ENCLOSURE 3

I

ASSESSMENT OF ULTRASONIC REFLECTORS IN THE WATTS BAR UNIT ~~II~~ REACTOR VESSEL NOZZLE BORES

Eam 2/12/81

R. D. Rishel
D. C. Adamonis

October 8, 1980

APPROVED: T. R. Mager

T. R. Mager, Manager
Metallurgical and NDE Analysis

Work Performed Under Shop Order No. UENM 6000

WESTINGHOUSE ELECTRIC CORPORATION
STRATEGIC OPERATIONS DIVISION
P. O. BOX 855
PITTSBURGH, PENNSYLVANIA 15230

8103270787

EVALUATION OF TEST RESULTS

The clad overlay procedures and the reflector characteristics indicate that the recorded reflectors categorized as suspect per the test procedure in Loop 1, Loop 3 and Loop 4 inlet nozzles can be considered underclad cold cracks. The large quantity of reflectors in the Loop 2 inlet nozzle, which appear in circumferential bands, occur in clusters, and are separated by 1 1/2" - 2", conform to the characteristics typical of reheat cracks.

An ASME Section XI evaluation, utilizing preservice acceptance criteria, of these ultrasonic reflectors requires a measurement of the through-wall dimensions. Current NDE technology, though, does not permit a direct measurement of through-wall dimensions, therefore a reliable method of estimating these dimensions is required.

The most realistic method relies on data gathered by destructive means. Since the underclad cold cracking phenomenon was identified, exhaustive destructive analyses have been performed to establish a correlation between ultrasonic test results and actual crack dimensions. The maximum crack depth observed was 7.5 mm (0.295"). In the case of reheat cracking, the flaws are always confined to the coarse-grained region of base material directly beneath weld bead overlaps. During extensive metallographic studies of this phenomenon the maximum depth of the coarse-grained zone was measured at 0.125" (3.2mm). Thus, for evaluation purposes, all reflectors will be assumed to have through-wall dimensions equal to 0.125" (3.2mm) or 1/3 the ultrasonically measured length, whichever is larger, to a maximum depth of 0.295" (7.5mm).

Review of IWA-3300 indicated it was not necessary to apply the criteria of IWA-3330 for multiple planar flaws or IWA-3350 for parallel planar flaws during the characterization process for recorded reflectors in the Loop 2 inlet nozzle. In the first case, distances between adjacent rows of indications were 1-1/2" to 2", much greater than the maximum 2a for the inlet nozzles, 0.59" (15mm); refer to ASME XI, 1977 Edition, Figure IWA-3330-1, Surface Flaw #1. In the second case, although the primary planes of individual flaws in a band were less than 1/2" apart, they were not displaced axially so as to significantly increase the length of the flaw; refer to ASME XI, 1977 Edition, Figure IWA-3350, Semi-Elliptical Surface Flaws. Therefore, all indications were characterized as individual surface flaws, IWA-3310, with through-wall dimensions equal to 0.125" or 1/3 their ultrasonically measured length, whichever is larger, to a maximum of 0.295" for ASME XI preservice acceptance calculations.

For Watts Bar Unit I, the inlet nozzle thickness, and the outlet nozzle thickness are 13.8 inches, and 11.3 inches, respectively. These thicknesses are determined per the method defined in Table IWB-3512, note 2, where $t = \frac{tn1 + tn2}{2}$. Dimensions tn1 and tn2 were obtained from the nozzle fabrication drawings.

The longest ultrasonically measured reflector observed in the inlet nozzles was 1.5 inches. Assuming a maximum depth of 7.5mm (0.295"), the allowable a/t value is 2.7% while the actual a/t value for this case is 2.1%.

After the test system was calibrated, instrument sensitivity was increased by 6 dB for scanning. Scanning was conducted on the clad nozzle bore surfaces in both circumferential directions. When an indication was detected, instrument sensitivity was returned to the primary reference level and the maximum amplitude obtained. If the amplitude was equal to or greater than 50% of primary reference, the indication was recorded per the criteria defined in the procedure.

The calibration sensitivity of this examination technique is at least 5 times that required by conventional ASME Section XI examination methods (3/32 side drilled hole). This fact was demonstrated by making a direct comparison between the instrument gain required to set the amplitude of the 2mm diameter flat bottom reference reflector to 80% of full screen height versus that required to obtain the same signal amplitude from a side drilled hole of the same diameter and depth. Calibration on the flat bottom hole required an instrument gain setting 14-16 dB greater than that for the side drilled hole.

Areas where reportable indications were detected with the 70° search unit were evaluated with a KBI, Gamma Series, 5.0 MHz, 0°, transmit-receive search unit. Calibration for this examination was established on the flat bottom of a 2mm diameter flat bottom hole drilled to the clad/base metal interface in a representative calibration block. Any indication detected by the 70° longitudinal wave inspection and also detectable by the 0° straight beam inspection was considered acceptable by the criteria defined in the test procedure. A copy of the detailed test procedure is attached as Appendix B.

The nozzle bore examinations were conducted by qualified ultrasonic test operators from Sonic Systems International, Houston, Texas under the direct supervision of Westinghouse personnel. Personnel and equipment certification records are on file.

INSPECTION RESULTS

The four outlet nozzles of Watts Bar Unit I contained no reportable indications as defined in the test procedure. The remaining four inlet nozzles contained indications characteristic of cracking.

Three of the inlet nozzles, identified as Loop 1, Loop 3 and Loop 4, displayed reflectors which correspond with those typical of cold cracking. The Loop 1 inlet nozzle contained three indications that must be considered suspect per the test procedure. The Loop 3 inlet nozzle contained 32 reportable indications, 13 of which must be considered suspect, and the Loop 4 inlet nozzle contained 8 reportable indications, 4 of which are suspect.

The remaining Loop 2 inlet nozzle contained numerous reflectors which conform to the characteristics normally associated with the reheat cracking phenomenon. Sixty-six reflectors were recorded, but numerous other reportable indications were observed. The large quantity and the repetitive nature, namely the circumferential banding and the clustering pattern, of these additional reflectors precluded individual evaluations. All the reflectors, though, are considered suspect.

Calibration and raw data sheets as well as reflector plots are included as Appendix C.

ASSESSMENT OF ULTRASONIC REFLECTORS IN THE WATTS BAR UNIT I REACTOR VESSEL NOZZLE BORES

INTRODUCTION

Ultrasonic examinations of the Watts Bar Unit I reactor vessel nozzle bores have resulted in a number of reflectors in the four inlet nozzles categorized as suspect per the test procedure. The characteristics of the reflectors in three of the inlet nozzles correspond with those typical of underclad cold cracking. The fourth contains reflectors which conform to the criteria normally associated with the reheat cracking phenomenon.

The following sections of this report will focus on providing details concerning the nozzle cladding process, on documenting the nozzle bore ultrasonic test results, and on determining the acceptability of the ultrasonic reflectors to the preservice acceptance criteria of the ASME Section XI, 1977 Edition.

NOZZLE CLAD HISTORY

Documentation provided by Rotterdam Heavy Equipment concerning the cladding inside the nozzles of Watts Bar Unit I as well as a summary of the welding parameters is given as Appendix A.

A detailed review of these welding parameters, namely the absence of preheat prior to the deposition of the second layer, indicates the Watts Bar Unit I reactor vessel nozzles may be susceptible to cold cracking. Alternatively, these parameters should preclude the potential for reheat cracking.

A variation from these welding parameters, may have resulted during repair of inlet nozzle No. 12, identified in this report as Loop #2 inlet. According to our records, a portion of the second layer of clad comprising beads number 13 through 19 was removed by machining due to chrome content less than 18%. This area was subsequently repaired.

DESCRIPTION OF ULTRASONIC TESTING TECHNIQUE

The examinations were conducted from the clad nozzle bore surfaces using 70° longitudinal wave, dual element, transmit-receive search units manufactured by Krautkramer/RTD/BAM. The time base of the instrument was calibrated on 2mm diameter side-drilled holes at depths of 3mm, 7mm, and 11mm. Test sensitivity was established on the flat bottom of a 2mm diameter hole drilled just below the clad/base metal interface in a representative calibration block.

Reflectors in the Loop 4 inlet nozzle in the vicinity of the safe end weld were evaluated to the 1977 Edition of ASME XI, Table IWB-3514-2. The thickness, t, is 3.2 inches as obtained from nozzle fabrication drawings. The maximum ultrasonically measured length of 0.25 inch would correspond to a through-wall dimension of 0.125" assuming a semi-circular flaw shape. The allowable a/t value is 8.4% based on an aspect ratio of 0.50 while the actual a/t value for this case is 3.9%, see Figure 2.

Thus, based on the assumption that flaw depths are 0.125" (3.2mm) or 1/3 their ultrasonically measured length, to a maximum of 0.295" (7.5mm), we conclude that all recorded reflectors meet the preservice acceptance criteria of IWB-3500, ASME XI, 1977 Edition.

REFERENCES

1. Rao, G. V.; WCAP-9704; Metallurgical Investigation of the Offshore Power Company Reactor Vessel Outlet Nozzle Cracks, April 1980.

$$t = \frac{tn_1 + tn_2}{2} = 13.8''$$

ℓ (LONGEST REFLECTOR) = 1.5" VIA 12 dB DROP

a (MAX.) = 7.5 mm
a/ℓ = 0.197
a/t (ALLOWABLE) = 2.7%
a/t (ACTUAL) = 2.1%

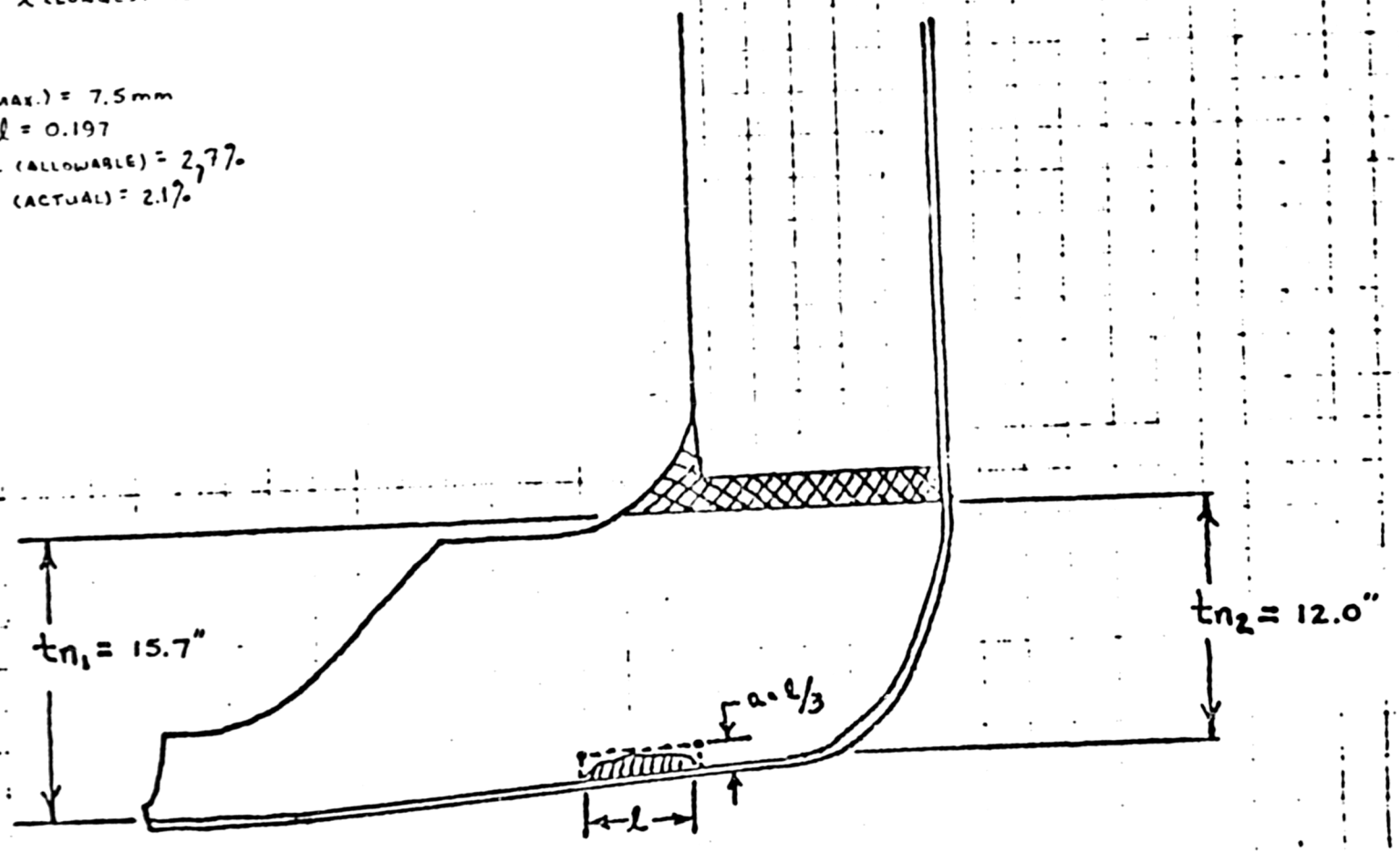


FIGURE 1: WATTS BAR UNIT I INLET NOZZLE TWB-3512-1 EVALUATION

$t = 3.2''$

ℓ (LONGEST REFLECTOR) $= 0.25''$

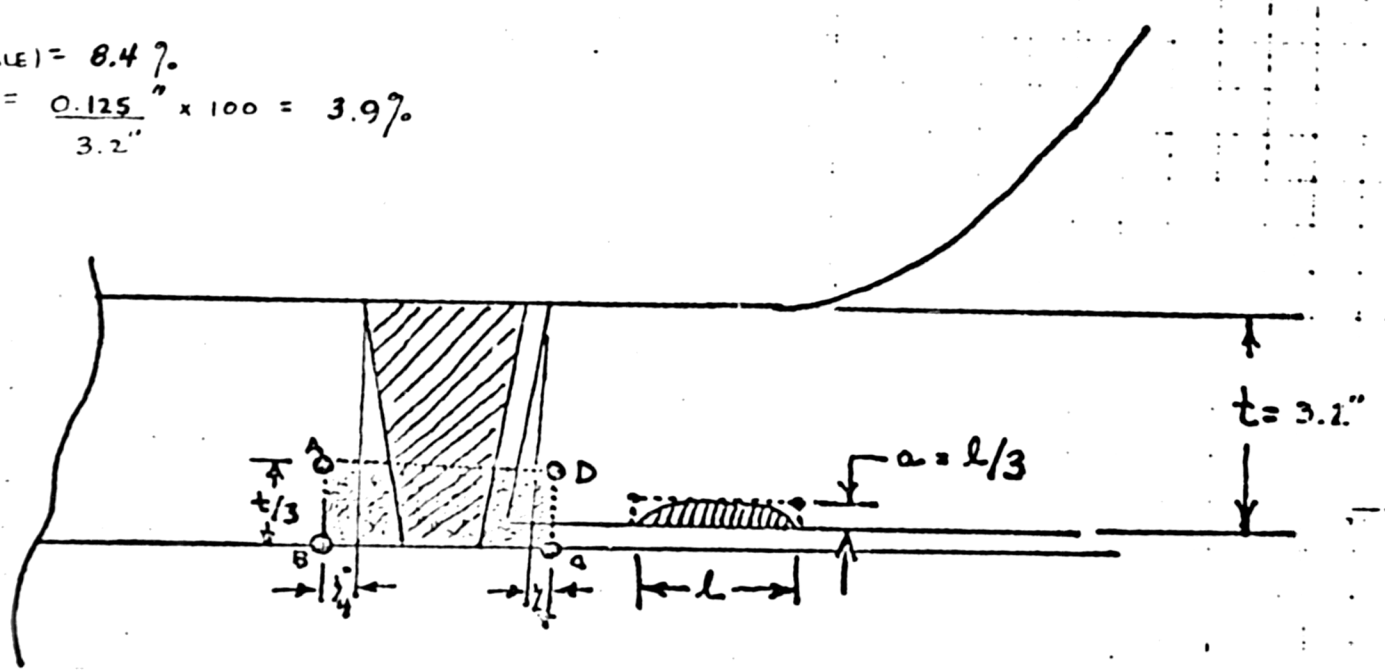
$a = \ell/3 = 0.083''$

$a = 0.125''$ SINCE $0.125'' > 0.083''$

$a/\ell = 0.50$

a/t (ALLOWABLE) $= 8.4\%$

a/t (ACTUAL) $= \frac{0.125''}{3.2''} \times 100 = 3.9\%$



NOTE: REQUIRED EXAMINATION VOLUME IS A-B-C-D

FIGURE 2: WATTS BAR UNIT I INLET NOZZLE IN VICINITY OF SAFE END

IWB-3514.2 EVALUATION (ASME XI 1977)

$$t = \frac{t_{n_1} + t_{n_2}}{2} = 11.3''$$

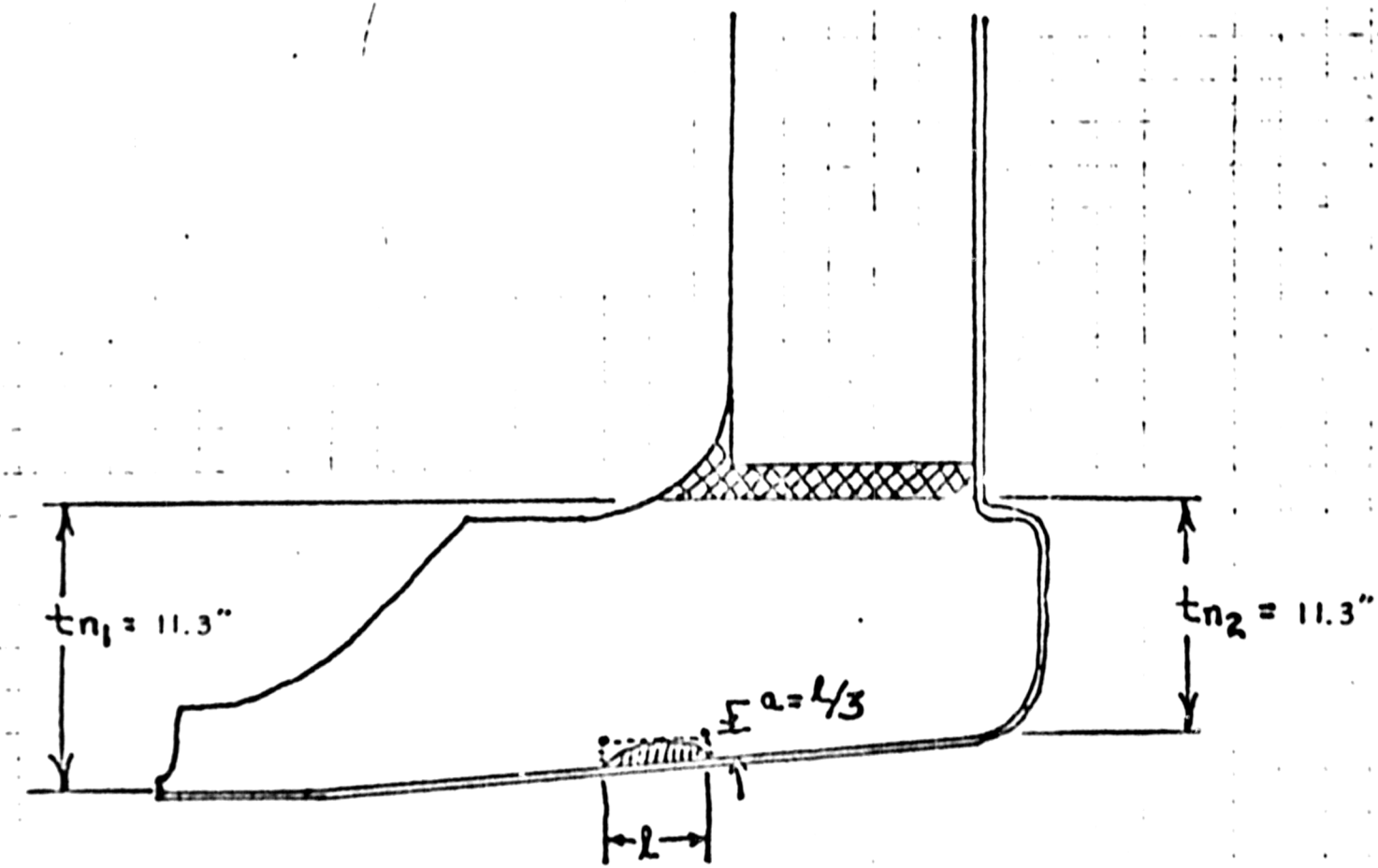


FIGURE 3: WATTS BAR UNIT I OUTLET NOZZLE
IWB-3512-1 EVALUATION

APPENDIX A: DOCUMENTATION OF CLADDING INSIDE NOZZLES/
ROTTERDAM HEAVY EQUIPMENT/ORDER NO. 30749 WAT

APPENDIX A.

WATTS BAR UNIT I NOZZLE CLADDING PROCEDURE

1. Base material specification grade and type

   ASTM A-508, Class 2

2. Process type, electrode sizes

   a. Two layer clad using submerged arc process
   b. 60 mm x 0.5 mm strip electrodes (Type 309 and Type 308)

3. Heat input for each layer (amps, volts, speed)

   First Layer: Amps = 600 - 630; Volts = 30 ± 2; Speed ≅ 6 inches/minute

   Second Layer: Amps = 600 - 650; Volts = 31 ± 2; Speed ≅ 4 inches/minute

4. Pre-heat, post-heat, interpass temperature

   a. Pre-heat temperature (1st layer) = 40°C (104°F)
   b. Post-heat temperature = raise pre-heat temperature to 210-220°C (410-428°F), hold for 2 hours, cool to ambient (soaking heat treatment)
   c. Interpass temperature (1st layer) = 15 - 100°C (59-212°F)
   d. Interpass temperature (2nd layer) = 15 - 125°C (59-257°F)

5. Post weld heat treatment (PWHT)

   Final PWHT = 595 - 635°C (1100-1175°F) held for 17-22 hours

6. Stress relief heat treatment

   Stress relief heat treatment is the same as shown in Item 5 above

7. Manufacturer and sub-contractors

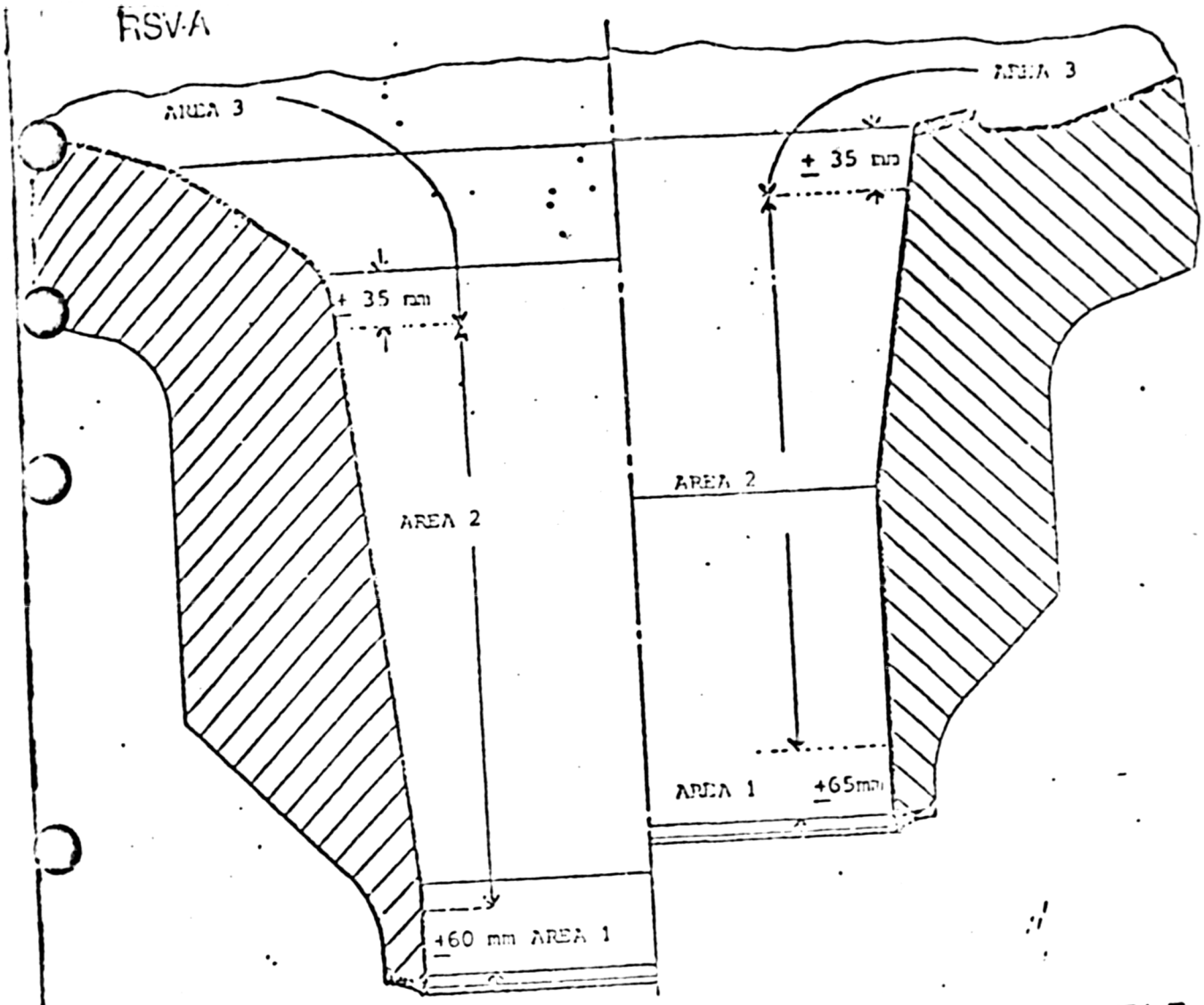
   The reactor vessel was fabricated by Rotterdam Dockyard Company, Rotterdam The Netherlands. The nozzles were clad by Rotterdam.

APPENDIX A

NOZZLE IDENTIFICATION

TVA IDENTIFICATION	RDM IDENTIFICATION
Loop 1 Inlet/67°	14
Loop 2 Inlet/113°	12
Loop 3 Inlet/247°	13
Loop 4 Inlet/293°	11

RSV-A



INLET NOZZLE

OUTLET NOZZLE

CUSTOMER : WESTINGHOUSE

CUST. REF. : ZCZC EBA 281

SUBJECT : CLADDING INSIDE NOZZLES

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment
RSV-A

Customer : Westinghouse
Customer Ref.: ZCZC EBA 281
Subject : : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Inlet
Number of nozzle: 11

General Welding Procedure: 36.02 Rev.: 8

		Weld.Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100-130°C
	2e layer				MSMAW-308	no
Area 2 *	1e layer	36.03	8	2	60x0.5mm309	40°C
	2e layer				60x0.5mm308	no
Area 3	1e layer	36.04	2	2	MSMAW-309	100-130°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking		2 hrs.	
Stress relieving	595-635°C	24 hrs. 54 min.	

Remarks: * For repair in area 2 see variation report V11-749-C25.02-002 and NDT report ND 7384.

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment

RSV-A

Customer : Westinghouse
Customer Ref.: ZCZC EBA 281
Subject : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Inlet
Number of nozzle: 12

General Welding Procedure: 36.02 Rev.: 8

		Weld.Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100/130°C
	2e layer				MSMAW-308	no
Area 2 *	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2	MSMAW-309	100/130°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	210-220°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	22 hrs. 50 min.	

Remarks: * For repair in area 2 see variation report V21-749-C26.02-004 and NDT report ND 7456.

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment
RSV-A

Customer : Westinghouse
Customer Ref. : ZCZC EBA 281
Subject : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Inlet
Number of nozzle: 13

General Welding Procedure: 36.02 Rev.: 8

		Weld. Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	110-130°C
	2e layer				MSMAW-308	no
Area 2 *	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2	MSMAW-309	100-150°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking		2 hrs.	After welding first layer
Stress relieving	595-635°C	25 hrs. 46 min.	

Remarks: * For repair in area 2 see variation report V16 749-C27.02-005 and NDT-report ND 7698.

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment
RSV-A

Customer : Westinghouse
Customer Ref.: ZCZC EBA 281
Subject : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Inlet
Number of nozzle: 14

General Welding Procedure: 36.02 Rev.: 8

		Weld.Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100-140°C
	2e layer				MSMAW-308	no
Area 2 *	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2	MSMAW-309	100-140°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	210-220°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	25 hrs. 44 min.	

Remarks: * For repair in area 2 see variation report V14 749-028.02-003 and NDT report ND 7457.

RSV-A
Rotterdam Heavy Equipment

Customer : Westinghouse
Customer Ref. : ZCZC EBA 281 :
Subject : : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Outlet
Number of nozzle: 15

General Welding Procedure: 36.02 Rev.: 8

		Weld. Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100-150°C
	2e layer				MSMAW-308	no
Area 2	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2 On nozzle protrution more layers have been welded. (Layer thickness 17mm)	MSMAW-309	100/120°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	205-210°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	25 hrs. 36 min.	

Remarks:

RSV-A

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment

Customer : Westinghouse
Customer Ref. : ZCZC EBA 281
Subject : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Outlet
Number of nozzle: 16

General Welding Procedure: 36.02 Rev.: 8

Weld. Proc. Rev.				Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100/120°C
	2e layer				MSMAW-308	no
Area 2	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2 On nozzle protrution more layers have bee welded (layer thickn	MSMAW-309	100/130°C
	2e layer				MSMAW-308 ss 17mm)	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	205-220°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	23 hrs. 56 min.	

Remarks:

RSV zware Apparatenbouw b.v.
Rotterdam Heavy Equipment

Customer : Westinghouse
Customer Ref. : ZCZC EBA 281
Subject : : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Outlet
Number of nozzle: 17

General Welding Procedure: 36.02 Rev.: 8

		Weld.Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100/150°C
	2e layer				MSMAW-308	no
Area 2	1e layer	36.03	8	2	60x0.5mm-309	40°C
	2e layer				60x0,5mm-308	no
Area 3	1e layer	36.04	2	2 On nozzle protrution more layers have been welded. (layer thickness 17mm)	MSMAW-309	100/125°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	205-210°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	25 hrs. 20 min.	

Remarks:

RSV-A

Customer : Westinghouse
Customer Ref. : ZCZC EBA 281
Subject : Cladding inside nozzles

Ordernumber : 30749
Type of vessel : WAT
Type of nozzle : Outlet
Number of nozzle: 18

General Welding Procedure: 36.02 Rev.: 8

		Weld.Proc.	Rev.	Technique		
				Number of layers	Filler Metal	Preheat
Area 1	1e layer	36.04	2	2	MSMAW-309	100/130°C
	2e layer				MSMAW-308	no
Area 2	1e layer	36.03	6	2	60x0.5mm-309	40°C
	2e layer				60x0.5mm-308	no
Area 3	1e layer	36.04	2	2 On nozzle protrution more layers have been welded (layer thickness 17mm)	MSMAW-309	100/150°C
	2e layer				MSMAW-308	no

Postweld heat treatement

	Temp	Total time	Remarks
Soaking	210-215°C	2 hrs.	After welding first layer
Stress relieving	595-635°C	23 hrs. 12 min.	

Remarks:

APPENDIX B: ULTRASONIC TEST PROCEDURE

MT-MNA-2098

From: Metallurgical and NDE Analysis
Extn: 244-3025
Date: June 9, 1980
Subject: Ultrasonic Test Procedure for Manual Contact Examination of Reactor Vessel Nozzle Bores for Sub-Clad Cracking

NUCLEAR TECHNOLOGY DIVISION

To: T. R. Mager, Manager
Metallurgical and NDE Analysis

cc: J. F. Enriatto
E. T. Hughes
E. R. Pade
R. J. Sero
J. J. Stepek
J. A. Vano
P. L. Ruddle
J. Duran
M. A. Siano
R. S. Howard
L. Luccardi-Spain

Attached for your information is a copy of the latest draft of our ultrasonic test procedure for manual contact examination of reactor vessel nozzle bores. The specification supercedes MT-MNA-851 "Ultrasonic Test Procedure for Manual Contact Examination of Reactor Vessel Nozzle Bores for Sub-Clad Cracking" by incorporating revisions made through actual field experience. In the event it becomes necessary to perform examinations of nozzles in vessels where remote test capability is not required, this procedure is recommended.

If you have any questions or comments, please contact one of us.

D. C. Adamonis
Metallurgical and NDE Analysis

R. D. Rishel
Metallurgical and NDE Analysis

Attachment

/js

Distr/Cre

ULTRASONIC TEST PROCEDURE FOR DETECTION OF SUB-CLADDING CRACKS IN REACTOR VESSEL NOZZLE BORES

1.0 SCOPE

1.1 This document describes the ultrasonic testing technique and evaluation criteria to establish the existence of cracks beneath cladding on reactor vessel nozzle bores.

2.0 EQUIPMENT

2.1 Pulse-echo ultrasonic equipment shall be used. The instrument shall be equipped with dB calibrated gain or attenuation controls.

2.2 A dual-element, transmit-receive, 2.0 MHz, 70° longitudinal wave search unit shall be used for the primary examination. This search unit shall be of the type Krautkramer-RTD-BAM SE-70-L2-150-F18, or equivalent.

2.3 A dual-element, transmit-receive, 2.0 - 5.0 MHz, miniature 0° longitudinal wave search unit shall be used to aid in evaluation of reflectors. This search unit shall be of the type Krautkramer SEB-4-KF-8, or equivalent.

2.4 Glycerine or an equivalent shall be used in sufficient quantity to maintain continuous coupling of the search unit to the part being examined.

2.5 A reference block shall be provided for calibration of the ultrasonic test system. The block shall be representative of the production part. The contour of the block shall be representative of the ID of the nozzle bore. The block shall contain 2mm diameter side drilled holes at locations specified in Figure 1.

3.0 SURFACE FINISH, CLAD THICKNESS, AND PREPARATION

3.1 All examinations will be conducted from the clad surface of the nozzle bore. The clad surface shall be free from dirt, weld spatter, or any other foreign material that might interfere with free movement or contact of the search unit.

3.2 The defects of concern are located in the heat-affected-zone of the nozzle material, just below the clad/base metal interface. To aid in evaluation of reflectors it is important to have as much information as possible concerning the nominal clad thickness.

3.3 Divide the nozzle bore into four equal sections to aid in scanning and recording of reflectors. Measure the circumference of the nozzle bore at the vessel and piping ends to establish the locations of the 0°, 90°, 180°, and 270° axes. Mark these axes along the entire length of the nozzle bore with an approved, semi-permanent marking pen.

4.0 SWEEP RANGE CALIBRATION

4.1 Establish a linear sweep presentation for the 70° examination system by adjusting the instrument delay and range controls to set the maximum responses from the side drilled holes whose axes are perpendicular to the clad bead direction such that each screen division represents 2mm of depth.

See Figure 1, reference holes "A", "B", and "C".

4.2 Establish a linear sweep presentation for the 0° T-R examination system by adjusting the instrument delay and range controls to set the maximum responses from the side drilled holes whose axes are perpendicular to the clad direction such that each screen division represents 2mm of depth.

See Figure 1, reference holes "A", "B", and "C".

5.0 TEST SENSITIVITY

5.1 Establish the test sensitivity for the 70° examination system by adjusting the instrument gain controls to obtain an 80% of full screen height indication from the flat bottom of the 2mm diameter hole drilled just below the clad/base metal interface and parallel to the clad bead direction. This is the primary reference level.

See Figure 1, reference hole "D".

5.2 Establish the test sensitivity for the 0° transmit-receive examination system by adjusting the instrument gain controls to obtain an 80% of full screen height indication from the flat bottom of the 2mm diameter hole drilled through carbon steel to the clad/base metal interface. This is the primary reference level.

See Figure 1, reference hole "E".

5.3 Calibration shall be checked at four hour intervals during the examination. If, during any calibration check it is determined that the primary reference amplitude has decreased by 20% of its amplitude, all data sheets since the last calibration check shall be marked void, a new calibration sheet made, and the voided examination areas reexamined.

If the primary reference amplitude has increased by 20% of its amplitude, all recorded indications since the last valid calibration check shall be reevaluated with the corrected calibration and their values shall be changed on the data sheets.

6.0 SCANNING - 70° EXAMINATION

6.1 Scanning with the 70° search unit shall be performed from the clad surface in both circumferential directions, i.e., parallel to the welding direction. The entire nozzle bore shall be examined in this fashion. The end face of all outlet nozzle projections shall be scanned in two circumferential and two radial directions.

6.2 The scanning speed shall not exceed 6 inches per second.

6.3 Each scan shall overlap the previous scan by at least 25% of the search unit width to assure complete examination coverage.

6.4 Scan using a gain setting of two times the primary reference level (+ 6 dB) provided cladding noise does not interfere with interpretation of test results. In this case scanning sensitivity in the range + 2 to + 6 dB is permitted. All indications shall be evaluated at the primary reference level.

7.0 RECORDING OF REFLECTORS - 70° EXAMINATION

7.1 Indications equal to or greater than 50% of the primary reference level defined in paragraph 5.1 shall be recorded and their locations marked on the nozzle bore for further evaluation with the 0° transmit-receive examination system.

7.2 The specific sequence for data recording is provided below.

7.2.1 Record the maximum amplitude of the reflector, a) in percent of the primary reference level when reflector amplitude is less than the primary reference level, or b) by number of dB required to reduce the maximum amplitude to the primary reference level when the reflector amplitude is greater than the primary reference level; i.e., "100% + 6" when reflector maximum amplitude is 200% of reference.

7.2.2 Record the search unit location where the maximum amplitude is observed. The search unit location is defined as the midpoint of the front of the search unit. Axial location shall be measured from the safe-end, circumferential location shall be measured from the nearest longitudinal axis of the bore; 0°, 90°, 180° or 270°.

7.2.3 Record the scanning direction, clockwise or counter-clockwise as viewed from the large diameter end of the nozzle (vessel side).

7.2.4 Record the depth of the reflector at the location of maximum amplitude as read from the instrument sweep.

7.2.5 Record the length of the reflector as determined by the "12 dB drop" method. Move the search unit to the left of the point of maximum amplitude until the reflector amplitude drops to 25% of maximum. Mark this point. Then move the search unit to the right of the point of maximum amplitude until the reflector again drops to 25% of maximum. The distance between these two points is the reflector length.

7.2.6 Mark the search unit location on the nozzle bore surface with an approved, semi-permanent marking pen.

7.2.7 Rotate the search unit 180° and scan the area of interest to establish whether the reflector can be detected when scanning in the opposite circumferential direction. Record any indication, regardless of amplitude, per paragraphs 7.2.1 through 7.2.5.

8.0 EVALUATION OF REFLECTORS WITH THE 0° TRANSMIT-RECEIVE EXAMINATION SYSTEM

8.1 Only areas where indications are detected with the 70° search unit shall be scanned with the 0° transmit-receive examination system. Any indication detected with the 0° transmit-receive search unit, regardless of amplitude, shall be recorded.

8.1.1 Record the maximum amplitude of the reflector, a) in percent of the primary reference level when reflector amplitude is less than the primary reference level, or b) by number of dB required to reduce the maximum amplitude to the primary reference level when the reflector amplitude is greater than the primary reference level; i.e., "100% + 6" when reflector maximum amplitude is 200% of reference.

8.2.1 Record the depth of the reflector at the location of maximum amplitude as read from the instrument sweep.

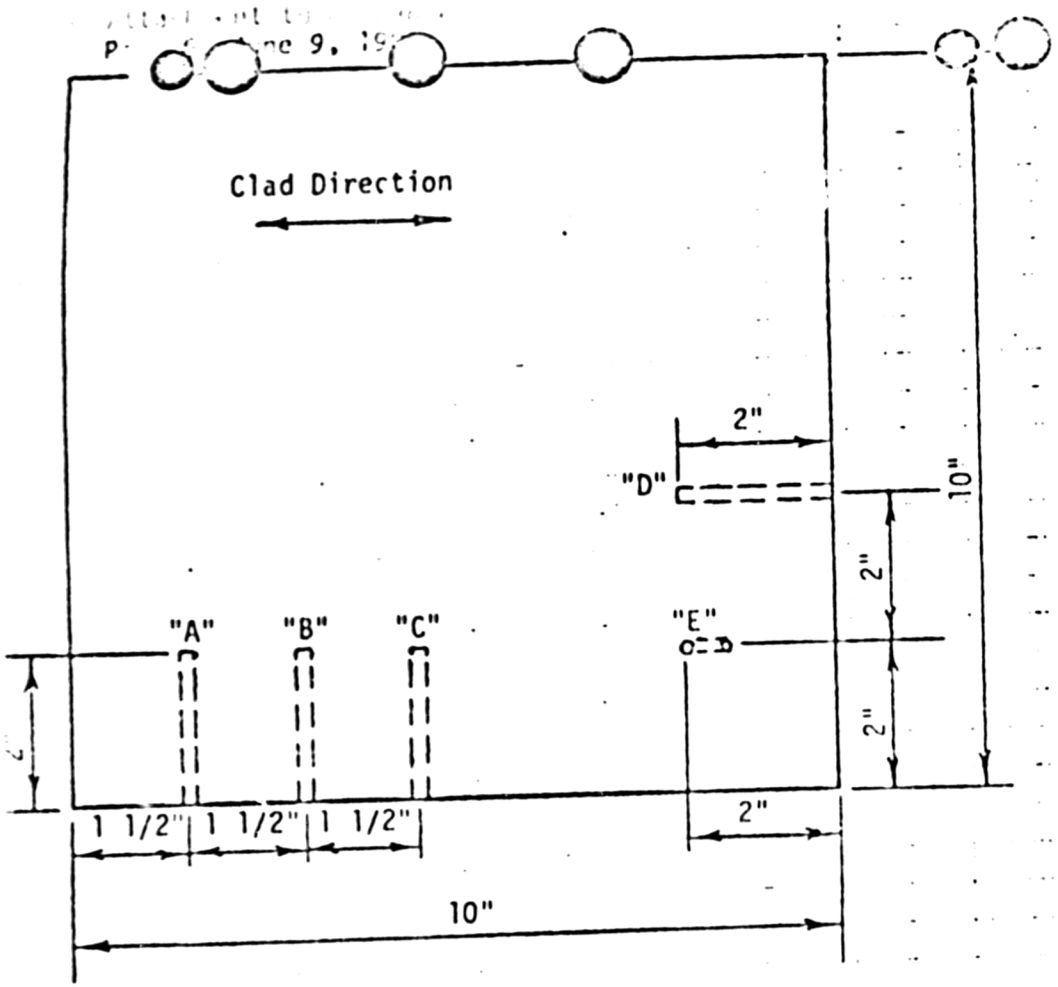
9.0 REFLECTOR CHARACTERIZATION

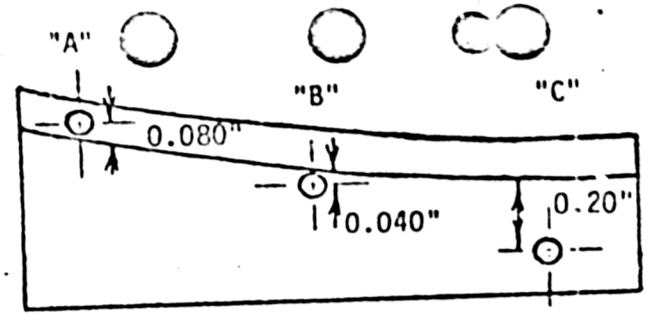
9.1 Reflectors which meet the following criteria are considered indicative of inclusions, porosity, or lack of bonding between the cladding and base material. They are, therefore, considered innocuous.

9.1.1 Any indication detected by the 70° examination, regardless of amplitude, at a depth within the weld-deposited, stainless steel cladding.

9.1.2 Any indication detected by the 70° examination, regardless of amplitude, also detected by the 0° transmit-receive examination at a corresponding location and at a depth within ± 2mm of that predicted by the 70° test.

9.2 Reflectors exhibiting characteristics other than those described above are considered suspect and will be subject to evaluation on an individual basis.

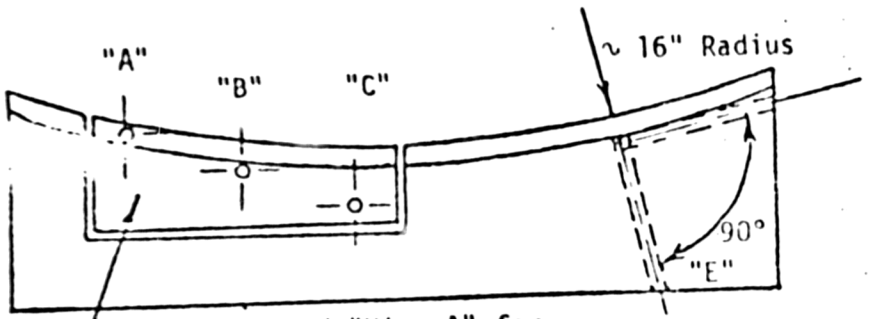




VIEW A

NOTES:

1. All drilled holes are 2mmϕ (5/64") with flat bottoms.
2. The flat bottom of hole "D" should be parallel to the block radius.
3. The flat bottom of hole "E" should be perpendicula to the block radius.



See Enlarged "View A" for Hole Locations

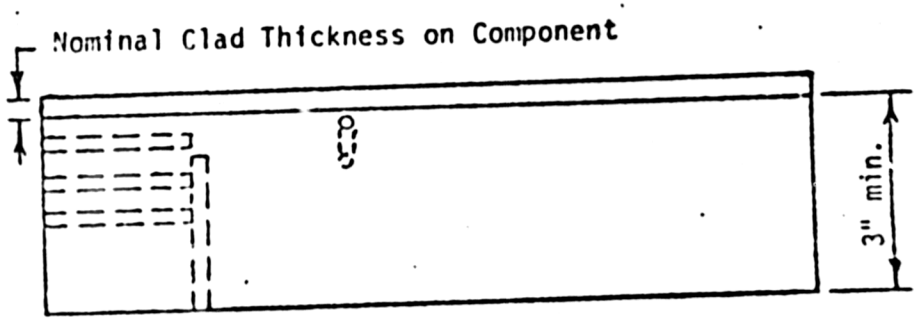


Figure 1. Calibration Block for Examination of Nozzle Bores for Detection of Cracking Beneath the Cladding, Recommended Design.

Plant/Unit _____
Comp/System _____

CALIBRATION DATA SHEET

Data Sheet No. _____
Procedure No. _____
Subject _____
Rev/Change No. _____
Calibration Block No. _____
Surface _____

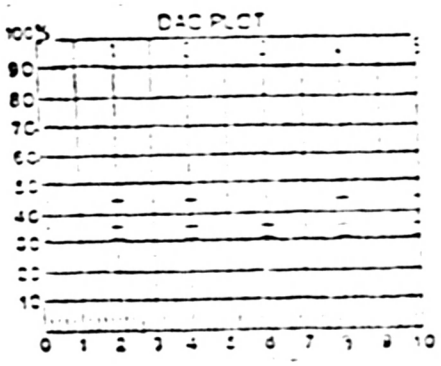
INSTRUMENT SETTINGS	SEARCH UNIT
Mfg/Model No.:	Scan Angle: Mode:
Serial No. :	Fixturing (if any):
Sweep Length :	Style or Type No. :
Sweep Delay :	Size & Shape :
Pulse Length/Damping:	Frequency :
Freq.: Rep. Rate:	Serial No/Brand:
Filter: Video: Lock:	Measured Angle :
DEC/Gate Switch: Range:	
Mode Select: Reject:	Couplant Brand:
Gain (coarse): Fine:	Couplant Batch:

Comm	DEPTH	ANGL.	ATTEN.

INSTR. LINEARITY CHL.				
	Amplitude			
	High	Low	High	Low
1		5		
2		6		
3		7		
4		8		

SCAN AREA	

DAC PLOT



ATTL. CONTROL LINEARITY		
Initial	± dB	Result
80	-6	
80	-12	
40	+6	
20	+12	

EXAMINATION WELD/AREA	RECORDABLE INDICATION		COMMENTS/REASON FOR INCOMPLETED SCAN(S)
	Yes	No	

CALIBRATION CHECKS	TIME
Initial Cal.	
Intermediate	
Intermediate	
Intermediate	
Final Cal.	

ADDITIONAL CHECKS	
Instrument	

EXAMINERS 1 _____ Date _____ Level _____
2 _____ Date _____ Level _____

Calibration Data Sheet # _____

Plant/ Unit _____

Comp/System _____

Examiners 1. _____ Level _____

2. _____ Level _____

Date _____

Reviewer _____ Date _____

Calibration #	Defect Axis	Tri-angulation Data			Location			Comp Data	
		Amplitude	Depth	Length	Nearest Axis	Distance	Distance	Ampl.	Depth
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							
		CW CCW							

APPENDIX C: CALIBRATION AND RAW DATA SHEETS AND ULTRASONIC REFLECTOR PLOTS

Plant/Unit WATTS BAR I
Comp/System RH NOZZLES
H-1, C-1

CALIBRATION DATA SHEET
2A

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface CLHD

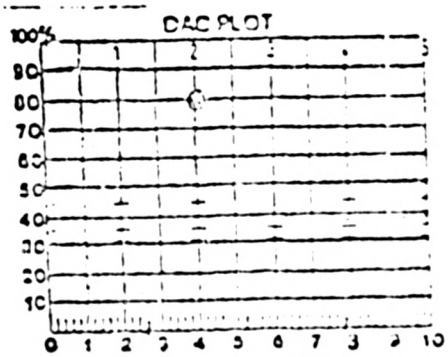
INSTRUMENT SETTINGS	SEARCH UNIT
Mfg/Model No.: SONIC MARK I	Scan Angle: 70° Mode: NORM
Serial No. : 781304	Fixturing (if any): CLOSED
Sweep Length : 1/1.20	Style or Type No. : R.T.D. DUAL
Sweep Delay : 1/2.03	Size & Shape: 15 mm ϕ
Pulse Length/Damping: MIN.	Frequency : 2 mHZ
Freq.: 2 MHZ Rep. Rate: 3K	Serial No/Brand: 591134 KB
Filter: HI Video: N/A Gack: N/A	Measured Angle : 70°
DEC/Gate Switch: N/A Range: N/A	
Mode Select: NORM Reject: OFF	Couplant Brand: KONOTRACE 40
Gain (coarse): 70 (fine): 4	Couplant Batch: 79294

INDEX	DEPTH	AMPL.	ATTEN.
A	3	—	—
B	7	—	—
C	11	—	—
D	8	80%	94

INSTR. LINEARITY CAL. Amplitude					
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA

DAC PLOT



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
H-1		✓	
C-1	✓		

CALIBRATION CHECKS	TIME
Initial Cal.	8:15
Intermediate	9:15
Intermediate	11:30
Intermediate	1:30
Final Cal.	5:00

ADDITIONAL SHEETS? (CHECK BOX)			
Continuation	✓	YES	
Supplements		None	

EXAMINERS 1 [signature] Date 8/26/80 Level II
2 John Carson Date 8-26-80 Level I
REVIEWER [signature] Date [illegible]

Plant/Unit WATTS BAR 1
Coop/System R.V. NOZZLES
C-1

CALIBRATION DATA SHEET
2B

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface CLAD

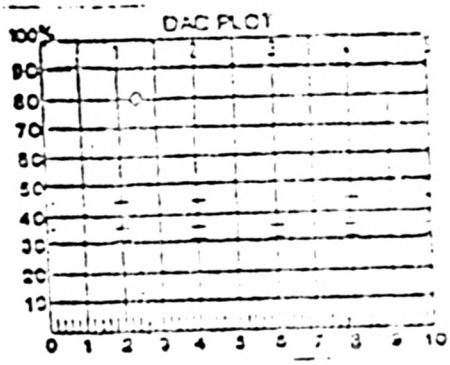
INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK II
Serial No.	: 755109
Sweep Length	: 1/1.48
Sweep Delay	: 1/0.22
Pulse Length/Damping:	MIN
Freq.: 5MHZ	Rep. Rate: 3K
Filter: H/I	Video: N/A Rack: N/A
DEC/Gate Switch: N/A	Range: N/A
Mode Select: N/A	Reject: OFF
Gain (coarse): 70	(fine): 5

SEARCH UNIT	
Scan Angle: 0°	Mode: NORM
Fixturing (if any):	CLOSED
Style or Type No. :	DUAL - R.T.D
Size & Shape:	.25" ϕ
Frequency	: 5MHZ
Serial No/Brand:	KB9002 KB
Measured Angle	: 0°
Couplant Brand:	SONOTRACE 40
Couplant Batch:	79284 --

NOTE	DEPTH	AMPL. %	ATTEN. %
E	5mm	80%	78%

INSTR. LINEARITY CAL.					
	Amplitude				
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
CLAD		✓	

CALIBRATION CHECKS	TIME
Initial Cal.	4:00
Intermediate	
Intermediate	
Intermediate	
Final Cal.	6:15

ADDITIONAL SHEETS? (CHECK BOX)		
Continuation	~~YES~~ NO	
Supplements	None	

EXAMINERS 1 [signature] Date 8/24/ Level II
2 [signature] Date 8/26/80 Level I
REVIEWER [signature] Date

Calibration Data Sheet # _____

Plant/Unit WATTS BAR

Comp/System REACTOR VESSEL NOZZLE BORES C-1

Examiners 1. _____ Level _____

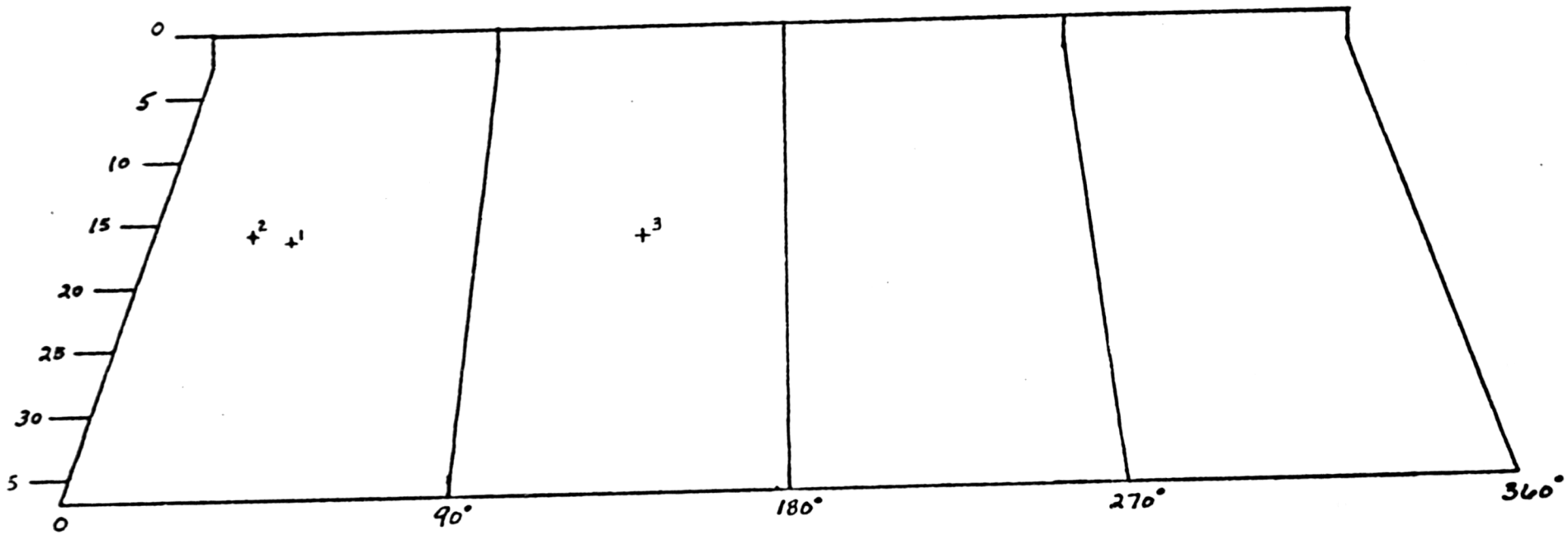
2. _____ Level _____

Date 8-26/8-27-80

Reviewer [illegible] Date 9/3/80

Location of	Between Axes	Longitudinal Data			Location			Data	
		Amplitude % OF-DAC	Depth	Length	Nearest Axis	Distance from N.A.	Distance from Seal	Ample	Depth
1	0°-90°	CW 100% +6	7.5mm	1/8"	0°	10 3/4"	16 1/2"	–	–
		CCW 100% +3	9mm	3/16"	0°	10 3/4"	16 1/2"		
2	0°-90°	CW 100% +1	11mm	3/8"	0°	7 3/4"	16"	–	–
		CCW 60%	10.5mm	–	0°	7 3/4"	16"		
3	90°-180°	CW 75%	9mm	1/16"	180°	11"	16 1/2"	–	–
		CCW 50%	9mm	1/16"	180°	11"	16 1/2"		
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							

WATTS BAR UNIT I
INLET NOZZLE
LOOP 1



Data Sheet No. N/A
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface CLAD

CALIBRATION DATA SHEET
#: 1A

INSTRUMENT SETTINGS	
Make/Model No.:	SONIC MARK I
Serial No.	: 781304
Sweep Length	: 1/1.00
Sweep Delay	: 1/2.63
Pulse Length/Damping:	N/A
Freq.: 2MHz	Rep. Rate: 3K
Filter: N/A	Video N/A Jack:
TDC/Gate Switch: N/A	Range:
Mode Select: NORM	Reject: OFF
Gain (coarse): 60	(fine):

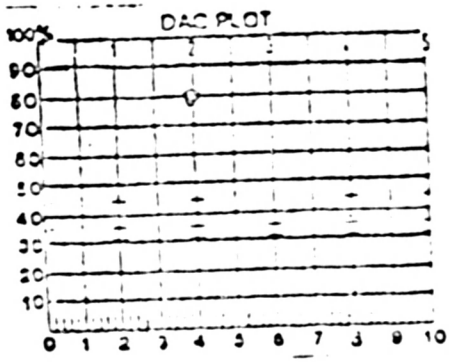
SEARCH UNIT	
Scan Angle: 70°	Mode: NORM
Fixturing (if any):	CLOSED
Style or Type No. :	DUAL RTD
Size & Shape:	12mm ϕ
Frequency	: 2MHz
Serial No/Brand:	591134K3
Measured Angle	: 70°
Couplant Brand:	SONOTRACE 40
Couplant Batch:	79284

mm	DEPTH	AMPL.	ATTEN.
A	3	—	—
B	7	—	—
C	11	—	—
D	8	80%	73

INSTR. LINEARITY CAL.					
	Amplitude				
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA

DAC PLOT



ATTL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

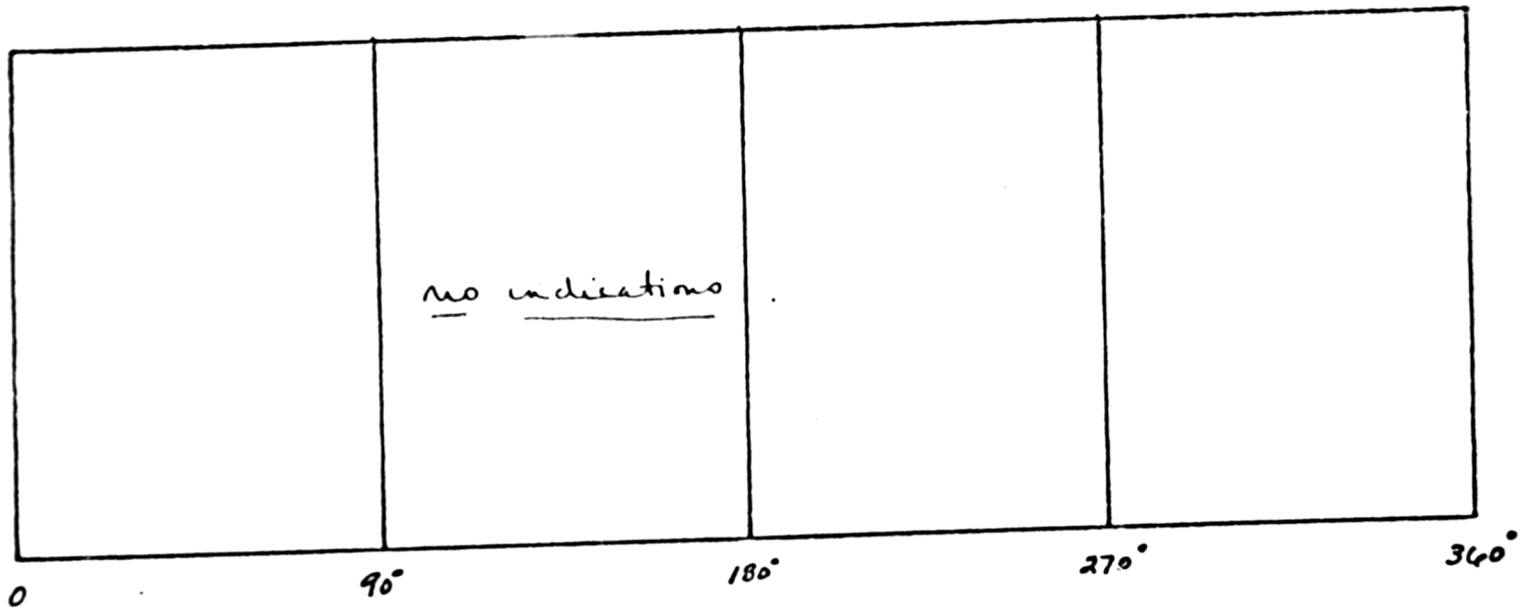
EXAMINATION WELD/AREA	RECORDABLE INDICATION		COMMENTS/REASON FOR INCOMPLETED SCAN(S)
	Yes	No	
H-2		✓	

CALIBRATION CHECKS	TIME
Initial Cal.	1:30
Intermediate	
Intermediate	3:30
Intermediate	
Final Cal.	5:30

VERIFICATION SYSTEM (CHECK TOP)		
Pulse Echo		
Through	None	✓

EXAMINERS 1 [signature] Date 8-3-90 Level II
2 [signature] Date 8-3-90 Level I
REVIEWER [signature] Date 9/3/90

WATTS BAR UNIT I
OUTLET NOZZLE
LOOP 2



Plant/Unit [illegible] PART I
Comp/System [illegible]
C-2

CALIBRATION DATA SHEET
2A

Data Sheet No. 1-6
Procedure No.
Subject NOZZLE ROOT
Rev/Change No.
Calibration Block No.
Surface CLAD

INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK II
Serial No.	78/204
Sweep Length	1/1.20
Sweep Delay	1/2.03
Pulse Length/Damping:	DUAL
Freq.: 2 mHZ Rep. Rate:	3K
Filter: Hi Video:	Track:
DEC/Gate Switch:	Range:
Mode Select:	Reject:
Gain (coarse): 60	(fine): 13

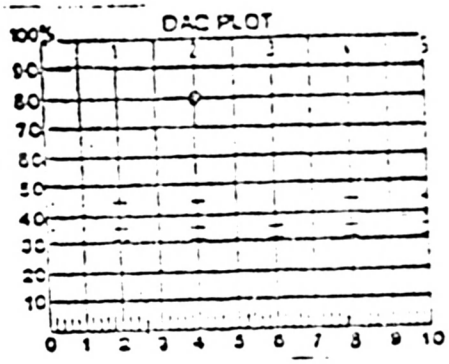
SEARCH UNIT	
Scan Angle: 70°	Mode: NORM
Fixturing (if any):	CLOSED
Style or Type No.:	DUAL R.T.D
Size & Shape:	12 mm ϕ
Frequency	: 2 mHZ
Serial No/Brand:	59/134 KB
Measured Angle	: 70°
Couplant Brand:	SONATRACE
Couplant Batch:	7920

FORM	DEPTH	AMPL.	ACTION
A	3	—	—
B	7	—	—
C	11	—	—
D	8	80%	73

INSTR. LINEARITY CAL.					
	Amplitude				
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA

DAC PLOT



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
CLAD C-2	✓		

CALIBRATION CHECKS	TIME
Initial Cal.	8:45
Intermediate	10:00
Intermediate	12:00
Intermediate	2:00
Final Cal.	5:30

ADDITIONAL SHEETS (CHECK FOR)		
Continuation	✓ YES	
Supplements	None	

EXAMINERS 1 [signature] Date 8/27/80 Level II
2 [signature] Date 8-27-80 Level I
REVIEWER [signature] Date [illegible]

Plant/Unit WATTS BAR I
Comp/System RV NOZZLES
C-2

CALIBRATION DATA SHEET
4A

Data Sheet No. 1-6
Procedure No.
Subject NOZZLE BOAT
Rev/Change No.
Calibration Block No.
Surface CLAD

INSTRUMENT SETTINGS	
Mfg/Model No.	SONIC DIMENSIONS
Serial No.	781304
Sweep Length	1/1.20
Sweep Delay	1/2.03
Pulse Length/Damping	MIN
Freq. 2MHZ Rep. Rate	1KHZ
Filter N/A Video N/A Jack N/A	
DEC/Gate Switch N/A Range N/A	
Mode Select N/A Reject OFF	
Gain (coarse) 40 (fine) 13	

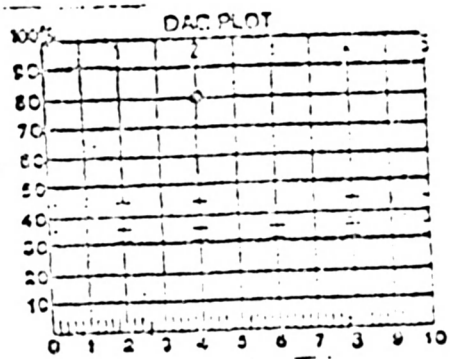
SEARCH UNIT	
Scan Angle	70° Mode ACOM
Fixturing (if any)	CLOSED
Style or Type No.	DUAL END
Size & Shape	19 mm ⌀
Frequency	2 MHZ
Serial No/Brand	591134 KB
Measured Angle	70°
Couplant Brand	CONTACT 40
Couplant Batch	77284

IDENT.	DEPTH	AMPL.	ATTEN.
BA	3	—	
B	7	—	
C	11	—	
D	8	80%	13

INSTR. LINEARITY CAL.					
	Amplitude				
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA

DAC PLOT



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
C-2	✓		

CALIBRATION CHECKS	TIME
Initial Cal.	9:00
Intermediate	12:00
Intermediate	1:30
Intermediate	
Final Cal.	5:30

ADDITIONAL SHEETS? (CHECK BOX)			
Continuation	✓	YES	
Supplements		None	

EXAMINERS 1 [signature] Date 8/28/80 Level II
2 [signature] Date 8-28-80 Level I
REVIEWER [signature] Date [illegible]

Plant/Unit [illegible]
Comp/System [illegible]
C-2

CALIBRATION DATA SHEET
4-B

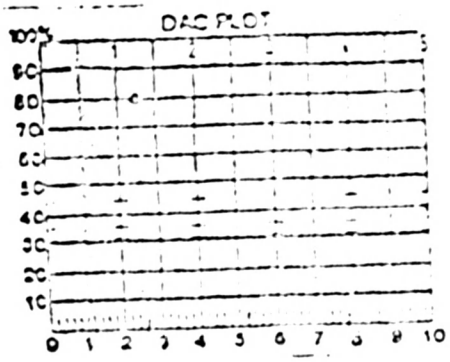
Data Sheet No. 1-6
Procedure No.
Subject [illegible]
Rev/Change No.
Calibration Block No.
Surface CLAD

INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK I
Serial No.	: 755109
Sweep Length	: 1/1.48
Sweep Delay	: 1/0.22
Pulse Length/Damping:	MIN
Freq.: 5MHZ Rep. Rate:	3K
Filter: HI Video: N/A Lock:	N/A
DEC/Gate Switch: N/A Range:	N/A
Mode Select: NORM Reject:	OFF
Gain (coarse): 70 (fine):	0

SEARCH UNIT	
Scan Angle: 0°	Mode: NORM
Fixturing (if any):	CLOSED
Style or Type No.	: DUAL
Size & Shape:	.25" ϕ
Frequency	: 5MHZ
Serial No/Brand:	KB
Measured Angle	: 0°
Couplant Brand:	SONITRACE 40
Couplant Batch:	79284

TRANS	DEPTH	AMPL.	[illegible]
E	5mm	80	70

DAC PLOT



INSTR. LINEARITY CAL.				
	Amplitude			
	High	Low	High	Low
1			5	
2			6	
3			7	
4			8	

SCAN AREA	

AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	20
40	+6	80
20	+12	80

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
C-2		✓	

CALIBRATION CHECKS	TIME
Initial Cal.	4:00
Intermediate	
Intermediate	
Intermediate	
Final Cal.	6:15

ADDITIONAL SHEETS? (CHECK BOX)		
Continuation		
Supplements	None	

EXAMINERS 1 [illegible] Date 8/28/80 Level II
2 John Green Date 8-28-80 Level I
REVIEWER [illegible] Date [illegible]

Plant/Unit WATTS BAR

Calibration Data Sheet # 1

Comp/System REACTOR NOZZLE BORE C-2

Examiners 1. O. McClaine Level II

2. John Carson Level I

Date 8-28-80

Reviewer [illegible] Date 9/3/80

Location #	Degrees Arc	Longitudinal Data: Amplitude of DAC	Depth	Length	Location: Nearest Axis	Distance from W.L.	Distance from Safe End	Amplitude	Depth
1	0°-90°	CW 100%+5	7 mm	1/2"	90°	1 1/4"	15 1/2"	-	-
		CCW 100%+3	7 mm	1/2"					
2	0°-90°	CW 100%+4	7.5 mm	1/2"	90°	3 3/4"	15 1/2"	-	-
		CCW 100%+4	7 mm	3/4"					
3	0°-90°	CW 100%+5	7 mm	1 1/2"	90°	7 1/2"	15 1/2"	-	-
		CCW 100%+5	6.5 mm	3/4"					
4	0°-90°	CW 100%+3	7.5 mm	3/4"	90°	2 1/4"	17 1/2"	-	-
		CCW 100%+6	7 mm	1/2"					
5	0°-90°	CW 100%+4	7 mm	1/2"	90°	4 1/4"	17 1/2"	-	-
		CCW 100%+3	7 mm	1/2"					
6	0°-90°	CW 100%+5	7 mm	3/4"	90°	5 1/4"	17 1/2"	-	-
		CCW 100%+4	6.5 mm	3/4"					
7	0°-90°	CW 100%+3	7 mm	1"	90°	2"	19 1/2"	-	-
		CCW 100%+4	7 mm	3/4"					
8	0°-90°	CW 100%+4	7 mm	3/4"	90°	3 1/2"	19 1/2"	-	-
		CCW 100%+2	6 mm	1"					
9	0°-90°	CW 100%+4	6.5 mm	1 1/8"	90°	5 3/4"	19 1/2"	-	-
		CCW 100%+3	6.5 mm	1/2"					
10	0°-90°	CW 100%+4	7 mm	5/8"	90°	0"	21 1/2"	-	-
		CCW 100%+1	6 mm	3/4"					
11	0°-90°	CW 100%+5	8 mm	3/8"	90°	2"	21 1/2"	-	-
		CCW 100%+2	8 mm	1"					
12	0°-90°	CW 100%+4	7.5 mm	3/4"	90°	3 1/2"	21 1/2"	-	-
		CCW 100%+2	7 mm	1 1/8"					
13	0°-90°	CW 100%+2	7 mm	3/4"	90°	1/2"	23 1/2"	-	-
		CCW 100%+2	6 mm	3/8"					
14	0°-90°	CW 100%+3	7 mm	7/8"	90°	2 3/4"	23 1/2"	-	-
		CCW 100%+5	7 mm	3/4"					
		CW -							
		CCW -							

NOZZLE BORE EXAMINATION DATA SHEET

Plant/Unit WATTS BAR I

Calibration Data Sheet # 2

Comp/System REACTOR VESSEL NOZZLE BORE C-2

Examiners 1. L. T. McClain Level II

2. John Carson Level I

Date 8/27/80 - 8/28/80

Reviewer [illegible] Date 9/3/80

Station #	Between Axes	70° Longitudinal Data			Location			0°-90° Data	
		Amplitude % OF DAC	Depth	Length	Nearest Axis	Distance from N.A.	Distance from Side of N.L.	Ampl.	Depth
15	0°-90°	CW 100%	8.5 mm	3/8"	90°	8 3/4"	14"	–	–
		CCW 100%+3	9.5 mm	3/8"	90°	8 3/4"	14"		
16	0°-90°	CW 100%+5	7 mm	3/8"	0°	6 3/4"	14"	–	–
		CCW 100%	7 mm	3/8"	0°	6 3/4"	14"		
17	0°-90°	CW 100%+3	6 mm	7/8"	90°	5 1/4"	23 1/2"	–	–
		CCW 100%+3	7 mm	1"	90°	5 1/4"	23 1/2"		
18	0°-90°	CW 100%+3	7 mm	1"	90°	1/2"	25 1/2"	–	–
		CCW 100%+4	6 mm	3/4"	90°	1/2"	25 1/2"		
19	0°-90°	CW 100%+5	5.5 mm	1/2"	90°	4 1/4"	25 1/2"	–	–
		CCW 100%+3	5.5 mm	1/2"	90°	4 1/4"	25 1/2"		
20	0°-90°	CW 100%+3	7 mm	7/8"	90°	7 3/4"	25 1/2"	–	–
		CCW 100%+5	5.5 mm	1 1/8"	90°	7 3/4"	25 1/2"		
21	0°-90°	CW 100%+5	6 mm	1/2"	90°	1"	27"	–	–
		CCW 100%+7	6 mm	7/8"	90°	1"	27"		
22	0°-90°	CW 100%+7	7 mm	5/8"	90°	4 1/2"	27"	–	–
		CCW 100%	6 mm	1/2"	90°	4 1/2"	27"		
23	0°-90°	CW 100%+6	7.5 mm	3/4"	90°	8 1/2"	27"	–	–
		CCW 100%+5	8 mm	7/8"	90°	8 1/2"	27"		
24	0°-90°	CW 100%+9	9.5 mm	5/8"	90°	1/2	29"	–	–
		CCW 100%+9	8 mm	5/8"	90°	1/2"	29"		
25	0°-90°	CW 100%+3	8 mm	7/8"	90°	4 1/2"	29"	–	–
		CCW 100%+2	10 mm	1/2"	90°	4 1/2"	29"		
26	0°-90°	CW 100%+4	8 mm	3/8"	90°	6 1/2"	29"	–	–
		CCW 100%+7	9.5 mm	3/8"	90°	6 1/2"	29"		
27	0°-90°	CW 100%+4	6.5 mm	1 1/4"	90°	1/4"	31"	–	–
		CCW 100%+4	6 mm	5/8"	90°	1/4"	31"		
28	0°-90°	CW 100%+5	7 mm	1/2"	90°	4"	31"	–	–
		CCW 75%	7 mm	5/8"	90°	4"	31"		
		CW							

Plant/Unit WATTS BAR 1

Calibration Block Serial

Comp/System R.V. NOZZLE BORE C-2

Examiners 1. G. McClain Level II

2. John Carson Level I

Date 8-27-80

Reviewer Richard Rickel Date 9/3/80

Location	Direction Axis	Longitudinal Data			Location			45°-70 Data	
		Amplitude of DAC	Depth	Length	Nearest Axis	Distance from N.A.	Distance from Setup	Ample	Depth
29	90°-180	CW 100%+3	7mm	1/2"	180°	10 1/4"	18"		
		CCW 100%+3	8mm	1/2"	180°	10 1/4"	18"		
30	90°-180°	CW 100%+4	7.5mm	1 1/4	90°	9 1/4"	18"		
		CCW 100%+5	7mm	5/8"	90°	9 1/4"	18"		
31	90°-180°	CW 100%+5	8mm	3/4"	90°	4 1/2"	18"		
		CCW 100%+2	7.5mm	3/4"	90°	4 1/2"	15"		
32	90°-180°	CW 100%+4	7mm	1 1/8"	90°	1/2"	18"		
		CCW 100%+4	7mm	3/4"	90°	1/2"	18"		
33	90°-180°	CW 100%+5	7mm	7/8"	180°	2 1/4"	19 1/2"		
		CCW 100%+3	6.5mm	3/4"	180°	2 1/4"	19 1/2"		
34	90°-180°	CW 100%+5	7mm	1 1/4"	180°	4 1/4"	19 1/2"		
		CCW 100% 6	7.5mm	3/4"	180°	4 1/4"	19 1/2"		
35	90°-180°	CW 100%+5	7mm	7/8"	180°	6"	19 1/2"		
		CCW 100%+5	7.5mm	1/2"	180°	6"	19 1/2"		
36	90°-180°	CW 100%	7mm	3/4"	180°	9 3/4"	19 1/2"		
		CCW 100+4	6.5mm	1/2"	180°	9 3/4	19 1/2"		
37	90°-180°	CW 100%+4	7.5mm	3/8"	90°	10 3/4"	19 1/2"		
		CCW 100%+1	8mm	1/4"	90°	10 3/4"	19 1/2"		
38	90°-180°	CW 100%+1	7.5mm	1/2"	90°	8 1/4"	19 1/2"		
		CCW 100%+6	7mm	3/4"	90°	8 1/4"	19 1/2"		
39	90°-180°	CW 100%+7	7.5mm	5/8"	90°	5 1/2"	19 1/2"		
		CCW 100%+4	7mm	3/4"	90°	5 1/2"	19 1/2"		
40	90°-180°	CW 100%	8mm	3/4"	90°	3 1/2"	19 1/2"		
		CCW 100%+6	7mm	1"	90°	3 1/2"	19 1/2"		
41	90°-180°	CW 100%+6	7.5mm	1"	90°	0"	19 1/2"		
		CCW 100%+2	8.5mm	1"	90°	0"	19 1/2"		
42	90°-180°	CW 100%+3	5.5mm	3/4"	180°	2 1/2"	21 1/2"		
		CCW 100%+6	7mm	3/4"	180°	2 1/2"	21 1/2"		
		CW							
		CCW							

NOZZLE BORE EXAMINATION DATA SHEET [illegible]

Plant/Unit WATTS BAR I

Calibration Data Sheet # 4

Comp/System RV NOZZLES C-2

Examiners 1. [illegible] Level II

2. John Carson Level I

Date 8-28-80

Reviewer [illegible] Date [illegible]

Location #	Between Axes	Longitudinal Data			Location			Circ Data	
		Amplitude of Disc	Depth	Length	Nearest Axis	Distance from N.Z.	Distance from Seal	Ampl.	Depth
43	90°-180°	CW 100%+5	9mm	1/2"	90	1"	31"		
		CCW 100%+4	7mm	3/8"	90	1"	31"		
44	90°-180°	CW 100%+3	9mm	3/8"	90	5"	31 1/2"		
		CCW 100%	7mm	1/4"	90	5"	31 1/2"		
45	90°-180°	CW 100%+4	8mm	1/2"	90	5 1/2"	26"		
		CCW 100%+5	9mm	1/2"	90	5 1/2"	26"		
46	90°-180°	CW 100%+8	8mm	1"	90	1 3/4"	26"		
		CCW 100%+4	7mm	3/4"	90	1 3/4"	26"		
47	90°-180°	CW 100%+5	7mm	1"	90	4 3/4"	21"		
		CCW 100%+6	7.5mm	3/4"	90	4 3/4	21"		
48	90°-180°	CW 100%	6.5mm	5/8"	90	1/2"	21"		
		CCW 100%	7mm	3/4"	90	1/2"	21"		
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							

NOZZLE DUAL EXAMINATION [illegible]

Plant/Unit WATTS BAR I

Calibration Data Sheet # 5

Comp/System R.V. NOZZLES C-2

Examiners 1. [illegible] Level II

2. [illegible] Level I

Date 8-28-80

Reviewer [illegible] Date 9/3/80

Location #	Between Axis	70° Longitudinal Data Amplitude DE DAC	Depth	Length	Location Nearest Axis	Distance from Weld	Distance from Stiffeners	0° Data Ampl.	Depth
49	180°-270°	CW 100%+7	9mm	3/8"	270	1 1/4"	29"		
		CCW 100%+2	9.5mm	3/8"	270	1 1/4"	29"		
50	180°-270°	CW 100%+4	7mm	3/8"	270	3 1/2"	27"		
		CCW 100%+4	6mm	1/2"	270	3 1/2"	27"		
51	180°-270°	CW 100%+3	6mm	1/2"	270	2"	24"		
		CCW 100%	7mm	1/2"	270	2"	24"		
52	180°-270°	CW 100%+7	6.5mm	3/4"	270	3 1/2"	24"		
		CCW 100%+6	8mm	5/8"	270	3 1/2"	24"		
53	180°-270°	CW 100%+5	6mm	3/8"	270	3 1/4"	18"		
		CCW 100%+4	6mm	3/8"	270	3 1/4"	18"		
54	180°-270°	CW 100%+4	6.5mm	5/8"	270	4"	15 1/2"		
		CCW 100%+1	6.5mm	5/8"	270	4"	15 1/2"		
55	180°-270°	CW 100%+4	6.5mm	3/4"	270	8"	15 1/2"		
		CCW 100%+2	7.5mm	3/4"	270	8"	15 1/2"		
56	180°-270°	CW 100%+3	8mm	1/4"	180	5 1/4"	26 1/2"		
		CCW 100%+4	9.5mm	1/4"	180	5 1/4"	26 1/2"		
57	180°-270°	CW 75%	5.5mm	3/8"	180	8"	30"		
		CCW 100%+4	9mm	3/8"	180	8"	30"		
58	180°-270°	CW 100%+8	8mm	5/8"	180	3"	18 1/2"		
		CCW 100%+5	7mm	1/2"	180	3"	18 1/2"		
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							

Calibration Data Sheet # 6

Plant/Unit [illegible] Unit 1

Comp/System RH NOZZLES C-2

Examiners 1. [illegible] Level II

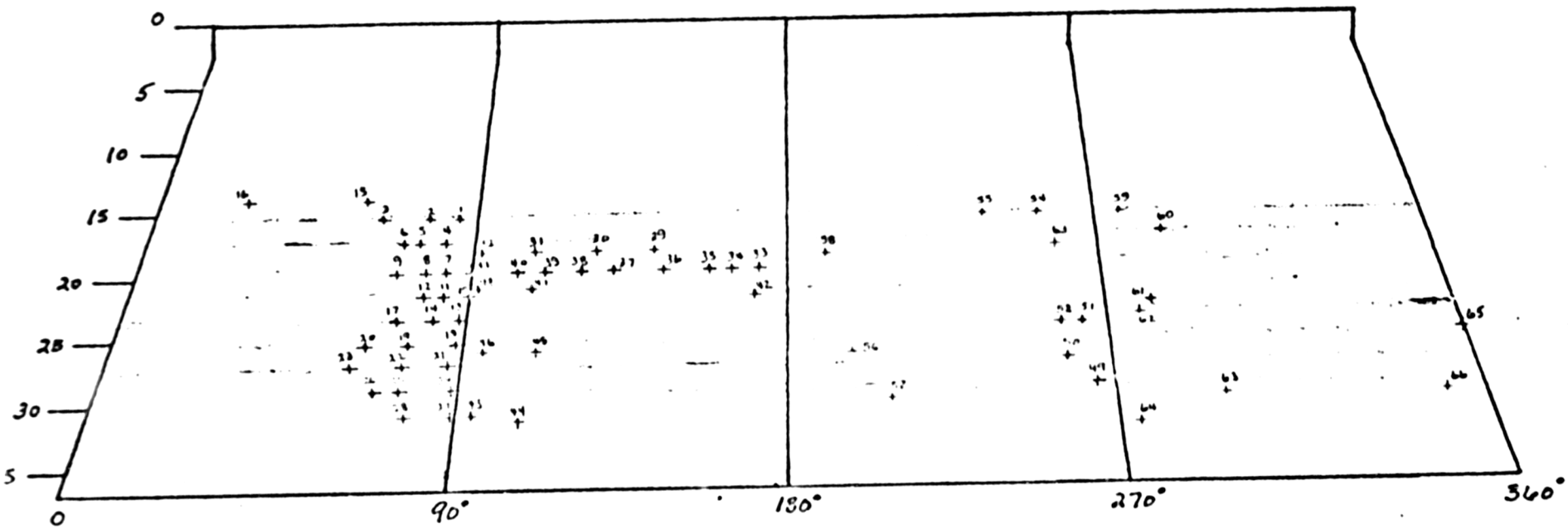
2. John Carson Level I

Date 8-28-80

Reviewer [illegible] Date 9/3/80

Station #	Direction axis	Longitudinal Data: Amplitude of DAC	Depth	Length	Location: Nearest Axis	Distance from N.A.	Distance from Seal Ext	OD Data: Ampl.	Depth
59	270-0	CW 100%+3	7mm	1/2"	270	2"	15 1/2"		
		CCW 100%+1	7mm	5/8"	270	2"	15 1/2"		
60	270-0	CW 100%+5	7mm	1"	270	5"	17 1/2"		
		CCW 100%+4	6.5mm	1"	270	5"	17 1/2"		
61	270-0	CW 100%+6	8.5mm	3/4"	270	3 3/4"	22 1/2"		
		CCW 100%+5	7.5mm	1"	270	3 3/4	22 1/2"		
62	270-0	CW 100%+6	7mm	3/4"	270	2 1/2"	23 1/2"		
		CCW 100%+6	10.5mm	3/8"	270	2 1/2"	23 1/2"		
63	270-0	CW 100%+5	8.5mm	1/2"	270	8 1/2"	30"		
		CCW 100%+5	8.5mm	1/2"	270	8 1/2"	30"		
64	270-0	CW 100%+6	8mm	5/8"	270	1 1/2"	32"		
		CCW 100%+5	7mm	3/4"	270	1 1/2"	32"		
65	270-0	CW 100%+6	7.5mm	1/2"	0	0"	23"		
		CCW 100%+7	8.5mm	5/8"	0	0"	23"		
66	270-0	CW 100%+1	9.5mm	1/2"	0	3"	30"		
		CCW 100%	9mm	1/2"	0	3"	30"		
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							

WATTS BAR UNIT I
INLET NOZZLE
LOOP 2



Plant/Unit [illegible] #1
Comp/System [illegible]

CALIBRATION DATA SHEET

#

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface diAD

INSTRUMENT SETTINGS	
Mfg/Model No.:	Sonic Mark I
Serial No. :	008685
Sweep Length :	2-0.10
Sweep Delay :	2.30
Pulse Length/Damping:	MW
Freq.: 2.25 Rep. Rate:	3K
Filter: Hi Video:	Back:
DEC/Gate Switch:	Range:
Mode Select:	Reject: OFF
Gain (coarse): 90 (fine):	1

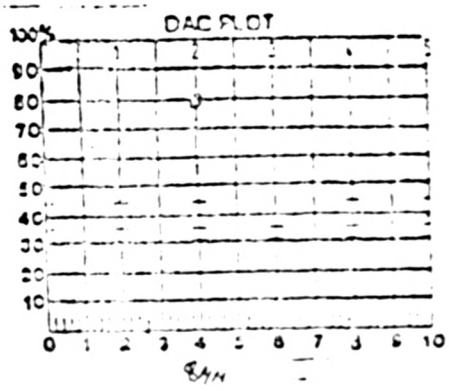
SEARCH UNIT	
Scan Angle:	70° Mode: L
Fixturing (if any):	CLOSED
Style or Type No. :	R.T.D.
Size & Shape :	19mm Round
Frequency :	2.0 MHz.
Serial No/Brand:	[illegible]
Measured Angle :	70°
Couplant Brand:	[illegible]
Couplant Batch:	[illegible]

INDEX	DEPTH	AMPL.	ATTEN.
A	2mm	—	—
B	5mm	—	—
C	11mm	—	—
D	2mm	99%	91

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5		
2		N	6	A	
3			7		
4			8		

SCAN AREA	
N/A	

DAC PLOT



AMPL. CONTROL LINEARITY		
Initial	1 dB	Result
80	-6	39
80	-12	19
40	+6	80
20	+12	82

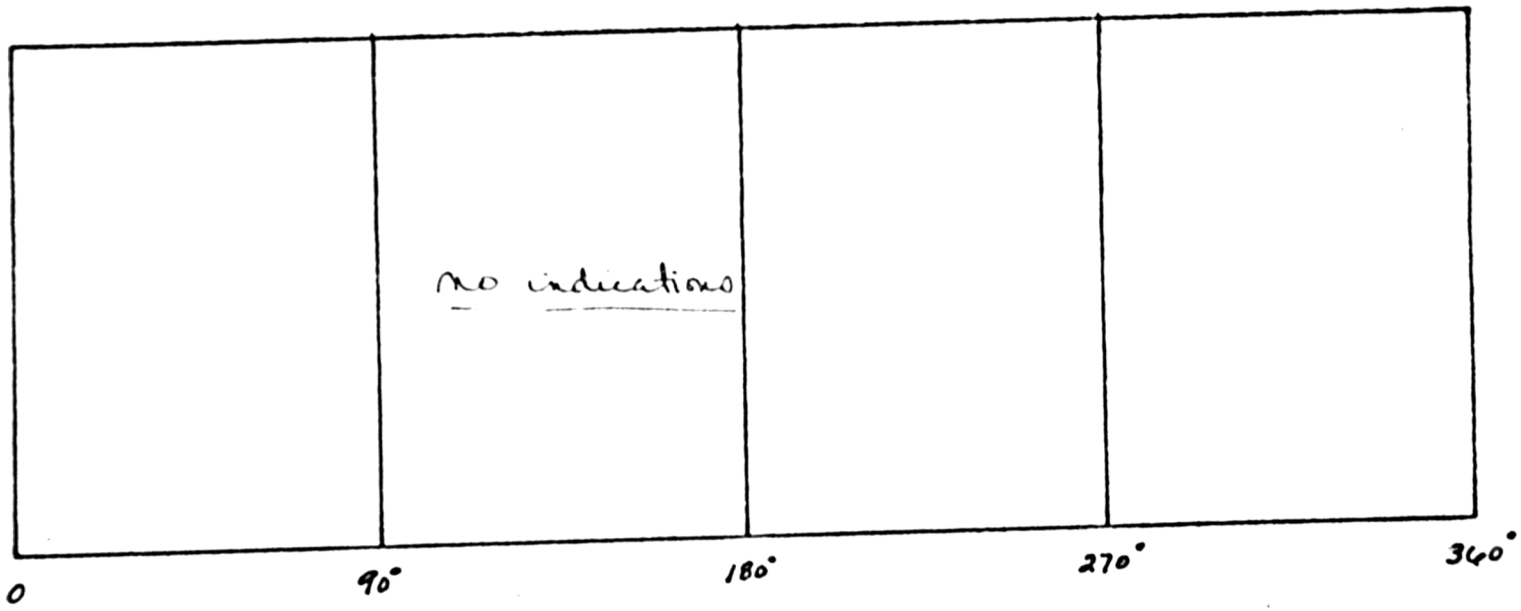
EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
Hot Leg		✓	
Loop 3			

CALIBRATION CHECKS	TIME
Initial Cal.	9:00
Intermediate	
Intermediate	
Intermediate	
Final Cal.	9:45

ADDITIONAL SHEETS (CHECK BOX)		
Continuation		
Supplemental	None	✓

EXAMINERS 1 [signature] Date 8-29-91 Level II
2 [signature] Date 8-29-91 Level I
Date

WATTS BAR UNIT I
OUTLET NOZZLE
LOOP 3



Plant/Unit WATTS BAR #1
Comp/System [illegible]

CALIBRATION DATA SHEET

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface C/AD

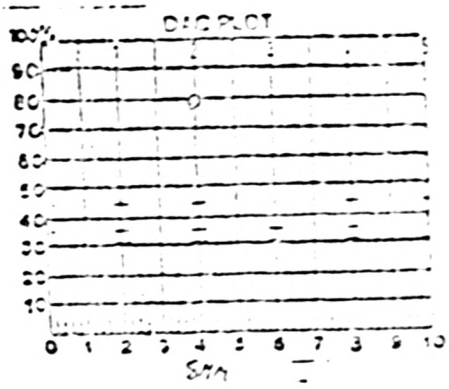
INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK II
Serial No. :	008695
Sweep Length :	2-0.10
Sweep Delay :	2.30
Pulse Length/Damping:	MED
Freq.: 2MG Rep. Rate:	3K
Filter: N/A Video: N/A Back:	OFF
SEC/Gate Switch: N/A Range:	[illegible]
Mode Select: N/A Reject:	OFF
Gain (coarse): 90 (fine):	0

SEARCH UNIT	
Scan Angle: 70° Mode:	L
Fixturing (if any):	CLOSED
Style or Type No. :	R.T.D.
Size & Shape:	18 mm Round
Frequency :	2.0 MHz
Serial No/Brand:	591-133
Measured Angle :	70°
Couplant Brand:	SHELL [illegible]
Couplant Batch:	[illegible]

Item	Depth	Refl.	Approx.
A	3mm	—	—
B	7mm	—	—
C	[illegible]	—	—
D	9mm	90%	[illegible]

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5		
2		N/A	7		
3			7		
4			8		

SCAN AREA	
N/A	



NPL. CONTROL LINEARITY		
Initial	1 dB	Result
60	-6	40
80	-12	19
40	+6	81
20	+12	81

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
COLD LEG	✓		
LOOP 3			

CALIBRATION CHECKS	TIME
Initial Cal.	9:55
Intermediate	11:05
Intermediate	2:30
Intermediate	5:35
Final Cal.	

ADDITIONAL SHEETS CHECK DOWN		
Continuation	✓	
Supplements		None

EXAMINERS 1 [signature] Date 8-[illegible] Level II
2 [signature] Date 8-[illegible] Level II
REVIEWER [signature] Date [illegible]

Plant/Unit WATTS BAR #1
Comp/System [illegible]

CALIBRATION DATA SHEET

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface [illegible]

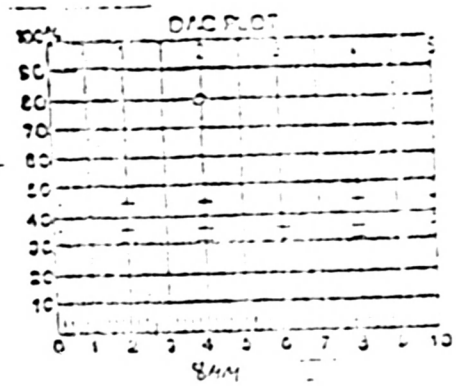
INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC [illegible]
Serial No. :	009682
Sweep Length :	2-0.10
Sweep Delay :	2.30
Pulse Length/Damping:	N/A
Freq.: 2.25 Rep. Rate:	8K
Filter: Hi Video: N/A Reject:	N/A
STC/Gate Switch: N/A Range:	N/A
Mode Select: A/A Reject:	OFF
Gain (coarse): 90 (fine):	1

SEARCH UNIT	
Scan Angle: 70° Mode:	L
Fixturing (if any):	N/A
Style or Type No. :	B.T.D.
Size & Shape:	10 mm Round
Frequency :	2.0 MHz.
Serial No/Brand:	591-133
Measured Angle :	70°
Couplant Brand:	[illegible]
Couplant Batch:	[illegible]

INDEX	DEPTH	AMPL.	ATTEN.
A	3 mm		
B	7 mm		
C	[illegible]		
D	9 mm	9 [illegible]	91

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5		
2		N/A	6		
3			7		
4			8		

SCAN AREA	
N/A	



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	19
40	+6	80
20	+12	83

CALIBRATION CHECKS	TIME
Initial Cal.	9:00
Intermediate	11:30
Intermediate	3:30
Intermediate	
Final Cal.	4:35

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
Cold LEG			
Loop 3	✓		
HOT LEG			
Loop 3		✓	

ADDITIONAL SHEETS (CHECK BOX)		
Continuation	✓	
Supplements		None

EXAMINERS 1 [signature] Date 8-23-86 Level II
2 [signature] Date 8-23-86 Level I
REVIEWER [signature] Date [illegible]

Plant/Unit WATTS BAR #1
Comp/System [illegible]

CALIBRATION DATA SHEET

#: _____

Data Sheet No. _____
Procedure No. _____
Subject _____
Rev/Change No. _____
Calibration Block No. _____
Surface CLAD.

INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK II
Serial No. :	755109
Sweep Length :	1-0.22
Sweep Delay :	1.50
Pulse Length/Damping:	Hi/L
Freq.: 5.0 Rep. Rate:	3K
Filter: Hi Video:	Lock:
SEC/Gate Switch:	Range:
Mode Select:	Reject: OFF
Gain (coarse): 70	(fine): 8

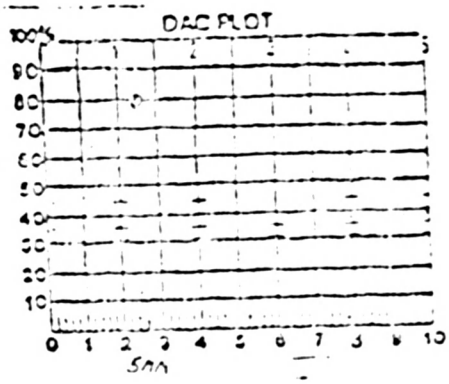
SEARCH UNIT	
Scan Angle: 0°	Mode: L
Fixturing (if any):	
Style or Type No. :	Gamma
Size & Shape :	½"
Frequency :	5.0 MHz
Serial No/Brand:	[illegible]
Measur d Angle :	0°
Couplant Brand:	[illegible]
Couplant Batch:	[illegible]

Index	DEPTH	AMPL.	ATTEN.
A	3mm	—	
B	7mm		
C	11mm	—	
D	8mm	—	—
E	5mm	30%	78

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5	✓	
2		N	6	A	
3			7		
4			8		

SCAN AREA	
N/A	

DAC PLOT



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	19
40	+6	81
20	+12	81

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
COLD LEG	✓		
LOOP 3			

CALIBRATION CHECKS	TIME
Initial Cal.	2:30
Intermediate	
Intermediate	
Intermediate	
Final Cal.	4:00

ADDITIONAL SHEETS? (CHECK BOX)		
Continuation	✓	
Supplements		None

EXAMINERS 1 [signature] Date [illegible] Level II
2 [signature] Date [illegible] Level II
REVIEWER [signature] Date [illegible]

Plant/Unit WATTS BAR #1

Comp/System COLD LEG INJECTION LOOP 3

Examiners 1. [illegible] Level II

2. [illegible] Level I

Date 8-26-80

Reviewer [illegible] Date 9/2/80

Calibration Data Sheet # ____

Indication #	Between Axes	Longitudinal Flaw Amplitude	Depth	Length	Location Nearest Axis	Distance from Nozzle	Distance from Safeend	90°-270° Data Ampl.	Depth
1	0°-90°	CW 100% DAC	7mm	3/8"	90°	11 1/2"	16"	100% DAC	5mm
		CCW [illegible]% DAC	7mm	5/16"	90°	11 1/2"	16"	80% DAC	5mm
2	90°-180°	CW 80% DAC	6mm	3/8"	90°	3 3/4"	11"	—	—
		CCW 80% DAC	7mm	5/16"	90°	3 3/4"	11"		
3	90°-180	CW 100% DAC	7mm	1/4"	180°	2 3/4"	18 1/2"	37% DAC	5mm
		CCW 100% DAC	7mm	1/4"	180°	2 3/4"	18 1/2"		
4	270°-180°	CW 100% DAC	6mm	1 1/4"	180°	1"	16 1/2	25% DAC	6mm
		CCW 100% DAC	6mm	5/16"	180°	1"	16 1/2		
5	180°-270°	CW 100% DAC	6mm	1 1/4"	180°	3"	20 1/2"	—	—
		CCW 100% DAC	6mm	1 3/4"	180°	3"	20 1/2"		
6	180°-270°	CW 60% DAC	7mm	5/16"	180°	13"	29"	—	—
		CCW 50% DAC	7mm	3/8"	180°	13"	29"		
7	180°-270°	CW 50% DAC	7mm	5/16"	270°	1 1/4"	25 1/2"	50% DAC	6mm
		CCW [illegible]% DAC	7mm	5/16"	270°	1 1/4"	25 1/2"	100% DAC	6mm
8	90°-180°	CW 55% DAC	6mm	3/8"	90°	4 1/4"	24"	75% DAC	5mm
		CCW 60% DAC	6mm	5/16"	90°	4 1/4"	24"	30% DAC	5mm
9	90°-180°	CW 55% DAC	6mm	3/8"	90°	1 1/4"	25 1/4"	% DAC	5mm
		CCW 60% DAC	6mm	5/16"	90°	1 1/4"	25 1/4"	55% DAC	5mm
10	0°-90°	CW 75% DAC	7mm	1/4"	90°	9 1/2"	27 1/2"	—	—
		CCW 60% DAC	7mm	3/8"	90°	9 1/2"	27 1/2"		
11	0°-90°	CW 70% DAC	6mm	3/8"	90°	1 3/4"	27"	73% DAC	5mm
		CCW 50% DAC	7mm	7/16"	90°	1 3/4"	27"	30% DAC	5mm
12	0°-90°	CW 79% DAC	7mm	1/4"	90°	10 3/4"	29 1/2	—	—
		CCW 100% DAC	7mm	3/8"	90°	10 3/4"	29 1/2"		
13	0°-90°	CW 60% DAC	6mm	7/16"	90°	1/2"	29 1/4	—	—
		CCW 65% DAC	6mm	1/2"	90°	1/2"	29 1/4		
14	0°-90°	CW 37% DAC	6mm	5/16"	0°	11 1/2"	36 1/4"	—	—
		CCW 55% DAC	6mm	5/16"	0°	11 1/2"	36 1/4"		
		CW							

Plant/Unit WATTS BAR #1

Comp/System CAID 15% NOZZLE LOOP 3

Examiners 1. [illegible] Level II

2. [illegible] Level I

Date 8-27-80

Reviewer [illegible] Date 9/3/80

Calibration Data Sheet # ____

Location #	Defect area	Longitudinal Data			Location			0°-90° Data	
		Amplitude	Depth	Length	Nearest Axis	Distance from W.L.	Distance from S.E.L.	Ampl.	Depth
15	0°-90°	CW 50% DAC	5 mm	1/4"	0°	12"	36 1/4	87% DAC	5MM
		CCW 50% DAC	5 mm	5/16"	0°	12"	36 1/4"	37% DAC	5MM
16	0°-90°	CW 50% DAC	6 mm	7/16"	90°	4 3/4"	34"	—	—
		CCW 60% DAC	6 mm	5/16"	90°	4 3/4"	34"		
17	0°-90°	CW 67% DAC	6 mm	3/8"	90°	3 1/4"	34"	—	—
		CCW 55% DAC	5 mm	3/8"	90°	3 1/4"	34"		
18	0°-90°	CW 43% DAC	7 mm	3/8"	90°	2 1/4"	34"	—	—
		CCW 50% DAC	7 mm	5/16"	90°	2 1/4"	34"		
[illegible]	0°-90°	CW 70% DAC	8 mm	5/16"	90°	1 1/2"	34"	100+% DAC	5MM
		CCW 55% DAC	7 mm	5/16"	90°	1 1/2"	34"	55% DAC	5MM
20	90°-180°	CW 100+% DAC	8 mm	3/8"	90°	1 3/4"	27"	—	—
		CCW 60% DAC	7 mm	5/16"	90°	1 3/4"	27"		
21	90°-180°	CW 90% DAC	7 mm	7/16"	90°	4 3/4"	26"	87% DAC	5MM
		CCW 75% DAC	7 mm	3/8"	90°	4 3/4"	26"	40% DAC	5MM
22	90°-180°	CW 60% DAC	9 MM	1/4"	90°	9 1/4"	26 1/2"	60% DAC	6MM
		CCW 75% DAC	8 MM	5/16"	90°	9 1/4"	26 1/2"	25% DAC	6MM
[illegible]	90°-180°	CW 87% DAC	9 MM	1/4"	180°	13"	26"	—	—
		CCW 87% DAC	8 MM	1/4"	180°	13"	26"		
24	90°-180°	CW 60% DAC	8 MM	7/16"	90°	1/2"	28 1/2"	60% DAC	5MM
		CCW 60% DAC	7 MM	3/8"	90°	1/2"	28 1/2"	25% DAC	5MM
[illegible]	90°-180°	CW 75% DAC	7 MM	5/16"	90°	3 3/4"	28"	100+% DAC	5MM
		CCW 60% DAC	7 MM	1/4"	90°	3 3/4"	28"	55% DAC	5MM
26	90°-180°	CW 50% DAC	8 MM	1/4"	90°	7"	28"	75% DAC	6MM
		CCW 55% DAC	7 MM	5/16"	90°	7"	28"	30% DAC	6MM
[illegible]	90°-180°	CW 50% DAC	6 MM	3/8"	90°	2 1/2"	33 1/2"	100+% DAC	4MM
		CCW 55% DAC	6 MM	7/16"	90°	2 1/2"	33 1/2"	55% DAC	4MM
28	90°-180°	CW 37% DAC	7 MM	5/16"	90°	5 1/2"	32 1/2"	100+% DAC	5MM
		CCW 50% DAC	7 MM	5/16"	90°	5 1/2"	32 1/2"	55% DAC	5MM
		CW							

NUCLEAR CORE EXAMINATION DATA SHEET

Calibration Data Sheet # ____

Plant/Unit Waits Bar #1

Comp/System Cold Leg Nozzle Loop 3

Examiners 1. [illegible] Level II

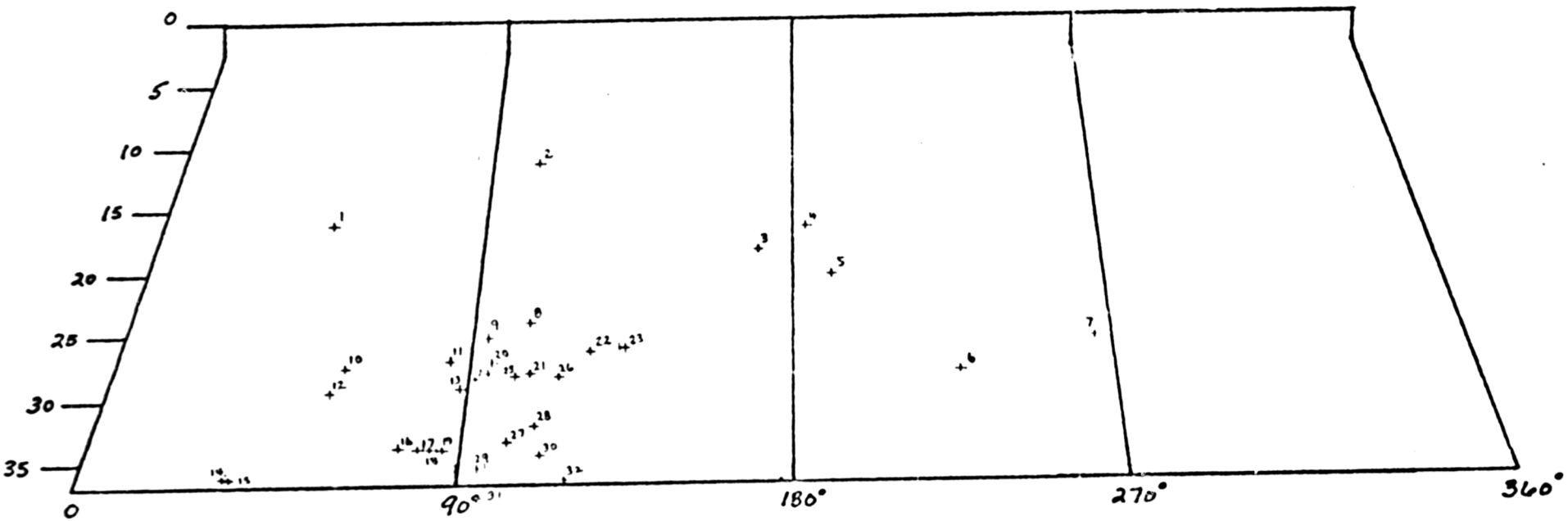
2. [illegible] Level I

Date 9-27-90

Reviewer [illegible] Date 9/28/90

Position #	Between Axis	Volumetrical Data: Amplitude	Depth	Length	Location: Reference Axis	Distance from W.E.	Distance from Weld	ID-OD Data: Ampl.	Depth
29	90°-180°	CW 55% DAC	7 mm	5/16"	90°	1 1/2"	35 1/2"	—	—
		CCW 75% DAC	8 mm	5/16"	90°	1 1/2"	35 1/2"		
30	90°-180°	CW 97% DAC	9 mm	1/4"	90°	6"	34 1/2"	75% DAC	6 mm
		CCW 55% DAC	7 mm	1/4"	90°	6"	34 1/2"	37% DAC	6 mm
31	90°-180°	CW 70% DAC	7 mm	1/2"	90°	1 3/4"	38"	80% DAC	5 mm
		CCW 55% DAC	6 mm	1/2"	90°	1 3/4"	38"	45% DAC	5 mm
32	90°-180°	CW 50% DAC	6 mm	3/8"	90°	9 1/4"	36 3/4"	50% DAC	5 mm
		CCW 35% DAC	6 mm	7/16"	90°	9 1/4"	36 3/4"	25% DAC	5 mm
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							

WATTS BAR UNIT I
INLET NOZZLE
LOOP 3



Plant/Unit WATTS BAR I
Comp/System RV NOZZLES
H-4

CALIBRATION DATA SHEET
1

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface CLAD

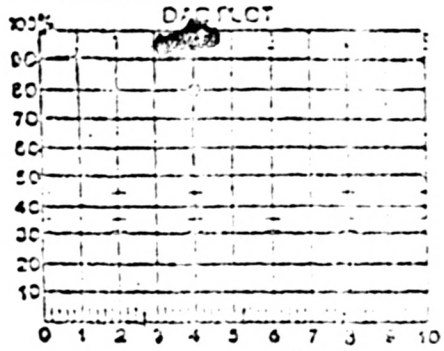
INSTRUMENT SETTINGS	
Mfg/Model No.:	SONIC MARK I
Serial No. :	781304
Sweep Length :	1/1.20
Sweep Delay :	1/2.03
Pulse Length/Damping:	N/A
Freq.: 2MH Rep. Rate:	3K
Filter: N/A Video: N/A	Lock: N/A
DEC/Gate Switch: N/A	Range: N/A
Mode Select: N/A	Reject: OFF
Gain (coarse): 70	(fine): 4

SEARCH UNIT	
Scan Angle: 70°	Mode: NORM
Fixturing (if any):	CLOSED
Style or Type No. :	K.T. DUPONT
Size & Shape:	18mm ⌀
Frequency :	2MHZ
Serial No/Brand:	591134 KB
Measured Angle :	70°
Couplant Brand:	SONOTRACE 40
Couplant Batch:	79294

POINT	DEPTH	AMPL.	ATTEN.
A	3	—	—
B	7	—	—
C	11	—	—
D	8	80%	74

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5		
2			6		
3			7		
4			8		

SCAN AREA



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	40
80	-12	19
40	+6	80
20	+12	81

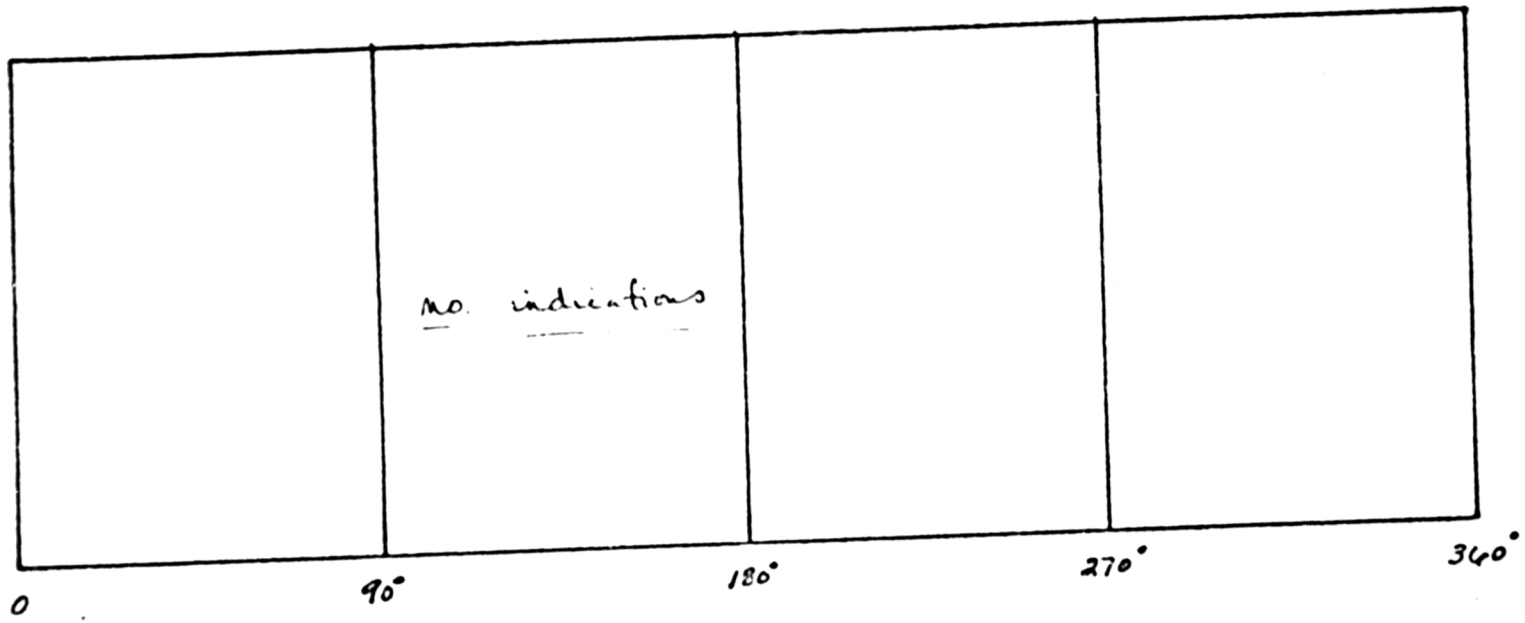
EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
H-4		✓	

CALIBRATION CHECKS	TIME
Initial Cal.	9:00
Intermediate	11:45
Intermediate	12:00
~~Intermediate~~ F.C.	17:00
Final Cal.	

ADDITIONAL SHEETS? (CHECK BOX)		
Continuation	NONE	
Supplements	None	

EXAMINERS 1 [signature] Date 8/25/90 Level II
2 [signature] Date 8-25-90 Level I
REVIEWER [signature] Date 8/25/90

WATTS BAR UNIT I
OUTLET NOZZLE
LOOP 4



Plant/Unit DATS RAP #1
Comp/System MAIN LOOP

CALIBRATION DATA SHEET
1A

Data Sheet No.
Procedure No.
Subject
Rev/Change No.
Calibration Block No.
Surface CLAD

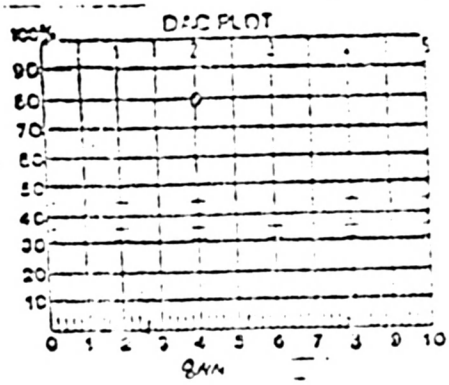
INSTRUMENT SETTINGS	
Mfg/Model No.:	Sonic MARK II
Serial No.	: 009608E
Sweep Length	: 4-0.10
Sweep Delay	: 2.30
Pulse Length/Damping:	N/A
Freq.: 2.25	Rep. Rate: 3K
Filter: N/A	Video: N/A Back: OFF
SMC/Gate Switch: N/A	Range: N/A
Mode Select: PC	Reject: OFF
Gain (Coarse): 80	(fine): 1

SEARCH UNIT	
Scan Angle: 70°	Mode: L
Fixturing (if any): CLOSED	
Style or Type No. :	R.T.D.
Size & Shape:	18 mm ROUND
Frequency	: 2.0 MHz
Serial No/brand:	591-133
Measured Angle	: 70°
Couplant Brand:	SONOTRACE 70
Couplant Batch:	[illegible]

INDEX	DEPTH	AMPL.	ATTEN.
A	3 mm	—	—
B	7 mm	—	—
C	11 mm	—	—
D	8 mm	50%	51

INSTR. LINEARITY CAL.					
Amplitude					
	High	Low		High	Low
1			5		
2		N/A			
3			7		
4			8		

SCAN AREA	
N/A	



NOTM. CONTROL LINEARITY		
Initial	1 dB	Result
80	-6	40
80	-12	19
40	+6	78
20	+12	80

CALIBRATION CHECKS	TIME
Initial Cal.	2:30
Intermediate	
Intermediate	
Intermediate	
Final Cal.	5:30

EXAMINATION WELD/AREA	RECORDABLE INDICATION Yes	No	COMMENTS/REASON FOR INCOMPLETED SCAN(S)
COLD LEG	✓		
LOOP 4			

ADDITIONAL SHEETS (CHECK BOX)			
Continuation	✓		
Supplements		None	

EXAMINERS 1 [signature] Date 9-25-90 Level II
2 [signature] Date 9-25-90 Level I
REVIEWER [signature] Date [illegible]

Plant / Unit [illegible]

Component [illegible] NOZZEL LOOP 4

Examiner 1. [illegible] Level II

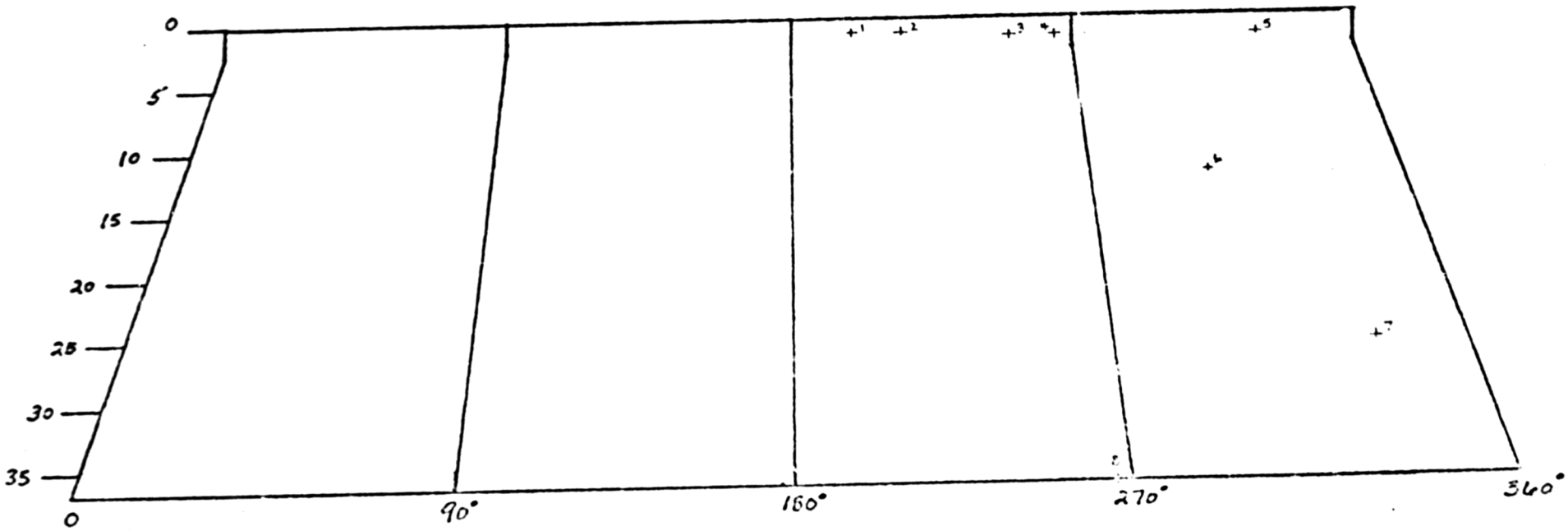
2. [illegible] Level I

Date 9-26-[illegible]

Reviewer [illegible] Date 9/3/[illegible]

Calibration Data Sheet

Position	Degrees Axis	Longitudinal Data Amplitude	Depth	Length	Location Nearest Axis	Distance from N.Z.	Distance from Seal Ring	Amplitude	Depth
1		CW	—	—	—	—	—	50% DAC	7MM
	180°-270°	CCW 60% DAC	8mm	1/2"	180°	4 3/4"	1"	150% DAC	8MM
		CW 50% DAC	7mm	3/16"	180°	8 1/2"	1"	50% DAC	6MM
	180°-270°	CCW 60% DAC	7mm	3/16"	180°	9 1/2"	1"	25% DAC	6MM
3		CW 55% DAC	8mm	1/4"	270°	4 3/4"	1 1/4"	50% DAC	5MM
	180°-270°	CCW 45% DAC	7mm	1/4"	270°	4 3/4"	1 1/4"	25% DAC	5MM
4		CW 50% DAC	6mm	1/4"	270°	5 1/2"	1 1/4"	37% DAC	5MM
	180°-270°	CCW 37% DAC	6mm	1/4"	270°	5 1/2"	1 1/4"		
		CW 65% DAC	7mm	1/4"	0°	7 3/4"	1 1/2"	—	—
	270°-0°	CCW 37% DAC	7mm	1/4"	0°	7 3/4"	1 1/2"		
6		CW 100% DAC	6mm	5/16"	270°	9"	12 1/4"	—	—
	270°-0°	CCW 75% DAC	6mm	1/4"	270°	9"	12 1/4"		
7		CW 95% DAC	6mm	5/16"	0°	7"	26"	—	—
	270°-0°	CCW 95% DAC	6mm	5/16"	0°	7"	26"		
8		CW 60% DAC	6mm	5/16"	270°	1 1/4"	37 1/2"	150% DAC	3MM
	180°-270°	CCW 25% DAC	6mm	1/4"	270°	1 1/4"	37 1/2"	75% DAC	3MM
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							
		CW							
		CCW							


0
5
10
15
20
25
30
35
0
90°
180°
270°
360°