ULTRASONIC EXAMINATION RESULTS OF THE LOWER HEAD-TO-BOTTOM HEAD WELD (2RRV-W01) FOR THE McGUIRE UNIT II JULY 1993 REACTOR PRESSURE VESSEL EXAMINATION

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Date: AUG. 12, 1993

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Date: 12 AUG '93

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Date: Aug 12 '93

CONTENTS

INTRODUCTION

During the July 1993 ultrasonic examination of the McGuire Unit II Reactor Pressure Vessel, an OD surface connected, planar flaw was detected adjacent to the Lower Head-to-Bottom Head weld (weld 2RPV-W01). Contained in this report is a description of the examination technique used for detection of the indication together with a summary of the examination results used for dispositioning the indication.

SUMMARY OF THE INDICATION DETECTED IN THE LOWER HEAD TO BOTTOM HEAD WELD

The ultrasonic (UT) examination was conducted using the B&W Nuclear Service Company's (BWNS) Automated Data Acquisition and Imaging System ACCUSONEX, together with the Automated Reactor Inspection System ARIS. ARIS served as a delivery tool for positioning the ultrasonic transducers in the examination region of interest. Data collected from the transducers was routed via triax cabling (500 feet) to the ACCUSONEX acquisition system which was staged inside the ARIS control trailer. Here the data was filtered, amplified, and subsequently digitized for storage onto an optical disk. The disk was then hand carried to the on-site analysis station for transferring, via computer modem, to BWNS Lynchburg for data analysis. The data was then analyzed in-accordance-with the BWNS procedure ISI-138, Revision 13 (Remote Ultrasonic Examination for Reactor Vessel and Associated Piping Welds Using ACCUSONEX). A copy of this procedure is provided in Section 5.

Examination of weld 2RPV-W01 was performed using the contact (vice immersion), full-node examination technique. (A full-node examination was performed due to an Incore Nozzle limiting the ARIS range of movement in the circumferential direction.) The water in the reactor vessel served as the coupling agent between the transducer and vessel's cladded surface. A total of seven transducers were simultaneously utilized for examination of the weld, namely two 45° shear waves, two 60° shear waves, two 70° longitudinal waves, and one 0° degree longitudinal wave. The transducers were housed in a 3X3 spring-loaded matrix referred to as the Contact-Head. (See figure 1 for an illustration of the transducer arrangement as viewed from the back of the Contact-Head (i.e., facing the vessel's ID surface)). The Contact-Head is attached to the ARIS Boom for delivery to the vessel's surface (see figures 2 and 3). Associated with the ARIS tool is a total of eight ranges of motion, also illustrated in figure 3. By lowering the Mast into the vessel ("Z" motion) contact can be made with the Lower Head-to-Bottom Head weld as illustrated in figure 4. After contact is made, examination of weld 2RPV-W01 can be performed using only two of the ARIS motions, namely Theta and Alpha. Theta is a circumferential movement in the horizontal plane, and Alpha is a circumferential movement in the vertical plane. Thus Theta is used to scan parallel to the weld axis, and Alpha is used to scan perpendicular to the weld axis.

Weld 2RPV-W01 was examined using six axial scans and twelve circumferential scans. (Axial is perpendicular to the weld axis, and circumferential is parallel to the weld axis.) The indication was detected on circumferential scan B1.2.1:C-2. (B1.2.1:C-2 is a scan identification number (SIN) unique to the ARIS tool.) The indication was initially detected, at 1/2 Vee, using the 60° and 45° shear wave transducers (transducers number 8 and 9 in figure 1). Both transducer beam directions were pointing clockwise when viewed looking down into the Reactor Vessel (i.e., Theta + direction). The following information was recorded with these scans:

ACCUSONEX printouts are provided in Section 4

Angle	Peak Amp.	Depth	Length	Alpha	Theta
45 S	16% DAC	5.72"	2.40"[1]	35.51 to 37.08	129.64
60 S	13% DAC	5.88"	1.74"[2]	34.85 to 36.36	129.71

1. Noise level length
2. Half maximum amplitude length

To further evaluate the indication, supplemental RF scans were performed using 40° , 50° , and 60° longitudinal wave transducers. All three transducers were configured such that the beam direction again pointed in the clockwise direction. Relative to figure 1, the 60° was loaded into position 7, the 50° into position 8, and the 40° into position 9. The results obtained from these transducers supported the results from the 45° and 60° shear wave transducers used for the initial detection scans.

EVALUATION

Evaluation of the indication was based on RF data acquired using the 45° shear wave transducer. As mentioned above, the longitudinal wave scans supported the shear wave results; however the shear wave yielded better sizing information.
Sizing of the indication was performed in both the through-wall dimension (TWD) and the length dimension. The TWD was based on results from the Tip Diffraction Technique, and the length dimension was based on "Noise level length". That is, the length where the indication blends with the noise generated from the component. The tip diffraction method yielded a TWD of 0.5" (one-half inch), and the noise level length method yielded a length of 2.4" (two and four tenths inches). Furthermore, the indication was determined to be oriented in the axial direction (vertical plane) at a mean Theta value of 129.68° (average of 129.64° and 129.71°) with an Alpha range of 35.51° to 37.08° . Physically, Theta zero coincides with the Reactor Vessel "W-Axis", and an Alpha value of

ULTRASONIC EXAMINATION RESULTS

OF THE LOWER HEAD-to-BOTTOM

HEAD WELD (2RPV-W01)

FOR THE McGUIRE UNIT II

JULY 1993

REACTOR PRESSURE VESSEL

EXAMINATION

ULTRASONIC EXAMINATION RESULTS

OF THE LOWER HEAD-to-BOTTOM

HEAD WELD (2RPV-W01)

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REACTOR PRESSURE VESSEL

EXAMINATION

36.1° coincides with the centerline of weld 2RPV-W01. Therefore summarizing: the indication is located 129.68° clockwise (looking into the vessel) from the "W-Axis", it is oriented transversely (relative to the weld axis) and travels from 0.9" above the weld centerline to 1.5" below the weld centerline for a total length of 2.4 inches. It should be noted that the indication was only characterized from one scan direction (i.e., Theta + direction) due to its location in close proximity to an Incore nozzle which prevented scanning from the opposite direction (i.e., Theta -). Disposition of the indication yields the following results:

OD Surface Connected, Planar Flaw
Oriented Perpendicular to the Weld Axis
Vessel Thickness @ Indication = 5.85" - 0.157" (clad) = 5.69"
length (l) = 2.4"
TWD (a) = 0.50"

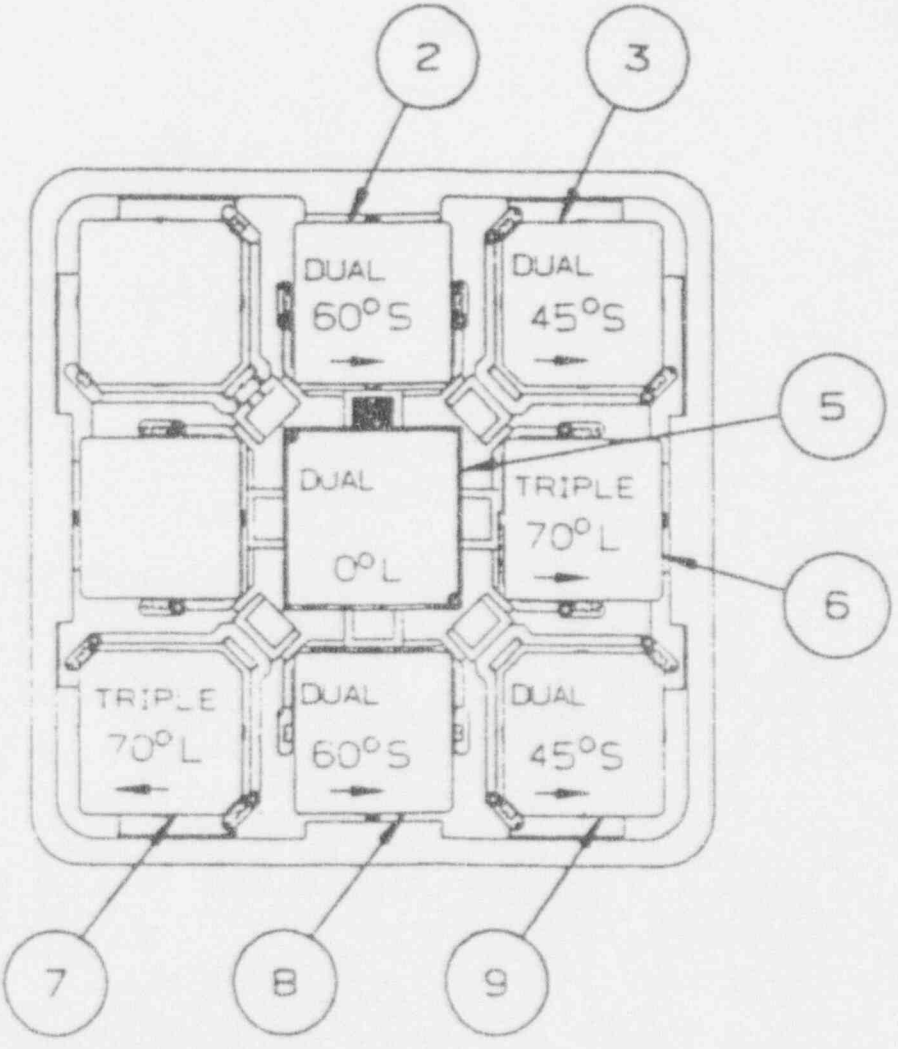
a/l = 0.50"/2.4" = 0.21
a/t% = 0.50"/5.69" *100 = 8.8%

1980 ASME Code, Section XI, IWB 3510-1 acceptance standard allows a maximum 2.8% a/t for an aspect ratio (a/l) of 0.21. Therefore based on the above findings, the indication has been determined to be UNACCEPTABLE.

In Section 3, Figure 5 a drawing is provided showing the physical location of the indication. Also, in Section 5 a copy of the Scan Plan drawing utilized for examination of the weld is provided for additional information.

LOOKING FROM BACK OF HEAD

GAMMA = 0 DEGREES
(CLOCKWISE +)



ALTERNATE HEAD

FIGURE 1

DIAGRAM OF THE ARIS-II MANIPULATOR

B&W NUCLEAR TECHNOLOGIES

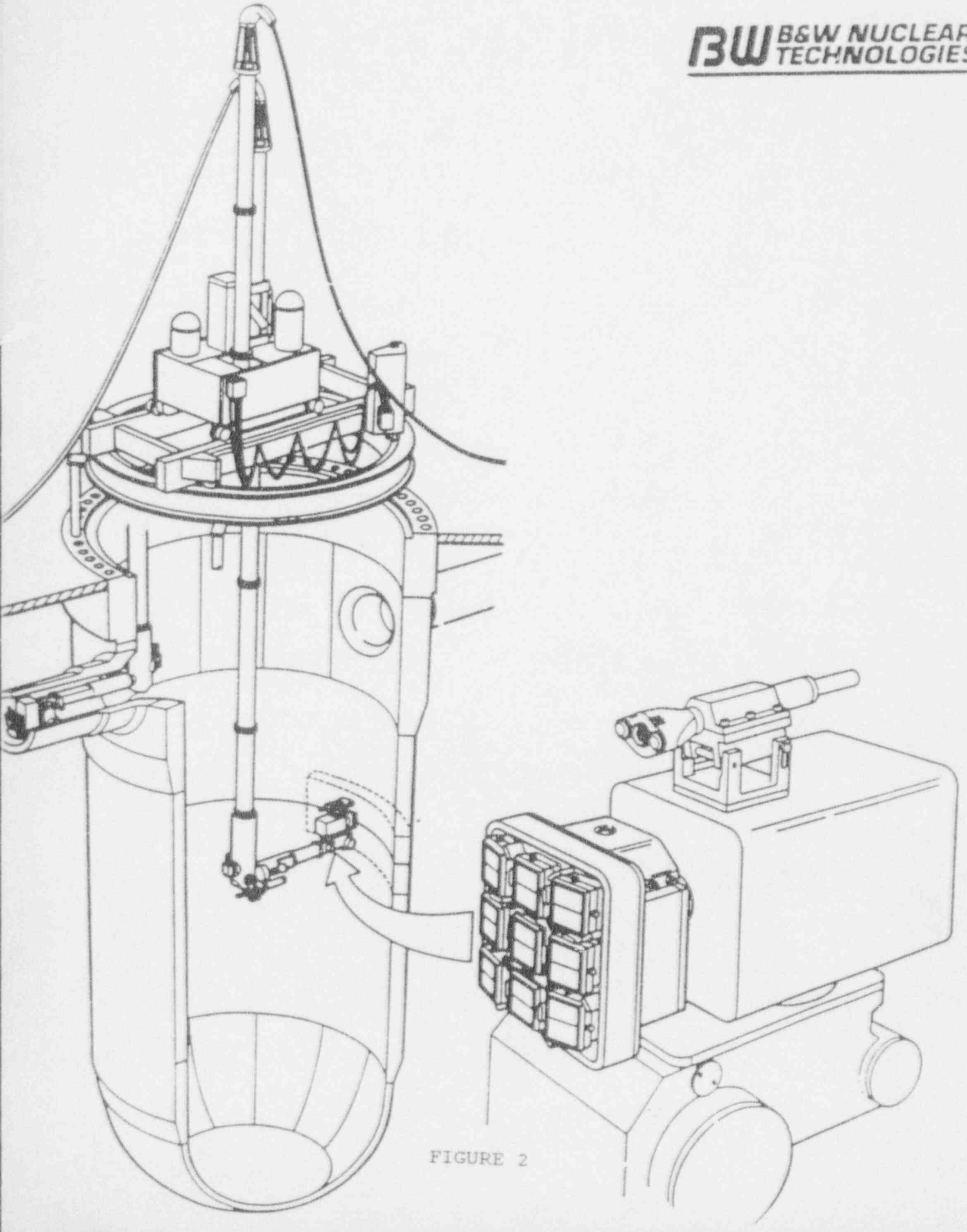


FIGURE 2

DETAILED VIEW OF THE ARIS-II MANIPULATOR

B&W NUCLEAR TECHNOLOGIES

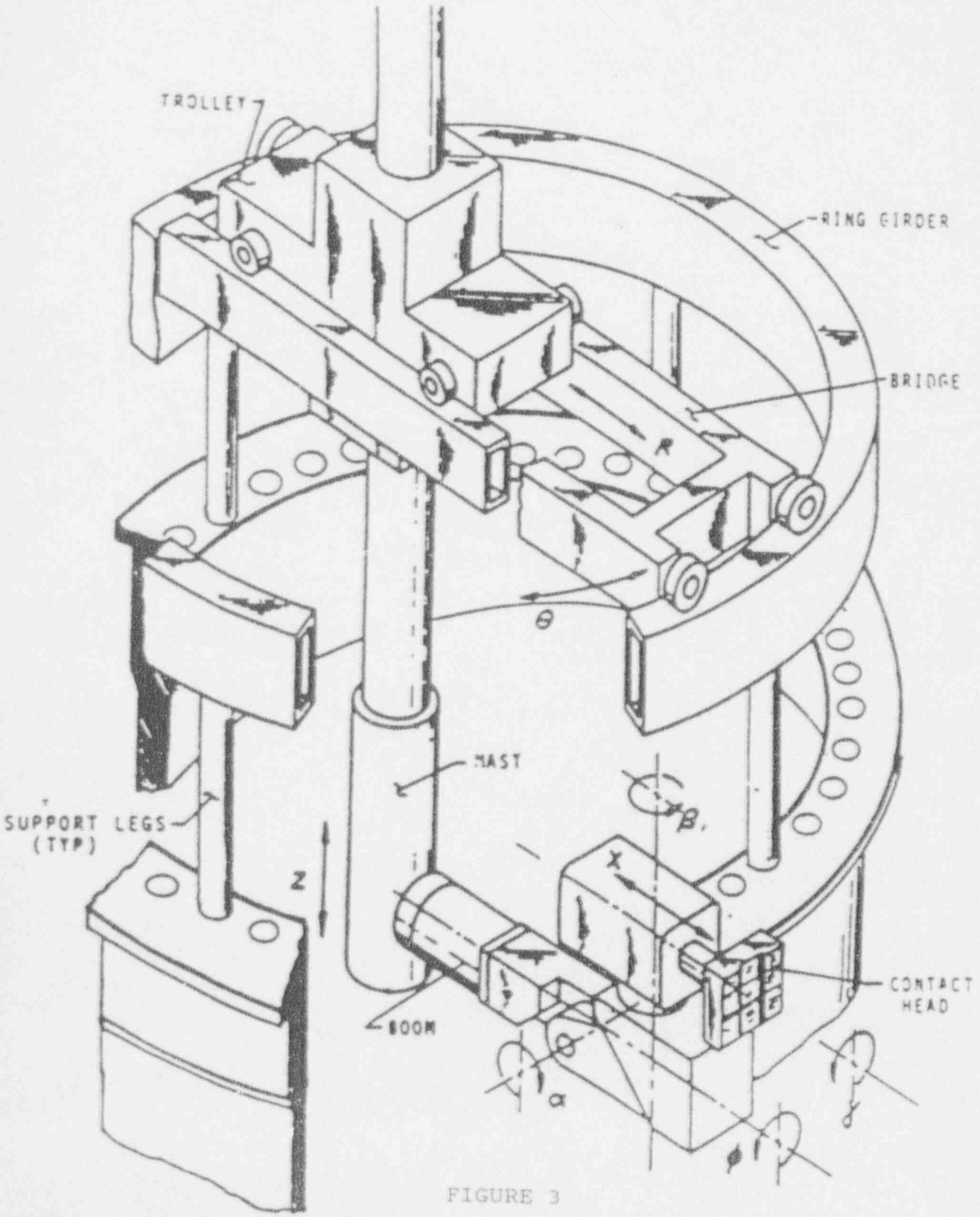


FIGURE 3

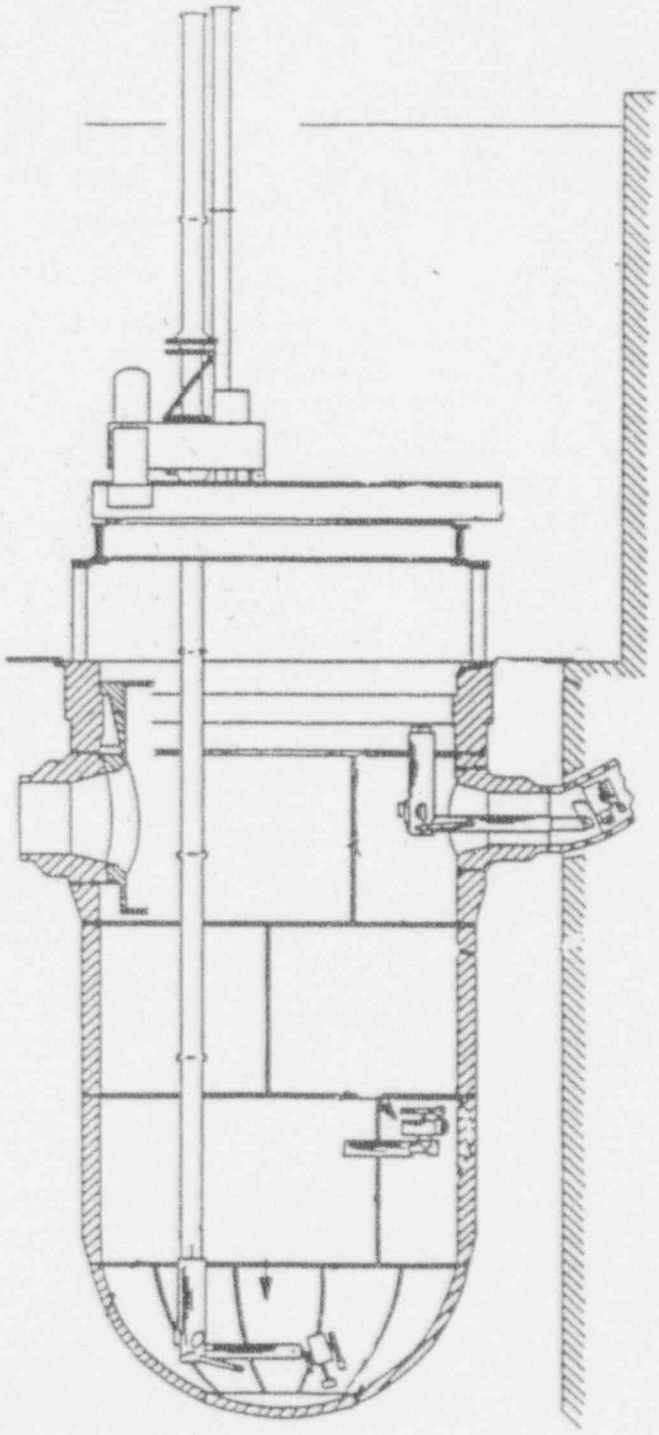
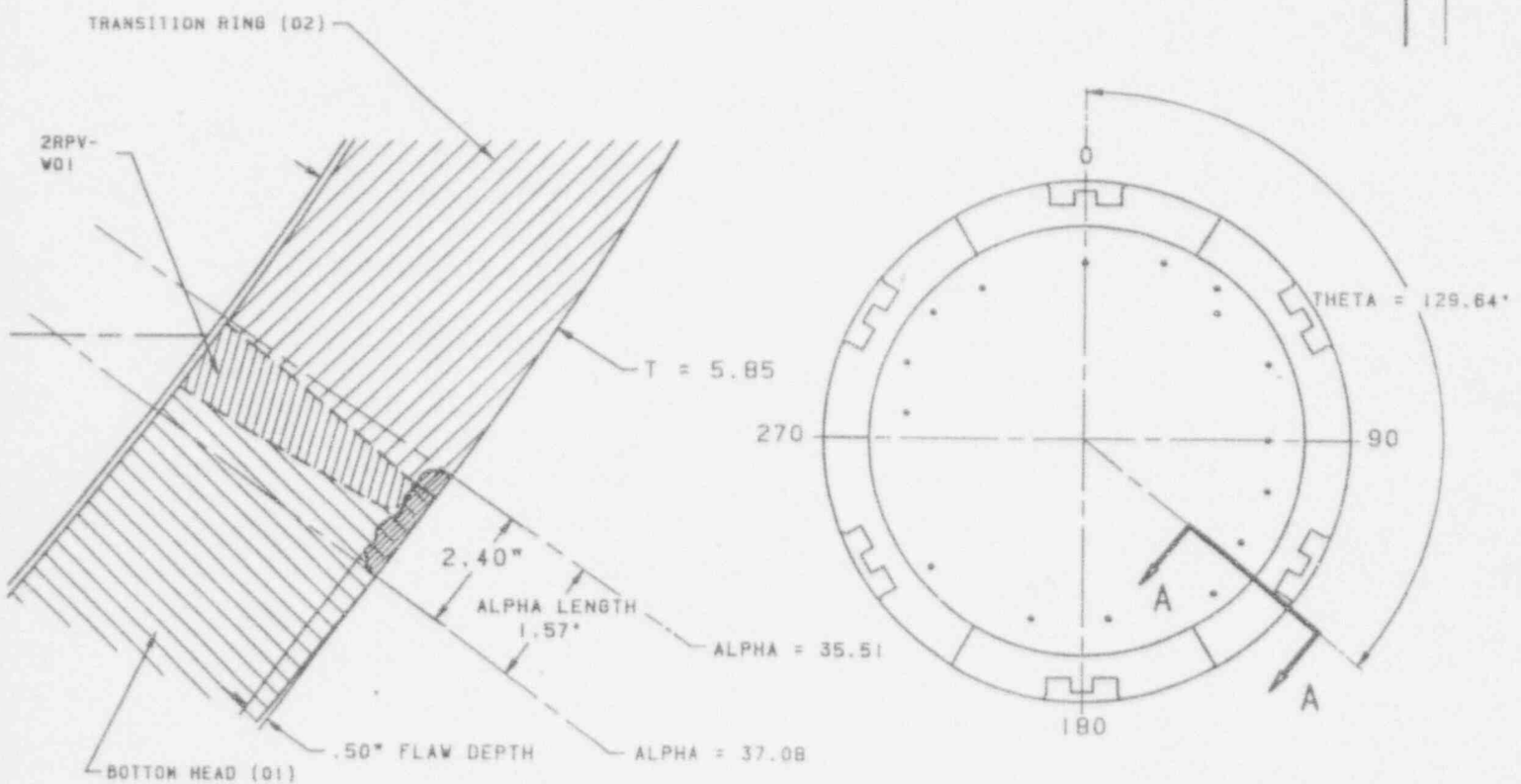


FIGURE 4

B&W NUCLEAR SERVICE COMPANY

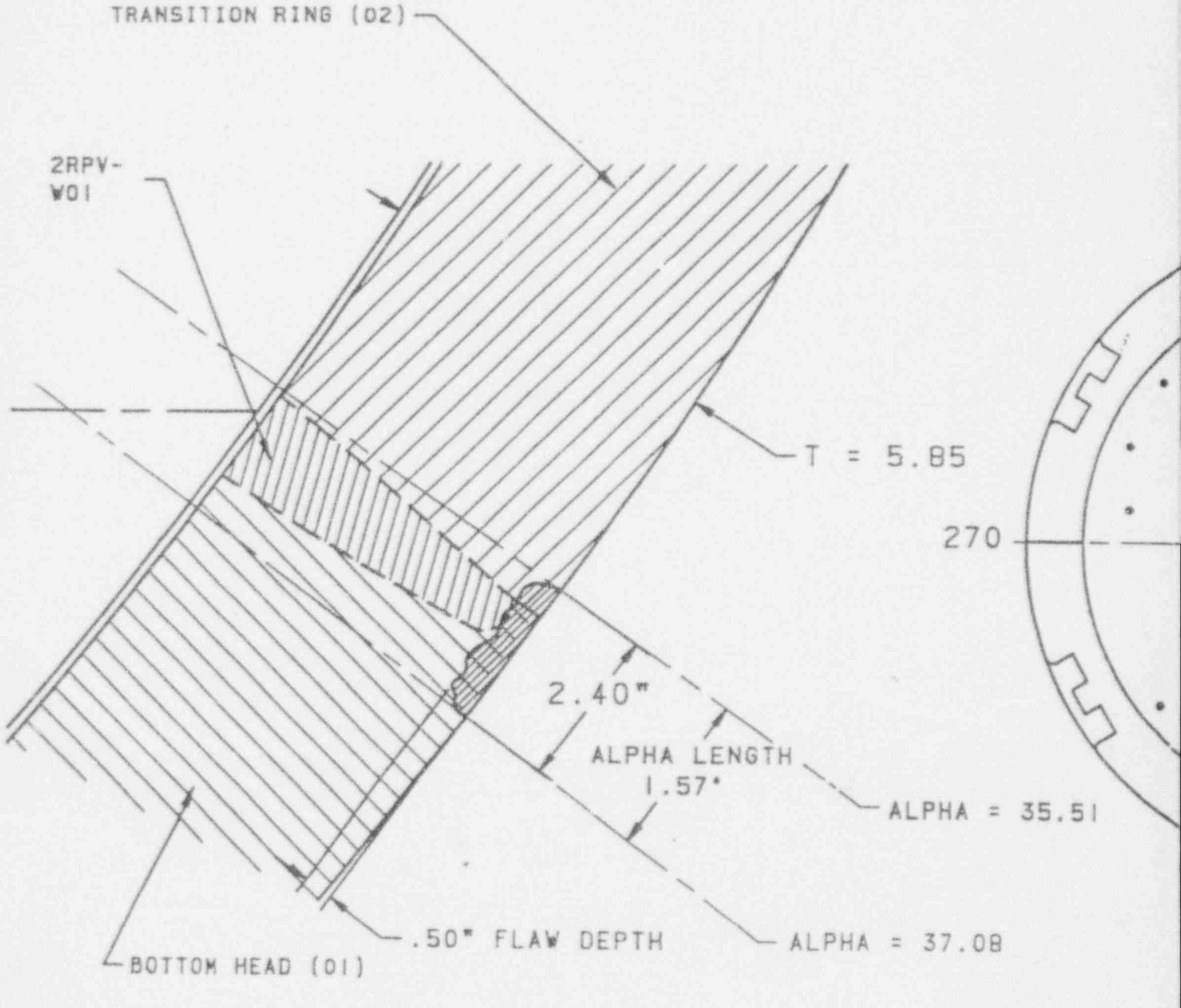
REVISIONS			
REV	DESCRIPTION	DATE	APPROVAL



SECTION A-A

FIGURE 5

SD L.GRAND		McGUIRE PLANAR INDICATION	SCALE NONE	DATE 08/04/9
			DWG NO 12278078-0	

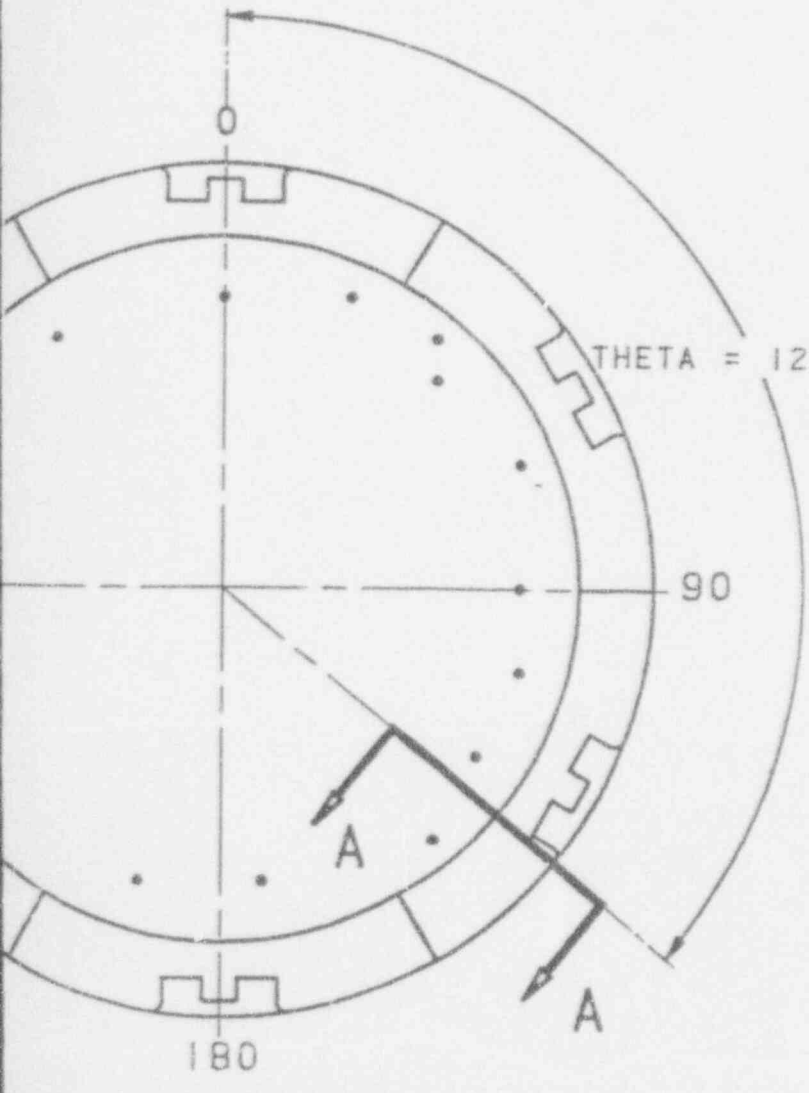


SECTION A-A

FIGURE 5

B&W NUCLEAR SERVICE COMPANY

REVISIONS			
REV	DESCRIPTION	DATE	APPROVAL



9308260330-01

DWN BY SD L.GRAND	CHK'D BY	McGUIRE PLANAR INDICATION	SCALE NONE	DATE 08/04/93
PROJECT BY	APP'D BY		DWG NO 1227807B-0	

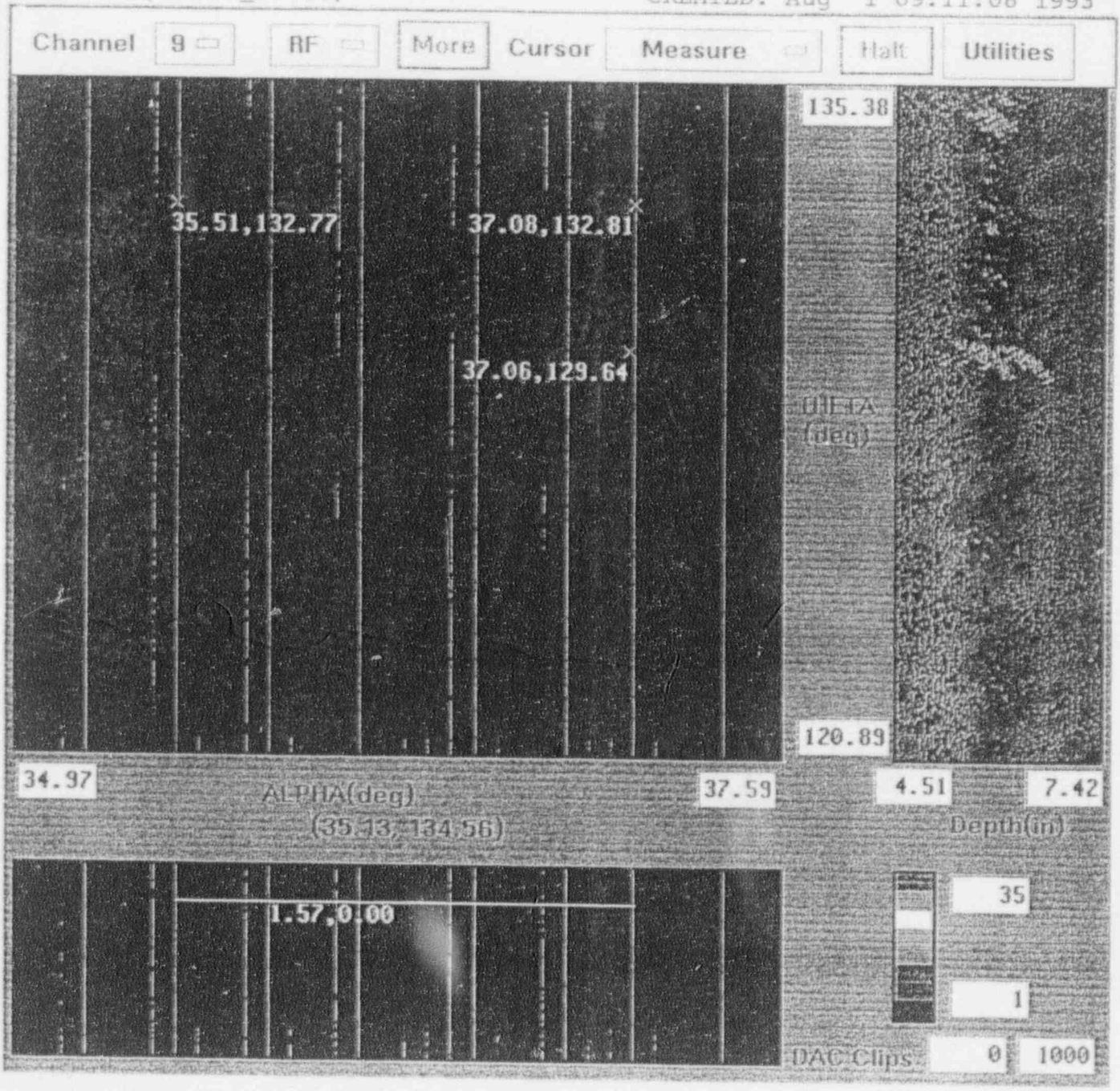
BWNS - NDE SERVICES

CUSTOMER: Duke Power Company
PLANT: McGuire Nuclear Station Unit 2
COMPONENT: Lower Head to Upper Head
TRANSDUCER: 45 DEG SHEAR(5508-93002)

Comments:45 degree shear wave indication at 129.64 deg. Theta
Length at noise level end points 35.51 to 37.08 deg. Alpha

SIN: B1.2.1 SUBSCAN: C-2 ANGLE: 45 BEAM DIR: 90

PATH: #0:/A3213_09.10/ CREATED: Aug 1 09:11:08 1993



Analyst: kjhacker Reviewer: _____ Date: Aug 2 16:37:15 1993

DUKE POWER COMPANY
MCGUIRE UNIT 2
07/93

SIN B1.2.1 : C-2

Channel # 9

Ind. Type Planar

Alpha 35.51 37.08 Depth 5.72"

Theta 129.64 Max Amp 16%

Ind. Length 50% DAC NA 20% DAC NA

Comments Length = 1.57 deg, 2.40" at noise level
TWD = 0.50" based on TIP measurement

Analyst KJ Hacker 8/2/93

Acceptance IWB-3510-1

Calculation l = 2.4", t = 5.85" - .157" clad = 5.69"
a = 0.50", a/l = 0.50/2.4 = .21 a/t % = 8.8%
IWB-3510-1 allows 2.8% a/t for a .21 aspect ratio

Disposition unacceptable Surface Planar Actual ER#

Reviewer KJ Hacker 8/2/93

Page ___ of ___

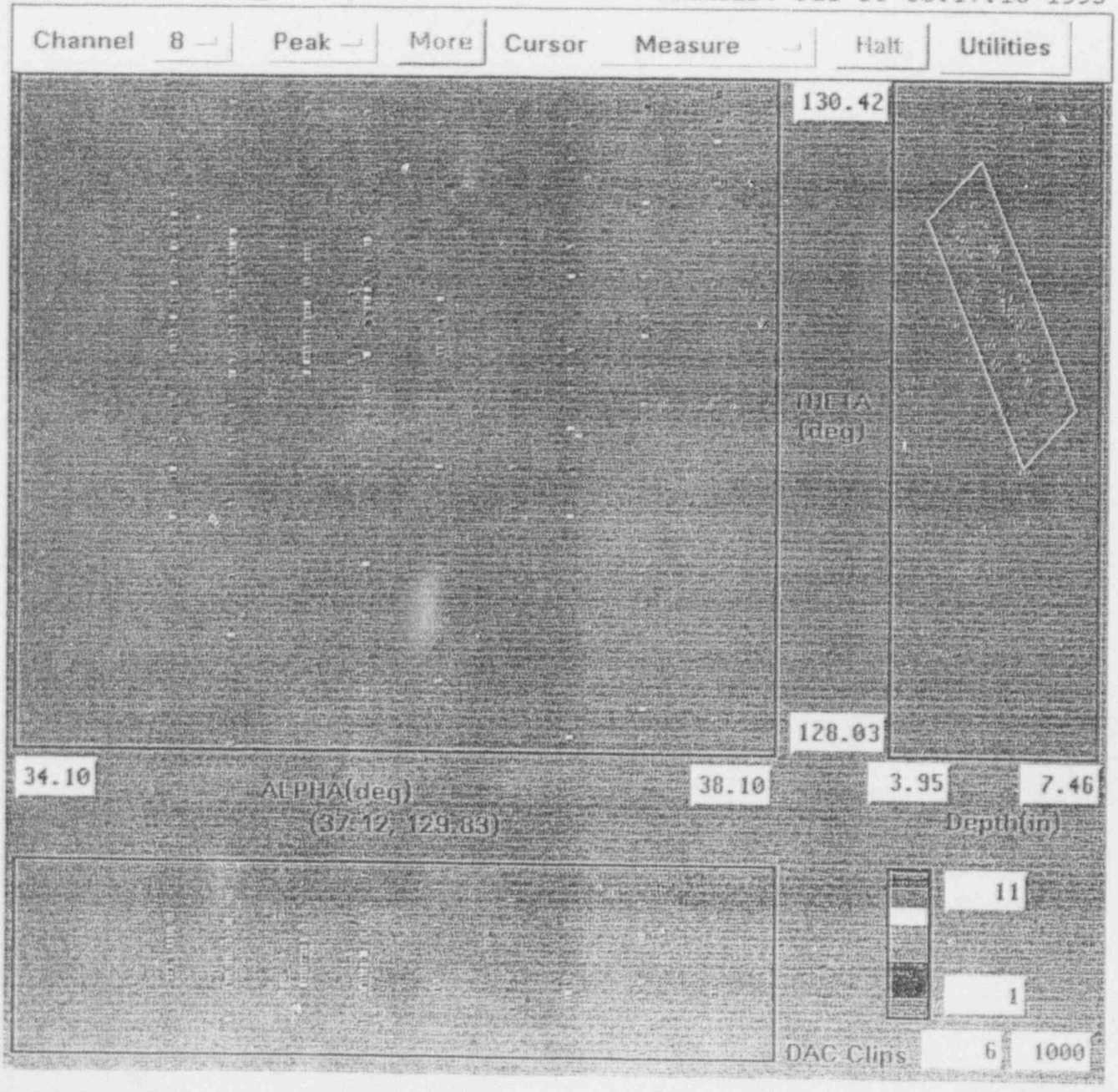
BWNS - NDE SERVICES

CUSTOMER: DUKE POWER COMPANY
PLANT:McGUIRE UNIT II
COMPONENT:LOWER HEAD TO BOTTOM HEAD WELD (W-01)
TRANSDUCER: 60 DEG SHEAR(5604-93003)

Comments:PLANAR INDICATION ON VESSEL OD.

SIN: B1.2.1 **SUBSCAN:** C-2 **ANGLE:** 60 **BEAM DIR:** 90

PATH: #42:/A3211_08.16/ CREATED: Jul 30 08:17:16 1993



Analyst: cemartin Reviewer: _____ Date: Jul 31 00:50:50 1993

Enclosure 13.4-1

REACTOR COOLANT SYSTEM

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.9.1 The Reactor Coolant System (except the pressurizer) temperature and pressure shall be limited in accordance with the limit lines shown on Figures 3.4-2, 3.4-3, 3.4-4, and 3.4-5 during heatup, cooldown, criticality, and inservice leak and hydrostatic testing with:

a. Maximum heatup rates as specified in Figures 3.4-2 and 3.4-3

b. Maximum cooldown rates as specified in Figures 3.4-4 and 3.4-5

c. A maximum temperature change of less than or equal to 10°F in any 1-hour period during inservice hydrostatic and leak testing operations above the heatup and cooldown limit curves.

APPLICABILITY: At all times.

ACTION:

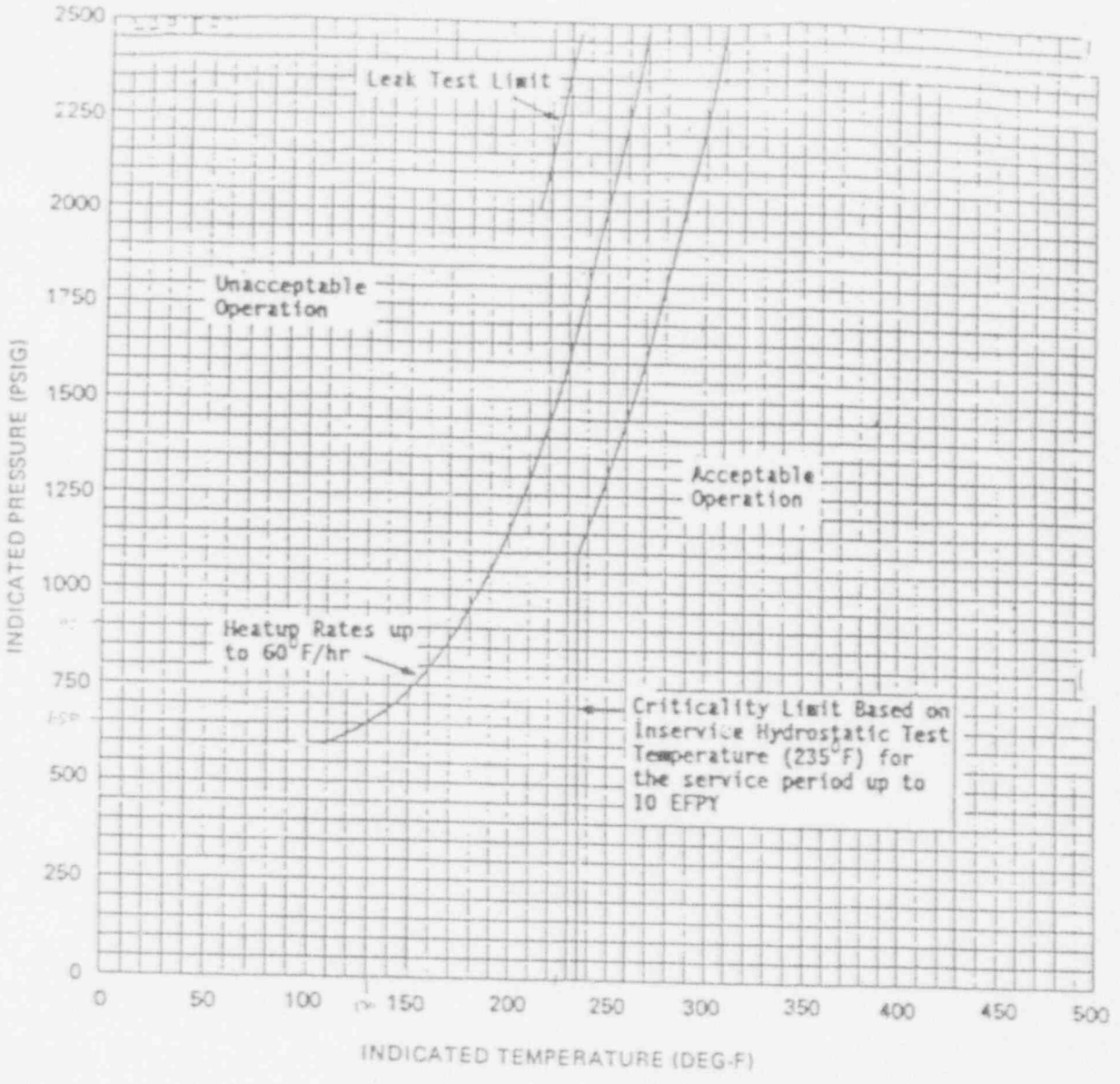
With any of the above limits exceeded, restore the temperature and/or pressure to within the limit within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the structural integrity of the Reactor Coolant System; determine that the Reactor Coolant System remains acceptable for continued operation or be in at least HOT STANDBY within the next 6 hours and reduce the RCS T_{avg} and pressure to less than 200°F and 500 psig, respectively, within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.9.1.1 The Reactor Coolant System temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

4.4.9.1.2 The reactor vessel material irradiation surveillance specimens shall be removed and examined, to determine changes in material properties, as required by 10 CFR 50, Appendix H in accordance with the schedule in Table 4.4-5. The results of these examinations shall be used to update Figures 3.4-2, 3.4-3, 3.4-4, and 3.4-5.

Enclosure 13.4-2



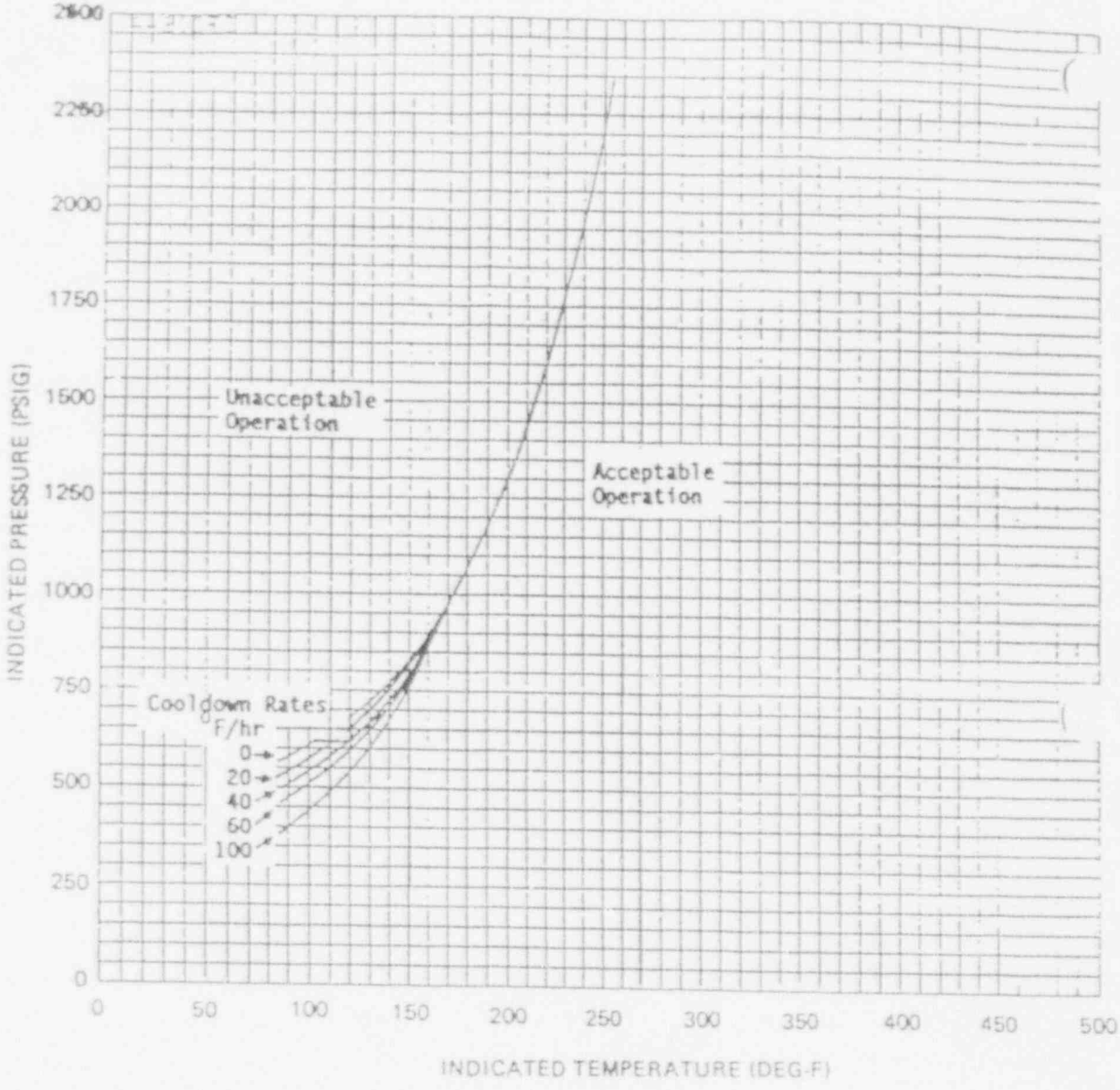
CURVES APPLICABLE FOR HEATUP RATES UP TO 60°F/HR FOR THE SERVICE PERIOD UP TO 10 EFPY. CONTAINS MARGINS OF 10°F AND 60 PSIG FOR POSSIBLE INSTRUMENT ERROR.

MATERIAL BASIS
CONTROLLING MATERIAL: LOWER SHELL
COPPER CONTENT: 0.15 wt%
RT_{NDT} INITIAL: -30°F
RT_{NDT} AFTER 10 EFPY: 1/4T, 80°F
3/4T, 61°F

FIGURE 3.4-3 McGUIRE UNIT 2 REACTOR COOLANT SYSTEM HEATUP LIMITATIONS NRC RG 1.99 REV 2 APPLICABLE FOR THE FIRST 10 EFPY

Amendment No. 115 (Unit 1)
Amendment No. 97 (Unit 2)

Enclosure 13.4-3



CURVES APPLICABLE FOR COOLDOWN RATES UP TO 100°F/HR FOR THE SERVICE PERIOD UP TO 10 EFPY AND CONTAINE MARGINS OF 10°F AND 60 PSIG FOR POSSIBLE INSTRUMENT ERRORS

MATERIAL BASIS
CONTROLLING MATERIAL – LOWER SHELL
COPPER CONTENT: 0.15 W/%
RT_{NDT} INITIAL: – 30°F
RT_{NDT} AFTER 10 EFPY: 1/4T, 80°F
3/4T, 61°F

FIGURE 3.4–5 McGUIRE UNIT 2, REACTOR COOLANT SYSTEM, COOLDOWN LIMITATIONS NRC RG 1.99 REV 2
APPLICABLE FOR THE FIRST 10 EFPY

13.5 Evaluation 2: Normal and Upset Conditions.

This evaluation considers Normal & Upset Transients.

Table 13.5-1 and its notes describe in summary form the results of this evaluation. Further discussion is given here.

In this evaluation stresses of combined cases of Pressure and Thermal Transient temperature fields (and residual) are used to calculate K_I values.

PRESSURE and TEMPERATURE STRESS FIELD DETERMINATION

Since K_{Ia} and K_{Ic} material values are a function of material temperature, and K_I values are a function of pressure, it is necessary that the appropriate pairings of pressure and temperature are evaluated.

Basic pressure and temperature combinations for Normal and Upset are 2250 psia and 557 °F as shown in Figure 1 of reference [11-4]. (Psia and psig are assumed equivalent herein.)

The effects of uneven heating through the vessel wall are the main subject of this evaluation. These effects increase in severity with the rate of heating or cooling, and since it is interior heating that will cause tensile stress on the exterior surface (additive with pressure stress), heating is evaluated. Table 13.5-2 shows the temperature changes and rates for those Normal and Upset Transients with an increase in Tcold. (Neither of the two faulted cases have increasing Tcold.) Instead of performing separate evaluations for each, an enveloping case, "Enveloped Heating Transients", is created by taking the maximum temperature rise and the minimum accompanying time.

The stress effects of this heating were determined using the computer program TRANS2A, described in section 14.0. The following summarizes the input.

Section Properties:

SECTION NUMBER	SECTION NAME	MATERIAL TYPE	INSIDE (DIAMETER (IN)	WALL THICKNESS (IN)	AMBIENT TEMPERATURE (F)	WALL DIVISIONS
1	LOWRHEAD	CMS	176.000	5.690	70.000	20

The input boundary conditions specified a ramped temperature function at the inside surface beginning at 557 °F at time zero and ending at 601 °F at eight seconds which is held constant until one hour is reached. The accompanying flow was set artificially high to conservatively force the inside metal temperature to respond at the same rate as the fluid. In view of the conservatisms employed, the effects of not considering the cladding are negligible.

The solution was numerically determined using one time step for each degree of temperature rise for the first 8 seconds, followed by one time step for each second until one minute is reached, followed by one time step for each minute until one hour is reached.

Figure 13.5-1 shows the inside, mid depth, crack tip, and outside temperature responses vs. time.

Since no rotation takes place in the vessel wall, the resulting stress at any point at any time is E * alpha * ΔT / (1-nu) where E is Young's modulus, alpha is the linear coefficient of thermal expansion, ΔT is the difference between the temperature at the point and the average through wall temperature at that time, and nu is Poisson's ratio.

This evaluation used the maximum stress at the exterior surface and conservatively assumed it to be all membrane in calculating K_I.

To find this maximum stress, Figure 13.5-2 shows the plot of the subject ΔT vs. time, and Figure 13.5-3 shows the profile of stress through the section at the time (240 seconds) when this ΔT is maximum. (Note the near flat slope of the profile near the exterior surface, reinforcing the decision to characterize this stress as all membrane in accordance with ASME Section XI Figure A-3200-1.)

In Figure 13.5-2, this maximum ΔT is 13.45 °F.

Pressure Stress is computed using thin wall theory. In Table 13.5-1, a stress of 2485 psig is conservatively used.

This location is sufficiently remote from significant structural discontinuities to preclude the necessity for stress multipliers.

RESIDUAL STRESS

The 10 ksi residual stress (as discussed in section 13.3) is applied as bending stress in accordance with ASME Section XI Figure A-3200-1.

K_I DETERMINATION

Calculation of KI and comparison to allowables for the appropriate combinations of stresses are shown in summary form in Table 13.5-1.

SUMMARY

Table 13.5-1 shows that the worst comparison of calculated K_I to allowable is 62.8%, even with all the conservatisms employed.

Table 13.5-1

1980 ASME Section XI Appendix A Analysis of Flaw Indications

Normal & Upset Transients w/Tcold Increasing
(Enveloped Heating Transients)

Units inch, kip, °F

	Note	
Reactor Temp	(1)	557.000
Press	(1)	2485.000
a	(2)	0.500
l	(2)	2.400
t	(2)	5.690
a/t		0.088
a/l		0.208
RT_{NDT}	(3)	10.000
$T-RT_{NDT}$		547.000
K_{Ia}	(4)	200.000
K_{Ic}	(4)	200.000
σ_m pres	(5)	19.298
ΔT memb	(6)	13.450
σ_m ΔT	(6)	4.090
σ_m resid	(7)	0
σ_m	(8)	23.389
σ_b pres	(5)	0
ΔT bend	(6)	1.170
σ_b ΔT	(6)	0
σ_b resid	(7)	10.000
σ_b	(8)	10.000
M_m	(9)	1.100
M_b	(9)	0.920
σ_{ys}	(10)	42.516
Q	(11)	1.214
K_I	(12)	39.723
$\sqrt{2}K_I/K_{Ic}$	(13)	0.281
$\sqrt{10}K_I/K_{Ia}$	(13)	0.628

Notes:

(1) Bounding reactor coolant temperature & pressure for Normal & Upset Transients w/Tcold Increasing; Reference [11-3] & Table 13.5-2

(2) Crack depth, length & vessel wall thickness, Reference 12-4 & "Characterization of Flaw" section 13.2

(3) Determination of Reference Transition/Nil Ductility Temperature, reference section 13.1

(4) Available fracture toughness based on crack arrest & fracture initiation, respectively, for the corresponding crack tip temperature (ksi$\sqrt{in}$) as defined in ASME Section XI, Appendix A, Figure A-4200-1 (reference section 4.0).

(5) Membrane pressure stress = PD/4t (thin wall theory hoop stress in a spherical shell) where D = 176.75". Bending component of pressure stress = 0.

(6) Maximum of average minus outside temperature from TRANS2A analysis (microfiche attachment M1 & Figure 13.5-2), used to calculate σm ($E\alpha\Delta T/(1-\mu)$ where E = 29.9E3, α = 7.12E-6 in/in/°F, μ = 0.3). Conservatively define all transient stress to be membrane (M_m is larger than M_b in K_I computation, reference ASME Section XI Appendix A, article A-3300).

(7) Residual stress is conservatively assumed to be 10 ksi bending per the 1986 edition of the ASME Section XI Appendix E, Table E-2.

(8) Total membrane/bending stress to be used in K_I determination. Sum of pressure, transient & residual stresses.

(9) Correction factors for membrane & bending stress as defined in ASME Section XI, Appendix A, article A-3300. See Figures A-3300-3 & A-3300-5 (M_m = 1.1 & M_b = 0.9).

(10) Yield stress of material @ temperature. Reference Figure 13.4-7 & ASME Section III, Appendix I, 1977.

(11) Shape factor for flaw as defined in Figure A-3300-1 of ASME Section XI Appendix A.

(12) Stress intensity factor as defined in ASME Section XI Appendix A, article A-3300. $K_I = \sigma_m M_m \sqrt{\pi} \sqrt{(a/Q)} + \sigma_b M_b \sqrt{\pi} \sqrt{(a/Q)}$

(13) Ratio to allowables; $K_I < K_{Ia}/\sqrt{10}$ for normal conditions and $K_I < K_{Ic}/\sqrt{2}$ for emergency & faulted conditions, are required by ASME Section XI article IWB-3612.

DUKE POWER COMPANY
MCGUIRE UNIT 2
07/93

Rbr: 11
1

SIN B1.2.1: C-2 Clip: 6

Channel # 8 (ALTERNATE HEAD) A3211-08.16 DISK #15

Ind. Type PLANAR

ALPHA	34.85	36.36	Depth	5.88"	
THETA	129.39	130.02	Max Amp	13% DAC	

Ind. Length	50% DAC	N/A	20% DAC	N/A

Comments HMA LENGTH = $(35.96^\circ - 34.90^\circ) \times (88.2 + 5.6) \times \frac{\pi}{180} = 1.74"$
TWD = 5.88" - 5.29" = 0.59" (TIPS)
ALPHA & THETA RADII = 88" AND 74" RESPECTIVELY

Analyst C.E. Mantz 7/31/93

Acceptance ICWB-3510-1

Calculation see evaluation of indication with 45° Scan

Disposition UNACCEPTABLE Actual ER# _____

Reviewer Howard Stoppelman

ATTACHMENT 2

DUKE POWER COMPANY
MCGUIRE NUCLEAR STATION

FABRICATION AND INSPECTION HISTORY OF WELD W01

Fabrication and Inspection History of Weld W01

The weld W01 Index provides a chronological list of fabrication events and inspections performed on this weld by the Rotterdam Dockyard Company (RDM) from 9/23/71 until 4/15/74. The associated reports are organized by file number from 664-W01-001 thru 664-W01-011. Reports for additional heat treatments that this weld underwent as a part of larger assemblies or the complete vessel are organized in file numbers 664-W03-006, 664-W05-004, and 30664-002. Also included are RDM weld specification and the baseline UT examination report.

Heat Treatments:

The following is a summary of all post weld heat treatments for weld W01(see Attachment 1 for drawings of the referenced assemblies):

Date	Report File	Heat Up Rate	Hold Temp	Hold Time	Cooldown Rate
11/5/71	W01-005	36 ^{O}C/hr from 315 C	595-605 ^{O}C	0h 28m	30.5 ^{O}C/hr to 300 C
12/22/71	W01-005	38 ^{O}C/hr from 315 C	595-610 ^{O}C	0h 44m	33 ^{O}C/hr to 300 C
2/28/72	W01-005	43 ^{O}C/hr from 315 C	595-610 ^{O}C	0h 40m	35.6 ^{O}C/hr to 300 C
		Total for W01 in Assembly 1 =		**1h 52m**	
6/12/72	W03-006	28.5 ^{O}C/hr from 315 C	595-605 ^{O}C	0h 34m	42 ^{O}C/hr to 300 C
		Total for W01 in Assembly 2 =		**2h 26m**	
4/4/73	W05-004	33 ^{O}C/hr from 315 C	595-615 ^{O}C	1h 20m	24.5 ^{O}C/hr to 300 C
4/21/73	W05-004	44 ^{O}C/hr from 315 C	595-625 ^{O}C	1h 30m	39 ^{O}C/hr to 300 C
5/25/73	W03-006	31 ^{O}C/hr from 315 C	595-605 ^{O}C	0h 55m	30.5 ^{O}C/hr to 300 C
6/9/73	30664-002	18 ^{O}C/hr from 315 C	595-620 ^{O}C	11h 20m	16 ^{O}C/hr to 300 C
		Total for W01 in Complete Vessel =		**17h 31m**	

Fabrication Inspections:

Magnetic Particle examinations were performed on weld W01 in as follows:

Date	Surface Examined	Results
11/11/71	W01 inside	No indications found
12/15/71	W01 ground rootpass	No indications found
12/28/71	W01 circle seam, outside	No indications found
2/22/72	W01 circle seam cavities	No indications found
2/24/72	W01 repaired areas inside & outside	No indications found
3/2/72	W01 repaired area on outside	No indications found
3/20/74	Complete vessel	No indications found

Ultrasonic examinations were performed on weld W01 in as follows:

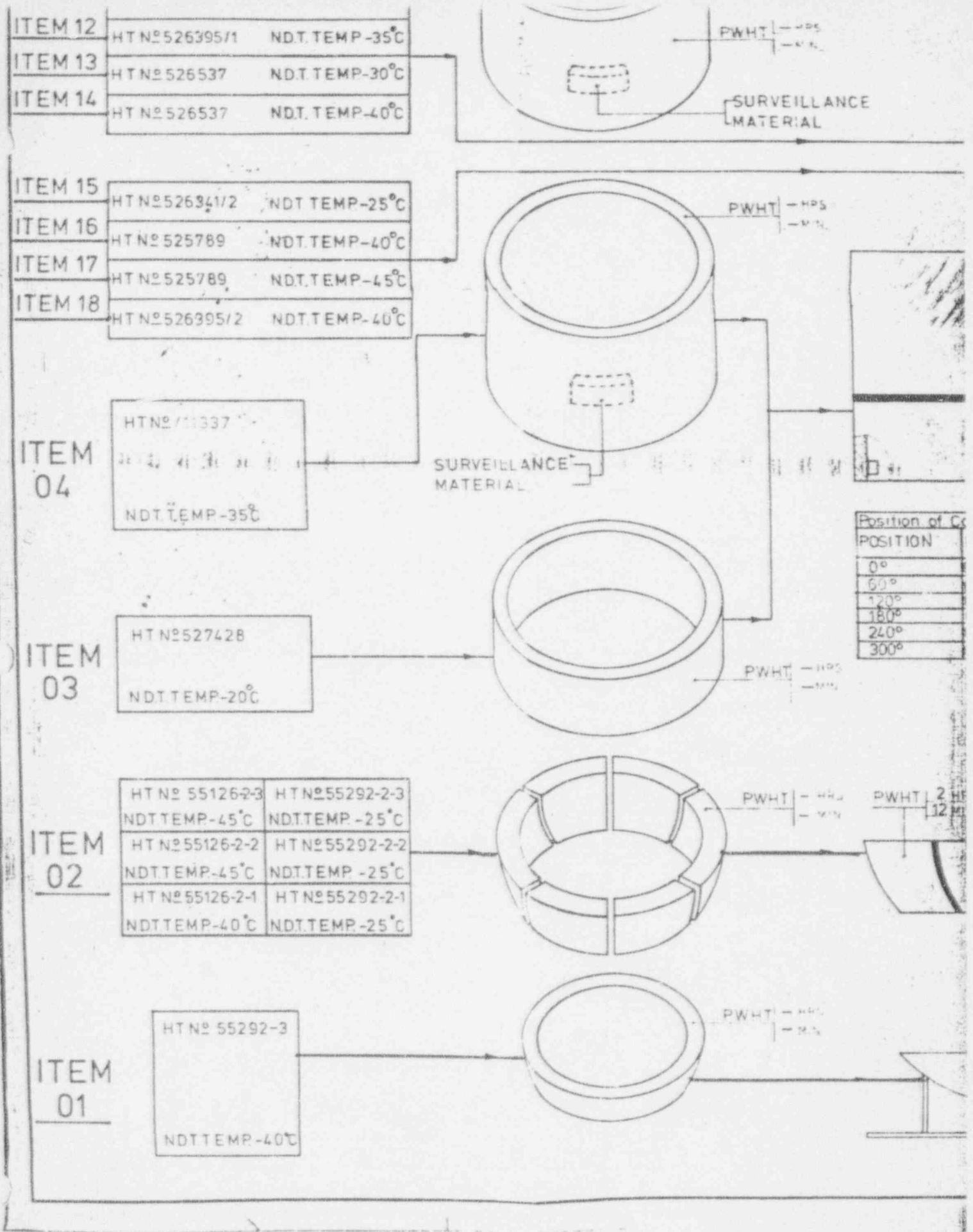
Date	Volume Examined	Results
1/3/72	W01 (complete weld)	Some indications found
2/2/72	W01 (repaired areas)	Cleared 1/3/72 results
4/25/73	W01, 3, 4, 5, 6, 7, and W11-W18	No indications found in W01
3/19/74	W01 after hydrostatic test	No indications found

Fabrication Inspections (cont'd)
A liquid penetrant examination was performed on weld W01 of the cladding C02 surface to verify removal of an indication found during the 1/21/72 radiography.

Baseline Radiography:
The only radiography for this weld was performed on 1/21/72 and 3/20/72 per report 030772, file number 664-W01-010. This report records all indications observed in the 1/21/72 inspection were cleared with 3/20/72 inspection. A recent review of this original inspection film from the area of the weld indication showed no defect to be present.

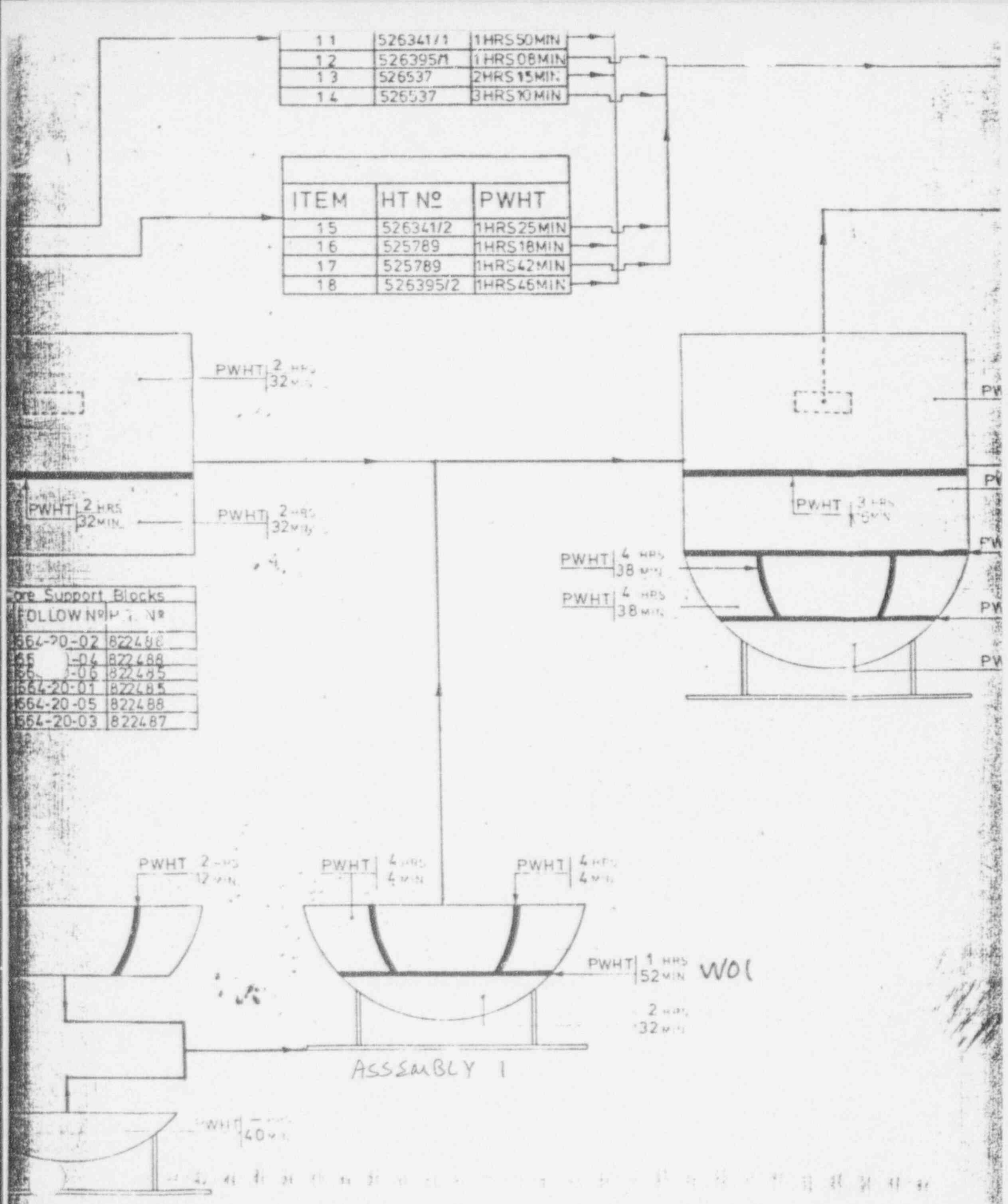
The dates of this radiography correspond to the fabrication step where only the bottom head and spherical shell were joined together. Therefore indications due to the additional fabrication required to make the complete vessel , shipping, or installation would not be present on this film.

Baseline Ultrasonic Examination:
The baseline ultrasonic examination was performed during the preoperational inservice inspection on 9/8/78. This examination was performed by B&W using an immersion UT technique, with water in the reactor vessel acting as the coupling agent, versus the contact technique used for the 10 year ISI. No indications were found during this examination in the area of the current indication.



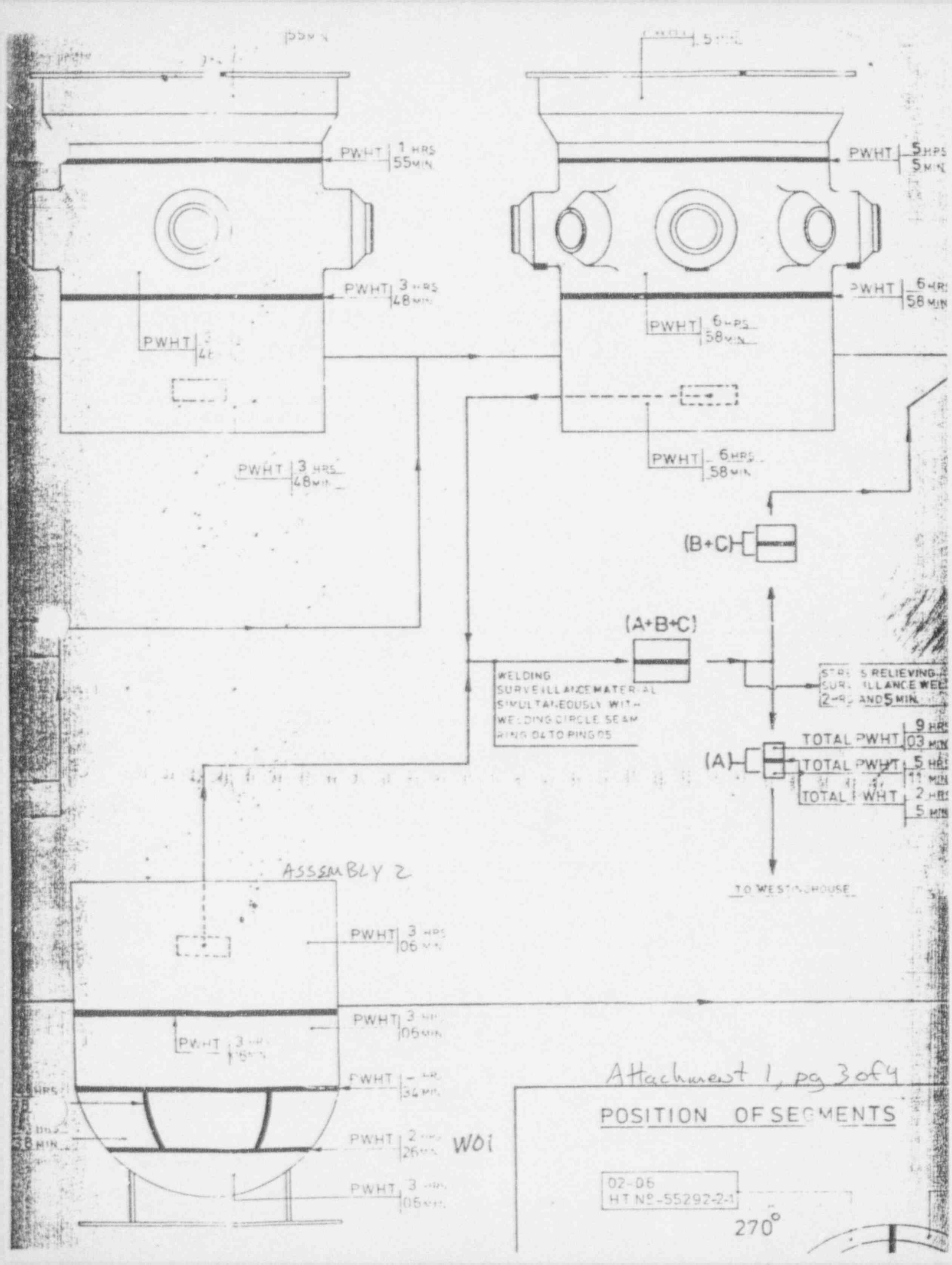
E F D

Attachment 1, pg 1 of 4



ore Support Blocks

FOLLOW Nº	P. Nº
564-20-02	822488
65 -04	822488
56 -06	822485
564-20-01	822485
564-20-05	822488
564-20-03	822487


PWHT 1 HRS 55 MIN
PWHT 3 HRS 48 MIN
PWHT 3 HRS 48 MIN
PWHT 5 HRS 5 MIN
PWHT 6 HRS 58 MIN
PWHT 6 HRS 58 MIN
PWHT 6 HRS 58 MIN
(B+C)
(A+B+C)
WELDING SURVEILLANCE MATERIAL SIMULTANEOUSLY WITH WELDING CIRCLE SEAM RING 04 TO RING 05
STRESS RELIEVING SURVEILLANCE WELD 2 HRS AND 5 MIN
(A)
TOTAL PWHT 9 HRS 03 MIN
TOTAL PWHT 5 HRS 11 MIN
TOTAL PWHT 2 HRS 5 MIN
TO WESTINGHOUSE
ASSEMBLY 2
PWHT 3 HRS 06 MIN
PWHT 3 HRS 05 MIN
PWHT 3 HRS 05 MIN
PWHT 2 HRS 26 MIN
W01
PWHT 3 HRS 05 MIN
Attachment 1, pg 3 of 4
POSITION OF SEGMENTS
02-06
HT NO.-55292-2-1
270°

11-06	W11	899680			7265	
12-06	W12	899680			NO REPAIRS	
13-06	W13	899680			7265	
14-06	W14	899680			7265	TD11/6143 7359/5201
15-06	W15	899680			NO REPAIRS	
16-06	W16	899680			NO REPAIRS	
17-06	W17	899680			7265	
18-06	W18	899680			NO REPAIRS	
19-07	W19	5655	4292		NO REPAIRS	

POSITIONS

18

22°

0°

22°

15

11

FITTED AFTER FINAL STRESS RELIEVING

W09

W08

W19

W07

W11-W18

W06

W05

(B+C)

W04

W03

W02 01-
W02 06

N01

TOTAL PWHT

PWHT 9 HRS 5 MIN

PWHT 6 HRS 58 MIN

21 HRS 23 MIN

14 HRS 25 MIN

17 HRS 41 MIN

STRESS RELIEVING SURVEILLANCE WELD 2 HRS AND 5 MIN

TOTAL PWHT 9 HRS 03 MIN

TOTAL PWHT 5 HRS 11 MIN

TOTAL PWHT 2 HRS 5 MIN

COMPLETE VESSEL

INLE	
ITEM	
11	5
12	5
13	5
14	5

OUTLE	
ITEM	
15	5
16	5
17	5
18	5

Attachment 1, pg 4 of 4

QUALITY CONTROL

TRAVELLER REPORT No.
Date :

Project: DUKE POWER

Contract ref.: 54-6-CVQ-116629 BP

Inspection by: Lloyds R.I.S.
MAPD

Order no.: 30664

RDM Drawing no.: 30738-1536

Item no.: 01-02

Subject: Weldjoint bottemheadcap to spherical ring

Seq. no.	Spec. no.	Activity	Notes	Result	Operator	Inspectors Par./Date
01	23.06-6	MT	Surface of weldprep on bottem headcap for W01 664-W01-001	OK	Pa Mt Gr	1971-09-23
02			Soaking after buttering for breakets 664-W01-003	OK		1971-10-06
03	23.06.-6	MT	Surface of butterings 664-W01-001	OK	Ba Vh	1971-10-10
04			Soaking after buttering for temp. lifting lugs 664-W01-003	OK		1971-10-18
05	23.06-6	MT	Surface of weldprep on spherical ring for W01 664-W01-001	OK	Ot	1971-10-21
06			Fit up 664-W01-004			1971-10-21
07			Deviation request 664-W01-002-D15			1971-10-25

Result:

OK : Acceptable
D : Minor imperfections removed and reexamined.
U : Unacceptable.

Activities:

LT : Leak testing
MT : Magnetic particle testing.
PT : Penetrant testing.
HT : Hardness testing.
RT : Radiographic testing.
TT : Thickness testing.
UT : Ultrasonic testing.
DIM : Dimensional check.
FT : Ferrite testing.

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QUALITY CONTROL — TRAVELLER REPORT NO.

Seq. no.	Spec. no.	Activity	Name	Result	Sign	Inspected by Date
08	53.01-9		Heattreatment after welding circle seam from ID side 664-W01-005	OK		1971-11-05
09	23.06-6	MT	Surface of circle seam (inside) 664-W01-001	OK	Ma Ba	1971-11-11
10	23.06-7	MT	Rootpass 664-W01-001	OK	Ms	1971-12-15
11	53.01-9		Heattreatment after welding circle seam from OD 664-W01-005	OK		1971-12-22
12	23.06-7	MT	Surface of circle seam (outside) 664-W01-001	OK	vH Pu	1971-12-28
13			Variation report 664-W01-006-V48			1972-01-21
14		UT	Depth measuring defects (see V48 664-W01-007	OK	M Ve	1972-01-26
15		DIM	Dimensional check cavities 664-W01-004			1972-02-03
16	23.06-7	MT	Surface of cavities (clears par 2.3 of V48) 664-W01-001	OK	Mo Gr	1972-02-22
17	23.06-7	MT	Surface of repaird area (clears par 2.6 of V48) 664-W01-001	OK	Pu	1972-02-24
18	22.07-5	RT	Radiographic examination circle seam W01 664-W01-010	U		1972-01-21
19	21.07-1	UT	Circle seam 664-W01-011	U	Ma dRo	1972-01-03
20	53.01-9		Heat treat ment after repair (clears par 2.5 of V48) 664-W01-005	OK		1972-02-28

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CLOSE

QUALITY AND METALLURGICAL DEPARTMENT

QUALITY CONTROL — TRAVELLER REPORT NO.

Seq. no.	Spec. no.	Activity	Notes	Result	Operator	Inspection Per./Date
21	24.06-8	PT	Surface of cladding (clears par 2.7 of V48) 664-W01-008	OK	H Gr	1972-03-02
22	21.05-9	UT	Cladbonding (clears par 2.7 of V48) 664-W01-009	OK	Bl	1972-03-02
23	22.07-5	RT	Repairs (clears par 2.8 of V48) 664-W01-010	OK		1972-03-20
24	21.07-2 60° probe	UT	Circle seams:W01,W03,W04,W05,W06, W07 and W11 thru W18 664-W01-011	OK	Ve vD Bl B	1973-04-25-26
25	21.08-7	UT	Circle seam W01 after Hydro test 664-W01-011	OK	Gr	1974-03 18
26	23.03-4	MT	Surface after Hydro test 664-W01-001	OK		1974-03-04-15

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