Title

MECHANIZED ULTRASONIC INSIDE SURFACE EXAMINATION INDICATION RESOLUTION AND SIZING PROCEDURE

EFFECTIVITY AND APPROVAL

Revision 1 of this procedure became effective on Apr. 8, 1988. This procedure consists of the pages and changes listed below.

Page No	Change	Date Effective
1 through 21	0	April 1988

Supersedes Procedure No. IX-FE-134-0

SA FLD

Approvals

Written By	Date 4/7/88	Technical Review L.W. Clayton	Date 4/7/88
Manager of Q.A. T.C. Tidwell	Date 4/7/88	Cognizant Director David Frank Rossow	Date 4/8/88

SwRI Form QA-40B-1

MECHANIZED ULTRASONIC INSIDE SURFACE EXAMINATION INDICATION RESOLUTION AND SIZING PROCEDURE

IX-FE-134-1

1. PURPOSE

This procedure describes the methodology to be applied for the investigation, evaluation, resolution, and sizing of flaws recorded during mechanized preservice and inservice examination of the nuclear power plant reactor pressure vessel (RPV) and associated piping welds, adjacent base material and components.

2. SCOPE AND APPLICATION

This procedure applies to indications found during mechanized ultrasonic examinations from the inside surface.

3. APPLICABLE DOCUMENTS

(1) American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections V and XI, the Edition and Addenda specified in the Southwest Research Institute (SwRI) Project Plan.

(2) NRC Regulatory Guide 1.150, Revision 1, Appendix A, titled "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations," as specified by "Southwest Research Institute Implementation of Regulatory Guide 1.150 Requirements," when required.

(3) SwRI Nuclear Quality Assurance Program Manual (NQAPM).

(4) The Nuclear Projects Operating Procedure (Mechanized Examination Procedure NDT-700 series) applicable to the examination.

4. RESPONSIBILITY

(1) The Director of the Department of NDE Services, Nondestructive Evaluation Science and Technology Division, shall be responsible for the preparation, review, approval, and control of this procedure.

(2) The Project Manager shall be responsible for the implementation of this procedure in accordance with the NQAPM specified in the applicable SwRI Project Plan.

(3) The data analyst (Level II or Level III) and the examiner shall be responsible for implementing the requirements of this procedure.

(4) The Manager of Quality Assurance shall be responsible for storage of records generated in accordance with this procedure.

5. PERSONNEL AND EQUIPMENT

5.1 Personnel

Personnel performing examinations for flaw resolution and sizing in accordance with this procedure shall be certified in accordance with SwRI NQAP 11-1, "Special Process Control," and the applicable revision of SwRI Procedure X-FE-106, "Qualification and Certification of Special Process Personnel Performing Mechanized Examinations in Critical Services to Nuclear Plant Components."

5.2 Reference Block

Reference blocks used for screen distance calibration and verification shall be made of the same material as the production material, stainless steel or carbon steel, and shall be one of the following: (1) SwRI Half-Round, (2) AWS Type DC, (3) IIW, or (4) applicable tip diffraction reference block.

5.3 Basic Calibration Block

The basic calibration block to be utilized for Code sizing shall be a Code-compliant block with Code-compliant reference reflectors.

5.4 Search Units

(1) Straight Beam and Shear-wave Angle Beam

Search unit sizes and frequencies shall be in conformance with Code unless determined otherwise by a Level II or a Level III examiner.

Search unit wedges for angle beam shall be fabricated to ensure that the proper angle of refracted shear waves and refracted longitudinal waves ±2° are produced in accordance with the appropriate SwRI Scan Plan. The actual examination angle shall be measured for each search unit wedge and recorded on the applicable SwRI Instrument Calibration Record.

The exit point of the sound beam and the actual refracted beam angle of shear-wave search units shall be determined on an IIW block. The exit point shall be marked on the search unit wedge.

(2) 50/70 Tandem Refracted Longitudinal-Wave

A 50/70 refracted longitudinal-wave 1/2" x 1/2" or 1/2" x 1", 2.25 MHz, dual-element search unit may be utilized for indication resolution and sizing.

(3) Shear/Longitudinal Inspection Confirmation (SLIC 50)

A SLIC 50 multimode, 2 to 5 MHz, dual-element search unit may be utilized for indication resolution and sizing.

5.5 Ultrasonic Instrument and Scanning Mechanisms

The examiner shall select an appropriate ultrasonic instrument from the following: (1) a Sonic FTS Mark II or (2) a Sonic UWA Mark III.

Each instrument used shall be aligned and shall display a valid alignment calibration tag as required by NQAP 10-1.

Rotating, revolving, or scanning mechanisms used when performing mechanized ultrasonic examinations shall be described in the SwRI Scan Plan.

Automatic defect alarm and recording equipment to be utilized is specified in the applicable revisions of SwRI Procedures XII-FE-103 and XII-FE-116.

5.6 Couplant

(1) Reactor-grade water shall be used when performing ultrasonic calibrations and examinations in accordance with this procedure.

(2) The couplant used for the examinations shall be the same as that used for the calibration.

5.7 Thermometer (if required by the applicable mechanized examination procedure)

The thermometer to be used to measure the calibration block and component temperatures shall be calibrated and certified and shall display a valid calibration tag as required by NQAP 10-1.

6. CALIBRATION METHOD

6.1 Instrument Linearity

Instrument linearity shall be conducted as specified in the applicable mechanized examination procedure.

6.2 Waveform Photos

Waveform photos shall be performed as specified in the applicable mechanized examination procedure.

6.3 Temperature (if required by the applicable mechanized examination procedure)

The basic calibration block temperature shall be within 25°F of the component temperature and shall be recorded on the SwRI Instrument Calibration Record for the initial calibration and each verification. The surface temperature of the component to be examined shall be measured prior to and after each examination and shall be recorded on the applicable SwRI Examination Record. Water temperature inside the vessel may be used for component temperature.

6.4 Calibration

Except as specified in this procedure, calibration details such as vee-path positions and sweep distances shall be determined by the data analyst/examiner.

An ultrasonic calibration shall be completed prior to conducting indication resolution and sizing.

The REJECT control shall be maintained in the 0 or OFF position during calibration and indication resolution and sizing.

The FREQ MHz control shall be set to 1 when a 1.5 MHz search unit is used, to 2 with a 2.25 MHz search unit, to 5 with a 5 MHz search unit or to a setting specified on the Search Unit Profile Form RD-4-3 or RD-5-3.

The centerline of the search unit shall be at least 3/4 inch from the nearest side of the calibration block. Rotating the beam into the corner formed by a hole and the side of the block may produce a higher amplitude at a longer beam path. This beam path shall not be used for calibration.

The type and length of the search unit examination cable shall be recorded on the SwRI Sonic Instrument Calibration Record, and all other information blocks on the form shall be filled in.

6.4.1 Straight-Beam Distance Calibration

Observing back reflections from the applicable reference block, set up the required linear sound path distance along the screen baseline. The screen distance chosen shall be the shortest applicable size to include at least 10% of the material thickness past the anticipated examination distance.

6.4.2 Angle-Beam Distance Calibration

Distance calibration shall be constructed by observing the radius echoes from an applicable reference block to set up a linear sound path distance along the screen baseline. The screen distance chosen shall be the shortest applicable size to include at least 10% vee-path past the anticipated examination distance.

6.4.3 Depth Calibration for 50/70 Tandem Search Units

Depth calibration for the 50/70 tandem search unit shall be as specified in the applicable mechanized examination procedure.

6.4.4 Depth Calibration for the SLIC 50 Search Units

Position the SLIC 50 multimode search unit on the appropriate tip diffraction reference block. Observe the pulse 2 reflector from the lower tip of the applicable notches. Set up a linear 2-inch depth screen distance along the instrument screen baseline.

6.5 High-Speed Signal Averager

If a high-speed signal averager is used, perform the required operation as specified in the applicable mechanized examination procedure.

6.6 Distance Amplitude Correction

6.6.1 Straight-Beam Distance Amplitude Correction for Material 1.0 Inch or Less in Thickness

Straight-beam DAC for material 1 inch or less in thickness shall be a one-point zone calibration that does not use electronic DAC.

Obtain maximum response from the basic calibration hole at 1/2T. Set this signal to a primary reference level at or between 40% and 80% of FSH, mark it on the instrument screen, and draw a straight horizontal line at this amplitude, which shall extend a distance equal to the nominal thickness of the production material. All indications recorded shall be referenced as a percentage of this line for signal amplitude.

6.6.2 Electronic Distance Amplitude Correction

NOTE

When an electronic DAC is used, the reflector responses from the calibration block shall be set equal in amplitude regardless of the distance of the reflector from the search unit. A second DAC curve showing the actual amplitudes and sweep readings obtained from the reflectors shall also be established and recorded.

6.6.2.1 Angle Beam and Straight Beam for Welds

Electronic DAC curves shall be constructed by utilizing the responses from the basic calibration hole(s) as determined in the SwRI Examination Plan as follows:

The initial point on the DAC curve is established by obtaining maximum response from the nearest suitable position, setting this response to a primary reference level at or between 40% to 80% of FSH and marking its amplitude on the instrument screen. Obtain maximum responses from the remaining required vee-path positions; mark and join all amplitude points with smooth curved line. The DAC markers shall be adjusted to this line. Then the TCG markers shall be adjusted to the primary reference level as established by the initial point for the entire examination range.

EXCEPTION

For the examination volume from 1" below the clad interface to 1/4t the calibration shall be performed as follows:

(1) Position the appropriate shear angle-beam search unit on the clad side of the basic calibration block to obtain a maximum response from the applicable 1/8" diameter side-drilled hole that produces the highest amplitude response.

(2) Set this response to the first reference level at or between 40% to 80% of FSH and mark its amplitude on the instrument screen.

(3) Without changing the gain controls, obtain maximum response from the remaining holes; mark and join all amplitude points with a smooth curved line. Then adjust the TCG markers to the reference level, as established in (2) above, for the entire examination range. Record these gain settings under REMARKS.

(4) Establish the sensitivity from the 1/4t side-drilled code size hole by setting the maximum response at the TCG markers reference level. This is the primary reference level and the 1/4t signal shall be marked with an X. Record this primary reference level gain settings under INSTRUMENT SETTINGS of the applicable Calibration Record.

6.6.2.2 Multiple-Point Zone Calibration

Obtain maximum response from the nearest suitable reflector, set this response to the primary reference level at or between 40% to 80% of FSH and mark it on the instrument screen. Obtain the maximum response from the remaining required reflectors; mark and join all amplitude points with a smooth curved line. The DAC markers shall be adjusted to this line. The TCG markers shall then be adjusted to the primary reference level as established by the nearest suitable reflector for the entire examination range.

6.6.2.3 Angle-Beam Longitudinal-Wave Distance Amplitude Correction for 50/70 Search Units

(1) Position the 50/70 tandem refracted longitudinal-wave search unit on the clad side of the basic calibration block to obtain a

maximum response from the appropriate side-drilled hole that produces the highest amplitude response.

(2) Set this response to a primary reference level at or between 40% to 80% of FSH and mark its amplitude on the instrument screen.

(3) Without changing the gain controls, obtain maximum response from the remaining holes; mark and join all amplitude points with a smooth curved line. Then adjust the TCG markers to the primary reference level, as established in (2) above, for the entire examination range.

(4) When the 50/70 calibration is used for examination of the volume between 1-inch depth and 1/4 wall thickness depth, the following comparison data shall be recorded: Position the search unit to obtain the maximum response from the Code-specified side-drilled hole located at 1/4 thickness depth. Adjust the gain to bring the 1/4t hole response to the DAC line established in (3) above and record the gain setting on the Calibration Record Sheet.

6.7 Remote Cable Calibrator Standardization

The remote cable calibrator standardization, if required, shall be conducted as specified in the applicable mechanized examination procedure.

6.8 Beam Spread and Beam Angle Determination

Beam spread and beam angle determination, if required, shall be conducted as specified in the applicable mechanized examination procedure.

6.9 Calibration Verification, Calibration Changes, and Recalibration

Frequency of instrument calibration verification, calibration changes, and recalibration requirements shall be in accordance with the applicable mechanized examination procedure.

7. INVESTIGATION AND SIZING

Ultrasonic indications detected during mechanized examinations which exceed the recording criteria of the applied SwRI-NDT procedure and thereby require further resolution shall be investigated by the Level II or Level III Data Analyst in accordance with the guidelines established herein.

7.1 Investigation of Ultrasonic Indications

7.1.1 False and Nonrelevant Indications

Not all ultrasonic indications represent relevant reflectors; false indications, such as those due to loss of search unit to component contact or scanner geometry, do not require further investigation once identified.

Not all ultrasonic reflectors indicate flaws; certain metallurgical discontinuities and geometric conditions may produce nonrelevant indications such as plate segregates in the heat-affected zone, clad interface and back-wall reflections. Plate segregates in the heat-affected zone may become reflective after fabrication, and may appear as spot or line indications when examined using straight-beam longitudinal-wave techniques. These indications shall not be considered reportable conditions nor do they require further investigation once identified.

7.1.2 Investigative Scanning of Relevant Indications

Indications requiring additional data for evaluation shall be recorded at scan intervals of 1/4 inch or less. The recorded information shall include the indication metal path, the search unit position for 20%, 50%, and 100% DAC and the maximum amplitude of the signal for indications at or within the inner 25% of the through-wall thickness of the vessel as measured from the inside surface; and the metal path, search unit position for 50% and 100% DAC, and maximum amplitude of the signal for indications within the outer 75% of the through-wall dimension. Indications exceeding 100% DAC shall also have 50% maximum amplitude recorded. Each indication recorded shall have a minimum of one scan conducted parallel to the scanning direction at the maximum amplitude position to determine length of indication.

7.1.3 Investigation Data Reduction

When investigating an indication, the following should be considered where practical and deemed necessary:

(a) Determine the general location of the indication using the information supplied by the readout from the PaR device.

(b) Review previous examination data, including construction radiographs.

(c) Review fabrication drawing for geometry and weld preparation profile.

(d) Plot the indication location on a scale drawing of the component using the information specified above.

(e) Determine the repair history of the component, if possible.

(f) Perform supplemental nondestructive examinations. Use of supplemental examination methods are at the investigator's discretion, but may include radiography, visual inspection or other surface methods if possible, or alternative ultrasonic techniques.

7.2 Sizing

NOTE

Alternate sizing methods or a combination of sizing techniques described in this procedure may be utilized if deemed necessary.

7.2.1 Definitions

(a) MP represents the beam distance from the incident point to a reflector.

(b) W represents the search unit scanning movement across the width of the flaw.

(c) L represents the length of the flaw or the search unit scanning movement along the length of the flaw.

(d) t represents the wall thickness (excluding clad components) at the location of the reflector and is used for flaw evaluation.

(e) A planar flaw is a reflector whose orientation relative to the plane parallel with the center axis of the component exceeds or equals an angle of 10°.

(f) A laminar flaw is a reflector whose orientation relative to the plane parallel with the center axis of the component is less than 10°.

7.2.2 General Sizing Criteria for RPV Indications

7.2.2.1 Indications that change metal path distances on the horizontal baseline of the instrument screen for a distance greater than indications from the calibration holes at 20% amplitude shall be recorded.

Indications at 25% or greater of the through-wall thickness of the vessel wall measured from the inside surface shall be recorded and investigated at 50% DAC.

Indications within the inner 25% of the through-wall thickness shall be recorded and sized at 20% DAC. When the indication is sized at 20% DAC, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20% DAC points) that is at a depth at or near the flaw depth. If the indication exceeds 50% DAC, the size shall be recorded by measuring the distance between 50% DAC points and between the 20% DAC points as corrected. The determined size shall be the larger of the two.

7.2.2.2 Indications Without Changing Metal Path

Indications that do not change metal path and continue for a scanning distance of more than 1 inch located within the outer 75% of the through-wall dimension shall be recorded and investigated at 50% DAC. If the indication falls within the inner 25% of the through-wall dimension, it shall be recorded at 20% DAC and investigated at 50% DAC.

7.2.3 Piping and RPV Welds

7.2.3.1 Straight-Beam Reflector Orientation

The orientation of the reflector relative to the surface shall be determined as follows in both the length and width direction:

(a) P_2 minus P_1 equals delta P

(b) P_2MP minus P_1MP equals delta MP

(c) TAN^{-1} (delta MP / delta P) equals the orientation of the reflector in degrees

P_1 represents either the L_1 or the W_1 search unit location.

P_2 represents either the L_2 or the W_2 search unit location.

P_1MP equals the metal path reading at the P_1 search unit location.

P_2MP equals the metal path reading at the P_2 search unit location.

7.2.3.2 Lamination Reflectors

(1) Use the length and width of the laminar reflector at the 50% loss of backwall extremities to calculate the area of the flaw in square inches. This information shall be used to determine the interference with the angle-beam examination.

(2) Laminar reflectors in vessels shall be sized in accordance with step (1) above at the following limits:

(a) The 50% loss of backwall area shall be sized to determine interference with the angle beam.

(b) The 100% loss of backwall area shall be sized to determine the acceptance of the reflector.

7.2.3.3 Straight-Beam Planar Reflector

A straight-beam planar reflector shall be evaluated for acceptance at the 100% DAC limits as follows:

(a) L_2 - L_1 will equal the flaw length.

(b) W_2MP - W_1MP will equal the through wall dimension of the flaw.

7.2.3.4 Near Surface Angle-Beam Planar Reflector

Reflectors other than nonrelevant detected with the 50/70 tandem search unit which exceed 20% DAC and are located within 1 inch below the clad interface or within 1 inch below the sound beam entry surface shall be sized with the SLIC 50 as follows:

(a) L_2 - L_1 will equal the flaw length.

(b) The doublet separation (in screen divisions) shall be determined by the upper and lower extremities of the flaw.

(c) The through-wall dimension shall be determined on the SLIC-50 GRAPH which is a plot of the doublet separation in screen divisions versus through-wall dimensions.

NOTES

The lower extremity tip-diffracted signal shall be used to locate the flaw in the through-wall dimension of the material.

In the interest of conservatism, the L limits of the flaw shall be determined at the extremity scans which have an absence of flaw indication.

7.2.3.5 Inner 1/4t Angle-Beam Planar Reflector

Reflectors other than nonrelevant detected with the 50/70 tandem search unit which exceed 20% DAC and are located between 1 inch below the clad interface and 1/4 thickness of the vessel wall shall be compared to the response from the Code-specified side-drilled hole located at 1/4t on

the Basic Calibration as described in Paragraph 6.6.2.3. Further investigation is required only when the amplitude of the indication exceeds 20% of the amplitude of the 1/4t hole.

7.2.4 RPV Circumferential and Longitudinal Welds

7.2.4.1 Circumferential Angle Beam Planar Reflectors

This section is applicable to reflectors detected on circumferential welds with the beam directed perpendicular to the weld axis, or on longitudinal welds with the beam directed parallel to the weld axis.

(1) Angle-Beam Planar Reflector (Parallel Surfaces)

Reflectors located within 1 inch below the clad interface shall be sized in accordance with Paragraph 7.2.3.4.

Reflectors located beyond 1 inch below the clad interface and within the inner 25% of the wall thickness shall be sized at the 20% DAC limits as follows:

(a) L_2 minus L_1 will equal the search unit delta length (SUL) of the flaw.

(b) The product of $W_{max}MP$ and the cosine of the angle (45 or 60 deg) will equal the flaw radius (FR) as from vessel.

(c) The product of SUL and the FR divided by the vessel IR will equal the flaw length as corrected for curvature.

(d) W_2MP minus W_1MP will equal the delta MP.

(e) The product of the delta MP and the cosine of the angle (45 or 60 deg) will equal the through-wall dimension.

NOTE

When the reflector is sized at 20% DAC, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20% DAC points) that is at a depth at or near the flaw depth.

(f) Repeat steps (a) through (e) using the 50% DAC limits if the reflector exceeds 50% DAC.

(g) The determined size (20% or 50%) of the flaw shall be the larger of the two.

Reflectors located in the outer 75% of the wall thickness shall be sized at 50% DAC limits as follows:

(h) Repeat steps (a) through (e) above.

(2) Angle-Beam Planar Reflector (Nonparallel Surfaces)

This section is applicable to reflectors which have been detected from a tapered surface.

Reflectors located within 1 inch below the clad interface shall be sized in accordance with Paragraph 7.2.3.4.

Reflectors located beyond 1 inch below the clad interface and within the inner 25% of the wall thickness shall be sized at the 20% DAC limits as follows:

(a) L_2 minus L_1 will equal the flaw length.

(b) W_2MP minus W_1MP will equal the delta MP.

(c) The product of the delta MP and the cosine of the angle (45 or 60 deg) divided by the cosine of the taper angle will equal the through-wall dimension of the flaw.

(d) Repeat steps (a) through (c) using the 50% DAC limits if the reflector exceeds 50% DAC.

(e) The determined size (20% or 50%) of the flaw shall be the larger of the two.

Reflectors located in the outer 75% of the wall thickness shall be sized at 50% DAC limits as follows:

(f) Repeat steps (a) through (c) above.

7.2.4.2 Axial Angle-Beam Planar Reflectors

This section is applicable to reflectors detected on circumferential welds with the beam directed parallel to the weld axis, or on longitudinal welds with the beam directed perpendicular to the weld axis.

Reflectors located within 1 inch below the clad interface shall be sized in accordance with Paragraph 7.2.2.4.

Reflectors located beyond 1 inch below the clad interface and within the inner 25% of the wall thickness shall be sized at the 20% DAC limits as follows:

(a) Length - L_2 minus L_1 will equal the flaw length.

(b) Through wall -

Using the following formula, calculate the next two steps below:

Square root of $[(IR^2 + MP^2) - (2 \times IR \times MP \times \text{cosine}[180 - \text{refracted angle}])]$

(c) Use the W_1MP to derive at the inner extremity radius of the flaw (R_1).

(d) Use the W_2MP to derive at the outer extremity of the flaw (R_2).

(e) (R_2) minus (R_1) will equal the through-wall dimension of the flaw.

NOTE

When the reflector is sized at 20% DAC, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20% DAC points) that is at a depth at or near the flaw depth.

(f) Repeat steps (a) through (e) using the 50% DAC limits if the reflector exceeds 50% DAC.

(g) The determined size (20% or 50%) of the flaw shall be the larger of the two.

Reflectors located in the outer 75% of the wall thickness shall be sized at 50% DAC limits as follows:

(h) Repeat steps (a) through (e) above.

7.2.5 RPV Flange-to-Shell Welds

Reflectors detected in vessel flange-to-shell welds using examinations from the seal surface shall be sized from the shell in accordance with Subsection 7.2.3.

7.2.6 RPV Spherical Head Welds

NOTE

This section is applicable to reflectors detected on circumferential, meridional, and dollar plate welds located in the hemispherical head.

7.2.6.1 Angle-Beam Planar Reflector

Reflectors located within 1 inch below the clad interface shall be sized in accordance with Paragraph 7.2.3.4.

Reflectors located beyond 1 inch below the clad interface and within the inner 25% of the wall thickness shall be sized at the 20% DAC limits as follows:

(1) Length

(a) L_2 minus L_1 will equal the search unit delta length (SUL) of the flaw.

(b) The product of $W_{max}MP$ and the cosine of the angle (45 or 60 deg) plus the lower head inside radius (IR) will equal the flaw radius (FR).

(c) The product of SUL and the FR divided by the lower head inside radius IR will equal the flaw length as corrected for curvature.

(2) Through Wall

(a) Using the following formula, calculate the next two steps below:

Square root of [$(IR^2 + MP^2)$ - (2 X IR X MP X cosine [180 - refracted angle])]

(b) Use the W_1MP to derive at the inner extremity radius of the flaw (R_1).

(c) Use the W_2MP to derive at the outer extremity of the flaw (R_2).

(d) (R_2) minus (R_1) will equal the through-wall dimension of the flaw.

NOTE

When the reflector is sized at 20% DAC, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20% DAC points) that is at a depth at or near the flaw depth.

(e) Repeat steps (a) through (c) of (1), and steps (a) through (d) of (2) above using the 50% DAC limits if the reflector exceeds 50% DAC.

(f) The determined size (20% or 50%) of the flaw shall be the larger of the two.

Reflectors located in the outer 75% of the wall thickness shall be sized at 50% DAC limits in accordance with step (e) above.

7.2.7 RPV Nozzle-to-Shell Welds

7.2.7.1 Straight Beam and Angle Beam

Reflectors located at or within the inner 25% of the wall thickness shall be sized to 20% and 50% DAC limits as follows:

(a) P_2 minus P_1 as determined from the SwRI rotator reading and projected to the reflector will equal the flaw length.

(b) P_2 minus P_1 as determined from the boom extend will equal the through-wall dimension of the flaw.

(c) The determined size (20% or 50%) of the flaw shall be the larger of the two.

NOTE

When the reflector is sized at 20% DAC with the angle, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20% DAC points) that is at a depth at or near the flaw location.

Reflectors located in the outer 75% of the wall thickness shall be sized to the 50% DAC limits as follows:

(d) Repeat steps (a) and (b) above.

7.2.7.2 Alternative Sizing for Nozzle-to-Shell Welds

Beam spread correction, as determined on the appropriate reflectors (i.e., flat-bottom holes), may be utilized to size indications detected from the nozzle bore.

8. REPORTING

If the size of an indication, as determined in accordance with Section 7 of this procedure equals or exceeds the allowable limits of Section XI of

the ASME Boiler and Pressure Vessel Code, the indication shall be reported to the customer.

9. RECORDS

The records generated with this procedure shall be identified in the applicable Scan Plan.

Maintenance and retention of these records shall be specified in the applicable SwRI Project Plan.