1

AUTOMATED ULTRASONIC EXAMINATION

PROCEDURE FOR THE EXAMINATION

OF CAST STAINLESS STEEL WELDS

DUKE POWER COMPANY

UNCONTROLLED

Project Application: Duke Power Company	Copy No.	Assigned To

APPROVALS

TITLE/DEPT. - SIGNATURE - DATE

REV NO	PREPARED BY	PQR	LEVEL III	Dept. Mgr.	Project Mgr.	QA Mgr.
0						
1	Z. D. Dargay 20 May 87	N	John J. Hayden 5/22/87	5/22/87	5/22/87	5-22-87
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

CONTROLLED COPY
VALID ONLY IF THIS STAMP IS RED

NES
A unit of Dillingham

NUCLEAR ENERGY SERVICES

REVISION LOG

DOCUMENT NO. 83A3180

REV. NO.	DATE	PAGE NO.	DESCRIPTION	APPROVAL
1	5/20/87	1	Change to NES Form 104	Zane D Daggy
		5	Paragraph 5.4A, change "2.25" to "1.0"	
		6	Change "5.4D" to "5.4E"	
			Change phrase "...is recorded..." to	
			"...shall be recorded..."	
		8	Paragraph 5.6, add "(3) Disruption of	
			power supply"	
		10	Paragraph 4, delete 10% overlap with	
			transducer oscillation requirements	
		3	Paragraph 2.1 change to read "... through	
			Winter 1982..."	
		10	Increase coverage requirements on parallel	
			exams	
		13	Add requirement to confirm source of	
			geometric indications by independent	
			means	
		3	Paragraph 2.2 change to Code Case N335-1	
			Refer to CRA 6489.	

1. PURPOSE

The purpose of this procedure is to establish the ultrasonic technique, recording criteria and equipment for the examination of pipe butt welds in cast stainless steels, utilizing the Ultrasonic Data Recording and Processing System (UDRPS).

2. REFERENCES

2.1 ASME B&PV Code, Section XI; 1980 Edition with Addenda through Winter 1982 (in order to incorporate site specific addenda requirements this procedure meets or exceeds the requirements of all the addendum associated with the 1980 Edition.) 1

2.2 ASME Code Case N-335-1, Rules for Ultrasonic Examination of Similar and Dissimilar Metal Piping Welds. 1

2.3 80A9053, NES Procedure for Ultrasonic Instrument Linearity Verification

2.4 80A9068, NES Procedure for Certifying Nondestructive Examination Personnel

3. PROCEDURE COMPLIANCE

The examination procedure defined in this document is based on References 2.1 and 2.2 but uses alternative techniques as allowed by Paragraph IWA 2240 of Section XI.

Limitations to the required examination coverage due to part geometry or access will be identified and described in the examination record.

4. PERSONNEL REQUIREMENTS

4.1 PERSONNEL CERTIFICATION REQUIREMENTS

A. Personnel performing ultrasonic examination governed by this procedure shall be certified in accordance with References 2.1 and 2.4.

B. Data Analysts shall have a minimum qualification of Level II UT and have received training in the operation of UDRPS equipment.

C. System Operators (Data Acquisition) shall have a minimum qualification of Level II UT except when the operation of the system consists only of operating the system console and running data acquisition or display programs. In this case, the personnel need only be trained and qualified in the operation of the UDRPS equipment.

D. Scanner Operators shall have received training in the operation of the automated scanning and positioning equipment used with the system. Scanner Operators using manually assisted scanners with the data acquisition systems shall have a minimum qualification of Level I "T" UT.

E. Examination crews shall have two or more members on each shift as necessary. At least one member of each crew shall have a minimum qualification of Level II UT.

4.2 PERSONNEL RECORDS

A. Records of personnel qualification shall be maintained by the on-site NES representative.

B. A copy of each examiner's certification summary and current eye test shall be submitted to the Plant Owner of his Agent prior to performing examinations in accordance with this procedure.

5. EQUIPMENT AND MATERIAL REQUIREMENTS

5.1 ULTRASONIC INSTRUMENT

A pulse echo flaw detection instrument with the following capabilities shall be used:

(1) stepped gain control calibrated in units of 2db or less.
(2) provision for external trigger.
(3) video and/or RF output for external data recording as required.
(4) square wave pulser

5.2 DATA RECORDING AND DISPLAY:

Data shall be recorded and displayed using the Ultrasonic Data Recording and Processing System (UDRPS).

5.3 SCANNING MECHANISM:

The scanning mechanism shall provide:
(1) raster scanning with the scan direction either parallel of perpendicular to the weld axis.
(2) an index increment adjustable in .1 inch or greater steps.

5.4 SEARCH UNITS

A. The nominal examination frequency shall be in the range of 0.5 to 1.0 MHz for all straight beam and angle beam examinations. The examination frequency shall be recorded on the examination record. 1

B. The examination angle shall generally be 45° using longitudinal or shear wave search units. The examination angle and type of beam shall be recorded on the examination record.

C. Search units shall consist of dual transducer elements focused at or near the ID surface. Search units with removable contact wedges shall use the same wedges for calibration as used for the examination.

D. Removable contact wedges shall be contoured for the appropriate pipe sizes.

E. UDRPS shall be optimized for the search units used with the system. A record of the UDRPS parameters shall be recorded with every UDRPS examination performed. 1

5.5 COUPLANT

Certified test reports for sulphur and halogen content shall be obtained for NES - supplied couplant. A copy of these test reports shall be maintained on-site.

The above requirements do not apply where couplant is furnished by the client.

6. PREREQUISITES

6.1 INSTRUMENT LINEARITY

UT instrument linearity shall be verified before the start of an examination or series of examinations and every 90 days thereafter while in use.

A. Screen Height Linearity

(1) Position a Search Unit (SU) so that echoes can be observed from any two reflectors.

(2) Adjust the SU position to give a 2:1 amplitude ratio between the two echoes, with the larger set at 80% of full screen height.

(3) Without moving the SU, adjust gain to successively set the larger echo from 100% to 20% full screen height (FSH) in 2 dB steps or 10% FSH increments. If the amplitude of the smaller echo does not remain at 50% of the larger echo amplitude (±5%FSH), the instrument shall not be used for examination.

B. Amplitude Control Linearity

(1) Position a search unit so that an echo from one reflector is peaked on the screen.

(2) With the increases and decreases in sensitivity shown below, the echo amplitude shall fall within the specified limits; if it does not, the instrument shall not be used for examination.

SPECIFIED LIMITS FOR ECHO AMPLITUDE

Indication Set at % of Full Screen	dB Control Change	Indication Limits %of Full Screen
80%	- 6 dB	32 to 48%
80%	-12 dB	16 to 24%
40%	+ 6 dB	64 to 96%
20%	+12 dB	64 to 96%

NOTE: Minus denotes decrease in amplitude; plus denotes increase.

C. Record information on the Ultrasonic Instrument Linearity Record.

6.2 SURFACE PREPARATION

A. All examination surfaces must be clean and free of dirt, weld spatter, or any other condition which would interfere with the examination by impairing proper transmission of the sound beam, or by preventing free movement of the search unit along the examination surface.

B. Irregularity of the surface contour to be scanned should not exceed 1/8" in any 2" of surface travel, or loss of proper sound transmission into the test part may be encountered.

7. EXAMINATION COVERAGE

The required examination coverage is identified in Appendix I.

8. GENERAL CALIBRATION REQUIREMENTS

8.1 UDRPS ultrasonic examination system calibration shall be performed in accordance with Appendix II. This system calibration shall be performed prior to, and verified on completion of, the examination period.

8.2 Calibration shall include the complete ultrasonic examination system. Any change in search units, shoes, couplants, cables, ultrasonic instruments, recording devices, or any other parts of the ultrasonic system shall be cause for calibration check.

8.3 The temperature difference between the component under examination and the applicable calibration block shall not exceed 25°F (14°C).

8.4 Calibration shall be performed from the surface of the calibration block which corresponds to the component surface to be examined.

8.5 The rate of search unit movement in the scan direction shall not exceed 6 inches per second.

8.6 A system calibration check shall be performed in accordance with Appendix I at the following times:

(1) At intervals not to exceed 12 hours.

(2) A change of ultrasonic system components.

(3) Disruption of power supply. 1

9. RECORDING CRITERIA

The UDRPS recording and display system records the entire examination. The recording criteria of Appendix III is the minimum by which the analyst can identify relevant indications recorded during the UDRPS examination.

10. EXAMINATION RECORDS

10.1 UDRPS data-file records are uniquely identified with a six-character alpha-numeric designation. Search-unit characterization, calibration, and examination records are all identified in this manner.

10.2 Hard copies of displays showing indications or areas of interest may be attached to the examination report to supplement or clarify analysis results. The analyst shall clearly identify such copies with content description and the appropriate data-set designation.

10.3 The report for each examination shall include:

A. Calibration data record(s)

B. Examination data record(s)

C. The recorded examination data (magnetic tape or optical disk)

APPENDIX I

EXAMINATION COVERAGE

1. The examination area shall be the inner 1/3 T of the weld including 1/4" on both sides of the weld as measured from the widest part of the weld, usually the weld crown.

2. For reflectors parallel to the weld the examination shall be performed using a one-half V path from two sides of the weld where practical. Examinations performed from one side of the weld shall be identified on the examination record.

3. For reflectors perpendicular to the weld the examination shall be performed using a one-half V path on the weld crown. Coverage shall include the area from 1/2" from one side of the weld crown to 1/2" from the other side of the crown, including the crown. Those welds with crown geometry that does not permit examination shall be identified on the examination record. 1

4. Transducer element overlap shall be a minimum of 50%. 1

APPENDIX II

CALIBRATION REQUIREMENTS

A. CALIBRATION

1. Calibration shall include the entire system.

2. The UT video output shall be adjusted such that an amplitude of 80% FSH shall be equivalent to a UDRPS display amplitude of 200 ± 15.

3. Adjust sweep to include the entire examination volume.

4. Initial characterization of the transducers with UDRPS may be performed with any block(s) of similar material characteristics as the material to be examined. Final characterization shall be performed using the specified Code calibration block.

5. Establish the final search unit characterization parameters by scanning over the ID notch in the required calibration block. These parameters may be established at any time before the start of examinations provided the same examination system is used to perform the characterization and examination.

6. Peak the ID notch response and adjust the sensitivity to obtain an 80% FSH signal. This is the reference sensitivity. Record this response on UDRPS.

7. The scanning sensitivity is established by scanning either on the calibration block or actual component and increasing the sensitivity to obtain substantial amount of ID noise.

NOTE: Use caution not to over sensitize the ID. This may obscure relevant reflectors making their interpretation difficult.

8. Record the reference and scanning sensitivity, and instrument settings on the examination record.

9. If a simulator block is going to be used for calibration checks, determine and record the instrument settings, and amplitude of the chosen reflector response on the examination record. Record this response on UDRPS.

B. CALIBRATION CHECKS

1. The calibration shall be checked by recording either the ID notch response from the calibration block or the reflector response from the simulator block at their corresponding reference sensitivities with UDRPS and comparing the resulting amplitude and signal position to the initial recorded UDRPS calibration record.

2. Final calibraiton shall be checked by recording the ID notch response at reference sensitivity with UDRPS and comparing the resulting amplitude and signal position to the initial recorded UDRPS calibration record.

3. If the system is found to be out of calibration then the UDRPS data will be evaluated by a Level II or IiI UT for disposition.

APPENDIX III

1. Prior to the final analysis of the weld-data set, the analyst shall verify that the data acquired is usable, e.g., good contact was maintained and that the ID geometry (root/counterbore) is properly recorded.

2. Data shall be analyzed using the display capabilities of UDRPS to the extent that the analyst can determine the shape, identity, and location of relevant indications.

3. Indications from geometric or metallurigical sources that are recorded in the data need not be further reported. The presence of geometric reflectors shall be confirmed by review of the fabrication drawings of the pipe edge preparation, the nondestructive examination records, or supplemental examination results. 1