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SOUTHWEST RESEARCH INSTITUTE
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NUCLEAR REACTOR PRESSURE VESSEL TRANSPORTATION INCIDENT

POINT BEACH UNIT 1

VOLUME I

PREPARED FOR

WISCONSIN MICHIGAN POWER COMPANY
231 WEST MICHIGAN STREET
MILWAUKEE, WISCONSIN 53201

July 9, 1969

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PREFACE

Volumes I and II of this report cover the Point Beach Unit 1 Nuclear Reactor Pressure Vessel Transportation Incident. The report includes a summary of the events from the time the reactor vessel was moved from the Kewaunee dock into and parked at the Two Rivers plant site until the completion of the rework of the inlet and outlet nozzle weld preparations.

This report

... describes the incident;

... provides statements of individuals engaged in the moving operation who witnessed the incident;

... covers the examinations following the incident, conducted during the progress of the work, and carried out following the work;

... outlines the evaluation of the damage, including a detailed stress and brittle fracture analysis of the primary inlet nozzle by The Babcock & Wilcox Company and an independent analysis by Southwest Research Institute;

... outlines the principal parties involved in the operation and defines their responsibilities;

... includes procedures for righting the reactor vessel after the incident, together with procedures for moving the reactor vessel to the temporary structure constructed to facilitate further nondestructive examinations and work operations;

... includes procedures and specifications for nondestructive testing and for conducting the work;

... outlines results of inspections and examinations;

... includes reports by representatives of Westinghouse Electric Corporation, The Babcock & Wilcox Company, The Hartford Steam Boiler Inspection and Insurance Company, and Southwest Research Institute;

... includes acceptance of the rework of the inlet and outlet nozzles by Westinghouse Electric Corporation and The Babcock & Wilcox Company.

It is concluded that the reactor vessel did not suffer permanent damage as a result of the occurrence and that the areas of the inlet and outlet nozzle weld preparations damaged by the incident have been properly reworked to permit safe operation of the reactor vessel.

It is felt that Volumes I and II of this report properly document the incident, the examinations following the incident, the considerations for reworking, the evaluation of damage, the rework operations, the procedures and specifications used in the rework, inspections and examinations carried out, responsibilities of the principal parties involved, and final acceptance of the reactor vessel by the principal parties.

Radiography of the welds at the completion of the inlet and outlet pipe attachments and the final hydrostatic test of the system will provide the final acceptance of the reactor vessel.

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NUCLEAR REACTOR PRESSURE VESSEL
TRANSPORTATION INCIDENT

POINT BEACH UNIT 1

I. INTRODUCTION

This report describes the reactor vessel transportation incident and contains the reports and data related to the analysis of the vessel, non-destructive examinations of the vessel, and repair of the vessel following the occurrence on February 22, 1969.

The report is issued in two volumes. Volume I is a record of the incident, the inspections made, and the repairs required. Volume II contains drawings and procedures which are considered proprietary to The Babcock & Wilcox Company and to Westinghouse Electric Corporation.

II. PARTIES INVOLVED

The following parties were involved in the evaluation and repair of the reactor pressure vessel following the occurrence:

Wisconsin Michigan Power Company
231 West Michigan Street
Milwaukee, Wisconsin

The Babcock & Wilcox Company
Barberton, Ohio

Westinghouse Electric Corporation
Power Systems
Atomic Power Divisions
Penn Center Site
Box 355
Pittsburgh, Pennsylvania

The Hartford Steam Boiler Inspection and Insurance Company
56 Prospect Street
Hartford, Connecticut

Southwest Research Institute
8500 Culebra Road
San Antonio, Texas

III. RESPONSIBILITIES

Wisconsin Michigan Power Company will be the user of the vessel and is responsible for obtaining final acceptance of the reactor vessel by the Atomic Energy Commission for a license to operate and by the State of Wisconsin for the required operating certificate.

The Babcock & Wilcox Company is the manufacturer of the reactor vessel and accepted responsibility to carry out the required nondestructive examinations, provide a stress analysis to determine load imposed by the incident, and to conduct the necessary repairs to the reactor vessel to correct the damage resulting from the incident.

Westinghouse Electric Corporation has the responsibility for the installation of the nuclear system and, therefore, the responsibility for providing supervision of the nondestructive examinations and the repairs by Babcock & Wilcox Company.

The Hartford Steam Boiler Inspection and Insurance Company accepted the responsibility to provide an inspector in possession of a National Board of Boiler and Pressure Vessel Inspectors' Commission to witness the repairs by Babcock & Wilcox Company and to certify that the minimum requirements established by the State of Wisconsin to permit the legal operation of the reactor vessel were met in the repair of the reactor vessel.

Southwest Research Institute accepted the responsibility to review the stress analysis prepared by Babcock & Wilcox Company, make a separate

stress analysis to determine the load imposed by the incident, review the procedures for welding and nondestructive examinations, audit nondestructive examinations, and witness the repair of the reactor vessel carried out by The Babcock & Wilcox Company.

IV. INCIDENT

The Belding Engineering Corporation moved the reactor vessel from the Kewaunee dock site to the Two Rivers plant site. On Friday, February 21, 1969, the reactor vessel was moved to just inside the plant yard and the wheels on the dollies were blocked to park the rig for the night.

The men reported for work at about 8:00 A.M. on February 22, 1969, and in preparation for continuing the move of the reactor vessel to the reactor site, they started to remove the blocks from the wheels of the dollies. The sequence of events is not clear, but it is reported that to accomplish the removal of the wheel blocks, both tractors (one pulling and one pushing) were started and the rig was rocked back and forth to loosen the blocks at the wheels. It is to be noted that the regular driver of the lead tractor was not available, and Mr. John Holmes, Belding Superintendent in charge of the operation, elected to operate the tractor. After an undetermined number of rocking operations, Mr. Nyle Vincent, Ironworker Foreman, reportedly gave the signal to move forward. However, one block remained in front of the left front dual of the front dolly of the rear tandem of the right tandem "Quad" dolly. Since neither of the tractor operators was signaled otherwise, they continued to move forward. The block was pushed along by the dual wheels, digging into the ground, with the result that more resistance was created. This caused the dolly to turn inward toward the center of the load. As it did, the tongue slide that was attached to the rear of the next forward dolly began to slide out of the connecting tongue. Whether the slide came all the way out

prior to the unloading is unknown, but the turning inward of the dolly caused the bolster that rested upon it to roll outward, thus dropping the quad bolster, cross beam, and the reactor vessel. The distance that the reactor vessel dropped was approximately 33 inches, which was more than enough to cause the center of gravity of the reactor vessel to pass beyond the center of the support. It was reported that the reactor vessel rolled slowly over on its side. According to witnesses, it rolled about 100 degrees and then rolled back to the resting position of about 90 degrees.

The cause of the occurrence is attributed to the failure to remove the wheel blocking and the lack of proper supervision by Mr. Holmes, Superintendent for Belding Engineering Corporation, in operating the lead tractor instead of directing the activity and personally giving the "all clear" signal to move after being satisfied that all blocking had been removed from the dolly wheels. Figure 19 illustrates the wooden block used to block the rear tandem of the right tandem dolly.

Figures 1 through 6 illustrate from various angles the position of the reactor vessel after the incident.

Figure 7 show e reactor vessel resting on the two nozzles and illustrates the penetration of nozzles into the ground. Figures 8, 9, and 10 show the outlet nozzle resting on the dolly wheel rim with tires and axle extending inside the nozzle bore. Figure 9 also shows the nozzle penetration into the ground. Figure 11 shows a close-up view of the inlet nozzle illustrating the degree of penetration of the nozzle into the ground. The extension

of the impression of the nozzle into the ground as shown in the photograph is evidence that the reactor vessel did roll beyond the resting position shown in Figures 1 through 6.

Appendix I is a record of the official temperatures recorded by the City of Two Rivers Water and Light Department from 8:00 A.M., Thursday, February 20, 1969, to 8:00 A.M., Monday, February 24, 1969. These data are included to provide information on the condition of the ground at the time of the occurrence and further to provide information on the reactor vessel temperature for possible brittle fracture considerations.

Figures 12 and 13 show the visible physical damage to the weld preparation of the inlet nozzle that penetrated the ground away from the dolly wheels. Figures 14 and 15 illustrate the visible physical damage to the outlet nozzle weld preparation caused by the rim of the dolly wheel. The internal bore of the outlet nozzle suffered some damage from the dolly axle. This damage is not visible in any of the photographs. The scar was initially judged to be about 0.045 inch deep; but after preliminary grinding that removed the upset area, it was re-evaluated and judged to be only about 0.005 inch deep. The only other visible damage to the object was some distortion of the vessel shipping skid; this can be seen in Figures 3, 4, 5, and 16.

Attached as Appendix II is a copy of a letter signed by Mr. S. A. Peterson, Westinghouse Electric Corporation, agreeing with Mr. Hartley Belding's summary of the reactor vessel incident. A copy of Mr. Belding's

summary, approved by Mr. W. A. Haemker, Secretary-Treasurer of Belding Engineering Corporation, is also attached as part of Appendix II.

Appendix III contains notarized statements by Messrs. John Holmes, Marvin Braun, Denny Dunn, Phil Pionkowski, Leslie F. Krause, Robert Krines, and Nyle Vincent, Belding Engineering Corporation employees engaged in the activity at the time of the incident.

Appendix IV is a report dated March 3, 1969, by Mr. R. Von Osinski, Westinghouse Electric Corporation, covering his observations during his visit to the site February 23 to February 25, 1969.

V. RIGHTING OF REACTOR VESSEL

A procedure for righting the reactor vessel was developed by Belding Engineering Corporation prior to any attempt to move the object. The procedure, dated February 25, 1969, together with Drawings Nos. 1 and 2, is attached as Appendix V.

Appendix VI is a report covering deviations from the procedure for righting the reactor vessel.

Appendix VII lists the reactor vessel wall temperatures recorded during the righting of the object, March 1 to March 3, 1969.

Figure 17 shows the cranes in position for the lift, and the reactor vessel on the rig en route to the temporary storage site is shown in Figure 18. Figure 20 shows the temporary reactor vessel storage site.

VI. POST-INCIDENT INSPECTION

Appendix VIII is a report dated March 18, 1969, by Mr. J. D. Furry, The Babcock & Wilcox Company, covering a period of time from March 7, 1969, to March 14, 1969. The report indicates that six diametrical checks were made on the inside bore of the two nozzles at the end of the 10-degree taper and at 6 inches in from that point. The nozzle bores were found to be within drawing tolerances, indicating that no distortion of the nozzle forgings resulted from the incident. The values were compared with "as-built" dimensions and found to be unchanged, including measurement of nozzle end to nozzle end.

Since the vessel was in the horizontal position, it was not possible to make angular displacement measurements because of the difficulty in establishing the theoretical centerline. Such measurements will be made when the vessel is set on the vessel supports. It is not anticipated that any changes occurred, based on the other dimensional analyses which were made.

Appendix IX is a nondestructive testing report prepared by Mr. M. W. Young, The Babcock & Wilcox Company. The report provides a detailed inspection summary of specific areas of the reactor vessel that were subjected to nondestructive examinations and the type of examinations conducted. Table I of the report provides a list of the applicable Babcock & Wilcox Company specifications used for the nondestructive examinations. Appendix X includes all of the nondestructive examination procedures listed in Table I of Appendix IX.

Appendix XI is the shop ultrasonic inspection report covering the ultrasonic examination of the reactor vessel and closure for the purpose of establishing a map of recordable discontinuity indications. The map was used for comparison after making the ultrasonic examination following the incident.

Appendix XII is a report dated March 20, 1969, by Mr. E. T. Hughes, Westinghouse Electric Corporation, covering the period of March 8, 1969, to March 11, 1969. The report covers Mr. Hughes' observations of nondestructive examinations carried out to March 11, 1969, and his conclusions that the examinations were properly conducted and that no areas of concern were disclosed.

Appendix XIII is a report dated March 16, 1969, by Mr. L. K. Isbill, Westinghouse Electric Corporation, covering the period of March 11, 1969, to March 13, 1969. The purpose of his visit was to observe additional nondestructive examinations. The report indicates that Mr. Isbill agreed with The Babcock & Wilcox Company's interpretation of results of the examinations.

Appendix XIV is a letter dated April 10, 1969, by Mr. J. R. Steele, Westinghouse Electric Corporation, and a report and photographs furnished by Mr. G. R. Forrer, The Babcock & Wilcox Company, demonstrating the feasibility of performing magnetic particle examinations on painted surfaces.

Southwest Research Institute reviewed the results of the post-incident inspection and concurred with the inspection procedure. It is significant that the indications found in the post-incident inspection were identical in location with those found in the shop mapping procedure. The slight difference in signal amplitude is believed to be insignificant.

VII. REPAIR CONSIDERATIONS

A meeting was held at the Wisconsin Michigan Power Company Point Beach Nuclear Plant, Two Rivers, Wisconsin, on April 15, 1969, to discuss proposed repair of the reactor vessel. Present at the meeting were representatives from Wisconsin Michigan Power Company, Westinghouse Electric Corporation, The Babcock & Wilcox Company, Public Service Commission of the State of Wisconsin, Boiler Division--Department of Labor of the State of Wisconsin, and Southwest Research Institute. A repair procedure was developed and accepted by the representatives at the meeting. Southwest Research Institute's Trip Report summarizing the meeting is attached as Appendix XV.

VIII. REACTOR VESSEL STRESS ANALYSIS

The Babcock & Wilcox Company prepared a stress and brittle fracture analysis of the primary inlet nozzle and reactor vessel shell; this report is attached as Appendix XVI. The results of the analysis produced a maximum stress intensity of 6.18 ksi at a point on the shell designated "CU" and indicates that this value is less than the 1.5 Sm allowable stress intensity limit of 40 ksi. It developed that the minimum crack size necessary for brittle fracture crack propagation in the vessel was found to be 2 feet. The report concluded that the reactor vessel was not stressed above allowable limits by the impact, and a brittle fracture was not possible under this loading condition.

The Babcock & Wilcox Company stress and brittle fracture analysis was reviewed by a Southwest Research Institute representative. Further, an independent stress analysis was developed by Mr. Peter S. Westine, Southwest Research Institute, and this report is attached as Appendix XVII. This approach also shows low stresses and is believed to be a more rational analysis of the dynamic loads which occurred during the incident.

IX. REPAIR

The repair of the reactor vessel was conducted by The Babcock & Wilcox Company. A Babcock & Wilcox Company quality control representative made inspections during the time of the repair and, in addition, the repair operations and the nondestructive examinations were observed by representatives from Westinghouse Electric Corporation, The Hartford Steam Boiler Inspection and Insurance Company, and Southwest Research Institute.

Figure 21 illustrates the ultrasonic examination technique employed for examination of the nozzle forgings. Figure 22 illustrates the outlet nozzle during the weld buildup of the weld lip. Figure 23 illustrates the outlet nozzle after completion of the weld buildup prior to the machining operation to facilitate the ultrasonic examination of the repaired area. Figure 24 shows the liquid penetrant examination of the outlet nozzle weld preparation after the final machining operation. Figures 25 and 26 illustrate the machining operations of the inlet nozzle weld preparations.

Appendix XVIII is a report of the repair by Mr. E. R. Reinhart, Southwest Research Institute. This report includes sketches; inspection records and inspection slips; reports of electrode chemistry; welder qualifications; Manufacturer's Report of Welded Repairs signed by Mr. Gordon Svendsen, Inspector for The Hartford Steam Boiler Inspection and Insurance Company; a report by Mr. J. S. Chaplan, Westinghouse Electric Corporation; and references to The Babcock & Wilcox Company procedures and specifications.

The acceptance inspection of each individual item of the repair procedure by The Babcock & Wilcox Company is given on inspection tickets. In addition, a summary report by Mr. E. T. Hughes of Westinghouse Electric Corporation is given in Appendix XIX. This report indicates acceptance of the repair by Westinghouse Atomic Power Divisions. A letter from Westinghouse Electric Corporation dated June 9, 1969, acknowledging acceptance of the reactor vessel repair is attached as Appendix XX.

Southwest Research Institute also witnessed all repair procedures and inspections and concurs that they meet the contractual requirements.

The Babcock & Wilcox Company final report covering the repair of the reactor vessel is attached as Appendix XXI. Also included in this Appendix (page XXI-17) is a letter to Westinghouse Electric Corporation from D. E. Kinsala, The Babcock & Wilcox Company, dated July 23, 1969, stating that the Hartford Steam Boiler Inspection and Insurance Company representative is in full concurrence with the repair procedures and that the "N" stamp on the vessel is still valid.

X. SUMMARY AND CONCLUSIONS

It is concluded that the reactor vessel for Point Beach Unit 1 did not suffer permanent damage as the result of the occurrence and that the areas of the inlet and outlet nozzles damaged by the incident have been properly repaired to permit safe operation of the reactor vessel.

Visual inspections, nondestructive examinations, data, and reports indicate that the damage as a result of the reactor vessel incident on February 22, 1969, was limited to nozzle end weld preparations on one inlet nozzle and on one outlet nozzle, superficial scoring of the overlay of the bore of the outlet nozzle, and insignificant distortion of the vessel shipping skid. Dimensional checks indicated that the vessel nozzles were within the drawing tolerances, indicating that they did not yield as a result of the occurrence.

The righting procedure for replacing the reactor vessel on the rig and moving it to the temporary storage area was accepted. The righting of the reactor vessel and the move to the storage area were without incident.

The temporary storage structure was constructed for protection from the elements to facilitate conducting the nondestructive examinations and the repairs. The structure was considered adequate and is illustrated in Figure 20.

Procedures for nondestructive examinations prior to the repair, during the repair, and after the repair were accepted. No discontinuities of concern were observed from the nondestructive examinations performed.

Radiography will be performed on the repaired area after the inlet and outlet piping is attached. Further, the repair will be subjected to a hydrostatic test at the time of the system test.

Welded repairs to the damaged inlet and outlet nozzle weld end preparations and to the scored nozzle overlay were carried out in accordance with the approved procedures and are considered acceptable.

The Babcock & Wilcox Company stress and brittle fracture analysis of the primary inlet nozzle and vessel shell indicates that the maximum stress intensity is 6.18 ksi at a point on the shell and that this value is less than the 1.5 Sm allowable stress intensity limit of 40 ksi. The minimum crack size necessary for brittle fracture crack propagation in the vessel was calculated to be two feet. The report concludes that the vessel was not stressed above the allowable limits by the impact, and a brittle fracture was not possible under the loading conditions. The Southwest Research Institute analysis concurs that stresses away from the nozzle tip were not above yield, although the calculation method is not in full agreement with The Babcock & Wilcox Company analysis and offers another approach to the problem.

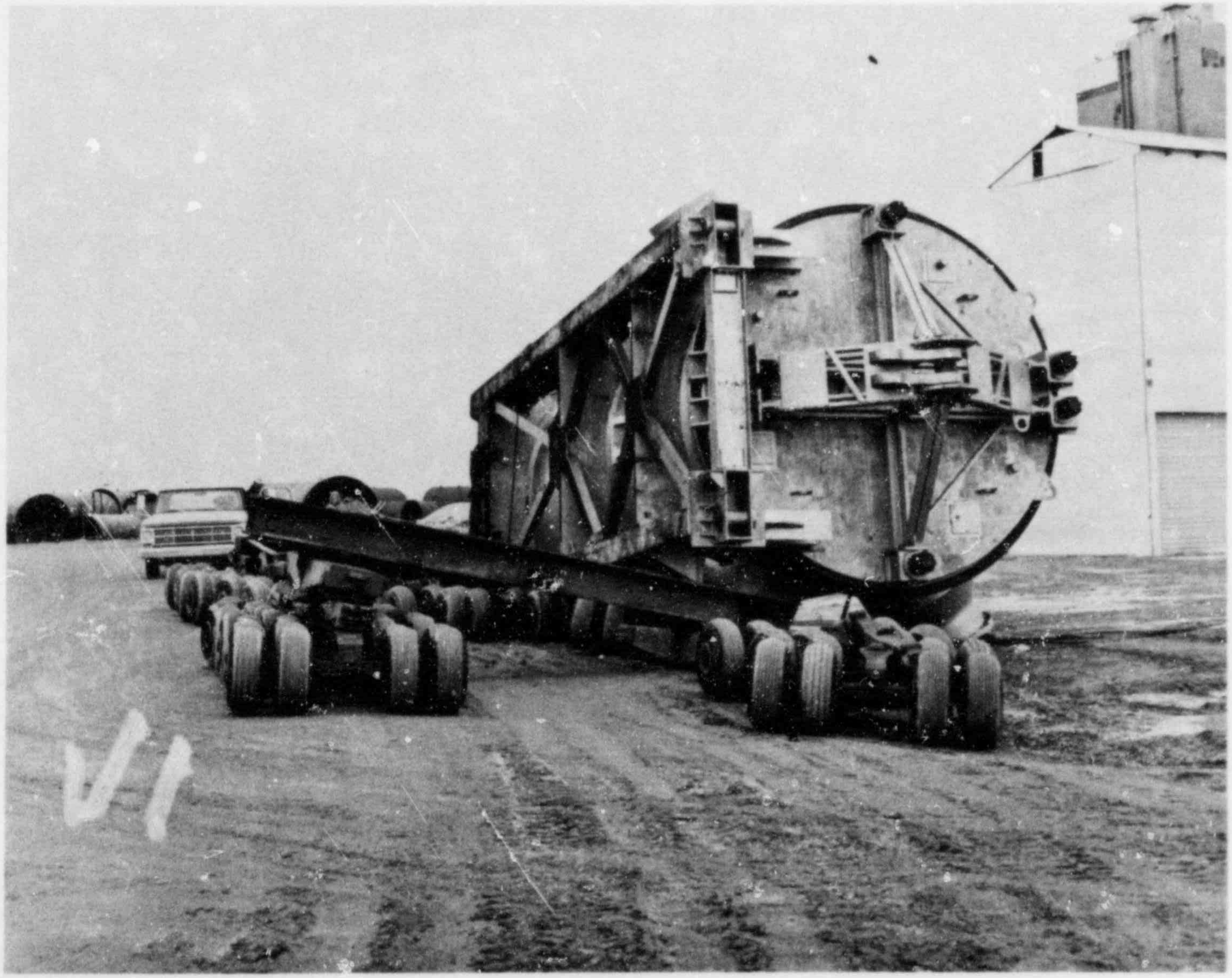

FIGURE 1. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 1.

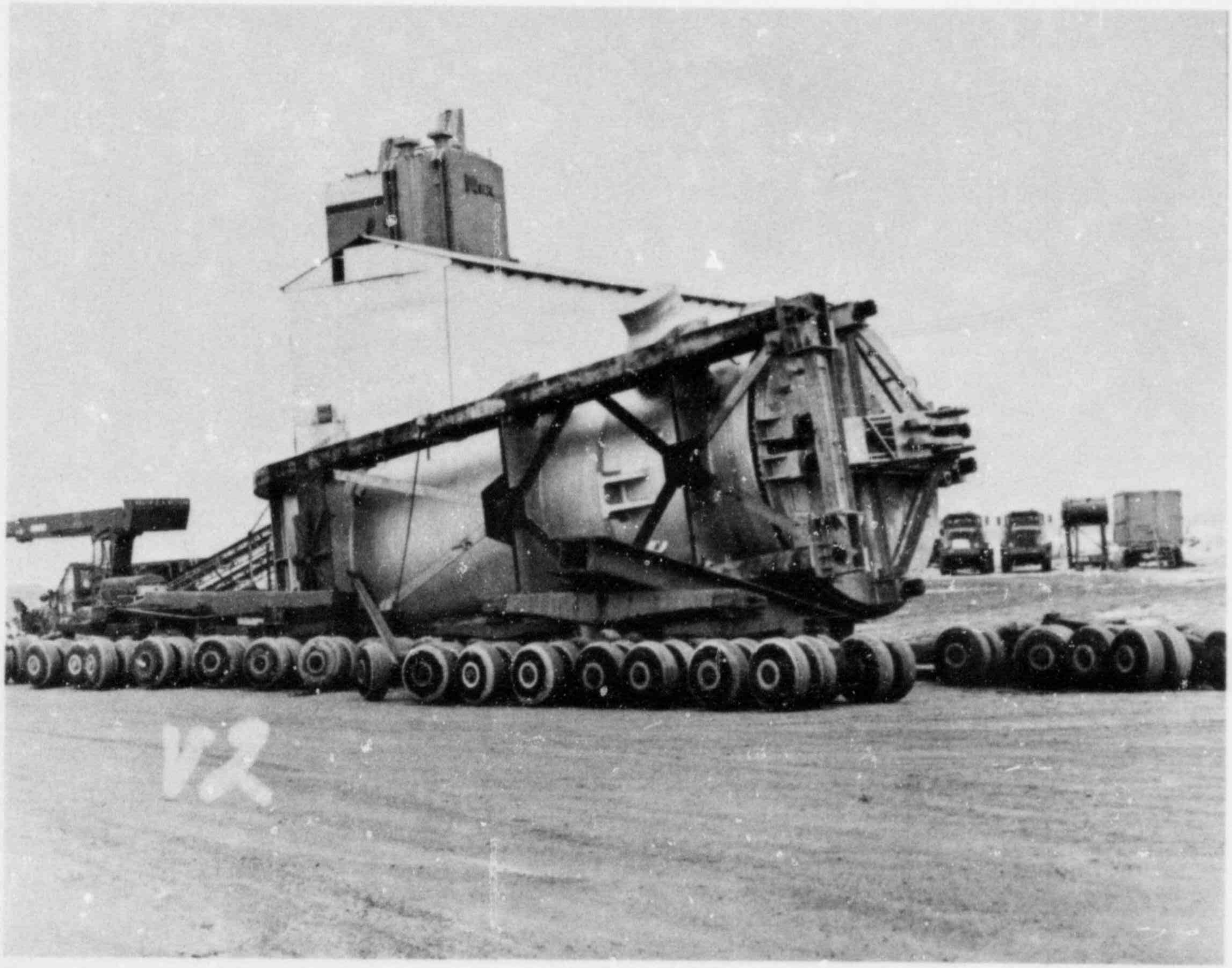

FIGURE 2. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 2.

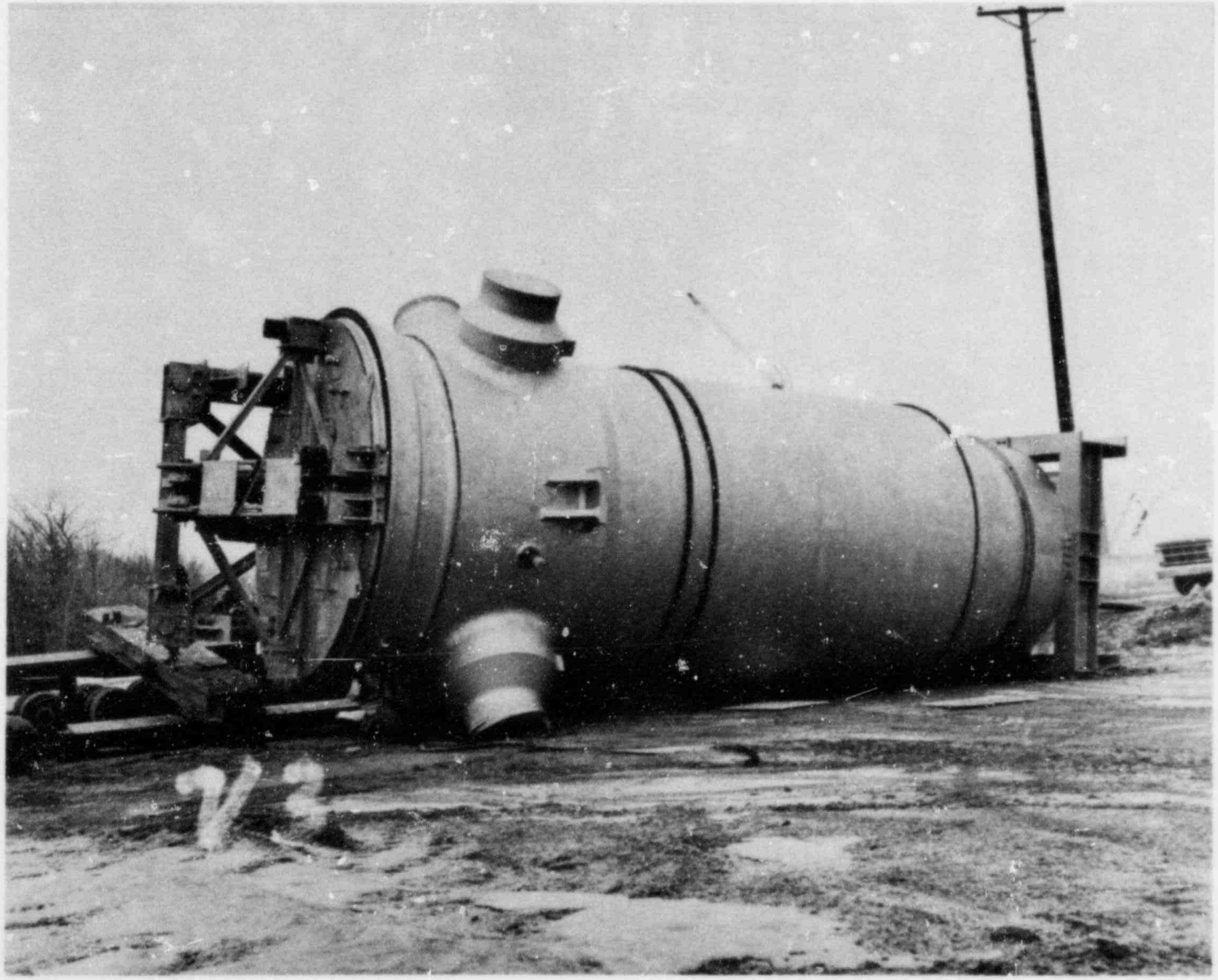

FIGURE 3. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 3.

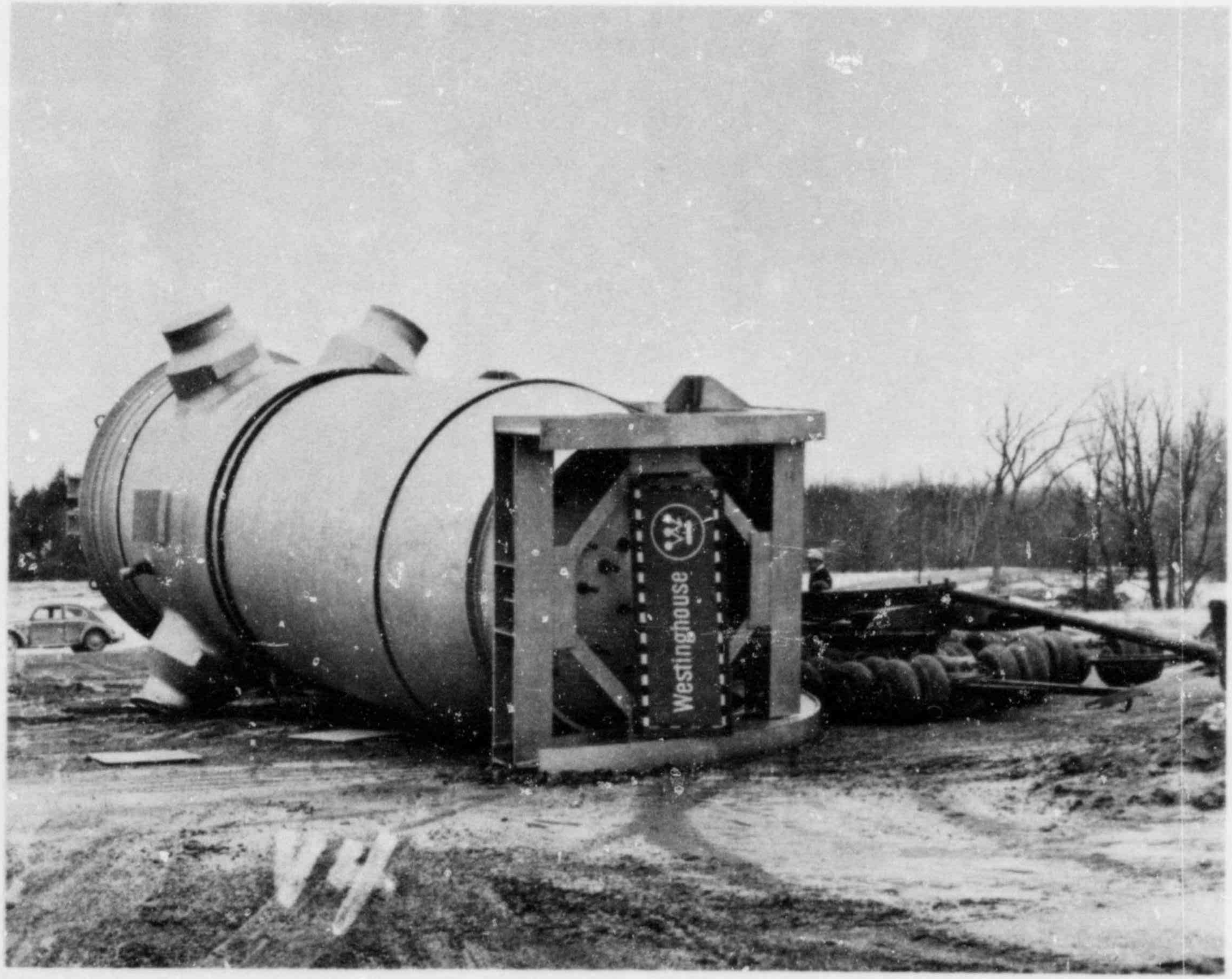

FIGURE 4. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 4.

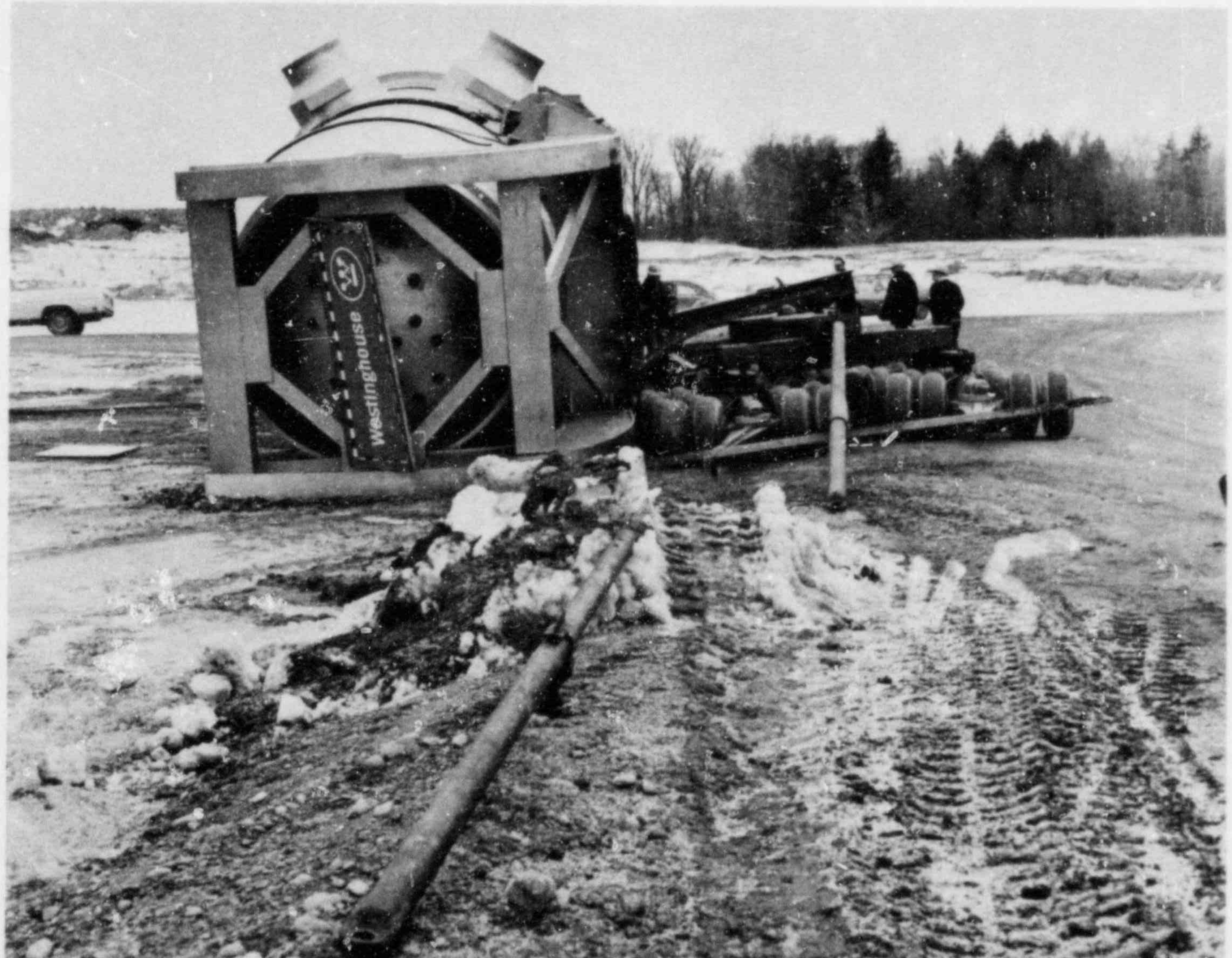

FIGURE 5. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 5.

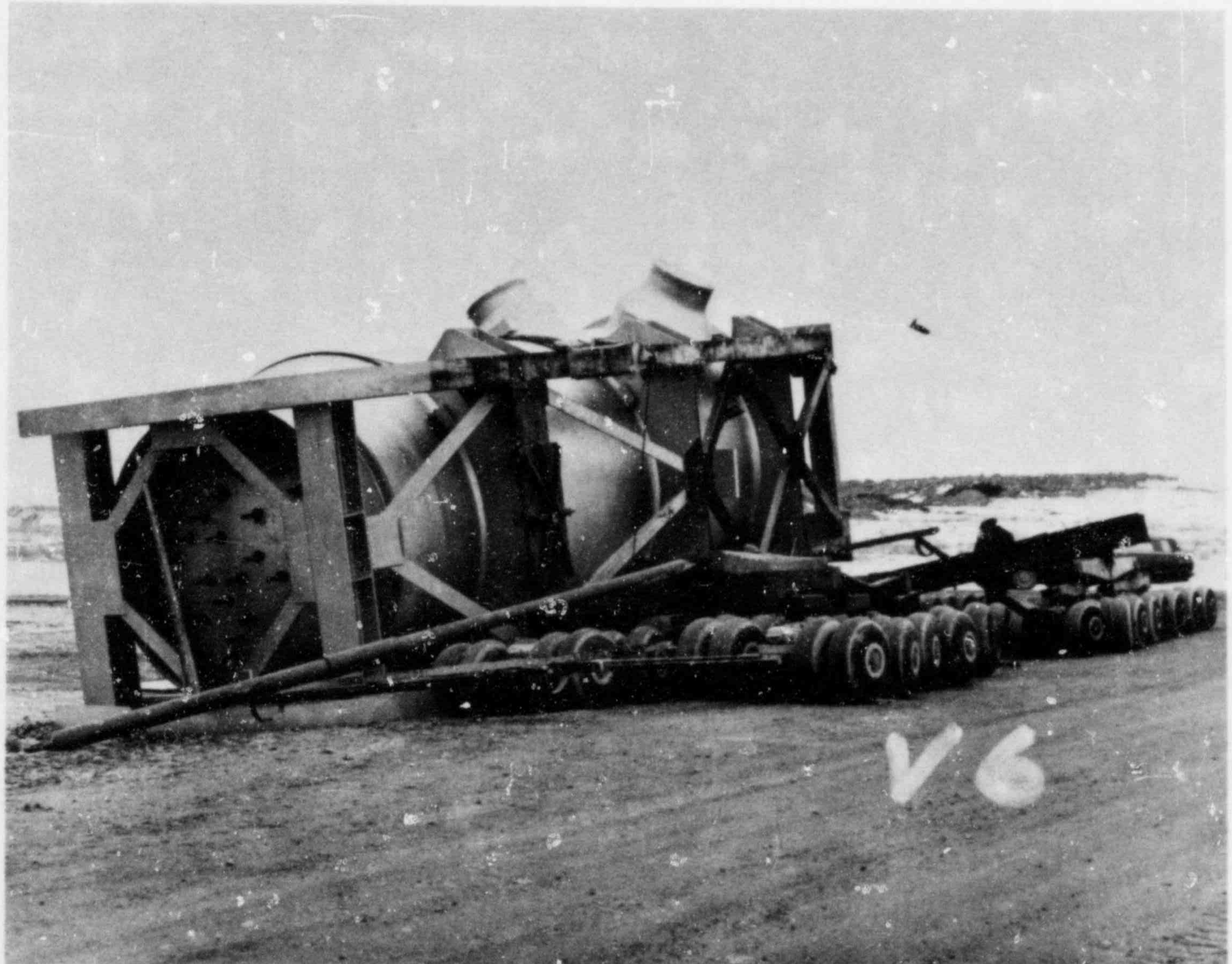

FIGURE 6. POSITION OF REACTOR VESSEL AFTER TRANSPORTATION INCIDENT - VIEW 6.

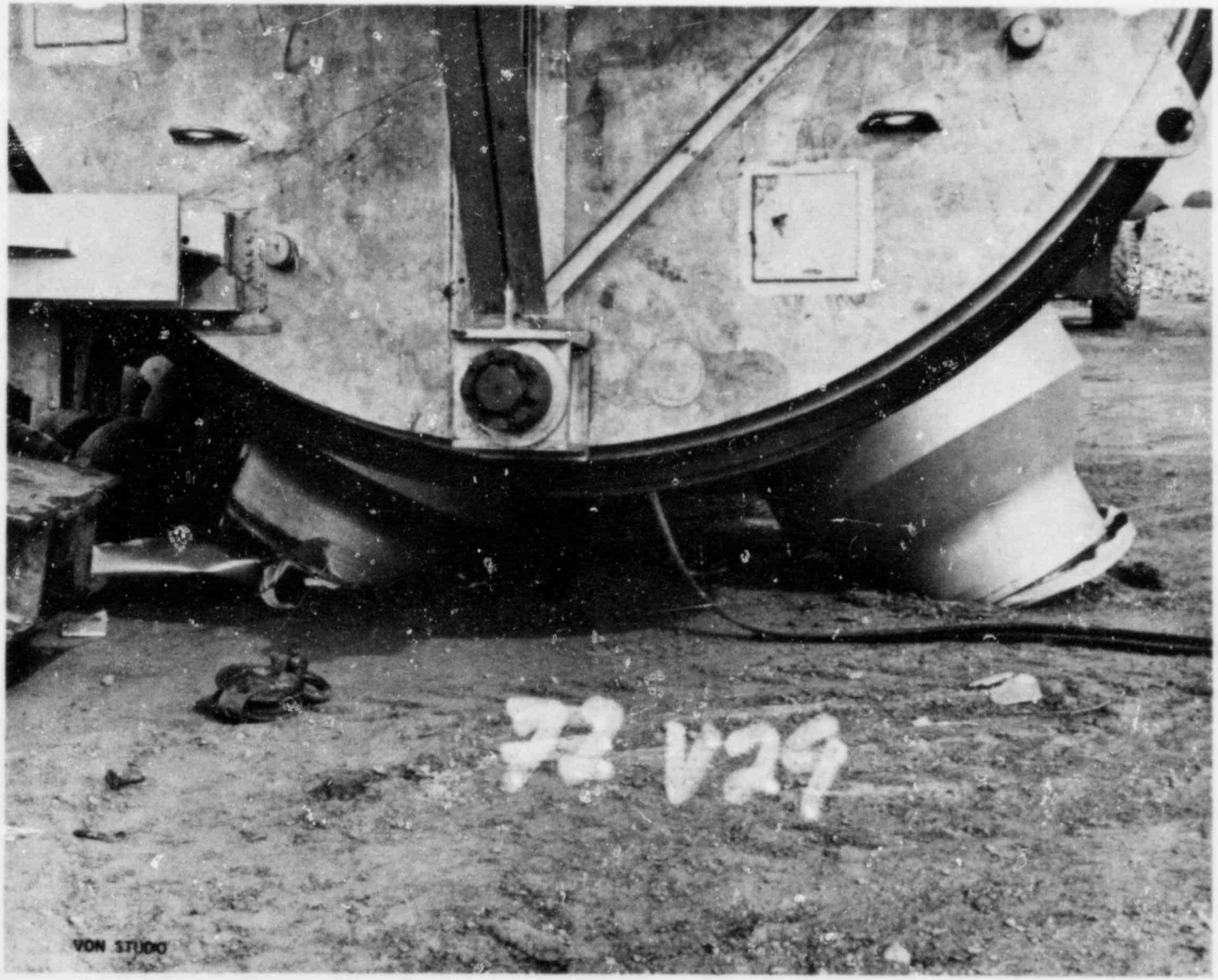

FIGURE 7. VIEW OF REACTOR VESSEL SHOWING PENETRATION OF NOZZLES INTO GROUND.

FIGURE 8. OUTLET NOZZLE RESTING ON DOLLY WHEEL RIM WITH TIRES AND AXLE EXTENDING INTO NOZZLE BORE - VIEW 1.

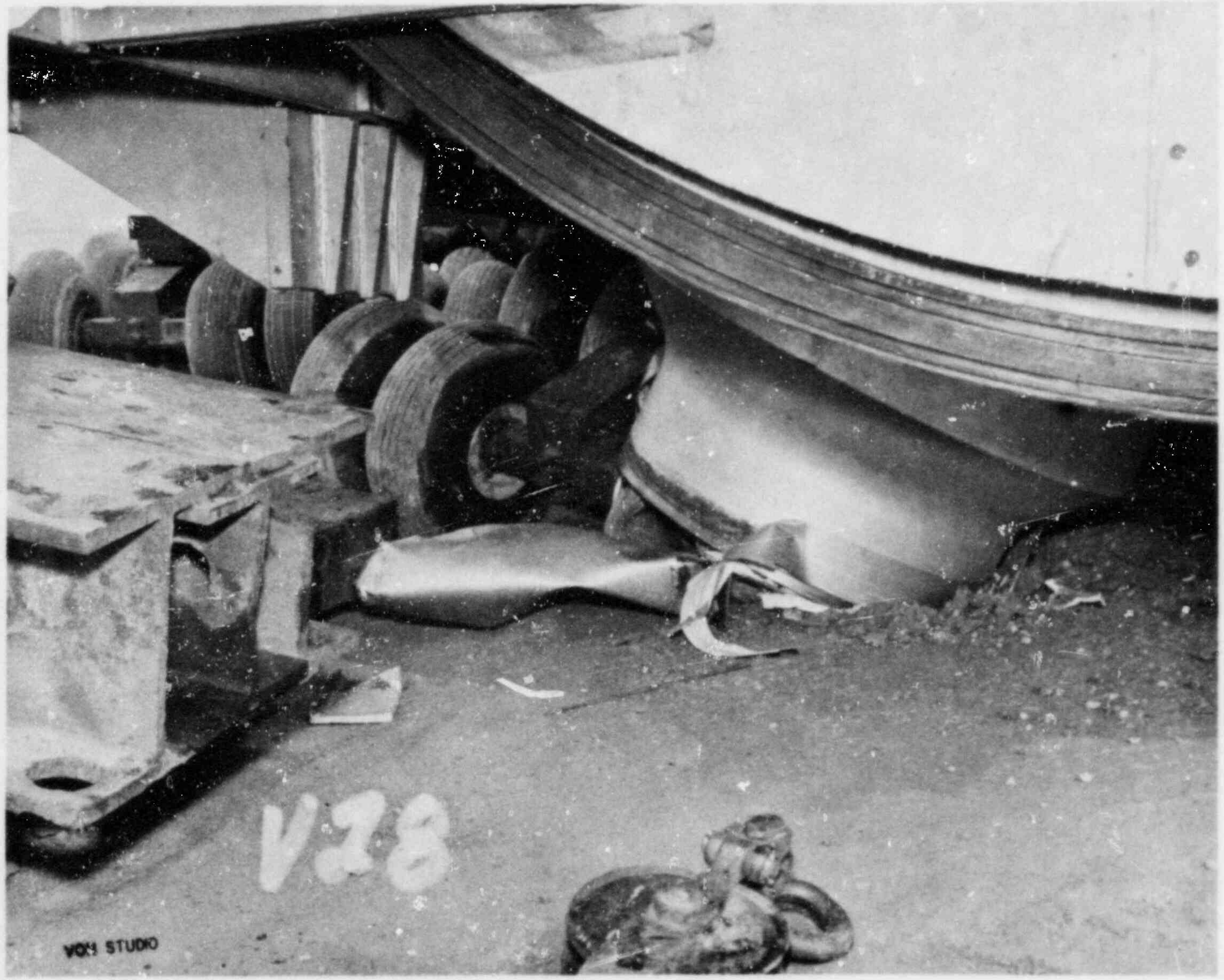

FIGURE 9. OUTLET NOZZLE RESTING ON DOLLY WHEEL RIM WITH TIRES AND AXLE EXTENDING INTO NOZZLE BORE - VIEW 2. Note penetration of nozzle into ground.

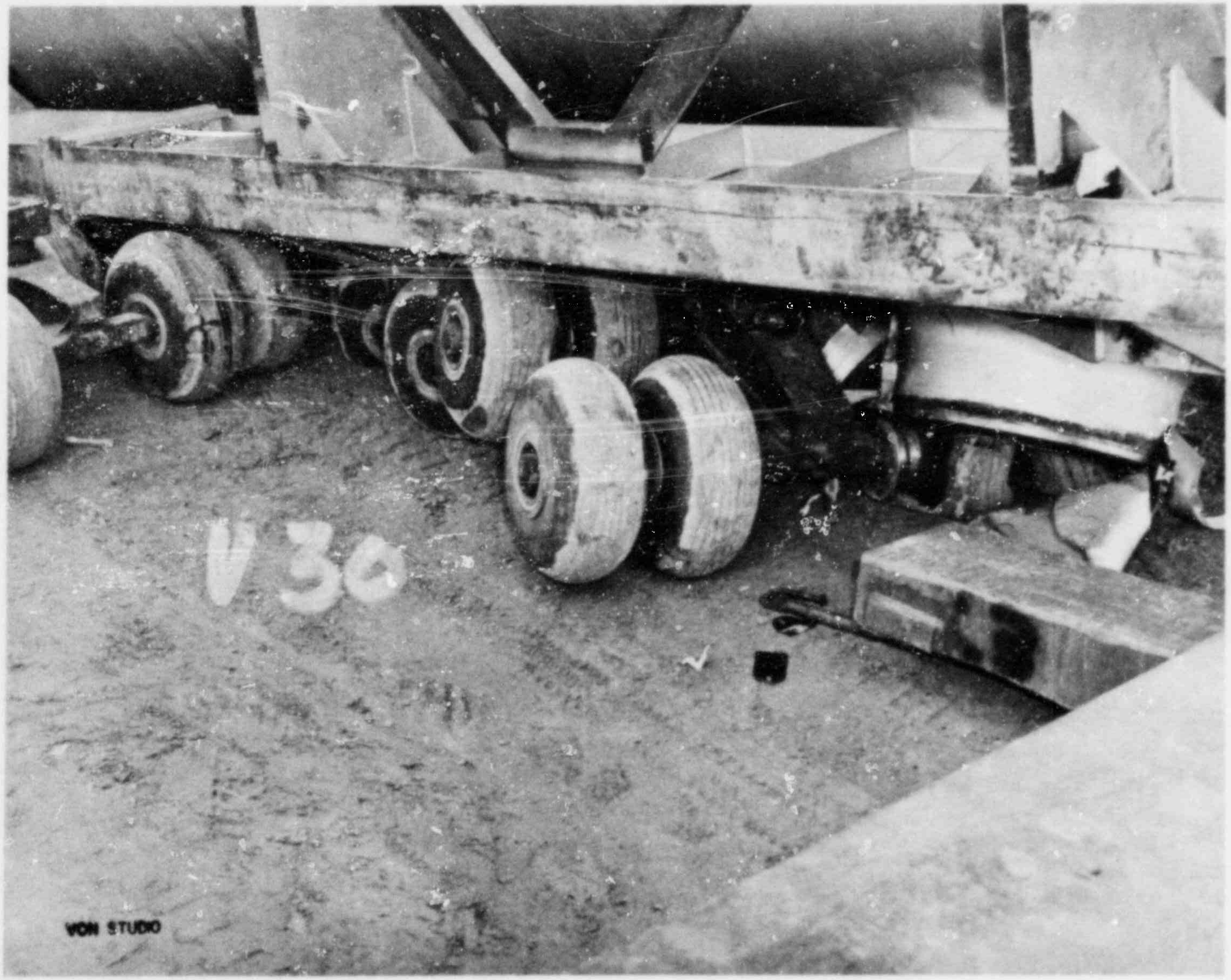

FIGURE 10. OUTLET NOZZLE RESTING ON DOLLY WHEEL RIM WITH TIRES AND AXLE EXTENDING INTO NOZZLE BORE - VIEW 3.

FIGURE 11. CLOSE-UP VIEW OF INLET NOZZLE ILLUSTRATING DEGREE OF PENETRATION INTO GROUND.

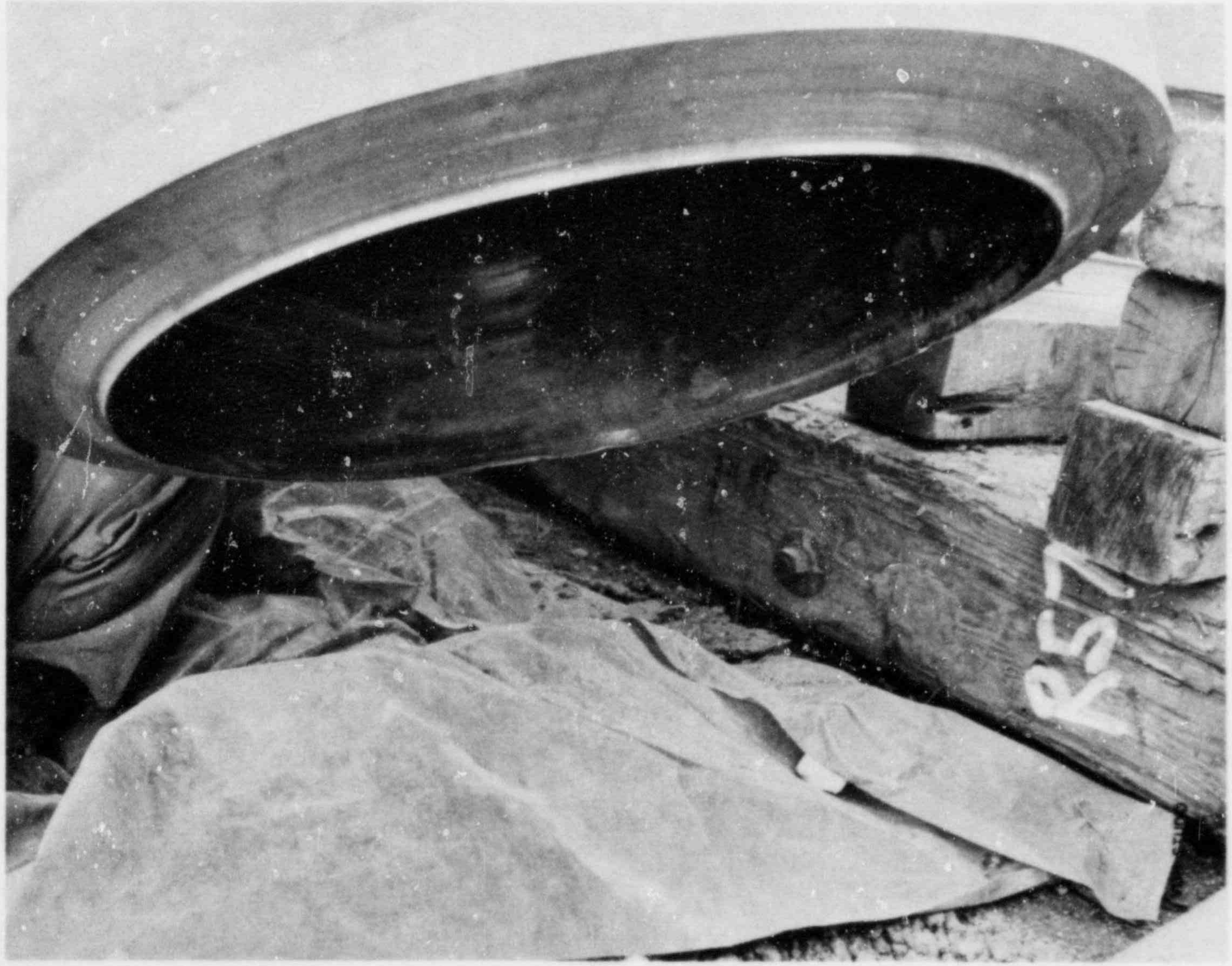

FIGURE 12. CLOSE-UP VIEW OF INLET NOZZLE ILLUSTRATING VISIBLE PHYSICAL DAMAGE TO LIP OF WELD PREPARATION - VIEW 1.

FIGURE 13. CLOSE-UP VIEW OF INLET NOZZLE ILLUSTRATING VISIBLE PHYSICAL DAMAGE TO LIP OF WELD PREPARATION - VIEW 2.

FIGURE 14. CLOSE-UP VIEW OF OUTLET NOZZLE ILLUSTRATING VISIBLE PHYSICAL DAMAGE TO LIP OF WELD PREPARATION - VIEW 1.

FIGURE 15. CLOSE-UP VIEW OF OUTLET NOZZLE ILLUSTRATING VISIBLE PHYSICAL DAMAGE TO LIP OF WELD PREPARATION - VIEW 2.

FIGURE 16. PORTION OF VESSEL SHIPPING SKID SHOWING DISTORTION.

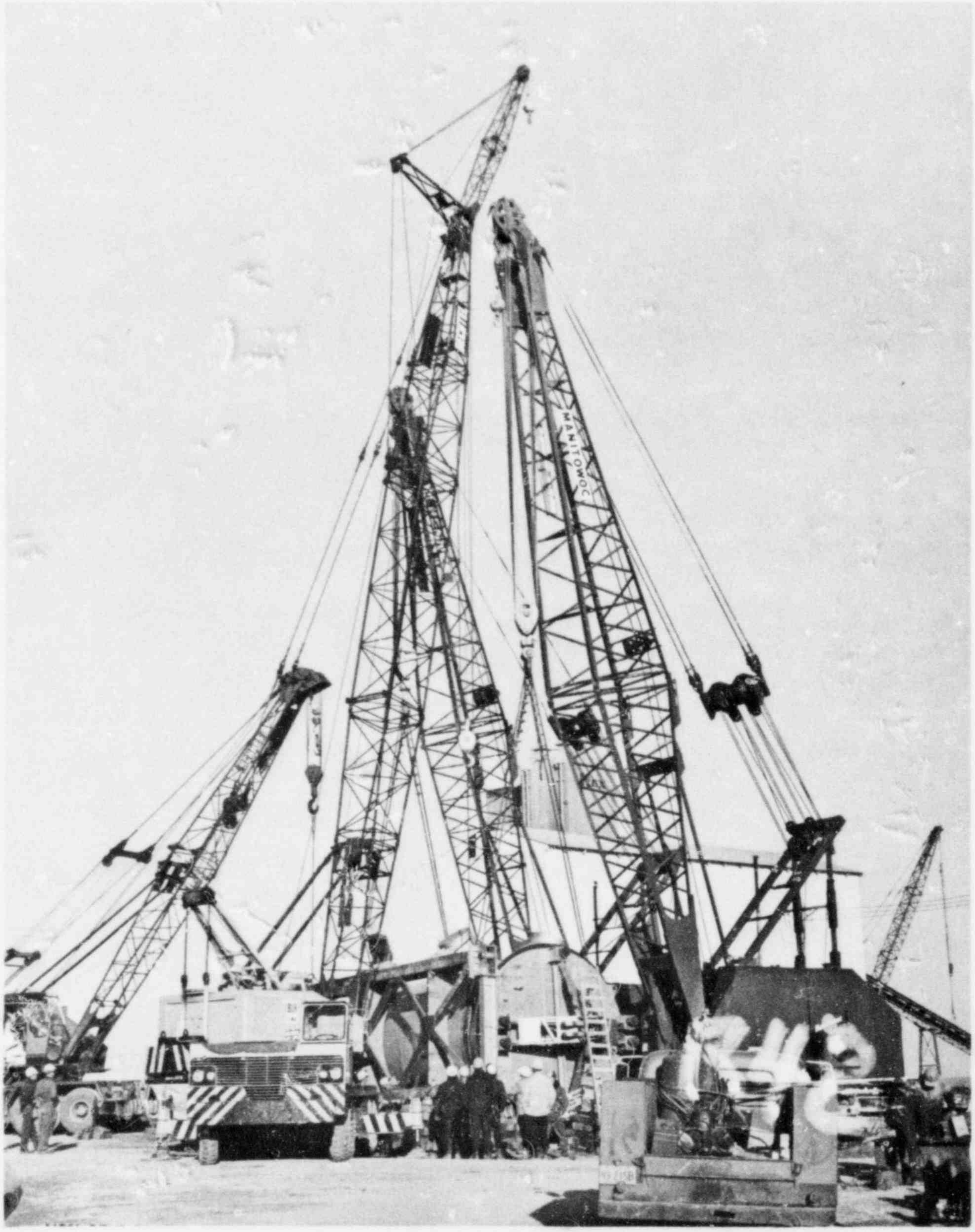

FIGURE 17. CRANES IN POSITION FOR LIFTING VESSEL.

FIGURE 18. REACTOR VESSEL ENROUTE TO TEMPORARY STORAGE SITE.

FIGURE 19. VIEW SHOWING THE WOODEN BLOCK USED TO BLOCK THE REAR TANDEM OF THE RIGHT TANDEM DOLLY.

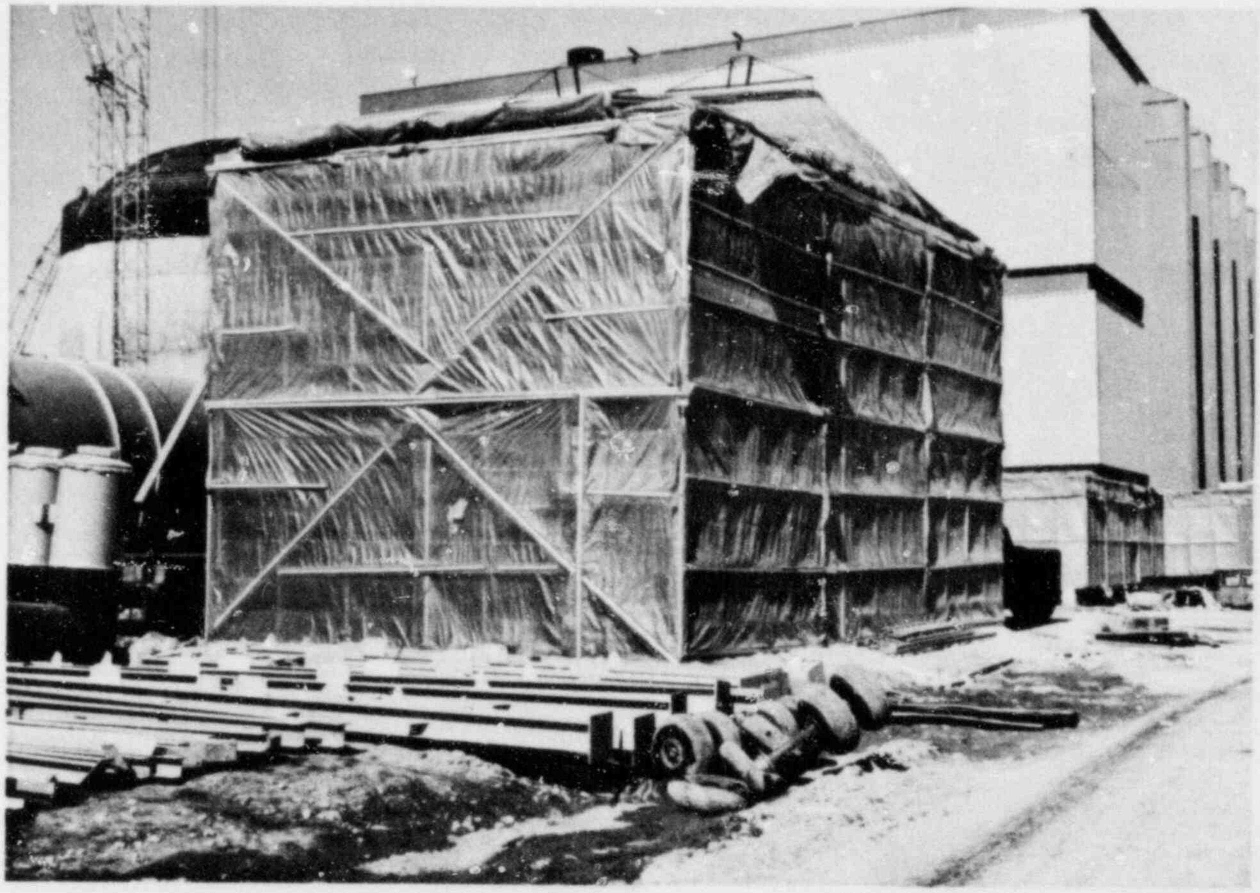

FIGURE 20. TEMPORARY REACTOR VESSEL STORAGE STRUCTURE.

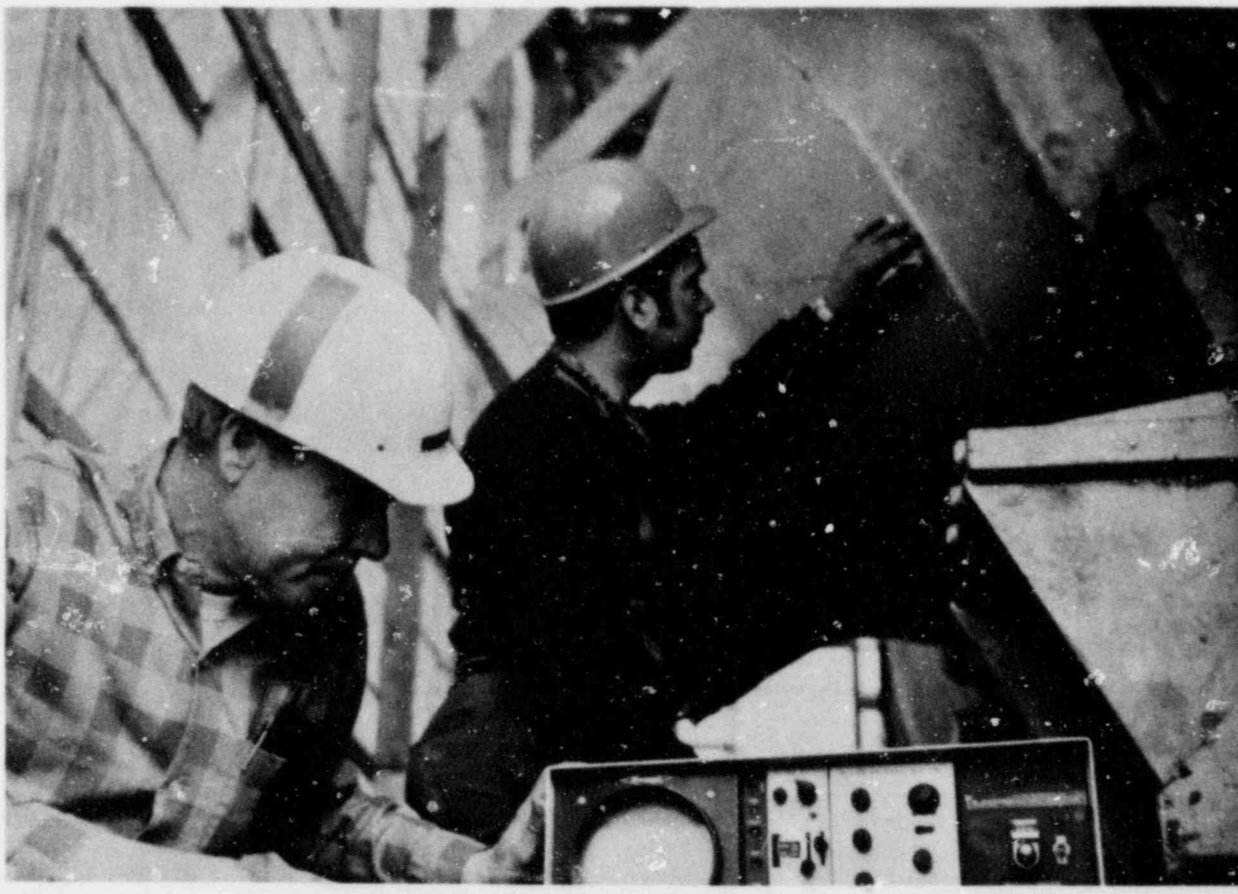

FIGURE 21. ULTRASONIC EXAMINATION OF NOZZLE - TECHNIQUE EMPLOYED FOR EXAMINATION OF NOZZLE FORGING.

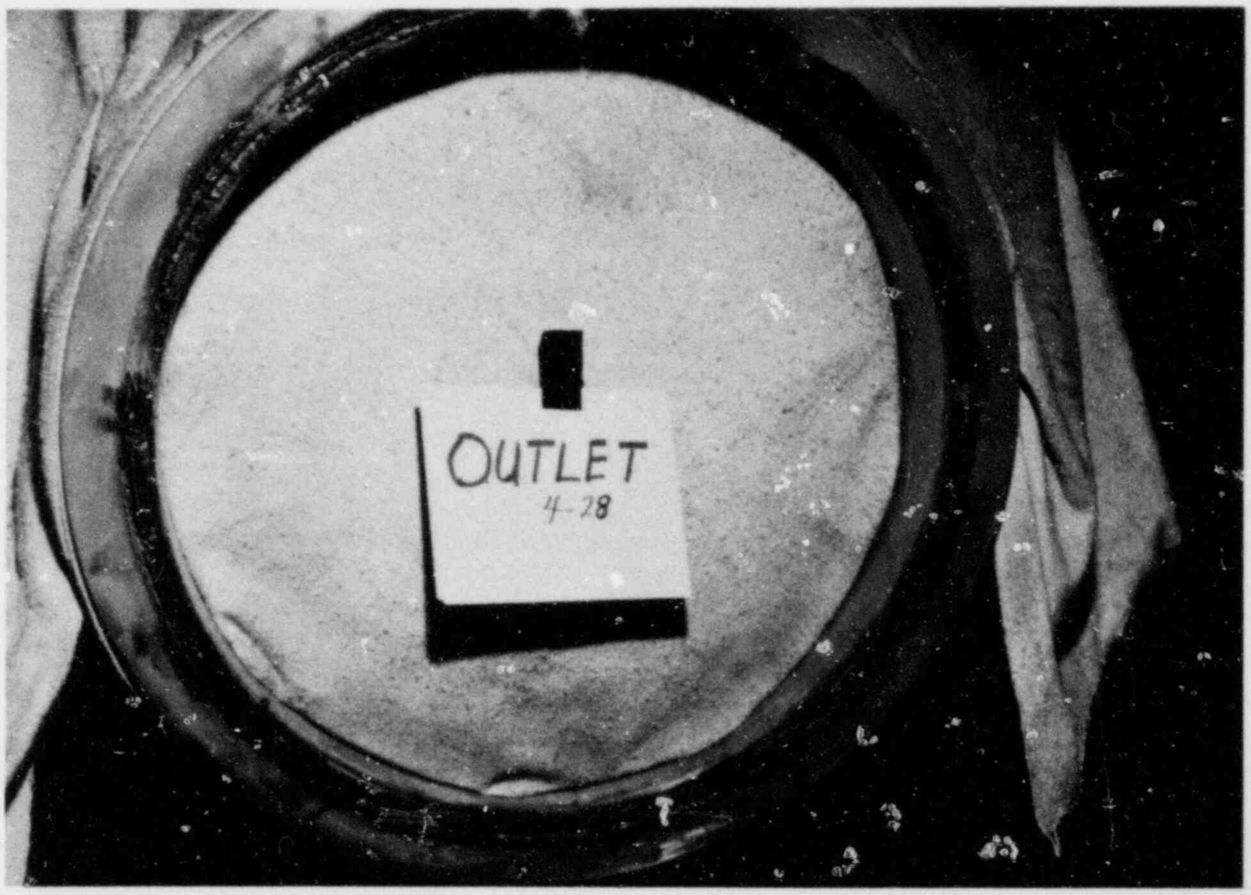

FIGURE 22. OUTLET NOZZLE DURING REPAIR WELDING - BUILDUP OF WELD LIP.

FIGURE 23. OUTLET NOZZLE AFTER COMPLETION OF WELDING THE ENTIRE WELD EDGE PREPARATION.

FIGURE 24. CUTLET NOZZLE - LIQUID PENETRANT EXAMINATION AFTER MACHINING.

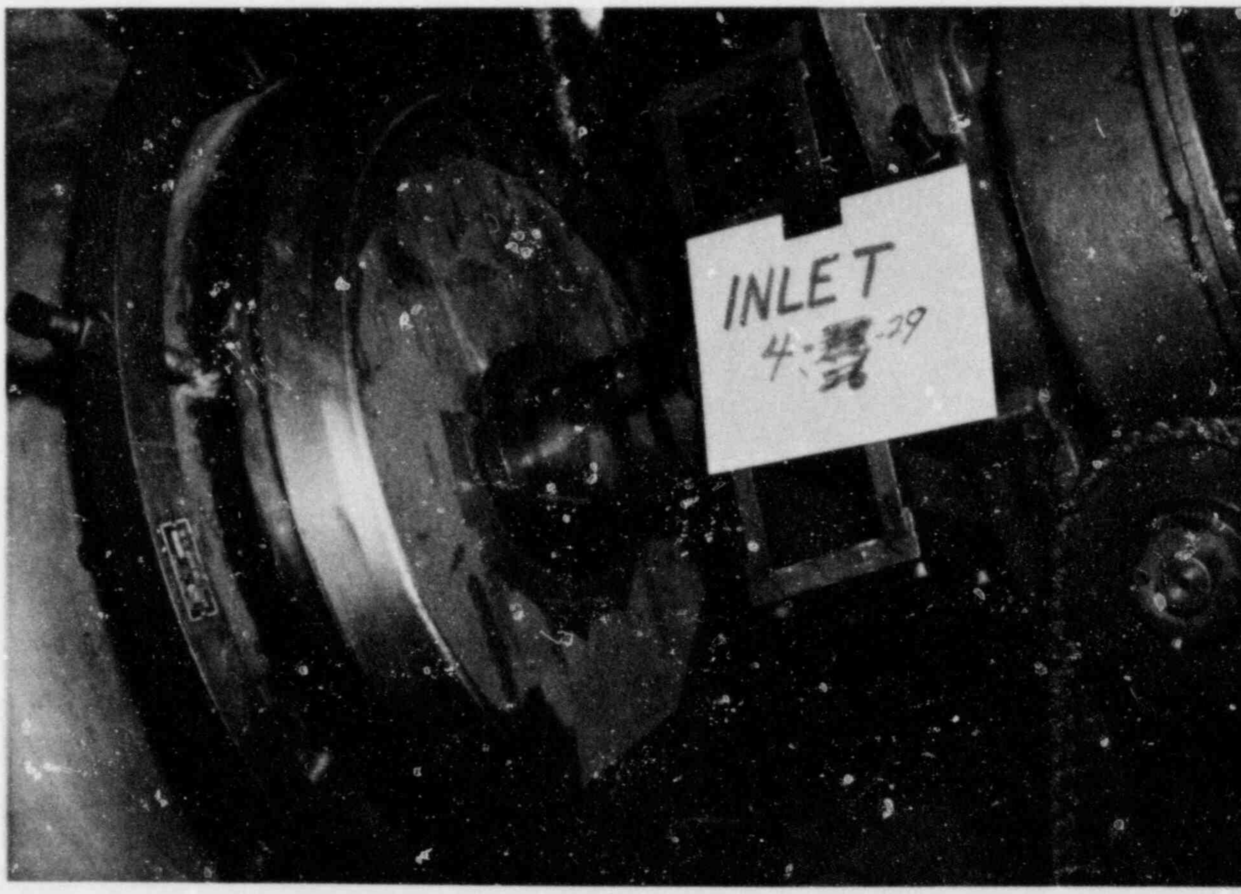

FIGURE 25. INLET NOZZLE - MACHINING OPERATION.

FIGURE 26. INLET NOZZLE - MACHINING OPERATION.

APPENDIX I

OFFICIAL TEMPERATURES RECORDED BY CITY OF TWO RIVERS WATER AND LIGHT DEPARTMENT

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City of Two Rivers, Water & Light Dept. (Official for City of T.R.)

Temperatures — 48 hours before 8:00 A.M. Sat. Feb. 22 *

Thurs 2/20	8:00 A.M. -	18 (Low for period)
	12 Noon -	30
	4:00 P.M. -	33
	8:00 P.M. -	28
	12 Midnight -	31
Fri 2/21	4:00 A.M. -	31
	8:00 A.M. -	31
	12 Noon -	33
	4:00 P.M. -	34
	8:00 P.M. -	34
	12 Midnight	34
Sat. 2/22	4:00 A.M. -	33
	8:00 A.M. -	34 *
	12 Noon -	35
	4:00 P.M. -	35
	8:00 P.M. -	35
	12 Midnight-	33
Sun. 2/23	4:00 A.M. -	33
	8:00 A.M. -	32
	12 Noon -	35
	4:00 P.M. -	36 (High for period)
	8:00 P.M. -	33
	12 Midnight-	33
Mon. 2/24	4:00 A.M. -	32
	8:00 A.M. -	33

APPENDIX II

SUMMARY OF REACTOR VESSEL TRANSPORTATION INCIDENT, HARTLEY BELDING, BELDING ENGINEERING CORPORATION and LETTER OF AGREEMENT, S. A. PETERSON, WESTINGHOUSE ELECTRIC SERVICE DIVISION

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I

DATE: February 22, 1969

TIME: 8:15 A.M.

ACCIDENT: Reactor, which had been parked overnight near the South Gate of the Project, was being moved toward designated storage spot when it rolled off its dollies and came to rest on its side.

II

DETAILS:

The Belding Engineering Co. crew on the job were as follows:

Superintendent	John Holmes
Foreman	Niles Vinson
Tractor Driver	C. Deutsch
Tractor Driver	C. Deutsch, Jr.

Three (3) Ironworker Journeymen
Two (2) Operating Engineers

The men, with the exception of C. Deutsch, Jr., reported for work at the job site at 8:00 A.M. Deutsch, Jr. had been detailed to start at Kewaunee in order to drive a truckload of blocks to the site from Belding's yard there.

Mr. Holmes, being anxious to commence moving, directed that the men remove the blocks from between the wheels of the dollies which had been placed there at the conclusion of the moving the previous day. Since one tractor driver, Deutsch, Jr., had not yet arrived, Mr. Holmes elected to operate one of the tractors during the rocking back and forth required to help free the blocks. In this operation both tractors were employed. After several minutes of this process, the Ironworker foreman, Mr. Vinson, gave a signal to move foreward. There is some confusion at this point as to the intent of the signal. Both tractor drivers (Holmes and Deutsch, Sr.) understood it to mean "All OK, Move Out." Mr. Vinson says he only wanted to move a foot. At any rate, they started to "Move Out." However, there still remained one block in front of the left front dual of the front dolly of the rear tandem of the right tandem "Quad" Dolly. (See Photo #V10, V1 and V2).* Since neither driver understood or were signaled otherwise, they continued foreward. The block was pushed along by the dual wheels, digging into the ground more as it went. This caused the dolly to turn inward, toward the center of the load. As it did so, the tongue slide, which was attached to the rear of the next forward dolly began to slide out of the connecting tongue (See Photo V30)** Whether the slide came all the way out prior to the unloading is unknown, but the turning inward of this dolly caused the bolster which rested upon it to roll outward, thus dropping the Quad Bolster, Cross Beam and the Reactor. The distance of the drop, being approximately 33 inches, was more than enough to cause the C.G. of the Reactor to pass beyond center of support. The surge thus resulted in

the Reactor to slowly, almost gently roll over on its side. It appeared to roll about 100° and then settle back, coming to rest at about 90° from its upright position.

III

CAUSES:

1. Immediate Cause - The Block.

2. Lack of attention by the Ironworker Foreman.

3. Superintendent was on a tractor instead of directing the job.

4. There should have been at least another experienced "Dolly" man on the job.

IV

CONCLUSION:

I shall recommend that henceforth no moving of equipment or machines be performed with less than two (2) experienced supervisors or foremen, none of whom shall do anything but supervise the work.

Hartley Belding

Approved by

W. A. Haemker
Sec.-Treas.
Belding Engineering Corp.

* See Figures 19, 1, and 2, pages 36, 18, and 19.
** See Figure 10, page 27.

Westinghouse Electric Corporation
731 N. Jackson Street
Milwaukee, Wisconsin

Engineering Coordination
System Checkout and Startup
Warranty Service
Installation
Field Modifications
Field Balancing and Alignment
Field Repairs
Field Tests
Maintenance Inspection
Subcontracting
Turnkey Projects

February 23, 1969

Mr. L. C. McKillip
Project Superintendent
Bechtel Corporation
P. O. Box 222
Two Rivers, Wisconsin 54241

Subject: Reactor Vessel Transportation Incident

Dear Mr. McKillip:

On behalf of the Electric Service Division, we have examined Mr. Hartley Belding's "Point Beach Reactor Vessel Transportation Incident." We agree therewith.

S. A. Peterson
Westinghouse Electric Service Division

mb

APPENDIX III

STATEMENTS BY BELDING ENGINEERING CORPORATION EMPLOYEES

Table of Contents

My name is John Holmes. I am a Belding Superintendent in charge of off loading of rail shipment for the materials for Point Beach. I was assigned by my company to take charge of moving the reactor to Point Beach. This we did on Friday Feb. 21. The load was parked for overnight. The front tank puller was unhooked to open Schuster's driveway. I issued the order to place a block across the back wheels. I did not order any other blocking to be placed between wheels; however, I did know some other wheel blocking had been used. On Saturday morning we loaded out a truck at Kewaunee with blocking and materials that would be needed at Point Beach. We drove to Point Beach in cars and trucks. I backed the lead tank retriever into pull position. The bucking poles were connected under my supervision using the Cherry Picker. Chuck Deutsch was driving the second retriever. I told the boys to remove the blocking that had been placed between the wheels. I was in the lead retriever. I leaned out and asked if they were ready to go. I got the signal to rock it. This is done to remove blocking. Then the iron worker forman, Kyle Vincent, gave me an all go signal. I am sure he moved his arm in the air and indicated a full forward motion. There is no doubt in my mind but that it was a all clear full go signal. Watching the load and the move I had assigned an iron worker foreman and three journey men. Also, an operating engineer, Marvin Braun, who at the time was unassigned while waiting for his winch truck to arrive, witnessed the work and the incident. Also Robert Krines, a cherry picker operator.

John Holmes

STATE OF WISCONSIN)
)ss
Kewaunee County)
Subscribed and sworn to before
this 3rd day of March 1969.
[illegible] Notary P
My commission expires May 2[illegible]

We moved ahead. I was driving and looking back and I motioned Charlie, in the second retriever, to move over further to the middle of the road. I think we moved about ten or fifteen feet. Then I saw the load start to roll. I poped in the clutch and stoped. The roll was slow. We were shocked. This was not expected.

J. Holmes
John Holmes

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to befor me this 3 day of March 1969.

Ruth Marsolle
Notary Public

My commission expires May 24, 1970

MAR 11 1969
POINT BEACH SITE

Marvin Braun March 2, 1969

I was working as an operator for Belding on Feb. 22. My winch truck had not yet arrived. I was interested in being useful. I heard someone say, "We must get this block out." I saw the block between the wheels on the right side, but I am not exactly sure which. One man was under the load trying to remove the block. It was stuck. I kicked on it, but it was tight against the tire. The signal man was about opposite me on the left side of the load. I could see him plainly. The load had been rocked a time or two. When they couldn't get the block out, the man who had been under the load crawled out. I then saw the signal man wave his arm in a circular motion and point forward. The first tire to hit the block loosened it. I was following along side the block and several times I reached down and tried to pull it out of the way. I couldn't get it out. I think the block jammed crossways under the wheels. The block rattled around under the carriage and somehow jammed some of the wheels. This, I am sure, turned the back wheels so that they tried to go under the load instead of in a straight line. Then I ran out of the way. I believe the block that had rolled around under the wheels jammed and turned the wheels under the load. That twisted the frame around and out of balance.

Marvin L Braun

Marvin Braun

STATE OF WISCONSIN)
)
Manitowoc County)

Subscribed and sworn to before me this 2nd day of March 1969.

Ruth Maigatter

Ruth Maigatter, Notary Public
My commission expires May 24, 1970.

APD
RECEIVED
MAR 11 1969
POINT BEACH SITE

Denny Dunn March 1, 1969

I'm Denny Dunn. I'm an iron worker for Belding. I put a block behind the back wheels on Friday night. Phil put a block behind the fourth or fifth wheels from the back. It was muddy.

I took away the back block Saturday morning. The front block wouldn't budge, because it was frozen into the ground. Phil had been under the load trying to get it loose. I think the load was backed up once, but I'm not sure. The signal was given by Nyles to move foreward 8 or 10 inches in order to remove the block. On the go signal at least one wheel went over the block. This broke the block loose from the ground. It rolled in front of the fourth or fifth wheel. We signalled to stop. I think the block moved cross ways. The block never got back of the last three wheels.

I had been on the right rear side but I was at the rear left at the time of the incident. I think the block caused the incident, but I'm not an engineer so I can't say for certain.

3-1-69

Denny Dunn

Denny Dunn

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to before me this 1st day of March 1969.

Ruth Maigatter

Ruth Maigatter, Notary Public

My commission expires May 24, 1970.

Phil Pionkowski March 1, 1969

I am Phil Pionkowski. I work for Belding as an iron worker. On Friday we moved to within a couple hundred feet of the plant. Everything was perfect. To make it safe another man and I blocked the wheels. The ground was soft. On Saturday morning we met at the Belding Yard. John Holmers was there. We drove to Point Beach in different cars and trucks. One block about 6 x 6 x 4 was stuck in the ground during the night and we couldn't get it loose. The block was cross ways. I do not remember exactly which wheels it was between, but it was near the rear on the right side. I tried to remove the block, but it was frozen or stuck in the ground. Denny Dunn went to get a bigger block to use as a ram to bust it loose. Maybe Nyle didn't know or didn't wait. I think Nyle and the drivers got their signals mixed up and the drivers went to far. The block jacknifed so that one tire was on top of the block As the truck drivers moved foreward the block dug into the ground and twisted the dollies. I think this caused the incident. There were four or five of us around the machine plus the drivers. We yelled to the drivers to stop. By the time they stopped the load slightly rolled to the right and then seemed it straightened itself out, almost stayed put, but then moved to the right again and kind of rolled off. At the time of the incident, I was standing and watching the rear right side, but when It started to tip I got out of the way.

Phillip Pionkowski
Phil Pionkowski 3/1/69

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to before me this 1st day of March 1969.

Ruth Maigatter
Ruth Maigatter, Notary Public

My commission expires May 24, 1970.

RECEIVED
APD
MAR 11 1969
POINT BEACH SITE

March 1, 1969

Les Krause

LFK I am Les Krause. I am working under a permit as an iron worker. I was with the move from Kewaunee to Point Beach on Friday. I did not see the load blocked on Friday because while other workmen were doing it I drove a truck with Jacking rigs and other materials to the Belding yard. I arrived on the Belding yard in Kewaunee about 7 o'clock Saturday morning. We loaded some material to haul to Point Beach. I rode to the job with Nylo Vincent. John Holmes had been at the Belding yard before 7 o'clock, but we got to Point Beach a little bit ahead of him. We waited for John to arrive before any work started. When I got to the job one ta retriever was still hooked to the load as it had been left the night before. The first thing we did was back the second tank retriever and hook it ahead of the other. John Holmes had parked his pick-up truck next to the load. John asked for someone to move it and I did so. While I was moving the pick-up I noticed through the rear mirror the reactor slowly rolled to the ground. So far as I know, the tank retrievers or load were not moving forward or backward at that particular time. After parking the truck I walked to the incident, but I do not know what caused the reactor to unload. LFK

Leslie F Krause

Leslie F. Krause

1 Mar 69

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to before me
this 1st day of March 1969.

[signature]

Ruth Maigatter, Notary Public

My commission expires May 24, 1970.

Robert Krines

I am Robert Krines and I have been working for Belding Engineering for about six or seven months as a crane operator. I run the cherry picker, so I left the job as my work was finished Friday, so I did not see the blocking. On Saturday morning after six or seven men had arrived I operated the cherry picker to pick up the pole, which was used to couple the two tank retrievers together. I then drove the cherry picker toward the plant, but I did not know of any problems. I did not see the incident except when I looked back I observed the reactor pretty much on the ground.

Robert Krines 3-1
Robert Krines

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to before me

this ___ day of [illegible] 1969.

[illegible]
Notary Public

My commission expires May 24, 1970.

RECEIVED APD
MAR 11 1969
POINT BEACH SITE

Nyle Vincent - Foreman

March 1, 1969

N.V. I am foreman on the job. I work for Belding. On Friday night, we used blocks to secure the load at various places between the wheels. On Saturday morning we wanted to remove all blocking, but one 6 x 6 x 4 couldn't be moved. I signaled the driver to back up. He did about a foot. The block remained tight in the ground. I then gave the driver a signal to move forward. I wanted him to go a foot or two. Apparently the driver thought the signal was a clear go because he moved out. This did not free the block and the block caused the dollies to twist and unbalance the load. We yelled for the drivers to stop. During this time the block was dragged and digging into the earth. The drivers did stop. The load did not immediately tip, but sort of wavered and eased in a slow roll to the ground. The vehicle was moving slowly at the time of the roll. There were about six men including the drivers working on the move. I was on the left side of the load near the middle. N.V.

Nyle Vincent

Nyle Vincent

STATE OF WISCONSIN)
) ss
Kewaunee County)

Subscribed and sworn to before me
this 1st day of March 1969.

Ruth Maigatter

Ruth Maigatter, Notary Public

My commission expires May 24, 1970.

APD
RECEIVED
MAR 11 1969
POINT BEACH SITE

APPENDIX IV

REPORT BY R. VON OSINSKI, WESTINGHOUSE ELECTRIC CORPORATION, DATED MARCH 3, 1969

Table of Contents

TRIP REPORT
WESTINGHOUSE FORM 51506 R

R. Kendall - info/file

IV-2

NOTE

1. Significant technical information and all classified information should be prepared as a WCAP report and referenced in the Summary.

2. Do not include any information in the Trip Report that will cause it to be classified.

AUTHOR R. Von Osinski

DATE OF REPORT

FILE NO.

DISTRIBUTION	ADDITIONAL DISTRIBUTION
Copies to:	
2 TECHNICAL INFORMATION CENTER	
1 PRELIMINARY PLANT ENGRG. (W. Henderson)	G. Haight, W. Lester
1 PROJECT MANAGER (W. Henderson)	T. Noel, J. Stiefel
1 PURCHASING (G. Duke)	B. Turner, T. Stern
1 INSPECTION ( )	D. Thorn, J. Taylor
2 MARKETING, IF NEGOTIATION ( )	L. Katz, L. Zane
2 ORDER SERVICE, IF CONTRACT ( )	R. Tedeschi
( )	

☐ SOCIETY MEETING	TRIP TO (NAME OF COMPANY AND/OR PERSON VISITED): Point Beach Nuclear Plant	SHOP ORDER NO.: WEP-105
☐ INSPECTION TRIP	LOCATED AT (FULL ADDRESS):	NEGOTIATION NO.:
☐ SALES NEGOTIATION	SUBJECT: WEP Reactor Vessel Transportation incident.	CONTRACT NO.:
☐ CONTRACT		BUDGET NO.: XARP 90359
☐	DATE(S) OF MEETING: February 24th and 25th	PURCHASE ORDER NO.:

PERSONS PRESENT

ATOMIC POWER DIVISION	OTHER WESTINGHOUSE	OTHER THAN WESTINGHOUSE
R. Tedeschi (2-24)		
G. Haight (2-24)	See Attached	See Attached Meeting
T. Noel (2-24)	Meeting Roster	Roster
R. Von Osinski (2-24 & 25)	(for 2-24, and 2-25)	(for 2-24 and 2-25)

SUMMARY

Attached is a description of my visit to the site to review with site personnel, Babcock & Wilcox, and others the damage to the Reactor Vessel when it was upset off the transporting vehicle. In addition B&W and I reviewed and approved with comments the Belding procedure for uprighting the vessel and transporting it to the storage area at the site, to assure no further damage to the vessel would occur.

Preliminary discussions were also held with B&W personnel (J. C. Quinn, T. A. Anderson) to lay groundwork for non-destructive examination, engineering justification, and the subsequent report to be prepared by B&W in order to continue their warranty of the vessel.

For additional comments see the trip report prepared by Mr. Tedeschi and Mr. Haight dated 2-25-69.

☐ ATTACHMENTS

☐ TECHNICAL REPORT PREPARED WCAP—

APPROVED (SUPERVISOR): L. R. Katz — L R Katz / RVO

AUTHOR: R. Von Osinski — R Von Osinski

ORGANIZATION: ATOMIC POWER DIVISION

PROJECT/SECTION GROUP:

TRIP REPORT
POINT BEACH NUCLEAR PLANT
TWO RIVERS, WISCONSIN
MARCH 3, 1969

2-23-69

I arrived in Green Bay Sunday evening and met with Messrs. Haight, Tedeschi and Noel to discuss the general procedures to be followed the following day. It was agreed that B&W must be the primary approval party and should be asked to do whatever they felt necessary to continue their vessel warranty.

2-24-69

We (W and B&W) arrived at the site Monday morning and viewed the vessel in its upset position. The vessel, skid and transporters had all been left untouched but additional wooden cribbing was added to stabilize the vessel. The writer has a complete set of photographs available for damage assessment to interested parties. The vessel was laying on its side on the zero axis resting on the outlet nozzle and the rear portion of the shipping skid. The reactor had rolled off the dolly's approximately 120° and returned to the 90° position where it stabilized. The temperature plots 48 hours prior to the incident were obtained and are in B&W's possession.

The exact extent of damage will be assessed when the vessel is righted but it is the writers and B&W's opinion all damage can be repaired at the site. A review of the photographs show weld prep damage and possible internal (clad) damage to the outlet nozzle. B&W will have an inspector on hand when the righting is accomplished to mark the visible areas of distress on the vessel for further non-destructive examination.

The soil in the impact area is a combination of sand and gravel and the extent of soil freeze during roll-off was difficult to ascertain even though the temperature was above freezing. It landed to the east side of the roadbed where the soil was not fully compacted.

The outlet nozzle was buried several inches in the soil and was partially resting on the damaged dollies as can be seen from the photographs. The shipping skid seems to have deformed slightly but this may be caused by its resting on the ground on the upending ski. The damage to the skid seems minor. The skid has rotated around the vessel approximately six inches. The protective cover around the bottom instrument nozzles is intact. The monitoring tubes and the safety injection nozzles seem undamaged.

Following the viewing of the vessel we returned to the W offices and held a short meeting with B&W (Austin Fragomen, J. C. Quinn, T. A. Anderson of B&W and R. Tedeschi, G. Haight and R. Von Osinski of W).

It was agreed in this meeting that B&W would proceed with all they deemed necessary in order to continue their warranty of the vessel. B&W was most co-operative and agreed to do all they could including NDT, and technical justifications. A purchase order will be issued by PWRSD Purchasing to B&W for this work.

Following this meeting, a meeting of all interested parties was held in the site conference room (see list attached). It was agreed that Belding would prepare an uprighting procedure which B&W (Quinn and Anderson) and Westinghouse (R. Von Osinski) would review and approve before the work proceeded.

We were handed this procedure in the afternoon and the three of us reviewed it in detail that evening in the motel. In addition B&W and I discussed the extents of NDT examinations and technical justifications we felt might be required to properly document this incident. This of course can not be finalized until the complete damage has been assayed.

2-25-69

At 9:00 a.m. we three met again with interested parties (see attached list) and reviewed in detail our comments, and the comments of others (including Mr. Reed of WMPC) and reached agreements of the proposed righting procedure assuring that the vessel would not be further damaged. The changes to the procedure were incorporated into meeting minutes which were signed by B&W personnel, site personnel, and the writer. The revised procedure and drawings were to be hand carried to Penn Center as soon as available (I now have this procedure).

Point Beach Site
Reactor Vessel Transportation Incident

Meeting Feb. 24, 1969 10:30 A.M.

Name	Company	Location
R. O. Schafer, Jr.	General Adj. Bureau	Milwaukee, Wis.
D. W. Krahn	General Adj. Bureau	Sheboygan, Wis.
L. C. McKillip	Bechtel	Pt. Beach Site
A. F. Stevenson	Bechtel	Pt. Beach Site
Tony Karpfinger	Wisconsin Michigan Power Co.	PBNP Site
Glenn A. Reed	" " "	PBNP Site
C. C. Doerrie	Westinghouse Electric Service	Minneapolis, Minn.
T. C. Noel	W	Pittsburgh
Geo. S. Haight	W	Pittsburgh
A. T. Fragomen	Babcock & Wilcox	Barberton, Ohio
R. Von Osinski	W	Pittsburgh
R. O. Tedeschi	W	Pittsburgh
L. J. Bell	W	Pt. Beach Site
J. C. Quinn	Babcock & Wilcox	Barberton, Ohio
T. A. Anderson	Babcock & Wilcox	Barberton, Ohio
Jack D. Lamphies	Belding Engineering(Insurance)	Chicago
H. D. Hickman	W	Point Beach Site
J. V. McKeown	W	Point Beach Site
John Carlstedt	V. P., Belding Engineering	W. Chicago
Wm. Haemker	Sect., Belding Engineering	W. Chicago
Stan Peterson, part time	W Electric Service	Milwaukee

POINT BEACH SITE

REACTOR VESSEL TRANSPORTATION INCIDENT

2-25-69
9:00 A.M.

NAME	COMPANY	TITLE
H.D. Hickman	W	Lead Engineer
T. A. Anderson	B &W	Nuclear Field Service Engineer
R. Von Osinski	W	Sr. Eng. Reactor Vessels-Plant App. D.
Tony Karpfinger	WMP Co.	Resident Engineer
L. J. Bell	W	NPS Mech. Comp. Engineer Point Beach
L. C. McKillip	Bechtel	Project Supt.
R. J. Raymond	W	Cons. Engineer
S. A. Peterson	W	Supervisor, Elec. Serv. Division
Hartley Belding	Belding Engineering	
John Carlstedt	Belding Eng.	V. P.
Will Haemker	Belding Eng.	S. T.
C. C. Doerrie	W	Elec. Service Mgr., Minneapolis
F. Siddens	Bechtel	
J. C. Quinn	B & W	Q. C. Manager
Glenn A. Reed	WMP Co.	General Supt.
J. V. McKeown	W	Manager, Field Operations Pt. Beach

APPENDIX V

PROCEDURE FOR RIGHTING OF REACTOR VESSEL, BELDING ENGINEERING CORPORATION, DATED FEBRUARY 25, 1969

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POINT BEACH PLANT NO. 1
REACTOR VESSEL

PROCEDURE FOR RIGHTING OF REACTOR VESSEL AND MOVING TO STORAGE SITE

DETAILED PROCEDURE WILL FOLLOW THESE CATEGORIES:

A. Cautions in Handling.

B. Personnel.

C. Testing of Lifting Apparatus.

D. Removing of Shipping Skid.

E. Placement of Temporary Protective Nipple Cover.

F. Setting of Wood Runways.

G. Rolling to Original Position with Respect to Skipping Center Line.

H. Inching to Center of Road.

I. Resetting on Shipping Skid located on Dollies.

J. Moving to Storage Site.

DETAILED RE-RIGHTING PROCEDURE OF REACTOR VESSEL TRANSPORTATION INCIDENT

CAUTION:

(a) Striking or bumping vessel with hard objects will not be permitted.

(b) Welding arcs or hot metal sparks or blows shall be avoided and vessel shall be covered with asbestos blankets wherever this work is necessarily performed.

(c) Nozzles at bottom of unit shall be shielded from any bumps or distortions.

(d) No handling or movement of the reactor vessel shall take place unless the reactor vessel temperature is equal to or greater than 30° F. This precaution is applicable until the reactor vessel is reinstalled on its original skid after uprighting.

(e) Softening material shall be used between cables and vessel and between shipping skid and vessel so that at no time is there a metal to metal contact.

(f) All prudent precaution shall be taken to prevent damage to all vessel nozzles during rigging operation, and no use shall be made of any nozzle for any purpose.

(g) During rigging operation, minor deviation can be made at the scene. Any deviation that changes the intent of this requires suspending of operations in a safe configuration and then a technical review before proceeding.

PERSONNEL:

1 - Belding Engineer

2 - Belding Superintendents

1 - Electric Service Division Engineer

1 - B&W representative to mark questionable areas during operations for future quality assurance evaluations.

Ironworkers and Operators as required.

1. TESTING OF LIFTING APPARATUS

Both the cranes to be used and cables to be used will be tested in the same configuration to be applied in lifting the reactor vessel. Test will use concrete test block assemblies and will stress all elements to 110% of the values to be sustained during the heaviest lift in this procedure.

2. THE CRANES TO BE USED ARE:

1 - Manitowoc 3900 W

1 - Manitowoc 4000

For load ratings see attached sketch

1 - 40 ton crane will be used for removal of shipping skids - No test will be required on this crane.

3. LIFTING CABLES WILL BE:
1-3/4" Cables Type TWRC

Rated at 306,000# Avg. Ult.

4. Cranes will be positioned at each end of vessel so as to permit the cables to be placed around the vessel in a closed basket type hitch and positioned with respect to center of gravity as shown on accompanying drawings. The required calculations are also shown on the attached drawings.

5. Damage, blocking and wooden beams shall be at hand prior to any raising so that immediately upon raising of the vessel, crews can place proper supports beneath.

6. A third crane of 40 ton capacity will be used, attached to the rolled-up portion of the skid with slings in such a manner so as to permit removal of the instrument protection cover without damaging the nipples. This shall be done after enough weight has been taken up by the main cranes to relieve any twist or other stress caused by the present position of the vessel. Whip lines from main cranes will be attached to shipping skid to prevent any turning movement of skid. A temporary protective shield, covering the nozzles, shall be installed immediately on removal of the rolled-up portion of skid.

7. At this time it will be necessary to make an on-the-spot determination as to whether further raising is necessary to facilitate removal of the main beams and associated tie down cables. In either event, this shall be done so as to make the vessel completely naked.

8. Damaged dollies and gear trapped beneath skid and vessel will be removed as freed and retained for Westinghouse & B&W review.

9. The vessel will be raised some distance further to permit the installation of two wooden cribbage runways which will serve as a soft runway upon which to position and subsequently roll the vessel to its original upright position. This being done, the vessel will be lowered on to its said runways.

9(A) Prior to rolling, the affected hot and cold leg nozzles will be cleaned of dirt with demineralized water or acetone. Temporary covers to be installed.

10. Basket hitches used in raising will be removed and a rolling hitch will be made by three dead wraps of cable around vessel.

and clamped. An 18" wide piece of belting between cable and vessel will be used as softening.

The vessel can now be rotated 90° to original center line position.

The vessel will travel approximately 9-1/2 feet towards crown of road during this operation.

10(A) To travel the remaining distance the cranes will be repositioned closer to the vessel; they will hoist -up about a foot, then boom down, moving the vessel to crown of road on the runways. This can be repetitive with cranes crawling as close to the vessel as necessary. Blocking will follow each repetitive move.

During this period the original shipping skid will have been positioned on the dolly system consisting of 64 wheels, and located on the level road south of vessel.

11. The vessel will now be raised - area beneath it cleared of all cribbage - the dolly system pulled underneath, and the vessel lowered into original skid position.

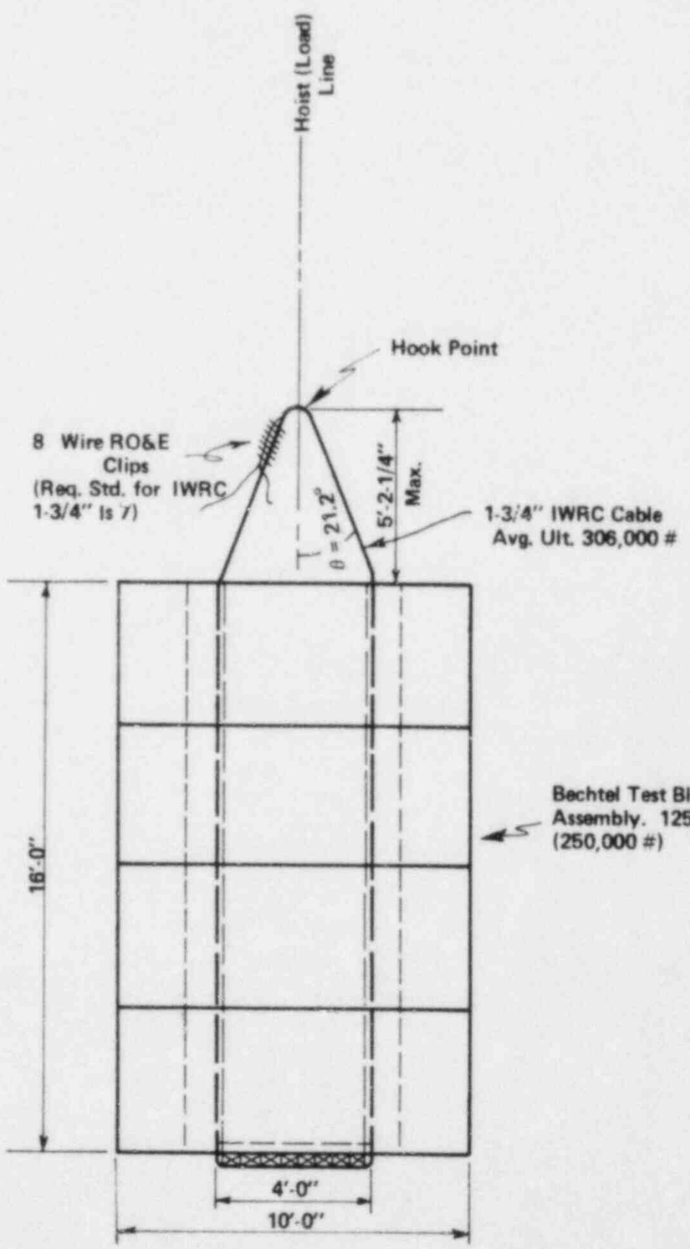
12. Prior to transporting to storage area, the road will be leveled.

13. The vessel will now be towed to its site - storage area east pf steam generators and west of entrance road.

14. The vessel will be hydraulically jacked up clear of dollies; dollies will be replaced with cribbing.

COPY - Prepared by Southwest Research Institute

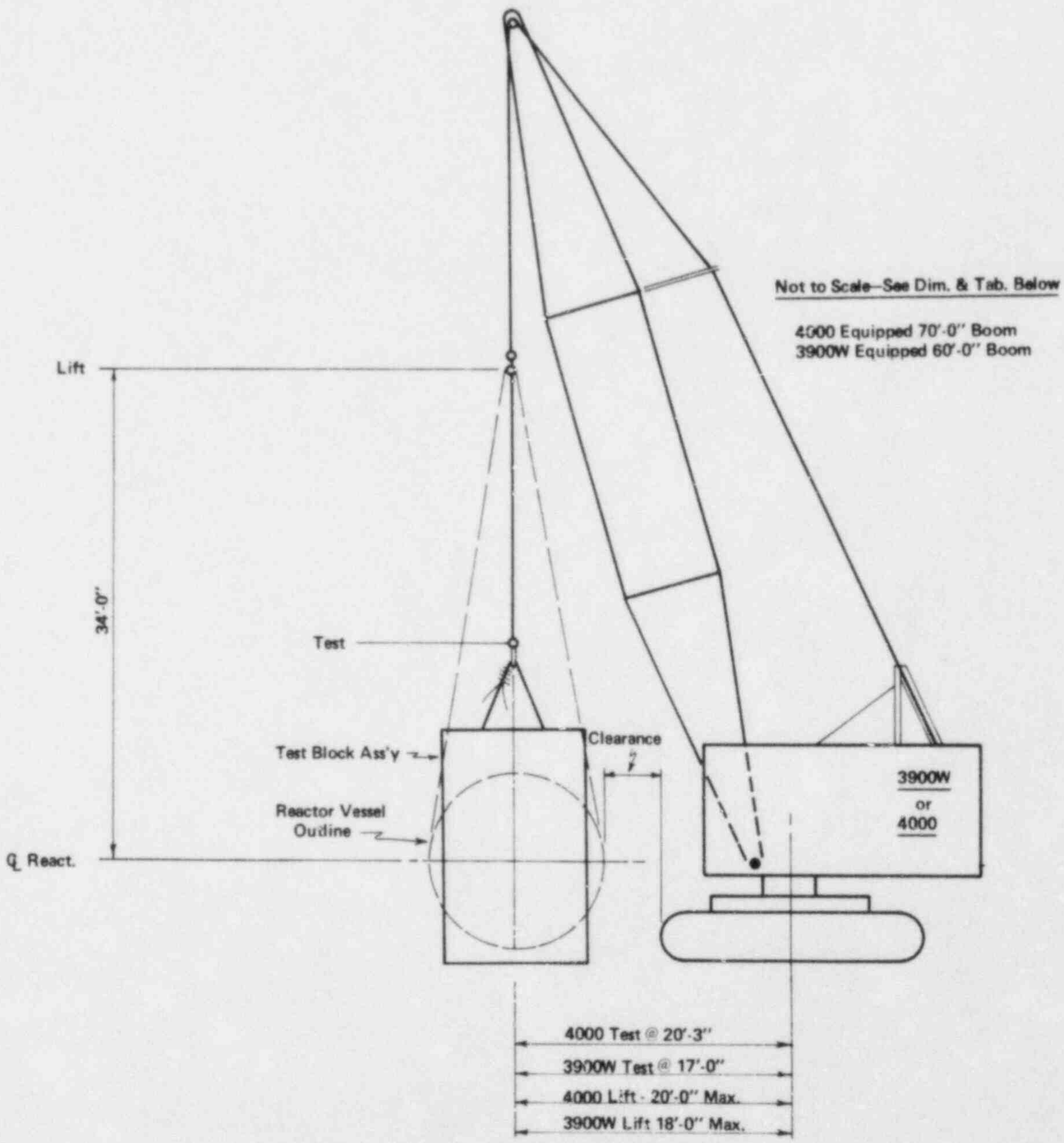
CRANE & RIGGING TESTING & APPLICATION FOR REERECTION OF REACTOR VESSEL, POINT BEACH, WISCONSIN
2/25/69 Ⓦ E.S. - BELDING RJR Ⓦ



Test Data & Procedure:

Load Piece to Be Raised - 450,200#. - Two, 4 Line Continuous Closed Basket Hitches Equally Sharing - Ideally 450,200/4 × 2 = 56,275#. Use 60,000# Each line. Maximum Angle Departure of Lines from Line of Lift Will Be Limited to 10°. Line Stress Therefore 60,000/cos 10° or 61,000#. Test to Be 110% of This Value or 67,100#. Test Load Above Weighs 250,000#. For 4 Line Support Pictured Line Stress Will Be 250,000/4 cos θ. For 67,100# $\theta = 21.2°$. Above Hitch Dimensions Provide This Angle and Thereby Provide Required Test Line Stress of 67,100#.
F.S. on the 1-3/4" IWRC Cable Is 306,000/67,100 = 4.56 on Test
F.S. on the 1-3/4" IWRC Cable Is 306,000/61,000 = 5.02 on Lift.

CRANE & RIGGING TESTING & APPLICATION FOR REERECTION OF REACTOR VESSEL, POINT BEACH, WISCONSIN
2/25/69 Ⓦ E.S. - BELDING RJR Ⓦ



On Test: Pick Shown for 4000 @ 20'-3" (110% of 225,100 = 248,000 - 75% Tip)
Pick Shown for 3900W @ 17'-0" (110% of 225,100 = 248,000 - 75% Tip)

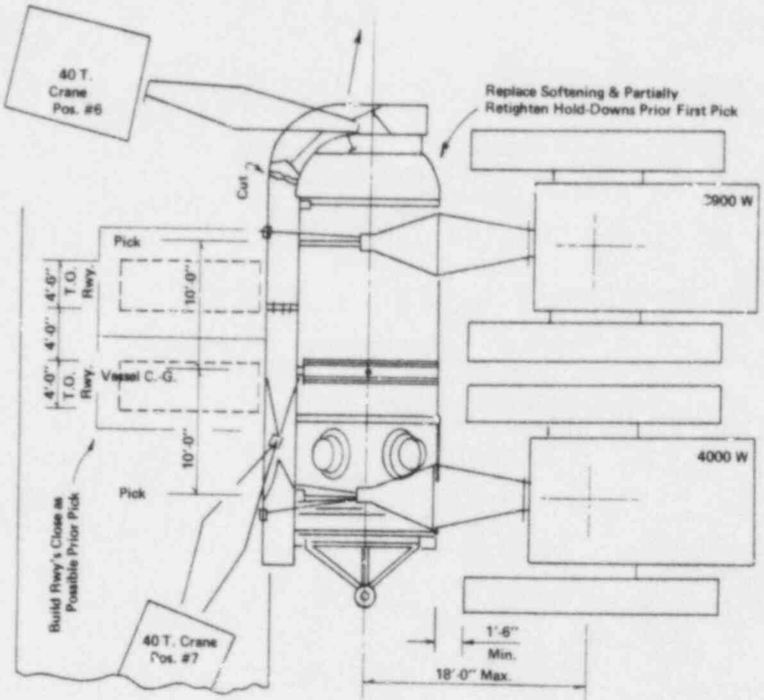
On Load Lift: Pick Shown for 4000 Limited 75% Tip to 20'-0" Rad. for 253,500# (112.5% of Actual and 149% of Tip)
Pick Shown for 3900W Limited 75% Tip to 18'-0" Rad. for 237,100# (105% of Actual and 140% of Tip)

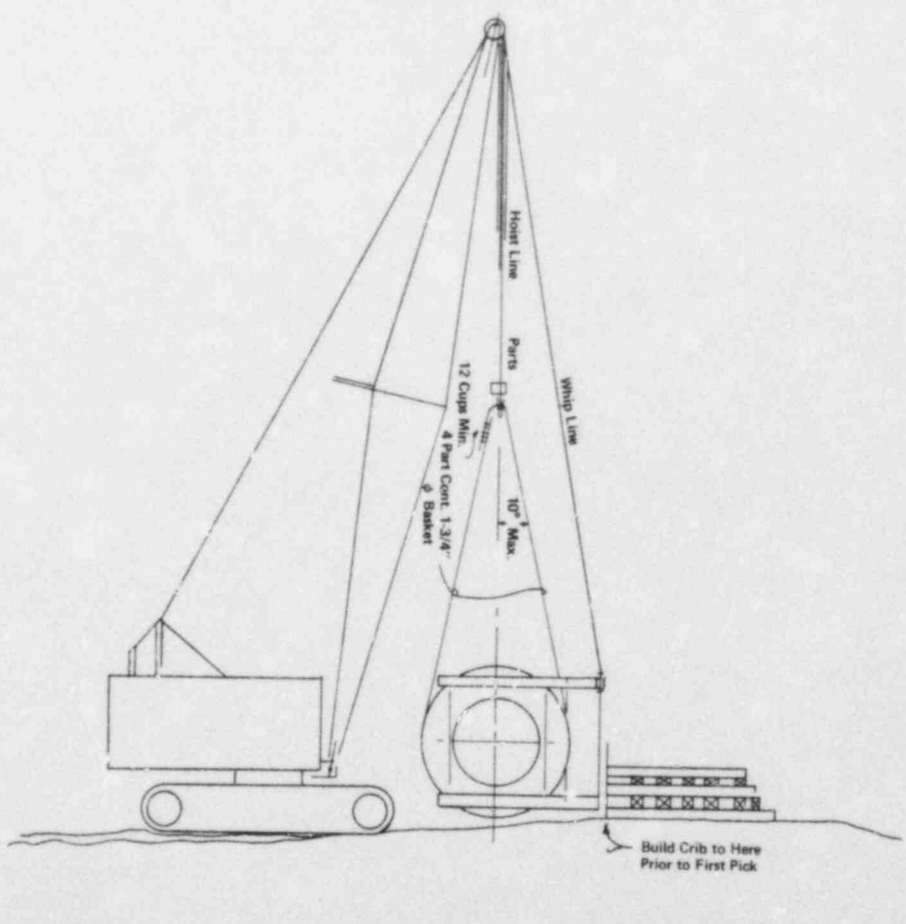
Source - Manitowoc Dwgs. 5225 & 5207

NOTE: ADOPT 18'-0" OF 3900W FOR BOTH CRANES AS A MAX. RADIUS

Clearance to Vessel @ Max. Radius is 3'-0" Min. Clearance to Vessel to Be 1'-6"

PROCEDURE FOR RIGHTING REACTOR VESSEL, POINT BEACH PLANT NO. 1 (REFER TO WRITTEN PROCEDURE - REVISION 1)
BELDING - Ⓦ ELEC. SERV. 2/26/69 RJR Ⓦ





PROCEDURE FOR RIGHTING REACTOR VESSEL, POINT BEACH PLANT NO. 1 (REFER TO WRITTEN PROCEDURE - REVISION 1)
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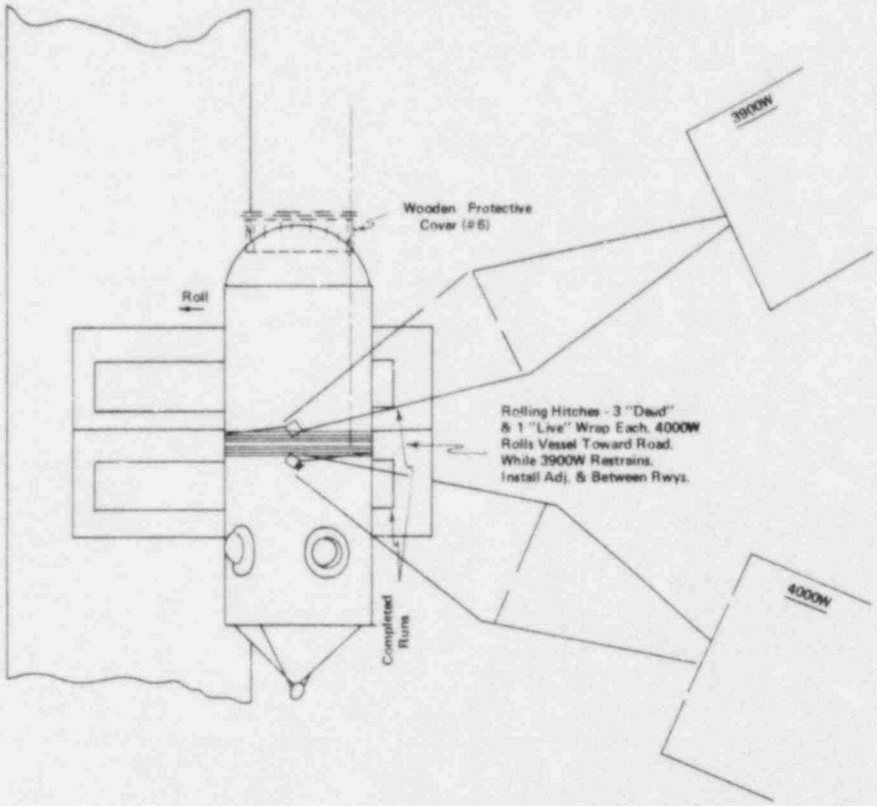
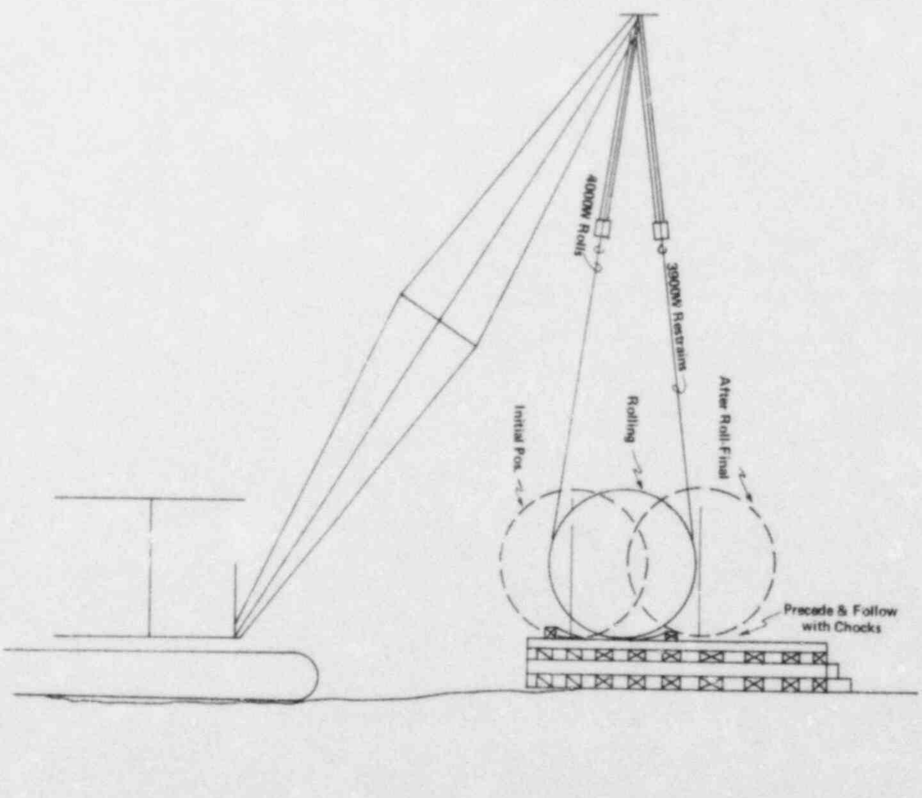
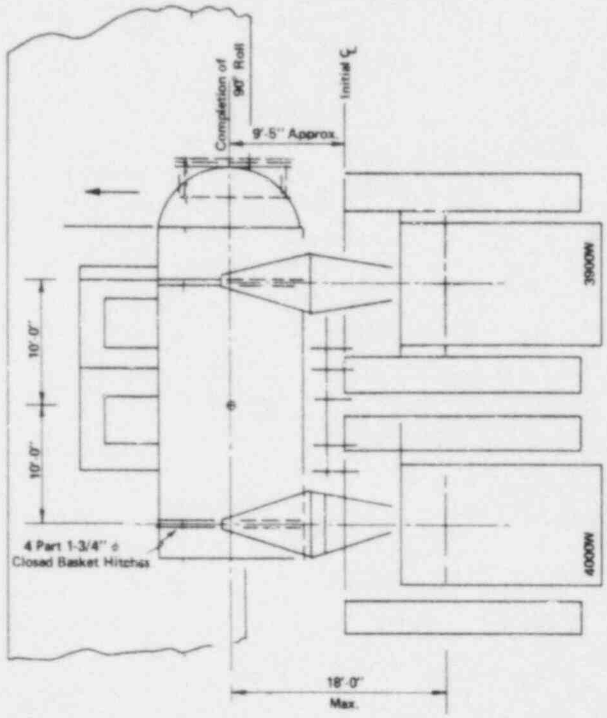


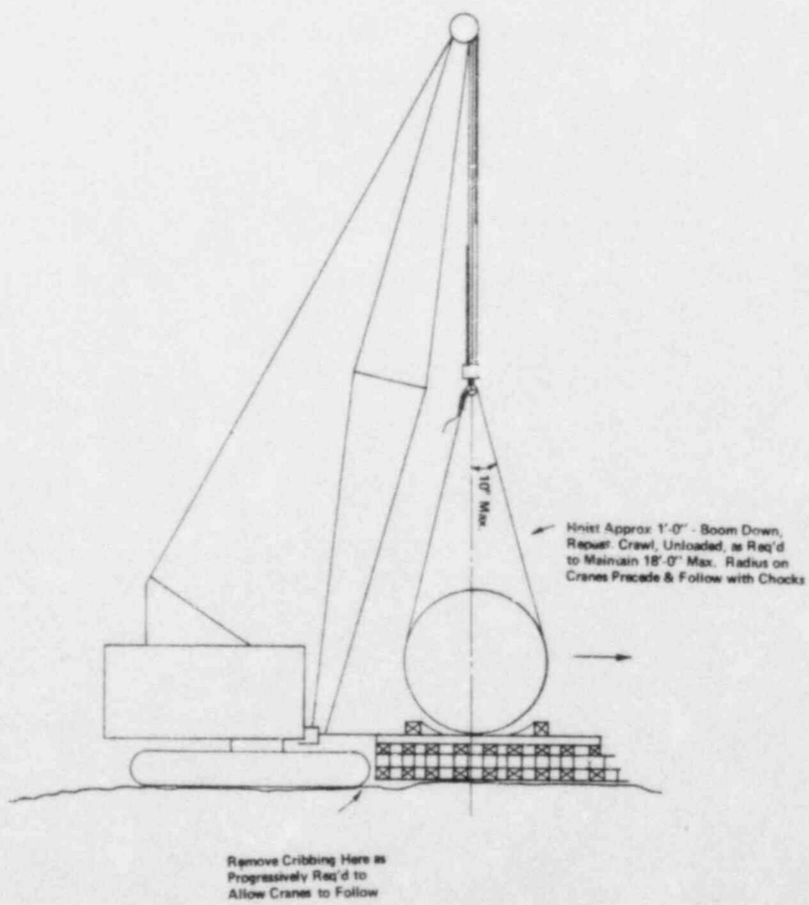


COPY - Prepared by Southwest Research Institute

PROCEDURE FOR RIGHTING REACTOR VESSEL, POINT BEACH PLANT NO. 1 (REFER TO WRITTEN PROCEDURE - REVISION 1)

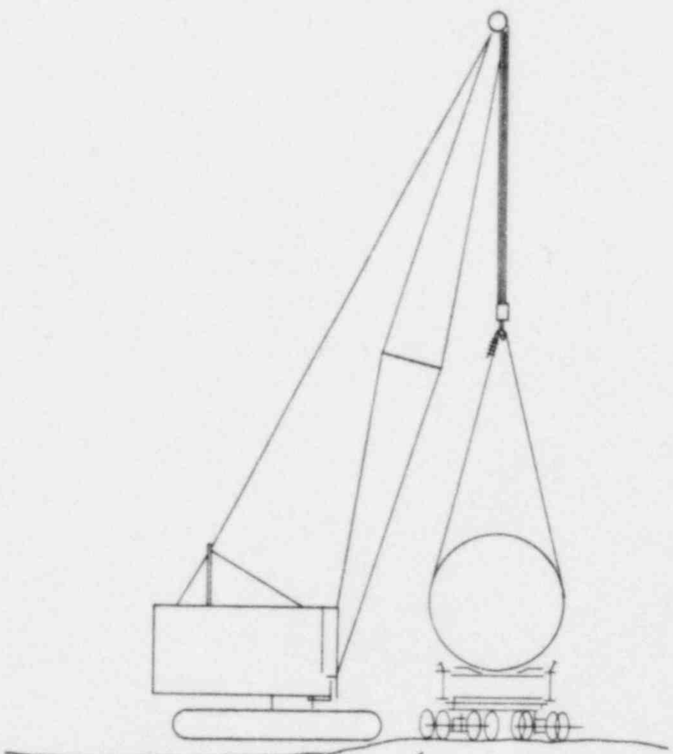
BELDING - Ⓦ ELEC. SERV. 2/26/69 RJR Ⓦ

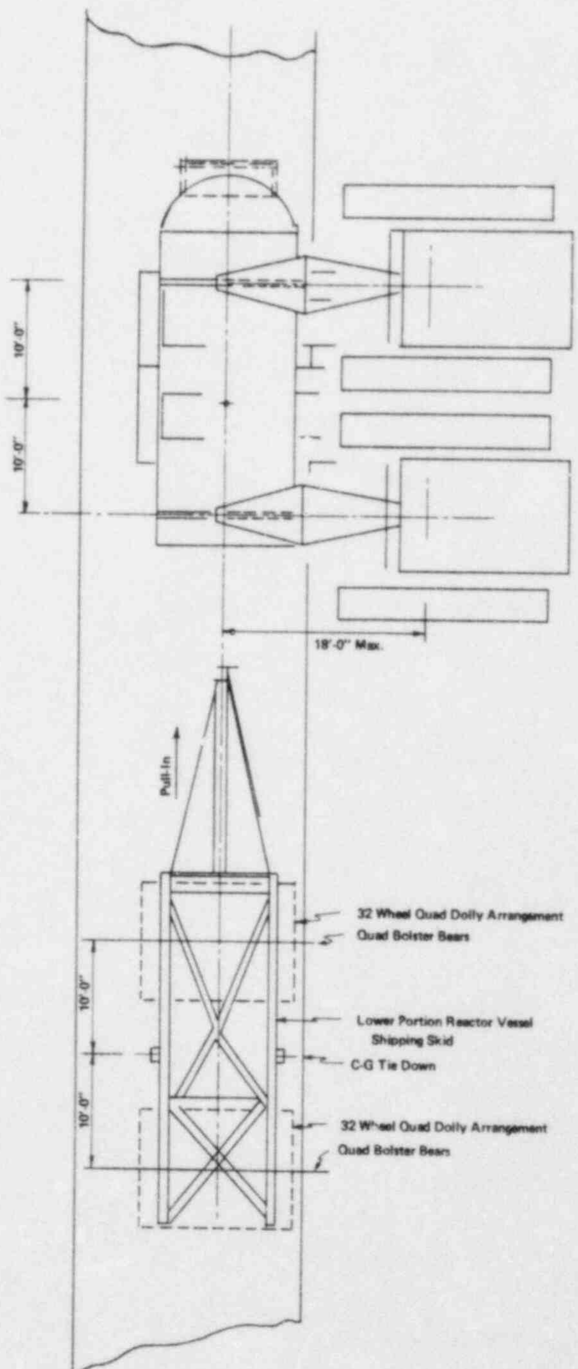




COPY - Prepared by Southwest Research Institute Page 4 of 4

PROCEDURE FOR RIGHTING REACTOR VESSEL, POINT BEACH PLANT NO. 1 (REFER TO WRITTEN PROCEDURE - REVISION 1)
BELDING - Ⓦ ELEC. SERV. 2/26/69 RJR Ⓦ





APPENDIX VI

REPORT OF DEVIATIONS FROM PROCEDURE FOR RIGHTING OF REACTOR VESSEL

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DEVIATIONS FROM

PROCEDURE FOR RIGHTING OF REACTOR VESSEL

2/28/69:
(1--3) All safety precautions complied with no deviations.

3/1/69:
(4) Because vessel was in contact with earth at the desired pick point for the 3900W crane, it was necessary that this pick be made at a point 9'-0" from C-C instead of 10'-0" as shown on the drawing. To remain within crane rating for this slightly increased load, the reduction of the radius of crane operation necessitated reduction of minimum clearance to less the indicated 1'-6" to maintain uniformity of radii, the 4000W crane radius was also shortened. The piece was protected from contact with crane crawler threads with timber softening.

(5) No deviations.

(6) A fourth crane was used in addition to the 40-ton unit listed. This crane expedited handling of the skid removal and enabled much more rapid progress at this stage.

(7) No deviations.

3/2/69:
(8) No deviations.

(9) The wooden cribbage runways were installed at a lower elevation then had been anticipated in order to increase the safety of subsequent rolling and inching operations. It was felt that it would be more practicable to keep these runways as low as possible while the piece was in lateral movement and to accomplish the required vertical elevation for skid-dolly installation after piece is in final loading position. As an added safety feature, a third runway with minimal contact was installed to be used during rolling at the "top" edge of the vessel.

(9-A) No deviations.

(10) Since the forces required to roll the piece are small and the work involved in converting basket hitches to rolling hitches and back again would add time exposure to the operation, the basket hitches were slacked off, retained as safeties, and the rolling accomplished with a lighter cable and a laterally placed winch truck.

(10-A) Runways were replaced with short crib blocking; otherwise, procedure followed.

(11--14) No deviations.

APPENDIX VII

REACTOR VESSEL WALL TEMPERATURES RECORDED DURING RIGHTING OF VESSEL

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TEMPERATURES TAKEN ON REACTOR VESSEL

Temperatures taken on reactor vessel during the righting and resetting of the reactor vessel on shipping skid. March 1, 2 and 3, 1969 at times and locations as indicated by Gary Hammond, Westinghouse Electric Service Division.

3/1/69

Bottom		Top Center	Top Rear
7:50 a.m.	45°F	49°F	47°F
8:25 a.m.	44°F	48°F	48°F
8:50 a.m.	45°F	48°F	49°F
9:30 a.m.	45°F	48°F	50°F (sun)
10:00 a.m.	45°F	48°F	50°F (sun)
10:45 a.m.	45°F	47°F	48°F
11:00 a.m.	45°F	47°F	
11:40 a.m.	45°F	46°F	
12:30 p.m.	45°F	48°F	
1:25 p.m.	45°F		
2:15 p.m.	46°F		
3:20 p.m.	50°F		
3:50 p.m.	45°F		
4:25 p.m.	47°F (rear of bottom)		
4:50 p.m.	47°F "		

3/2/69

7:30 a.m.	61°F (rear of bottom)
8:10 a.m.	61°F "
9:00 a.m.	64°F "
9:45 a.m.	64°F "
11:00 a.m.	67°F "
12:50 p.m.	65°F "
1:25 p.m.	63°F "
1:30 p.m.	removed for rolling of vessel

3/3/69

Middle of Bottom

7:40 a.m.	60°F
8:30 a.m.	55°F
9:50 a.m.	52°F
10:25 a.m.	52°F
11:30 a.m.	49°F
3:00 p.m.	48°F
4:10 p.m.	on skid

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

To	J. LANG - QUALITY ASSURANCE
From	J. D. FURRY - QUALITY ASSURANCE
Cust.	WESTINGHOUSE APD
File No. or Ref.	610-0115-51-18
Subj.	TRIP REPORT - POINT BEACH REACTOR - TWO CREEKS, WIS.
Date	MARCH 18, 1969

805 663-4

This letter to cover one customer and one subject only.

This report will cover the period of time from March 7, 1969 to March 14, 1969.

A protection cover fabricated of plywood was securely fastened over the instrumentation nozzles which penetrate the lower head. The vessel was then lashed to the three original saddles of the front shipping sled, (B&W Drawing 117843E) and moved to a suitable storage area on the rubber tired dolly arrangement consisting of sixty-four wheels. By hydraulic jacking arrangement, the dolly wheels were removed leaving the vessel and shipping sled resting on wooden cribbing. The vessel was made as near level as practical by the hydraulic jacking arrangement.

The vessel was covered by an enclosure fabricated of wood and polyethylene with emphasis placed upon a clean area around the inlet and outlet nozzles which were affected by the transportation incident. The enclosure is equipped with floor and heaters to facilitate nondestructive testing and repairs. The majority of work required to accomplish the forgoing was completed on Saturday March 8, 1969.

A meeting was held on March 8, 1969 to discuss the B&W plan for nondestructive testing of the portions of the reactor affected by the incident. Those listed were in attendance:

Ray Pearsall	Westinghouse	Cog. Engineer
J. R. Steele	Westinghouse	Project Q. C.
H. D. Hickman	Westinghouse	Lead Engineer - Site
Gary Hammond	Westinghouse	Elect. Service Eng.
D. L. Reddick	Bechtel	Q. A. Engineer
J. L. Sulzbach	B&W Field Service	
J. D. Furry	B&W Quality Assurance	

Four additions were made to the nondestructive testing plan as delineated in Mr. T. A. Anderson's letter dated March 7, 1969. A list of B&W Quality Control Specifications is included with the nondestructive testing plan. These specifications were copied and distributed to all interested parties. Copies of the revised plan are included with this report. Inspection ticket numbers have been added to each item of the plan for information purposes with the exception of the testing of the longitudinal seams in the lower courses

of the vessel. Those tickets are listed as follows:

UT of long seams - H-40666
MT of long seams - H-40665
Visual insp. of long seams - H-40676

By copy of this report, all original copies of the inspection tickets are being forwarded to Mr. T. A. Anderson. Mr. Anderson shall please note sketch attached for ticket H-40667.

All nondestructive testing began on March 9, 1969 and was completed March 13, 1969. Qualified inspector-operators Mr. C. E. Davidson and Mr. W. Good of the Barberton Works performed all required testing. Ultrasonic and some liquid penetrant inspection was witnessed by Mr. Eugene Hughes of Westinghouse APD and Magnetic Particle and the remainder of liquid penetrant was witnessed by Mr. L. Isbill of Westinghouse APD. During the nondestructive testing, no indications other than the original reportable indications were observed.

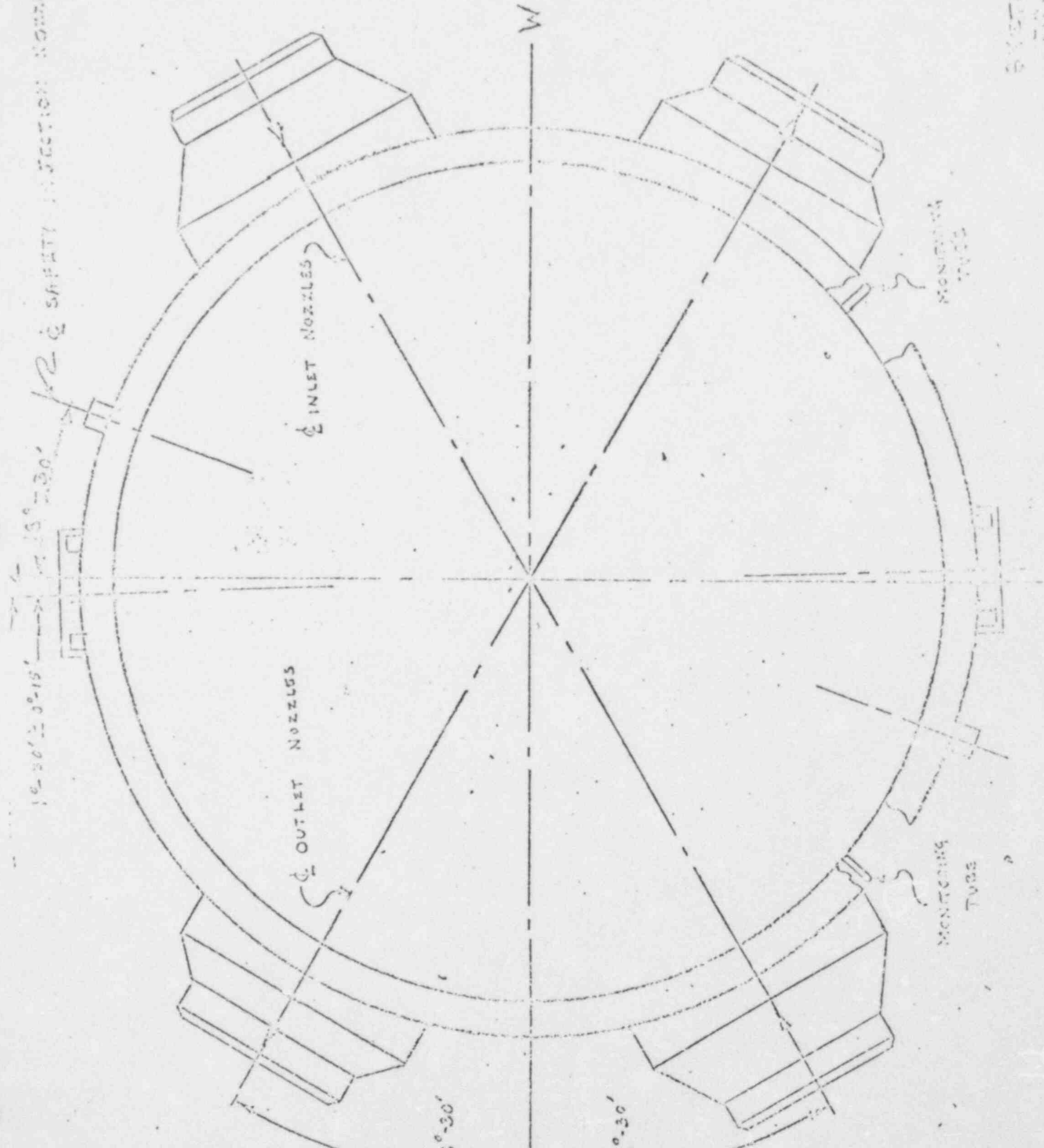
Close-up photographs of the damage to the inlet and outlet nozzles were received by the writer and they have been forwarded to Mr. T. A. Anderson. Casts of some of the worst damage condition to weld preparations were made and have also been forwarded to Mr. T. A. Anderson.

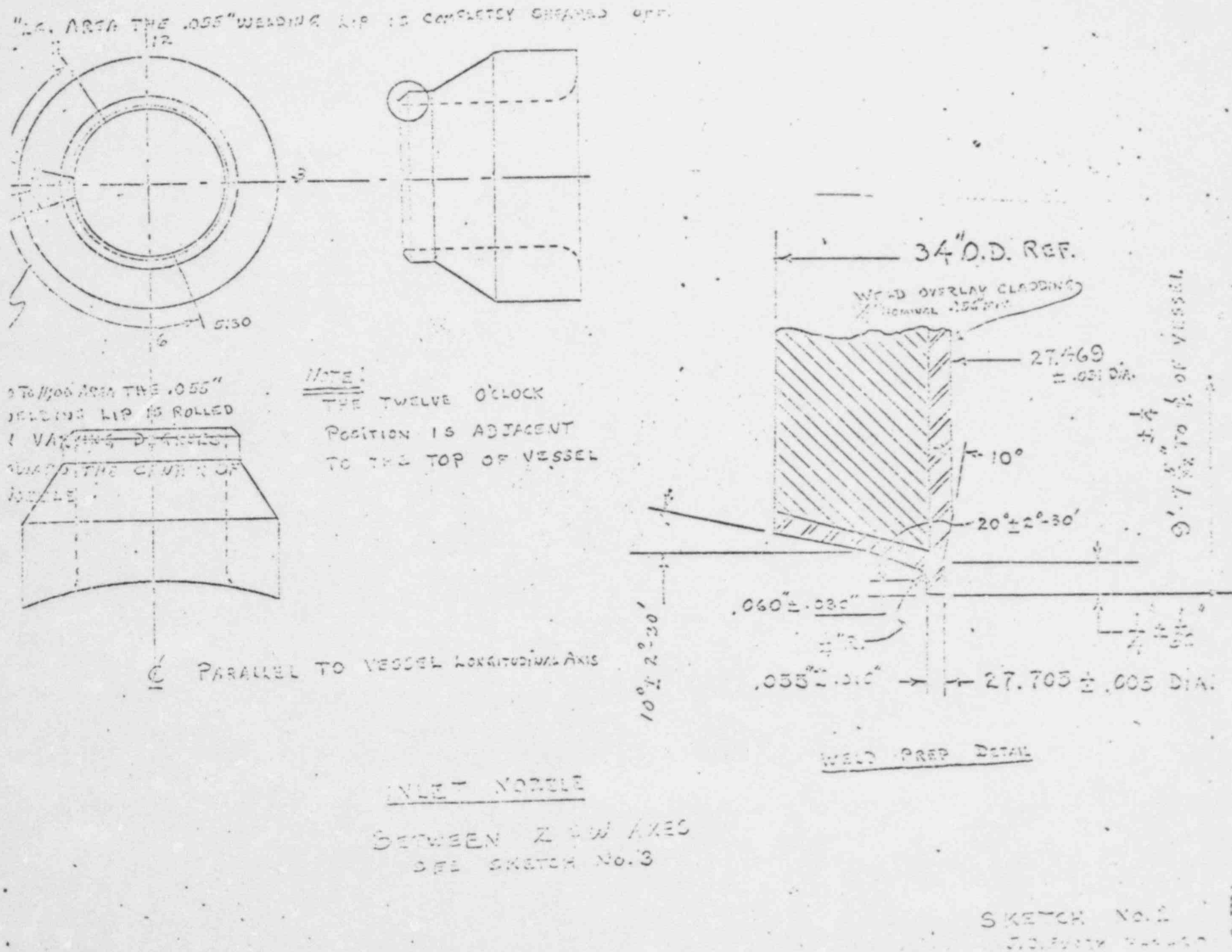
During visual inspection of damage, the writer made a dimensional check of the inside bore of each of the affected nozzles to determine distortion or out of roundness. This was accomplished by the use of a hand made tube and rod arrangement used in the same manner as an inside micrometer. Six diametrical checks were made on the inside bore at the end of the 10^{o} taper and at six inches from this point toward the center of the reactor. From these checks it was determined that nozzle bore diameters were within drawing tolerance.

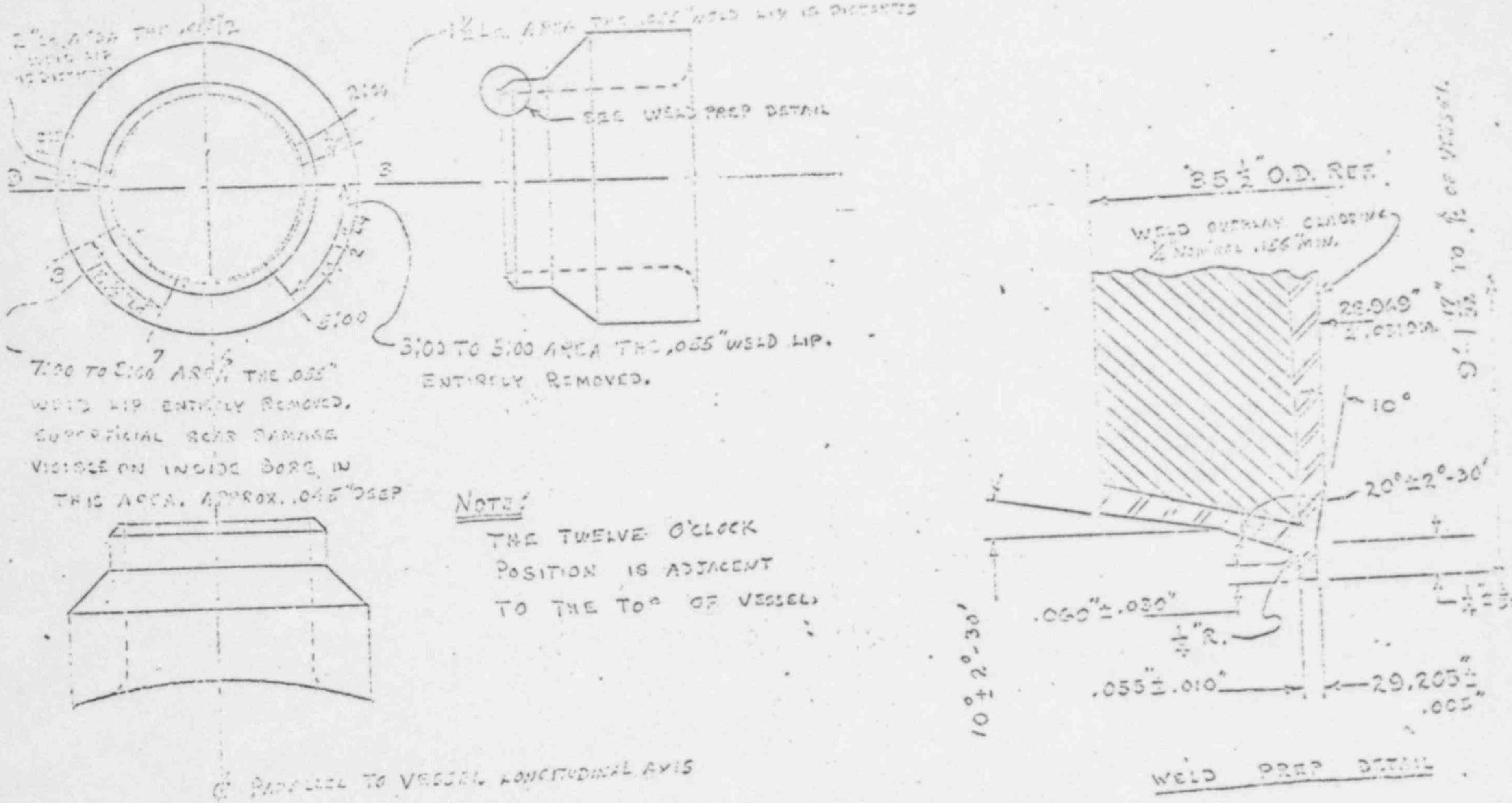
J. D. Furry
J. D. Furry

JDF/er

cc: T. Anderson
W. C. Grygotis
G. R. Forrer
J. C. Quinn
J. A. Van Meter
P. F. Olhoeft
File


W
℄ SAFETY INJECTION NOZZLES
℄ INLET NOZZLES
℄ OUTLET NOZZLES
MONITORING TUBE
MONITORING TUBE
13°-30'
28°-30'
31°-30'

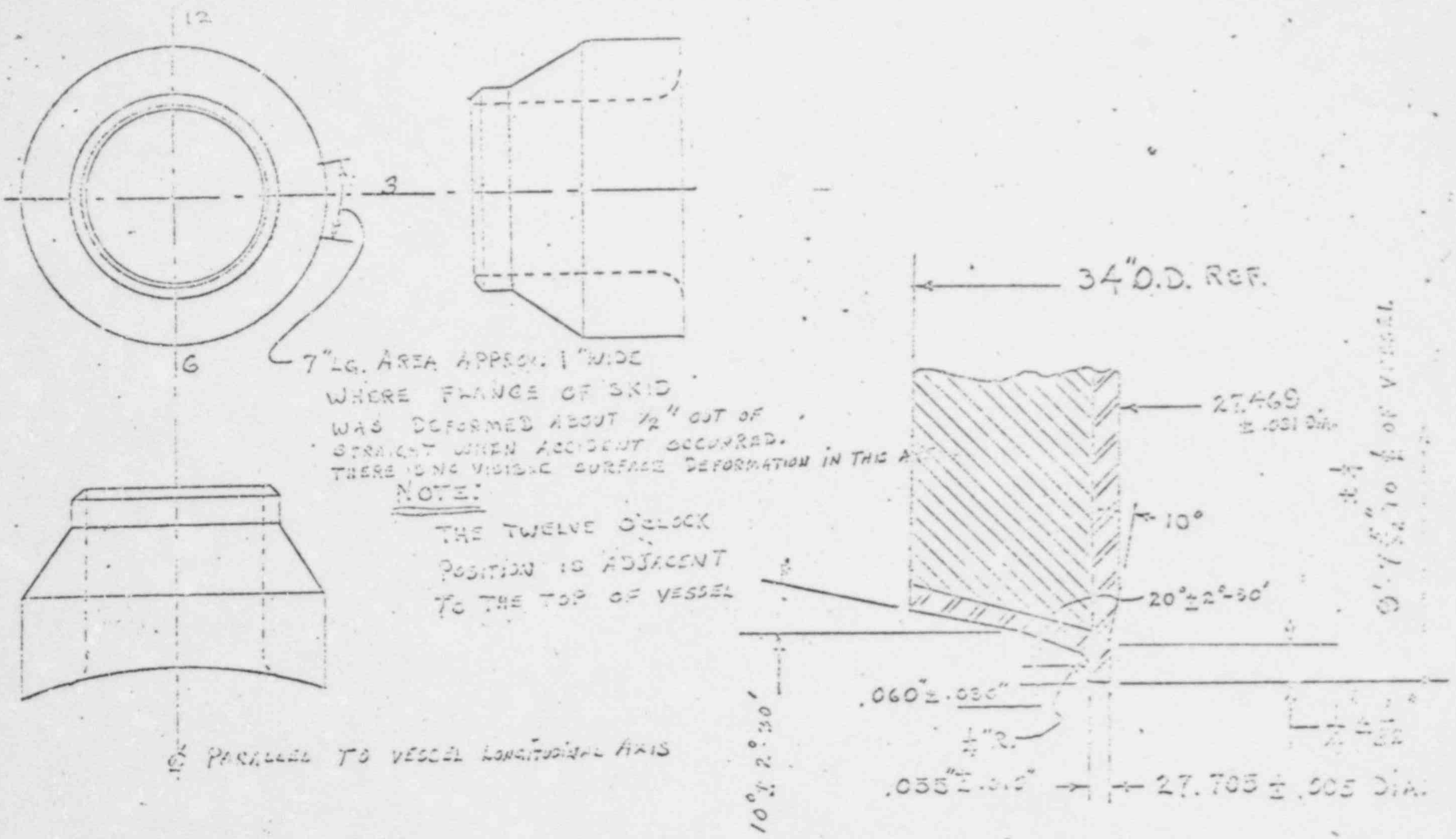

12
6
5:30
NOTE!
THE TWELVE O'CLOCK
POSITION IS ADJACENT
TO THE TOP OF VESSEL
℄ PARALLEL TO VESSEL LONGITUDINAL AXIS
34" O.D. REF.
WELD OVERLAY CLADDING
27.469
± .031 DIA.
10°
20° ± 2°-30'
.060" ± .030"
.055" ± .010"
27.705 ± .005 DIA.
10° ± 2°-30'
WELD PREP DETAIL
INLET NOZZLE
BETWEEN Z & W AXES
SEE SKETCH No. 3
SKETCH No.



OUTLET NOZZLE

BETWEEN W & X AXES

SEE SKETCH NO. 3



WELD PREP DETAIL

INLET NOZZLE

BETWEEN X & Y AXES

SEE SKETCH No. 3

SKETCH No.

APPENDIX IX

NON-DESTRUCTIVE TESTING REPORT OF POINT BEACH UNIT #1 REACTOR VESSEL, THE BABCOCK & WILCOX COMPANY, JUNE 12, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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NON-DESTRUCTIVE TESTING REPORT

OF

POINT BEACH UNIT #1 REACTOR VESSEL

June 12, 1969

BABCOCK & WILCOX CONTRACT - ES-3582

WESTINGHOUSE PURCHASE ORDER NO. 54-Q-100235

Prepared By: W. M. Young
W. M. Young

Approved By: T. A. Anderson
T. A. Anderson

NON-DESTRUCTIVE TESTING INSPECTION OF POINT BEACH #1 (WEP) NUCLEAR REACTOR VESSEL

I. INTRODUCTION

A. PURPOSE OF NON-DESTRUCTIVE TESTING INSPECTION

This report covers the non-destructive inspection of the Point Beach #1 Nuclear Reactor Vessel fabricated by the Babcock and Wilcox Company for Westinghouse Atomic Power Division. The purpose of non-destructively examining sections and components of this vessel was to determine what areas have been affected by the incident that occurred February 22, 1969, while transporting the reactor vessel to the site.

B. GENERAL INFORMATION

The vessel was inspected at the Point Beach #1 site on March 8, 9, 10, and 11, 1969, by the following Babcock and Wilcox Company personnel:

C. Davidson - Quality Control Non-Destructive Testing Section
W. Good - Quality Control Non-Destructive Testing Section
J. D. Furry - Quality Assurance Department

Mr. Davidson and Mr. Good had performed the ultrasonic mapping of the vessel in the Mount Vernon facilities prior to vessel shipment.

This inspection was under the technical supervision of Mr. E. T. Hughes - Westinghouse Atomic Power Division. The procedures listed in Table I were used as the basis for all of the non-destructive testing performed.

C. AREAS SELECTED FOR INSPECTION

1. The primary coolant nozzles on the W-X Axis and W-Z Axis were selected, due to the direct impact loading imposed on them from the incident.

2. Circular and longitudinal weld seams, between the primary nozzles and lower head, were selected, due to the beam effect imposed on the shell from the incident.

3. The area on the lower head was selected, due to the direct impact.

4. The instrumentation nozzles in the lower head were selected because they have the lowest cross-sectional area. If shock waves propagated in the vessel as a result of the impact, these nozzles would most likely be subjected to the highest stresses.

II. DETAILED REVIEW OF NONDESTRUCTIVE TESTING PERFORMED

A. TESTING TECHNIQUES

The non-destructive testing techniques used to examine the various sections of the vessel consisted of:

1. Liquid Penetrant
2. Ultrasonic
3. Magnetic Particle
4. Visual

All inspections were performed in accordance with Standard B&W Inspection Procedures that were approved for use by Westinghouse Atomic Power Division. The inspection techniques performed on each section of the vessel were selected on the basis of their ability to provide the most information concerning the integrity of the section to be examined.

B. SUMMARY

A detailed inspection summary of the specific areas examined is:

1. Inlet Nozzle (W-Z Vessel Axis)
   Outlet Nozzle (W-X Vessel Axis)
   a. Weld Metal Safe End Buttering
      1) Ultrasonic inspection - The safe end buttering was tested for bond in accordance with B&W Specification UT-66, Rev. 2 and was found acceptable. Testing was done using a longitudinal wave search from the end of each nozzle as shown in Figure 1. The following ultrasonic equipment was used:

         a) Instrument - Sperry UM-721
         b) Search Unit - 2.25 MH_z Long 1-1/8" dia. Barium Titanate
         c) Couplant - Hamikleer

      2) Visual Inspection - Weld metal safe ends were examined with a 5X glass and found acceptable. There were no reportable indications except for the damage to the .055" lip.

3) Liquid Penetrant - Weld metal safe ends were inspected in accordance with B&W Specification S-10, Rev. 5. The materials used for testing were as follows:

a) Cleaner - Magnaflux Corporation	Group I
b) Dye - Magnaflux Corporation	Group I
c) Developer - Magnaflux Corporation	Group I

NOTE: Due to damage of .055" lip on weld prep, the liquid penetrant inspection was rejected. (See Figure 2)

b. Weld Metal Overlay Cladding on Inside Bore for a Distance of 12" from Weld Prep

1) Ultrasonic Inspection - The inside bore of the nozzle was scanned 360 degrees for a 12" distance to determine the bond of the cladding to the base material in accordance with B&W Specification UT-66, Rev. 2 and was found acceptable. Testing was done using a longitudinal wave search from the inside diameter of each nozzle as shown in Figure 1. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long 1-1/8" dia. Barium Titanate

c) Couplant - Hamikleer

c. Ring Area of the Cladding Extending Radially 10" from the Inside Bore of the Nozzles

1) Ultrasonic Inspection - The weld overlay cladding was tested for bond in accordance with B&W Specification UT-66, Rev. 2 and found acceptable. Testing was done using a longitudinal wave search from inside of the vessel radially 10" from the inside bore of each nozzle, as shown in Figure 1. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate

c) Couplant - Hamikleer

d. Entire Outside Surface of Nozzle Forgings

1) Ultrasonic Inspection - The entire base material volume of the nozzles was tested by scanning from the outside surface in accordance with B&W Specification S-204B, Rev. 0 and found acceptable. Testing was done using a longitudinal wave search and shear wave search. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Units - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate
1.0 MH_z 45° Angle - 1" Sq. Lithium Sulfate

c) Couplant - Hamikleer

2) Magnetic Particle - The entire outside surface of the nozzles was tested in accordance with B&W Specification S-102T, Rev. 5 and found acceptable. The following magnetic particle equipment was used:

   a) AC - Yoke

   b) Dry Powder - Red

3) Visual Inspection - The entire outside surface of the nozzles was examined with a 5X glass and found acceptable.

e. Nozzle to Shell Weld

1) Ultrasonic Inspection - The entire weld was tested in accordance with B&W Specification S-102Z, Rev. 3 and found acceptable. The ultrasonic testing of the nozzle to shell weld revealed only three discrete indications of reportable (20% and greater) amplitude. The three indications were found in the W-Z inlet nozzle to shell weld at the interface between the weld and base metal of the vessel wall. Assuming the top (top of vessel) of the nozzle to be 12:00 o'clock and viewing the nozzle from inside the vessel, one of the indications was found at the 1:00 o'clock position, the other two in the 9:30-10:00 o'clock position. The 1:00 o'clock indication was ascertained to be approximately 100% in amplitude, the two oters about 40% in amplitude. Examination of the report of the original ultrasonic mapping of the vessel indicated

that the three indications found were most likely the same ones reported in the original mapping; no increase in size or extent was indicated. The three indications were listed in the mapping report as 110%, 50%, and 50% in amplitude. Testing was done using a longtidinal wave search. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Units - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate

c) Couplant - Hamikleer

2) Magnetic Particle - The entire outside weld surface was tested in accordance with B&W Specification S-102B, Rev. 6 and found acceptable. The following magnetic particle equipment was used:

a) AC - Yoke

b) Dry Powder - Red

3) Visual Inspection - The entire outside weld surface was examined with 5X glass and was found acceptable.

f. Nine-Inch Wide Ring Encompassing Inlet (W-Z Axis) and Outlet (W-X Axis) Nozzles

1) Ultrasonic Inspection - Forging material was tested in accordance with B&W Specification S-204A, Rev. 1 and found acceptable. Testing was done using a longitudinal wave search from the outside surface. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate

c) Couplant - Hamikleer

2) Magnetic Particle - Forging material around each nozzle was tested in accordance with B&W Specification S-102T, Rev. 5 and found acceptable. The following magnetic particle equipment was used:

a) AC - Yoke

b) Dry Powder - Red

3) Visual Inspection - The entire outside surface was examined with 5x glass and found acceptable.

2. Weld Seams (See Figures 3 and 6)

a. Nozzle forging shell course to shell weld plus one base material thickness:

1) Ultrasonic Inspection - Circumferential weld seam was tested 90° in both directions from the "W" Axis in accordance with B&W Specification S-204C, Rev. 1 and found acceptable. Testing was done from the outside of the vessel using a longitudinal wave and shear wave search as shown in Figure 3. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate - 1.0 MH_z 45° Angle - 1" Square Lithium Sulfate

c) Couplant - Hamikleer

2) Magnetic Particle - Circumferential weld seam was tested 90° in both directions from the "W" Axis in accordance with B&W Specification S-102B, Rev. 6 and found acceptable. The following magnetic particle equipment was used:

   a) AC - Yoke

   b) Dry Powder - Red

3) Visual Examination - Circumferential weld seam was inspected 90° in both directions from the "W" Axis with a 5X glass and found acceptable.

b. Circumferential Weld Seam Between Two Cyclindrical Shell Courses Plus One Base Material Thickness

1) Ultrasonic Inspection - Circumferential Weld seam was tested 90° in both directions from the "W" Axis in accordance with B&W Specification S-204C. Rev. 1 and found acceptable. Testing was done from the outside of the vessel using a longitudinal wave and shear wave search as shown in Figure 3. The following ultrasonic equipment was used:

   a) Instrument - Sperry UM-721

   b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate
      1.0 MH_z 45° Angle 1" Square Lithium Sulfate

   c) Couplant - Hamikleer

2) Magnetic Particle - Circumferential weld seam was tested 90° in both directions from the "W" Axis in accordance with B&W Specification S-102B, Rev. 6 and fond acceptable. The following magnetic particle equipment was used:

a) AC - Yoke

b) Dry Powder - Red

3) Visual Inspection - Circumferential weld seam was examined 90° in both directions from the "W" Axis with a 5X glass and found acceptable.

c. Two Longitudinal Weld Seams Plus One Base Material Thickness In The Vessel

1) Ultrasonic Inspection - The two longitudinal weld seams were tested in accordance with B&W Specification S-204, Rev. 1 and found acceptable. Testing was done from the outside of the vessel using a longitudinal wave and shear wave search as shown in Figure 3. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate
1.0 MH_z 45° Angle - 1" Square Lithium Sulfate

c) Couplant - Hamikleer

2) Magnetic Particle - The two longitudinal weld seams were tested in accordance with B&W Specification S-102B, Rev. 6 and found acceptable. The following magnetic particle equipment was used:

a) AC - Yoke

b) Dry Powder - Red

3) Visual Inspection - The two longitudinal weld seams were examined with 5X glass and found acceptable.

3. Three-foot Diameter Circle Centered About Impact Point - Located On The "W" Axis Of The Vessel (See Figure 6)

   a. Three-foot diameter circle plus one base material thickness.

      1) Ultrasonic Inspection - The three-foot diameter area was tested in accordance with B&W Specification S-204A, Rev. 1 and found acceptable. Testing was done from the outside of the vessel using a longitudinal wave and shear wave search as shown in Figure 3. The following ultrasonic equipment was used:

         a) Instrument Sperry UM-721

         b) Search Units - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate
            1.0 MH_z 45^o Angle - 1" Square Lithium Sulfate

         c) Couplant - Hamikleer

      2) Magnetic Particle - The three-foot diameter area was tested in accordance with B&W Specification S-102T, Rev. 5 and found acceptable. The following magnetic particle equipment was used:

         a) AC - Yoke

         b) Dry Powder - Red

      3) Visual Inspection - The entire outside surface was examined with 5x glass and found acceptable.

4. Nine Instrumentation Nozzle to Vessel Attachment Welds

   a. Attachment welds (See Figure 4)

      1) Liquid Penetrant Inspection - Attachment welds were inspected in accordance with B&W Specification S-102R, Rev. 1 and found acceptable. The materials used for

testing were as follows:

a) Cleaner - Magnaflux Corporation   Group I

b) Dye - Magnaflux Corporation   Group I

c) Developer - Magnaflux Corporation   Group I

2) Visual Inspection - Attachment welds were examined with 5X glass and found acceptable.

5. <u>One-inch X Seven-inch Area On Large Diameter (52-1/2" OD) Nozzle Where Skid Flange Was Distorted By Striking The Inlet Nozzle On The X-Y Axis</u>

1) Ultrasonic Inspection - The 1" x 7" area plus on base material thickness was tested in accordance with B&W Specification S-204B, Rev. 0 and found acceptable. Testing was done using longitudinal wave and shear wave search from the outside of the nozzle. The following ultrasonic equipment was used:

a) Instrument - Sperry UM-721

b) Search Unit - 2.25 MH_z Long. 1-1/8" dia. Barium Titanate
1.0 MH_z 45° Angle - 1" Square Lithium Sulfate

c) Couplant - Hamikleer

2) Magnetic Particle - The 1" x 7" area plus on base material thickness was tested in accordance with B&W Specification S-102T, Rev. 5 and found acceptable. The following magnetic particle equipment was used:

a) AC - Yoke

b) Dry Powder - Red

6. Final Cleaning

Upon completion of all the above steps, the entire inside surface of the vessel was wiped down with acetone (supplied by Westinghouse) saturated lint-free cloths, and all nozzle openings were covered.

III. CONCLUSION

As a result of the examination and the dimensional inspection, it is considered improbable, based upon available nondestructive testing techniques, that there is any damage to the vessel other than the nozzle weld preps. The .055" lip on the weld preps were distorted and sheared off, due to the transportation incident.

TABLE I *

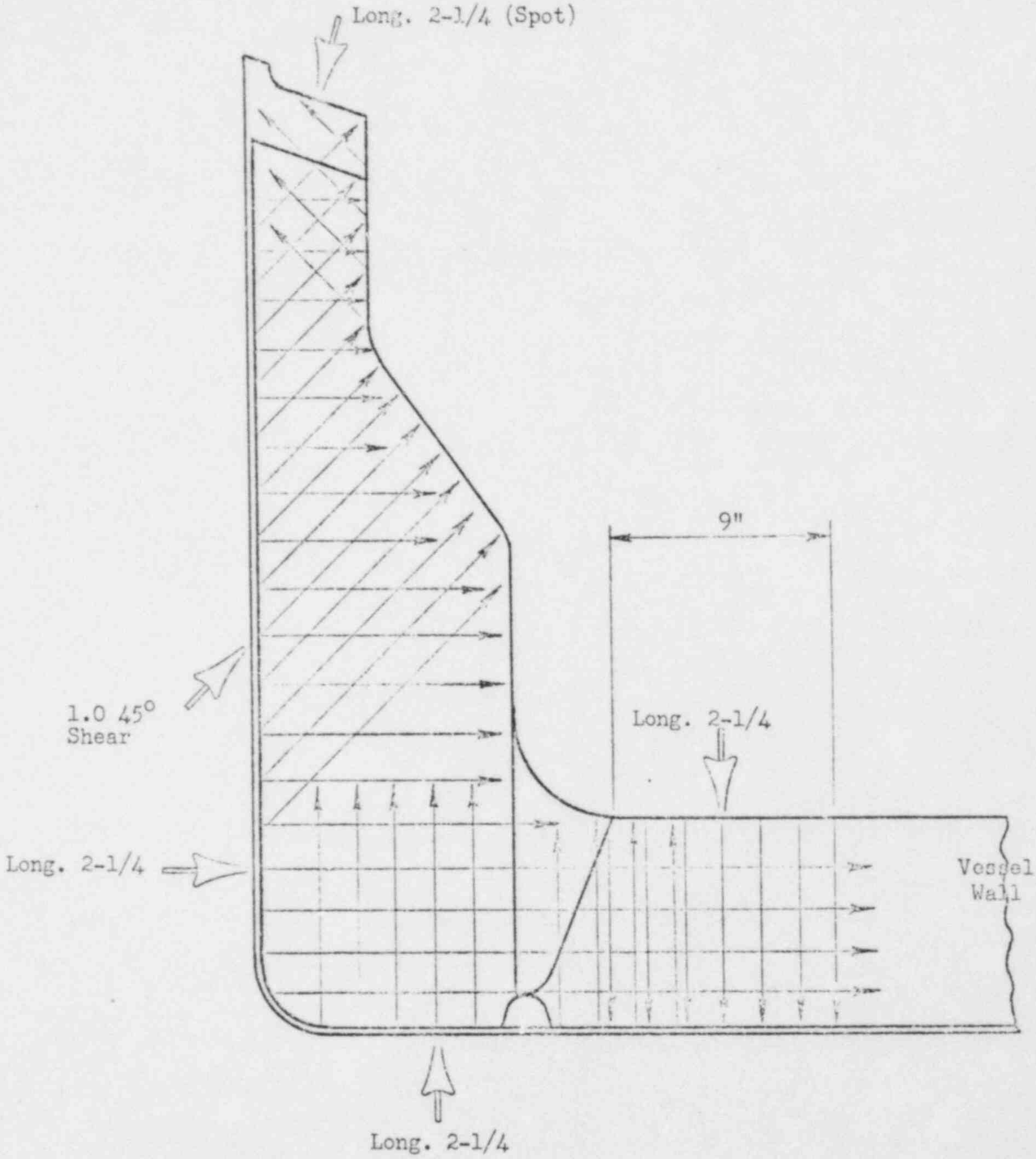
Specifications For Non-Destructive Testing Relative To

The Point Beach #1 Reactor Vessel Transportation Incident

Babcock and Wilcox Company
Boiler Division
Quality Control Specifications

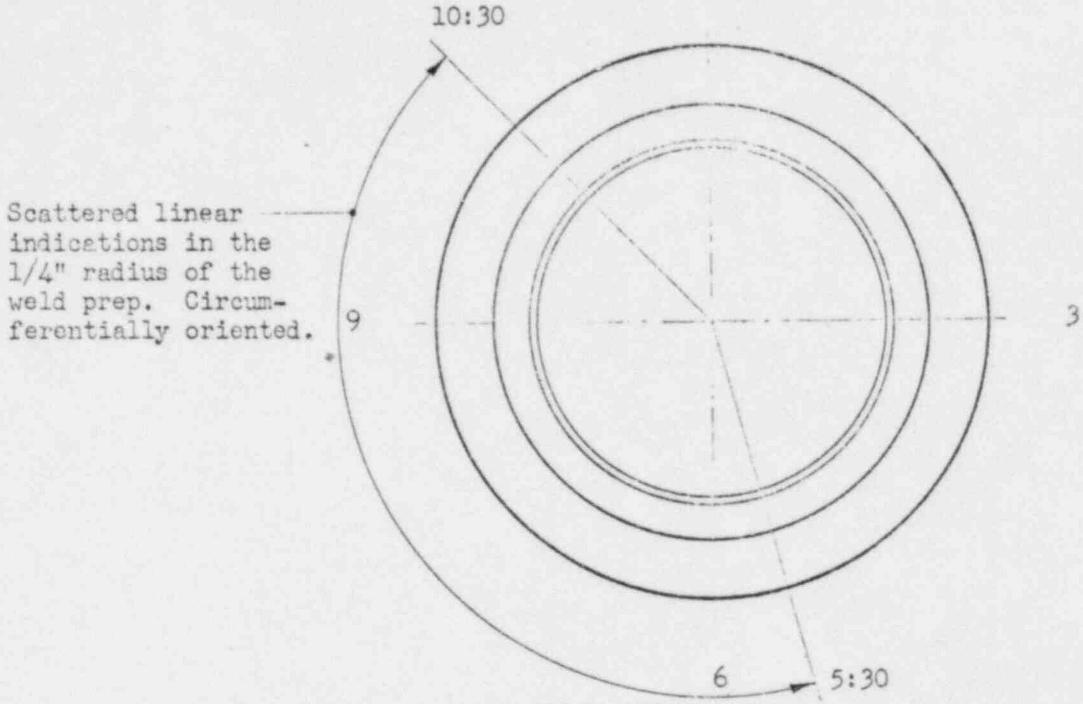
Issue	Title	Spec. No.
5/24/61	Dye Penetrant Inspection	S-10
5/22/61	Magnetic Particle Inspection - Welds	S-11
2/28/56	Non-Destructive Inspection Requirements	S-102
4/5/67	Magnetic Particle Inspection and Acceptance Standards - Welds	S-102B
5/16/66	Dye Penetrant Inspection and Acceptance Standards - Base Materials	S-102R
7/18/66	Magnetic Particle Inspection and Acceptance Standards - Base Materials	S-102T
9/14/67	Ultrasonic Inspection of Full Penetration Nozzle Welds of Similar Materials	S-102Z
10/4/67	Requirements for Final Non-Destructive Testing of Class "A" Nuclear Vessels Built in Accordance with ASME Code	S-204
2/16/68	Ultrasonic Inspection of Plate by Straight Beam and Angle Beam	S-204-A
2/19/68	Ultrasonic Inspection of Ring and Hollow Forgings by Longitudinal (normal) and Shear Wave (angle) Beams	S-204-B
3/19/68	Ultrasonic Inspection of Circumferential and Longitudinal Weld Seams Joining Similar Materials	S-204-C
4/13/66	Ultrasonic Inspection for Bond of Weld Metal Overlay Cladding	UT-66

* All Babcock & Wilcox Company Procedures and Specifications referenced throughout this report are contained in Appendix X, Volume II.

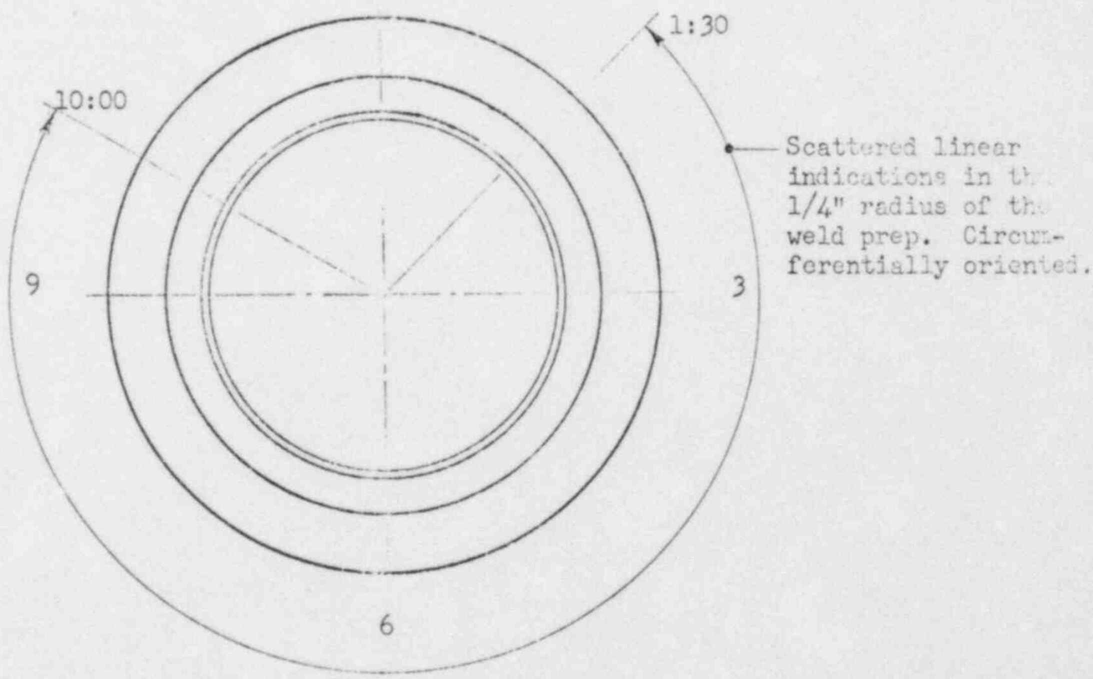


Nozzle cross section showing (schematically) the mode, test frequency, test direction, extent of testing and the test surfaces used in the contact ultrasonic testing performed on the W-Z and W-X nozzles of the WEP vessel.

Figure 1

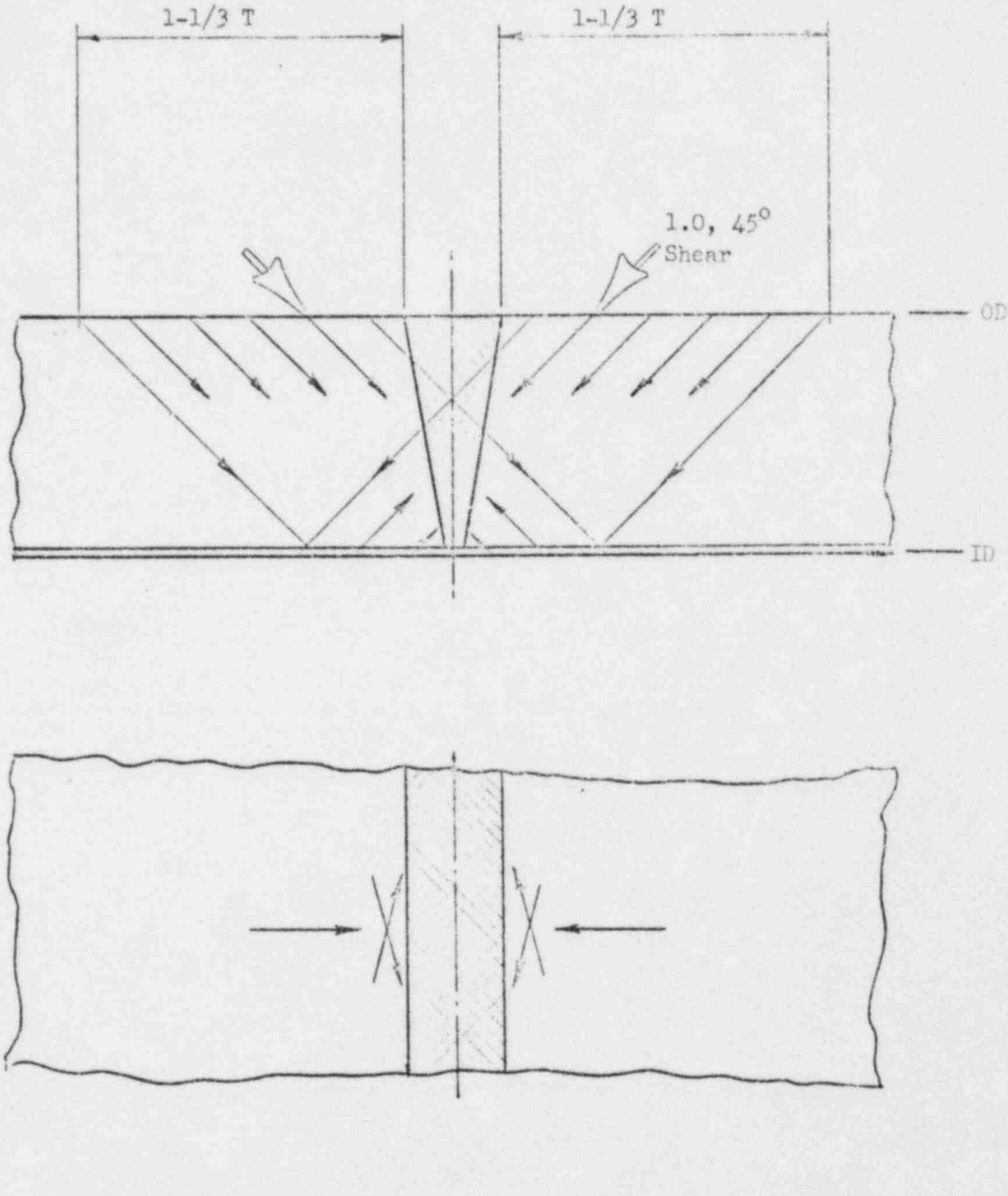


INLET BETWEEN W & Z AXES



OUTLET BETWEEN W & X AXES

Figure 2



Weld cross sections showing, schematically, the mode, test frequency, test directions, extent of testing and the test surfaces used in the contact ultrasonic testing of the circumferential and axial seam welds in the WEP reactor vessel.

Figure 3

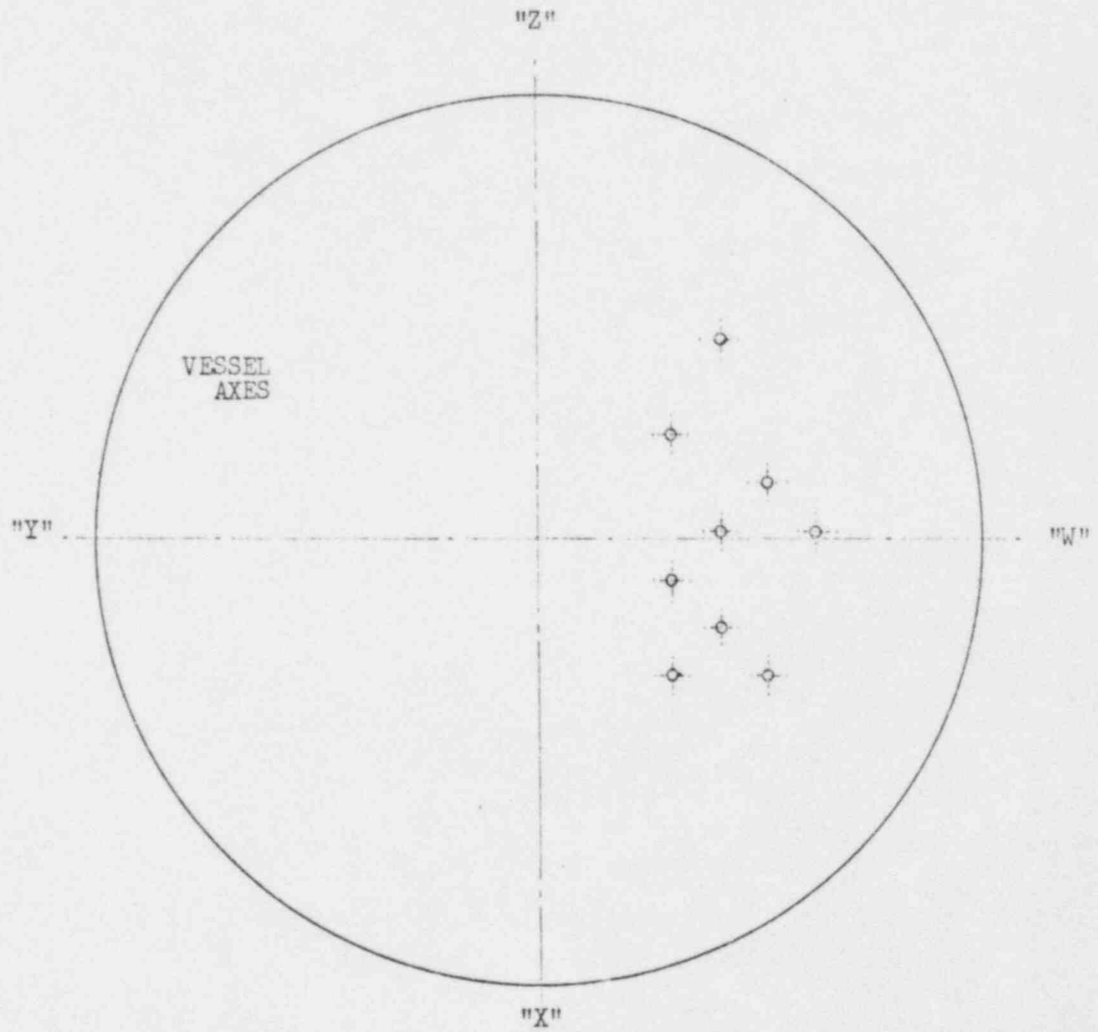


Figure 4

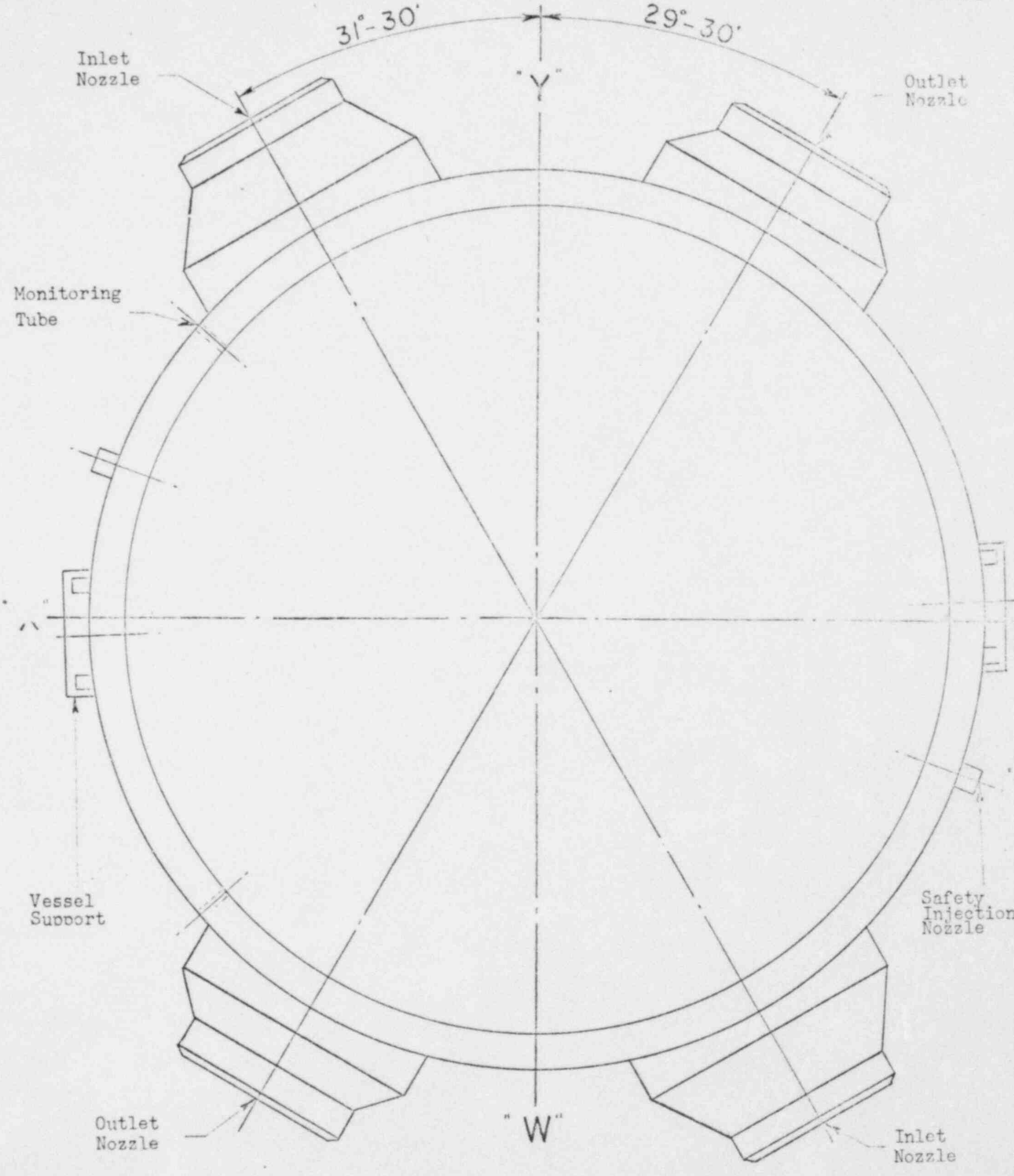

31°-30'
29°-30'
"Y"
Inlet Nozzle
Outlet Nozzle
Monitoring Tube
Vessel Support
Safety Injection Nozzle
Outlet Nozzle
"W"
Inlet Nozzle

FIGURE #5

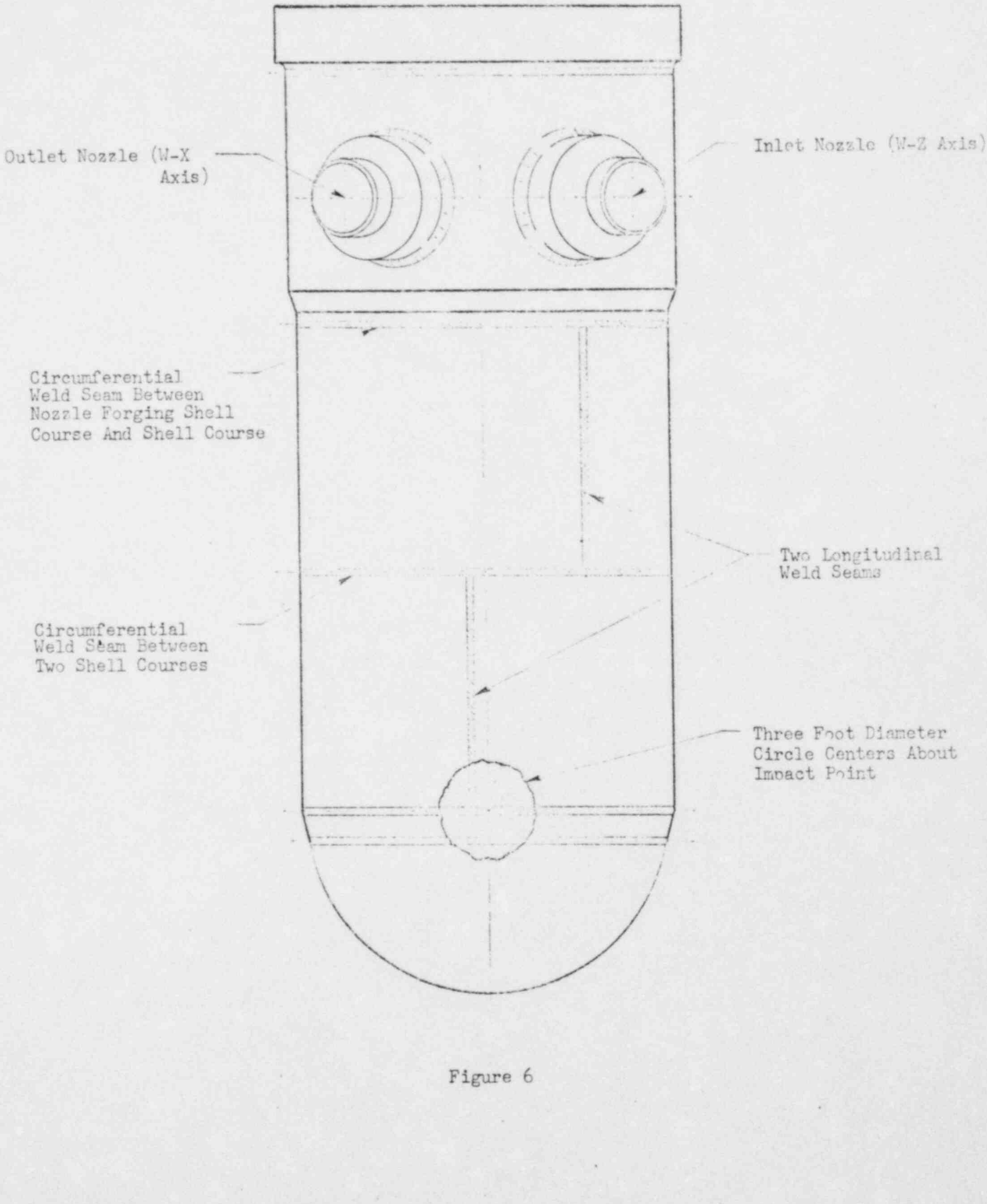

Outlet Nozzle (W-X Axis)
Inlet Nozzle (W-Z Axis)
Circumferential Weld Seam Between Nozzle Forging Shell Course And Shell Course
Two Longitudinal Weld Seams
Circumferential Weld Seam Between Two Shell Courses
Three Foot Diameter Circle Centers About Impact Point

Figure 6

APPENDIX X

THE BABCOCK & WILCOX COMPANY SPECIFICATIONS AND PROCEDURES

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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APPENDIX XI

ULTRASONIC INSPECTION REPORT, THE BABCOCK & WILCOX COMPANY, DECEMBER 18, 1968

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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ULTRASONIC INSPECTION OF

WISCONSIN ELECTRIC POWER CO.

NUCLEAR REACTOR

B&W FABRICATION CONTRACT 610-0115

B&W REPORT NO. 1

DECEMBER 18, 1968

BY: GLENN WALTON

APPROVED BY: W. C. BUSKEY

ULTRASONIC INSPECTION REPORT
WESTINGHOUSE ATOMIC POWER DIVISION - FOR
WISCONSIN ELECTRIC POWER COMPANY
B&W CONTRACT 610-0115

1. Purpose: This report covers the ultrasonic inspection of the reactor vessel and closure head for B&W contract 610-0115 for the purpose of establishing a map of recordable discontinuity indications. This map shall be used by the customer as a reference for future ultrasonic examinations conducted while the vessel is in service. The inspection was performed in accordance with the requirements specified by the customer, Westinghouse A.P.D.

2. General Information: The closure head and reactor vessel was inspected at the B&W Company, Mt. Vernon Works, Mt. Vernon, Indiana, on December 2, 3, and 4, 1968.

   The inspection was supervised by the following representatives of B&W Quality Control (NDT) Section, Barberton, Ohio: Glenn Walton, Clarence Davidson, Wilbur Good. The inspection was performed by the following representives of B&W Quality Control (NDT) Section, Mt. Vernon, Indiana: R. Roos, R. Brown, J. Dean, R. Hobbs, H. Corcoran, E. Voegel, J. Reich, and K. Bates.

   The inspection was partially witnessed by Mr. John White, Westinghouse (A.P.D.), Mr. William Owens, Westinghouse (A.P.D.) and Mr. Alan Whiting, Southwest Research.

3. Requirements: The following areas were ultrasonically examined from the inside surface of the components except where noted and the results documented:

   (1) Vessel Flange

   (2) The Primary Coolant Nozzles

   (3) The Intermediate Shell Course

   (4) The Lower Shell Course above the Radial Core Supports.

   (5) The Closure Head from the Cooling Shroud to the Flange Radius. This inspection was performed from the outside surface.

   (6) The Nozzle to Nozzle Shell Course Welds.

   (7) The Intermediate to Lower Shell Course Weld.

   (8) The Nozzle Shell Course to Intermediate Shell Course Weld.

   (9) The Vessel Flange to Nozzle Shell Course Weld.

3.1 Recording Requirements:

The recording requirements for inspection of areas (1), (3), (4), (5), (6), (7), (8), and (9) are in accordance with the approved B&W Specification S-204, 204 A, 204 B, and 204 C.

3.2 The recording and calibration requirements for area (2), Primary Coolant Nozzles as stated in paragraph 3.1 are as follows:

3.2.1 In areas such as nozzles and nozzle to upper shell welds where nonpanel surfaces exist, the report is based on a discontinuity indication rather than loss of back reflection.

3.2.1.1 The inlet outlet nozzle base material areas where nonparallel surfaces exist the recording levels were based upon amplitudes of discontinuity indications that exceed a 50% am-

plitude obtained from a 3/8" diameter side drilled hole. The remaining areas were inspected in accordance with paragraph 3.1.

3.2.1.2 The recording level for the inlet and outlet nozzle to upper shell weldments were based upon amplitudes of discontinuity indications that exceeded a 20% amplitude obtained from a 3/8" diameter side drilled hole. These inspections were performed in compliance with B&W specification S102-Z, Rev 3, using the longitudinal wave method in two perpendicular directions from the inside surface of the nozzles and from the inside surfaces of the vessel.

3.2.1.3 The recording level and calibration for testing the safety injection nozzle to upper shell weldments were performed to the same requirements as stated in paragraph 3.1. The inspections were performed from the inside surfaces of the vessel.

3.2.2 The calibration and recording requirements as stated in paragraphs 3.2.1.1 and 3.2.1.2 were obtained by using reference blocks.

3.2.3 On the areas that were inspected from the inside surfaces, the inspection of the cladding for bond was performed concurrently with the longitudinal wave inspection. This inspection was performed in compliance with B&W Specification UT-66 Rev. 2.

4. Results: The results of the inspections performed on the areas specified in paragraph 3 are as follows:

4.1 Closure Head, Area (5)-One area was detected by longitudinal wave. This area is 3" x 3½" in size when marked using a 50% or greater loss of back reflection. The indications were recorded as shown in Figure 1. No recordable areas were

detected using shear wave.

4.2 Reactor Vessel

4.2.1 Areas (1) Vessel Flange and (9) Vessel Flange to Nozzle Shell Course Weld - No recordable indications were detected by longitudinal and shear wave testing. Inspection of the vessel flange was limited by the stud holes.

4.2.2 Area (7) The intermediate to lower shell course weld. No recordable indications were detected by longitudinal wave testing. Using the shear wave a mode conversion was occurring in the areas where the cladding was tapered to blend in with the weld. The front of the transducer was tilting forward and a longitudinal wave was reflecting from the O.D. These areas are not a bona-fide indication and are not recorded.

4.2.3 Area (2) - The primary coolant nozzles - No recordable indications were detected by longitudinal and shear wave testing.

4.2.4 Area (4) The lower shell course above the radial core supports - Seventeen (17) indications were detected by the longitudinal wave testing and charted as shown in figure 1. Two (2) indications were detected by the shear wave testing and charted as shown in figure 1. One of the areas is the same area detected using longitudinal wave. This is area #10. This area is recorded in two (2) different amplitudes. One amplitude, 2.6" S/P or 170%, is the indication height when positioned on the indication at the - ½ node (approx. ¼ node). The other indication height .5" S/P or 33% is the indication height when positioned on the indication at the + ½ node (approx. 3/4 node). The instrument was calibrated to a 3% notch at full node and the amplitude response was 1.6" S/P or 100%. Using the full node

calibration, the indication area would be more accurately compared to the 3% notch at the +half node position which is 33% of the standard.

4.2.5 Area (3) The intermediate shell course - six (6) indications were detected by the longitudinal wave testing and charted as shown in figure 1.

4.2.6 Area (8) The nozzle shell course to intermediate shell course weld-No recordable indications were detected by the longitudinal wave or shear wave testing.

4.2.7 Area (6) The nozzle to nozzle shell course welds - Three (3) recordable indications were detected when testing in accordance with Paragraph 3.2.1.2 and charted as shown in Figure 3.

5. Equipment: The equipment used to perform the inspection was as follows:

5.1 Closure Head and Reactor Vessel:

(1) Sperry VM 721 Reflectorscopes - 5N Pulser - Receiver

(2) A Sperry 1-1/8" diameter - 2.25 MH_z - Quartz search unit was used for longitudinal wave inspection.

(3) A Sperry 1" square 45° 1.0 MH_z lithium sulfate search unit was used for shear wave inspection of the inlet outlet nozzles.

(4) A Sperry 1" square 45° 2.25 MH_z lithium sulfate search unit was used for shear wave inspection of all areas except where mentioned above.

(5) Couplant: Hamikleer

6. Testing Technique:

6.1 Closure Head - The inspections were performed from the outside (OD) surface prior to painting. Surface preperation was not required.

6.1.1 The longitudinal inspection was performed by calibrating the instrument on the first back reflection through the base material and the cladding. The back reflection fluctuated as the transducer was moved over the surface. This fluctuation was due to the high and low areas of the cladding on the inside surface. Therefore, the instrument sensitivity was increased to display a minimum 3" sweep to peak back reflection as the transducer was moved over the surface. At this sensitivity setting all signals were marked. To evaluate an indication, the transducer was held stationary adjacent to the indication and the instrument re-adjusted to display a 3" sweep to peak back reflection. The transducer was then placed on the indication and evaluated.

6.1.2 The shear wave inspection was performed by calibrating the instrument to a 3" sweep to peak signal indication on a full node from a 3% notch as shown in figure 4. The head was examined in the circumferential and longitudinal directions.

6.2 Reactor Vessel Shell and Vessel Flange - The inspections were performed from the inside (I.D.) clad surface. The crowns of the weld overlay beads were flat. Valleys existed between the beads.

6.2.1 The longitudinal wave inspection was performed by calibrating the instrument to a 3" minimum sweep to peak back reflection while moving the transducer over the test surface. To evaluate an indication, the transducer was held stationary adjacent to the indication and the instrument re-adjusted to display

a 3" sweep to peak back reflection. The transducer was then placed on the indication and evaluated.

6.2.2 The shear wave inspection was performed by calibrating the instrument to 1.5" sweep to peak minimum with the transducer placed on the full node position on the 3% notch as shown in figure 4.

6.3 Circumferential Weld Seams -

6.3.1 The longitudinal wave inspections on the weld seams were performed from the inside of the vessel. The instrument was calibrated on a 5/16" dia. side drilled hole to 75% at the ¼T distance. The response was then obtained from the 5/16" dia. at the 3/4T depth. A curve was drawn on the cathode ray tube connecting the two points and extended to the total thickness. The calibration block used for this inspection is shown in figure 4.

6.3.2 The shear wave inspections on the weld seams were performed from the inside of the vessel. The instrument was calibrated on a 5/16" dia. side drilled hole. The transducer was posotioned on the test block in the 1/8 node position and the amplitude adjusted to 75% of full screen. The transducer was then positioned on the 3/8, 5/8, and 7/8 node positions and the amplitude marked on the cathode ray tube. The points were then connected and the curve extended to the full thickness. The calibration block used for this inspection is shown in figure 4.

6.4 Reactor Vessel Primary Coolant Nozzles.

6.4.1 The longitudinal wave inspection was performed on the inlet and outlet nozzles by scanning from the inside surface. The instrument was calibrated to a 3" sweep to peak back reflection. In areas where a back reflection could not be obtained

due to non-parallel surfaces, the instrument was calibrated to a 3/8" dia. side drilled hole.

6.4.2 The Shear Wave inspection was performed on the inlet and outlet nozzles by scanning from the inside surface in both the circumferential and longitudinal directions. The instrument was calibrated to a 3% notch on the full node position as shown in figure 5.

6.5 Reactor Vessel Inlet, Outlet and Safety Injection Nozzles -

6.5.1 The longitudinal wave inspection was performed on the inlet and outlet nozzles weldments by calibrating the instrument to a 5/16" dia. side drilled hole in accordance with B&W Specifications S-102-Z. Rev. 3.

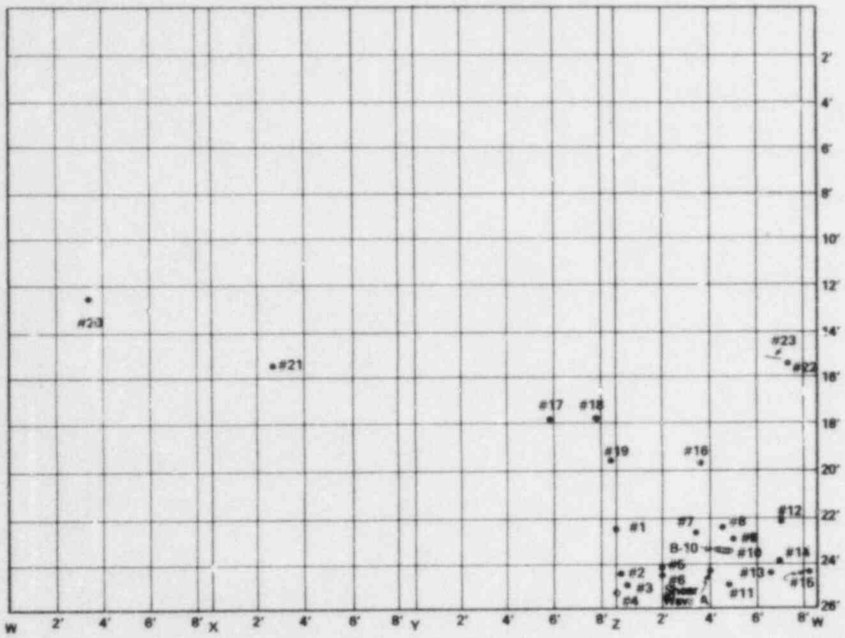
6.5.2 The Shear Wave inspection was performed on the inlet and outlet nozzle weldments by calibrating the instrument to a 5/16" dia. side drilled hole as specified in S-102-Z Rev. 3.

6.5.3 The Longitudinal Wave inspection was performed on the safety injection nozzle weldments by calibrating the instruments to a 5/16" dia. side drilled hole as specified in S-102-Z Rev. 3.

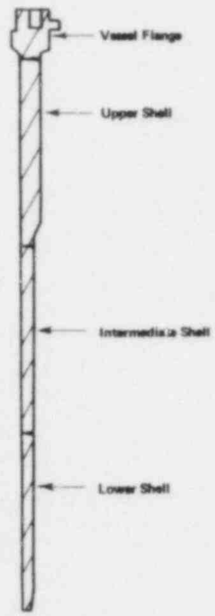
6.5.4 The Shear Wave inspection was performed on the safety injection nozzle weldments by calibrating the instrument to a 5/16" dia. side drilled hole as specified in S-102-Z Rev. 3.

Glenn A. Walton

GAW/jak



Scale 1/4" = 1'

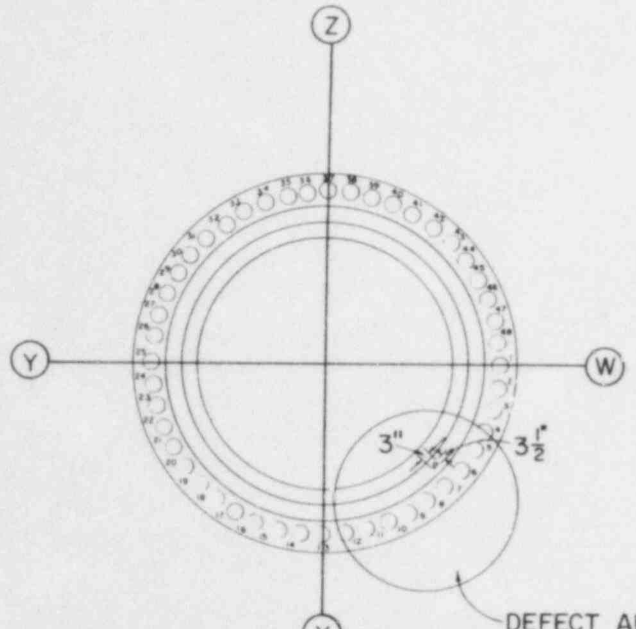


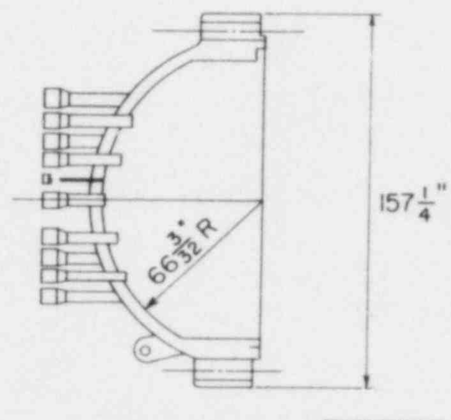
Ind. No.	Size	Depth From Inside	Ind.	Back Reflection Reduction	
1	1" X 7/8"	3-1/8"	40% S/P	50%	
2	1" X 5/8"	3-7/8"	80% "	60%	
3	3/4" X 1/2"	3"	70% "	50%	
4	1/2" X 1/2"	4"	70% "	65%	
5	1/2" X 1/2"	3"	60% "	70%	
6	1" X 1/2"	3-1/2"	35% "	90%	
7	1/2" X 1/2"	3"	30% "	80%	
8	1/4" X 1/2"	3-1/2"	10% "	70%	
9	1" X 1/2"	3-1/2"	10% "	80%	
10	6" X 1-1/4"	3-1/2"	30% "	85-100%	
11	1/4" X 1/4"	3-1/2"	30% "	70%	
12	1/2" X 1/2"	3-1/2"	10% "	75%	
13	1" X 1/2"	3-1/2"	56% "	80%	
14	3/4" X 1/2"	3-1/2"	40% "	80%	
15	1/2" X 1/2"	3-1/2"	25% "	90%	
16	1/2" X 1/2"	2"	50% "	80%	
17	1/2" X 1/2"	4"	40% "	90%	
18	1/2" X 1/2"	4"	30% "	90%	
19	1/2" X 1/2"	4"	20% "	90%	
20	1/2" X 1/2"	2-1/2"	20% "	60%	
21	3/4" X 3/4"	4"	25% "	75%	
22	1" X 1"	4"	80% "	80%	
23	9" X 1/2"	4"	20-80%	75-100%	
A	5/8"	3-1/2"	56% "		Shear Wave
B-10	1-1/2"	3-1/2"	33% "		Shear Wave

COPY -
Prepared by Southwest Research Institute

DWN BY CHKD BY EXAM BY APPD BY DATE	BABCOCK & WILCOX COMPANY NEW YORK, NEW YORK		
APPROVED BY	CODE INDENT NO.	SIZE	DRAWING NO. / REV
	SCALE	WT	SECT

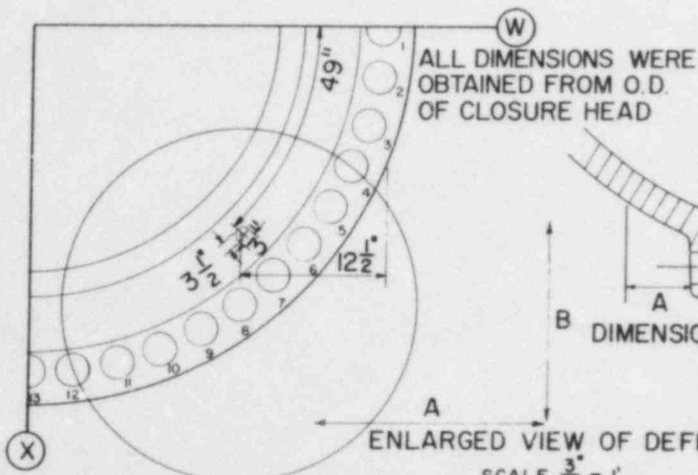
FIGURE 1
REPORTABLE INDICATIONS ON THE REACTOR VESSEL

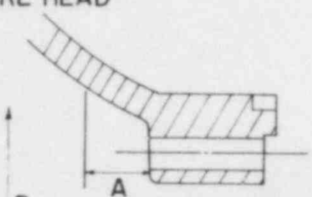




SECTION A-A

NO.	IND.	B.R.R.	DEPTH	A DIM	B DIM
1	30-100%	40-100%	3"	$12\frac{1}{2}$"	49"





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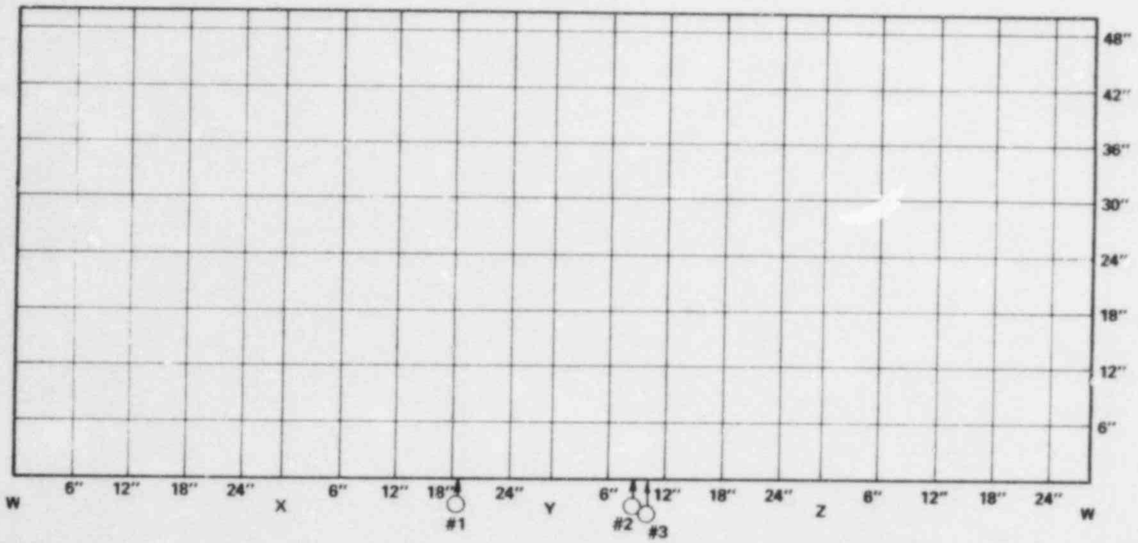
ENLARGED VIEW OF DEFECT AREA
SCALE $\frac{3}{4}$" = 1'

FIGURE 2

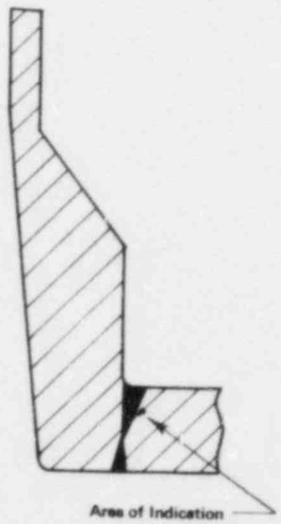
DWN BY CHKD BY EXAM BY APPD BY DATE	BABCOCK & WILCOX COMPANY NEW YORK, NEW YORK
APPROVED BY	CODE INDENT NO. / SIZE / DRAWING NO. / REV SCALE / WT / SECT

REPORTABLE INDICATIONS ON THE CLOSURE HEAD ASSEMBLY

Ind. No.	Amp.	Depth
1	110%	4"
2	50%	4"
3	50%	4"



INLET NOZZLE W-Z
Scale 1" = 12"



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BABCOCK & WILCOX COMPANY
NEW YORK, NEW YORK

DWN BY
CHKD BY
EXAM BY
APPD BY
DATE
APPROVED BY

CODE INDENT NO.	SIZE	DRAWING NO.	REV
SCALE	WT	SECT	

FIGURE 3

REPORTABLE INDICATIONS ON THE INLET NOZZLE

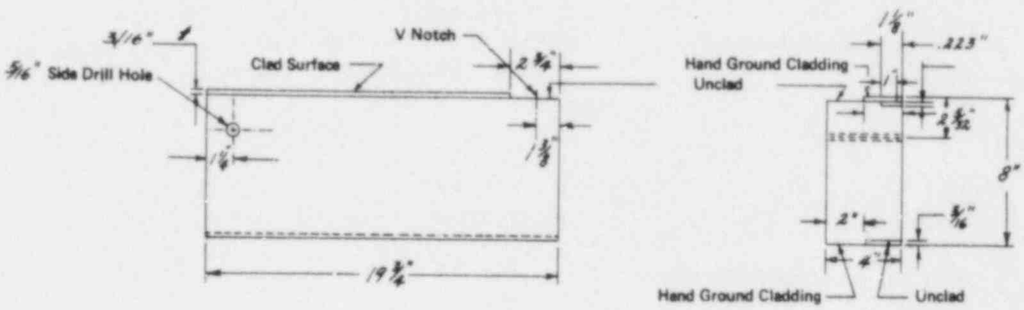
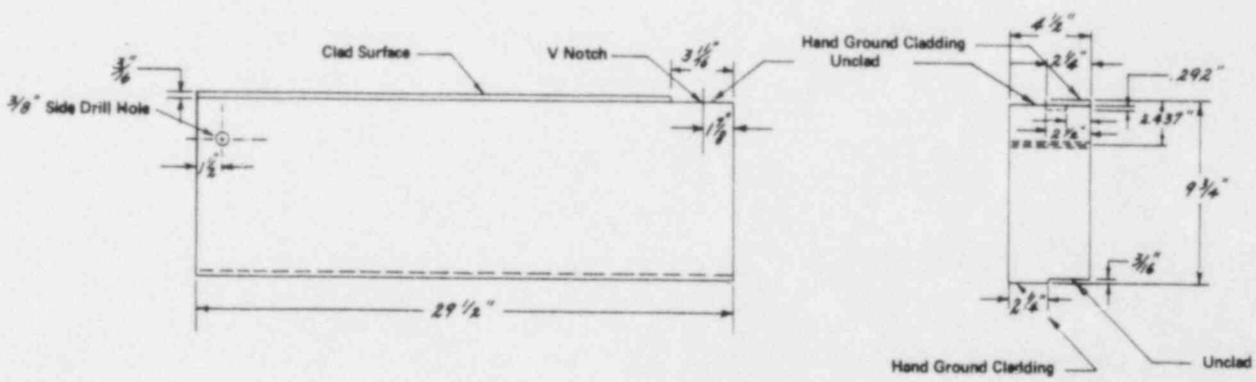


FIGURE 4

ULTRASONIC CALIBRATION BLOCK



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DWN BY CHKD BY EXAM BY APPD BY DATE	BABCOCK & WILCOX COMPANY NEW YORK, NEW YORK			
APPROVED BY	CODE INDENT NO.	SIZE	DRAWING NO.	REV
	SCALE	WT	SECT	

FIGURE 5

ULTRASONIC CALIBRATION BLOCK

APPENDIX XII

TRIP REPORT,
E. T. HUGHES, WESTINGHOUSE ELECTRIC CORPORATION,
MARCH 20, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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TRIP REPORT
WESTINGHOUSE FORM 31306B

NOTE:

1. Significant technical information and all classified information should be prepared as a WCAP report and referenced in the Summary.
2. Do not include any information in the Trip Report that will cause it to be classified.

AUTHOR E. T. Hughes
DATE OF REPORT March 20, 1969
FILE NO.

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	( )	J. S. Moore	

☐ SOCIETY MEETING	TRIP TO (NAME OF COMPANY AND/OR PERSON VISITED): Point Beach #1 Site (WEP)	SHOP ORDER NO.: WEP-105
☐ INSPECTION TRIP	LOCATED AT (FULL ADDRESS): Wisconsin	NEGOTIATION NO.:
☐ SALES NEGOTIATION	SUBJECT: Non-destructive Evaluation of Point Beach #1 (WEP) Reactor Vessel	CONTRACT NO.:
☐ CONTRACT		BUDGET NO.: XARP-90359
☐	DATE(S) OF MEETING: March 8, 9, 10, 11, 1969	PURCHASE ORDER NO.:

PERSONS PRESENT

ATOMIC POWER DIVISION	OTHER WESTINGHOUSE	OTHER THAN WESTINGHOUSE
R. Pearsall	H. Hickman - Site	J. D. Furry - B&W
J. Steele	J. McKeown - Site	C. Davidson - B&W
E. Hughes		W. Good - B&W

SUMMARY:

The results of the non-destructive evaluation conducted on the designated areas (sections) of the Point Beach #1 (WEP) reactor vessel indicate that no damage, other than that visually evident, was sustained by the vessel as a result of the transportation incident.

☐ ATTACHMENTS

☐ TECHNICAL REPORT PREPARED. WCAP-

APPROVED (SUPERVISOR): W. S. Hazelton W.S. Hazelton

AUTHOR (SIGNATURE): E. T. Hughes -- E. Hughes

ORGANIZATION: ATOMIC POWER DIVISION

PROJECT/SECTION/GROUP: Plant Materials Engineering

On March 8, 9, 10 and 11, 1969, the Point Beach #1 site was visited for the purpose of non-destructively examining (primarily ultrasonic testing) the reactor vessel (WEP) sections and components most likely to have been affected by the incident that occurred February 22, 1969 while transporting the reactor vessel to the site. The non-destructive testing conducted on the indicated portions of the subject vessel was performed by B&W personnel under my technical supervision. The B&W procedures listed in Table I were used as the basis for all of the non-destructive testing performed.

In all cases, the components and/or sections to be ultrasonically examined were scanned critically using the beam directions and modes most likely to detect damage resulting from the accidental forces applied, e.g. the interface (fusion zone) between safe end buildup and nozzle base metal was examined ultrasonically from the I.D. surface of the nozzle using an angled shear wave technique, and from the end face of the weld metal buildup using the longitudinal mode, to indicate possible damage resulting from the shear and bending forces applied to the ends of the nozzles.

The portions of the vessel selected for critical evaluation and the applicable combinations of ultrasonic, magnetic particle, liquid penetrant and visual non-destructive test methods used in each case were as follows:

1. W-Z (Vessel Axes) Inlet Nozzle including base metal, safe end weld metal (stainless) buildup, cladding, nozzle to shell weld and 9" annulus of vessel wall around nozzle to shell weld--ultrasonic, magnetic particle on the O.D. and liquid penetrant on selected areas.

2. W-X Outlet Nozzle including base metal, safe end weld metal buildup, cladding, nozzle to shell weld and 9" annulus of vessel wall around nozzle to shell weld--ultrasonic, magnetic particle on the O.D. and liquid penetrant on selected areas.

3. X-Y Inlet Nozzle abraded area only on the O.D. surface of heavy section of the nozzle--magnetic particle and ultrasonic from tapered section O.D. of the nozzle.

4. Nozzle shell course to intermediate shell course weld--180°, Z-W-X (vessel axes) segment--ultrasonic (shear 45°) in six directions from O.D., magnetic particle from O.D.

5. Intermediate shell course to lower shell course weld--180°, Z-W-X segment--ultrasonic (shear 45°) in six directions from O.D. and magnetic particle from O.D.

6. Intermediate shell axial seam weld--ultrasonic (shear 45°) in six directions from O.D. and magnetic particle from O.D.

7. Lower shell axial seam weld--ultrasonic (shear 45°) in six directions from O.D. and magnetic particle from O.D.

8. Abraded area, lower shell course to bottom head transition section weld--ultrasonic (shear 45°) in three directions from O.D. on lower shell course side of weld and magnetic particle from O.D.

9. Instrumentation nozzle I.D. welds--9, random selections; liquid penetrant, I.D. surface.

Primary Coolant Nozzles (Ultrasonic Examination)

The inlet and outlet nozzles, items 1 and 2 above, were ultrasonically examined using shear and longitudinal mode contact techniques from the I.D. surfaces of the nozzle and the reactor vessel as shown in the sketch attached as Figure 1. The nominally 45°, shear wave testing was conducted from the I.D. surfaces of both primary coolant nozzles at 1.0 Mhz using search units (wedges) ground to fit the curvatures involved. The couplant (Hamikleer) was kept cold to increase the viscosity and thereby increase the continuity of the coupling. The distance corrected tuning levels for the shear wave testing were established, based on the thickness to be examined, on clad reference blocks* containing 3/8 inch diameter and 5/16 inch diameter side drilled reference holes. B&W S-204C was used as the referenced procedure instead of S-204B for examining the nozzle forgings; the "B" procedure requires notches for calibration which are not permitted in finished vessels. The 100% DAC reference line, and a 20% DAC recording line were drawn on the CRT as specified in B&W procedure S-204C; all indications exceeding 10% of reference to be investigated to determine the maximum amplitude attainable. It should be pointed out that the tuning level was established on the reference block prior to contouring the search unit to fit the I.D. of the nozzles and then rechecked following the shaping of the search unit wedge; no significant (less than 10%) change in tuning level was noted. The basic shear mode scanning, as shown in Figure 1, was conducted axially, i.e. with the sound beam directed toward the open (outer) end of the nozzles. Shear wave (approximately 45°) scanning from the I.D. of the nozzles in the circumferential and axial (toward the inner end of the nozzles) directions was conducted on the outer end (6 inches) of the subject nozzles in the quadrants exhibiting the most surface damage.

Two directional longitudinal mode testing at 2-1/4 Mhz was conducted on the (items 1 and 2) nozzles, nozzle to shell welds and the vessel wall in the immediate vicinity of the nozzles as shown in Figure 1. The distance corrected tuning levels for the longitudinal mode testing were established in accordance with

*The same blocks used in the original ultrasonic mapping of the subject vessel by the vessel fabricator.

B&W procedure S102-Z on the 3/8 inch diameter side drilled hole in the clad portion of the reference block described earlier. The tuning level for the testing from the O.D. of the vessel wall was established, using the same reference hole, on an unclad portion of the reference block. Comparison of the back reflections obtained on the reference block and the wall of the vessel were approximately equal, indicating equivalent sensitivity levels in the block and vessel wall. The required 100% DAC reference line was drawn on the CRT screen along with a 20% of reference reporting level line. As in the shear wave testing, all indications exceeding 10% of reference were required to be investigated to determine the maximum aplitude attainable. In the longitudinal wave testing conducted from the I.D. surfaces of the nozzles and vessel, the cladding bond quality was also determined. Longitudinal mode testing on a spot check basis (surfaces were too rough to do otherwise) was conducted from the end faces of the safe end weld buildup. The test frequency was 2-1/4 Mhz and the tuning level the same as that established for testing radially from the I.D. surface of the nozzle.

The ultrasonic testing of the subject nozzles, safe ends, welds and vessel wall revealed only three discrete indications of reportable (20% and greater) amplitude. The three indications were found in the W-Z inlet nozzle to shell weld at the interface between the weld and base metal of the vessel wall. Assuming the top (top of vessel) of the nozzle to be 12:00 o'clock and viewing the nozzle from inside the vessel, one of the indications was found at the 1:00 o'clock position, the other two in the 9:30-10:00 o'clock position. The 1:00 o'clock indication was ascertained to be approximately 100% in amplitude, the two others about 40% in amplitude. Examination of the report of the original ultrasonic mapping of the vessel indicated that the three indications found were most likely the same ones reported in the original mapping; no increase in size or extent was indicated. The three indications were listed in the mapping report as 110%, 50% and 50% in amplitude.

Shell Welds (Ultrasonic Examination)

The ultrasonic examination of the circumferential and axial seam welds, items 4, 5, 6, 7 and 8, was conducted from the O.D. surface of the vessel because of the increased detectability afforded by the better surface available. The testing was performed in general accordance with the appropriate B&W procedure (S-204C) in the manner shown in Figure 2, attached. The testing, as indicated in Figure 2, was conducted at 1.0 Mhz in the shear wave mode at an angle (approximate) of 45° at a distance corrected tuning level established on the 5/16" diameter side drilled reference hole in the unclad portion of the reference block used; the recording level was set at 20% of reference. The circumferential seams were scanned (100% volumetrically) in a critical manner, because of the accidental bending moments applied, over

a distance of approximately 1-1/3T on both sides of the weld with the sound beam directed 90° to the weld axis and in a less critical manner along the weld in two directions on both sides of the weld with the sound beam directed at an angle of 15° to the weld axis. The abraded length (36 inches) of the lower shell course to bottom head transition section weld was examined in the same manner from the lower shell course side of the weld only. Surface roughness and the contour of the transition section precluded testing from the opposite side of the weld.

The axial seam welds were examined in the same manner, i.e. in six directions from the O.D. surface of the vessel, and at the same tuning level as the circumferential seams except that the more critical examination, because of the bending moment applied, was performed with the sound beam directed along (15° to the weld axis) the welds instead of across (90°) as in the circumferential seams.

No reportable, i.e. equal to and/or exceeding 20% of the reference, indications were noted in the examination of the circumferential and axial seam welds. Four discrete indications, 15% of reference amplitude, produced by discontinuities in the weld metal-cladding interface were found in the flange to intermediate shell weld generally in line with the W-X outlet nozzle. These indications were detected from the intermediate shell course side of the weld only. One indication of 15% amplitude, similar in character to the four previously noted, was found in the intermediate shell course to lower shell course weld approximately 9 inches off (toward the W axis) the Z axis of the vessel.

X-Y Inlet Nozzle (Ultrasonic Examination)

The abraded area on the O.D. of the X-Y inlet nozzle, item 3, was ultrasonically examined using angled shear wave techniques from the tapered O.D. surface of the nozzle. A test frequency of 2-1/4 Mhz referenced to the 5/16 inch diameter side drilled hole in the unclad portion of the reference block was used to examine the nozzle area in question. No indications of discontinuities were found.

Magnetic Particle Examination*

Magnetic particle examination performed in accordance with B&W procedures S-102T and S-11 on the designated areas, items 1, 2, 3, 4, 5, 6, 7 and 8, of the vessel revealed no indications.

Dye Penetrant Examination*

Dye penetrant inspection of the I.D. instrumentation nozzle welds, item 9

*For details of magnetic particle and liquid penetrant examinations see PWR Quality Assurance Report "L. Isbille Trip Report #   ."

and the safe end areas of the W-Z and W-X primary coolant nozzles, items 1 and 2, revealed no indications of damage other than that visibly noted on the safe end weld preps.

Summary

The 100% volumetric ultrasonic examination of the designated portions of the Point Beach #1 reactor vessel did not reveal any discontinuity indications, other than those reported by the vessel vendor in the ultrasonic mapping conducted on the vessel, equal to or exceeding the 20% reporting level set for the testing. Five indications, four in the cladding base (weld) metal interface of the flange to intermediate shell weld, one in the same location (cladding-base (weld) metal interface) in the intermediate shell--lower shell weld, were found in the 180° segments of the circumferential seam welds examined. All five indications were 15% of reference amplitude and smaller. All of the discontinuities indicated by the ultrasonic testing performed were characterized as discrete, i.e. having little, if any, measureable extent in any dimension, well defined and isolated with respect to others in the immediate vicinity and definitely not crack-like.

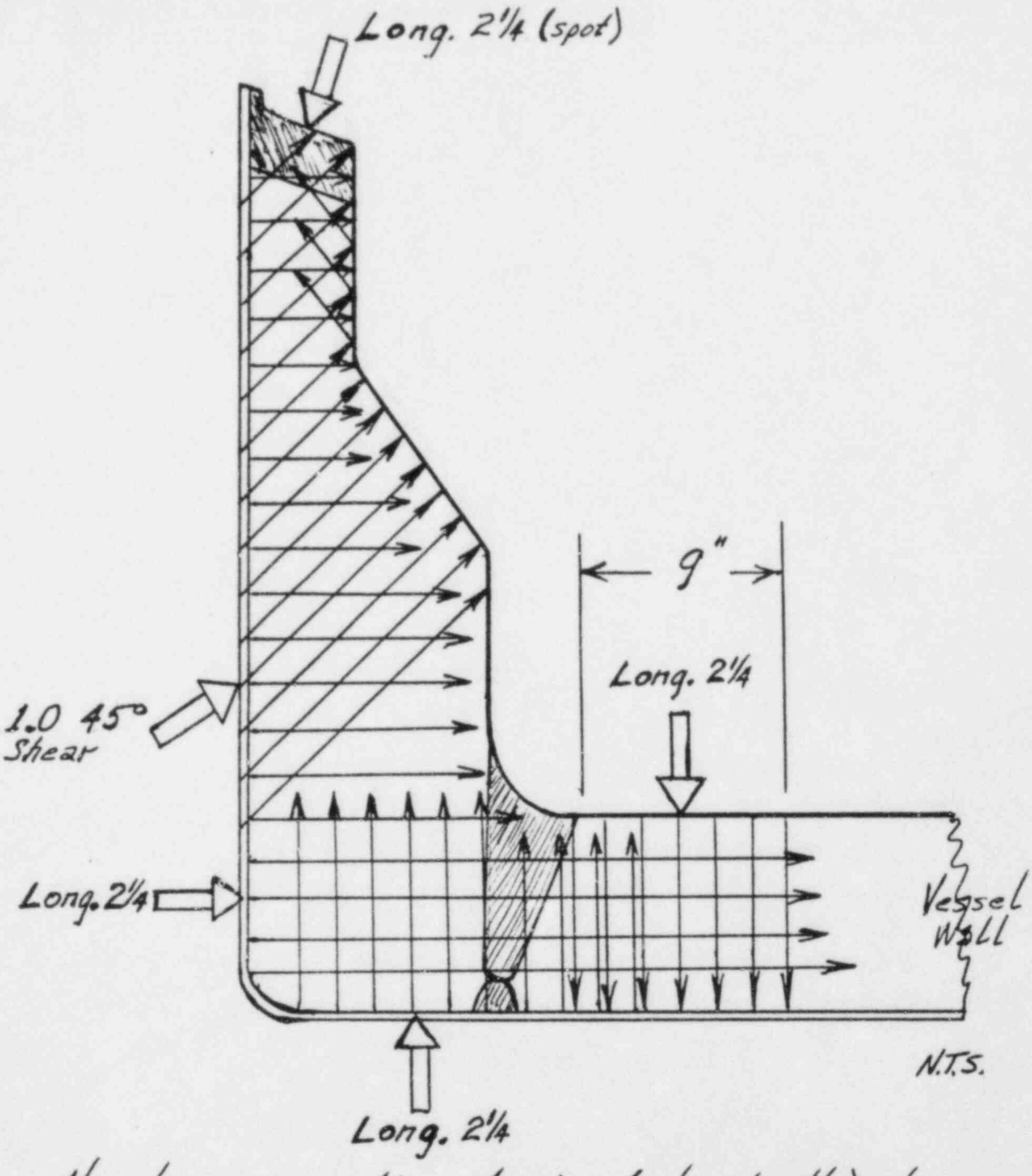
No magnetic particle and liquid penetrant indications were found in the areas examined.

In my opinion, based upon the results obtained in the non-destructive evaluation performed on the designated areas of the Point Beach #1 reactor vessel, no damage other than that visibly noted, was sustained by those portions of the vessel examined as a result of the transportation incident.

TABLE I *

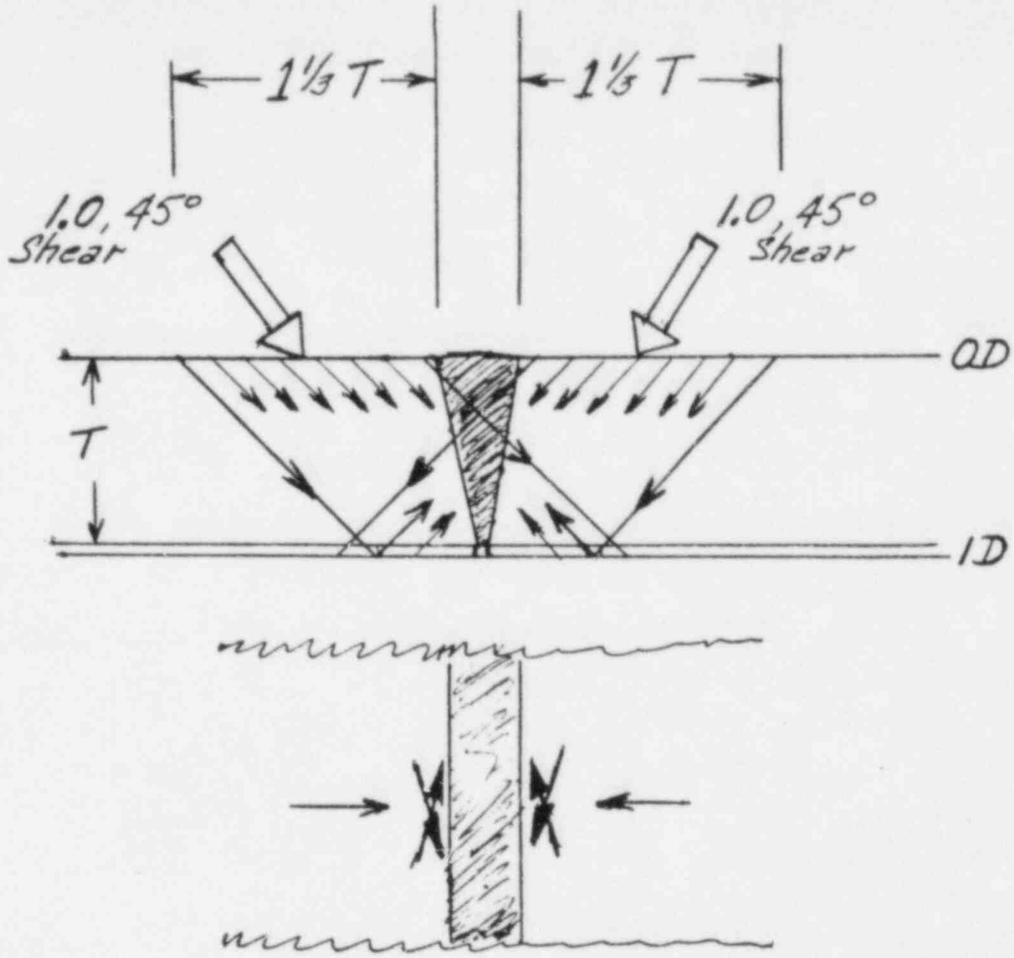
Issue	Title	Spec. No.
10/4/67	Requirements for Final Non-destructive Testing of Class "A" Nuclear Vessels Built in Accordance with ASME Code	S-204
2/16/68	Ultrasonic Inspection of Plate by Straight Beam and Angle Beam	S-204-A
2/19/68	Ultrasonic Inspection of Ring and Hollow Forgings by Longitudinal (normal) and Shear Wave (angle) Beams	S-204-B
3/19/68	Ultrasonic Inspection of Circumferential and Longitudinal Weld Seams Joining Similar Materials	S-204-C
9/14/67	Ultrasonic Inspection of Full Penetration Nozzle Welds of Similar Materials	S-102Z
4/13/66	Ultrasonic Inspection for Bond of Weld Metal Overlay Cladding	UT-66
7/18/66	Magnetic Particle Inspection and Acceptance Standards - Base Materials	S-102T
5/22/61	Magnetic Particle Inspection - Welds	S-11
5/24/61	Dye Penetrant Inspection	S-10
5/16/66	Dye Penetrant Inspection and Acceptance Standards for Base Materials	S-102R

* All Babcock & Wilcox Company Specifications and Procedures referenced throughout this report are contained in Appendix X, Volume II.



Nozzle cross section showing (schematically) the mode, test frequency, test direction, extent of testing and the test surfaces used in the contact ultrasonic testing performed on the W-Z and W-X nozzles of the WEP vessel.

Figure 1



Weld cross sections showing, schematically, the mode, test frequency, test directions, extent of testing and the test surfaces used in the contact ultrasonic testing of the circumferential and axial seam welds in the WEP reactor vessel.

Figure 2

BOX 254-2   5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

AREA 1" X 7" ON LARGE OD [illegible]
SURFACE OF INLET NOZZLE
BETWEEN X & Y AXIS WHERE
SAID FLANGE WAS DISTORTED BY
STRIKING NOZZLE
INSTRUMENT - SPERRY UM 721
SEARCH UNIT - 2.25 MHz [illegible] BarT.
1 MHz - 1" [illegible]

[illegible]

AREA AFFECTED [illegible] ONE BASE
MAT'L THICKNESS. TESTED IN ACC[illegible]
WITH B & W SPEC. [illegible]

INSPECTORS
[illegible]
[illegible]

4. RESULTS: $\boxed{\text{ACCEPT}}$ REJECT   UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
[illegible]	[illegible]	[illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible] (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
[illegible] 3-12-69		N 40363

QCD 254-107A

RDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

[illegible] WIDE RING [illegible]
INLET & OUTLET [illegible]
[illegible]
[illegible] FORGING
[illegible] TANK
INST. - SPERRY UM721
SEARCH UNIT - [illegible] MHz [illegible]
COUPLANT - HAMIKLEER
[illegible] MAT'L TESTED IN ACCORDANCE
WITH B&W SPEC. S-204A REV. 1

INSPECTORS:
C.E. DAVIDSON
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE		CONTRACT
1179CC	SEE ABOVE		610-0115-51-18
CUST. INSP.		HSB INSP.	GOVT. INSP.
F. HUGHES (?)			
B & W INSP. - DATE - SHIFT - SHOP		RECORDED	
[illegible] 3-[illegible]-69			N 40649

QCD 26-107A

RDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

TWO LONGITUDINAL WELD SEAMS
PLUS ONE BASE MATERIAL THICKNESS
IN THE CYLINDRICAL SECTION OF
THE VESSEL (6⅞ THK) TESTED
IN ACCORDANCE WITH B&W SPEC.
S-204C REV. 1
INSTRUMENT - SPERRY UM721
SEARCH UNITS - 2.25 MHz 1⅛" DIA. BAR.T.
1 MHz - 1" SQ - LITH. S.

COUPLANT - HAMIKLEER

INSPECTORS:
C. E. DAVIDSON.
W. GOOD

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE		CONTRACT
1178?E	SEE ABOVE		610-0115-51-18
CUST. INSP.		HSB INSP.	GOVT. INSP.
[illegible] BILL (?)			
B & W INSP. - DATE - SHIFT - SHOP		RECORDED	
J.D. FURDY 3-15-69			N 40660

QCD 26-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

[illegible]
NOZZLE FORGING TO [illegible] WELD
[illegible] MATERIAL THICKNESS
[illegible] SPERRY [illegible]

SEARCH UNIT - [illegible] MHz [illegible]
[illegible]

COUPLANT - HAMIKLEER
[illegible]
AXIS [illegible] IN ACCORDANCE
WITH B&W SPEC. S-204C REV. 1

INSPECTORS:
[illegible] DAWSON
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117917E	SEE ABOVE	[illegible]-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. B. [illegible] [illegible]-69		11 46350

QCD 2E4-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

[illegible] FOOT DIAMETER CIRCLE [illegible]
ABOUT IMPACT POINT LOCATED ON
THE [illegible] AXIS OF [illegible] IN THE ZONE
OF LOWER HEAD TO SHELL WELDS.

INST. - SPERRY UM 721

SEARCH UNIT - 2.25 MHz [illegible] T
1 MHz - [illegible] - LITH 5

COUPLANT - HAMIKLEER
CIRCLE PLUS ONE BASE MATERIAL
THICKNESS TESTED IN ACCORDANCE
WITH B&W SPEC. S-204A REV. 1

INSPECTORS:
[illegible] DAWSON
W. GOOD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117917E	SEE ABOVE	[illegible]-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. B. CURRY [illegible]-69		11 46352

QCD 2E4-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z [illegible] AXE.

OUTLET NOZZLE BETWEEN [illegible] AXE

INST - [illegible]

SEARCH UNITS - [illegible] MH_Z [illegible] LITH.S.

[illegible] MH_Z [illegible] 1/2 DIA. CAR.TR.

COUPLANT - HAMIKLEER

NOZZLE FORGING MAT'L TESTED IN

ACCORDANCE WITH [illegible]

INSPECTORS: [illegible]

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
[illegible]	12 13	[illegible] 51-17
CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible] (W)		
B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.D.FURRY 3-7-69		40846

QCD 264-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

CIRCUMFERENTIAL WELD [illegible] VESSEL BETWEEN TWO CYLINDRICAL SHELL COURSES PLUS ONE BASE MATERIAL THICKNESS.

INST. - SPERRY UM 721

SEARCH UNIT - 2.25 MH_Z [illegible] - 1 1/8 DIA. PART

1 MH_Z - [illegible] - LITH.S.

COUPLANT - HAMIKLEER

[illegible] OF WELD TESTED [illegible] IN BOTH DIRECTIONS

AXIAL [illegible] IN ACCORDANCE WITH B&W [illegible] REV.1

INSPECTORS:
[illegible] DAVIDSON
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117817E	[illegible]	610-0115-51-18
CUST. INSP.	HSB INSP.	GOVT. INSP.
L. HUGHES (W)		
B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.D. FURRY 3-10-69		40[illegible]

QCD 264-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

WELD METAL OVERLAY CLADDING [illegible] BORE OF INLET AND OUTLET NOZZLES [illegible] $W\frac{1}{4}X$ AXES [illegible] FOR A DISTANCE OF 12" [illegible] WELD PREP [illegible] END

INSTRUMENT - SPERRY UM721

SEARCH UNIT - 2.25 MHZ - 1⅛ DIA [illegible] LONG.

COUPLANT - HAMIKLEER

WELD OVERLAY CLADDING, INSIDE NOZZLE BORES [illegible] TESTED FOR BOND IN ACCORDANCE WITH B&W SPEC. UT-66 REV. 2

INSPECTORS:
C.E. DAVIDSON - W. GOOD

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117817E	SEE ABOVE	610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FORRY 5-11-67		N 48654

QCD 2E4-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

[illegible] AREA CLADDING EXTENDING RADIALLY 10" FROM INSIDE BORE OF INLET AND OUTLET NOZZLES BETWEEN $W\frac{1}{4}Z$ AND $W\frac{1}{4}X$ AXES RESPECTIVELY

INSTRUMENT - SPERRY UM721

SEARCH UNIT - 2.25 MHZ - 1⅛ DIA BAR. T. LONG.

COUPLANT - HAMIKLEER

WELD OVERLAY CLADDING, TESTED FOR BOND IN ACCORDANCE WITH B&W SPEC. UT-66 REV. 2

INSPECTORS:
C.E. DAVIDSON
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117817E	SEE ABOVE	610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FORRY 5-11-67		N 48653

QCD 2E4-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z 4 1/4 & 4-E [illegible] TO SHELL

OUTLET NOZZLE BETWEEN W 1/2 X AND [illegible] TO SHELL

INST. — [illegible]

SEARCH UNIT — [illegible] MHz [illegible] 1 1/2 [illegible]

COUPLANT — [illegible]

[illegible]

[illegible] SPEC [illegible]-10 [illegible] REV 3

INSPECTORS:
[illegible]
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
[illegible]	[illegible]	[illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.D. FERRY [illegible]		11 40647

QCD 254-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION:

WELD METAL OVERLAY SAFE END AND BUTTERING OF INLET & OUTLET NOZZLES BETWEEN W 1/2 Z AND W 1/4 X AXES RESPECTIVELY.

INSTRUMENT — SPERRY UM 721

SEARCH UNIT — 2.25 MHz 1 1/2 [illegible] BAR.T

COUPLANT — HAMIKLEER

WELD METAL OVERLAY SAFE END BUTTERING TESTED FOR BOND IN ACCORDANCE WITH B&W SPEC. UT-66 REV 2

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117172E	[illegible] ABOVE	610-[illegible]-CP18

CUST. INSP.	HSB INSP.	GOVT. INSP.
E. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
T. D. FURRY [illegible]		11 40655

QCD 254-107A

APPENDIX XIII

TRIP REPORT, L. K. ISBILL, WESTINGHOUSE ELECTRIC CORPORATION, MARCH 16, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

Table of Contents

TRIP REPORT
[illegible] FORM 3150GB

XIII-2

NOTE:

1. Significant technical information and all classified information should be prepared as a WCAP report and referenced in the Summary.

2. Do not include any information in the Trip Report that will cause it to be classified.

AUTHOR L. K. Isbill

DATE OF REPORT March 16, 1969

FILE NO. QCV-TR-358

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	( )		QC (2)

[ ] SOCIETY MEETING	TRIP TO (NAME OF COMPANY AND/OR PERSON VISITED): WEP Site	SHOP ORDER NO.: XARP-90359
[X] INSPECTION TRIP	LOCATED AT (FULL ADDRESS): Two Creeks, Wisconsin	NEGOTIATION NO.:
[ ] SALES NEGOTIATION	SUBJECT: Witness non-destructive testing on reactor vessel unit #1	CONTRACT NO.:
[ ] CONTRACT		BUDGET NO.:
[ ]	DATE(S) OF MEETING: March 11, 12, 13, 1969	PURCHASE ORDER NO.: 54-Q-100235

PERSONS PRESENT

ATOMIC POWER DIVISION	OTHER WESTINGHOUSE	OTHER THAN WESTINGHOUSE
L. K. Isbill	W. Henderson - Project Manager	J. Furry - B&W QC Engineer
	H. Hickman - Oper. Manager	C. Davidson - B&W NDT Tech.
	J. Steele - QA Manager	W. Good - B&W NDT Tech.
	A. Garrett - QC Engineer	
	L. Bell - Mach. Engineer	

SUMMARY:

The purpose of this visit to WEP Site was to witness additional non-destructive testing on unit no. 1 reactor vessel as a result of field accident.

The testing was done in accordance with procedures and specifications approved by W Engineering on March 8, 1969. See attached sheets.

All the tests except one were accepted by B & W Quality Control.

The one reject was dye penetrant inspection on the inlet and outlet nozzles which were in the damaged areas. The rejected indications are at the land on the .055" weld preparation. A repair procedure is to be submitted to W for approval before work is started on these areas.

The author concurred with B & W's interpretation of this test and approved these tests. Attached are sheets giving the outline and description of each test with results.

[ ] ATTACHMENTS

[ ] TECHNICAL REPORT PREPARED. WCAP---

APPROVED (SUPERVISOR): N. T. Dressel, Manager

AUTHOR (SIGNATURE): L. K. Isbill

ORGANIZATION: ATOMIC POWER DIVISION

PROJECT/SECTION/GROUP: QUALITY ASSURANCE/PRESSURE VESSELS

BDS 1243-3

QUALITY CONTROL INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO

TICKET H-40664

CUSTOMER	W[illegible] A.P.D.	JOB. NO.	61[illegible]-0115-[illegible]
SUBJECT	IN[illegible]UMENTATION NOZZLE TO VESSEL ATTACH [illegible] [illegible] [illegible] D	DWG. NO.	1173[illegible] MKR
		BY	J.D. [illegible]
		DATE	[illegible]

3/12
Inspection

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION LIQ PENETRANT
3. DESCRIPTION:

INLET AND OUTLET NOZZLES BETWEEN Z & W AND W & X AXES RESPECTIVELY TESTED IN ACCORDANCE WITH B & W SPEC. S-10 REV. 5

NON-WATER WASHABLE MATERIALS APPROVED FOR USE.
CLEANER — MAGNAFLUX CORP.
DYE — — MAGNAFLUX CORP.
DEVELOPER — MAGNAFLUX CORP.

INSPECTORS:
C. E. DAVIDSON
W. GOOD

UNIT #1

4. RESULTS: ACCEPT - REJECT [illegible] DAMAGE TO .035" WELD PREPARATION

DWG. NO.	MK. NO. OR USE	CONTRACT
[illegible]	[illegible]	610-0115-[illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
[illegible]		H 40667

QCD 2E+10/A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION LIQ. PENETRANT
3. DESCRIPTION:

NINE INSTRUMENTATION NOZZLES TO VESSEL ATTACH WELDS [illegible] IN ACCORDANCE WITH B & W SPEC. S-10 R REV. 1

NON-WATER WASHABLE MATERIALS APPROVED FOR USE.
CLEANER — MAGNAFLUX CORP.
DYE — — MAGNAFLUX CORP.
DEVELOPER — MAGNAFLUX CORP.

INSPECTORS:
C. E. DAVIDSON
W. GOOD

SEE SKETCH FOR LOCATION.

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117793E	SEE ABOVE	610-0115-51-17

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible] ISBELL		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
T. D. PERRY 3-15-69		H 40668

QCD 2E+10/A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

TWO LONGITUDINAL WELD SEAMS PLUS THE BASE MATERIAL THICKNESS IN THE CYLINDRICAL SECTION OF [illegible] (6 ½ THK) TESTED IN ACCORDANCE WITH B&W SPEC S-102B REV. 6

AC YOKE
DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
215178 E	SEE ABOVE	610-0115-51-17

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. J. GILL (V)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FURRY 3-19-67		40665

QCD 254-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXES
WELD - NOZZLE TO SHELL
OUTLET NOZZLE BETWEEN W & X AXES
WELD - NOZZLE TO SHELL

INSPECTED ENTIRE WELD OUTSIDE SURFACE IN ACCORDANCE WITH B&W SPEC. S-102B REV.6

AC- YOKE
DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
113580 E 117235 E	12 & 13	610-0115-51-16

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. J. GILL (V)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FURRY 3-12-67		40657

QCD 254-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXE
OUTLET NOZZLE BETWEEN W & X AXES

INSPECTED [illegible] SURFACE
OF ENTIRE NOZZLE FORGED
MAT'L IN ACCORDANCE WITH
B&W SPEC. [illegible]-102T REV 5

[illegible] - YOKE
[illegible]

INSPECTORS:
G. E. DAVIDSON
W. GOLD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117502E	12 & 13	610-0115-51-18
CUST. INSP. L. L. BILL (W)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J. D. FURRY 3-12-67	RECORDED	H 40656

QCD 264-107A

BDX 254-2

5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG PARTICLE
3. DESCRIPTION:

1" WIDE RING ENCOMPASSING
INLET & OUTLET NOZZLES BETWEEN
Z & W AND W & X AXES RESPECTIVELY
THIS RING IS A PORTION OF SHELL
FORGING 9 INCHES THK.

FORGED MAT'L INSPECTED IN ACCORDANCE
WITH B&W SPEC. S-102T REV.5

AC - YOKE
DRY POWDER - RED

INSPECTORS:
G.E. DAVIDSON
W. GOLD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117502E	SEE ABOVE	610-0115-51-18
CUST. INSP. L. L. BILL (W)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J. D. FURRY 3-12-67	RECORDED	H 40653

QCD 264-107A

BDX 254-2 5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

CIRCUMFERENTIAL WELD SEAM OF VESSEL BETWEEN TWO CYLINDRICAL SHELL COURSES PLUS ONE BASE MATERIAL THICKNESS.

OUTSIDE SURFACE 180° OF WELD TESTED - 90° FROM "W" AXIS IN BOTH DIRECTIONS CIRCUMFERENTIALLY IN ACCORDANCE WITH B&W SPEC. S-102B REV.6

AC - YOKE

DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117817E		610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. I. BILL (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.D. FURRY 3-12-69		N 40860

QCD 254-107A

BDX 254-2 5

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

NOZZLE FORGING SHELL COURSE TO SHELL WELD PLUS ONE BASE MATERIAL THICKNESS.

OUTSIDE SURFACE
180° OF WELD TESTED - 90° FROM "W" AXIS IN BOTH DIRECTIONS CIRCUMFERENTIALLY IN ACCORDANCE WITH B&W SPEC. S-102B REV.6

AC - YOKE

DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117817E	SEE ABOVE	610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. I. BILL (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.D. FURRY 3-12-69		N 40859

QCD 254-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

AREA 1'x1' ON [illegible] OD (5½")
[illegible] INLET NOZZLE
BETWEEN X & Y AXIS [illegible]
[illegible] FLANGE WAS [illegible]
[illegible] THE NOZZLE

AREA AFFECTED PLUS [illegible]
BASE MAT'L THICKNESS TESTED
IN ACCORDANCE WITH B&W SPEC.
S-102T REV. 5
AC-YOKE
DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117[illegible]	SEE ABOVE	610-0115-51-18

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. ISBILL (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FURRY 3-13-67		40006

QCD 254-107A

BOX 254-2

5

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAG. PARTICLE
3. DESCRIPTION:

3 FOOT DIAMETER CIRCLE CENTERED
ABOUT IMPACT POINT LOCATED ON
THE W AXIS OF VESSEL IN THE ZONE
OF LOWER HEAD TO SHELL WELDS.

CIRCLE PLUS ONE BASE MAT'L
THICKNESS TESTED IN ACCORDANCE
WITH B&W SPEC. S-102T REV. 5

AC - YOKE
DRY POWDER - RED

INSPECTORS:
C. E. DAVIDSON
W. GOOD

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE	CONTRACT
117-19E	SEE ABOVE	610-0115-51-18

CUST. INSP.	HSB INSP.	GOVT. INSP.
L. ISBILL (W)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J. D. FURRY 3-13-67		40081

QCD 254-107A

APPENDIX XIV

CORRESPONDENCE, FEASIBILITY OF MAGNETIC PARTICLE INSPECTION

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Note: Pages XIV-2 through XIV-5 contain proprietary information and are included in Volume II of this report.

APPENDIX XV

TRIP REPORT, R. D. WYLIE AND R. J. CEPLUCH, SOUTHWEST RESEARCH INSTITUTE, APRIL 15, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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SOUTHWEST RESEARCH INSTITUTE

8500 CULEBRA ROAD SAN ANTONIO, TEXAS 78228

TRIP REPORT
SwRI Project 17-2367-04

TRIP TO: Wisconsin Michigan Power Company
Point Beach Nuclear Plant
Two Rivers, Wisconsin

BY: R. D. Wylie and R. J. Cepluch

DATE: April 15, 1969

PURPOSE OF TRIP: Attend Meeting to Discuss Procedures For Projected Repair of Damaged Point Beach Reactor Vessel #1

PERSONNEL PRESENT:

Wisconsin Michigan Power Company
- C. W. Fay
- W. A. Pollock
- A. L. Karpfinger

Westinghouse Electric Corporation
- R. L. Gifford
- R. Von Osinski
- J. R. Steele
- W. B. Henderson*
- L. J. Bell
- E. M. Reno
- A. W. Garrett
- E. T. Hughes

Babcock and Wilcox Company
- T. A. Anderson
- J. R. Fletcher*
- A. Anderson*

Public Service Commission of State of Wisconsin
- H. E. Galineau
- L. L. Smith
- R. E. Purucker

Boiler Division-Department of Labor State of Wisconsin
J. J. Duffy

Southwest Research Institute
R. D. Wylie
G. Kearney*
R. J. Cepluch

* Attended part-time

Mr. Fay opened the meeting and stated that it had been called by Wisconsin Michigan Power Company to permit all interested parties to review and discuss proposed repair procedures and express their views and, hopefully, have agreement prior to the completion of the projected repair of the damaged reactor vessel. He added that in addition to the representatives in attendance, representatives from the Atomic Energy Commission (AEC) and the Hartford Steam Boiler Inspection and Insurance Company were invited. He stated that he did not receive a reply from AEC, but that AEC has been kept posted on all details to date and that AEC does understand that Southwest Research Institute (SwRI) has been retained to follow the repair through to completion and write a final report. The Hartford Steam Boiler Inspection and Insurance Company elected not to attend the meeting but will require that their representative review the repair procedures developed for ASME Code compliance.

Mr. Fay asked Mr. Von Osinski to review the events to date. Mr. Von Osinski's summary repeated the events outlined in his Trip Report dated March 3, 1969(1) (copy in SwRI file) covering his visit to the plant site on February 23, 24, and 25, 1969 following the reactor incident on February 22, 1969.

Mr. Von Osinski stated that a procedure was developed for righting the vessel(2) (copy in SwRI file dated February 25, 1969) and the vessel was moved to its present location and a temporary house erected. He added that the vessel was inspected by B&W representatives under Westinghouse representative supervision and the concensus was that with the exception of some damage to the skid, it was judged that physical damage to the vessel proper was limited to the inlet and outlet nozzles with the weld preps of both nozzles being damaged - principally the weld lips and a superficial scar on the inside of the outlet nozzle. The scar was initially judged to be about 0.045 inch deep, but after preliminary grinding that removed the upset area, it was re-evaluated and judged to be only about 0.005 inch deep. The location of the area was

(1) See Appendix IV.
(2) See Appendix V.

difficult to find and Mr. Fay expressed concern over B&W not mapping the area for positive location. The question of building up the area with weld metal was discussed at length. Subsequent examination of the area and further discussion developed the decision to overlay the area with weld metal and grind the overlay to the contour of the nozzle wall.

Mr. Von Osinski stated that examinations of the weld preps of both nozzles did not disclose any discontinuities other than the visual damage of the weld preps, principally the lips. Examinations of the weld preps at the time of the visit disclosed an area in each nozzle prep outside of the damaged area that had been ground. This resulted in much discussion and an expression of dissatisfaction by Mr. Fay that B&W had ground in the undamaged areas after reporting that no discontinuities existed, and without agreement of all parties concerned. The explanation offered was that the ground area in the weld prep on the inlet nozzle was done at the B&W shop before the vessel was shipped and the grinding in the outlet nozzle face was due to finding a discontinuity that was not related to the incident.

The subject of grinding was discussed at length. It was agreed that grinding was to be limited to the extent necessary to prepare the damaged areas only for the weld overlay. It was agreed that no further grinding would be conducted in other areas without complete agreement among Westinghouse, Babcock and Wilcox (B&W), and SwRI.

The preliminary stress analysis prepared by B&W was discussed. Mr. Wylie pointed out that SwRI was not satisfied with the initial attempt and that he would have Mr. Pickett confirm in writing his telephone conversation with Westinghouse on the matter. It was agreed that B&W would complete the stress analysis after receiving Mr. Pickett's comments and Westinghouse would obtain a copy of the final analysis for SwRI's review.

The welding procedure specifications to be used in making the repair were discussed. It was agreed that it would be manual arc welding and B&W would redraft Welding Procedure Specification WS-69-5 as required and SwRI would be provided with a copy of the revised procedure.

The position of the vessel was discussed and it was agreed that all position qualifications would be a requirement for the welders. Welders are to be qualified in the 2G and 5G positions in butt welds; it being agreed that cladding qualification would not be applicable since the overlay becomes an integral part of the final weld. Welder qualification was being carried out at the time of the visit and SwRI will receive copies of qualification reports when completed.

Weld progression for the overlay of the nozzle preps was discussed together with the geometry of the completed weld. Babcock and Wilcox developed a sketch to illustrate the weld progression and a copy is attached as Appendix A.

Preparation of the weld overlay for ultrasonic testing was discussed. It was agreed that ultrasonic testing would have to precede the final contour machining and that Babcock and Wilcox would prepare a sketch to illustrate preparation for ultrasonic testing and furnish SwRI a copy for review. Ultrasonic testing procedure is to be submitted for review and Babcock and Wilcox is to prepare calibration block to be 1 inch thick, 3 inches long, and 6 inches wide of the same material as the weld overlay and contain three 1/8-inch flat bottom holes drilled to a depth of 7/8t, 1/2t, and 1/4t. The procedure is to set forth the acceptance criteria.

After a satisfactory ultrasonic examination, the nozzle preps are to be machined to dimensions of original vessel drawings and the finished surface to be liquid penetrant examined. A copy of the liquid penetrant procedure and acceptance criteria is to be furnished SwRI for review.

It was agreed that radiography will be performed after the inlet and outlet pipes are attached.

Iron contamination of the stainless steel overlay was discussed. It was understood that checks have indicated some degree of contamination. Efforts will be made to correct this condition and additional checks will be made after completion of the repair. Southwest Research Institute will be furnished copies of reports.

The repair procedure transmitted by wire dated April 8, 1969 was discussed. A revised rough draft was developed (attached as Appendix B) and accepted by all parties present. The procedure will be rewritten and distributed by Westinghouse.

The meeting ended with it being understood that the repair will be followed through to completion by the following people:

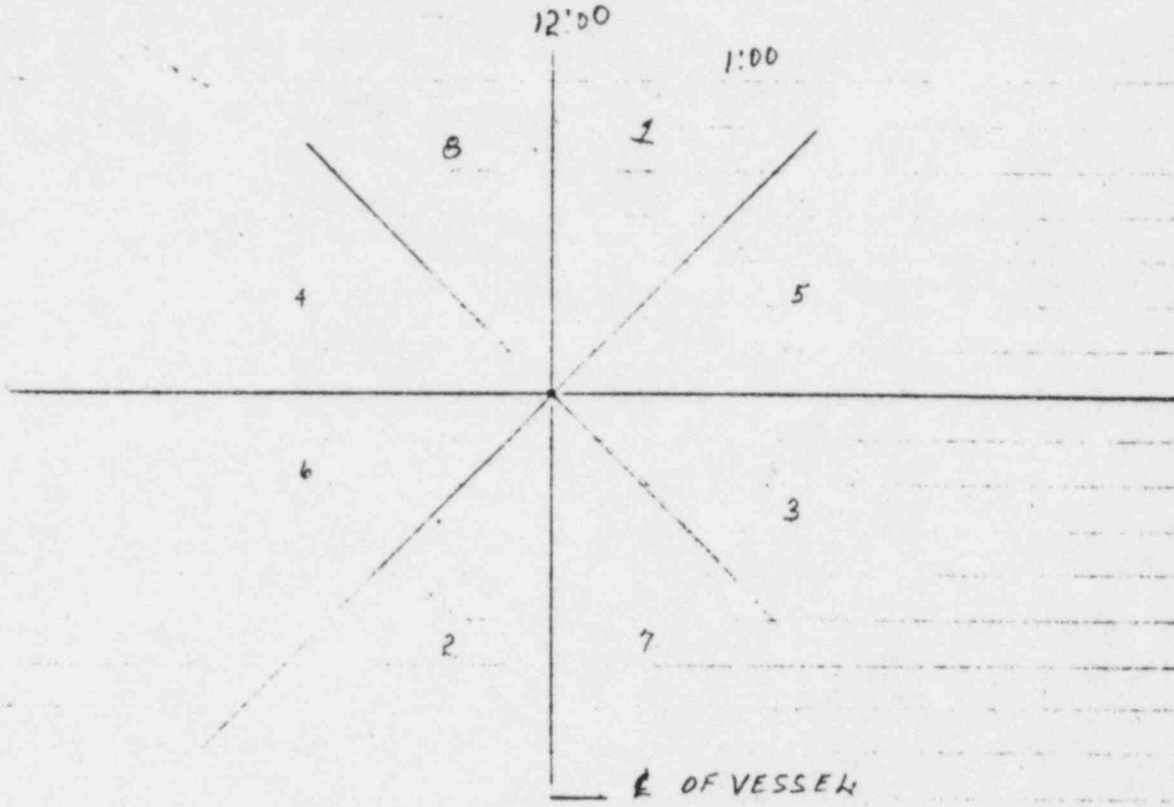
L. J. Bell - Westinghouse
A. Anderson - B&W
J. R. Fletcher - B&W
Salsbach - B&W
G. Kearney - SwRI*

*Southwest Research Institute may have another representative present to witness ultrasonic testing and liquid penetrant examinations.

Robert J. Cepluch

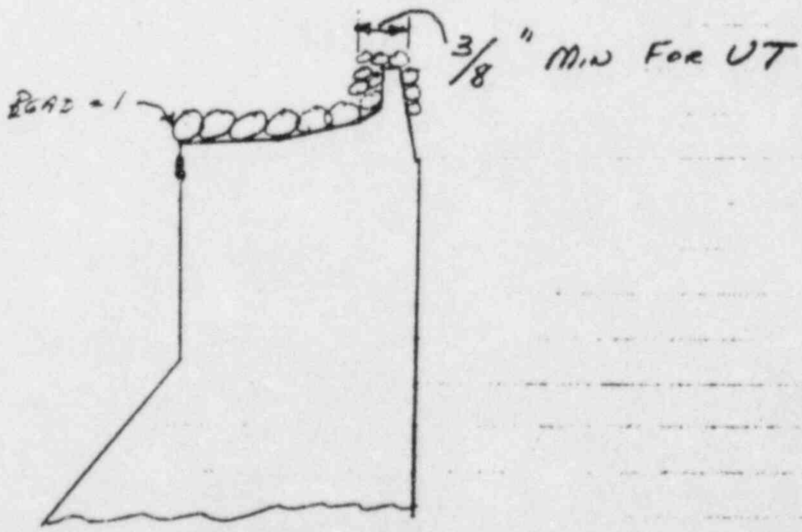
Robert J. Cepluch
Regional Manager
Hartford Operations Office

RJC/j



NOTES

1. Length of rod deposit determines length of intermittent weld length.
2. Numbers indicate welding area sequence.
3. Welding beads will begin at outer edge of weld prep & progress toward I.D. of nozzle.
4. Starts & Stops will be inspected in accordance with para. 3.2.1.4 of W.S. 69.-5



APPENDIX B

April 15, 1969

REVISED BABCOCK AND WILCOX PROCEDURE CNR-109

The following changes apply to B&W repair Procedure CNR-109-1. This supersedes previous information. Procedure now reads:

1. Grind the weld prep where damaged suitable for PT and welding.

2. PT ground areas and face of weld groove to Spec. S-102-C, Rev. 5.

3. Probe grind to remove defects and reinspect by PT. Caution to be taken not to grind any deeper than required to remove defects. If probe grinding to remove defects exposes base metal or cladding is removed closer than 1/8 in. to base metal, weld repairs must be made per Spec. W-6, Rev. 2 with Westinghouse approval.

4. Prepare weld buttering and six (6) in. of bore for iron contamination check. Examine for free iron per Spec. S-207. Remove any contamination found.

5. Establish nozzle terminals dimensionally prior to weld repair for subsequent nozzle machining.

6. Weld repair safe end lip and weld prep to Spec. WS-69-5. Process per paragraph 3.2.1, using 3/32", 1/8", 5/32" electrode. Repair will include one layer of weld over the complete face of the weld prep.

7. Grind welded area suitable for ultrasonic testing.

8. UT Test per B&W specification S-4 as modified by attachment (see note 2).

9. Repeat steps 3, 6, 7, 8 as required.

10. Set up portable mill to inside of nozzle and remachine weld prep contours per B&W drawing 117817-E-6.

11. Dimensionally inspect weld prep contours to the requirements of B&W Drawing 117817-E-6 and verify fitup dimensions.

12. PT machined weld prep per Spec. S-102C-5.

NOTE:

1) Dry grinding of indications other than to the weld lip must be reviewed for disposition by B&W, W, and SwRI.
2) Any indications found must be reviewed by B&W, W, and SwRI before proceeding.
3) All ground areas will be mapped.

APPENDIX XVI

STRESS AND BRITTLE FRACTURE ANALYSIS PRIMARY INLET NOZZLE AND VESSEL SHELL
by
THE BABCOCK & WILCOX COMPANY

Table of Contents

Note: Pages XVI-24, XVI-25, and XVI-26 contain proprietary information and are included in Volume II of this report.

Stress and Brittle Fracture Analysis

Primary Inlet Nozzle and Vessel Shell

For

Westinghouse APD

Point Beach Reactor Vessel

Westinghouse Order No. 54-Q-100235

B&W Contract No. 596-3582-51-18

Prepared by:

Reviewed by:

Approved by:

Nuclear Components Engineering

The Babcock & Wilcox Company

Barberton, Ohio

Revisions

Number	Description	Date	Prepared By	Checked By
1	Fatigue analysis added as page 19. Reference 10 added.	5-27-69	[illegible]	P.J.S.

CONTENTS

[illegible]:

This report covers the stress analysis and brittle fracture analysis of the Point Beach reactor vessel under the loads imposed by the incident in which the vessel was dropped from its transporting devise.

Results:

The maximum stress intensity is 6.18 ksi at point CU* on the shell. This value is less than the 1.5 Sm allowable stress intensity limit of 40 ksi. The minimum crack size necessary for brittle fracture crack propagation in the vessel was found to be 2 feet. A flaw of the size was not present in the vessel.

Conclusions:

The vessel was not stressed above allowable limits by the impact, and a brittle fracture was not possible under this loading condition.

----

*Note: See sketch 1, page 5

References

General

1. Hough, B.K., "Basic Soils Engineering", The Ronald Press Co.

2. Pellini, W.S. and P.P. Puzak, "Fracture Analysis Diagram Procedures for the Fracture-Safe Engineering Design of Steel Structures", Welding Research Council Bulletin #88, May, 1963.

Drawings

4. B&W Company Drawing 117804E (Page XVI-24, Volume II)

5. B&W Company Drawing 117802E (Page XVI-25, Volume II)

6. B&W Company Drawing 117803E (Page XVI-26, Volume II)

Photographs

7. Mark Von Photo #V26 (See Figures 11 and 12, pages 28 and 29, Volume I)

8. Mark Von Photo #R73 (Photo #R73 is similar to Figures 12 and 13, pages 29 and 30, Volume I)

Programs

8. B&W Program 91139, "Local Stresses in Cylindrical Vessels Due to External Loadings".

9. B&W Program 91139A, "Stresses in a Nozzle Due to External Mechanical Loads".

Codes and Specifications

10. A.S.M.E. Code, Section III, Fig. N-415(B), page 25.

Rev. 1
2

Determination of Loads

The photographs of the vessel taken after the fall and the reports of witnesses indicate that the vessel landed totally on one inlet nozzle and then rolled back onto an outlet nozzle as the head hit the ground. Based on this evidence, two locations on the vessel were chosen for analysis; these were the inlet nozzle and the junction of that inlet nozzle with the vessel shell. These were the highest stressed areas in the vessel.

From the photographs taken after the fall, it was determined that the forward edge of the inlet nozzle entered about 6-inches into the soil while the rear edge remained at grade level (see Sketch 2 page 7). We, therefore, assumed an average depth of penetration of 3-inches over the cross-sectional area of the nozzle. A soil subgrade modulus of 700 psi/inch was used (see Reference #1). We also took the total load as a point load acting on Point A (see Sketch 2). This assumption is conservative.

In the analysis of brittle fracture it was necessary to assume that the load on the nozzle tip was a distributed load, since assuming a point load leads to local stresses which are not realistic. We assumed that the load was distributed uniformly over an area equal to the thickness of the nozzle end times one-half that portion of the circumference on which the weld preparation was deformed. The factor of one-half was used to take care of discrepancies in estimating the lengths of deformed portions from the photographs and to allow us to use a uniform distribution of loading (see Sketch 3 Page 9).

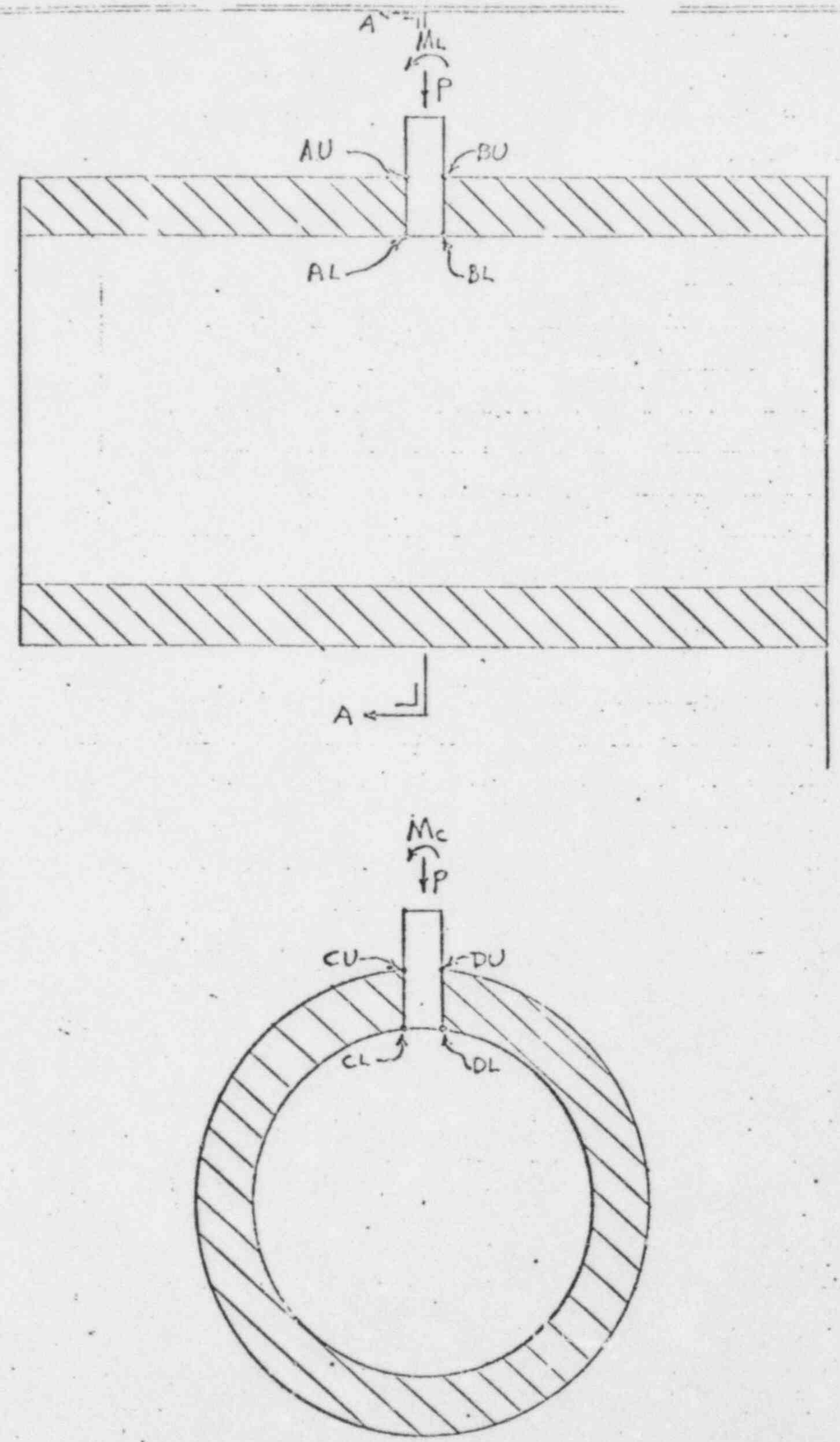
Since the load normal to the plane of the nozzle, F_x, produces compressive stresses it can not contribute to brittle fracture. Therefore, only the shear stresses, F_y and F_z, go into the maximum stress calculation at the nozzle end. At points remote from the tip of the nozzle, the stress computed under the assumption of point loads were used.

Method of Analysis:

The load F on point A was broken into components F_x and F_y. Two sets of moments; M_x, M_y, and M_z, were computed, one for the moments at the inlet nozzle weld end and one set for the moments at the midplane of the vessel shell. A circumfrential load F_z was assumed equal to F_y. The torsional moment on the nozzle, M_x, was assumed equal to 0 since the vessel did not rotate about the nozzle as it fell.

For the stress analysis of the two areas under consideration, two B&W programs were used. The first, program #91139, calculated stresses in the vessel at the juncture of the inlet nozzle and the vessel shell. The inputs to this program were the loads and geometry of this area (see Ref. #7). The output shows a maximum stress intensity of 6.18 ksi at point CU (see sketch 1 and computer output attached). The second program B&W #91139A, calculated the stresses in the nozzle remote from the tip. Input and output are as described in the user's guide of reference #9. The maximum stress intensity in this area was 3.28 ksi.

Brittle fracture minimum crack size was found by entering figure 9 of Ref. #2 at the stress level and a temperature below the nil-ductility temperature, N.D.T., to find minimum flaw size necessary to cause fracture. Three values of stress were used; 6.18 ksi, 3.28 ksi, and 3.49 ksi. A value of yield stress of 50 ksi was used. Only 6.18 ksi gave a finite crack size.



Section A-A

BABCOCK & WILCOX COMPANY
DEPARTMENT

Sketch 1 BY

LOCATION OF STRESSES

Page - 5
DATE
JOB NO.

Determination

of

Loads

BABCOCK & WILCOX COMPANY
DEPARTMENT BY C L T[illegible] DATE
JOB NO. [illegible]

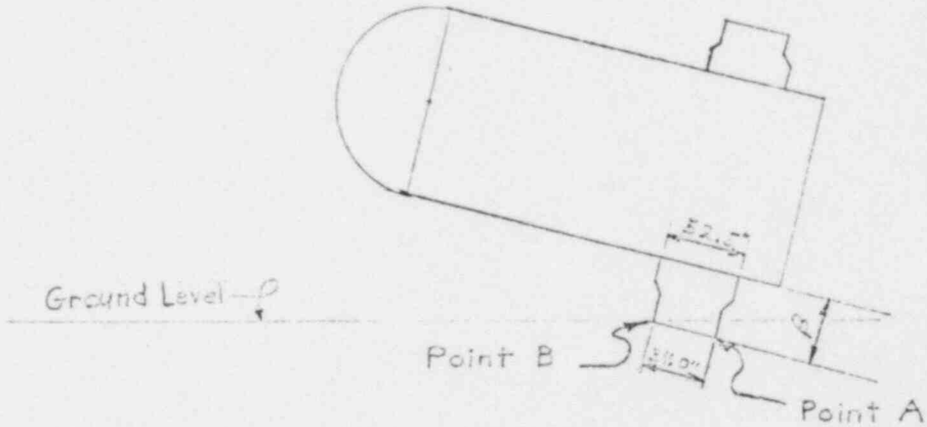
Impact loads on the Inlet Nozzle of the Point Beach Reactor

I. Data

r_o = 26.25 inches @ vessel (outside radius of nozzle)
r_o = 17.0 inches @ nozzle free end outside radius
R_m = 70.625 inches, (mid thickness radius of vessel)
T_v = 9.0 inches, vessel thickness
T_n = 3.148 inches, nozzle thickness at free end
β = 44.65625 inches, distance from nozzle free end to mid thickness of shell

Nozzle penetration into soil
6 inches at Point A
0 inches at Point B
See Sketch below

Vessel total weight = 220 Tons



Sketch #2

II. Assumptions

1. The initial impact was taken on the inlet nozzle.
2. Point A on the above sketch hit first.
3. The soil subgrade modulus used was 700 psi/inch. This value was chosen from Figure 13-6 of Reference 1 because this value is the most conservative, and because it is associated with a soil condition similar to that found at the incident site.

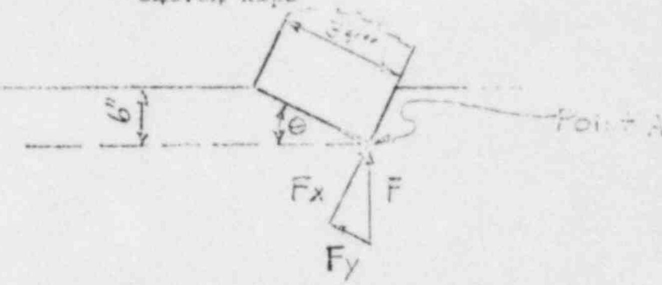
III. Load Calculations

A. $F = KAb$

where

F = force on the nozzle
K = soil subgrade modulus
A = cross-sectional area of the nozzle free end
b = average depth of penetration into soil

$$F = 700(3)''\left(\pi\left[(17)^2 - (13.8525)^2\right]\right) = 640{,}640 \text{ lbs.} = 640.64 \text{ kips}$$



B. $F_x = F\cos\theta$

$\sin\theta = \dfrac{6}{34}$

$= 0.17647$

$\theta = 10°9'51.4''$

$\cos\theta = 0.984307$

$F_x = 640.64(0.984307) = 630.59$ kips = Radial Force on vessel

C. $F_y = -F\sin\theta$

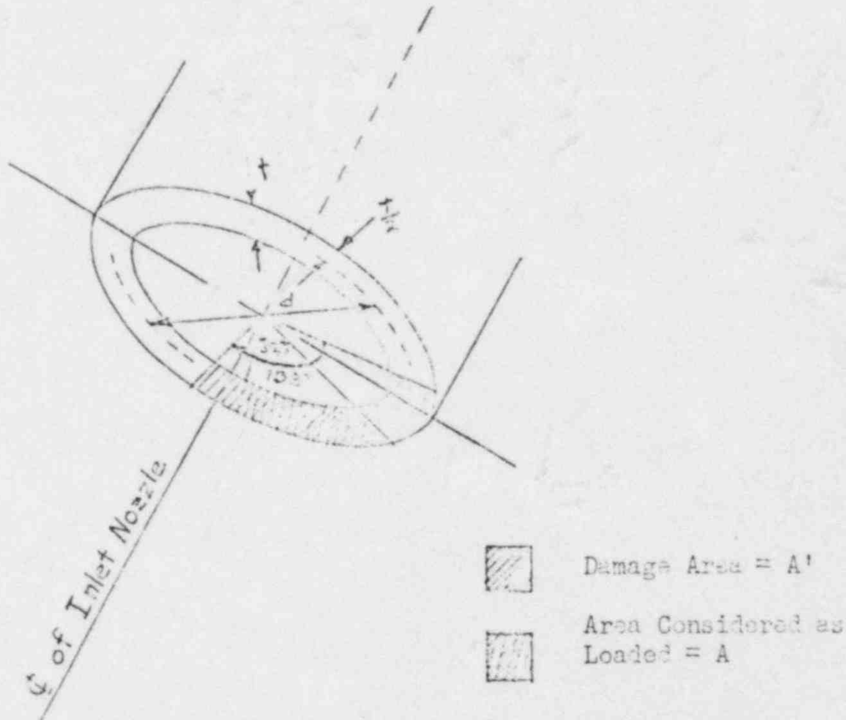
$F_y = -640.64(0.17647) = -113.05$ kips = Longitudinal shear force

D. $M_y = 5048.38$ k-in (assume 0 for moment on nozzle end.) Circumferential moment on vessel

E. $M_z = +P(17) - V_L(44.65625) = +5{,}671.61$ K-in longitudinal moment on vessel.
$M_z = 17P = 10720.0$ K-in on nozzle

F. $M_x = 0.0$ torsional moment on nozzle

G. $F_z = -113.05$ kips



$A = \frac{1}{2} A'$

$A = \frac{1}{2}(t) \left(\frac{108^\circ}{360^\circ}\right) (\pi d)$

where t = the nozzle thickness

$\frac{108^\circ}{360^\circ}$ = the fraction of the circumference on which the weld preparation was damaged by the fall.

π = 3.14159

d = the mid thickness diameter of the nozzle.

Brittle Fracture:

Determination of minimum flaw size that would cause failure in the primary inlet nozzle in the vicinity of the loading zone. Please see Reference #2.

$$A = \tfrac{1}{2}(3.1475)\underbrace{(0.3)(\pi)(30.8525)}_{\text{deformed circumference at mid surface of nozzle}}$$

A_o = 45.761 square inches

The distributed load is, therefore

$F' = \dfrac{640.64}{45.76} = 14.00$ kips on each square inch = the local bearing stress

$F'_y = \dfrac{113.05}{45.76} = 2.47$ ksi from shear component of total load

$F'_z = \dfrac{113.05}{45.76} = 2.47$ ksi from shear component of total load

$$\sigma_{max} = \sqrt{(F'_z)^2 + (F'_y)^2} = \sqrt{2(2.47)^2} = \sqrt{12.2018} = 3.493 \text{ ksi}$$

$$K\% = \frac{\sigma_m}{S_y} = \frac{3.493(100)}{50} = 7\%$$

$\therefore$ from Figure 9 of Reference 2 there is no crack large enough to cause fracture due to the local stress at the nozzle end.

From the stress calculations on page 16

$\sigma_{max} = 6.18$ ksi @ Point CU

$K\% = \dfrac{6.18}{50} = 12.4\%$

$\therefore$ from Figure 9 the minimum crack size at Point CU is 2feet

BABCOCK & WILCOX COMPANY

DEPARTMENT BY C. L. Tows DATE

JOB NO.

Analysis

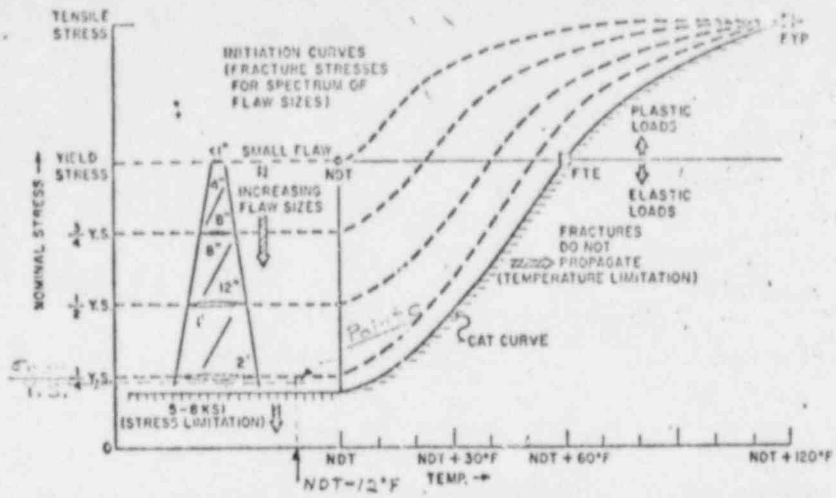


Fig. 9—Generalized fracture analysis diagram, as referenced by the NDT temperature

The maximum NDT for any point on the vessel is +50°F. The temperature at the time of the fall was 38°F. This is NDT -12°F for the loaded sections.

The maximum stress level found was 6.18ksi, this value is less than 1/4 yield stress.

Entering the graph above at these values we find point C which appears below the dashed line for a crack size of 2-feet. Therefore, we know that the minimum crack size to produce propagation is greater than 2-feet for the loading described.

PROGRAM 91139 BIJLAARD ANALYSIS OF SHELL STRESSES DUE TO ATTACHMENT LOADINGS DATE 04/15/69

POINT BEACH REACTOR IMPACT LOADING ON INLET NOZZLE(1.156 G) VESSEL STRESS

INPUT DATA --- GEOMETRY DESCRIPTION

EXTERNAL LOADS HAVE BEEN INPUT

THIS ANALYSIS IS PER SECTION III SPECIFICATIONS

HALF THE LENGTH OF RECTANGULAR LOADING SURFACE IN CIRCUMFERENTIAL DIRECTION IS.................	0.0	IN.
HALF THE LENGTH OF RECTANGULAR LOADING SURFACE IN LONGITUDINAL DIRECTION IS....................	0.0	IN.
MEAN RADIUS OF VESSEL SHELL IS......................	70.625	IN.
WALL THICKNESS OF VESSEL SHELL IS....................	9.000	IN.
OUTSIDE RADIUS OF ROUND ATTACHMENT IS................	26.250	IN.

INPUT DATA --- LOADING CONDITIONS

RADIAL LOAD IS..................................	-630.590	KIPS
FORCE IN CIRCUMFERENTIAL DIRECTION IS..............	-113.050	KIPS
CIRCUMFERENTIAL MOMENT IS..........................	-5048.379	K-IN
FORCE IN LONGITUDINAL DIRECTION IS.................	-113.050	KIPS
LONGITUDINAL MOMENT IS.............................	5071.609	K-IN
TORSIONAL MOMENT IS................................	0.0	K-IN
PRESSURE INSIDE VESSEL IS..........................	0.0	KSI

REFERENCE MANUAL USED BY THIS PROGRAM IS ENTITLED - LOCAL STRESSES IN SPHERICAL AND CYLINDRICAL SHELLS DUE TO EXTERNAL LOADINGS - PUBLISHED IN BULLETIN 107 BY WELDING RESEARCH COUNCIL, AUGUST 1965, WRITTEN BY K. R. WICHMAN, A. G. HOPPER AND J. L. MERSHON.

LETTERS USED IN OUTPUT ARE THE SAME AS SHOWN ON PAGE 9 OF THE ABOVE REFERENCE

PROGRAM 91139 BIJLAARD ANALYSIS OF SHELL STRESSES DUE TO ATTACHMENT LOADINGS DATE 04/15/69

POINT BEACH REACTOR IMPACT LOADING ON INLET NOZZLE(1.456 G) VESSEL STRESS

CONSTANTS FROM RADIAL LOAD GRAPHS WITH GAMMAS AND BETAS USED AS INPUT

GAMMA = 0.7847E 01	BETA = 0.3252E 00	MQ = 0.8922E-01
	BETA = 0.3252E 00	MX = 0.5583E-01
	BETA = 0.3252E 00	NQ = 0.7792E 00
	BETA = 0.3252E 00	NX = 0.1201E 01

CONSTANTS FROM CIRCUMFERENTIAL MOMENT GRAPHS WITH GAMMAS AND BETAS USED AS INPUT

GAMMA = 0.7847E 01	BETA = 0.3252E 00	MQ = 0.9496E-01
	BETA = 0.3252E 00	MX = 0.5221E-01
	BETA = 0.3252E 00	NQ = 0.2836E 00
	BETA = 0.3252E 00	NX = 0.5564E 00

CONSTANTS FROM LONGITUDINAL MOMENT GRAPHS WITH GAMMAS AND BETAS USED AS INPUT

GAMMA = 0.7847E 01	BETA = 0.3252E 00	MQ = 0.3869E-01
	BETA = 0.3252E 00	MX = 0.6459E-01
	BETA = 0.3252E 00	NQ = 0.9579E 00
	BETA = 0.3252E 00	NX = 0.2864E 00

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PROGRAM 91139   BIJLAARD ANALYSIS OF SHELL STRESSES DUE TO ATTACHMENT LOADINGS   DATE 04/15/69

POINT BEACH REACTOR IMPACT LOADING ON INLET NOZZLE(1.456 G) VESSEL STRESS

ALL STRESSES ARE IN KSI

CIRCUMFERENTIAL STRESS   SEE SKETCH 1 PAGE 5 FOR LOCATIONS OF AU, AL etc.

LOAD	AU	AL	BU	BL	CU	CL	DU	DL
P	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
P	3.75	-3.75	3.75	-3.75	3.75	-3.75	3.75	-3.75
MC	0.0	0.0	0.0	0.0	0.10	0.10	-0.10	-0.10
MC	0.0	0.0	0.0	0.0	1.55	-1.55	-1.55	1.55
ML	-0.37	-0.37	0.37	0.37	0.0	0.0	0.0	0.0
ML	-0.71	0.71	0.71	-0.71	0.0	0.0	0.0	0.0
TOTAL	3.44	-2.64	5.60	-3.31	6.16	-4.42	2.88	-1.53

LONGITUDINAL STRESS

LOAD	AU	AL	BU	BL	CU	CL	DU	DL
P	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19
P	2.61	-2.61	2.61	-2.61	2.61	-2.61	2.61	-2.61
MC	0.0	0.0	0.0	0.0	0.19	0.19	-0.19	-0.19
MC	0.0	0.0	0.0	0.0	0.85	-0.85	-0.85	0.85
ML	-0.11	-0.11	0.11	0.11	0.0	0.0	0.0	0.0
ML	-1.18	1.18	1.18	-1.18	0.0	0.0	0.0	0.0
TOTAL	2.51	-0.35	5.09	-2.49	4.84	-2.07	2.76	-0.76

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PROGRAM 91139 BIJLAARD ANALYSIS OF SHELL STRESSES DUE TO ATTACHMENT LOADINGS DATE 04/15/69

POINT BEACH REACTOR IMPACT LOADING ON INLET NOZZLE(1.456 G) VESSEL STRESS

ALL STRESSES ARE IN KSI

SHEAR STRESS

LOAD	AU	AL	BU	BL	CU	CL	DU	DL
MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VC	-0.15	-0.15	0.15	0.15	0.0	0.0	0.0	0.0
VL	0.0	0.0	0.0	0.0	0.15	0.15	-0.15	-0.15
TOTAL	-0.15	-0.15	0.15	0.15	0.15	0.15	-0.15	-0.15

COMBINED STRESS INTENSITY

AU	AL	BU	BL	CU	CL	DU	DL
3.46	-2.65	5.64	-3.34	6.19	-4.43	2.99	-1.56

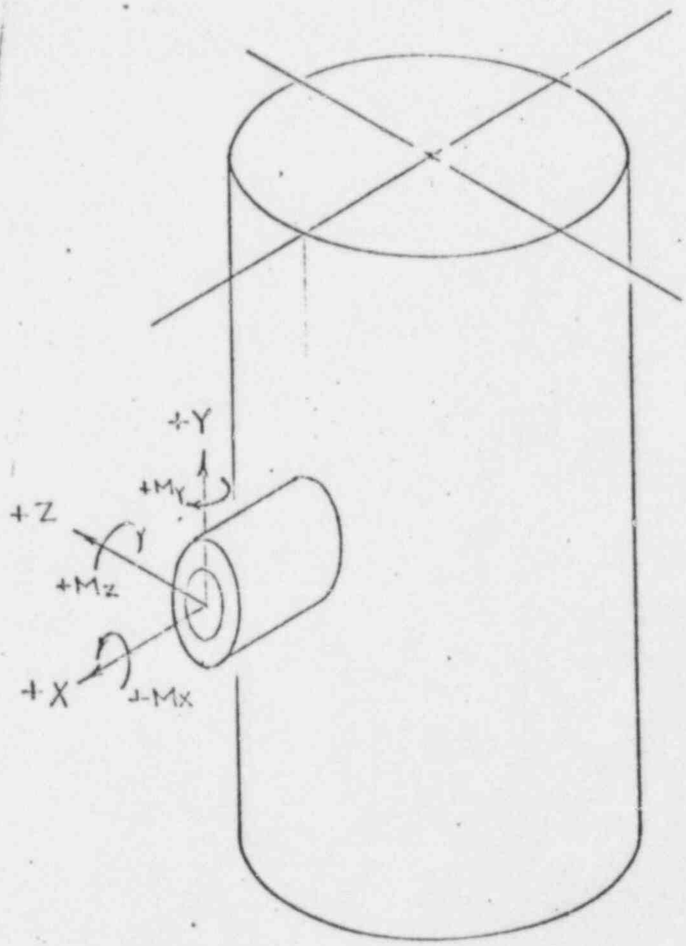

FIGURE 1

STRESSES IN A NOZZLE DUE TO EXTERNAL MECHANICAL LOADS

POINT BEACH REACTOR IMPACT LOADING ON INLET NOZZLE (1.456 G)NOZZLE STRESS

INSIDE RADIUS.................................. 13.8525 INCHES

OUTSIDE RADIUS................................. 17.0000 INCHES

INTERNAL PRESSURE.............................. 0.0 KSI

KIPS			IN-KIPS		
FX	FY	FZ	MX	MY	MZ
-630.60	-113.05	-113.05	0.0	0.0	10720.20

ALL LOADS ARE ON A TOTAL LOAD BASIS

	LONGITUDINAL STRESS	CIRCUMFERENTIAL STRESS	RADIAL STRESS	CIRCUMFERENTIAL SHEAR STRESS
INSIDE	1.98	0.0	-0.0	0.74
OUTSIDE	2.90	0.0	0.0	0.74

	PRINCIPAL STRESSES			STRESS INTENSITIES		
	S1	S2	S3	S12	S23	S31
INSIDE	2.23	-0.25	-0.0	2.47	-0.25	-2.23
OUTSIDE	3.08	-0.18	0.0	3.26	-0.18	-3.08

ALL VALUES ARE IN KSI

THE FOLLOWING ANGLES ARE MEASURED

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Fatigue Analysis

R = Fatigue Strength Reduction Factor = 5.0

We believe that the value of R chosen will lead to a conservative fatigue life.

S = Maximum stress found by the previous analysis = 6.18 ksi

$V = \frac{RS}{2} = 2.5\ S = 15.45$ ksi = 15450 psi = 1.5×10^4 psi

The material used in the area considered is SA-302 GR.B* steel, therefore, we use Fig. N-415(B) of Section 3 of the ASME Code to find the allowable number of cycles of this loading.

N_i = Allowable number of cycles

By entering Fig. N-415(B) at an ordinate of 1.55×10^4 psi and moving horizontally to the right to the plotted line we find that the line is always above the 1.55×10^4 psi level. From this we can state that infinite cycles are allowed.

*ASME Designation

Rev. 1

APPENDIX XVII

STRESS ANALYSIS OF POINT BEACH REACTOR VESSEL
by
PETER S. WESTINE, SOUTHWEST RESEARCH INSTITUTE

Table of Contents

Stress Analysis of Point Beach Reactor Vessel

By

Peter S. Westine

May 26, 1969

Summary

This stress analysis of the Point Beach Containment vessel reviews the B&W analysis and makes its own analysis. The estimated peak force in the B&W analysis is much too low. That force would not provide enough deceleration to stop the motion of the vessel in 6 inches. In addition, the B&W estimate of peak force would not damage a 108° segment at the lip of the inlet nozzle. B&W misused the coefficient of subgrade reaction. The first portion of theSwRI analysis tells how it was misused.

A single degree of freedom SwRI analysis is presented in which the resistance of the soil to penetration increases with depth of penetration. This is a fairly realistic condition near the surface of the ground. The dynamic analysis yields a numerical value for the earth's resistance to penetration as well as the magnitude of the peak force. An estimate is also made of the duration of the impact.

The peak g's from the SwRI analysis are then compared to the average g's required to halt a falling vessel. This observation indicates that the SwRI analysis is much more realistic.

SwRI then estimates the peak compressive stress from the shock wave which propagates up the nozzle. The magnitude of this stress is very acceptable. The period of vibration for the containment vessel is determined in order to compare the stiffness of the vessel to the stiffness of the ground, and to determine which loading realm best characterizes the impact. Very definitely, the vessel is stiff relative to the soil. A static determination of the stresses from a knowledge of the magnitude of the applied load is acceptable.

An SwRI stress analysis is enclosed which shows the location for the application of the load, the load components, and the magnitude of stresses at the weld joining the nozzle to the vessel and at the impact location. P/A forces are the major cause of stress near the weld. SwRI estimates the maximum compressive principle stress to equal 8,600 psi in the weld before including any stress concentration factor.

At the tip of the nozzle, SwRI estimates damage over a 108° to 120° segment of the nozzle. This conclusion conforms with observations in the field and gives added confidence to the SwRI calculations and our estimate of impact velocity.

Discussion On B&W Analysis Using The Coefficient Of Subgrade Reaction Approach

The settlement caused by the shape of the soil under the load is termed distortion or contact settlement. Usually the soil is treated as an elastic homogeneous medium in such analysis. The distortion settlement of a rigid square footing on a semi-infinite homogeneous elastic medium[1] is:

$$\delta = \frac{0.8\, q\, b\, (1-\mu^2)}{E} \qquad (1)$$

where δ is deflection (in)
q is average stress (P/A) (lb/in^2)
b is footing width (in)
E is modulus of elasticity
μ is Poisson's ratio

As should be apparent from equation (1), the coefficient of subgrade reaction, k, equals:

$$k = \frac{E}{b\ 0.8\,(1-\mu^2)} \qquad (2)$$

Note that k is inversely proportional to footing width. If the footing width is doubled, k is reduced by a factor of two. Similarly, if b is halved, k is doubled. Babcock and Wilcox used a value of 700 lb/in^3 for k in their analysis. This value was one of the largest values in fig. 13-6 from Hough's book[2]. The k values in Hough's book are coefficients of subgrade reaction

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1 Foundation Engineering, edited by G. A. Leonard, Chapter 6 on "Shallow Foundations," by G. F. Sowers, McGraw-Hill, 1962.

2 B. K. Hough, Basic Soil Engineering.

for plates 30 inches in diameter, as a careful reading of this book indicates. Babcock and Wilcox used a k of 700 without modifying it because of the width of the footing. The nozzle impacting the ground is only 3.15 inches thick. k should be increased by 30/3.15 or a factor of 9.5 times 700 to account for footing width. k for a 3.15 inch square should equal 6,650 lb/in^3. This same observation would also be reached using the European school or point of view.[3]

In this reviewer's opinion, a value of k for a square footing is a poor approximation to the shape of the contact surface. Because a large ring contacts the surface of the soil, this writer would ~~approximate~~ reduce k by a factor of 2.54 as indicated by table 6-6 in reference 1. A rectangle footing must distribute its load per unit length in a plane, whereas a square footing may distribute the load throughout a volume. This observation indicates that the aspect ratio does have a significant influence on the coefficient of subgrade reaction. By assuming that an aspect ratio of 10 is sufficiently close to an infinite long footing, the factor 2.54 may be divided into k for the square footing to obtain, k = 2,610 lb/in^3.

Finally the coefficient of subgrade reaction should be modified to reflect dynamic as opposed to static results. J.K. Poplin[4] reports that a factor of from 1.5 to 3.0 is appropriate. Theoretically a factor of 2.0 would

3 D. D. Barkan, Dynamics of Bases and Foundations.

4 J. K. Poplin, Dynamic Bearing Capacity of Soils, Report 2, Dynamically Loaded Small-Scale Footing Tests On Dry, Dense, Sand, W.E.S. Technical Report 3-599, September 1965.

occur if the response of the system is in the quasi-static loading realm. This writer believes a factor of 2.0 is a realistic compromise and would increase k to:

$$k = 5,220 \text{ lb/in.}$$

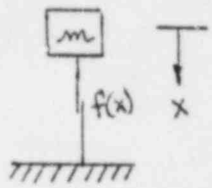
This value of k is 7.46 times the value used in the Babcock and Wilcox analysis. The force using this approach equals: $4.78 \times 10^{+6}$ lbs.

In addition we should note that the use of the coefficient of subgrade reaction should be limited to elastic response. The plate load test being used to obtain the coefficient is generally loaded until the deflection equals 0.1 inches. Because the plate is 30 inches in diameter, this means that $\delta/b = 0.0033$. On the other hand, our 3.15 inch thick flange penetrated an average of 3.0 inches, or $\delta/b = 0.95$. This response is not of the same magnitude, and the deformation in the soil was permanent.

This reviewer believes that soil conditions should have been considered to a depth of 6 inches plus 3b or 15.5 inches. A significant stress bulb penetrates at least 3 footing widths. A coefficient of subgrade reaction based on an upper bound for soil properties may not be too realistic if the permafrost penetrates this stress bulb.

Single Degree of Freedom Model

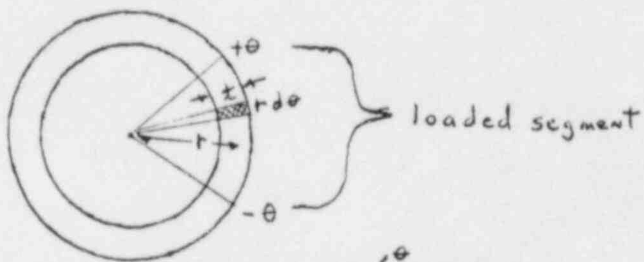
Consider a single degree of freedom system as follows.



Then the equation of dynamic equilibrium is:

$$m\ddot{x} + f(x) = 0 \tag{1}$$

We are forcing a cylinder into the ground so that only a portion is loaded. k is the coefficient of subgrade reaction.



$$F = 2\int_0^{\theta} t\, r\, d\theta\ kx \tag{2}$$

The following boundary conditions apply:

$x = 0$	$\theta = 0$	just touching
$x = 3''$	$\theta = \pi/2$	
$x = 6'' = x_{max}$	$\theta = \pi$	back has just touched

These three boundary conditions mean:

$$x = \frac{6r}{17\pi}\theta \tag{3}$$

$$\text{and } \ddot{x} = \frac{6r}{17\pi}\ddot{\theta} \tag{4}$$

Substituting equation 2 into equation 1 gives:

$$m\ddot{x} + 2\int_0^{+\theta} (t\,r\,d\theta\,k\,x) = 0$$

Or upon substituting (3) and (4) into the above equation and rearranging terms:

$$\ddot{\theta} + \left[\frac{t\,r\,k}{m}\right] \theta^2 = 0$$

We prefer to conduct the solution in x and not θ so:

$$\ddot{x} + \frac{17\pi}{6} \left[\frac{t\,k}{m}\right] x^2 = 0 \tag{5}$$

Equation (5) has the form

$$\ddot{x} = A\,x^2 = 0 \qquad \text{where } A = \frac{17\pi}{6} \quad \frac{t\,k}{m} \tag{6}$$

If Let $y = \frac{dx}{dt} = \frac{dx}{dt}\,\frac{dy}{dy} = \frac{dx}{dy}\,\frac{dy}{dt}$

Then $\frac{dy}{dt} = \frac{d^2x}{dt^2}$

And $\frac{d^2x}{dt^2} = y\,\frac{dy}{dx}$

Upon substituting into equation (6), the equation becomes separable and may be integrated to obtain:

$$y\,\frac{dy}{dx} + A\,x^2 = 0$$

Or

$$1/2\; y^2 = -A/3\; x^3 + C \qquad \text{where C is a constant.}$$

Replace y with $\frac{dx}{dt}$ and rearrange to obtain:

$$\left(\frac{dx}{dt}\right)^2 = \frac{-2A}{3}\,X^3 + C$$

This equation of motion describes the response after substituting in

initial conditions. At t=0, x=0, and $\frac{dx}{dt}$ equals V_0 ; therefore, $C = V_0^2$ and

$$\left(\frac{dx}{dt}\right)^2 = -\frac{2A}{3} x^3 + V_0^2 \qquad (7)$$

At $\frac{dx}{dt} = 0$ the motion stops, if no rebound occurs the displacement at this time is x_{max}; thus,

$$0 = -\frac{2A}{3} x_{max}^3 + V_0^2 \qquad (8)$$

And

$$A = \frac{3 V_0^2}{2 x_{max}^3}$$

Equation 6 presents A as a function of k, k equals

$$k = \frac{9 m V_0^2}{17 \pi t x_{max}^3}$$

The maximum force equals

$$F_{max} = 2 \int_0^{\theta_{max}} t r \, d\theta \, k x$$

Or

$$F_{max} = \frac{12}{\pi} t \frac{r^2}{17} k \int_0^{\theta} \theta \, d\theta$$

Which equals

$$F_{max} = \frac{6}{\pi} t \frac{r^2}{17} k \theta^2$$

Upon substituting for θ gives

$$F_{max} = \frac{17\pi}{6} t k x_{max}^2$$

Or as an alternative upon substituting for k

$$F_{max} = \frac{3 m V_0^2}{2 x_{max}}$$

Or

$$F_{max} = \frac{3 m g h}{x_{max}}$$

Substituting $h = 53$ inches into this equation gives a maximum force of

$$\boxed{F_{max} = 11.7 \times 10^{+6} \text{ lbs.}}$$

The duration of loading may be obtained by combining and rearranging equations 7 and 8 to obtain:

$$\Delta t = \frac{\Delta x}{V_0 \sqrt{1 - \left(\frac{x}{x_{max}}\right)^3}}$$

Estimate of Duration of Loading (V_0 = 200 in/sec)

dx	x avg	$\frac{x\ avg}{x\ max}$	$\sqrt{1-\left(\frac{X_{AVG}}{X_{MAX}}\right)^2}$	dt	x total	t total
3"	1.5"	1.5/6.0	1.0	1.5*10^{-2}sec.	3.0"	1.5*10^{-2}
1"	3.5"	3.5/6.0	0.9	0.5*10^{-2}sec.	4.0"	2.0*10^{-2}
1"	4.5"	4.5/6.0	0.65	0.77*10^{-2}sec.	5.0"	2.77*10^{-2}
0.5"	5.25	5.25/6.0	0.425	0.59*10^{-2}sec.	5.5"	3.36*10^{-2}
0.3"	5.65	5.65/6.0	0.400	0.38*10^{-2}sec.	5.8"	3.74*10^{-2}
0.2:	5.90	5.90/6.0	0.16	0.62*10^{-2}sec.	6.0"	4.36*10^{-2}

$\boxed{\text{Duration = 44.0 m. s.}}$

Comparison of Forces From Single
Degree of Freedom Analysis and Subgrade Approach

The deceleration of the vessel can be estimated using the following approach.

$$V^2 = 2as$$
$$2gh = 2as$$
$$a/g = h/s$$

This indicates that the average deceleration of the vessel is:

$$a/g = 53/6$$
$$a_{Avg} = 8.85 \text{ g's}$$

To stop a 0.44*10^{+6} pound mass with forces from the various analyses gives:

$$a_{max} = \frac{F}{wt.}$$

$$a_{max\ \text{single degree-of-freedom}} = \frac{11.7*10^{+6}}{0.44*10^{+6}} = 26.3 \text{ g's}$$

$$a_{max\ \text{corrected subgrade}} = \frac{4.78*10^{+6}}{0.44*10^{+6}} = 10.9 \text{ g's}$$

$$a_{max\ \text{B+W subgrade}} = \frac{0.631*10^{+6}}{0.44*10^{+6}} = 1.44 \text{ g's}$$

The maximum deceleration should equal at least twice the average deceleration in any realistic system. The B&W peak deceleration could not possibly stop the vessel without having 10 times the indentation in the soil. A peak deceleration of 26.3 g's does appear very realistic relative to 8.85 g's. If we had used an average indentation of the soil (3") instead of 6", the average

deceleration of the vessel would double to 17.7 g's. Very definitely the high forces which are indicated by the single degree-of-freedom model are much more appropriate. Note also that the magnitude of the force associated with propagating a wave up the nozzle are of the same magnitude as the force in the single degree of freedom system.

Wave Propagation Up Nozzle

The elastic stress, σ, in a column due to impacting the column with an object at velocity, V_0, equals*:

$$\sigma = \frac{V_0 E}{a} \tag{9}$$

where E is the modulus of elasticity
a is sonic velocity of the material equals $\sqrt{\frac{E g}{\rho}}$

The velocity of impact, V_0, equals:

$$V_0 = \sqrt{2gh}$$

Substituting for V_0 and a in equation (9) gives

$$\sigma = \sqrt{2hE\rho}$$

Notice that σ is independent of the mass of the impacting object. This calculation indicates that:

$$\sigma = \sqrt{2(53)(3.0 \times 10^{+7})(0.3)}$$

$$\sigma = 30{,}000 \text{ psi}$$

---

* Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill, Second Edition 1951, Chapter 15.

This stress is a conservative estimate for the intensity of the compression wave in the nozzle near the open end. The object which was impacted has no elasticity and is not set into motion; thus the upper bound.

Observe that the area of the nozzle increases considerably at the attachment of the nozzle to the vessel. This compressive stress wave should be reduced because of this increase in area

$$\sigma_{weld} = \frac{A_{free}}{A_{weld}} \sigma_{free}$$

$$\sigma_{weld} = \left(\frac{97\pi}{497\pi}\right)(30{,}000)$$

$$\boxed{\sigma_{weld} = 5{,}860 \text{ psi}}$$

Of interest is the peak force at the free end of the nozzle. By multiplying the area at the free end by the stress at the free end one obtains:

$$F = 9.15 \times 10^{+6} \text{ lbs.}$$

Period of Containment Vessel And Stiffness

The frequency for bending a hoop is given by Timoshenko* as:

$$f_i = \frac{1}{2\pi} \sqrt{\frac{Eg}{\gamma} \frac{I}{Ar^4} \frac{i^2(i^2-1)}{i^2+1}}$$

The lowest mode is for i=2 as i=1 is translation of the hoop. Inverting this formula and setting i=2 to obtain a period gives:

$$\tau_H = 2\pi \sqrt{\frac{\gamma}{Eg} \frac{Ar^4}{I} \frac{5}{36}}$$

* Timoshenko, Stephen, Vibration Problems In Engineering

Substituting in values for the Point Beach Containment Vessel yields

$$\tau_H = 2\pi\sqrt{\frac{(0.285)\quad(12)\,(70.0)^4\,(5)}{(3.*10^{+7})\,(3.86*10^{+2})\,(9.)^2\,(36)}}$$

Or

$$\tau_H = 22.5 \text{ m.s.}$$

A similar estimate for bending in the containment vessel was made by treating the vessel as a beam to obtain:

$$\tau_B = \frac{2\pi}{3.65}\sqrt{\frac{(w+)\ L^3}{EI\ g}}$$

Or

$$\tau_B = \frac{2\pi}{3.65}\sqrt{\frac{(220)(2000)\,(31)^3(12)^3}{(3.*10^{+7})(1.0*10^{+7})(386.)}}$$

Or

$$\tau_B = 24.0 \text{ m.s.}$$

Because the period, the stiffness, and mass of the vessel are all related we may calculate the stiffness of the vessel as:

$$k_{vessel} = m\,w^2$$

Or

$$k_{vessel} = \left(\frac{220 * 2000}{386}\right)\left(\frac{2\pi}{0.0225}\right)^2$$

Or

$$k_{vessel} = 8.89 * 10^{+7}\ \text{lb/in}$$

Note that the maximum force at the soil vessel interfaced equals $11.7*10^{+6}$ lbs. for a 6.0 inch deflection. This indicates that the spring constant for

the soil equals in magnitude:

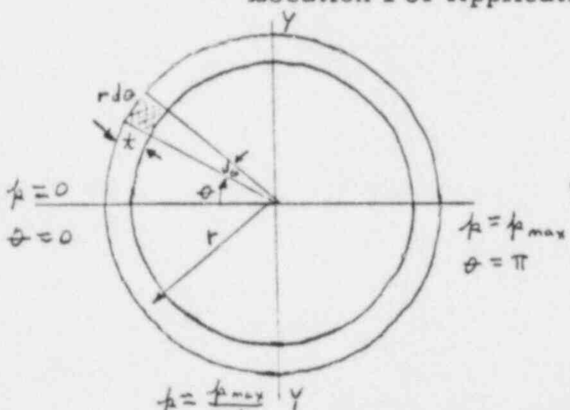
$$k_{soil} \approx 1.95 \times 10^{+6} \ \text{lb/in}$$

The vessel is more than 45 times stiffer than the ground using this estimate.

This observation indicates that all flexibility is in the soil. A static analysis using these forces applied to the tip of the nozzle should be acceptable.

Stress Analysis

Location For Application Of Load



At time of maximum load $p = p_{max}\frac{\theta^2}{\pi^2}$

Thus the force equals:

$$F = 2\int_0^{\pi} p_{max}\frac{\theta^2}{\pi^2}\, t\, r\, d\theta$$

$$F = 2\,\frac{p_{max}\, t r}{\pi^2}\int_0^{\pi}\theta^2 d\theta$$

$$F = \frac{2\pi}{3}\, p_{max}\, t r$$

The moment about the y-y axis is:

$$M_{y-y} = 2\int_{\pi/2}^{\pi} p_{max}\frac{\theta^2}{\pi^2}\, t\, r\, d\theta\, r\cos(\pi-\theta) - 2\int_0^{\pi/2} p_{max}\frac{\theta^2}{\pi^2}\, t\, r\, d\theta\, r\cos\theta$$

$$M_{y-y} = \frac{2\, p_{max}\, t\, r^2}{\pi^2}\left[\int_{\pi/2}^{\pi}\theta^2\cos(\pi-\theta)\,d\theta - \int_0^{\pi/2}\theta^2\cos\theta\, d\theta\right]$$

$$M_{y-y} = \frac{4\, p_{max}\, t\, r^2}{\pi} \qquad (10)$$

The location of this load, $\bar{r}$, can be determined by

$$\bar{r} = \frac{M_{y-y}}{F}$$

$$\bar{r} = \frac{6}{\pi^2}\, r$$

Force Components

$F = 11.7 * 10^{+6}$ lbs

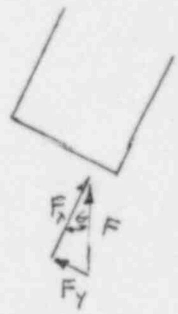
$\theta = 10° 9'$

$\sin\theta = 0.1765$

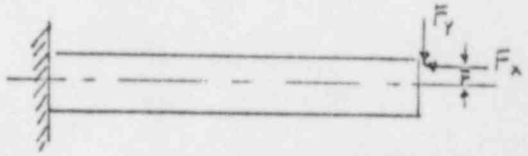
$\cos\theta = 0.984$

$F_x = 11.5 * 10^{+6}$ lbs

$F_y = 2.06 * 10^{+6}$ lbs.



Bending Stresses



$M = 44.6 (2.06 * 10^{+6}) - 11.5 * 10^{+6} \left(\frac{6}{\pi^2} \cdot \frac{17.0 + 13.55}{2}\right)$

$M = 92.0 * 10^{+6} - 108.0 * 10^{+6}$

$M = -16.0 * 10^{+6}$ in lbs

$A = \pi(26.25^2 - 13.85^2) = 1565.$ in^2

$I = \frac{\pi}{4}(26.25^4 - 13.85^4) = 3.44 * 10^{+5}$ in^4

$\sigma = \frac{-P}{A} \mp \frac{Mc}{I}$

$\sigma = \frac{-11.5 * 10^{+6}}{1.565 * 10^{+3}} \mp \frac{16.0 * 10^{+6} * 26.25}{3.44 * 10^{+5}}$

$\sigma = -7.35 * 10^{+3} \mp 1.22 * 10^{+3}$

$\sigma = -8.57 * 10^{+3}$ psi at top of nozzle

$\sigma = -6.13 * 10^{+3}$ psi at bottom of nozzle

Shear Stresses

$$Q_{circle} = \int_0^R \int_0^{2\pi} r\,d\theta\,dr\,r\sin\theta$$

$$Q = \frac{2R^3}{3}$$

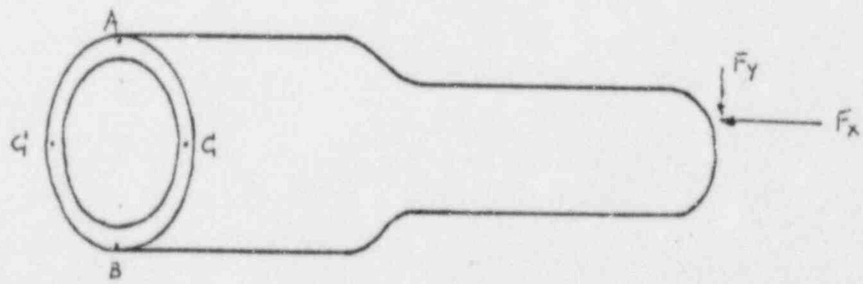
$$Q_{ring} = \frac{2}{3}\left(26.25^3 - 13.85^3\right) = 10,300 \text{ in}^3$$

$$\tau = \frac{VQ}{It}$$

$$\tau = \frac{2.06*10^{+6} * 1.03*10^{+4}}{3.44*10^{+5} * 2 * (26.25-13.85)}$$

$$\tau = 2.49 * 10^{+3} \text{ psi} \quad \text{at middle of nozzle}$$

Summary Of Stresses

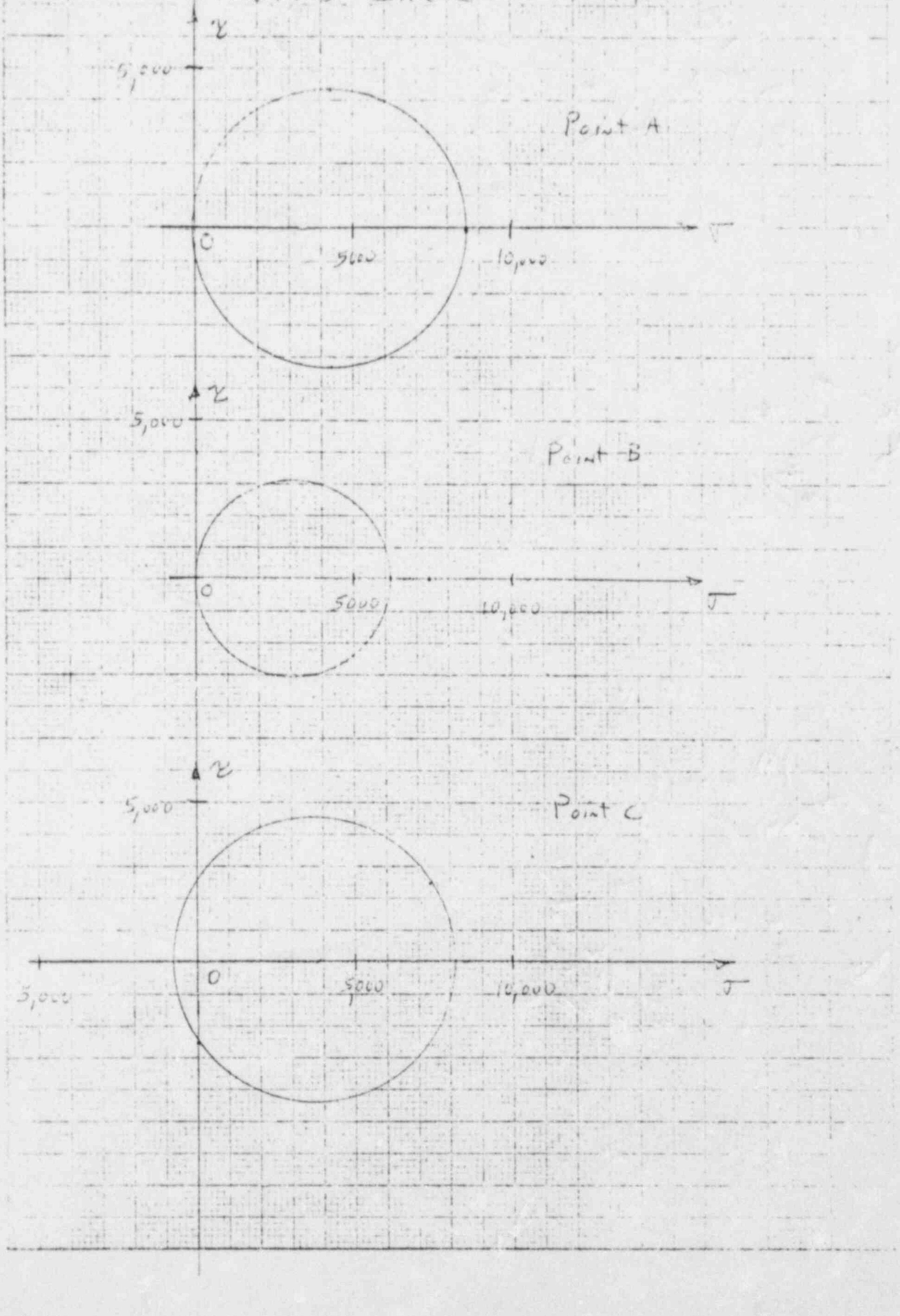


At Point A $\sigma = -8,570$ psi $\tau = 0$

At Point B $\sigma = -6,130$ psi $\tau = 0$

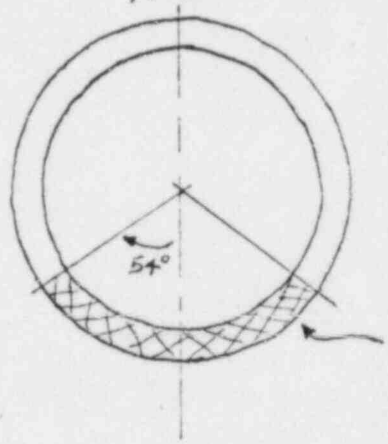
At Point C $\sigma = -7,350$ psi $\tau = 2,490$ psi

Mohr's Circle



At Tip Of Nozzle (Stress Analysis)

$$M = \frac{4\,\sigma_{max}\,t\,r^2}{\pi}$$ from equation 10, page 14



$$\sigma_{max} = \frac{\pi}{4}\,\frac{M}{t\,r^2}$$

$$\sigma_{max} = \frac{\pi}{4}\,\frac{(108.\times 10^{+6})}{(3.148)(15.43)^2}$$

$$\boxed{\sigma_{max} = 113.\ \text{ksi}}$$

$$\sigma_{\theta} = \sigma_{max}\,\frac{\theta^2}{\pi^2}$$

$$\sigma_{54^\circ} = \left(\frac{113.}{\pi^2}\right)(\pi - 0.943)^2$$

$$\boxed{\sigma_{54} = 55.1\ \text{ksi}}$$

for a 108° segment

$$\frac{50}{113}\,\pi^2 = \theta^2$$

$$\theta^2 = 4.37$$

$$\theta = 2.09\ \text{rad.}$$

$$\theta = 120^\circ$$

$\boxed{\text{damaged segment} = 2(180^\circ - 120^\circ) = 120^\circ}$ assuming 50 ksi yield.

If one assumes the yield point is 50 ksi as used in design calculations, then the calculated damaged segment is 120°. Actually the 50 ksi design yield strength is a lower limit. The average actual yield strength is prob-

ably higher. If we assume the actual yield strength is 10% higher (this magnitude is approximately correct), then the damaged segment is 108°. Actual observations showed the lip of the nozzle to have yield over a 108° segment.

One of the most difficult decisions in this entire analysis is the selection of an appropriate velocity of impact. We selected a velocity by assuming a 53-inch drop height. Actually two pieces of evidence exist, not one, as maintained by B&W. The size of the depression in the soil is one piece of evidence. This was used in all analysis techniques. The second piece of evidence was the size of the segment which was bent at the lip of the nozzle. The SwRI approach estimates that the 108° segment would be damaged. This calculation adds confidence to the SwRI analysis, and strongly indicates that the impact velocity must have been approximately the velocity for a drop of 53 inches.

APPENDIX XVIII

TRIP REPORT,
E. R. REINHART, SOUTHWEST RESEARCH INSTITUTE,
APRIL 16 TO MAY 8, 1969;
REPORT OF REPAIRS

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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SOUTHWEST RESEARCH INSTITUTE

8500 CULEBRA ROAD SAN ANTONIO, TEXAS 78228

TRIP REPORT
SwRI Project 17-2367-04

TRIP TO: Point Beach Nuclear Plant
Manitowoc, Wisconsin

BY: E. R. Reinhart

PERIOD COVERED: April 16 to May 8, 1969

ACKNOWLEDGMENTS: This report is compiled from individual Trip Reports written by the following individuals, covering the indicated time period.

Mr. G. Kearney, Research Assistant, April 16 to May 2, 1969

Mr. S. A. Viaclovsky, Research Engineer, April 27 to April 30, 1969

Mr. E. R. Reinhart, Senior Research Engineer, May 5 to May 8, 1969.

PERSONNEL CONTACTED:

Wisconsin Michigan Power Company
- C. W. Fay, Project Manager
- A. Karpfinger, Resident Engineer
- G. A. Reed, General Superintendent
- F. Young, Maintenance Engineer
- J. Mielke, Office Manager

Westinghouse Electric Corporation
- E. T. Hughes, Quality Control
- A. Garrett, Quality Assurance
- E. Reno, Quality Assurance
- L. J. Bell
- W. Fitch, Welding Engineer
- J. Caplan, Welding Engineer

Hartford Steam Boiler Inspection and Insurance Co.
- G. Svendsen, Inspector

PERSONNEL CONTACTED (Continued)

Babcock & Wilcox Company
- A. Anderson, Field Project Manager
- W. Buskey, Quality Control, Mt. Vernon Shops
- J. Fletcher, Quality Control Representative
- J. Salzbach, Field Service Engineer
- B. Champion, Welding Technician

Bechtel Corporation
- W. J. Martin, Welding Engineer
- D. Reddick, Quality Assurance Engineer
- H. J. Mantle, Welding Engineer

PURPOSE OF TRIPS: Witness the repair of two damaged nozzles, inlet and outlet, of the Point Beach nuclear reactor pressure vessel.

DOCUMENTS: All documents and records covering the repair operations are contained in the attached appendices as follows:

Appendix A - Procedures and Specifications *
Appendix B - Inspection Records
Appendix C - Correspondence

SEQUENCE OF EVENTS:

April 16th

The following events were witnessed and reported by Mr. G. Kearney. The condition of the two reactor nozzles, as viewed by Mr. Kearney prior to any repairs, was:

Outlet Nozzle

Refer to Sketch No. 2 of Repair Procedure CNR-109 (See Volume II, page X-96). At the 2:00 position, the .055 lip was distorted for a length of 1-1/2 inches. At the 3:00 to 5:00 position, or approximately 18 inches in length, the .055 lip was entirely removed. At the 7:00 to 8:00 position (29 inches in length), the .055 lip was entirely removed. At the 9:30 position, the lip was distorted for a length of 2 inches. On the inside diameter at the 6:00 position, scar damage had been polished smooth for later weld buildup. At the 12:00 position on the machined weld preparation, an indication had been removed leaving a cavity approximately 1-1/8 inches long by 5/8 inch wide by 7/64 inch deep.

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* The Procedures and Specifications are contained in Appendix X, Volume II of this report.

This cavity had been radiused smooth for later weld buildup.

Inlet Nozzle

Refer to Sketch No. 1 of Repair Procedure CNR-109 (Volume II, page X-96). The .055 lip from the 5:30 to the 11:00 position, an approximate distance of 50 inches, appeared rolled in varying degrees toward the centerline of the nozzle. At the 9:00 position, approximately 4 inches of the .055 lip was entirely removed.

The entire reactor vessel was contained in a large wood-framed, plastic-covered building. Thermostatically controlled heaters were used in the building to keep the temperature of the vessel above the ductile/brittle transition temperature. This was verified by periodic temperature measurements of the vessel. All repairs to the reactor vessel were conducted in this building.

The repair of the damaged nozzles began with the removal, by grinding, of any bent or broken material on the lip of the machined weld preparation areas. On both nozzles, several small scar areas on the face of the machined weld preparations were blended smooth. No measurable amount of stock was removed in the blending operations.

After the above operations were completed, the reactor outlet nozzle was cleaned and a free-iron inspection performed per the Babcock & Wilcox (B&W) Specification No. S-207 (Volume II, page X-62). For this procedure, the outlet nozzle was first vacuumed and then cleaned with lint-free cloths saturated with acetone. The nozzle was then wiped dry with more lint-free cloths. A copper sulfate solution was then applied per B&W Specification No. S-207. Indications of free-iron contamination were detected on areas of the face and inside diameter. These contaminated areas were then buffed and polished with aluminum oxide abrasive paper by hand and by grinding with pencil grinder (flapper) wheels.

April 17th

The above process was repeated approximately 6 times until the outlet nozzle was completely free of iron contamination (pages XVIII-32 and XVIII-34). A liquid penetrant test (PT) was then performed on the nozzle. Mr. Fletcher of B&W performed this inspection in accordance with B&W Specification Nos. S-10 and S-102C (Volume II, pages X-44 and X-63). The nozzle exhibited two small surface indications on the face of the weld preparation. These spots were polished and re-inspected and found to be free of defects. A record of this inspection is shown on pages XVIII-30, XVIII-31, and XVIII-35. After the PT, the nozzles were cleaned and a plastic cover was placed over the surface.

April 18th

Free-iron checks and a PT inspection were performed on the inlet nozzle with the same results as reported above. A record of these inspections is shown on pages XVIII-32, XVIII-38, and XVIII-39.

After these inspections and prior to the welding repairs, both nozzles were protected by wrapping sheet asbestos over the outside surface within 1/2 inch of the nozzle face. Asbestos sheets were also draped over the sides of the vessel to protect the entire surface from weld spatter. Asbestos-covered plugs were also inserted into the nozzles, approximately 6 inches from the face.

April 19th

On this date, Mr. Kearney witnessed welding qualification tests for welders to be used for the nozzle repairs. These tests were performed at the Edgewater Power and Light Company, Sheboygan, Wisconsin. From the results of these tests (pages XVIII-13 - XVIII-15) only Roy McMahon was certified to weld on the repair of the nozzle face. Two welders, Roy McMahon and Harold Kirchner, were certified for the ID repairs. Since some difficulty was experienced in machining the weld test specimens, the results of the weld certification tests were not received until the afternoon of April 22.

All welder qualification tests were conducted under the direction of Mr. Boyd Champion of B&W.

April 22nd

Due to weather conditions, the two heaters in the work building were turned on to keep the temperature of the vessel above the NDT temperature.

April 23rd

Prior to the initiation of welding repairs, the temperature of the inlet nozzle was taken by Pyrometer S/N 63-2518 (calibrated on 4-18-69) and found to be 73°F. Nozzle temperatures were taken by the same Pyrometer each day before the start of welding. The record of these temperature recordings is contained in Appendix B. Temple sticks were also used to monitor the interpass temperature and verify that this temperature did not exceed 350°F maximum. The weld buildup started at 9:30 A.M. The inlet nozzle was welded in the sequence shown in Appendix C (page XVIII-78). The bottom half of the nozzle face was welded with stringer beads starting along the outside diameter (OD), following the contour of the nozzle, and progressing toward the ID or lip. The top half of the nozzle face was welded with stringer beads starting along the ID or lip and progressing toward the OD, following the nozzle contour. Additional weld buildup was also applied to the nozzle lip to supply a

working surface for ultrasonic inspection (UT) of the repair welds. This welding was performed last. Welding continued until approximately 5:30 P.M.

April 24th

Prior to welding, the nozzle inlet temperature was taken at 7:00 A.M. and found to be 73°F. Welding was resumed and continued until 5:30 P.M.

April 25th

Welding was resumed and continued until 11:32 A.M. when electric power was shut off. The pressurized air supply was shut off at 12:30 P.M. The loss of power was due to a dispute between a contractor and a labor union. Electric power was again turned on at 2:00 P.M. Electric power grinders (Side Winders) were obtained and welding was resumed. Due to the unsatisfactory type of grinders used, the overall welding process was slowed down approximately 60 percent. Welding continued until 5:30 P.M.

April 26th

Welding was resumed and continued until 9:45 A.M. when welding was thought to have been completed. After a dimensional check, the lip revealed a lack of sufficient material for UT. Welding was resumed and completed at 12:30 P.M. The boring machine was then installed and adjusted until 5:30 P.M., when work terminated for the day.

April 27th

The temperature of the outlet nozzle was taken at 7:00 A.M. and recorded as 73°F. Initial welding repair of the outlet nozzle was then started. This welding was also performed per a sequence chart and both the top and bottom halves of the nozzle were progressively welded toward the nozzle OD.

Rough machining of the inlet nozzle was also started. The lip buildup for UT was found to be short of material. Work continued until 5:30 P.M. At the end of this work shift, Mr. Kearney departed for SwRI.

April 28th

The following discussion of repair procedures and ultrasonic inspection were witnessed and reported by Mr. S. A. Viaclovsky of SwRI. Mr. Viaclovsky also witnessed the repair operations on April 29th and 30th.

The ID of the inlet nozzle was ground smooth for the addition of weld material. Weld material was added in sequence to obtain a 1/2-inch lip buildup for UT. After welding, the lip was machined to supply a flat surface on the lip forward

face. A sketch of this area is shown on page XVIII-53.

Welding of the outlet nozzle continued until 5:30 P.M.

The ultrasonic inspection of the inlet nozzle was performed the evening of April 28th after 5:30 P.M. This inspection was performed according to B&W Quality Control Specification No. S-4 (Volume II, page X-90). The record of this inspection is shown on pages XVIII-52 to XVIII-54. For this inspection, a Branson Sonoray 301 ultrasonic instrument was used with the following crystals:

1. 2.25 mHz, 1/2-inch-diameter T&R, Type Z103
2. 3.5 mHz, 3/8-inch-diameter T&R, Type Z103.

Prior to testing, the ultrasonic equipment was calibrated using a reference block. This reference block was built by Babcock & Wilcox and had a 1-inch, Type 308 stainless steel weld buildup over a carbon steel base. Test metal distances of 3/8 wall thickness (T) and 1/2 T were used to assure that the 1/8-inch-diameter flat-bottom holes could be resolved at various depths. The 3.5 mHz crystal was used on the nozzle surface up to the weld buildup area. Both the 2.25 mHz and 3.5 mHz crystals were used to inspect the weld buildup area (lip location).

The tuning point for the 3.5 mHz at a 3/8-inch test distance was 80 percent screen display. The 1/8-inch and 1/4-inch depth indications were above full screen and were clearly resolvable.

The tuning point for the 2.25 mHz at a 1/2-inch test distance was a 100 percent full-screen display. The 1/4-inch and 3/8-inch depth indications were above full-screen amplitude and were clearly resolvable. The personnel witnessing the inspection were:

G. Svendsen - Hartford Steam Boiler Inspection and Insurance Co.
S. A. Viaclovsky - Southwest Research Institute
E. T. Hughes - Westinghouse Electric Corporation
J. Fletcher - Babcock & Wilcox Company (performed inspection).

The results of the inspection revealed that no indications were detected that had any length or sizeable dimensional area.

<u>April 29th</u>

After the usual temperature checks, final machining of the inlet nozzle was initiated and welding on the outlet nozzle was resumed. After machining of the inlet nozzle was completed, it was evident that not enough weld metal had been deposited on the ID surface of the nozzle as well as on the edge of the OD.

The inside area was located approximately 3/4 inch from the lip toward the vessel and was located circumferentially for approximately 180 degrees. Areas on the OD were intermittent. Mr. E. T. Hughes called Mr. R. Von Osinski to see if it was acceptable to change the ID lip slope from 10 degrees to a minimum of 7 degrees. This was proposed as a remedy for the ID situation. A question arose as to whether or not SwRI and Westinghouse had qualified personnel available to witness the welding of the nozzles and work was halted by Mr. Hughes. In addition, some questions on the weld procedure were brought up.

To resolve these questions, a meeting was held with Westinghouse, Babcock & Wilcox, and Southwest Research Institute personnel present. The weld procedure was found to be acceptable according to a specification change in the lip slope which had been approved earlier by Mr. Hughes and Mr. Von Osinski. The change was signed by the proper personnel; a record of this change is shown on page XVIII-84. Witnessing of the welding was decided to be satisfactory with the personnel available and welding of the outlet nozzle was resumed. Machining of the inlet nozzle to the new angle of 7 degrees was completed. However, the angle change did not remedy the condition that existed on the ID of the nozzle. It was therefore decided to weld in another bead using a 3/32-inch-diameter welding electrode.

April 30th

One weld pass from the 12:00 to the 6:00 position was used to fill in the low condition on the ID of the inlet nozzle. Grinding of the OD edge of the inlet nozzle cleared the OD condition, but by measuring, the OD was found to be slightly under tolerance. Since the rough machining for ultrasonic inspection left the nozzle face with approximately 1/32 inch excess material, it was determined that by machining this material off the nozzle face to bring the nozzle length to the proper dimension, the outside diameter would also be brought into tolerance. This machining was performed, and the nozzle was now found to be in tolerance.

Mr. Kearney returned to the site at noon on this day and witnessed the repair operations for the remainder of the day.

Final machining on the inlet nozzle and welding of the outlet nozzle were continued for the remainder of the work shift. Near the end of this shift, Mr. Viaclovsky departed for SwRI.

May 1st

Mr. Kearney witnessed the following two days of repair operations.

Weld buildup of the outlet nozzle was resumed and continued until 1:30 P. M. Weld buildup of the nozzle was then thought to be complete. However, a dimensional inspection revealed insufficient material on the lip area for

ultrasonic inspection. Welding of this area was resumed and continued until 3:45 P.M. when all power was shut off due to a dispute between a contractor and a labor union.

May 2nd

Since a labor union pickett line existed at the gate of the site, all further repair work was cancelled. Work was scheduled for resumption pending the resolution of the dispute between the contractor and the labor union. At this time, Mr. Kearney returned to Southwest Research Institute.

May 5th

The remaining repair operations (May 5th through May 9th) were witnessed and reported by Mr. E. R. Reinhart of Southwest Research Institute.

Differences were resolved between the contractor and the labor union and the welding repair of the outlet nozzle was resumed on Monday morning, May 5th. Prior to resumption of welding, the temperature of the nozzle was taken and recorded as 73°F (see page XVIII-58). The welding and repair of the outlet nozzle was completed according to B&W Specification WS-69, Rev. 5 (Volume II, page X-73). The record of weld rods used in this repair was checked and found to be identical to those listed in the B&W Record of Electrode Qualification Test (page XVIII-16).

After the above welding was completed, the boring machine was removed from the inlet nozzle and moved to the outlet nozzle. A plastic cover was then placed over the inlet nozzle. At no time during the removal and re-insertion of the boring bar was there metal contact with the nozzle surface. After the boring machine was inserted into the outlet nozzle, adjustments were made for final machining operations to begin the following day.

May 6th

The final liquid penetrant inspection of the inlet nozzle was completed. Those witnessing this test were:

E. R. Reinhart - Southwest Research Institute
E. T. Hughes - Westinghouse Electric Corporation
J. Fletcher - Babcock & Wilcox Company

This test was conducted in accordance with B&W Inspection Procedure S-10 (Volume II, page X-44). The number 2 combination of liquid cleaners, penetrants, and developers was used. No defects of rejectable size were detected. Minor circular defects of approximately 1/32-inch diameter were blended with a pencil grinder. A record of this inspection is shown on pages XVIII-59 and XVIII-60. Since the Hartford Steam Boiler Inspection and Insurance Company

representative was not present for this inspection, the entire inspection was repeated the following day.

After the above inspection was completed, the machining of the outlet nozzle for ultrasonic testing was initiated and continued for the remainder of the work shift.

May 7th

A liquid penetrant test of the inlet nozzle was rerun for Mr. G. Svendsen of the Hartford Steam Boiler Inspection and Insurance Company and declared satisfactory by him. A copy of Mr. Svendsen's report is shown on page XVIII-73. A free-iron test was also conducted on the inlet nozzle and found to be acceptable. With the completion of these tests, the repair of the inlet nozzle was finished.

Final machining of the outlet nozzle for ultrasonic inspection was not completed. One small area on the forward lip between the 5:00 and the 8:00 positions did not clean up during machining. A weld bead was applied to this area, the area was machined smooth, and the nozzle was then ready for ultrasonic testing.

Calibration procedures using a standard block were verified as being conducted in accordance with B&W Inspection Procedure S-4. As in the inspection of the inlet nozzle, a Branson Sonoray Model 301 ultrasonic instrument was used with the following crystals:

1. 2.25 mHz, 1/2-inch-diameter T&R, Type Z103
2. 3.5 mHz, 3/8-inch-diameter T&R, Type Z103.

Both the 2.25 mHz and the 3.5 mHz crystals were used to inspect the weld buildup area from the flat front face. The ultrasonic inspection was conducted in accordance with B&W Inspection Procedure S-4.

Personnel present during this inspection were:

E. R. Reinhart - Southwest Research Institute
E. T. Hughes - Westinghouse Electric Corporation
G. Svendsen - Hartford Steam Boiler Inspection and Insurance Co.
J. Fletcher - Babcock & Wilcox Company (performed inspection).

No indications of flaws of any length or sizeable dimensional area were detected. The results of this inspection are shown on pages XVIII-61 and XVIII-62. After this test, machining of the outlet nozzle was resumed.

May 8th

During this work shift, the final machining of the outlet nozzle was completed. A final penetrant inspection of the outlet nozzle was also performed. As shown on page XVIII-66, a number of small, acceptable, circular imperfections

of 1/32 - 1/64-inch diameter were detected along with two small linear imperfections. The linear imperfections were surface only, as they were removed by pencil grinding and polishing. This inspection was performed in accordance with B&W Inspection Procedure CNR-109, Sequence 12 (Volume II, page X-96), and was witnessed by:

E. R. Reinhart - Southwest Research Institute
E. T. Hughes - Westinghouse Electric Corporation
G. Svendsen - Hartford Steam Boiler Inspection and Insurance Company
J. Fletcher - Babcock & Wilcox Company (performed inspection).

After this inspection, a small depression on the inside diameter of the outlet nozzle, previously reported to be approximately .005 inch maximum depth, was filled in with a series of short weld beads. This area was located at the 5:00 position, approximately 4-1/4 inches from the lip. Dimensions of this weld buildup were 4-5/8 inches by 7-1/2 inches (long side in 12:00 direction). After the welding, the area was ground, polished, and liquid penetrant tested. The results of this test indicated no flaws of rejectable size were present (page XVIII-68). This inspection was performed by J. Fletcher and was witnessed by E. R. Reinhart.

After the above operations were successfully completed, the boring machine was removed from the inlet nozzle and a plastic cover was placed over the nozzle.

<u>May 9th</u>

Final dimensional checks and free-iron checks were successfully performed to complete the repair of the nozzles (pages XVIII-69 to XVIII-71).

Mr. C. W. Fay of Wisconsin Michigan Power Company was contacted and a brief description of the completed repair work was given. It was decided that this writer should return to Southwest Research Institute since there was no further repair work to be monitored.

E. R. Reinhart

E. R. Reinhart
Senior Research Engineer

ERR/wt

APPENDIX A

PROCEDURES AND SPECIFICATIONS

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

THE BABCOCK & WILCOX COMPANY, BARBERTON, OHIO

CERTIFICATE OF PERFORMANCE QUALIFICATION TEST

Prepared according to the requirements of Section IX of the ASME Boiler Code

395-22-3875

Welder Name Roy McMAHON Date Welded 4/22/69 Symbol No RM

Welding Process MANUAL METAL ARC

Position (If vertical state whether upward or downward)(Flat, horizontal, vertical or overhead; see Pars. & Figs. Q-2 & Q-3, or QN-2 & QN-3) UPWARD-HORIZONTAL FIXED

In accordance with procedure specification no WS-69-5 & W-6

Material Specification SA-312 TYPE 304 to SA312 TYPE 304 P-No 8 to P-No 8

Diameter and Wall Thickness (if pipe) otherwise Joint Thickness 7/8" THICK X 6 5/8" OD

Thickness Range this qualifies ALL THICKNESSES

Filler Metal

Specification No A-298-62T Group No. F 8

Describe Filler Metal if not included in Table Q-11.2 or QN-11.2

Is Backing Strip Used? YES

For Information Only

Filler Metal Diameter and Trade Name
Babcock & Wilcox E308-15
3/32" & 1/8"

Flux for Submerged Arc or Gas for Inert Gas Shielded Arc Welding
NONE

Guided Bend Test Results (Figs. Q-7.1, Q-7.2, QN-7.1, QN-7.2, QN-7.3)

PREHEAT 70° MIN, INTERPASS TEMP. 350° MAX, NO STRESS

Type and Figure No.	Result	Type and Figure No.	Result
5G SIDE BEND	ACCEPTABLE		
4 SPECIMENS	NO DEFECTS		

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

Date 4/23/69

Signed THE BABCOCK & WILCOX COMPANY

By Boyd J. Champion

THE BABCOCK & WILCOX COMPANY, BARBERTON, OHIO

CERTIFICATE OF PERFORMANCE QUALIFICATION TEST

Prepared according to the requirements of Section IX of the ASME Boiler Code

387-20-6759

Welder Name Harold Kirchner Date Welded 4/17/69 Symbol No HK

Welding Process Shielded Metal Arc.

Position (If vertical state whether upward or downward)(Flat, horizontal, vertical or overhead; see Pars. & Figs. Q-2 & Q-3, or QN-2 & QN-3) Horizontal Fixed

In accordance with procedure specification no WS69 + WL6 - PQ 1427

Material Specification SA 302 Gr. B to P-No 3 to P-No

Diameter and Wall Thickness (if pipe) otherwise Joint Thickness 2" Thick Plate

Thickness Range this qualifies All Thicknesses

Filler Metal

Specification No A 298-62T Group No. F 8

Describe Filler Metal if not included in Table Q-11.2 or QN-11.2

Is Backing Strip Used? .... No..............

For Information Only

Filler Metal Diameter and Trade Name
Babcock & Wilcox E-305-15 1/8"
Airco E 305-16 1/8"

Flux for Submerged Arc or Gas for Inert Gas Shielded Arc Welding
None

In Accordance With Para. N543.3 Section III ASME

Guided Bend Test Results (Figs. Q-7.1, Q-7.2, QN-7.1, QN-7.2, QN-7.3)

Preheat 200°F Interpass 350° Max - No Stress

Type and Figure No.	Result	Type and Figure No.	Result
Two Transverse	Side Bends -	Acceptable / No	Defects
Two Longitudinal	Side Bends -	Acceptable	No Defects

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

Date 4/23/69

Signed THE BABCOCK & WILCOX COMPANY

By [signature]

805-236-1

THE BABCOCK & WILCOX COMPANY, BARBERTON, OHIO

CERTIFICATE OF PERFORMANCE QUALIFICATION TEST

Prepared according to the requirements of Section IX of the ASME Boiler Code

395-22-3575

Welder Name Roy McMahon Date Welded 4/23/69 Symbol No P.M

Welding Process Manual Metal Arc

Position (If vertical state whether upward or downward)(Flat, horizontal, vertical or overhead; see Pars. & Figs. Q-2 & Q-3, or QN-2 & QN-3) Horizontal Fixed

In accordance with procedure specification no WS69 + W6 — PQ 4/27

Material Specification SA 302 Gr.B to P-No 3 to P-No

Diameter and Wall Thickness (if pipe) otherwise Joint Thickness 2" Thick Plate

Thickness Range this qualifies All Thicknesses

Filler Metal

Specification No A298-67T Group No. F 8

Describe Filler Metal if not included in Table Q-11.2 or QN-11.2

Is Backing Strip Used? ....No..............

For Information Only

Filler Metal Diameter and Trade Name
Babcock + Wilcox E 308-15
Airco E 309-16

Flux for Submerged Arc or Gas for Inert Gas Shielded Arc Welding
None

In Accordance With Para N513.3 Section III ASME

Guided Bend Test Results (Figs. Q-7.1, Q-7.2, QN-7.1, QN-7.2, QN-7.3)

Preheat 200°F Interpass 350° Max - No Stress

Type and Figure No.	Result	Type and Figure No.	Result
Two Transverse	Side Bends -	Acceptable / No	Defects
Two Longitudinal	Side Bends -	Acceptable / No	Defects

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

Date 4/23/69 Signed THE BABCOCK & WILCOX COMPANY

By Boyd J. Champion

1030503

BOILER DIVISION
BARBERTON, OHIO

XVIII-16

RECORD OF ELECTRODE QUALIFICATION TEST

SIZE	ELECTRODE SPECIFICATION	ELECTRODE IDENTIFICATION	CORE WIRE HEAT. NO
1/8	A-298-62T	E-308-15	—

P-ORDER NUMBER	TYPE OF CURRENT	AMPERES
818-024948	D.C.	105

AUG 20

GROOVE WELD TEST

WET BATCH EQUIVALENCY CHEMICAL ANALYSIS TESTS

BATCH	LAB. NO.	PAD	C.	MN.	P.	S.	SI.	CR.	NI.	MO.	
	E65390	2471	.07	1.92	023	021	52	20.30	10.23		

TENSILE PROPERTIES

TEST NO.	HEAT TREATMENT	ULT. TEN. STR. PSI	YIELD POINT PSI	E-LONG IN 2" %	RED OF AREA %

FERRITE CONTENT

BATCH		BATCH	

BEND TESTS

GUIDED FACE-BEND

GUIDED ROOT-BEND

GUIDED SIDE-BEND

CHARPY ________ IMPACT TEST @ _____ °F ________ FT/LBS ENERGY LOAD.

TEST NO.	FT/LBS.	TEST NO.	FT/LBS.

FILLET WELD TEST.

TEST NO.	POSITION	SIZE	LEG.	CONVEXITY.
	OVERHEAD			
	VERTICAL			
	HORIZONTAL			

WE HEREBY CERTIFY THAT THE ABOVE MATERIAL HAS BEEN TESTED IN ACCORDANCE WITH THE ABOVE LISTED SPECIFICATION AND IS IN CONFORMANCE WITH ALL REQUIREMENTS.

SIGNED G. Hinkle

INSPECTION AGENCY BABCOCK & WILCOX CO.

INSPECTOR

8

RECORD OF FILLER WIRE QUALIFICATION TEST

TEST NO. ____________

SIZE	ELECTRODE SPECIFICATION	ELECTRODE IDENTIFICATION	CORE WIRE HEAT NO.
3/32	A298-62T	308-15	41606

P. ORDER NUMBER	TYPE OF CURRENT	AMPERES
818-023932	DC	30-80

WET BATCH EQUIVALENCY CHEMICAL ANALYSIS TESTS

BATCH	LAB. NO.	PAD	C.	MN.	P.	S.	SI.	CR.	NI.	MO.	Cb+Ta ZR
	E-65637	2484	06	1.77	006	014	53	20.40	9.65		01
	TEST REPORT	ANALYSIS									

Ferrite 8½%

TENSILE PROPERTIES

TEST NO.	HEAT TREATMENT	ULT. TEN. STR. PSI	YIELD POINT PSI	E-LONG IN 2" %	RED OF AREA %

FILLET WELD TEST

	OVERHEAD
SIZE	
LEG.	
CONVEXITY	
	VERTICAL
SIZE	
LEG.	
CONVEXITY	
	HORIZONTAL
SIZE	
LEG.	
CONVEXITY	

CHARPY ________ IMPACT TEST @ ______ °F ______ FT/LB. ENERGY LOAD

HEAT TREATMENT	TEST NO.	FT/LB.	TEST NO.	FT. LB.

MATERIAL APPROVAL

NAVSHIPS ____________
ASME ____________
NAVY NUCLEAR STD. ____________
STEAM GENERATORS ____________
COMMERCIAL NUCLEAR STD. ____________
OSCILLATED COVER BEAD ____________

GUIDED BEND TESTS

FACE	ROOT	SIDE

MICRO OR MACRO FISSURE ANALYSIS.	

GROOVE WELD TEST

RADIOGRAPHIC EXAMINATION

WE HEREBY CERTIFY THAT THE ABOVE MATERIAL HAS BEEN TESTED IN ACCORDANCE WITH THE ABOVE LISTED SPECIFICATION AND IS IN CONFORMANCE WITH ALL REQUIREMENTS.

DATE 9/17/68

SIGNED G Herbble

INSPECTION AGENCY ____________

INSPECTOR

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION
BARBERTON, OHIO

RECORD OF FILLER WIRE QUALIFICATION TEST

TEST NO. ____________

SIZE	ELECTRODE SPECIFICATION	ELECTRODE IDENTIFICATION	CORE WIRE HEAT NO.
1/8"	2E4-156-4	E308-15	03511

P. ORDER NUMBER	TYPE OF CURRENT	AMPERES
818-026019	D.C	90-110

WET BATCH EQUIVALENCY CHEMICAL ANALYSIS TESTS

BATCH	LAB. NO.	PAD	C.	MN.	P.	S.	SI.	CR.	NI.	MO.	OTHER
	E-68809	2686	.07	1.91	024	014	46	20.20	10.31		
	TEST REPORT	ANALYSIS									

TENSILE PROPERTIES

TEST NO.	HEAT TREATMENT	ULT. TEN. STR. PSI	YIELD POINT PSI	E-LONG IN 2" %	RED OF AREA %

FILLET WELD TEST

	OVERHEAD
SIZE	
LEG.	
CONVEXITY	
	VERTICAL
SIZE	
LEG.	
CONVEXITY	
	HORIZONTAL
SIZE	
LEG.	
CONVEXITY	

CHARPY ________ IMPACT TEST @ ______ °F ______ FT/LB. ENERGY LOAD

HEAT TREATMENT	TEST NO.	FT/LB.	TEST NO.	FT. LB.

MATERIAL APPROVAL

NAVSHIPS ________
ASME ________
NAVY NUCLEAR STD. ________
STEAM GENERATORS ________
COMMERCIAL NUCLEAR STD. ________
OSCILLATED COVER BEAD ________

GUIDED BEND TESTS

FACE	ROOT	SIDE

MICRO OR MACRO FISSURE ANALYSIS.	

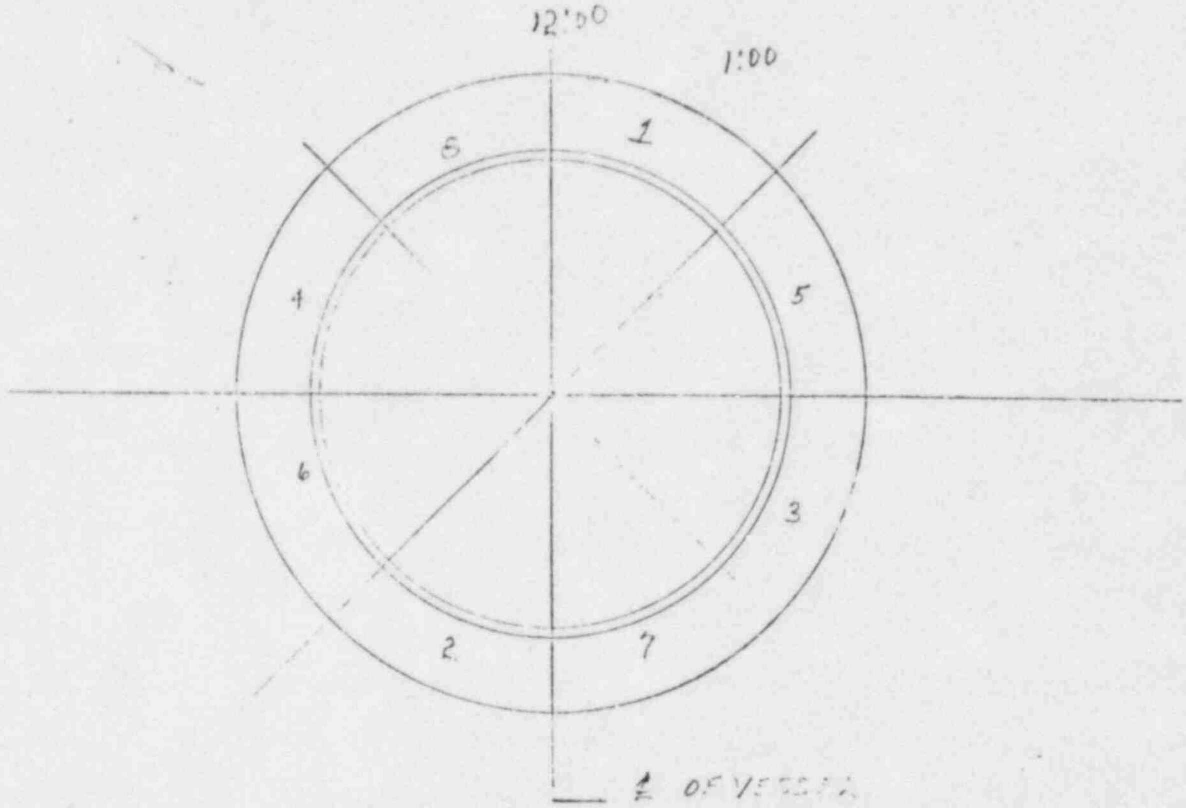
GROOVE WELD TEST
RADIOGRAPHIC EXAMINATION

WE HEREBY CERTIFY THAT THE ABOVE MATERIAL HAS BEEN TESTED IN ACCORDANCE WITH THE ABOVE LISTED SPECIFICATION AND IS IN CONFORMANCE WITH ALL REQUIREMENTS.

DATE MAR 1 ? 19??

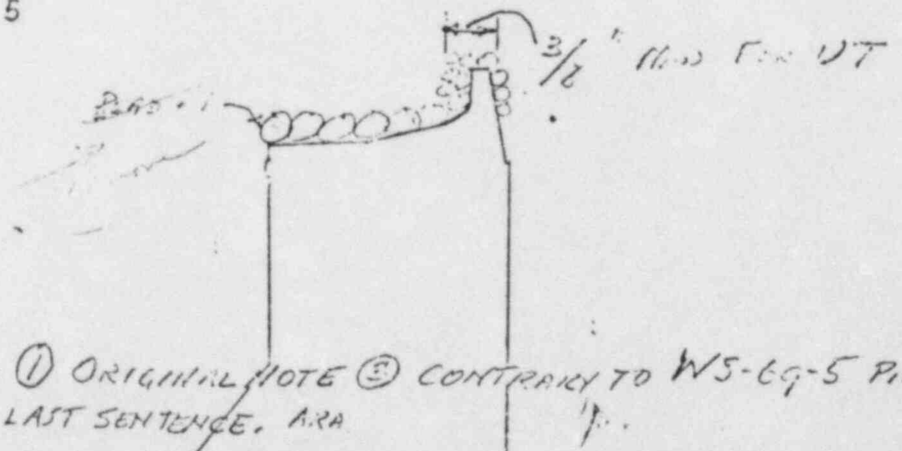
SIGNED G. Hinkle

INSPECTION AGENCY BABCOCK & WILCOX CO.



NOTES

1. Length of rod deposit determines length of intermittent weld length
2. Numbers indicate welding sequence.
3. WHEN WELDING IS PERFORMED IN ANY POSITION OTHER THAN FLAT, THE WELDING PROGRESSION SHALL BE UPHILL
4. Starts & Stops will be inspected in accordance with para. 5.2.1.[illegible] of W.S. 69 - 5

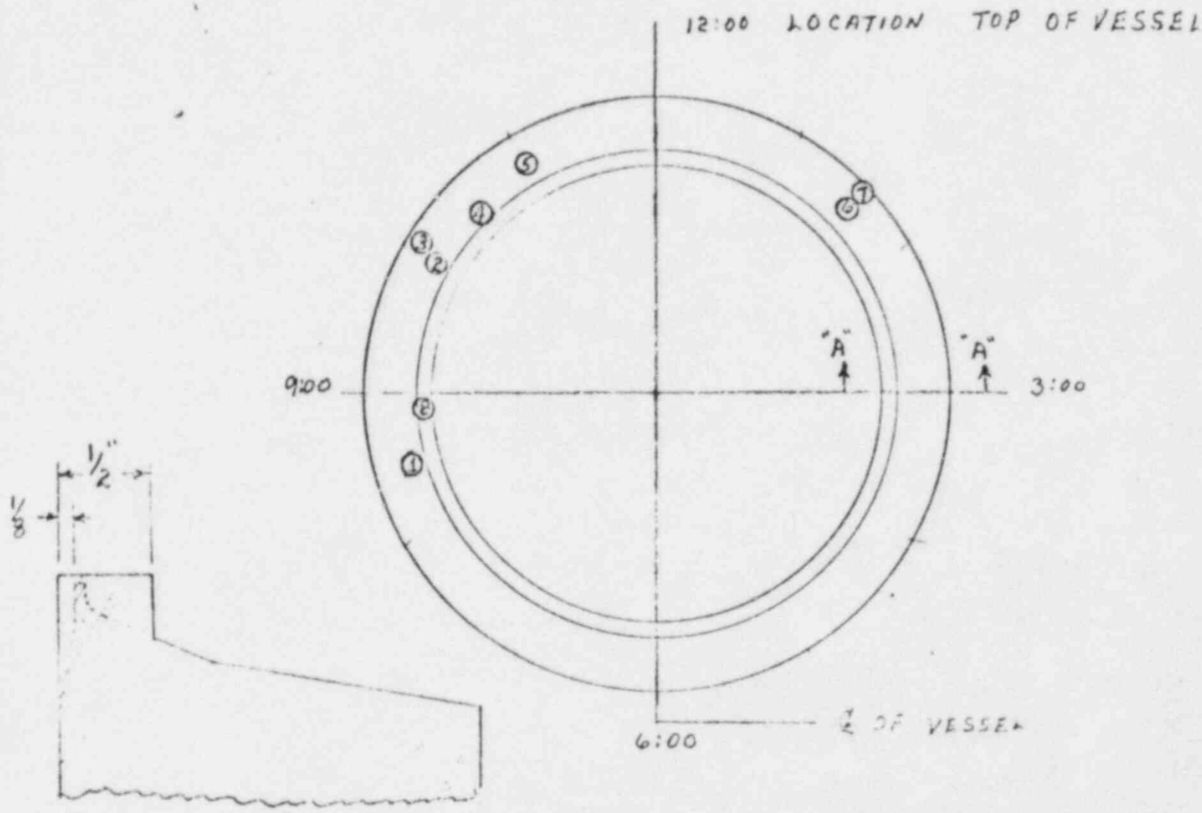


4/23/69 REVISION ① ORIGINAL NOTE ③ CONTRARY TO WS-69-5 PARA. 3.1.1.2 LAST SENTENCE. ARA

(9)

QUALITY CONTROL
INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO



SEC "A-A"

INDICATIONS RECORDED

INSTRUMENT USED:
BRANSON SONORAY 301

SEARCH UNITS:
2.25 MHZ 1/2" ⌀ T&R Z103
3.5 MHZ 3/8" ⌀ T&R Z103

REFERENCE BLOCK:
B&W WELD BUILDUP
BLOCK #1 308 S.S.

NO.	LOCATION	DISTANCE FROM OD	DEPTH	AMPLITUDE
1	11:30	2 1/4"	3/8"	4 50%
2	1:00	* NEXT TO BUILD-UP	1/8"	5 15%
3	1:00+	1/2"	1/8"	5 15%
4	1:30	* NEXT TO BUILD-UP	1/8"	7 15%
5	2:00	" " "	1/8"	9 20%
6	4:30	2"	3/8"	50%
7	4:30	ON OD	1/8"	15%
8	11:55	* ON BUILD-UP	3/16"	10%

* BUILD-UP 1/2" WIDE

RESULTS: NO INDICATIONS WERE DETECTED THAT HAD ANY LENGTH OR SIZEABLE DIMENSIONAL AREA.

INSPECTION TICKET # A-10304

CUSTOMER WESTINGHOUSE

JOB. NO. 610-0115-51-[illegible]

SUBJECT ULTRASONIC INSPECTION - MAPPING OF INDICATIONS INLET NOZZLE BETWEEN Z & W AXIS.

DWG. NO. 7 PAGE 1 OF 2

BY J.R. FLETCHER

DATE 4/28/69

REFERENCE AREA:

1/8" DIAMETER FLAT BOTTOM HOLE.
TUNING POINT FOR 3/8 ɸ 3.5 MHZ CRYSTAL
3/8" TEST DISTANCE, 8 DIVISIONS ON SCREEN.
THE 1/8" & 1/4" DEPTH INDICATIONS WERE
OFF SCREEN AND CLEARLY RESOLVEABLE.

TUNING POINT FOR 1/2" ɸ 2.25 MHZ CRYSTAL
1/2" TEST DISTANCE, 10 DIVISIONS ON SCREEN.
THE 1/4" & 3/8" DEPTH INDICATIONS WERE OFF
SCREEN AND CLEARLY RESOLVEABLE.

RECORDING LEVEL:

RECORDING LEVEL FOR TEST WAS 25%
OF REFERENCE STANDARD.

PERSONNEL:

HARTFORD INSURANCE —— GORDON SVENDSEN
SOUTHWEST RESEARCH —— SYL VIACLOVSKY
WESTINGHOUSE —— E. F. HUGHES
BABCOCK & WILCOX CO. —— J.R. FLETCHER

CUSTOMER WESTINGHOUSE
JOB. NO. 610-0115-51-18
DWG. NO. 7 PAGE 2 OF 2
SUBJECT
ULTRASONIC INSPECTION – MAPPING OF INDICATIONS
INLET NOZZLE BETWEEN Z & W AXIS
BY J.R. FLETCHER
DATE 4/28/69

APPENDIX B

INSPECTION RECORDS

The following section contains inspection records of work performed during repair operations of two damaged nozzles on the Wisconsin Michigan Power Company's nuclear reactor pressure vessel. A copy of a Babcock & Wilcox Company file document is shown on pages XVIII-23 through XVIII-26. This document lists the inspection tickets, sequenced in the order in which they were performed.

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

To FILE	
From J. R. FLETCHER, BARBERTON ERECTION	FCS 663-4
Cust. WESTINGHOUSE ELECTRIC CORPORATION	File No. or Ref. #610-0115-51-18 R&8 191-28326
Subj. INSPECTION TICKETS	Date MAY 13, 1969

This letter to cover one customer and one subject only.

Ref: Repair Procedures CNR109-5 & CNR110-1

In order to make our inspection tickets easier to delineate, we have outlined the tickets according to ticket number and description as follows:

Inspect. Ticket No.	Description	Date
H-40293	Dimensional Established for Subsequent Machining Operation on Inlet and Outlet Nozzles (Sketch No. 1 attached to ticket)	4-11-69
H-40279	Inlet Nozzle - Liquid Penetrant on ground areas. (acceptable)	4-12-69
H-40280	Outlet Nozzle - Liquid Penetrant on ground areas. (reject)	4-12-69
H-40281	Outlet Nozzle - Liquid Penetrant on rejected area. This ticket clears ticket No. H-40280	4-14-69
H-40282	Iron Free Inspection on Inlet and Outlet Nozzle. (See sketch No. 5 attached to ticket)	4-14-69
H-40287	Iron Free Inspection on Outlet Nozzle Acceptable (clears ticket No. H-4028 on for Outlet Nozzle)	

Inspect. Ticket No.	Description	Date
H-40295	Outlet Nozzle - Liquid Penetrant of Indentation area after grinding (Sketch No. 6 Attached to ticket)	4-16-69
H-40288	Outlet Nozzle - Liquid Penetrant Retested Face of Weld Prep and including 6" inside bore per request by Mr. J. Steele and Mr. Reno, Westinghouse Representative. (acceptable)	4-16-69
H-40286	Inlet Nozzle - Free Iron Inspection Acceptable (clears ticket #H-40282 for Inlet Nozzle)	4-17-69
H-40290	Inlet Nozzle - Liquid Penetrant Retested face of weld prep and including 6" inside bore per request by Mr. J. Steel, and Mr. E. Reno, Westinghouse Representatives.	4-17-69
H-40297	Outlet Nozzle - Charting of Cavities and Ground Areas. (Sketch #3 Attached to ticket)	4-22-69
H-40298	Outlet and Inlet Nozzles - Dimensionals on Buttering Thickness. (Sketch #4 attached to ticket)	4-22-69
H-40296	Inlet Nozzle - Charting of Cavities and Ground Areas. (Sketch #2 Attached to ticket)	4-22-69
H-40299	Inlet Nozzle - Temperature Verification of min temp of 70°	4-23-69
H-40300	Inlet Nozzle - Temperature Verification of min. temp. 70°	4-24-69
H-40301	Inlet Nozzle - Temperature Verification of min. temp. of 70°	4-25-69
H-40305	Inlet and Outlet Nozzle -Temperature Verification of min. temp. of 70°	4-26-69
H-40302	Inlet and Outlet Nozzle - Temperature Verification of min. temp. of 70°	4-27-69

Inspect. Ticket No.	Description	Date
H-40307	Inlet and Outlet Nozzle - Temperature Verification of min. temp. of 70°	4-28-69
H-40304	Inlet Nozzle - Ultrasonic Inspec. tion (Sketch #7 attached to ticket)	4-28-69
H-40308	Inlet and Outlet Nozzle - Temperature Verification	4-29-69
H-40309	Inlet and Outlet Nozzle - Temperature Verification	4-30-69
H-40310	Outlet Nozzle - Temperature Verification	5-1-69
H-40311	Outlet Nozzle - Temperature Verification	5-5-69
H-40266	Inlet Nozzle - Final PT Inspection (Sketch #8 attached to ticket)	5-6-69
H-40265	Outlet Nozzle - Ultrasonic Inspection (Sketch #9 attached to ticket)	5-7-69
H-40267	Inlet Nozzle - Free Iron Inspection	5-7-69
H-40263	Outlet Nozzle - Temperature Verification	5-7-69
H-40269	Outlet Nozzle - Final PT (Sketch #10 attached to ticket)	5-8-69
H-40264	Outlet Nozzle - Temperature Verification (for welding on procedure CNR110-1)	5-8-69
H-40271	Outlet Nozzle - Final PT on Indentation (Procedure CNR110-1 Sequence 6)	5-8-69
H-40268	Outlet Nozzle - Free Iron Inspection (Indentation area included)	5-9-69
H-40270	Inlet and Outlet Nozzle - Dimensionals (Sketch #11 attached to ticket)	5-9-69

Inspect. Ticket No.	Description	Date
H-40306	Clad Test Block for Welder Performance Qualification - PT Inspection	4-21-69

The above inspection tickets are sequenced in the order in which they were performed and are inclusive of all inspections for referenced procedures.

J.R. Fletcher
J. R. Fletcher
Erection Quality Control

JRF:kg

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION DIMENSIONALS ESTABLISHED
3. DESCRIPTION:

REFERENCE POINTS ESTABLISHED FOR SUBSEQUENT MACHINING OPERATION AND DIMENSIONS TAKEN.

See Attached Sketch # 1

INLET & OUTLET NOZZLES BETWEEN W & X & Z & W AXIS.

4. RESULTS: ACCEPT - REJECT

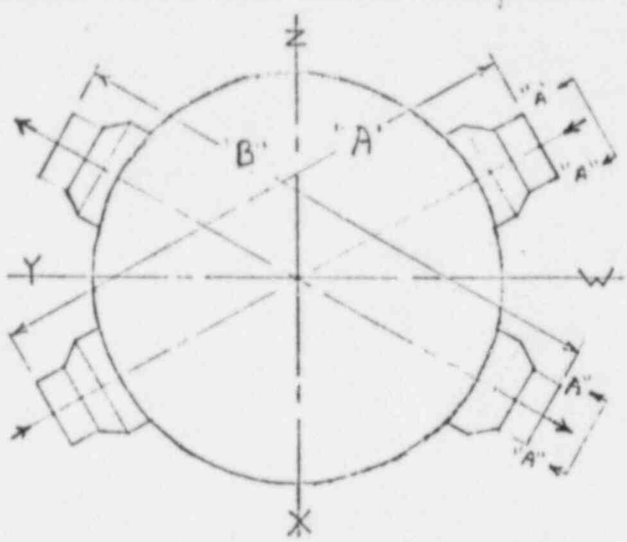
UNIT #1

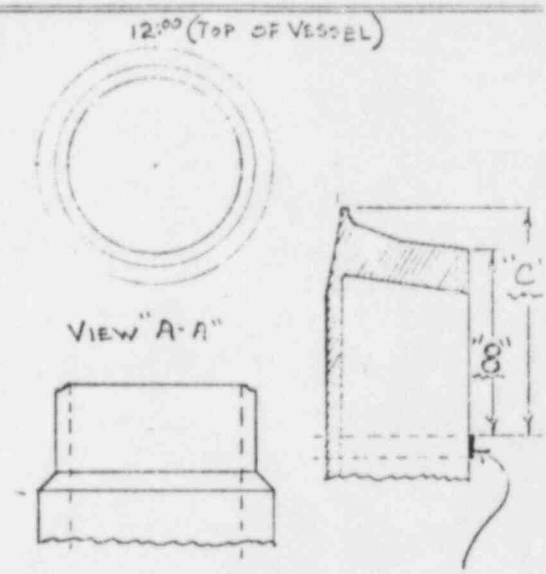
DWG. NO.	MK. NO. OR USE	CONTRACT
SL-315 / 185172E-C		[illegible] / 610-0115-29-[illegible]
CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible signature]		
B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J F Fletcher 4-11-69		N 40293

QCD 2E4-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

BMC-247





INLET NOZZLE ("C" Dim = 8 31/32")

Reading No.	Approx Clock Loc. See "A-A"	"A" Dim.	
1.	12:00	19'-2"	℄ Toward Top of Vessel
2.	1:15	19'-2 1/16	12" from 1st Location
3.	2:30	19'-2 1/16"	12" " 2nd "
4.	4:15	19'-2 1/[illegible]	12" " 3rd "
5.	6:00	19'-2 1/16"	18" " 4th "
6.	7:00	19'-2 1/16"	9 1/2" " 5th "
7.	8:30	19'-2"	13" " 6th "
8.	10:30	19'2"	19" from 7th Location

OUTLET NOZZLE ("C" Dim = 8 15/16")

Reading No	Approx. Clock Loc. See "A-A"	"B" Dim	
1	12:00	18'-3 1/4	℄ Toward Top of Vess[illegible]
2	9:00	18'-3 3/16	25" from 1st Location
3	5:30	18'-3 1/8"	31" " 2nd "
4	2:00	13'-3 3/16"	35" from 3rd Location

BABCOCK & WILCOX COMPANY
DEPARTMENT [illegible] Q.C. & N.C.E. BY J.R.F. & J.L.S.
DATE Apr 22, 19[illegible]
Seal Measurements - Inlet to Inlet and Outlet to Outlet Face
JOB NO. 59[illegible]
SHEET 1 OF

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION: (Procedure CNR-164-4 Sequence 2)

SS Buttering - Safe End

INLET NOZZLE BETWEEN Z & W Axis

DAMAGED PORTION OF NOZZLE GROUND. ~~CAVITIES~~ Ground Areas INSPECTED IN ACCORDANCE WITH B & W SPEC S102-C REV. 5.

APPROVED NON WATER WASHABLE MATERIALS (MAGNAFLUX CORP) COMBINATION 2

SEE REJECT TICKET # H 40067 DATED 3/12/69 (J. FURRY) ON ORIGINAL INSPECTION AFTER INCIDENT

SEE ~~[illegible]~~ SKETCH FOR CHARTING OF GROUND AREAS ATTACHED TO INSPECTION TICKET # H 40296

GROUND AREAS (Acceptable for weld repair)

4. RESULTS: ACCEPT - REJECT

UNIT # 1

DWG. NO.	MK. NO. OR USE	CONTRACT
[illegible]		197-23326 610-0116-51-18

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible signature]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
JR Fletcher 4-12-69		H 40279

QCD 2E4-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

MOORE BUSINESS FORMS, INC.

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION (Procedure CNR-69-4 Sequence 2)

SS BUTTERING - SAFE END
OUTLET NOZZLE BETWEEN W & X AXIS.

DAMAGED PORTION OF NOZZLE GROUND.
GROUND AREAS INSPECTED IN ACCORDANCE WITH B & W SPEC S102C-5

MATERIALS.
APPROVED NONWATER WASHABLE
MAGNAFLUX CORP - COMBINATION 2

See Rejected Inspection Ticket # H 40667 Dated 3-12-69 (J. Furry) on initial Inspection after incident.

Transverse indication at 12:30 Position 3/16" in length. The remaining ground areas were acceptable

4. RESULTS: ACCEPT - REJECT

UNIT 1

DWG. NO.	MK. NO. OR USE	CONTRACT
~~[illegible]~~ 1172-57		141-23536 610-0115-51-18

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
JR Fletcher 4-12-69		H 40280

QCD 264-107A

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MOORE BUSINESS FORMS, INC.

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid PeneTrant
3. DESCRIPTION: (Procedure # CNS-104-4 Sequence 213)

S.S. BUTTERING - SAFE END

OUTLET NOZZLE BETWEEN W & X AXIS

LINEAR INDICATION AT 12:30 POSITION

& GROUND & REINSPECTED IN

ACCORDANCE WITH B & W SPEC. S102C-5

MATERIALS:

APPROVED NONWATER WASHABLE.

MAGNAFLUX CORP. - COMBINATION 2

THIS TICKET CLEARS REJECT

TICKET # H 40280

CAVITY DIM 1" x 1/2" x 7/64.

OUTLET NOZZLE ACCEPTABLE & FOR

WELDING

4. RESULTS: ACCEPT - REJECT

UNIT 1

DWG. NO.	MK. NO. OR USE		CONTRACT
~~[illegible]~~ 117825E			610-0115-51-18 [illegible]
CUST. INSP. [illegible signature]	HSB INSP.		GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP: J.R. Fletcher 4-14-69	RECORDED	H 40281	

QCD 2E4-107A

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BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION IRON FREE INSPECTION
3. DESCRIPTION (Procedure CNR-107-4 Sequence 4)

BUTTERING - SAFE END
INLET NOZZLE BETWEEN Z & W AXIS
OUTLET NOZZLE BETWEEN W & X AXIS

INSPECTED WELD BUTTERING & 6" OF BORE IN ACCORDANCE WITH B & W SPEC S-207. FOR IRON CONTAMINATION.

SEE ATTACHED SKETCH FOR IRON CONTAMINATED AREAS. SKETCH #5

INLET & OUTLET NOZZLES

4. RESULTS: ACCEPT - REJECT

UNIT #1

DWG. NO.	MK. NO. OR USE		CONTRACT
117532E 117535E			[illegible] [illegible]-51-15
CUST. INSP. [illegible signature]	HSB INSP.	GOVT. INSP.	
B & W INSP. - DATE - SHIFT - SHOP J.R. Fletcher 4-14-[illegible]	RECORDED	H 40282	

QCD 2E4-107A

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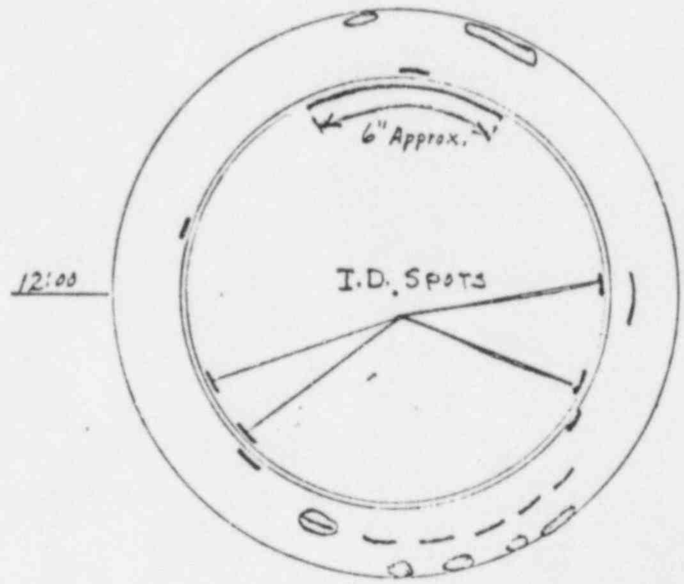
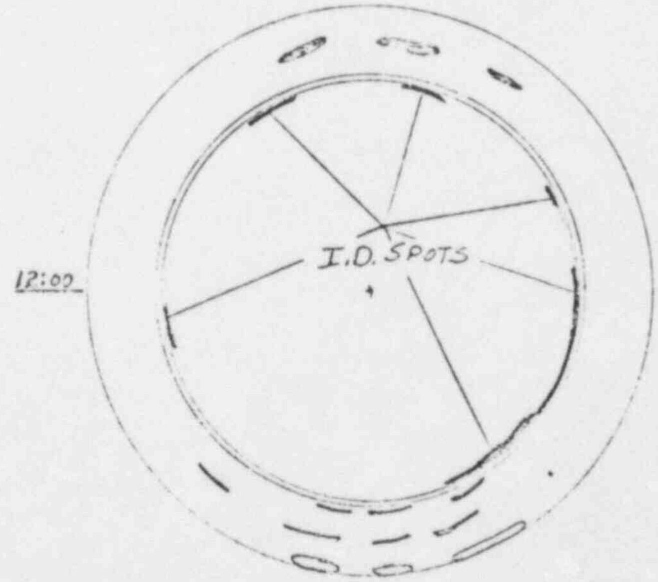
BMS-247



INLET



OUTLET

BABCOCK & WILCOX COMPANY

DEPARTMENT Erection Q.C. & N.C.E. BY J.R.F. & J.L.S. DATE April 23, 19[illegible]

Inspection Report - Free Iron Check JOB NO. 59[illegible]

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION IRON FREE INSPECTION
3. DESCRIPTION: (Procedure GNR-109-4 Sequence 4)

S.S. BUTTERING - SAFE END

OUTLET NOZZLE BETWEEN W & X AXIS

GROUND LOCALIZED IRON CONTAMINATED AREAS.

REINSPECTED AREAS IN ACCORDANCE WITH B&W SPEC. S-207

THIS TICKET CLEARS Rejected TICKET #H-40282 FOR OUTLET NOZZLE

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE		CONTRACT
~~HF-255~~ 1129357F			1?1-25320 610-0115-51-18
CUST. INSP. [signature]	HSB INSP.		GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J.R. Fletcher 4-16-69	RECORDED	H 40287	

QCD 2E4-107A

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MOORE BUSINESS FORMS INC

BOX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION: PROCEDURE QNR 110-1

S.S. CLADDING INSIDE NOZZLE

OUTLET NOZZLE BETWEEN W4X AXIS

INDENTATION GROUND & INSPECTED IN ACCORDANCE WITH B&W SPEC S102-C-5

MATERIALS:
APPROVED NON-WATER WASHABLE
MAGNAFLUX CORP - COMBINATION 2

GROUND AREA .005" DEEP BY APPROX 1" DIA.

SKETCH ATTACHED FOR INDENTATION LOCATION SKETCH # 6

GROUND AREA ACCEPTABLE FOR WELD REPAIR.

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825E-2		171-2552L 610-0115-51-15

CUST. INSP	HSB INSP	GOVT. INSP
[signature]		

B & W INSP · DATE · SHIFT · SHOP	RECORDED	
J.R. Fletcher 4-16		H-40295

QCD 2E4-107A

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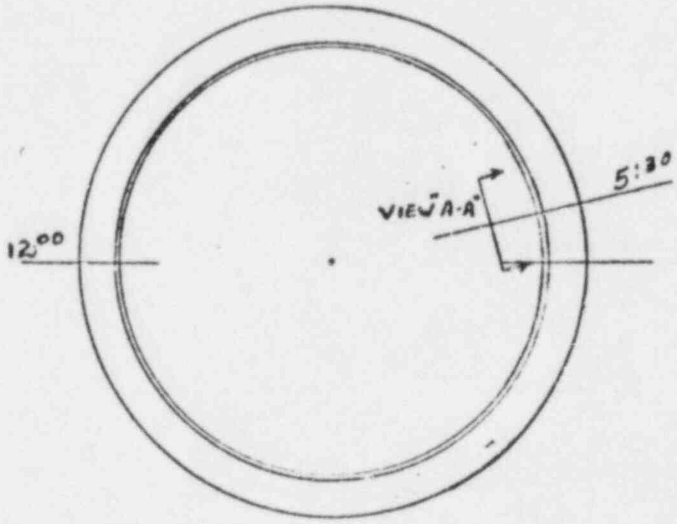
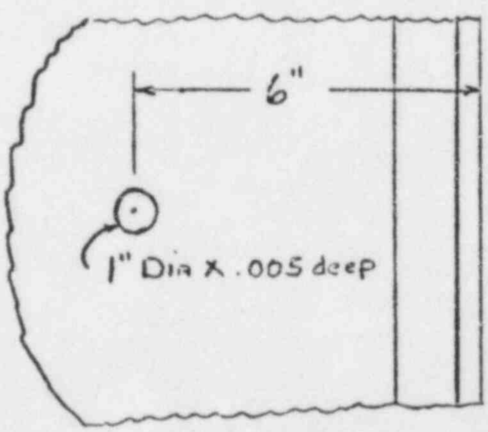
BMS-247





VIEW "A-A"

BABCOCK & WILCOX COMPANY

DEPARTMENT Erection Q.C. & N.C.E. BY J.R.F. & J.L.S.

INDENTATION ON OUTLET NOZZLE

DATE April 23, 1969

JOB NO 596-3582-51-12

SHEET 6 OF

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION: Procedure CHR 107-4

S.S. BUTTERING - ~~SAFE~~ SAFE END
OUTLET NOZZLE BETWEEN W & X AXIS.
RETESTED FACE OF WELD PREP
INCLUDING 6" INSIDE BORE.

THIS INSPECTION PERFORMED AFTER
IRON FREE INSPECTION. INSPECTION AT THIS
TIME WAS REQUESTED BY MR. J. STEELE & MR. E. RENC WESTINGHOUSE
MATERIALS.
APPROVED NON-WATER WASHABLE
MAGNAFLUX CORP. - COMBINATION 2

ALL GROUND AREAS & 6" EXTENDING
INSIDE BORE ACCEPTABLE

4. RESULTS: $\boxed{\text{ACCEPT}}$ - REJECT
OUTLET NOZZLE ACCEPTABLE FOR WELDING

DWG. NO.	MK. NO. OR USE	CONTRACT
~~[illegible]~~ 113522E		7?-25526 610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
[signature]		
B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
JR Fletcher 4-16-69		H 40288

QCD 264-107A

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MOORE BUSINESS FORMS INC

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION IRON FREE INSPECTION
3. DESCRIPTION (Procedure CNR-109-4 Sequence 4)

SS BUTTERING - SAFE END

INLET NOZZLE BETWEEN Z & W AXIS

GROUND LOCALIZED CONTAMINATED AREAS.

REINSPECTED AREAS IN ACCORDANCE WITH B&W SPEC. S-207.

THIS TICKET CLEARS Rejected TICKET #H40282 FOR INLET NOZZLE

4. RESULTS: ACCEPT - REJECT

DWG. NO. 1173002	MK. NO. OR USE	CONTRACT 171-28326 620-0015-51-18
CUST. INSP. [illegible] (U)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J.R. Fletcher 4-17-69	RECORDED	H. 40286

QCD 2E4-107A

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MOORE BUSINESS FORMS, INC.

BOX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION: Procedure CNR-109

SS BUTTERING - SAFE END

INLET NOZZLE BETWEEN Z & W AXIS.

RETESTED FACE OF WELD PREP INCLUDING 6" INSIDE BORE.

THIS INSPECTION PERFORMED AFTER IRON FREE INSPECTION. INSPECTION AT THIS TIME WAS REQUESTED BY Mr J. STEELE & Mr E RENO. WESTINGHOUSE

MATERIALS:

APPROVED NON-WATER WASHABLE

MAGNAFLUX CORP. - COMBINATION 2

ALL GROUND AREAS & 6" EXTENDING 6" INSIDE BORE ACCEPTABLE

4. RESULTS: ACCEPT - REJECT

INLET NOZZLE ACCEPTABLE FOR WELDING

DWG. NO. 1175[illegible] E [illegible]	MK. NO. OR USE		CONTRACT 19-25526 610-0115-51-18
CUST. INSP. [illegible signature]	HSB INSP.		GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP: JR Fletcher 4-17-69	RECORDED	H 40290	

QCD 2E4-107A

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MOORE BUSINESS FORMS INC.

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION MAPPING CHART
3. DESCRIPTION:

S.S. BUTTERING - SAFE END

OUTLET NOZZLE BETWEEN W + X AXIS

GROUND AREAS & CAVITIES CHARTED.

SKETCH #3 (MAPPING CHART) ATTACHED

4. RESULTS: ACCEPT · REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825 F 6		171-25326 Lic-CHS

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible] (III)		

B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J R Fletcher 4-22-69		. H 40297

QCD 2E4-107A

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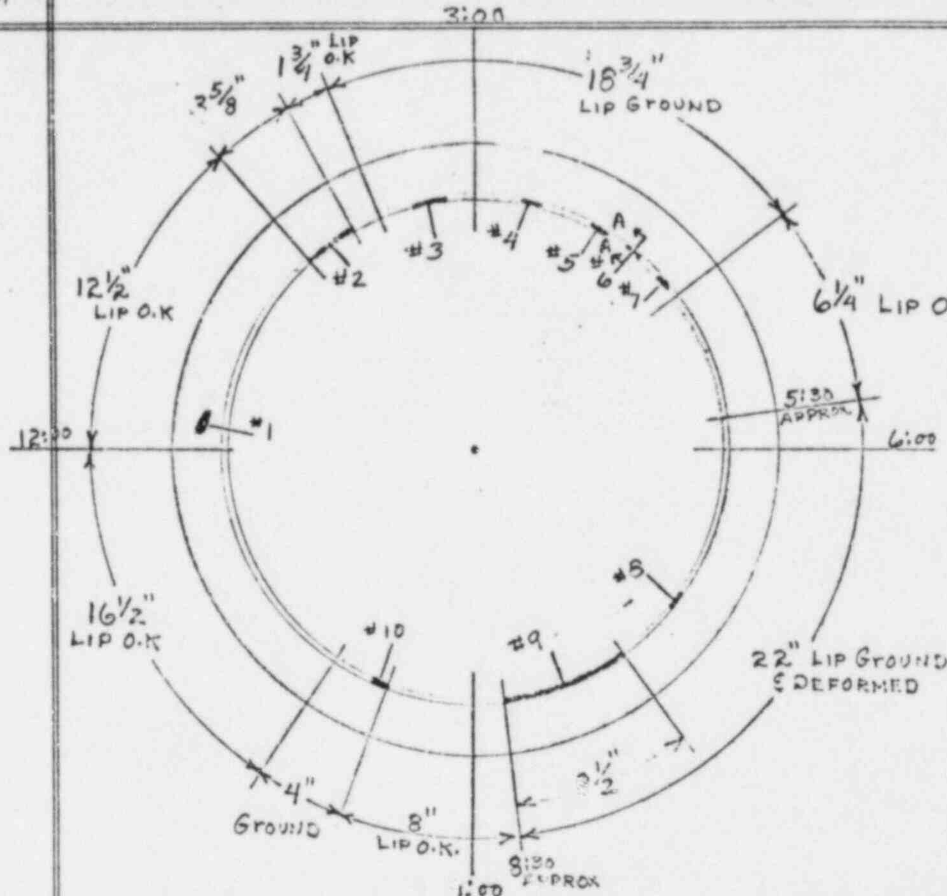
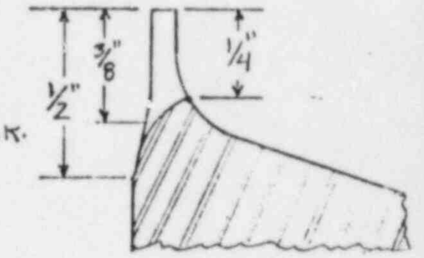
BWS-247





Sec. A-A

I.D. dim TAKEN Approx. 1" in bore from FACE

12:00 - 6:00 = 28.981
1:30 - 7:30 = 28.976
3:00 - 9:00 = 28.986
4:30 - 10:30 = 28.976

INDICATION NO	Type	Size
#1	CAVITY	9/16" WIDE X 1 5/32" Lg. X 7/64 (.102) deep
#2	GROUND LIP	5/32" LIP Ground down X 3 5/8"
#3	"	5/32 " " " X 2" Lg
#4	"	3/16" " " " X 1" Lg.
#5	"	7/32" " " " X 1" Lg
#6	"	1/4" LIP Ground Down X 1 1/8" Lg (See Sec. A-A.)
#7	"	1/32" TAPERED Down from Acceptable LIP.
#8	"	7/64" LIP Ground Down X 1" Lg
#9	"	7/32 - 9/32" " " X 8 1/2" Lg
#10	Ground LIP	1/8" LIP Ground Down

BABCOCK & WILCOX COMPANY

DEPARTMENT Erection Q.C. & N.C.E. BY J.R.F. & J.L.S. DATE April 22, [illegible]

Outlet Nozzle: Mapping Sketch (Cavities & Ground Areas) JOB NO. 59[illegible]-3532-51-[illegible]

SHEET 3 OF

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION DIMENSIONAL
3. DESCRIPTION: PROCEDURE CNR-109-4

SS. BUTTERING - SAFE END
OUTLET NOZZLE BETWEEN W & X AXIS
INLET NOZZLE BETWEEN Z & W AXIS

DIMENSIONS TAKEN TO DETERMINE
SS BUTTERING THICKNESS ON NOZZLE
WELD PREP.

SEE ATTACHED SKETCH # 4
TO VERIFY ACTUAL BUTTERING
THICKNESS PRIOR TO WELD REPAIR.
REFERENCE DWGS. 117820-E-4 &
117825 E-6
DIMENSIONALS WITNESSED BY:
A GARRETT - WESTINGHOUSE QA.
G. KEARNEY - SOUTHWEST RESEARCH

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117820 E-4 117825 E-6		141-25326 610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible signature]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J R Fletcher 4-22-75		H. 40298

QCD 2E4-107A

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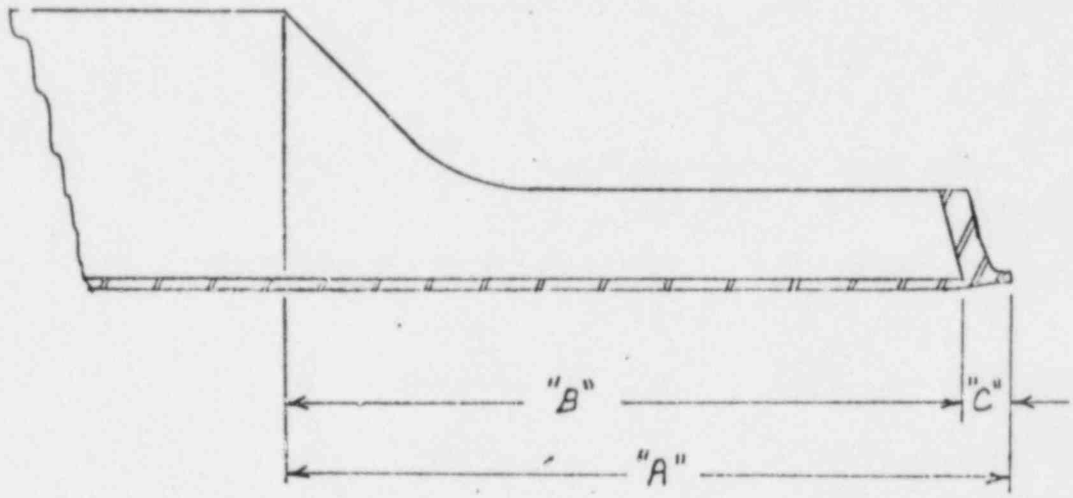

OUTLET NOZZLE

"A" = 18 7/8"
−"B" = 17 3/4"
"C" = 1 1/8"

INLET NOZZLE

"A" = 24 3/8"
−"B" = 23 3/8"
"C" = 1"

Dim "A" - As measured from Intersecting Point - O.D of Nozzle & Angle to End of Weld Prep

Dim "B" - As machined dim. from B&W dwgs (117820 E 4 - Inlet Nozzle & 117825E - Outlet Nozzle), End of Base Mat'l to Intersecting Point - O.D of Nozzle & Angle

Dim "C" - Calculated Thickness of S.S. build-up on End of Nozzle

BABCOCK & WILCOX COMPANY	
DEPARTMENT Erection Q.C. & N.C.E. BY J.R.F. & J.L.S.	DATE April 23, 19..
Buttering Thickness	JOB NO. 596-3582-51-..
	SHEET 4 OF

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION MAPPING CHART
3. DESCRIPTION:

SS. BUTTERING - SAFE END

INLET NOZZLE BETWEEN Z & W AXIS

GROUND AREAS & CAVITIES

CHARTED. SKETCH # 2 (MAPPING SKETCH)
ATTACHED

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825 E-4		[illegible] 610-0115-51-13

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J R Fletcher 4-22-69		H 40296

QCD 2E4-107A

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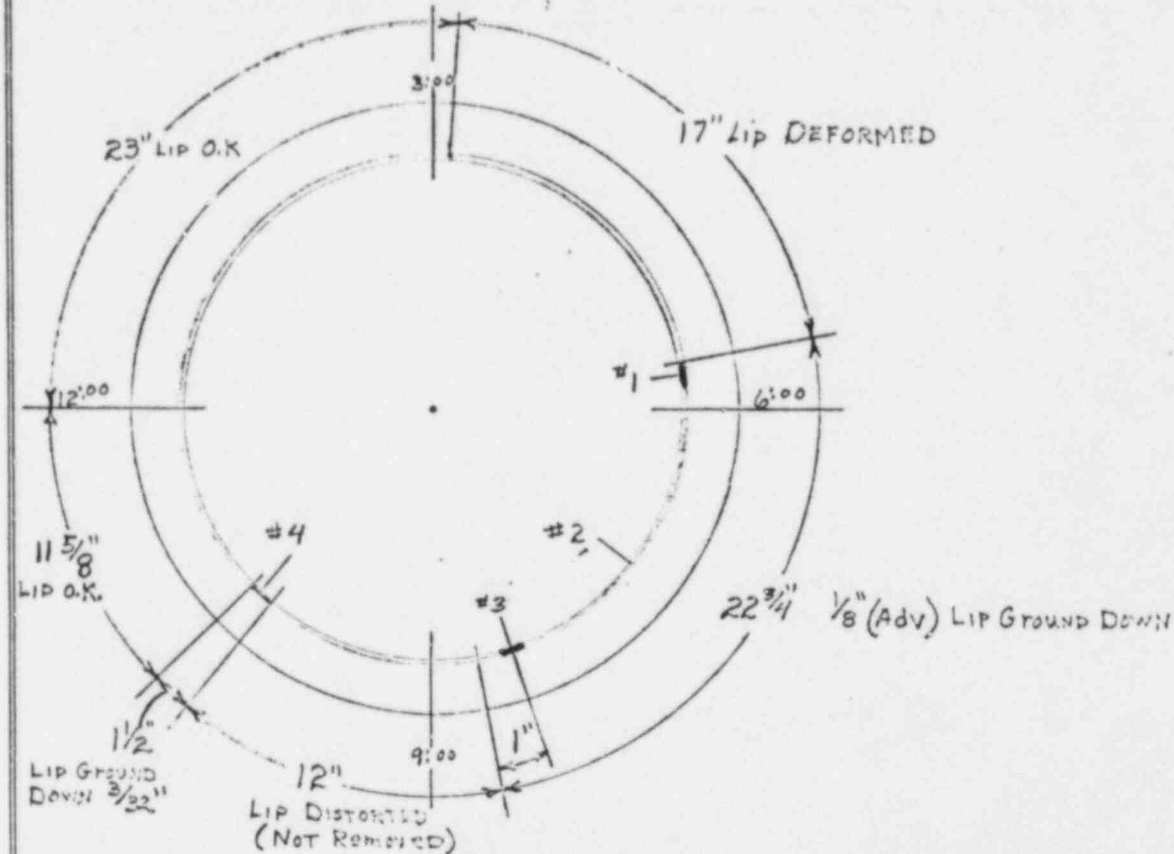
BWS-241



Indication No.	Type	Size
# 1	Ground Lip	3/16" Removed From Face x 1 1/4" Lg.
# 2	"	1/8" " " " x 22 3/4" Lg
# 3	"	3/16" " " " x 2 1/2" Lg.
# 4	Ground Lip	3/32 Removed From Face x 1 1/2" Lg

I.D. dim. Taken approx. 1" in bore from face

12:00 - 6:00 = 27.53?
1:30 - 7:30 = 27.512
3:00 - 9:00 = 27.491
4:30 - 10:30 = 27.517

BABCOCK & WILCOX COMPANY
DEPARTMENT Erection Q.C. & N.C.E. BY J.R.F. & J.L.S. DATE April 22, 19?
Inlet Nozzle - Mapping Sketch (Cavities & Ground Areas) JOB NO. 596-352?-51-
SHEET 2 OF

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z ¢ W AXIS

TEMPERATURE MEASURE TO ESTABLISH MINIMUM ACCEPTABLE TEMPERATURE PER WS 169-5 & S170-2.

TEMPERATURE RANGE ACCEPTABLE:
MIN. 70° - MAX. 350°

INSTRUMENT USED TO ESTABLISH TEMP
PYROMETER INSTRUMENT CO
CONTACT PYROMETER S/N 63-2515
CALIBRATION DATE 4-18-69
TEMP. MEASURED 73° RECORDED AT 930AM
MEASURE TAKEN PRIOR TO WELDING

4. RESULTS: ACCEPT - REJECT

TEMP. SATISFACTORY FOR WELDING

DWG. NO.	MK. NO. OR USE		CONTRACT
117520E-4			610-0115-51-15
CUST. INSP. [illegible]	HSB INSP.	GOVT. INSP.	
B & W INSP. - DATE - SHIFT - SHOP: J.R Fletcher 4-23-69	RECORDED	H 40299	

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MOORE BUSINESS FORMS, INC.

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION PREHEAT TEMPERATURE.
3. DESCRIPTION:

INLET NOZZLE - BETWEEN Z & W AXIS

TEMPERATURE MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 69-5 & S170-2, PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2519
CALIBRATION DATE 4-18-69
TEMP. RECORDED 75°

TEMP. SATISFACTORY FOR WELDING.

4. RESULTS: ACCEPT - REJECT

DWG. NO. 1175206 E - 9	MK. NO. OR USE	CONTRACT 111-25... 610-0115-51-18
CUST. INSP. C. H. Everett (W)	HSB INSP	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J.R. Fletcher 4-24-69	RECORDED	H 40300

QCD 264-107A

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BOX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION PREHEAT TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS

TEMPERATURE MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 69-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2518
CALIBRATION DATE 4-18-69
TEMP. RECORDED 78°

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117820E.-9		191-28326 610-0113 SH-18

CUST. INSP.	HSB INSP.	GOVT. INSP.
A. N. Sinnett (AI)		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.R. Fletcher 4-25-69		H 40301

QCD 2E4-107A

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BOX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION PREHEAT TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS
OUTLET NOZZLE BETWEEN W & X AXIS

TEMPERATURE MEASUREMENT TO ESTABLISH MINIMUM TEMP OF 70° PER WS 69-5 & S170-2, PRIOR TO WELDING

INSTRUMENT USED:
PYROMETER INSTRUMENT CO
CONTACT PYROMETER S/N 63-2518
CAL. DATE 4-18-69
TEMP RECORDED 78° 7:00 AM

TEMP SATISFACTORY FOR WELDING.

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117325E-6 117520E-9		171-28326 610-0115-51-18
CUST. INSP. (signature) (W)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J.R. FLETCHER 4-26-69	RECORDED	H 40305

QCD 2E4-10/A

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BDX 254-2

1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION PREHEAT TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS
OUTLET NOZZLE BETWEEN W & X AXIS
TEMPERATURE MEASUREMENT TO
ESTABLISH MINIMUM TEMP. OF 70°
PER WS 64-5 & S170-2 PRIOR TO
WELDING

INSTRUMENT USED
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2518
CAL. DATE 4-18-69
TEMP. RECORDED 72° 7:00 AM

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT - REJECT

DWG. NO. 117920E-4 117525E-4	MK. NO. OR USE	CONTRACT 141-25326 610-0115-51-15
CUST. INSP. A. W. Chanett (10)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP JR FLETCHER 4-27-69	RECORDED	H 40302

QCD 2E4-107A

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MOORE BUSINESS FORMS, INC.

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS
OUTLET " " W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS69-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2518
CAL DATE 4-18-69

TEMP RECORDED 74° 7:00 AM.

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT · REJECT

DWG NO	MK. NO. OR USE	CONTRACT
1175 [illegible] - 9 1175 [illegible] - 6		6 [illegible] 6 610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible signature] (W)		

B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J. R. FLETCHER 9-28-69		H·40307

QCD 2E4-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

MOORE BUSINESS FORMS INC

BOX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION: PROCEDURE # CNR 109 Seq # 8

S.S. BUTTERING - SAFE END

INLET NOZZLE BETWEEN Z & W AXIS

STRUMENT:

BRANSON SONORAY 301

SEARCH UNITS 2.25 MHZ 1/2" ϕ T & R
TYPE Z 103 3.5 MHZ 3/8" ϕ T & R

COUPLANT - HAMIKLEER

SEE MAPPING SKETCH # 7 ATTACHED

WELD METAL BUTTERING TESTED FOR BOND & DEFECTS IN ACCORDANCE WITH B&W SPEC S4-9 AS MODIFIED

PERSONNEL WITNESSING TESTS

SYL VIACLOVSKY - SOUTHWEST RESEARCH

GENE HUGES - WESTINGHOUSE

GORDON SIENDSEN - HARTFORD INS

4. RESULTS: ACCEPT - REJECT

ACCEPTABLE FOR MACHINING

DWG. NO.	MK. NO. OR USE	CONTRACT
117520E-4	See ABOVE	610-0115-51-53
CUST. INSP. [illegible]	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP JR Fletcher 4-25-[illegible]	RECORDED	H 40304

QCD 254-107A

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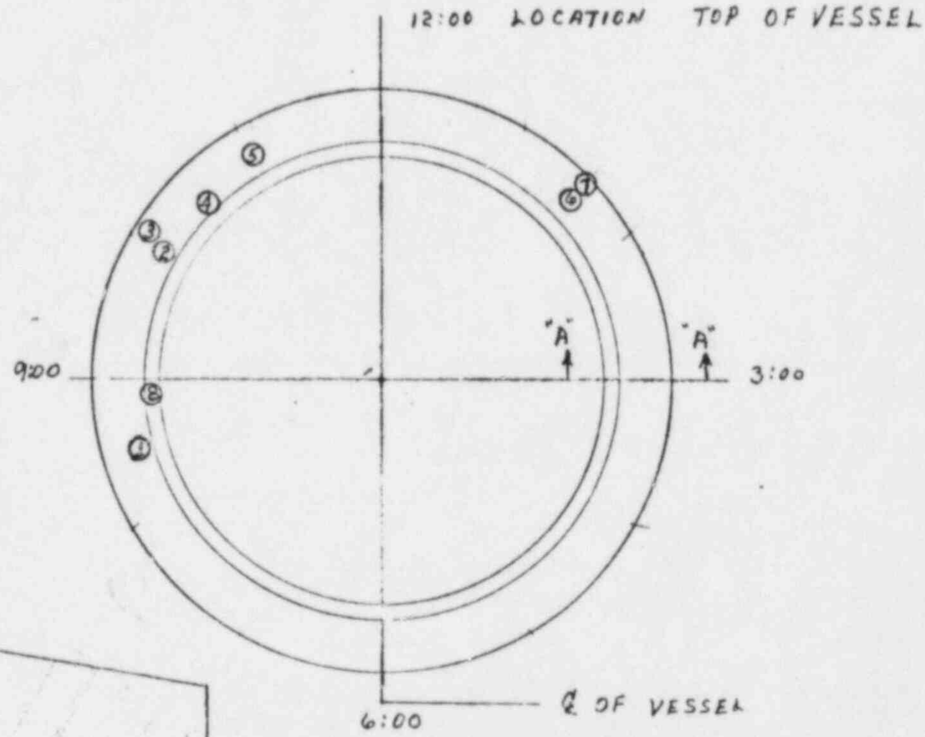
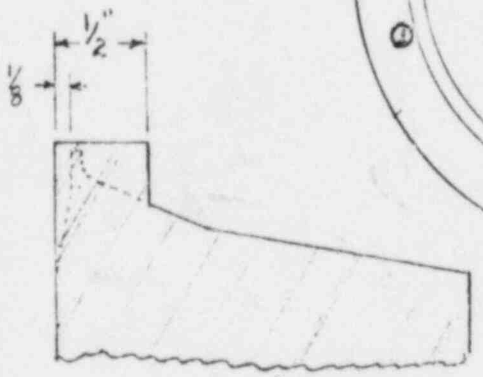
MOORE BUSINESS FORMS, INC.

QUALITY CONTROL INSPECTION

THE BABCOCK & WILCOX CO. POWE GENERATION DIVISION BARBERTON, OHIO





SEC "A-A"

INSTRUMENT USED:
BRANSON SONORAY 301
SEARCH UNITS:
2.25 MHZ 1/2" ϕ T/R Z103
3 5 MHZ 3/8" ϕ T/R Z103
REFERENCE BLOCK:
B & W WELD BUILDUP
BLOCK #1 308 S.S.

* BUILD-UP 1/2" WIDE

INSPECTION TICKET # H-10304

INDICATIONS RECORDED

NO.	LOCATION	DISTANCE FROM OD	DEPTH	AMPLITUDE	
1	11:30	2 1/4"	3/8"	4	50%
2	1:00	* NEXT TO BUILD-UP	1/8"	5	15%
3	1:00+	1/2"	1/8"	5	15%
4	1:30	* NEXT TO BUILDUP	1/8"	7	15%
5	2:00	" " "	1/8"	9	20%
6	4:30	2"	3/8"	4	50%
7	4:30	ON OD	1/8"	6	15%
8	11:55	* ON BUILD-UP	3/16"		10%
	RESULTS:	NO INDICATIONS WERE DETECTED THAT HAD ANY LENGTH OR SIZEABLE DIMENSIONAL AREA.			

CUSTOMER WESTINGHOUSE

JOB. NO. 610-0115-51-18

SUBJECT
ULTRASONIC INSPECTION - MAPPING OF INDICATIONS
INLET NOZZLE BETWEEN Z & W AXIS

DWG. NO. 1 PAGE 1 OF 2

BY J.R FLETCHER

DATE 4/28/69

QUALITY CONTROL
INSPECTION

THE BABCOCK & WILCOX CO POWER GENERATION DIVISION BARBERTON, OHIO

REFERENCE AREA:

1/8" DIAMETER FLAT BOTTOM HOLE.
TUNING POINT FOR 3/8 ϕ 3.5 MHZ CRYSTAL
3/8" TEST DISTANCE, 8 DIVISIONS ON SCREEN.
THE 1/8" & 1/4" DEPTH INDICATIONS WERE
OFF SCREEN AND CLEARLY RESOLVEABLE.

TUNING POINT FOR 1/2" ϕ 2.25 MHZ CRYSTAL
1/2" TEST DISTANCE, 10 DIVISIONS ON SCREEN.
THE 1/4" & 3/8" DEPTH INDICATIONS WERE OFF
SCREEN AND CLEARLY RESOLVEABLE.

RECORDING LEVEL:

RECORDING LEVEL FOR TEST WAS 25%
OF REFERENCE STANDARD.

PERSONNEL:

HARTFORD INSURANCE —— GORDON SVENDSEN
SOUTHWEST RESEARCH —— SYL VIACLOVSKY
WESTINGHOUSE —— E. F. HUGHES
BABCOCK & WILCOX CO. —— J. R. FLETCHER

CUSTOMER WESTINGHOUSE
JOB. NO. 610-0115-51-18
DWG. NO. 7 PAGE 2 OF 2
SUBJECT ULTRASONIC INSPECTION - MAPPING OF INDICATIONS
INLET NOZZLE BETWEEN Z & W AXIS
BY J.R. FLETCHER
DATE 4/28/69

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS
OUTLET " " W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 69-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2519
CAL. DATE 4-18-69

TEMP. RECORDED 73° 7:00 AM

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT - REJECT

DWG. NO. 11732UE-4, 11732SE-?	MK. NO. OR USE		CONTRACT 41-2832L, 610-0115-51-19
CUST. INSP. A. McGreen (signature)	HSB INSP.		GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP JR FLETCHER 4-29-69	RECORDED	H 40308	

QCD 2E4-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

MOORE BUSINESS FORMS, INC.

BDX 254-2

1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

INLET NOZZLE BETWEEN Z & W AXIS
OUTLET " " W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH
MINIMUM TEMP. OF 70° PER WS 69-5
& 5170-2 PRIOR TO WELDING

INSTRUMENT USED:
PYROMETER INSTRUMENT CO
CONTACT PYROMETER S/N 63-25B
CAL DATE 4-18-69
TEMP. RECORDED 73° 7:00 AM

TEMP SATISFACTORY FOR WELDING.

4. RESULTS: ACCEPT - REJECT

DWG NO 117520E - 4, 117535E - 6	MK. NO. OR USE	CONTRACT 610-28526, 0C-0115-51-18
CUST. INSP. [signature]	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP: J.R FLETCHER 4-30-69	RECORDED	H 40309

QCD 2E4-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

MOORE BUSINESS FORMS INC

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

~~INLET NOZZLE BETWEEN Z & W AXIS.~~
OUTLET NOZZLE BETWEEN W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 64-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2518
CAL. DATE 4-13-69
TEMP. RECORDED 76° 7:15 AM

TEMP. SATISFACTORY FOR WELDING.

4. RESULTS: ACCEPT · REJECT

DWG. NO. 117820E-4 117[illegible]E-1	MK. NO. OR USE	CONTRACT 141-25326 610-0115-51-12
CUST. INSP. [illegible]	HSB INSP.	GOVT. INSP.
B & W INSP. · DATE · SHIFT · SHOP J.R. FLETCHER 5-1-69	RECORDED	H 40310

QCD 2E4-127A

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

OUTLET NOZZLE BETWEEN W & X AXIS

TEMPERATURE MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER W.S 69-5 & S 170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO
CONTACT PYROMETER S/N 63-2518
CALIBRATION DATE 4-18-69
TEMP. RECORDED 73° 7:10 AM

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117935E-4		611-2[illegible] 610-015-51-[illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.C. [illegible] 5-5-[illegible]		H 40311

QCD 2E4-137A

BDX 254-2 2

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION LIQUID PENETRANT
3. DESCRIPTION: PROCEDURE CNR 109 Sequence # 12

SS BUTTERING - SAFE END
INLET NOZZLE BETWEEN Z & W AXIS.

FINAL MACHINED SURFACE OF NOZZLE
INSPECTED IN ACCORDANCE WITH B & W
SPEC. S-102-C-5.

MATERIALS:
APPROVED NON WATER WASHABLE.
MAGNAFLUX CORP. - COMBINATION # 2

THIS TICKET CLEARS ORIGINAL REJECTED
TICKET # H 60067 DATED 3-12-69 (S. FURRY)

PERSONNEL WITNESSING TEST:
E.T. HUGHES - WESTINGHOUSE
E.R. REINHART - SOUTHWEST RESEARCH
GORDON SVENDSEN - HARTFORD INSURANCE

4. RESULTS: ACCEPT · REJECT
SEE SKETCH # 2

DWG. NO.	MK. NO. OR USE	CONTRACT
117526 E - 5		610-0115-51-1 [illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.

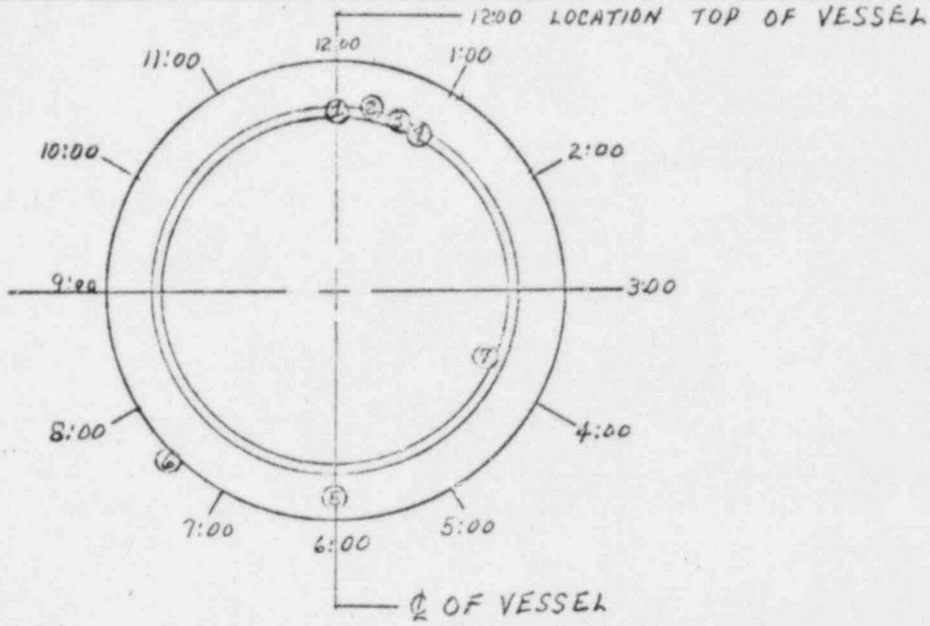
B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J.R. FLETCHER 5-6-69		H 40266

QCD 254-107A

805 1243

QUALITY CONTROL INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO



INDICATIONS RECORDED

	NO.	LOCATION	DIMENSION	DISPOSITION
FINAL P.T.	1	12:00 ON LIP	3/64 RD.	OK.
INSPECTION TICKET	2	12:00 + 1" ON LIP	1/32 RO	OK
# H-40266	3	12:00 + 1 5/8 ON LIP	1/32 RO	OK.
	4	12:00 + 3 1/2" ON LIP	1/32 RO	OK
	5	6:00 IN CENTER OF	1/64 RO	OK
	—	WELD PREP		
	6	7:30 ON O.D.		LINEAR REMOVED
	7	3:45 ON ID OF LIP PARALLEL TO EDGE 1/16" W.	.072" LONG	REMOVED - POLISHED.

CUSTOMER WESTINGHOUSE

SUBJECT LIQUID PENETRANT — MAPPING OF INDICATIONS INLET NOZZLE BETWEEN W & Z AXIS

JOB. NO. 610-0115-51-18

DWG. NO. 8 MKH

BY J.R. FLETCHER

DATE 5-6-69

BDX 254-7 2

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION ULTRASONIC
3. DESCRIPTION: PROCEDURE # CNR 109 Seq. 8

S.S. BUTTERING - SAFE END.

OUTLET NOZZLE BETWEEN W & X AXIS.

INSTRUMENT:

EKANSON SONORAY 301

SEARCH UNITS 2.25 MHZ ½" ⌀ T & R } Z 102
3.5 MHZ ⅜ ⌀ T & R }

COUPLANT - HAKIKLEER

REFERANCE BLOCK: B&W WELD BUILD-UP BLOCK #1 202.SS

WELD METAL BUTTERING TESTED IN ACCORDANCE S 4 - 9 AS MODIFIED. TESTED FOR BOND & DEFECTS.

PERSONNEL WITNESSING TEST:

E.T. HUGHES - WESTINGHOUSE.

E.R. REINHART - SOUTHWEST RESEARCH INST.

GORDON SVENOREN - HARTFORD INSURANCE

4. RESULTS: ACCEPT - REJECT

SEE ATTACHED SKETCH #9

DWG. NO.	MK. NO. OR USE	CONTRACT
179256-6		610-0115-51-13

CUST. INSP.	HSB INSP.	GOVT. INSP.
E.T. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.R. FLETCHER 5-7-69		H 40265

GCD 2E4 107A

QUALITY CONTROL
INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO

REFERENCE AREA

* 1/8" DIAMETER FLAT BOTTOM HOLE.
TUNING POINT FOR 3/8" ϕ 3.5 MHZ CRYSTAL
3/8" TEST DISTANCE, 4 DIVISIONS ON SCREEN
1/8" TEST DISTANCE 20% = FULL SCREEN
1/4" " " 25% = " "
3/8" " " 25% = 1 DIVISION ON SCREEN

* TUNING POINT FOR 1/2" ϕ 2.25 MHZ CRYSTAL
1/2" TEST DISTANCE, 5 DIVISIONS ON SCREEN
THE 1/4" & 3/8" DEPT INDICATIONS ON REFERENCE
BLOCK WERE OFF SCREEN & CLEARLY RESOLVEABLE

* NO INDICATIONS WERE EQUAL TO OR EXCEEDING 10%
OF D.A.C. REFERENCE LEVEL.

PERSONNEL:
E. T. HUGHES —— WESTINGHOUSE
E.R REINHART —— SOUTHWEST RESEARCH
GORDON SVENDSEN —— HARTFORD INSURANCE
J.R FLETCHER —— BABCOCK & WILCOX CO.

INSPECTION TICKET # H 40265

CUSTOMER WESTINGHOUSE
SUBJECT
ULTRASONIC INSPECTION
OUTLET NOZZLE BETWEEN W & X AXIS

JOB. NO. 610-0115-51-18
DWG. NO. 9 MK4
BY J.R FLETCHER
DATE 5-8-69

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION FREE IRON INSPECTION
3. DESCRIPTION: PROCEDURE CNR-109 Seq. 13.

S.S. BUTTERING - SAFE END

INLET NOZZLE BETWEEN W & Z AXIS

INSPECTED IN ACCORDANCE WITH

B&W SPEC. S-207

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117820E-9		141-28326 [illegible]-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
E.T. HUGHES		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.R. FLETCHER 5-2-[illegible]		H 40267

QCD 2E4-107A

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION TEMPERATURE
3. DESCRIPTION:

OUTLET NOZZLE BETWEEN W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 69-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2513
CAL. DATE 4-18-69
TEMP. RECORDED 74°

TEMP. SATISFACTORY FOR WELDING

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825E-1		111-25326 / 711-0115-51-13

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J.R. [illegible] 5-7-69		H 40263

QCD 264-137A

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION LIQUID PENETRANT
3. DESCRIPTION: PROCEDURE CHY 109 Seq 12

S.S. BUTTERING - SAFE END

OUTLET NOZZLE BETWEEN W & X AXIS.

FINAL MACHINED SURFACE INSPECTED IN ACCORDANCE WITH B&W SPEC. # S-102-C-5.

MATERIALS:

APPROVED NONWATER WASHABLE

MAGNAFLUX CORP. - COMBINATION 2

THIS TICKET CLEARS ORIGINAL REJECT TICKET (ON DAMAGED NOZZLES) # H70667 DATED 3-10-69. (U. FURRY)

PERSONNEL WITNESSING TEST:

E.T. HUGHES - WESTINGHOUSE

E.R. REINHART - SOUTHWEST RESEARCH

GORDON SVENDSEN - HARTFORD INSURANCE.

4. RESULTS: ACCEPT · REJECT

SEE ATTACHED SKETCH # 10

DWG. NO.	MK. NO. OR USE	CONTRACT
117835 E-6		11-35226 610-0115-51-12

CUST. INSP.	HSB INSP.	GOVT. INSP.
E.T. HUGHES		

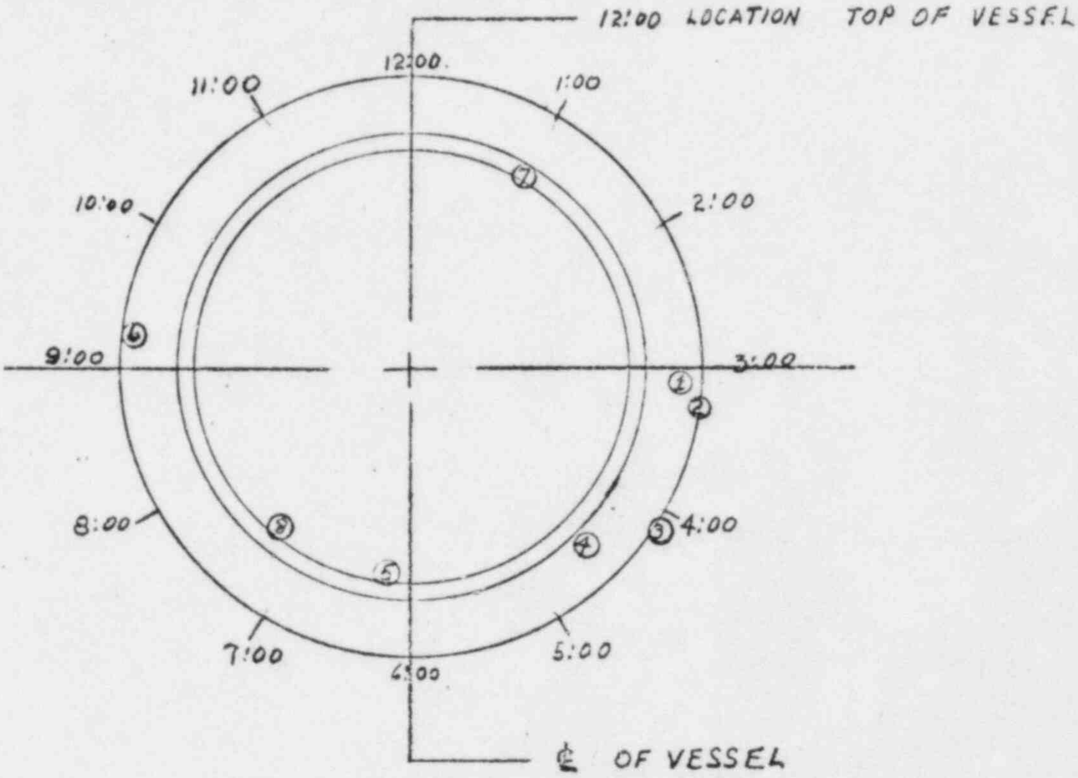
B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J.R. FLETCHER 5-8-69.		H 40269

QCD 254-107A

BOS 1.

QUALITY CONTROL
INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO



FINAL P.T.

INSPECTION TICKET #
H-40269

INDICATIONS RECORDED

NO.	LOCATION	DIMENSION	DISPOSITION
1	3:00 + 1 3/4" ON FACE	3/32" RD.	REMOVED - CAVITY .062" IN DEPTH PREPARED FOR WELDING
2	3:00 + 3 1/2" EDGE OF OD	3/32" LINEAR	REMOVED
3	4:00 + 1 5/8" ON O.D	1/8" RD	REMOVED
4	4:00 + 5 1/4"	1/8" RD	OK
5	6:00 + 1", 3/8" FROM LIP ON ID	1/16 RD	OK
6	9:00 + 4" ON FACE	1/32 RD	OK
7	1:00 TEAR ON LIP	1/16" LINEAR	REMOVED
8	6:00 + 2" 1.8" FROM LIP ON ID.	1/2" LONG VISUALLY GLOBULAR ON END	REMOVED - LESS THAN .005" DEPTH CAVITY

CUSTOMER WESTINGHOUSE

JOB. NO. 610-0115-51-18

SUBJECT LIQUID PENETRANT - MAPPING OF INDICATIONS. OUTLET NOZZLE BETWEEN W & X AXIS

DWG. NO. 10 MK#

BY J.R.F.

DATE 5-8-69

BDX 254-2 2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OF INSPECTION TEMPERATURE.
3. DESCRIPTION:

OUTLET NOZZLE BETWEEN W & X AXIS

TEMP. MEASUREMENT TO ESTABLISH MINIMUM TEMP. OF 70° PER WS 69-5 & S170-2 PRIOR TO WELDING.

INSTRUMENT USED:
PYROMETER INSTRUMENT CO.
CONTACT PYROMETER S/N 63-2513
CAL. DATE 4-18-69
TEMP. RECORDED 77°

TEMP. SATISFACTORY FOR WELDING.

WELDING ON .005" INDENTATION ON ID
PROCEDURE CNR116-2.

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825E-6		111-25326 610-0045-51-12

CUST. INSP	HSB INSP.	GOVT. INSP.
[illegible signature]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
R. FLETCHER 5-8-69		H 40264

QCD 254-107A

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION LIQUID PENETRANT
3. DESCRIPTION: PROCEDURE CNP ~~##~~ 110-1 Seq. 6 (INDENTATION).

S.S. CLADDING

OUTLET NOZZLE BETWEEN W & X AXIS
INDENTATION AREA WELDED & GROUND.
4" DIA AREA INSPECTED IN ACCORDANCE WITH B&W SPEC. S-102-C-5.

MATERIALS:
APPROVED NONWATER WASHABLE.
MAGNAFLUX CORP. -COMBINATION # 2.

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117825E-6		171-23326 610-0115-51-15

CUST. INSP.	HSB INSP.	GOVT. INSP.
[illegible]		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.R. FLETCHER 5-2-69.		H 40271

QCD 2E4-107A

BDX 254-2 2

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION FREE IRON INSPECTION
3. DESCRIPTION: PROCEDURE CNR-109 Seq. 13

S.S. BUTTERING - SAFE END
OUTLET NOZZLE BETWEEN W&X AXIS

INSPECTED IN ACCORDANCE WITH
B&W SPEC. S-207

INDENTATION AREA INCLUDED IN
THIS INSPECTION (CNR 110-)

4. RESULTS: $\boxed{\text{ACCEPT}}$ - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
117835 E 6		1-11-28226 [illegible]

CUST. INSP.	HSB INSP.	GOVT. INSP.
E.T. Hughes		

B & W INSP. - DATE - SHIFT - SHOP	RECORDED	
J.R. Fletcher 5-9-[illegible]		H 40268

QCD 2E4-107A

BDX 254-2

2

THE BABCOCK & WILCOX COMPANY

REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING · IN PROCESS · FINAL
2. TYPE TEST OR INSPECTION DIMENSIONAL
3. DESCRIPTION:

INLET NOZZLE BETWEEN W-Z AXIS &
OUTLET NOZZLE BETWEEN W-X AXIS

DIMENSIONS MEET TOLERANCES
ON "AS BUILT DIM" (SK. 318) AND
"VESSEL ASSY & FINAL MACHINING" (DWG
117817E6)

SEE ATTACHED SKETCH # 11

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT
See Above		11-[illegible] 610-[illegible]-51-18

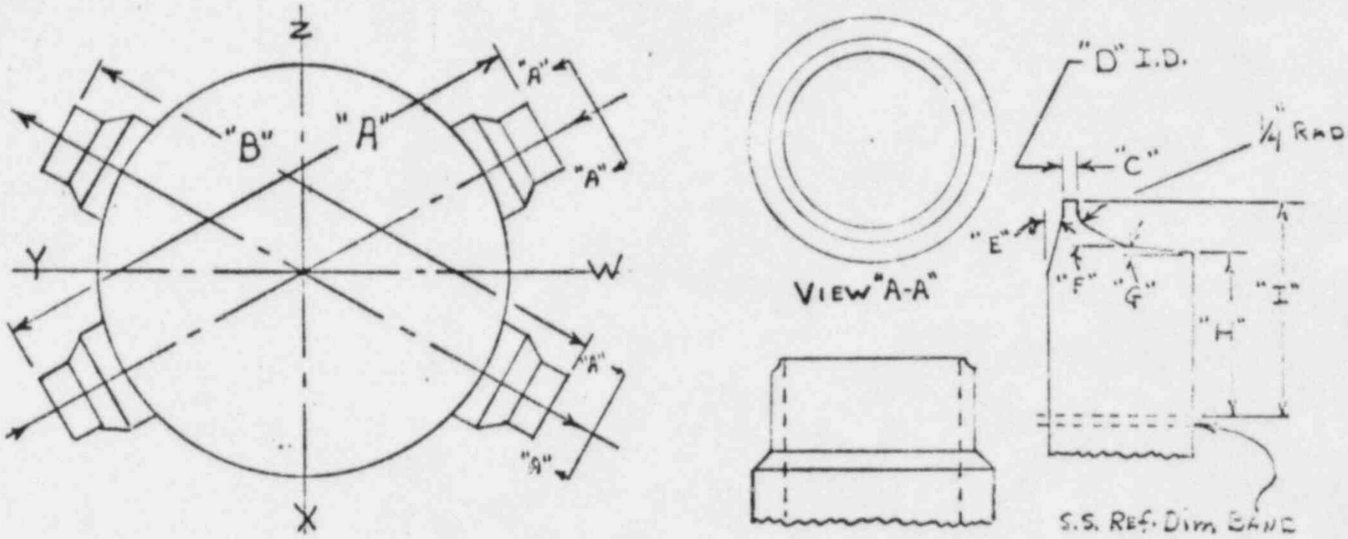
CUST. INSP.	HSB INSP.	GOVT. INSP.
E.T. Hughes		

B & W INSP. · DATE · SHIFT · SHOP	RECORDED	
J.P. Fletcher		H 40270

QCD 264-107A

QUALITY CONTROL INSPECTION

THE BABCOCK & WILCOX CO. POWER GENERATION DIVISION BARBERTON, OHIO



INLET NOZZLE

CLOCK LOC. SEC "A-A"	DIM "A"
12:00	19' 2 1/16"
3:00	19' 2 1/16"
6:00	19' 2 1/16
9:00	19' 2 1/16

OUTLET NOZZLE

CLOCK LOC. SEC. "A-A"	DIM "B"
12:00	18' 3 5/32"
3:00	18' 3 3/32
6:00	18' 3 3/32
9:00	18' 3 5/32"

"C" WIDTH OF SPIKE	.0525-.055
"D" SPIKE I.D.	27.7045
"E" INTER ANGLE	8°
"F" 1ST W.P. ANGLE	19°
"G" 2ND W.P. ANGLE	11 1/2°
"H" INTERSECTING POINT IN S.S. BAND	8"
"I" OVERALL HEIGHT TO S.S. BAND	9 1/64" - 9 1/32"

"C"	.056
"D"	29.205
"E"	10°
"F"	20°
"G"	10°
"H"	8"
"I"	8 29/32" - 8 15/16"

INSPECTION TICKET # H-90270

CUSTOMER WESTINGHOUSE

JOB. NO. 596-3582-51-18

SUBJECT FINAL MACHINED DIM. ON INLET AND OUTLET NOZZLE

DWG. NO. 11 MKN

BY J.R.F. & J.L.S.

DATE MAY 9, 1969

BDX 254-2 1

THE BABCOCK & WILCOX COMPANY
REPORT OF INSPECTION

1. WHEN INSPECTED: RECEIVING - IN PROCESS - FINAL
2. TYPE TEST OR INSPECTION Liquid Penetrant
3. DESCRIPTION: PQ 1427 W564 & W6.

CLAD TEST BLOCK FOR WELDER PERFORMANCE QUALIFICATION.

PT INSPECTED CLADDING ON TEST BLOCK AS REQUIRED BY ASME III PARA. N 545.3. INSPECTED IN ACCORDANCE WITH B&W SPEC S102C-5

WELDERS TESTED
RAY McMAHON
HAROLD KIRCHNER

MATERIALS
APPROVED NON-WATER WASHABLE.
MAGNAFLUX CORP - COMBINATION 2

4. RESULTS: ACCEPT - REJECT

DWG. NO.	MK. NO. OR USE	CONTRACT 177-2552L 610-0115-51-18
CUST. INSP. A.W. Everett (?)	HSB INSP.	GOVT. INSP.
B & W INSP. - DATE - SHIFT - SHOP J.R. Fletcher 4-21-69	RECORDED	H 40306

QCD 254-107A

PRESS HARD TO OBTAIN CLEAR 5TH COPY

XVIII-73

MANUFACTURER'S REPORT OF WELDED REPAIRS OR ALTERATIONS

1 REPAIRED BY (*Name and address of Manufacturer or Repair Concern*)
Babcock & Wilcox Company, Erection Dept , Barberton, Ohio

2 REPAIRED FOR (*Name and plant address of owner*)
Westinghouse APD Point Beach Nuclear Plant, Two Creeks, Wisconsin

3 OBJECT AND TYPE (*Boiler, pressure vessel, F.T., W.T., jacketed, etc.*)
Nuclear Reactor Vessel

4 IDENTIFICATION NUMBER (*Owner's, State, other*)
NB# N-138
YEAR BUILT
1968

5 DESCRIPTION OF REPAIR (*Use separate sheet or sketch if necessary*)
all supplements - see attached

6 REPAIRS MADE IN ACCORDANCE WITH
[X] Owner's Instructions [X] Nat'l Board Rules [X] Repair Concern's Plans

7 REPAIR PLANS APPROVED BY (*Name of Owner representative*)
Westinghouse APD, Pittsburgh, Pa.
DATE OF APPROVAL
April 15, 1969

8 WELDING PROCEDURE QUALIFICATION AND WELDER QUALIFICATION IN ACCORDANCE WITH ASME CODE
[X] YES [ ] NO

PROCEDURE DESIGNATION	DATE OF QUALIFICATION	TEST RESULTS AVAILABLE
WS-69-5		[X] YES [ ] NO

WELDER'S NAME	DATE LAST QUALIFIED	WELDER'S NAME	DATE LAST QUALIFIED
Roy McMahon	4/23/69		

9 REPAIRS COMPLETED (*Date*)
May 7, 1969
~~HYDROSTATIC~~ TEST (*Pressure*)
UT & PT

We certify the above statements to be correct and that the repairs ~~when~~ completed satisfactorily ~~withstood the hydrostatic test without evidence of leakage or other signs of distress.~~

Date ______ 19__ Signed ______ (*Manufacturer or Repair Concern*) By ______ (*Representative*)

CERTIFICATE OF WELDED REPAIR INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State of Wisconsin have inspected during repair the object described above and state that to the best of my knowledge and belief the statements made and certified to above by the representative of Hartford Steam Boiler I & I Company are correct.
(*Manufacturer or Repair Concern*)

By signing this certificate neither the Inspector nor The Hartford Steam Boiler Inspection and Insurance Company makes any warranty, expressed or implied, concerning the object described in this report. Furthermore neither the Inspector nor The Hartford Steam Boiler Inspection and Insurance Company shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection, except such liability as may be provided in a policy of insurance which The Hartford Steam Boiler Inspection and Insurance Company may issue upon said object and then only in accordance with the terms of said policy.

Date ______ 19__ Signed ______ (*Inspector*) Commissions NB-6188 (*State or Nat'l Board No.*)
WIS. COMM. 303

2033

APPENDIX C

CORRESPONDENCE

The following section contains copies of sketches, notes, and correspondence pertaining to the nozzle repair operations performed on the Point Beach nuclear reactor pressure vessel.

BDS 1743-2

FIELD CORRESPONDENCE-ERECTION DEPT.

XVIII-75

TO: Mr. Tom Kukk

CUSTOMER Westinghouse APD Point Beach, Wis.

JOB. NO. T1-28336

DATE 4/22/69

Please be advised that I have furnished the below listed documents to Hartford Steam Boiler & Westinghouse:

1. T. Kukk ltr to A.R. Anderson dated 4/11/69 w/att.
2. QC Spec. S-102C Dye Penetrant Inspection
3. Certificate of Performance Qualification Tests
4. Weld schedule for Nozzle repairs
5. T. Kukk ltr. to A.R. Anderson dated 4/17/69 re - qualification of welder.
6. T. Kukk ltr to A.R. Anderson dated 4/17/69 re - Procedure Qualification w/att.
7. A Hopkins ltr. of 4/15/69 re - J.R. Fletcher NDT Technician
8. Electrode Analysis Reports.
9. Sketch on-revised buttering sequence.

Bernard J. Anderson

CT - Mr. G.L. Proffitt - w/attachments

COPY SENT TO: KCT Mr. Ted Anderson, Field Services (enclosed)

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

To	GUEST HOUSE INN A. R. ANDERSON - MANITOWOC, WISCONSIN 54220	
From	T. J. KUKK - BARBERTON ERECTION	805 663-4
Cust.	WESTINGHOUSE - APD	File No. or Ref. 191-28326
Subj.	REPAIR SPECIFICATIONS AND PROCEDURES	Date APRIL 11, 1969

This letter to cover one customer and one subject only.

For your use, please find attached a complete set of procedures and specifications required for the subject job as follows:

Repair Procedure for Nozzle Weld Preps, CNR-109-3, revised 4/9/69 ✓

Repair for Indentation on W-X Axis Outlet Nozzle I.D. Surface, CNR-110-1, revised 4/8/69 ✓

Inlet Nozzle, Sketch #1, by J. D. Furry, dated 3/3/69 ✓

Inlet Nozzle, Sketch #1a, by J. D. Furry, dated 3/3/69 ✓

Outlet Nozzle, Sketch #2, by J. D. Furry, dated 3/3/69 ✓

Reactor Vessel Cross Section, Sketch #3, by J. D. Furry, dated 3/3/69 ✓

Repair of Welds and Base Materials for Special Products or Nuclear Application, Specification WS-69, Rev. 5 ✓

Half-Bead Weld Repair, Specification W-6, Rev. 2 ✓

Free Iron Check Procedure, Specification S-207, Rev. 0 ✓

Storage and Handling of Electrodes and Flux, Specification S-161, Rev. 3 ✓

Dye Penetrant Inspection, Specification S-10, Rev. 5 ✓

Preheat and Interpass Temperature Control, Specification S-170, Rev. 2 ✓

Ultrasonic Inspection for Defect and Bond of Weld Metal Overlay Cladding, Specification S-4, Rev. 11.

T J Kukk

T. J. Kukk

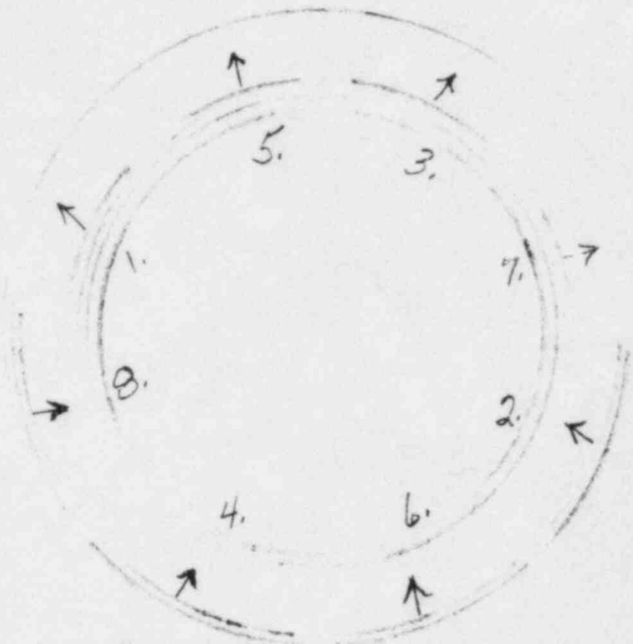
TJK:dmg

Attachments

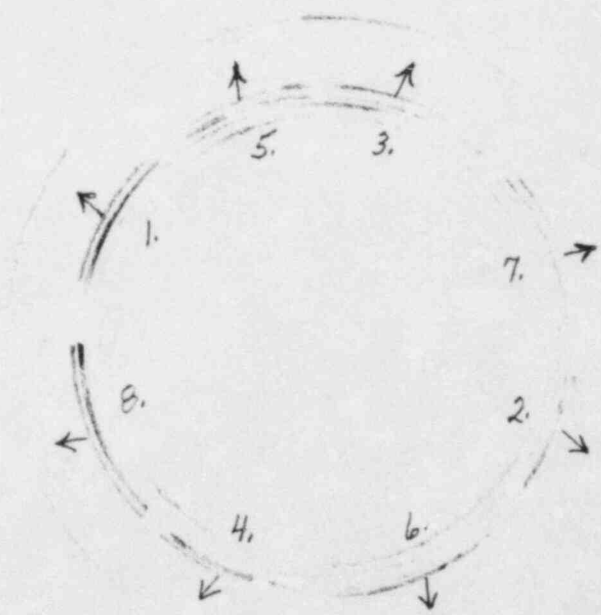
cc: T. A. Anderson
G. D. Profita
E. M. Rochester

WELD SEQUENCE AND DIRECTION OF STRINGER WELD BEADS
WELDING PROGRESSION IS UPHILL

INLET NOZZLE



OUTLET NOZZLE



WHOM IT MAY CONCERN

S. M. HOPKINS, BARBERTON ERECTION

NDT TECHNICIAN QUALIFICATION APRIL 15, 1969

Please be advised that Mr. James R. Fletcher is a qualified Level II NDT Technician in Magnetic Particle Testing, Radiographic Testing, Liquid Penetrant Testing and Ultrasonic Testing.

Documentation and certification will be retained in our Barberton office.

S M Hopkins/KJ

S. M. Hopkins, Level III NDT Examiner
Erection Quality Control

SMH:kj
cc: J. R. Fletcher

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

To: A. R. ANDERSON - MANITOWOC, WISCONSIN	
From: T. J. KUKK - BARBERTON ERECTION	BDS 663-4
Cust.: WESTINGHOUSE - APD	File No. or Ref.: 191-28326
Subj.: QUALIFICATION OF WELDERS FOR REPAIR WELDING	Date: APRIL 17, 1969

This letter to cover one customer and one subject only.

In order to qualify the welders for making repairs to the weld preps damaged during the accident, each man must weld a pipe in the 2G and 5G operation. The test assembly shall consist of stainless steel pipes at least 3/4" thick with stainless steel backing rings and butt welded using type E-308-15/16 electrodes. Preheat shall be 70°F minimum with a maximum interpass temperature of 350°F.

Additional heating such as stress relief is not permitted. The welding technique shall be such that the penetration into the side wall will be kept at a minimum.

The bend samples shall be prepared prior to bending in such a manner that all evidence of notches resulting from the backing strip are removed.

The above test will qualify a welder to perform welding in accordance with WS-69 or W-6 using stainless steel electrodes.

The qualification requirements for repairing the cladding inside the nozzle shall be to weld overlay a manganese-moly plate. The plate shall be welded with E-309-15/16 for the first layer and E-308-15/16 for the next layer. Preheat shall be 200°F minimum with a 350°F maximum interpass temperature. Testing shall be in accordance with paragraph N543.3 of Section III.

Manganese-moly plate to be a minimum 3/4" thick and either SA-302, Gr. B, or SA-533, Gr. B, material. Only two layers of weld metal need be deposited for the cladding test.

T J Kukk

T. J. Kukk

TJK:dmg
cc: T. A. Anderson
G. D. Profita
J. C. Quinn
R. W. Straiton
J. S. Wolf

(5)

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

To A. R. ANDERSON - MANITOWOC, WISCONSIN	
From T. J. KUKK - BARBERTON ERECTION	BDS 663-4
Cust. WESTINGHOUSE - APD	File No. or Ref. 191-28326
Subj. PROCEDURE QUALIFICATION	Date APRIL 17, 1969

This letter to cover one customer and one subject only.

Quality Control Specifications WS-69 and W-6 are backed up by Procedure Qualification Tests, which are on record in our Quality Control Department. Attached you will find records of these Procedure Qualification Tests as follows:

Nozzle Safe End Repairs - PQ0408

Cladding Repairs - PQ-1427

TJ Kukk

T. J. Kukk

TJK:dmg

Attachments

cc: T. A. Anderson
G. D. Profita
J. C. Quinn
R. W. Straiton

(6.

4/23/69

WELD SCHEDULE FOR NOZZLE REPAIR

UPPER NOZZLE

WED	4/23/69	BUTTER WELD PREP AREA	
THUR	4/24	DITTO	TEST WELDER
FRI	4/25	DITTO TO NOON	DITTO
		MOUNT BORING BAR NOON TO 5:30 PM	
SAT	4/26	DITTO TO NOON	
		MACHINE & GRIND FOR UT	
SUN	4/27	UT TEST	
MON	4/28	MACHINE FOR WELD PREP	MACHINE
TUES	4/29	DYE CHECK	BEND

LOWER NOZZLE

FRI	4/25	BUTTER WELD PREP AREA - NOON TO 5:30 PM
SAT	4/26	DITTO
SUN	4/27	DITTO
MON	4/28	MOUNT BORING BAR
TUES	4/29	MACHINE & GRIND FOR UT
WED	4/30	UT TEST
THUR	5/1	MACHINE FOR WELD PREP
FRI	5/2	DYE CHECK

CT - J. McKEOWN
N. FITCH
A. GARRETT (2)

[signature]

4

A. Garrett

BECHTEL CORP
FROM
WESTINGHOUSE NUCLEAR ENERGY SYSTEMS
~~PITTSBURGH, PENN.~~

4-30-69

TO
D E KINSALA
BABCOCK & WILCOX

ALSO TO: J MCKEOWN - WEP SITE

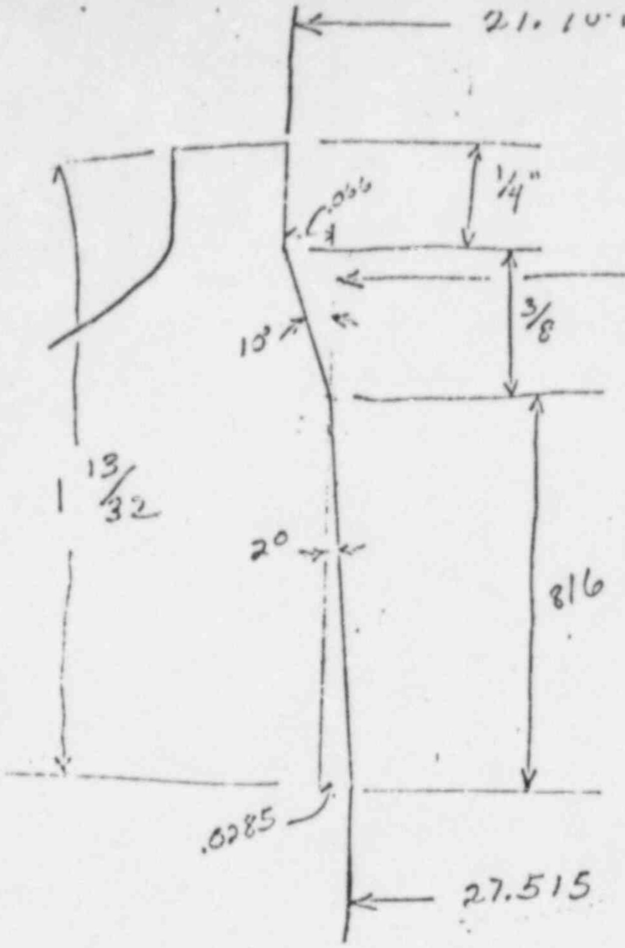
REORDER S#-?-100835 WEP REPAIR

PER TELECON BETWEEN T ANDERSON (B&W) AND PEARSALL, AN ANGLE ON INNER LIP OF WELD PREP OF 7 DEGREES TO 10 DEGREES IS ACCEPTABLE TO BOTH W AND B&W. B&W SPEC CNR-109 ADD PARAGRAPH 13 TO READ EXAMINE FOR FREE IRON ON REPAIRED AREAS PER SPEC S-207.

T E HAND, SENIOR BUYER
WNES PENN CENTER

END

ID LIP SLOPE



27.704
2×.066 = .132
27.572
2×.0285 = .057
27.515

.250
.375
.816
1.441

412-256-4203

Change 10° angle to
7° +½° -0° and blend
by grinding to nozzle bore
per R. Von Osinski 4/29/69

8⅛ 038-1055-328

BY TELEPHONE GENE HUGHES TO R. VON OSINSKI
Appd - L. Yeager 4/29/69
Appd - S. Neaderbosch 4/29/69
E. Hughes (W)

TRIP REPORT
WESTINGHOUSE FORM 31306II

XVIII-85

NOTE:

1. Significant technical information and all classified information should be prepared as a WCAP report and referenced in the Summary.

2. Do not include any information in the Trip Report that will cause it to be classified.

AUTHOR J. S. Caplan

DATE OF REPORT May 1 1969

FILE NO. WEP-105/2

DISTRIBUTION		ADDITIONAL DISTRIBUTION	
Copies to:			
2 TECHNICAL INFORMATION CENTER		D. E. Thorn	Sara Johnston
1 PRELIMINARY PLANT ENGRG.	( )	L. R. Katz	E. Repp
1 PROJECT MANAGER	(W.B. Henderson)	R. Von Osinski	
1 PURCHASING	( )	W. S. Hazelton	
1 INSPECTION	(N. Dressel)	E. Landerman	
2 MARKETING, IF NEGOTIATION	( )	R. D. Pearsall	
2 ORDER SERVICE, IF CONTRACT	( )	R. Hickman	
	( )		

APD RECEIVED MAY 12 1969 POINT BEACH SITE

☐ SOCIETY MEETING

☐ INSPECTION TRIP

☐ SALES NEGOTIATION

☐ CONTRACT

☒ TECHNICAL

TRIP TO (NAME OF COMPANY AND/OR PERSON VISITED): Point Beach Site (WEP)

LOCATED AT (FULL ADDRESS): Two Creeks, Wisc.

SUBJECT: Repair of Reactor Vessel Primary Nozzles

DATE(S) OF MEETING: April 23, 24, 25, 26, 1969

SHOP ORDER NO. XARP-90359

NEGOTIATION NO.

CONTRACT NO.

BUDGET NO.

PURCHASE ORDER NO.

PERSONS PRESENT

ATOMIC POWER DIVISION	OTHER WESTINGHOUSE	OTHER THAN WESTINGHOUSE
J. S. Caplan		B&W - A. Anderson
		J. Fletcher
		B. Champion

SUMMARY

Preparation for welding of the damaged inlet and outlet nozzles was completed by April 22, 1969. Compliance, by B&W, with the approved repair weld procedure was to be witnessed by the author. Prior to the start of welding on April 23, 1969, a significant change was made to the procedure: This involved the direction of welding and sequence of weld bead deposition. This change, reflected in Note 3 of the attached B&W Procedure CNR-109-4, Sketch #1, was approved by J. S. Caplan. Except for several low areas, welding was completed on the inlet nozzle (time: 3-1/2 days) at the time of my departure on April 26, 1969. WNES was assured that B&W planned to follow the same procedure for repair of the outlet nozzle.

	HICKMAN	
	BELL	
	ETLINGER	
	FITCH	
1	GARRETT	5/13/69
	THOMAS	
	ELENTJE	
	PROPER	
	COULTHARD	
	CHARLTON	
	CAMPBELL	
	LENKIEWICZ	
2	FILE 105	

/R.V. INCIDENT

☒ ATTACHMENTS

☐ TECHNICAL REPORT PREPARED. WCAP

APPROVED (SUPERVISOR): W. S. Hazelton *W S Hazelton*

AUTHOR (SIGNATURE): J. S. Caplan *J S Caplan*

ORGANIZATION: ATOMIC POWER DIVISION

PROJECT SECTION/GROUP: PLANT MATERIALS ENGINEERING

BARBERTON, OHIO

CONTRACT NO
SPECIFICATION XVIII-86

CORD OF PROCEDURE AND/OR OPERATOR QUALIFICATION TEST-QC 2E4-122

PS ..300-1	ASME SECTION 3	ASME SECTION I & ..	OTHER	PLATE	PIPE		SINGLE PASS	MULTIPLE PASS
☐	X	☐	☐	X	☐	☐	☐	X

LDING PROCESS	QUALIFICATION POSITION	METAL THICKNESS	SINGLE LAYER	MULTIPLE LAYER
MANUAL TIG	OVER HEAD 4 G	3/8 IN.	☐	X

TERIAL SPECIFICATION	SINGLE ARC	MULTIPLE ARC
304 to 304 STN. STL.	X	☐

AT TREATMENT	MACRO. EXAM.	MICRO. EXAM.
N.R.		

UX NAME OR COMPOSITION	PREHEAT TEMPERATURE	INTERPASS TEMPERATURE	WELDER SYMBOL CLOCK NO.
N.A.	70 °F MIN.	350 °F MAX.	BOYER 1184

PE OF BACKUP (STRIP OR GAS) AND COMPOSITION	FILLER METAL GROUP NO.	SHIELDING GAS	CUP SIZE	TORCH GAS FLOW RATE
ARGON PURGE		ARGON	#6	20 CFH

PS, VOLTS, CURRENT, POLARITY
D.C.S.P. 50-145 Amps 9-16 volts

ZE OF ELECTRODE, IN. DIA. / ZE OF FILLER WIRE, IN. DIA.	ELECTRODE EXT. BEYOND CUP IN.	TRAVEL SPEED IPM	WIRE FEED IPM	OSCILLATION CY/PM	DWELL TIME SEC.
3/32 tungsten / 1/16 308 L	1/8	NR	NA		

QUID PENETRANT	MAGNETIC PARTICLE	RADIOGRAPH	ULTRASONIC TEST
NR	NR	ACCEPTABLE	NR

MARKS: Operator Qualification for welding in the manual Tig Process, overhead Position, using 3/32 tungsstem electrode and 1/16 308 L Filler wire

CHEMICAL ANALYSIS - % E NO.

OCATION	C	MN	P	S	SI	CR	NI	MO	FE	CU	CB	CO	TA	TI	AL
						NR									

REDUCED SECTION TENSILE (TRANSVERSE TO WELD)

SPECIMEN NO.	DIMENSIONS, INCHES WIDTH	THICKNESS	AREA SQ. IN.	ULTIMATE LOAD LBS.	ULTIMATE TENSILE STRENGTH PSI	FRACTURE LOCATION
			NR			

BEND TEST

1 Face bend Q-7.2 Acceptable
1 Root Bond Q-7.2 Acceptable

ALL WELD METAL TENSILE

SPECIMEN NO.	DIAMETER, IN.	AREA SQ. IN.	YIELD POINT PSI	TENSILE STR. PSI	ELONG % IN 2"	RED AREA %
		NR				

TYPE CHARPY	IMPACT TEST AT °F		FT. LBS. ENERGY LOAD
D METAL	FT. LBS.		
D METAL	FT. LBS.	NR	
T AFFECTED ZONE	FT. LBS.		

WE CERTIFY THAT TO THE BEST OF OUR KNOWLEDGE THE STATEMENTS MADE IN THIS RECORD ARE CORRECT AND THAT THE TEST WELDS WERE PREPARED, WELDED AND TESTED IN ACCORDANCE WITH THE APPLICABLE SPECIFICATIONS.

N.R. = NOT REQUIRED N.A. = NOT APPLICABLE

PQ ______

WITNESSED W. R. Kock

BY ______

DATE March 15, 1968

BABCOCK & WILCOX COMPANY

APPENDIX XIX

TRIP REPORT, E. T. HUGHES, WESTINGHOUSE ELECTRIC CORPORATION, JUNE 2, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

Table of Contents

TRIP REPORT

WESTINGHOUSE FORM 31306B

NOTE:

1. Significant technical information and all classified information should be prepared as a WCAP report and referenced in the Summary.
2. Do not include any information in the Trip Report that will cause it to be classified.

AUTHOR E. T. Hughes

DATE OF REPORT June 2, 1969

FILE NO.

DISTRIBUTION		ADDITIONAL DISTRIBUTION	
Copies to:		R. J. Von Osinski (2)	H. Hickman*
2 TECHNICAL INFORMATION CENTER		R. D. Pearsail (2)	J. McKeown*
1 PRELIMINARY PLANT ENGRG.	( )	J. R. Steele (4)	L. Bell*
1 PROJECT MANAGER	(W.B. Henderson)	W. S. Hazelton	A. Garrett*
1 PURCHASING	(G. L. Duke)	E. Landerman	L. R. Katz
1 INSPECTION	(N. Dressel)	J. S. Caplan	A. R. Collier
2 MARKETING, IF NEGOTIATION	( )	D. E. Thorn	J. S. Moore
2 ORDER SERVICE, IF CONTRACT	( )	H. P. Perkins	
	( )		*WEP Site

☐ SOCIETY MEETING	TRIP TO (NAME OF COMPANY AND/OR PERSON VISITED): WEP Point Beach #1 Site	SHOP ORDER NO.: WEP-1050
☐ INSPECTION TRIP	LOCATED AT (FULL ADDRESS): Two Creeks, Wisconsin	NEGOTIATION NO.:
☐ SALES NEGOTIATION	SUBJECT: NDT of Nozzle Weld Prep Repairs	CONTRACT NO.:
☐ CONTRACT		BUDGET NO.: XARP-90359
☐	DATE(S) OF MEETING: 4/28-4/30/69 & 5/6-5/8/69	PURCHASE ORDER NO.:

PERSONS PRESENT

ATOMIC POWER DIVISION	OTHER WESTINGHOUSE	OTHER THAN WESTINGHOUSE
E.T. Hughes		J. Fletcher - B&W
		G. Svendsen - Hartford Ins.
		S. Viaclovsky - SWRI
		G. Reinhart - SWRI

SUMMARY:

The weld metal buildup on the WZ inlet and on the WX outlet primary coolant nozzle weld preps was ultrasonically examined and released for final machining of the weld prep contours.

Dye penetrant examination of the repaired (machined) areas revealed several indications of acceptable size and shape and some linear indications which were removed by light local polishing. Recheck of the polished areas confirme the removal of the discontinuities indicated.

Free iron check of all repaired areas indicated no iron contamination.

Based on the non-destructive test results obtained, the weld repairs to the WZ and WX nozzles were considered acceptable.

☐ ATTACHMENTS

☐ TECHNICAL REPORT PREPARED. WCAP-0

APPROVED (SUPERVISOR): W. S. Hazelton W.S. Hazelton

AUTHOR (SIGNATURE): E. T. Hughes E. Hughes

ORGANIZATION: ATOMIC POWER DIVISION

PROJECT/SECTION/GROUP: PLANT MATERIALS ENGINEERING

On April 28 through April 30 and again on May 6 through May 9, 1969, the WEP Point Beach #1 Site was visited to supervise and witness the non-destructive examination of the weld repaired areas on the WZ inlet and WX outlet nozzles of the WEP reactor vessel. The examinations were conducted by J. R. Fletcher of B&W under the technical supervision of the writer and witnessed by Gordon Svendsen, Hartford Steam Boiler Inspection and Insurance Company, S. Viaclovsky, Southwest Research Institute and G. Reinhart of the Southwest Research Institute.

The ultrasonic examination of the weld metal buildup on the weld preps of the two nozzles in question was conducted from the machined faces of the weld deposited buildup using a 3/8" diameter 3-1/2 Mhz T-R[1] search unit for examining the thinner sections and a 1/2" diameter 2-1/4 Mhz T-R search unit for examining the heavier sections of the weld repair. The tuning levels for the testing were established on B&W weld buildup (308 SS) reference block #1 containing 1/8" diameter reference areas at test metal distances of 1/8", 1/4", 3/8", 1/2", 5/8" and 3/4". The tuning level for the 3/8" diameter, 3-1/2 Mhz "thin-section" testing was set to provide clear resolution of the 1/8", 1/4" and 3/8" test distance reference areas with sufficient signal amplitudes to permit definition of the 25% of reference reporting level required. The tuning level for the 1/2" diameter, 2-1/4 Mhz "thick-section" testing was set to provide resolution of the 1/4", 3/8" and 1/2" (included 3/4") test distances with, as above, the 25% of reference reporting capability; details of the tuning levels are shown in table form below.

TABLE I

TUNING LEVELS UT OF WELD PREP REPAIR, INLET NOZZLE (WZ)

Search Unit	Reference Area	TM Dist.	Signal Ampl.	25% Rep Ampl.
3/8", T-R 3-1/2 Mhz	1/8" diam	1/8"	Off Screen	10 div*
3/8", T-R 3-1/2 Mhz	1/8" diam	1/4"	Off Screen	12 div* (off screen)
3/8", T-R 3-1/2 Mhz	1/8" diam	3/8"	8 div	2 div
1/2", T-R 2-1/4 Mhz	1/8" diam	1/4"	Off Screen	11 div** (off screen)
1/2", T-R 2-1/4 Mhz	1/8" diam	3/8"	Off Screen	12 div** (off screen)
1/2", T-R 2-1/4 Mhz	1/8" diam	1/2"	10 div	2.5 div
1/2", T-R 2-1/4 Mhz	side drilled hole	3/4"	approx 4 div	-

* Determined by proportionally attenuating 3/8" tmd 8 div signal

** Determined by proportionally attenuating 1/2" tmd 10 div signal

1. See note at end of report

TABLE II

TEST RESULTS INLET NOZZLE (WZ)

Ind. No.	Clock Position*	Radial Location	Depth (tmd)	Ampl.	Est. % of Ref
1	11:30	2-1/4" from O.D.	3/8"	4 div	50%
2	1:00	Adj to Buildup for Lip	1/8"	5 div	<15%
3	1:00+	1/2" from O.D.	1/8"	5 div	<15%
4	1:30	Adj to Buildup for Lip	1/8"	7 div	15%
5	2:00	Adj to Buildup for Lip	1/8"	9 div	20%
6	4:30	2" from O.D.	3/8"	4 div	50%
7	4:30	O.D. edge	1/8"	6 div	<15%
8	12:00-	On Buildup	3/16"		10%

*12:00 o'clock - Top of Vessel

The less than 25% of reference indications were recorded for possible correlation with PT results on finish machined weld prep. Evaluation of all of the recorded indications showed that none of the discontinuities indicated had any length or extent. The discontinuities indicated were considered acceptable and the repair released for final machining.

The weld buildup repair of the weld prep on the outlet nozzle (WX) was ultrasonically examined in the same manner as the inlet nozzle, except that lower sensitivity levels were used to reduce the number of irrelevant indications noted in the testing of the inlet nozzle repair. This reduction in sensitivity was accomplished by setting the response from the 3/8" tmd reference area (1/8" diam) to 4 divisions amplitude, one half the original setting, using the 3/8" diam 3-1/2 Mhz T-R search unit and the response from the 1/2" tmd reference area (1/8" diam) to 5 divisions amplitude, also one half original setting, using the 1/2" diam, 2-1/4 Mhz T-R search unit; see lines 3 and 6 in Table I for original settings. No indications equal to or exceeding 10% of the 1/8" diam, DAC reference level were found in the stainless weld deposit repair on the outlet nozzle weld prep. The repair was released for machining of the weld prep contour.

Penetrant testing (PT) per B&W procedure S-102 C Rev 5 was conducted on the repaired portions of the weld prep on both nozzles. Tables III and IV, WZ inlet and WX outlet nozzles respectively, list the indications found and the dispositions made.

TABLE III

PT RESULTS WZ INLET NOZZLE REPAIR

Location	Size	Shape	Disposition
12:00 o'clock on Land	1/64	Rounded	Acceptable
12:00 + 1" on Land	1/32	Rounded	Acceptable
12:00 + 1-5/8" on Land	1/32	Rounded	Acceptable
12:00 + 3-1/2" on Land	1/32	Rounded	Acceptable
6:00 in center of weld prep	1/64	Rounded	Acceptable
7:30 on OD of nozzle (safe end)	1/8	Linear	Removed*
3:45 ID of Land, parallel to edge of Land 1/16" from end	.072"	Linear	Removed*
1:15 OD, weld repair	—	Linear	Removed*

*In all cases, removal of the indicated condition was accomplished, including PT, by light (0.002" - 0.003") local grinding and polishing.

TABLE IV

PT RESULTS WX OUTLET NOZZLE REPAIR

3:00 + 1-3/4" face of weld prep 1" from OD	3/32	Irreg. Rounded	Removed by grinding to 1/16" - blended into weld prep
3:00 + 3-1/2" OD edge of weld prep	3/32	Linear	Removed*
4:00 + 1-5/8" OD of safe end 3/8" from edge of weld prep	—	Linear	Removed*
4:00 + 5-1/4" face of weld prep 1-1/8" from ID	1/32	Rounded	Acceptable
6:00 ID (cladding) 3/4" from end of Land	1/16	Rounded	Acceptable
9:00 + 4" face of weld prep 3/16" from OD	1/32	Rounded	Acceptable
1:00 edge of Land		Linear	Removed*

*In all cases, removal of the indicated condition was accomplished, including PT, by light (0.002" - 0.003") local grinding and polishing.

During polishing and blending operations at the edge of the weld repair on the I.D. of the nozzle, the grinder noted a high spot in the cladding approx 2" from the outer end of the nozzle and proceeded to dress up the area. The polishing, however, opened a flaw of approximately 1/2 inch length, 1.8 inches from the outer end of the land of the weld prep. The globular shape of the ends of the flaw and the discoloration of the surfaces visible indicated to the writer that the flaw was associated with a repair of the cladding during fabrication of the nozzle and not damage resulting from the vessel incident. Removal of the flaw was directed with the stipulation that if removal of the flaw required the removal of 0.030" or more of cladding (drawing requirement 0.156 minimum - design minimum 0.125"), repair by half bead techniques would be required; less than 0.030", no repair except for esthetic reasons. Less than 0.005" was required to remove the cladding flaw. PT of the area showed no indications - no repair was made.

PT of the overlay repair of the shallow gouge (5:30 o'clock, approx 6" from end) in the outlet (WX) nozzle cladding revealed no indications.

Free iron check of all of the repaired areas showed no iron contamination.

Pending a dimensional check, the repair of the safe end weld preps of the WZ inlet and the WX outlet nozzles was considered acceptable and complete.

1. T-R designates that the search unit is a transmit receive type, i.e. one half of the crystal transmits and the other half receives. The advantage is near test surface resolution of defects, e.g. the 3/8" diam. T-R unit used was found to be capable of detecting 1/8" diam. defects 1/16" below the test surface.

APPENDIX XX

LETTER,
WESTINGHOUSE ELECTRIC CORPORATION,
JUNE 9, 1969
STATING ACCEPTANCE OF REPAIRS

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Westinghouse Electric Corporation
POWER SYSTEMS
Atomic Power Divisions
Penn Center Site
Box 355, Pittsburgh, Pa 15230

June 9, 1969

PBW-WMP-1359

Ref: PBM-WMP-1023

S.O.: WEP-105

Mr. C. W. Fay, Manager
Cost & Control Division
Wisconsin Michigan Power Company
231 West Michigan Street
Milwaukee, Wisconsin 53201

Dear Mr. Fay:

POINT BEACH NUCLEAR PLANT
WEP Reactor Vessel

The Babcock & Wilcox Company has restored the WEP Reactor Vessel to its original condition following a transportation incident, February 22, 1969. Repairs and inspections have been completed to comply with all agreements made during the meeting at Point Beach on April 15, 1969 as summerized in the reference letter.

It is the opinion of Westinghouse that the B&W Reactor Vessel Warrenty should be continued and that the Vessel Code Stamp has not been violated.

Very truly yours,

R. J. Von Osinski, Manager
Pressure Vessels

Approved by: W. B. Henderson, Manager
Point Beach Project

cc: E. G. Taylor
D. E. Thorn
L. R. Katz
R. O. Tedeschi
R. J. Von Osinski
W. B. Henderson
J. R. Steele

JRS:rd

APPENDIX XXI

FINAL REPORT OF TRANSPORTATION INCIDENT INVESTIGATION FOR POINT BEACH UNIT #1 REACTOR VESSEL,

M. W. YOUNG, THE BABCOCK & WILCOX COMPANY,

JUNE 17, 1969

Note: Appendix X contains all Babcock & Wilcox Company Specifications and Procedures referenced throughout this report. The Specifications and Procedures are proprietary to The Babcock & Wilcox Company and are contained in Volume II of this report.

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FINAL REPORT OF TRANSPORTATION INCIDENT

INVESTIGATION FOR POINT BEACH UNIT

#1 REACTOR VESSEL

June 17, 1969

BABCOCK & WILCOX CONTRACT - ES-3582

WESTINGHOUSE PURCHASE ORDER NO. 54-Q-100235

Prepared by: W. M. Young

W. M. Young

Approved by: T. A. Anderson

T. A. Anderson

I. Introduction

A. This report summarizes all efforts to verify the structural integrity of the Point Beach #1 Reactor Vessel. This was necessary as a result of the transportation incident that occurred February 22, 1969.

To verify the structural integrity of the vessel, various efforts were required. These were:

1. Visual inspection to access damage to vessel.
2. Nondestructive testing to verify vessel integrity.
3. Stress analysis to verify vessel integrity.
4. Repair of damaged areas.
5. Recertification of vessel code stamp.

II. Summary

A. Visual Examination

1. To provide a preliminary assessment of damage and a basis for a more detailed nondestructive testing program for the vessel[1], a thorough visual examination of the vessel was made. The conclusion of the visual inspection of the vessel was that the extent of damage was limited to the .055" lip on the weld preparations of the inlet nozzle (W-Z Axis) and the outlet nozzle (W-X Axis).

B. Nondestructive Testing

1. To determine in detail the extent of damage to the vessel, as a result of the transportation incident, a detailed nondestructive testing program was performed. A detailed review of the areas tested and the techniques employed is located in Appendix "A" * of this report.

The result of the nondestructive testing yielded no evidence of damage to the vessel except for the .055" lip on the weld preparations of the inlet nozzle (W-Z Axis) and the outlet nozzle (W-X Axis).

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[1] See Figures 1 & 2.

* See Appendix IX, Volume I.

C. Stress Analysis

1. To verify the results of the nondestructive testing and to determine the effect of the impact loading resulting from the transportation incident on vessel fatigue life, a stress analysis was performed. This analysis attempted to evaluate in a conservative manner the loads imposed on the vessel as a result of the transportation incident. The stress analysis report is located in Appendix "B" of this report. *

   The results of the analysis show that:

   a. The stresses imposed on the vessel and its appurtenances were low.

   b. The fatigue life of the vessel and its appurtenances is not reduced by the loading.

   c. The minimum crack size for propagation of brittle fracture would have to be approximately two feet long.

D. Repair

1. To return the vessel to its as shipped condition, the nozzles were repaired in accordance with B&W Specifications. Significant phases of the repair and inspection were witnessed by Westinghouse, Southwest Research Institute, and Hartford Steam Boiler Insurance.

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* See Appendix XVI, Volume I.

The detailed report of the repair of the vessel is located in Appendix "C" of this report.

E. Recertification of Vessel Code Stamp

In order to assure that the repair to the vessel was in accordance with the requirements of the ASME Codes, repair procedures were reviewed and significant phases of the repair were witnessed by a representative of the Hartford Steam Boiler Insurance Company. The signed certificate of the Hartford Steam Boiler Insurance Company representative is included as Appendix "D" of this report. *

* See Page XVIII-73, Appendix XVIII, Volume I.

III. CONCLUSION

. After completing repairs as set forth in this report, our examination has not disclosed any residual damage to the vessel due to this transportation incident which were discoverable by available nondestructive testing techniques.

LIST OF ILLUSTRATIONS

Note: The above-referenced Drawings are considered proprietary to The Babcock & Wilcox Company and are contained in Appendix XVI, Volume II, of this report.

LIST OF APPENDICES

Notes:
(1) See Appendix IX, Volume I.
(2) See Appendix XVI, Volume I.
(3) See Page XVIII-73, Appendix XVIII, Volume I.

FINAL REPORT ON FIELD REPAIR

OF

POINT BEACH UNIT #1 REACTOR VESSEL

JUNE 3, 1969

BABCOCK & WILCOX CONTRACT - ES-3582

WESTINGHOUSE PURCHASE ORDER NO. 54-Q-100235

Prepared By: J. L. Sulzbach
J. L. Sulzbach

Approved By: T. A. Anderson
T. A. Anderson

596-3582-51-18 610-0115-51

REPAIR OF INLET NOZZLE (W-Z AXIS) & OUTLET NOZZLE (W-Y AXIS) #1 (WEP)

I. Introduction

A. The purpose of the repair was to correct the damage to the Stainless Safe Ends of the Inlet Nozzle (W-Z Axis) and Outlet Nozzle (W-X Axis) which occured during the transportation incident of February 22, 1969.

B. The .055 wide weld prep lip on both nozzles and an area approximately 5" inside the outlet nozzle at the 5:$\frac{30}{OC}$ position were repaired. The entire face of both nozzle safe ends was welded with one layer of weld to anneal the surface.

C. The method of repair was to prepare the nozzle by grinding, welding the prepared surface, rough machining, ultrasonic testing for bond and defect, final machining and final nondestructive testing consisting of free iron, liquid penetrant, and dimensional inspection.

II. Summary

Prior to starting nozzle weld repair restoration, a welder was qualified, in accordance with Section IX of the ASME Boiler Code to perform welding, in accordance with B&W Specification WS-69 and W-6. In accordance with B&W Specification CNR-109-5, a reference plane per Step 5 was established by clamping a S.S. Band around the small OD of each nozzle to aid in welding and remachining the the nozzle weld preps. The nozzles were then prepared as outlined in Steps 1 through 4 of B&W Specification CNR-109-5. The nozzles were welded per Step 6 and rough machined for ultrasonic testing with a Portable Boring Machine. The ultrasonic test for bond and defect per Step 8 of B&W Specification CNR-109-5 was performed with acceptable results. All repair and inspection work performed on the nozzle preparation were witnessed by representatives of Westinghouse, Southwest Research Institute, and Hartford Steam Boiler Insurance.

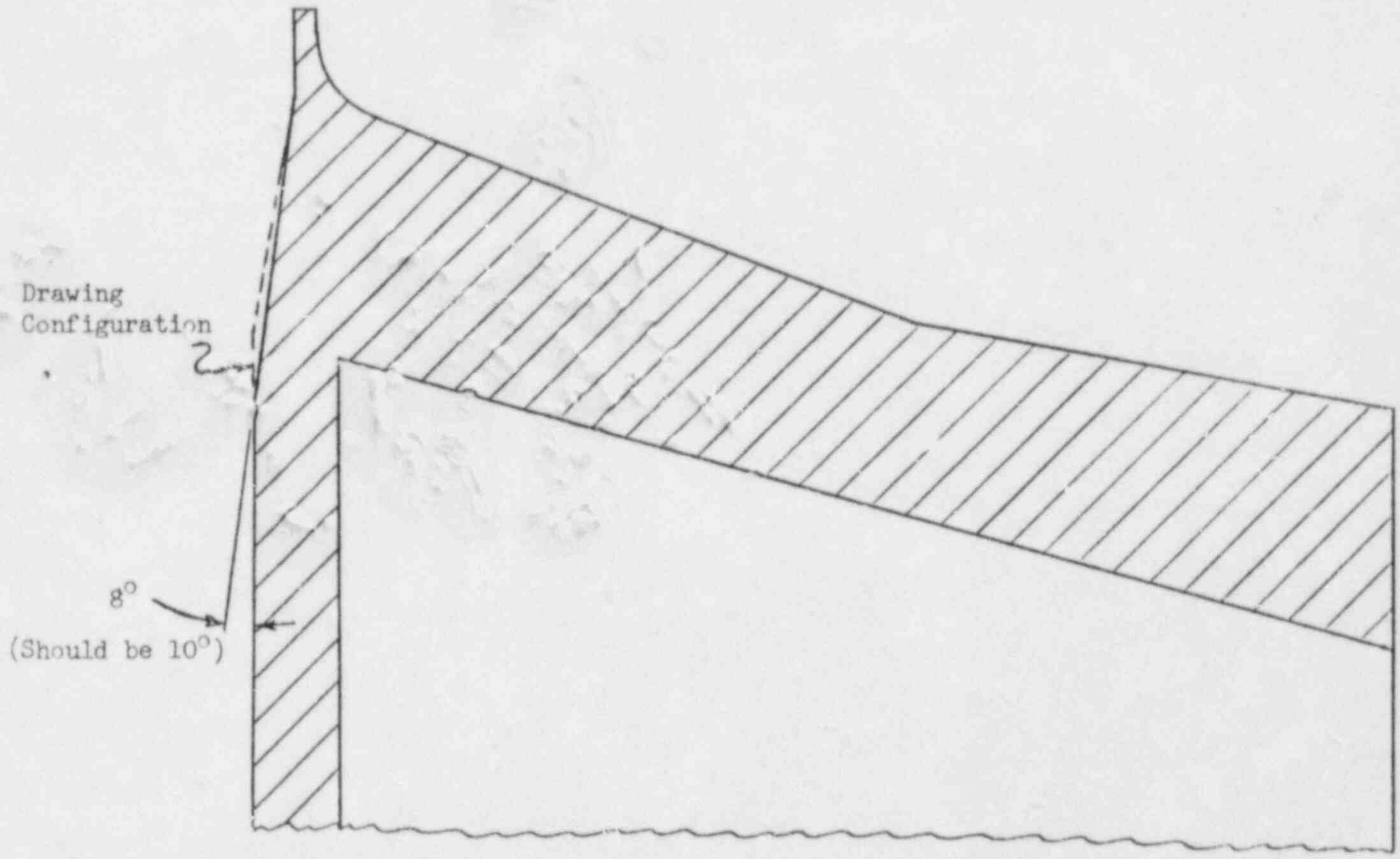
Final machining of the nozzles per Step 10 of B&W Specification CNR-109-5 was done, with all dimensions meeting drawing tolerance with the exception of the 10° angle on the ID of the inlet nozzle which was machined to 8° (see attached illustration) to blend out weld repaired area without additional welding.

After removing the Portable Boring Machine, Steps 11 through 13 were completed with acceptable results.

The indentation on the ID of the outlet nozzle was welded, ground and liquid penetrant inspected in accordance with B&W Specification CNR-110-1, completing the repair to both nozzles.

III. Conclusion

As a result of the repair to the nozzle weld preparations, the nozzles which were damaged during the transportation incident are returned to the as shipped condition.



Final Machining - Inlet Nozzle

Scale 2:1

V. Specifications (See Appendix X, Volume II.)

Spec. No.	Title
CNR-109-5	Repair Procedure For Nozzle Weld Preps
CNR-110-1	Repair For Indentation On W-X Axis Outlet Nozzle ID Surface
S-4-11	Ultrasonic Inspection For Defect And Bond Of Weld Metal Overlay Cladding
S-102C-5	Dye Penetrant Inspection And Acceptance Standards For Welds
S-161	Storage And Handling Of Electrodes And Flux
S-170-2	Preheat And Interpass Temperature
S-207	Free Iron Check Procedure
W-6	Half Bead Weld Repair
WS-69-5	Repair Of Welds And Base Material For Special Products Or Nuclear Applications

John Steele
Bldg. #5

1/28

XXI-17

Babcock & Wilcox

Power Generation Division

Barberton, Ohio 44203
Telephone: (216) 753-4511

July 23, 1969

RECEIVED
JUL 28 1969
PURCHASING

Westinghouse Electric Corporation
Atomic Power Division
P.O. Box 355
Pittsburgh, Pennsylvania 15230

Attention Mr. T. R. Hand

Re: Your Order 54-Q-55180
Our 610-0115

Gentlemen:

Mr. Ed Reno of your Quality Control Department has asked whether Hartford Inspection was appraised of cladding repair on the vessel head. He was particularly interested in whether we were in compliance with ASME, Section III, Page 78, N-528, if so, there was no problem.

This is to advise that we have contacted our Mount Vernon Works and have been assured that Mr. R. Mason, the resident H.S.B. representative, has been appraised of all work and is in complete concurrence with our corrected actions and repair procedures. The "N" stamp on the vessel and closure head is valid.

Please advise Mr. John Steel and Mr. Reno of the above.

Sincerely,

THE BABCOCK & WILCOX COMPANY

D. E. Kinsala
D. E. Kinsala
Commercial Nuclear Components

DEK:rtd

cc: T. J. Kukk
W. C. Buskey