

PART 1

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- B. EBASCO NON-DESTRUCTIVE EXAMINATION PERSONAL CERTIFICATIONS
- C. EBASCO NON-DESTRUCTIVE EXAMINATION EQUIPMENT AND MATERIAL CERTIFICATIONS
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ABBREVIATIONS LIST

ASME - American Society of Mechanical Engineers  
ASNT - American Society of Nondestructive Testing  
CCW - Counterclockwise  
CW - Clockwise  
DAC - Distance Amplitude Correction  
FSH - Full Screen Height  
ISI - Inservice Inspection  
MT - Magnetic Particle Testing  
NDE - Nondestructive Examination  
OPPD - Omaha Public Power District  
PT - Liquid Penetrant Testing  
QA - Quality Assurance  
UT - Ultrasonic Testing  
VT - Visual Testing  
WHAZ - Weld Heat Affected Zone

## INTRODUCTION

### Section 1

During March and April 1984, the first inservice inspection of the second interval was performed at the Omaha Public Power District Fort Calhoun Nuclear Station. This inspection was performed to provide compliance with the ASME Boiler and Pressure Vessel Code Section XI, 1980 Edition up to and including the Winter 1980 Addenda. Visual, liquid penetrant, magnetic particle and ultrasonic examination methods were employed in this inspection.

The information contained in this report provides a complete package of documents associated with this inspection. Included in this report are examination procedures, personnel qualifications, equipment calibration records, material certifications, examination records, and a list of examinations accomplished.

Prior to this inspection, an examination program was provided by OPPD to EBASCO, listing the examinations to be performed. To accomodate plant conditions during the outage, some changes were made to this original program. All changes were made under direction of the OPPD ISI Coordinator. A complete listing of all examinations conducted is given in Section III of Volume II.

This examination program contains a representative sampling of the following components and areas.

#### CLASS 1

##### Reactor Pressure Vessel

Closure Head to Flange Weld

##### Pressurizer

Longitudinal Welds

Circumferential Welds

Nozzle Welds

Safe End Welds

Support Skirt

##### Regenerative Heat Exchanger

Longitudinal Welds

Circumferential Welds

Piping

12 in. Safety Injection  
12 in. Shutdown Cooling  
10 in. Pressurizer Surge  
6 in. Safety Injection  
4 in. Pressurizer Spray  
4 in. Pressurizer Safety  
3 in. Pressurizer Spray  
3 in. Pressurizer Relief  
3 in. High Pressure Header  
2½ in. High Pressure Header  
2 in. High Pressure Header  
2 in. Charging Line  
2 in. Letdown Line  
2 in. Auxiliary Spray

CLASS 2

Regenerative Heat Exchanger

Circumferential Welds

Shutdown Heat Exchanger

Circumferential Welds

Piping

28 in. Main Steam  
24, 20, 6 in. Safety Injection  
16 in. Feedwater  
14, 12, 10, 8 in. Low Pressure Safety Injection  
12 in. Shutdown Cooling

12, 10, 6 in. Low Pressure Header

12, 8, 6 in. Containment Spray

8, 6 in. High Pressure Safety Injection

Records of all examinations performed during this inspection are included in Section IV of Volume II. Included in this section are calibration records for UT examinations and examination records for all NDE methods. These examination records include the following information.

Type of NDE performed

Materials utilized in performance of examination

Calibration parameters for UT examinations

Component of area examined

Date examination performed

Personnel performing examination

Results of examination

A summary of components and areas examined along with pertinent information for each component or area is available in Section III of Volume II.

No relevant recordable indications were discovered during this inspection. All indications noted were found to be acceptable.

During the course of this inspection, a complete walkdown of all Class 1 and Class 2 piping systems was conducted. These walkdowns generated drawing revisions which reflect up-to-date as-built conditions. A copy of these revised drawings will be submitted when completed.

# EXAMINATION SUMMARY

## Section 3

To provide a concise listing of examinations conducted during the 1984 inservice inspection, along with pertinent information regarding these examinations, an examination summary has been compiled. This summary is divided into major components and piping by class, their descriptions are listed under the system identification on the ISI EXAMINATION SUMMARY sheets.

### Explanation of Examination Summary Format

8870/9-84

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 ISI EXAMINATION SUMMARY

PAGE \_\_\_\_ OF \_\_\_\_

PROJECT			SYSTEM IDENTIFICATION							EXAMINATION PERIOD			
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NR	OTHER	
1	2	3	4	5a	5b	5c	5d	6	7	8a	8b	8c	9

1. Item No. - Reference numbers intended as an aid in the location of data sheets.
2. Component/Weld Identification No. - Gives examination area for components and for piping the line size - system abbreviation - line number/examination area is given. A description of the examination area is given below the Component/Weld Identification No. For circumferential piping welds, the connection is shown in order of system fluid flow.
3. Report No. - Assigns a unique identifier to each NDE report.
4. Isometric Drawing No. - The SWRI isometric number in which the examination area is contained.
5. NDE Method - Identifies type of examination performed.
  - 5a. An X in this column indicates an ultrasonic examination was performed.
  - 5b. An X in this column indicates a magnetic particle examination was performed.
  - 5c. An X in this column indicates a liquid penetrant examination was performed.
  - 5d. An X in this column indicates a visual examination was performed.

6. Procedure Utilized - The EBASCO procedure utilized for each examination.
7. Calibration Block Used - The abbreviated number for ultrasonic calibration standards. See the list below for complete block numbers.
8. Results - Results of the particular NDE examination.
  - 8a. RI - Recordable indications
  - 8b. NRI - No recordable indications
  - 8c. Other - Geometric, metallurgical or other non-relevant indication
9. Remarks - Comments regarding the examination

Calibration Block Abbreviations

<u>Abbreviation Listed</u>	<u>Complete Number</u>
2.5-FCL	10-SS-1.0-2.5-FCL
6-FCL	5-CSCL-60FCL
7-FCL	7-CSCL-7-FCL
8-FCL	3-CSCL-8-FCL
15-FCL	28-CS-X-10-15-FCL
16-FCL	16-CS-80-.844-16-FCL
17-FCL	14-SS-20-.312-17-FCL
18-FCL	12-SS-40S-.375-18-FCL
19-FCL	10-SS-40S-.365-19-FCL
20-FCL	8-SS-40S-.322-20-FCL
21-FCL	6-SS-40S-.280-21-FCL
23-FCL	20-SS-STD-.375-23-FCL
6-S160	6-2501-2-S160
10-S160	10-2507-1-S160
12-S160	12-2501-1-S160

6070/86 Commercial Service Date 9/26/73

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**ISI EXAMINATION SUMMARY**

PROJECT:		SYSTEM IDENTIFICATION:						EXAMINATION PERIOD:					
FORT CALHOUN		PRESSURIZER						SPRING 1984					
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
1	2-403D Longitudinal Seam	1-001	A-3	X				FC-UT-2	6-FCL		X		0° Examined 12 in.
		1-002		X				FC-UT-2	6-FCL		X	45° Examined 12 in.	
		1-003		X				FC-UT-2	6-FCL		X	60° Examined 12 in.	
2	3-403 Lower Shell to Bottom Head	1-001	A-3	X				FC-UT-2	6-FCL		X		0° Shell Side
		1-002		X				FC-UT-2	6-FCL		X	45° Shell Side	
		1-003		X				FC-UT-2	6-FCL		X	60° Shell Side	
		2-001		X				FC-UT-2	8-FCL		X	0° Head Side	
		2-002		X				FC-UT-2	8-FCL		X	45° Head Side	
		2-003		X				FC-UT-2	8-FCL		X	60° Head Side	
3	PRL-1 Inner Radius		A-4										To be examined next outage
	PSL-1 Inner Radius		A-4										To be examined next outage
4	PRL-1 Top Head to Nozzle	4-001	A-4	X				FC-UT-2	8-FCL		X		0°
		4-002		X				FC-UT-2	8-FCL		X	45°	
		4-003		X				FC-UT-2	8-FCL		X	60°	
5	PRL-1/1A Nozzle to Safe-End	5-001	A-19				X	FC-PT-1	N/A		X		
6	3-405 Support Skirt	6-001	A-3		X			FC-MT-1	N/A		X		
7	Manway Bolting		A-4										To be examined next outage

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## ISI EXAMINATION SUMMARY

PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
FORT CALHOUN		REGENERATIVE HEAT EXCHANGER							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
8	7 Cap Weld	8-001A	A-7	X				FC-UT-1	2.5-FCL		X		
		8-001C		X				FC-UT-1	2.5-FCL		X		
9	18 Longitudinal Seam	8-001A	A-7	X				FC-UT-1	2.5-FCL		X		Examined 12 in. Examined 12 in.
		8-001C		X				FC-UT-1	2.5-FCL		X		
10	4 Circumferential Weld	10-001	B-43			X		FC-PT-1	N/A		X		

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ISI EXAMINATION SUMMARY

PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
FORT CALHOUN		CLASS 1 PIPING							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
11	10 in. PSL-10/4 Pipe to Elbow	11-001	A-14			X		FC-PT-1	N/A		X		To be examined next outage
		11-002A		X				FC-UT-1	10-S160		X		
		11-002C		X				FC-UT-1	10-S160		X		
	10 in. PSL-10/5 Elbow to Pipe	11-001	A-14			X		FC-PT-1	N/A		X		
		11-002A		X				FC-UT-1	10-S160		X		
		11-002C		X				FC-UT-1	10-S160		X		
12	4 in. PSS-1/5 Pipe to Elbow	12-001	A-15			X		FC-PT-1	N/A		X		
	4 in. PSS-1/6 Elbow to Pipe	12-001	A-15			X		FC-PT-1	N/A		X		
13	4 in. PSL-1/3		A-16										
14	3 in. PSS-14/24 Pipe to Elbow	14-001	A-17			X		FC-PT-1	N/A		X		
	3 in. PSS-14/25 Elbow to Pipe	14-001	A-17			X		FC-PT-1	N/A		X		
15	3 in. PSS-22/28 Elbow to Pipe	15-001	A-18			X		FC-PT-1	N/A		X		
	3 in. PSS-22/29 Pipe to Elbow	15-001	A-18			X		FC-PT-1	N/A		X		
	3 in. PSS-22/30 Elbow to Pipe	15-001	A-18			X		FC-PT-1	N/A		X		
16	3 in. PRL-1/5		A-19									To be examined next outage	
17	2½ in. PRL-3/20 Valve to Pipe	17-001	A-20			X		FC-PT-1	N/A		X		
18	12 in. SI-12/11 Pipe to Tee	18-001	A-22			X		FC-PT-1	N/A		X		
		18-002A		X				FC-UT-1	12-S160		X		
		18-002C		X				FC-UT-1	12-S160		X		
19	12 in. SI-24/10 Pipe to Tee	19-001	A-25			X		FC-PT-1	N/A		X		
		19-002A		X				FC-UT-1	12-S160		X		
		19-002C		X				FC-UT-1	12-S160		X		
20	6 in. SI-12/10 Pipe to Tee	20-001	A-26			X		FC-PT-1	N/A		X		
		20-002A		X				FC-UT-1	6-S160		X		
		20-002C		X				FC-UT-1	6-S160		X		
21	6 in. SI-14/6 Pipe to Elbow	21-001	A-27			X		FC-PT-1	N/A		X		
		21-002A		X				FC-UT-1	6-S160		X		
		21-002C		X				FC-UT-1	6-S160		X		
	6 in. SI-14/7 Elbow to Pipe	21-001	A-27			X		FC-PT-1	N/A		X		
		21-002A		X				FC-UT-1	6-S160		X		
		21-002C		X				FC-UT-1	6-S160		X		
	6 in. SI-14/9 Elbow to Pipe	21-001	A-27			X		FC-PT-1	N/A		X		
		21-002A		X				FC-UT-1	6-S160		X		
		21-002C		X				FC-UT-1	6-S160		X		

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PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
FORT CALHOUN		CLASS 1 PIPING							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
22	6 in. SI-22/3 Valve to Elbow	22-001	A-28			X		FC-PT-1	N/A		X		
		22-002A		X				FC-UT-1	6-S160	X			
		22-002C		X				FC-UT-1	6-S160	X			
	6 in. SI-22/4 Elbow to Pipe	22-001	A-28			X		FC-PT-1	N/A		X		
		22-002A		X				FC-UT-1	6-S160	X			
		22-002C		X				FC-UT-1	6-S160	X			
23	6 in. SI-24/10 Pipe to Tee	23-001	A-29			X		FC-PT-1	N/A		X		
		23-002A		X				FC-UT-1	6-S160	X			
		23-002C		X				FC-UT-1	6-S160	X			
24	3 in. HPH-12/3 Tee to Pipe	24-001	A-30			X		FC-PT-1	N/A		X		
25	3 in. HPH-14/4 Pipe to Flange	25-001	A-31			X		FC-PT-1	N/A		X		
	3 in. HPH-14/5 Flange to Pipe	25-001	A-31			X		FC-PT-1	N/A		X		
26	3 in. HPH-22/5 Flange to Pipe	26-001	A-32			X		FC-PT-1	N/A		X		
	3 in. HPH-22/6 Pipe to Elbow	26-001	A-32			X		FC-PT-1	N/A		X		
27	3 in. HPH-24/7 Elbow to Pipe	27-001	A-33			X		FC-PT-1	N/A		X		
28	2 in. HPH-1.14/28 Pipe to Elbow	28-001	A-34			X		FC-PT-1	N/A		X		
	2 in. HPH-1.14/29 Elbow to Pipe	28-001	A-34			X		FC-PT-1	N/A		X		
29	2 in. HPH-1.22/20 Elbow to Pipe	29-001	A-36			X		FC-PT-1	N/A		X		
30	2 in. HPH-1.24/14 Pipe to Elbow	30-001	A-37			X		FC-PT-1	N/A		X		
	2 in. HPH-1.24/16 Pipe to Tee	30-001	A-37			X		FC-PT-1	N/A		X		
31	2 in. HPH-2.12/16 Pipe to Elbow	31-001	A-38			X		FC-PT-1	N/A		X		
	2 in. HPH-2.12/17 Elbow to Pipe	31-001	A-38			X		FC-PT-1	N/A		X		
32	2 in. HPH-2.22/27 Pipe to Elbow	32-001	A-40			X		FC-PT-1	N/A		X		
	2 in. HPH-2.22/28 Elbow to Pipe	32-001	A-40			X		FC-PT-1	N/A		X		
33	2 in. HPH-2.24/13 Elbow to Pipe	33-001	A-41			X		FC-PT-1	N/A		X		
	2 in. HPH-2.24/22 Pipe to Reducer	33-002	A-41			X		FC-PT-1	N/A		X		

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PROJECT:		SYSTEM IDENTIFICATION:						EXAMINATION PERIOD:					
FORT CALHOUN		CLASS 1 PIPING						SPRING 1984					
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
34	12 in. SDC-20/12 Elbow to Pipe	34-001	A-42			X		FC-PT-1	N/A		X		Acceptable indications
		34-002A		X				FC-UT-1	12-S160		X		
		34-002C		X				FC-UT-1	12-S160		X		
	12 in. SDC-20/13 Pipe to Penetration	34-001	A-42			X		FC-PT-1	N/A		X		
		34-002A		X				FC-UT-1	12-S160		X		
		34-002C		X				FC-UT-1	12-S160		X		
35	2 in. CL-12/2A Pipe to Tee	35-001	A-43			X		FC-PT-1	N/A		X		
	2 in. CL-12/2B Valve to Pipe	35-001	A-43			X		FC-PT-1	N/A	X			
36	2 in. CL-22/5 Valve to Pipe	36-001	A-44			X		FC-PT-1	N/A		X		
37	2 in. LL-1/2 Pipe to Elbow	37-003	A-45			X		FC-PT-1	N/A		X		
	2 in. LL-1/3 Elbow to Pipe	37-003	A-45			X		FC-PT-1	N/A		X		
	2 in. LL-1/5 Elbow to Pipe	37-001	A-45			X		FC-PT-1	N/A		X		
	2 in. LL-1/23 Elbow to Pipe	37-001	A-45			X		FC-PT-1	N/A		X		
	2 in. LL-1/24 Pipe to Elbow	37-002	A-45			X		FC-PT-1	N/A		X		
	2 in. LL-1/25 Elbow to Pipe	37-002	A-45			X		FC-PT-1	N/A		X		
	38	2 in. LL-2/8 Pipe to Tee	38-001	A-46			X		FC-PT-1	N/A		X	
		2 in. LL-2/9 Tee to Reducer	38-001	A-46			X		FC-PT-1	N/A		X	
39	2 in. LL-2/10 Tee to Pipe	38-001	A-46			X		FC-PT-1	N/A		X		
	2 in. LL-21/8		A-47									To be examined next outage	
82	2 in. AS-1/3 Valve to Pipe	82-001	A-21			X		FC-PT-1	N/A		X		
	2 in. AS-1/4 Pipe to Elbow	82-001	A-21			X		FC-PT-1	N/A		X		
	2 in. AS-1/5 Elbow to Pipe	82-001	A-21			X		FC-PT-1	N/A		X		

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EBASCO SERVICES INCORPORATED  
 ISI EXAMINATION SUMMARY

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PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
FORT CALHOUN		CLASS 2 PIPING							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
40	28 in. MS-2001/3 Pipe to Elbow	40-001	B-3		X			FC-MT-1	N/A		X		
		40-002A		X				FC-UT-1	15-FCL		X		
		40-002C		X				FC-UT-1	15-FCL		X		
	28 in. MS-2001/4 Elbow to Pipe	40-001	B-3		X			FC-MT-1	N/A		X		
		40-002A		X				FC-UT-1	15-FCL		X		
		40-002C		X				FC-UT-1	15-FCL		X		
41	28 in. MS-2002/3 Pipe to Elbow	41-002	B-5		X			FC-MT-1	N/A		X		
		41-003A		X				FC-UT-1	15-FCL		X		
		41-003C		X				FC-UT-1	15-FCL		X		
	28 in. MS-2002/4 Elbow to Pipe	41-002	B-5		X			FC-MT-1	N/A		X		
		41-003A		X				FC-UT-1	15-FCL		X		
		41-003C		X				FC-UT-1	15-FCL		X		
	28 in. MS-2002/12-PR-1 Pipe Restraint	41-001	B-6				X	FC-VT-3	N/A		X		
	28 in. MS-2002/MSS-13B-S Pipe Restraint	41-001	B-6				X	FC-VT-3	N/A		X		
	16 in. FW-2001/1-PR-2 Pipe Restraint	42-001	B-7				X	FC-VT-3	N/A		X		
		16 in. FW-2001/8 Pipe to Elbow	42-002	B-7		X			FC-MT-1	N/A		X	
			42-003A		X				FC-UT-1	16-FCL		X	
	42-003C			X				FC-UT-1	16-FCL		X		
16 in. FW-2001/9 Elbow to Pipe	42-002	B-7		X			FC-MT-1	N/A		X			
	42-003A		X				FC-UT-1	16-FCL		X			
	42-003C		X				FC-UT-1	16-FCL		X			
43	16 in. FW-2002/8		B-8									To be examined next outage	
44	14 in. LPSI-2001/2-PR-1 Pipe Restraint	44-001	B-9				X	FC-VT-3	N/A		X		
	14 in. LPSI-2001/2-PR-2 Pipe Restraint	44-001	B-9				X	FC-VT-3	N/A		X		
	14 in. LPSI-2001/2-PR-3 Pipe Restraint	44-001	B-9				X	FC-VT-3	N/A		X		
	14 in. LPSI-2001/A4-PR Pipe Restraint	44-001	B-9				X	FC-VT-3	N/A		X		
	14 in. LPSI-2001/6 Tee to Pipe	44-003A	B-9	X				FC-UT-1	17-FCL		X		
		44-003C		X				FC-UT-1	17-FCL		X		
		44-004				X		FC-PT-1	N/A		X		
	14 in. LPSI-2001/7 Pipe to Reducer	44-002	B-9			X		FC-PT-1	N/A		X		
		45-003A		X				FC-UT-1	17-FCL		X		
		45-003C		X				FC-UT-1	17-FCL		X		
45	14 in. LPSI-2002/A-4-PR-1 Pipe Restraint	45-001	B-10				X	FC-VT-3	N/A		X		
	14 in. LPSI-2002/A-4-PR-2 Pipe Restraint	45-001	B-10				X	FC-VT-3	N/A		X		

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**ISI EXAMINATION SUMMARY**

PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
PORT CALHOUN		CLASS 2 PIPING							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
45	14 in. LPSI-2002/3-LUI	45-002	B-10			X		FC-PT-1	N/A		X		Augmented Exam Examined 12 in. Augmented Exam Examined 12 in.
Cont'd	Longitudinal Seam	45-003A		X				FC-UT-1	17-FCL		X		
		45-003C		X				FC-UT-1	17-FCL		X		
46	12 in. SDC-2020/12-PR	46-001	B-11				X	FC-VT-3	N/A		X		Augmented Exam Augmented Exam
	Pipe Restraint												
	12 in. SDC-2020/16-PR-2A	46-001	B-11				X	FC-VT-3	N/A		X		
	Pipe Restraint												
	12 in. SDC-2020/15	46-002	B-11			X		FC-PT-1	N/A		X		
	Pipe to Pipe	46-003A		X				FC-UT-1	18-FCL		X		Augmented Exam
		46-003C		X				FC-UT-1	18-FCL		X		Augmented Exam
47	12 in. LPSI-2012/6-PR-1	47-001	B-12				X	FC-VT-3	N/A		X		
	Pipe Restraint												
	12 in. LPSI-2012/6/PR-2	47-001	B-12				X	FC-VT-3	N/A		X		
	Pipe Restraint												
48	12 in. LPSI-2014/4L	48-001	B-13			X		FC-PT-1	N/A		X		Augmented Exam Augmented Exam
	Longitudinal Seam	48-002A		X				FC-UT-1	18-FCL		X		
		48-002C		X				FC-UT-1	18-FCL		X		
49	12 in. LPSI-2022/A7-PR	49-001	B-14				X	FC-VT-3	N/A		X		
	Pipe Restraint												
50	12 in. LPSI-2024/6-PR-1	50-002	B-15				X	FC-VT-3	N/A		X		Augmented Exam Augmented Exam
	Pipe Restraint												
	12 in. LPSI-2024/3	50-001	B-15			X		FC-PT-1	N/A				
	Pipe to Elbow	50-003A		X				FC-UT-1	18-FCL		X		
		50-003C		X				FC-UT-1	18-FCL		X		Augmented Exam
51	12 in. LPH-2001/16-PR	51-001	B-16				X	FC-VT-3	N/A		X		
	Pipe Restraint												
	12 in. LPH-2001/11	51-002	B-16			X		FC-PT-1	N/A		X		
	Pipe to Tee	51-003A		X				FC-UT-1	18-FCL		X		Augmented Exam
		51-003C		X				FC-UT-1	18-FCL		X		Augmented Exam
	12 in. LPH-2001/17	51-002	B-16			X		FC-PT-1	N/A		X		Augmented Exam Augmented Exam
	Pipe to Flange	51-003A		X				FC-UT-1	18-FCL		X		
		51-003C		X				FC-UT-1	18-FCL		X		
	12 in. LPH-2001/25-PR	51-004	B-16				X	FC-VT-3	N/A		X		
	Pipe Restraint												
	12 in. LPH-2001/26-PR-2	51-004	B-16				X	FC-VT-3	N/A		X		
	Pipe Restraint												
	12 in. LPH-2001/5	51-005	B-16			X		FC-PT-1	N/A		X		Augmented Exam Augmented Exam
	Elbow to Pipe	51-006A		X				FC-UT-1	18-FCL		X		
		51-006C		X				FC-UT-1	18-FCL		X		
52	12 in. LPSI-2002/17	52-001	B-17			X		FC-PT-1	N/A		X		Augmented Exam Augmented Exam
	Pipe to Elbow	52-002A		X				FC-UT-1	18-FCL		X		
		52-002C		X				FC-UT-1	18-FCL		X		
	12 in. LPSI-2002/18	52-001	B-17			X		FC-PT-1	N/A		X		Augmented Exam Augmented Exam
	Elbow to Pipe	52-002A		X				FC-UT-1	18-FCL		X		
		52-002C		X				FC-UT-1	18-FCL		X		

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				UT	MT	PT	VT			RI	NRI	OTHER		
52 Cont'd	12 in. LPSI-2002/19	52-001	B-17			X		FC-PT-1	N/A		X			
	Pipe to Elbow	52-002A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		52-002C		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. LPSI-2002/1-PR-1	52-003	B-17				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. LPSI-2002/8-PR	52-003	B-17				X	FC-VT-3	N/A		X			
	Pipe Restraint													
53	12 in. LPSI-2003/9	53-001	B-18			X		FC-PT-1	N/A		X			
	Elbow to Pipe	53-003A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		53-003C		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. LPSI-2003/10	53-001	B-18			X		FC-PT-1	N/A		X			
	Pipe to Pipe	53-003A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		53-003A		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. LPSI-2003/2-PR-1	53-002	B-18				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. LPSI-2003/2-PR-2	53-002	B-18				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. LPSI-2003/15-PR-1	53-004	B-18				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. LPSI-2003/17-PR-1	53-004	B-18				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. LPSI-2003/17-PR-2	53-004	B-18				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	54	12 in. CSS-2002/8	54-001	B-20			X		FC-PT-1	N/A		X		
		Elbow to Pipe	54-002A		X				FC-UT-1	18-FCL		X		Augmented Exam
		54-002C		X				FC-UT-1	18-FCL		X		Augmented Exam	
55	12 in. CSS-2001/9	55-001	B-19			X		FC-PT-1	N/A		X			
	Elbow to Pipe	55-002A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		55-002C		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. CSS-2001/10	55-001	B-19			X		FC-PT-1	N/A		X			
	Pipe to Elbow	55-002A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		55-002C		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. CSS-2001/11	55-001	B-19			X		FC-PT-1	N/A		X			
	Elbow to Pipe	55-002A		X				FC-UT-1	18-FCL		X		Augmented Exam	
		55-002C		X				FC-UT-1	18-FCL		X		Augmented Exam	
	12 in. CSS-2001/17-PR-1	55-003	B-19				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. CSS-2001/17-PR-2	55-003	B-19				X	FC-VT-3	N/A		X			
	Pipe Restraint													
	12 in. CSS-2001/11-PR	55-004	B-19				X	FC-VT-3	N/A		X			
	Pipe Restraint													
12 in. CSS-2001/22	55-005	B-19			X		FC-PT-1	N/A		X				
Elbow to Pipe	55-006A		X				FC-VT-1	18-FCL		X		Augmented Exam		
	55-006C		X				FC-UT-1	18-FCL		X		Augmented Exam		

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				UT	MT	PT	VT			RI	NR1	OTHER	
56	12 in. SDC-2001/15-PR Pipe Restraint	56-001	B-21				X	FC-VT-3	N/A		X		
	12 in. SDC-2001/17-PR-2 Pipe Restraint	56-001	B-21				X	FC-VT-3	N/A		X		
	12 in. SDC-2001/18 Pipe to Flange	56-002	B-21			X		FC-PT-1	N/A		X		
		56-003A		X				FC-UT-1	18-FCL		X		Augmented Exam
		56-003C		X				FC-UT-1	18-FCL		X		Augmented Exam
	12 in. SDC-2001/19 Flange to Pipe	56-002	B-21			X		FC-PT-1	N/A		X		
		56-003A		X				FC-UT-1	18-FCL		X		Augmented Exam
		56-003C		X				FC-UT-1	18-FCL		X		Augmented Exam
57	12 in. SDC-2002/21-PR-1 Pipe Restraint	57-001	B-22				X	FC-VT-3	N/A		X		
	12 in. SDC-2002/21-PR-2 Pipe Restraint	57-001	B-22				X	FC-VT-3	N/A		X		
	12 in. SDC-2002/7 Pipe to Tee	57-002	B-22			X		FC-PT-1	N/A		X		
		57-004A		X				FC-UT-1	18-FCL		X		Augmented Exam
		57-004C		X				FC-UT-1	18-FCL		X		Augmented Exam
	12 in. SDC-2002/8 Pipe to Tee	57-002	B-22			X		FC-PT-1	N/A		X		
		57-004A		X				FC-UT-1	18-FCL		X		Augmented Exam
		57-004C		X				FC-UT-1	18-FCL		X		Augmented Exam
58	12 in. SDC-2002/14-PR-1 Pipe Restraint	57-003	B-22				X	FC-VT-3	N/A		X		
	12 in. SDC-2002/14-PR-2 Pipe Restraint	57-003	B-22				X	FC-VT-3	N/A		X		
	12 in. SDC-2003/17 Elbow to Pipe	58-001	B-22A			X		FC-PT-1	N/A		X		
		58-002A		X				FC-UT-1	18-FCL		X		Augmented Exam
		58-002C		X				FC-UT-1	18-FCL		X		Augmented Exam
	12 in. SDC-2003/10 Pipe to Elbow	58-003	B-22A			X		FC-PT-1	N/A		X		
		58-004A		X				FC-UT-1	18-FCL		X		Augmented Exam
		58-004C		X				FC-UT-1	18-FCL		X		Augmented Exam
59	10 in. LPH-2001/32 Pipe to Elbow	59-001	B-23			X		FC-PT-1	N/A		X		
		59-002A		X				FC-UT-1	19-FCL		X		Augmented Exam
		59-002C		X				FC-UT-1	19-FCL		X		Augmented Exam
	10 in. LPH-2001/33 Elbow to Pipe	59-001	B-23			X		FC-PT-1	N/A		X		
		59-002A		X				FC-UT-1	19-FCL		X		Augmented Exam
		59-002C		X				FC-UT-1	19-FCL		X		Augmented Exam
	10 in. LPSI-2001/9-PR Pipe Restraint	60-001	B-24				X	FC-VT-3	N/A		X		
	10 in. LPSI-2001/6 Pipe to Elbow	60-002	B-24			X		FC-PT-1	N/A		X		
60		60-003A		X				FC-UT-1	19-FCL		X		Augmented Exam
		60-003C		X				FC-UT-1	19-FCL		X		Augmented Exam

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FORT CALHOUN		CLASS 2 PIPING							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
61	10 in. LPSI-2002/1-PR Pipe Restraint	61-001	B-25				X	FC-VT-3	N/A		X		
	10 in. LPSI-2002/3-PR-1 Pipe Restraint	61-001	B-25				X	FC-VT-3	N/A		X		
	10 in. LPSI-2002/7 Elbow to Pipe	61-002	B-25			X		FC-PT-1	N/A		X		
		61-003A		X				FC-VT-1	19-FCL		X		Augmented Exam
		61-003C		X				FC-UT-1	19-FCL		X		Augmented Exam
	10 in. LPSI-2002/8 Pipe to Elbow	61-002	B-25			X		FC-PT-1	N/A		X		
		61-003A		X				FC-UT-1	19-FCL		X		Augmented Exam
		61-003C		X				FC-UT-1	19-FCL		X		Augmented Exam
	10 in. LPSI-2002/9 Elbow to Pipe	61-002	B-25			X		FC-PT-1	N/A		X		
		61-003A		X				FC-UT-1	19-FCL		X		Augmented Exam
		61-003C		X				FC-UT-1	19-FCL		X		Augmented Exam
	10 in. LPSI-2002/30 Pipe to Valve	61-004	B-25			X		FC-PT-1	N/A		X		
		61-005A		X				FC-UT-1	19-FCL		X		Augmented Exam
		61-005C		X				FC-UT-1	19-FCL		X		Augmented Exam
62	8 in. CSS-2002/3-PR-1 Pipe Restraint	62-001	B-27				X	FC-VT-3	N/A		X		
63	8 in. CSS-2003/14-PR-1 Pipe Restraint	63-001	B-28				X	FC-VT-3	N/A		X		
	8 in. CSS-2003/14-PR-2 Pipe Restraint	63-001	B-28				X	FC-VT-3	N/A		X		
	8 in. CSS-2003/2-PR-1 Pipe Restraint	63-002	B-28				X	FC-VT-3	N/A		X		
	8 in. CSS-2003/2-PR-2 Pipe Restraint	63-002	B-28				X	FC-VT-3	N/A		X		
	8 in. CSS-2003/2-PR-3 Pipe Restraint	63-002	B-28				X	FC-VT-3	N/A		X		
	8 in. CSS-2003/5 Elbow to Pipe	63-003	B-28			X		FC-PT-1	N/A		X		
		63-004A		X				FC-UT-1	20-FCL		X		Augmented Exam
		63-004C		X				FC-UT-1	20-FCL		X		Augmented Exam
	8 in. CSS-2003/10 Pipe to Elbow	63-003	B-28			X		FC-PT-1	N/A		X		
		63-004A		X				FC-UT-1	20-FCL		X		Augmented Exam
		63-004C		X				FC-UT-1	20-FCL		X		Augmented Exam
64	8 in. LPSI-2001/17 Pipe to Pipe	64-001	B-29			X		FC-PT-1	N/A		X		
		65-003A		X				FC-UT-1	20-FCL		X		Augmented Exam
		65-003C		X				FC-UT-1	20-FCL		X		Augmented Exam
	8 in. LPSI-2001/20 Pipe to Elbow	64-001	B-29			X		FC-PT-1	N/A		X		
		65-003A		X				FC-UT-1	20-FCL		X		Augmented Exam
		65-003C		X				FC-UT-1	20-FCL		X		Augmented Exam
	8 in. LPSI-2001/22 Pipe to Elbow	64-001	B-29			X		FC-PT-1	N/A		X		
		65-003A		X				FC-UT-1	20-FCL		X		Augmented Exam
		65-003C		X				FC-UT-1	20-FCL		X		Augmented Exam
	8 in. LPSI-2001/8-PR-2 Pipe Restraint	64-002	B-29				X	FC-VT-3	N/A		X		

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				UT	MT	PT	VT			RI	NRI	OTHER	
64 Cont'd	8 in. LPSI-2001/15-PR-1 Pipe Restraint	64-002	B-29				X	FC-VT-3	N/A		X		
	8 in. LPSI-2001/15-PR-2 Pipe Restraint	64-002	B-29				X	FC-VT-3	N/A		X		
	8 in. LPSI-2001/8-PR-1 Pipe Restraint	64-003	B-29				X	FC-VT-3	N/A		X		
65	8 in. LPSI-2002/5 Elbow to Valve	65-001 65-003A 65-003C	B-30				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 20-FCL 20-FCL		X X X		Augmented Exam Augmented Exam
	8 in. LPSI-2002/6 Valve to Pipe	65-001 65-003A 65-003C	B-30				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 20-FCL 20-FCL		X X X		Augmented Exam Augmented Exam
	8 in. LPSI-2002/10 Elbow to Pipe	65-001 65-003A 65-003C	B-30				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 20-FCL 20-FCL		X X X		Augmented Exam Augmented Exam
	8 in. LPSI-2002/10-PR-1 Pipe Restraint	65-002	B-30				X	FC-VT-3	N/A		X		
66	6 in. LPH-2002/3B Elbow to Pipe	66-001 66-002A 66-002C	B-31				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 21-FCL 21-FCL		X X X		Augmented Exam Augmented Exam
67	6 in. SI-2024/1A-PR Pipe Restraint	67-001	B-32				X	FC-VT-3	N/A		X		
68	6 in. LPH-2014/7 Elbow to Pipe	68-001 66-002A 66-002C	B-34				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 21-FCL 21-FCL		X X X		Augmented Exam Augmented Exam
	6 in. LPH-2014/1-PH Pipe Hanger	68-002	B-34				X	FC-VT-3	N/A		X		
	6 in. LPH-2014/9-PR-1 Pipe Restraint	68-002	B-34				X	FC-VT-3	N/A		X		
	6 in. LPH-2014/9-PR-2 Pipe Restraint	68-002	B-34				X	FC-VT-3	N/A		X		
69	6 in. CSS-2001/5-PR-1 Pipe Restraint	69-001	B-35				X	FC-VT-3	N/A		X		
	6 in. CSS-2001/5 Elbow to Pipe	69-002 69-003A 69-003C	B-35				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 21-FCL 21-FCL		X X X		Augmented Exam Augmented Exam
	6 in. CSS-2001/4 Pipe to Elbow	69-002 69-003A 69-003C	B-35				X	FC-PT-1 FC-UT-1 FC-UT-1	N/A 21-FCL 21-FCL		X X X		Augmented Exam Augmented Exam
71	24 in. SI-2001/14-PR Pipe Restraint	71-001	B-36				X	FC-VT-3	N/A		X		
	24 in. SI-2001/6-PR-1 Pipe Restraint	71-002	B-36				X	FC-VT-3	N/A		X		
	24 in. SI-2001/3 Elbow to Pipe	71-003A 71-003C 71-004	B-36	X X				FC-UT-1 FC-UT-1 FC-PT-1	23-FCL 23-FCL N/A		X X X		Augmented Exam Augmented Exam

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				UT	MT	PT	VT			RI	NRI	OTHER	
72	20 in. SI-2001/3 Pipe to Tee	72-001	B-36				X	FC-PT-1	N/A		X		
		72-002A		X				FC-UT-1	23-FCL		X	Augmented Exam	
		72-002C		X				FC-UT-1	23-FCL		X	Augmented Exam	
	20 in. SI-2001/4 Elbow to Pipe	72-001	B-36				X	FC-PT-1	N/A		X		
		72-002A		X				FC-UT-1	23-FCL		X	Augmented Exam	
		72-002C		X				FC-UT-1	23-FCL		X	Augmented Exam	
73	24 in. SI-2002/2 Pipe to Elbow	73-001	B-37				X	FC-PT-1	N/A		X		
		73-002A		X				FC-UT-1	23-FCL		X	Augmented Exam	
		73-002C		X				FC-UT-1	23-FCL		X	Augmented Exam	
	24 in. SI-2002/8-PR-A Pipe Restraint	73-003	B-37				X	FC-VT-3	N/A		X		
	73-003	B-37					X	FC-VT-3	N/A		X		
	24 in. SI-2002/8-PR-B Pipe Restraint	73-003	B-37				X	FC-VT-3	N/A		X		
74	12 in. CSS-2004/2 Pipe to Elbow	74-001	B-38				X	FC-PT-1	N/A		X		
		74-002A		X				FC-UT-1	18-FCL		X	Augmented Exam	
		74-002C		X				FC-UT-1	18-FCL		X	Augmented Exam	
	12 in. CSS-2004/3 Elbow to Pipe	74-001	B-38				X	FC-PT-1	N/A		X		
		74-002A		X				FC-UT-1	18-FCL		X	Augmented Exam	
		74-002C		X				FC-UT-1	18-FCL		X	Augmented Exam	
	12 in. CSS-2004/6-PR-1 Pipe Restraint	74-003	B-38				X	FC-VT-3	N/A		X		
	74-003	B-38					X	FC-VT-3	N/A		X		
	12 in. CSS-2004/6-PR-2 Pipe Restraint	74-003	B-38				X	FC-VT-3	N/A		X		
	75	12 in. CSS-2005/3-PR-1	75-001	B-38				X	FC-VT-3	N/A		X	
76		12 in. CSS-2011/2-PR-3 Pipe Restraint	76-001	B-39				X	FC-VT-3	N/A		X	
	76-002						X	FC-PT-1	N/A		X		
	76-003A		X					FC-UT-1	19-FCL		X	Augmented Exam	
	76-003C	X				FC-UT-1	19-FCL		X	Augmented Exam			
77	8 in. HPSI-2001/2-PR-1 Pipe Restraint	77-001	B-40				X	FC-VT-3	N/A		X		
78	6 in. HPSI-2001/6 Reducer to Tee	78-001	B-41				X	FC-PT-1	N/A		X		
		78-002A		X				FC-UT-1	21-FCL		X	Augmented Exam	
		78-002C		X				FC-UT-1	21-FCL		X	Augmented Exam	
79	6 in. SI-2002/1 Reducer to Elbow	79-001	B-42				X	FC-PT-1	N/A		X		
		79-003A		X				FC-UT-1	21-FCL		X	Augmented Exam	
		79-003C		X				FC-UT-1	21-FCL		X	Augmented Exam	
	6 in. SI-2002/2 Elbow to Pipe	79-001	B-42				X	FC-PT-1	N/A		X		
		79-003A		X				FC-UT-1	21-FCL		X	Augmented Exam	
		79-003C		X				FC-UT-1	21-FCL		X	Augmented Exam	
	6 in. SI-2002/6-PR Pipe Restraint	79-002	B-42				X	FC-VT-3	N/A		X		
	79-002	B-42					X	FC-VT-3	N/A		X		
	6 in. SI-2002/10-PR-3 Pipe Restraint	79-002	B-42				X	FC-VT-3	N/A		X		

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ISI EXAMINATION SUMMARY

PROJECT:		SYSTEM IDENTIFICATION:						EXAMINATION PERIOD:					
FORT CALHOUN		SHUTDOWN HEAT EXCHANGER						SPRING 1984					
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NRI	OTHER	
80	AC-4A/2	80-001	B-44	X				FC-UT-1	PL-SS- .765-63	X			

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**ISI EXAMINATION SUMMARY**

PROJECT:		SYSTEM IDENTIFICATION:							EXAMINATION PERIOD:				
FORT CALHOUN		REACTOR VESSEL							SPRING 1984				
ITEM NO.	COMPONENT/WELD IDENTIFICATION NO.	REPORT NO.	ISOMETRIC DRAWING NO.	NDE METHOD				PROCEDURE UTILIZED	CALIBRATION BLOCK USED	RESULTS			REMARKS
				UT	MT	PT	VT			RI	NR	OTHER	
81	Flange-To-Closure Head Weld From Stud Holes 33 to 0												
	33 to 41	81-001	A-2a	X				FC-UT-4	7-FCL	X			0° WHAZ
	33 to 41	81-002	A-2a	X				FC-UT-4	7-FCL	X			0° Base Metal
	33 to 41	81-003 A/C	A-2a	x				FC-UT-4	7-FCL	X			45°
	33 to 41	81-004 A/C	A-2a	X				FC-UT-4	7-FCL	X			60°
	33 to 41	81-005	A-2a		X			FC-MT-1	N/A	X			
	42 to 0	81-006	A-2a		X			FC-MT-1	N/A	X			
	42 to 0	81-007 A/C	A-2a	X				FC-UT-4	7-FCL	X			60°
	42 to 0	81-008 A/C	A-2a	X				FC-UT-4	7-FCL	X			45°
	42 to 0	81-009	A-2a	X				FC-UT-4	7-FCL	X			0° Base Metal
	42 to 0	81-010	A-2a	X				FC-UT-4	7-FCL	X			0° WHAZ

AUGMENTED EXAMINATIONS

Section 1

To provide continued compliance with IE-Circular 76-06, ultrasonic examinations were performed on a number of Class 2 piping welds that would otherwise not require a volumetric examination. A total of fifty two (52) circumferential welds and two (2) longitudinal weld sections were examined volumetrically for this purpose. These volumetric examinations were conducted in addition to the surface examinations required by IWC-2500-1. These examinations are identified in the remarks column of the ISI Examination Summary.

RPV HEAD TO FLANGE WELD

Section 2

Prior to the examination of the Reactor Head-to-Flange Weld it was determined that due to certain conditions the requirements of NRC Regulatory Guide 1.150 Revision 1 could not be met. These conditions consisted of physical restrictions on transducer movement and the relationship of the weld/base-metal interface to the sound beam angle.

The physical restrictions consisted of a permanently attached seismic support skirt and the flange radius. The close proximity of these limitations did not allow for sufficient transducer travel to provide complete coverage of the required examination volume. Please refer to the next page for approximate coverage areas.

The relationship of the weld/base-metal interface to the sound beam can be important in the detection of reflectors located along that interface. It is desirable to obtain a relationship as close to perpendicular as possible. Due to physical limitations mentioned and other considerations, it was determined that a 60° angle would come closest to perpendicular while obtaining maximum coverage.

All conditions affecting Reg. Guide 1.150 were discussed with the OPPD ISI Coordinator prior to conducting this examination.

It should be noted that the conditions mentioned here affected only the ultrasonic examination and had no impact on the surface examination.

Omaha Public Power District, 1623 Harney St., Omaha, NE 68102,  
Fort Calhoun Station - Unit 1, P.O. Box 399, Fort Calhoun, NE 68023-0399  
Commercial Service Date 9/26/73

HEAD TO FLANGE WELD

Drawn to Scale

FLANGE SIDE

ACTUAL EXIT POINTS

HEAD SIDE

60°  
45°

60°  
45°

Area receiving full coverage

All other areas received partial coverage

