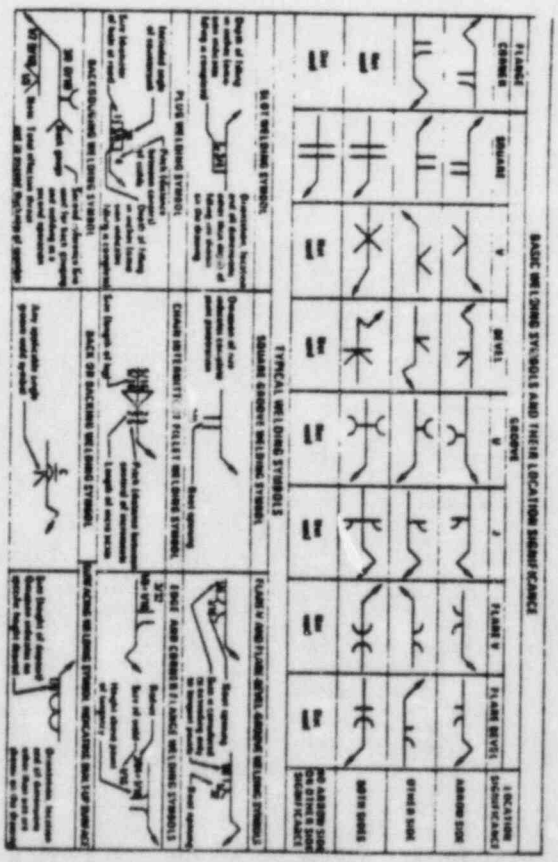
IF MINIMUM W MEASURED IS LESS THAN S SPECIFIED, CONSULT THE TABLE BELOW TO VERIFY THAT W MEASURED IS GREATER THAN OR EQUAL TO W REQUIRED.

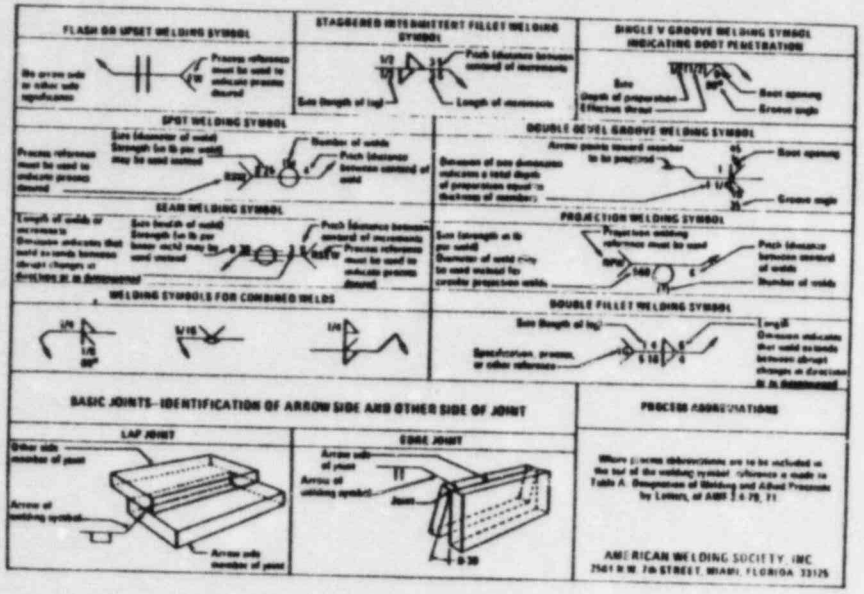
IF MINIMUM W MEASURED IS LESS THAN W REQUIRED, WELD IS UNDERSIZE.

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

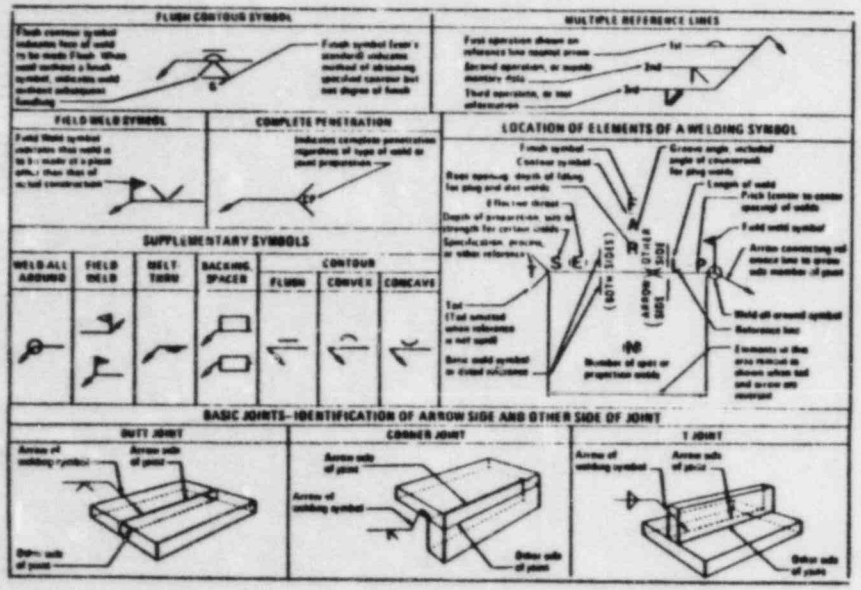
S / θ	3/16	1/4	5/16	3/8	7/16	1/2	5/8	5/8	11/16	3/4	13/16	7/8	15/16	1
15°	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	1/4
20°	3/16	3/16	3/16	3/16	3/16	3/16	3/16	1/4	1/4	1/4	5/16	5/16	5/16	3/8
25°	3/16	3/16	3/16	3/16	3/16	1/4	1/4	5/16	5/16	5/16	3/8	3/8	7/16	7/16
30°	3/16	3/16	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	7/16	1/2	1/2
35°	3/16	3/16	3/16	1/4	1/4	5/16	3/8	3/8	7/16	7/16	7/16	1/2	9/16	5/8
40°	3/16	3/16	1/4	1/4	5/16	5/16	3/8	7/16	7/16	1/2	9/16	9/16	5/8	11/16
45°	3/16	3/16	1/4	5/16	5/16	3/8	7/16	7/16	1/2	3/16	5/8	5/8	11/16	3/4
50°	3/16	3/16	1/4	5/16	3/8	3/8	7/16	1/2	9/16	5/8	5/8	11/16	3/4	13/16
55°	3/16	1/4	1/4	5/16	3/8	7/16	1/2	9/16	9/16	5/8	11/16	3/4	13/16	13/16
60°	3/16	1/4	5/16	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	3/4	13/16	7/8

EQUIVALENT WELD SIZE "W" FOR PARTIAL PENETRATION BEVEL WELDS (SEE PARAGRAPH 6.8.2.6.G(2)).

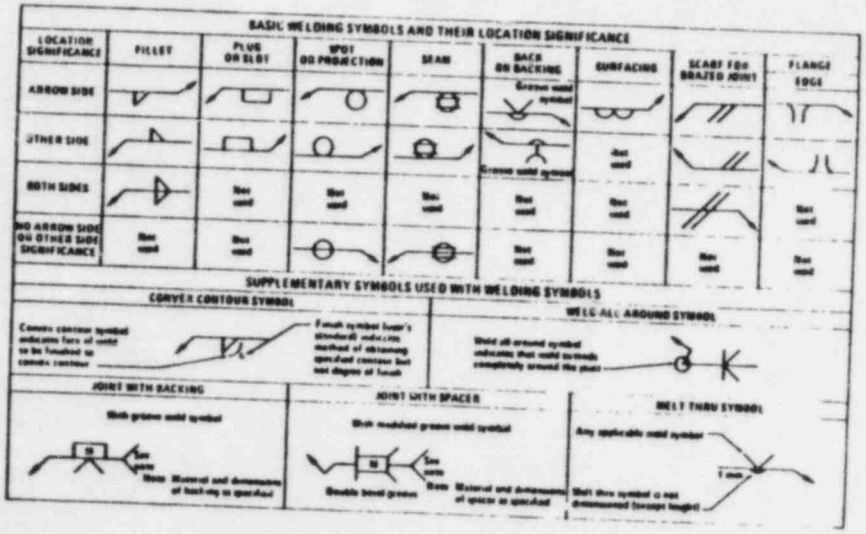



FLASH OR UPSET WELDING SYMBOL
STAGGERED INTERMITTENT FILLET WELDING SYMBOL
SINGLE V GROOVE WELDING SYMBOL INDICATING ROOT PENETRATION
SPOT WELDING SYMBOL
DOUBLE BEVEL GROOVE WELDING SYMBOL
SEAM WELDING SYMBOL
PROJECTION WELDING SYMBOL
WELDING SYMBOLS FOR COMBINED WELDS
DOUBLE FILLET WELDING SYMBOL
BASIC JOINTS–IDENTIFICATION OF ARROW SIDE AND OTHER SIDE OF JOINT
PROCESS ABBREVIATIONS
LAP JOINT
EDGE JOINT
AMERICAN WELDING SOCIETY, INC.
7501 N.W. 7th STREET, MIAMI, FLORIDA 33125

7-10


FLUSH CONTOUR SYMBOL
MULTIPLE REFERENCE LINES
FIELD WELD SYMBOL
COMPLETE PENETRATION
LOCATION OF ELEMENTS OF A WELDING SYMBOL
SUPPLEMENTARY SYMBOLS
WELD ALL AROUND
FIELD WELD
MELT THRU
BACKING SPACER
CONTOUR
FLUSH
CONVEX
CONCAVE
BASIC JOINTS–IDENTIFICATION OF ARROW SIDE AND OTHER SIDE OF JOINT
BUTT JOINT
CORNER JOINT
T JOINT

7-8


BASIC WELDING SYMBOLS AND THEIR LOCATION SIGNIFICANCE
LOCATION SIGNIFICANCE
FILLET
PLUG OR SLOT
SPOT OR PROJECTION
SEAM
BACK OR BACKING
SURFACING
SCARF FOR BRAZED JOINT
FLANGE EDGE
ARROW SIDE
OTHER SIDE
BOTH SIDES
NO ARROW SIDE OR OTHER SIDE SIGNIFICANCE
SUPPLEMENTARY SYMBOLS USED WITH WELDING SYMBOLS
CONVEX CONTOUR SYMBOL
WELD ALL AROUND SYMBOL
JOINT WITH BACKING
JOINT WITH SPACER
MELT THRU SYMBOL

7-9

GOVERNMENT ACCOUNTABILITY PROJECT
Institute for Policy Studies
1901 Que Street, N.W., Washington, D.C. 20009
(202) 234-9382

ATTACHMENT 3

March 2, 1984

Mr. Thomas Bishop
Division Director
U.S. N.R.C.
Region Five
1450 Maria Lane, Ste 210
Walnut Creek California 94596

Re: PACIFIC GAS AND ELECTRIC (Diablo Canyon Nuclear Power Plant, Unit 1), Dkt. No. 50-275

Dear Mr. Bishop:

Enclosed with this letter is a copy of a petition filed with the Commission pursuant to 10 C.F.R. 2.206 on March 1, 1984, together with Attachments 1 through 17 thereto.

Also enclosed for your use, bound separately in this package, are three documents that were not included in the petition filed on February 2, 1984: Exhibit 4 to Attachment 2, and two Discrepancy Reports inadvertently omitted from Attachment 7.

Best wishes in your continuing investigation.

Sincerely yours,

John Clewett

Enclosures: A/S