NUCLEAR ENERGY SERVICES, INC.

DOCUMENT NO. 80A3467 REV. C



# REFERENCE UTRASONIC EXAMINATION PROCEDURE

# GENERAL REQUIREMENTS

# FOR

# STANDARDIZED NUCLEAR UNIT POWER PLANT SYSTEM

| Project Application 5555 | Prepared By H. Edward Hartman | | Date 2/19/80 |
|---|---|---|---|
| APPROVALS | | | |
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NUCLEAR ENERGY SERVICES, INC.

DOCUMENT NO. 80A3467

# REVISION LOG



| REV. NO. | DATE | PAGE NO. | DESCRIPTION | APPROVAL |
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# ULTRASONIC EXAMINATION - GENERAL REQUIREMENTS

## 1. SCOPE

1.1 This procedure details the general requirements for ultrasonic examination of welds and base material.

1.2 These requirements shall be considered a part of a specific ultrasonic procedure where referenced. All the requirements specified herein shall be complied with unless otherwise stated within a specific procedure.

1.3 This procedure cannot be used for ultrasonic examination in itself. Specific procedures are written for each area of examination and are to be used in conjunction with this general requirement procedure.

## 2. REFERENCES

2.1 ASME Section V, Article 5, "Ultrasonic Examination," 1974 Edition, up to and including the Summer of 1975 Addenda.

2.2 ASME Section XI, 1974 Edition including the Summer of 1975 Addenda, with the provisions of Appendix I or Appendix III, including Addenda through the Winter of 1975, as applicable.

2.3 The American Society for Nondestructive Testing, SNT-TC-1A, June 1975 Edition.

2.4 80A9068 NES Division "Procedure for Qualification and Certification of Nondestructive Examination Personnel." (Latest revision)

2.5 80A9053, NES "Procedure for Ultrasonic Instrument Linearity Verification," as modified by Section 4.2 of this procedure. (Latest revision)

2.6 80A9035, NES "Procedure for Weld Marking (of) Datum Points and Identification." (Latest revision)

2.7 80A9060, NES "Inservice Inspection Field Change Procedure". (Latest revision)

2.8 80A2922 NES Reference QA Program Plan.

2.9 80A2923 NES Reference Program Plan.

## 3. PERSONNEL AND MATERIAL REQUIREMENTS

3.1 Personnel shall be certified in accordance with references 2.2, 2.3, and 2.4. At least one member of an ultrasonic examination team shall be certified to at least Level II. A copy of the examiner's certification summary and a current eye test as required by SNT-TC-1A shall be submitted to the plant owner or his agent, prior to performing examinations.

3.2 The couplant shall be approved and shall be certified to contain less than 1% by weight of total residual halogens and less than 1% by weight of total sulphur. Ultragel shall be used on all vessel exams. Sonotrace shall be used on all piping exams.

3.3 The couplant shall be supplied in clean containers of sufficient quantity for performance of the examination.

3.4 Sonotrace may only be used in the following temperature range: 32°F to 120°F. For temperatures over 120°F and up to 150°F, Ultragel shall be used. No ultrasonic examinations shall be performed on components over 150°F.

3.5 The search unit cable may be Microdot (RG174AU) or BNC (RG64U) of any convenient length or combination of lengths. Record actual useage on the Calibration Data Sheet.

## 4. ULTRASONIC EQUIPMENT REQUIREMENTS

4.1 A contractor-supplied pulse echo type ultrasonic flaw detection instrument shall be used. The instrument shall be equipped with a stepped gain control calibrated in units of 2dB or less, or fine adjustments of at least 2dB or less.

4.2 Complete instrument linearity checks shall be performed in accordance with the technique in the procedure referenced in Section 2.5. When examinations of items other than piping are to be performed, the instrument linearity shall be checked daily. During the examination of piping welds, linearity checks shall be performed at the beginning of each week.

4.3 During the examination of piping welds, a daily check of the instrument amplitude control linearity shall be performed as follows:

A. Obtain a 80% FSH indication from a reflector in a calibration standard. Decrease the gain by 6 dB. The resultant indication should drop to nominally 40% Full Screen Height (FSH) (the allowed range is 32% FSH to 48% FSH).

B. Obtain a 20% FSH indication from a reflector in a calibration standard. Increase the gain by 12 dB. The resultant indication should increase to nominally 80% FSH (the allowed range is 64% FSH to 96% FSH).

4.4 Should the instrument prove to be nonlinear, it shall be tagged and not used. All examinations which were performed with that instrument since the previous valid linearity check shall be identified in writing to a NES Level III for disposition. The Level III disposition shall become a part of the permanent PSI records.

4.5 The nominal examination frequency shall be 2.25 MHz unless otherwise specified within the specific examination procedure.

4.6 During preservice examination other pulse frequencies shall be used if such variables as material attenuation, grain structure, etc., necessitate their use to achieve penetration or resolution. This information shall be recorded in the data sheets.

## 5. EXAMINATION SYSTEM CALIBRATION

5.1 Calibration shall include the complete ultrasonic examination system. Any change in search units, shoes, couplants, cables, ultrasonic instruments, Level II Personnel, recording devices, or any other parts of the examination system shall be cause for calibration check. The original and final calibration must be performed on the basic calibration block. Intermediate Calibration checks may be performed on a basic calibration block simulator, but must include a check of the entire examination system.

5.2 Ultrasonic instrument calibration consists of two basic steps, linear range and sensitivity.

1. Horizontal linear range may be established in inches of metal path. Refer to Table 1 for appropriate metal path calibration that coincides with the examination requirements; such as examination angle, material thickness, and vee path.

2. Vertical instrument sensitivity is established by obtaining reflections from the side drilled holes or notches, or both, located in the code calibration block.

5.3 BASIC CALIBRATION TECHNIQUE (PIPING - FULL VEE)

5.3.1 The instrument linear range, as displayed on the CRT, will be calibrated in inches by use the "Miniature Angle Beam Verification Block".

5.3.2 The search unit is then positioned on the appropriate piping calibration standard to obtain maximized responses from the notches. The 1/2 vee path to the ID notch is set at 80% FSH, the CRT is marked to record the position and amplitude of this primary reference response.

5.3.3 Without changing the instrument gain, the search unit is then positioned to successively maximize responses from the OD notch and the ID notch (at the 1-1/2 vee position). These responses are marked on the screen to establish a Distance Amplitude Correction (DAC) curve. This is the reference sensitivity level.

5.4 BASIC CALIBRATION TECHNIQUE (PIPING - 1/2 VEE)

5.4.1 When the examination technique is limited to a 1/2 vee path, side drilled holes shall be used to obtain the slope and shape of the DAC. A minimum of two holes, each of the same diameter, located at 1/4T and 3/4T, shall be placed in the end surfaces of the calibration standards. The holes shall be parallel to the length axis of the pipe calibration standard. The minimum hole length shall be 1-1/2 inches.

5.4.2 Calibration shall be accomplished by constructing a DAC from the side drilled holes so that the maximum amplitude point is at 80% FSH. Once the shape and slope are determined and marked on the screen, the curve shall be extrapolated 1/4T to cover the full examination thickness.

5.4.3 The ID notch response is then maximized and the instrument gain control is adjusted to bring this signal to the level of the DAC curve. This is the reference level sensitivity for 1/2 vee examinations.

5.5 BASIC CALIBRATION TECHNIQUE - VESSELS AND SIMILAR COMPONENTS

5.5.1 After the linear range is established, sensitivity calibration shall generally be accomplished by maximizing responses from side drilled holes. The maximum amplitude point is set at 80% FSH. The response amplitudes and positions of the other holes within the examination range are marked on the instrument CRT.

5.5.2 After the CRT is marked, the points are connected by a continuous line to cover the full examination volume. This DAC curve is the reference sensitivity level.

5.5.3 Angle beam position calibration shall consist of fabricating an indication locating strip (indexing strip) as follows.

1. Position search unit to obtain peak indication from the 1/4 T hole.

2. Place a taped ruler or other suitable strip material against the front of the search unit and mark the distance from the test surface to the hole (in inches and in terms of T) on the strip where it crosses the surface scribe line over the holes. (Mark the search unit if it covers the scribe line.)

3. Successively position the search unit to peak on the 1/2 T hole, 3/4 T hole, opposite notch, and 3/4 T hole after bounce if a suitable echo is obtained. Mark the respective distance from the surface (in inches and in terms of T) on the strip where it crosses the surface scribe line over the holes.

4. Subdivide the scale made in the above steps so that the distance from the surface to an indication may be read to the nearest 1/16 T.

5. The date, angle, Calibration Standard Identity, Examination surface (clad or unclad) and Search Unit serial number shall be recorded on the indication locating strip.

5.5.4 Beam spread measurements for the vertical plane of each angle beam search unit and weld thickness combination shall be made using the locating strip (paragraph 5.5.3) as follows.

1. Position search unit for maximum response from the 1/4 T hole. Set amplitude response at 80% FSH and mark location according to paragraph 5.5.3 (2).

2. Increase instrument sensitivity 2X(6dB) over reference sensitivity and move the search unit toward the hole until signal amplitude is equal to the DAC curve drawn on the screen. Mark a small "1" on the indication location strip where it crosses the scribe line over the 1/4 T hole.

3. Move the search unit away from the 1/4 T hole, through the maximum amplitude point, until the signal amplitude is again equal to the DAC curve drawn on the screen. Again, mark a small "1" on the strip.

4. Repeat steps 2 and 3 for 1/2 T, 3/4 T and 1-1/4 T holes, using small numbers "2", "3" and "5" respectively.

5. Using suitable Beam Plot Forms for appropriate thicknesses, transfer the measurements from the standard to the paper. Connect points to determine spread and angle information.

   Note: Curvature of the calibration standard used may cause some deviation in beam spread and beam angle information.

6. Beam spread plots shall become part of the examination record.

5.6 BASIC CALIBRATION TECHNIQUE - BOLTING MATERIAL

5.6.1 Instrument linear range and sensitivity calibration shall generally be accomplished by maximizing responses from flat bottomed holes. The calibration standard is designed to provide reference responses within the near zone and far zone of each examination item.

5.6.2 Distance amplitude correction for the full examination volume may be accomplished with one calibration on a single calibration standard, on two calibration standards, or it may be divided into two calibration zones in order to accommodate exceptionally long sound paths; i.e. RPV Closure Head Studs.

5.7 CALIBRATION CHECKS

5.7.1 A system calibration check shall verify the Distance-Amplitude Correction curve and the sweep range calibration at the start and finish of each examination, with any change in Level II examination personnel, transducers, cables, shoes, batteries, couplants and at least every 4 hours during an examination. Calibration checks shall be performed as follows:

1. Adjust the sensitivity control settings to match those recorded for the calibrated reference sensitivity.

2. Reposition search unit at each respective calibration hole or notch and observe maximum signal response amplitudes and horizontal screen positions.

5.7.2 If any point on the Distance-Amplitude Correction (DAC) curve has changed by more than 20% (2 dB) of its amplitude, all data sheets since the last calibration or calibration check shall be marked void. A new calibration shall be made and recorded and the voided examination areas shall be reexamined. (Applicable to vessel examinations)

5.7.3 If any point on the DAC curve has moved on the sweep line more than 5% of the sweep division reading, correct the sweep range calibration and note the correction in the examination record. If recordable reflectors are noted on the data sheets, those data sheets shall be voided, a new calibration shall be recorded, and the voided examination shall be repeated. (10% if examination conducted on piping)

5.7.4 If any point on the Distance-Amplitude Correction (DAC) curve has decreased 20% or 2dB of its amplitude, all data sheets since the last calibration check shall be marked void. A new calibration shall be made and recorded and the voided examination areas reexamined. If any point on the Distance-Amplitude Correction curve has increased

more than 20% or 2dB of its amplitude, recorded indications taken since the last valid calibration or calibration check may be reexamined with the correct calibration and their values changed on the data sheets. (Applicable to piping examinations)

5.8 Specific details for the system calibration and calibration block requirements are included in the specific application procedures.

5.9 The temperature of the Calibration Standard shall be within 25°F of the component temperature. Calibration standard and component temperatures shall be recorded on the Calibration Data Sheet.

5.10 The identity of the Calibration Standard used for performing calibration shall be recorded on each Calibration Data Sheet.

## 6. SURFACE PREPARATION

6.1 The examination surface shall be free of irregularities, loose foreign matter, or coatings which interfere with ultrasonic wave transmission. Where the surface or other conditions do not permit a meaningful examination, the examiner shall report the location and the particular interfering condition in the space provided on the Calibration Data Sheet, and report same to the examination supervisor for corrective action or disposition.

6.2 The weld crown shall be sufficiently smooth to permit proper transmission of the sound beam as determined by the examiner.

6.3 Unacceptable surface conditions shall be referred to the owner for disposition.

## 7. EXAMINATION VOLUME AND COVERAGE

To provide maximum examination coverage to ensure weld integrity, each weld shall be scanned with a minimum of 25% overlap of the transducer width (diameter) for each scan pass.

7.1 VESSEL WELDS

The examination volume shall include the weld metal and the adjoining base material for one-half plate thickness beyond the edge of the weld.

7.2 PIPING WELDS

The examination volume shall include the weld metal and the adjoining base material for a distance of one wall thickness beyond the edge of the weld. For Class 1 piping, each longitudinal weld shall be examined for 100% of its length. For Class 2 piping, only 12" of the longitudinal weld shall be examined, measured from the intersection with each circumferential weld.

7.2.1 The examiner shall refer to the individual weld "t" map for each weld when scanning, and shall observe reflectors on the CRT which may be the weld prep taper, counterbore, weld root, and shrinkage, and also any other condition noted during the 0° examination of the WRV.

7.2.2 Spot thickness checks of the Austenitic Piping welds and the areas of examination shall be made during preservice examinations to ensure that the proper Calibration Standard is used to establish locations of counter-bore areas.

7.3 INTEGRALLY WELDED SUPPORTS

The examination volume shall include the weld to the pressure boundary, plus the base metal of the component beneath the weld and along the support attachment for a distance of two support thicknesses.

7.4 BOLTING MATERIAL

The examination volume shall include 100% of the length of each part. The examination technique will consist of an axial scan from one end through the full length or an axial scan from both ends through over 50% of the part length. The scan(s) shall cover the full end surface(s).

7.5 To assure complete coverage of the material, each pass of the search unit shall overlap a minimum of 25% of the transducer piezoelectric element dimension perpendicular to the direction of scan. The rate of search unit movement shall not exceed 6 in/sec.

7.6 During the examination of butt welds, wherever feasible, the scanning of the examination volume shall be carried out from both sides of the weld. Where configuration or adjacent parts of the component are such that scanning from both sides is not practical, a full vee technique from one side shall be considered acceptable. Any areas not scanned shall be described in detail on the data sheet. The examination volume shall be scanned by angle beams, both directed at right angles to the weld axis and along the weld axis in two directions.

7.7 The examination volume is defined in Sections 7.1 through 7.4, and in each specific examination procedure. Figure 5 of this procedure presents a typical sketch of scan distances, from the edge of the examination volume, to fully scan that volume with the specified angle and "Vee" path. Detailed sketches will be included within each specific procedure to cover each unique examination.

7.8 Manual scanning shall be performed at a gain setting at least two times (+6 dB) the reference level, except that the reference level shall be used when an electronic distance-amplitude correction is used. Recording of indications shall be carried out with the gain setting at the reference level

7.9 WELD IDENTIFICATION AND DATUM POINTS

The appropriate weld maps in the Program Plan shall be used to locate and identify each weld.

7.9.1 Prior to examination, the examiner shall determine if a reference datum point and reference marking system have been permanently marked for each weld, to which all examination data and recorded indications shall be referenced.

7.9.2 If a suitable permanent radiographic marking system exists, these may be used in lieu of an additional set of marks.

7.9.3 If no marking exists, then the procedure referenced in Section 2.6 shall be used to provide permanent marking.

## 8. EVALUATION CRITERIA

8.1 RECORDING OF INDICATIONS

8.1.1 For straight beam examinations of base metal for laminations, all areas giving indications equal to or greater than the remaining back reflection shall be recorded on the appropriate data sheet prior to angle beam examination of the weld and required volume.

1. Each recorded area shall be identified as to distance from surface, length, and position relative to the weld datum point.

2. Pertinent recorded data shall be taken on each parallel scan pass at increments not to exceed that permitted by the 25% overlap of transducer element diameter (width).

8.1.2 During angle beam examination, all indications showing signal amplitudes in excess of 20% DAC shall be investigated to the extent that the examiner can determine their true nature, as set forth below:

1. If, the indication is determined to be of geometric origin, locate the maximum signal strength area, record the required information for that location on the appropriate form and add the following or similar notation (if over 50% DAC):

"Determined to be (ID) geometry caused by (one side is thicker). This has been verified by (a review of the radiograph), (UT thickness). This indication exists for _____degrees around the pipe".

2. If the signal is over 20% of DAC and it is a crack, incomplete fusion, or incomplete penetration, it shall be plotted and recorded over its full length.

3. If the signal is slag or porosity or another spherical reflector you may ignore its presence; if it does not exceed 50% DAC, do not record it.

8.1.3 For straight beam examinations of weld and/or required volume and angle beam examinations, all non-geometric indications showing a signal amplitude response equal to or greater than 50% of the reference response, shall be recorded on the appropriate data sheet at the time of weld examination.

1. Each recorded indication shall be identified as to depth (as a percent of thickness), distance from surface, length, signal amplitude and location relative to the weld datum point.

2. Recorded data shall be taken on each parallel scan pass at increments not to exceed that permitted by the 25% overlap of transducer element diameter (width).

3. The end points of recorded indications shall be determined by 50% DAC amplitude points.

8.1.4 Indications from all circumferential welds shall be recorded in inches from the weld centerline up stream or down stream and in inches CW or CCW from the weld datum point when looking toward the direction of flow.

8.1.5 Indications for all longitudinal welds shall be recorded in inches up stream or down stream from the datum point and in inches CW or CCW from the weld datum point when looking towards the direction of flow.

## 8.2 EVALUATION OF INDICATIONS

8.2.1 Evaluation of all indications shall be made at the reference sensitivity and in accordance with the requirements of the referenced ASME Boiler and Pressure Vessel Code, Section XI, Article IWB-3000.

8.2.2 Cracks, incomplete fusion, and incomplete penetration are unacceptable regardless of size or amplitude.

8.2.3 The results of this evaluation shall be reported to the Plant Owner, or his Agent, in accordance with the requirements of the referenced ASME Boiler and Pressure Vessel Code, Section XI, Article IWA-6000. All evaluations will be performed by a Level II or Level III Examiner.

# 9. EXAMINATION RECORDS

## 9.1 CERTIFICATION OF RECORDS

The examiner shall complete and sign the appropriate weld scan data sheet(s) immediately upon the completion of each weld examination, noting applicable NDE Certification levels.

## 9.2 FILING OF RECORDS

9.2.1 Records of personnel qualifications shall be maintained by the Examination Contractor.

9.2.2 The Examination contractor shall be responsible for submitting to the Plant Owner, or his Agent, a completely documented set of examination records including certification of personnel qualifications with a current eye test report.

## 9.3 PROCEDURE CORRECTIONS AND ADDITIONS

9.3.1 All procedure corrections and/or additions required during the preservice and/or inservice examinations may be initiated by either the owner or the senior NES site representative. All such changes shall have the approval of the owner and an NES Level III.

9.3.2 The Plant Owner, or his Agent, and the authorized inspector shall be notified of such changes and their approval obtained as required.

## METAL PATH CALIBRATION TABLE

### 1&1/2 VEE SCAN PATH EXAMINATION

| Metal Path Calibration Required | Material Thickness Range | | |
|---|---|---|---|
| | 45° | 60° | 70° |
| 2.5 " | ≤0.5" | ≤0.4" | N/A |
| 5.0 " | > 0.5" - ≤ 1.0" | > 0.4" - ≤ 0.8" | ≤ 0.5" |
| 10.0 " | > 1.0" - ≤ 2.0" | > 0.8" - ≤ 1.6" | > 0.5"- ≤1.0" |
| 20.0 " | > 2.0" - ≤ 4.5" | 1.6" - ≤ 3.3" | > 1.0"-≤2.2" |

### FULL VEE SCAN PATH EXAMINATION

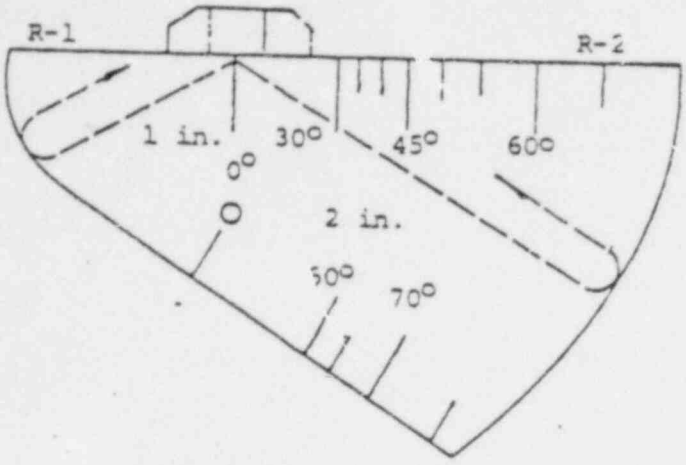
| Metal Path Calibration Required | Material Thickness Range | | |
|---|---|---|---|
| | 45° | 60° | 70° |
| 2.5 " | ≤ 0.8" | ≤ 0.6" | ≤ 0.4" |
| 5.0 " | > 0.8" - ≤ 1.7" | > 0.6" - ≤ 1.2" | > 0.4" - ≤ 0.8" |
| 10.0 " | > 1.7" - ≤ 3.5" | > 1.2" - ≤ 2.5" | > 0.8" - ≤ 1.6" |
| 20.0 " | > 3.5" - ≤ 7.0" | > 2.5" - ≤ 5.0" | > 1.6" - ≤ 3.3" |

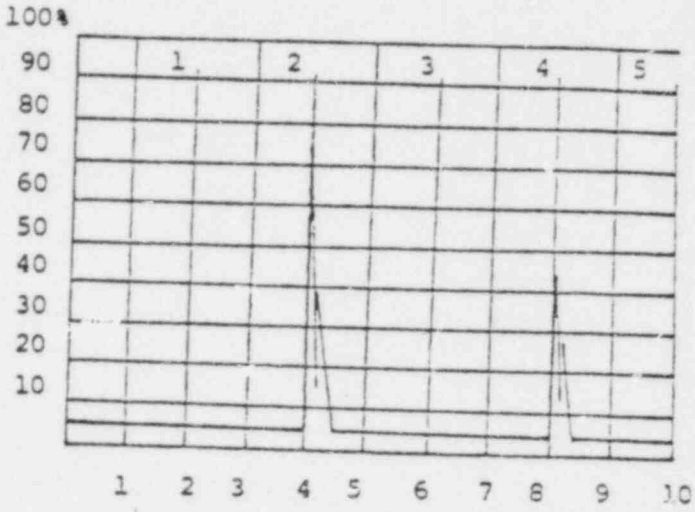
### 1/2 VEE SCAN PATH EXAMINATION

| Metal Path Calibration Required | Material Thickness Range | | |
|---|---|---|---|
| | 45° | 60° | 70° |
| 2.5 " | ≤ 1.7" | ≤ 1.2" | ≤ 0.8" |
| 5.0 " | > 1.7" - ≤ 3.5" | > 1.2" - ≤ 2.5" | > 0.8" - ≤ 1.6" |
| 10.0 " | > 3.5" - ≤ 7.0" | > 2.5" - ≤ 5.0" | > 1.6" - ≤ 3.3" |
| 20.0 " | > 7.0" - ≤ 14.0" | > 5.0" - ≤ 10.0" | > 3.3" - ≤ 6.6" |

INSTRUCTIONS: The Vee Path and the examination angle are given in the specific procedure. Using the appropriate Vee Path Examination Chart (1/2 Vee, Full Vee, and 1-1/2 Vee Paths) and the appropriate examination angle column, find the thickness range that encompasses the thickness of the material being examined. To the extreme left is the Metal Path Calibration to be utilized.

ANGLE BEAM VERIFICATION BLOCK




METAL PATH CALIBRATION FOR A 2.5" CRT PRESENTATION

1- Obtain a maximized indication from the short radius (R-1) reflection surface of the "Miniature Angle Beam Verification Block" (1" metal path).

2- Using the material calibration control and the delay control, align this signal at CRT position 4.

3- Revolve the search unit around and obtain a maximized indication from the long radius (R-2) reflection surface (2" metal path).

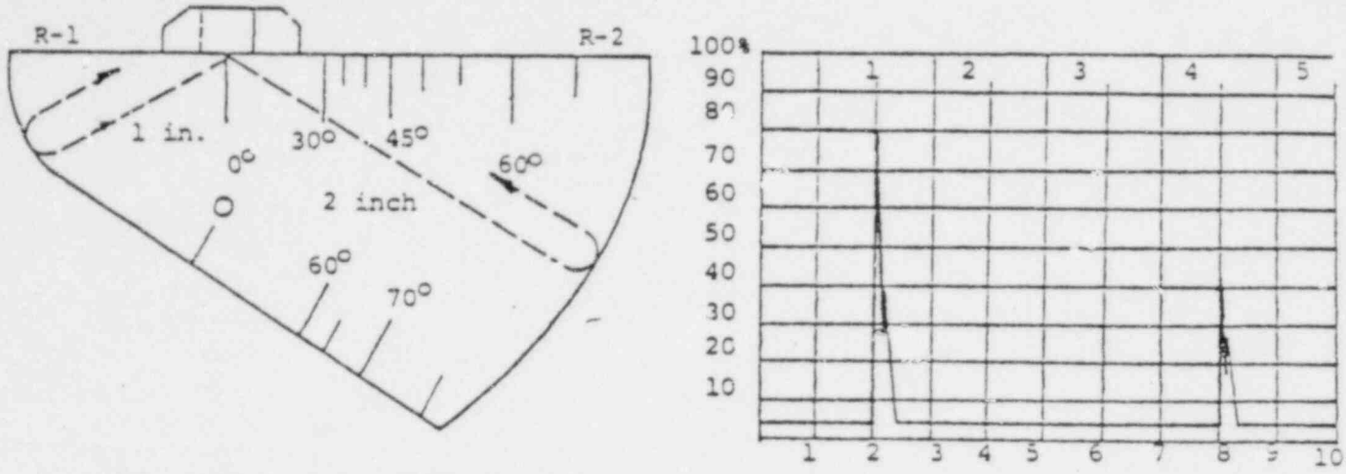
4- Using the material calibration control align this signal at CRT position 8.

5- Repeat steps 1 through 4 until no further adjustments need to be accomplished.

6- The CRT is now calibrated in inches of metal path, (each major division equaling 1/4 inch). Make no further adjustments to the sweep range or delay controls.

FIGURE 2

ANGLE BEAM VERIFICATION BLOCK




METAL PATH CALIBRATION 5" CRT PRESENTATION

1- Obtain a maximized indication from the short radius (P-1) reflection surface of the "Miniature Angle Beam Verification Block" (1" metal path)

2- Using the material calibration control and the delay control, align this signal at CRT position 2.

3- Increase the instrument gain until a secondary echo occurs.

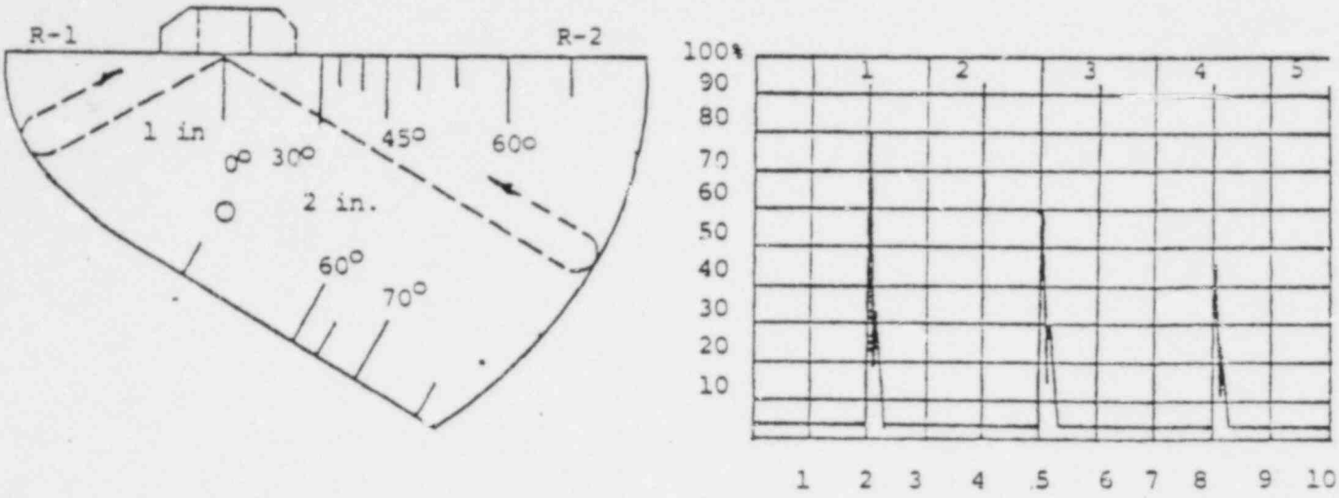
4- Align the secondary signal at CRT position 8.

5- For reference check the primary signal from the long radius (2"). This signal should peak at CRT position 4.

6- The CRT is now calibrated in inches of metal path, (each major division equaling 1/2 inch). Make no further adjustments to the sweep range or delay controls.

FIGURE 3

ANGLE BEAM VERIFICATION BLOCK




METAL PATH CALIBRATION 10" CRT PRESENTATION

1- Obtain a maximized indication from the long radius (R-2) reflection surface of the "Miniature Angle Beam Verification Block" (2" metal path).

2- Using the material calibration control and the delay control, align this signal at CRT position 2.

3- Increase the instrument gain until secondary echos occur.

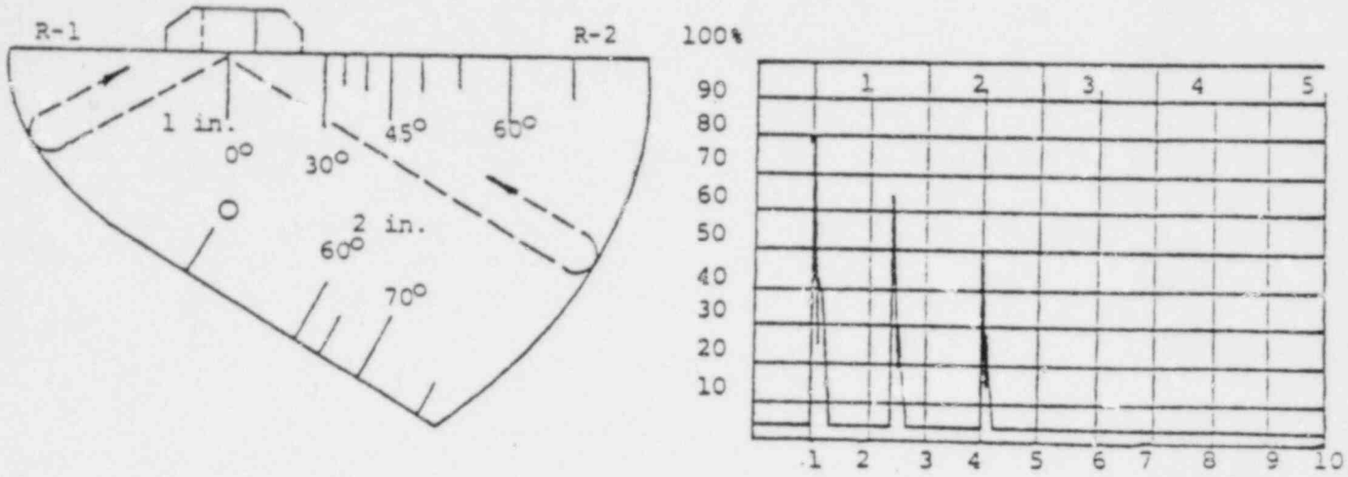
4- Align the secondary echos shall be aligned at CRT positions 5 and 8.

5- The CRT is now calibrated in inches of metal path (each major division equaling 1 inch). Make no further adjustments to the sweep range or delay controls.

6- The CRT is now calibrated in inches of metal path (each major division equaling 1 inch). Make no further adjustments to the sweep range or delay controls.

FIGURE 4

ANGLE BEAM VERIFICATION BLOCK




METAL PATH CALIBRATION FOR A 20" CRT PRESENTATION

1- Obtain a maximized indication from the long radius (R-2) reflection surface of the "Miniature An[illegible]n Verification Block" (2" metal path).

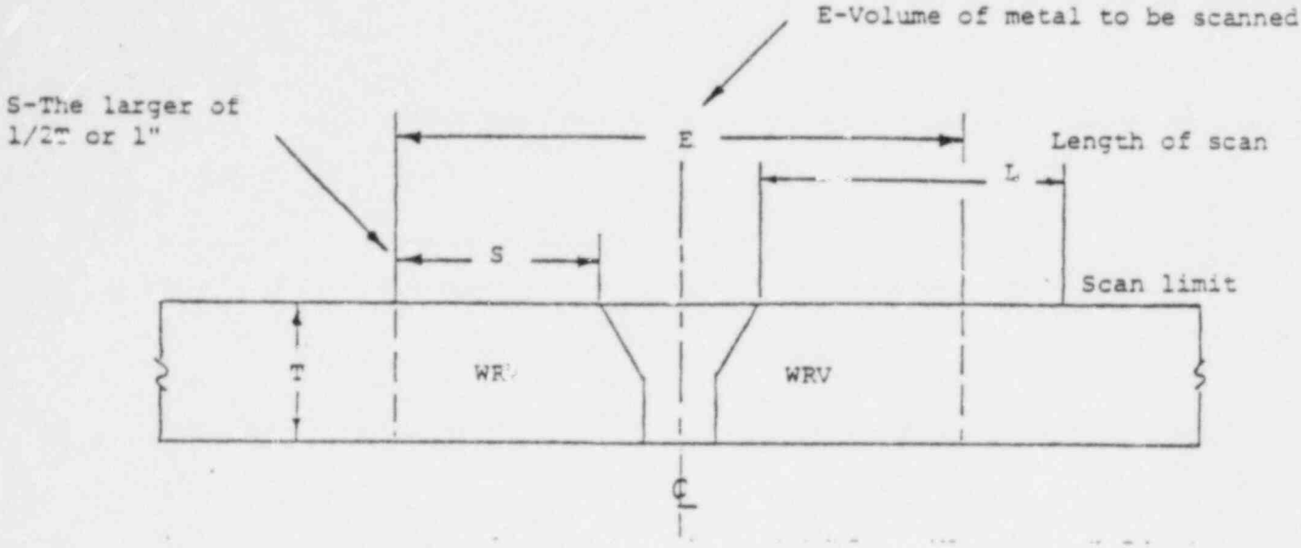
2- Using the material calibration control and the delay control, align this signal at CRT position 1.

3- Increase the instrument gain until secondary echos occur.

4- Secondary echos shall be aligned at CRT position 2.5 and 4.

5- The CRT should now be claibrated in inches of metal path (each major division equaling 2 inches). Make no further adjustments to the sweep range or delay controls.

6- The CRT is now calibrated in inches of metal path (each major division equaling 2 inches). Make no further adjustments to the sweep range or delay controls.




| Nominal Pipe Dia. | Pipe Schedule | T | S | E | 1-1/2 Vee L | Calibration Standard |
|---|---|---|---|---|---|---|
| 6.0" | 80 | .432" | 1.0" | 2.5" | 2.5" | UT-70 |
| 8.0" | 80 | .500" | 1.0" | 2.5" | 2.5" | UT-71 |
| 16.0" | 80 | .844" | 1.5" | 3.5" | 4.5" | UT-72 |
| 24.0" | 80 | 1.290" | 1.5" | 3.5" | 5.0" | UT-73 |



FIGURE 5

DOCUMENT NO. 80A3467

# 1125



Plant/Unit _____
Comp/System _____
ISO _____ Loop _____

## CALIBRATION DATA SHEET

Data Sheet No. _____
Procedure No. _____
Subject: _____
Rev/Change No. _____
Calibration
Block No. _____
Surface _____
Block Temp _____ °F
Comp. Temp _____ °F

| INSTRUMENT SETTINGS |
|---|
| Mfg/Model No.: |
| Serial No. : |
| Sweep Length : |
| Sweep Delay : |
| Pulse Length/Damping: |
| Freq.: Rep. Rate: |
| Filter: Video: Jack: |
| DEC/Gate Switch: Range: |
| Mode Select: Reject: |
| Gain (coarse): (fine): |

| SEARCH UNIT |
|---|
| Scan Angle: Mode: |
| Fixturing (if any): |
| Style or Type No. : |
| Size & Shape : |
| Frequency : |
| Serial No/Brand: |
| Measured Angle : |
| Cable Type & Length: |
| Couplant Brand: |
| Couplant Batch: |

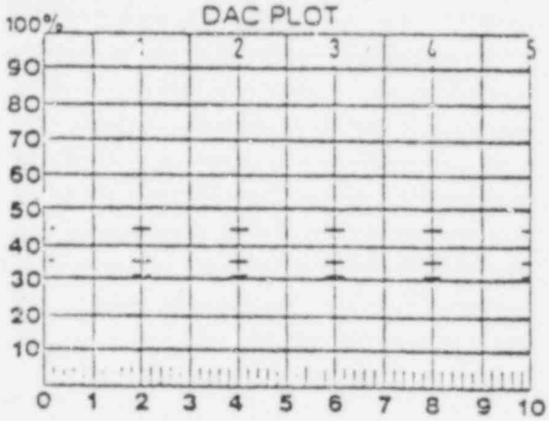
INSTR. LINEARITY CAL.

| Amplitude | | | | | |
|---|---|---|---|---|---|
| | High | Low | | High | Low |
| 1 | | | 5 | | |
| 2 | | | 6 | | |
| 3 | | | 7 | | |
| 4 | | | 8 | | |

AMPL. CONTROL LINEARITY

| Initial | Δ dB | Result |
|---|---|---|
| 80 | -6 | |
| 80 | -12 | |
| 40 | +6 | |
| 20 | +12 | |

DAC PLOT




| SCAN AREA |
|---|
| 0° WRV |
| 0° Mat'l |
| To Weld |
| To Weld |
| Calibration |
| Axial |
| Circ |

| EXAMINATION WELD/AREA | Recordable Indications | | | COMMENTS/REASON FOR INCOMPLETED SCAN(S) |
|---|---|---|---|---|
| | Yes | No | Geom | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

SAMPLE ONLY

SIMILAR VERSIONS WHICH REQUIRE THE SAME INFORMATION ARE ACCEPTABLE.

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

| ADDITIONAL SHEETS? (CHECK BOX) | | | |
|---|---|---|---|
| Continuation | | Beam Plot | |
| Supplements | | None | |

EXAMINERS 1 _____ Date _____ Level _____

2 _____ Date _____ Level _____

REVIEWER _____ Date _____

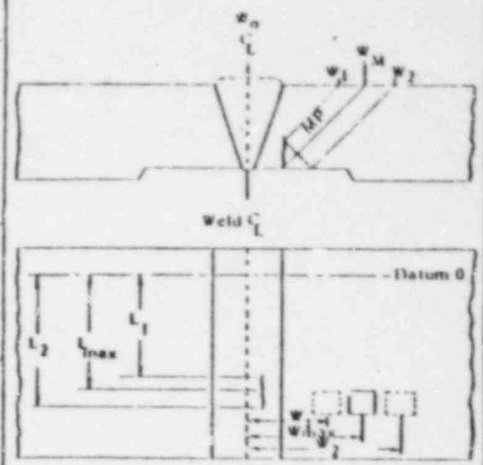
INDICATION REPORT SHEET

DOCUMENT NO. 80A3467 FIGURE 7 PAGE 23 of 25

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project No. | Site | $L_o$ Location | | | | | Date: (Day/Mo/Yr) |
| Item Identification | | $W_o$ Location | | | | | Page _____ of _____ |
| Examiner: TC-1A Level | | Angle Used | $0^o$ | $45^o$ L | $45^o$ ll | | Attached Cal. Data Sheet _____ |
| Examiner: TC-1A Level | | Scanning dB | | | | | Thickness _____ |
| | | | | | | | Diameter (nom.) |

MP Metal Path
RBR Remaining Back Reflection
L Distance from Datum 0

Wmax Distance from $\mathcal{C}_L$ to S.U. at maximum response.
$W_1$ Distance from weld $\mathcal{C}_L$ at 50% of DAC (fwd)
$W_2$ Distance from weld $\mathcal{C}_L$ at 50% of Wmax. (backward)




| Ind. No. | % of DAC | FWD 50% DAC $W_1$ | FWD 50% DAC MP | W MAX | MP | BACKWARD 50% DAC $W_2$ | BACKWARD 50% DAC MP | $L_1$ 50% DAC | L max | $L_2$ 50% DAC | RBR amp | S. U. Loc. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |



Remarks:

Limitation (Describe, i.e., valve, hanger in scan path 3" from weld @ L position 2, etc.)

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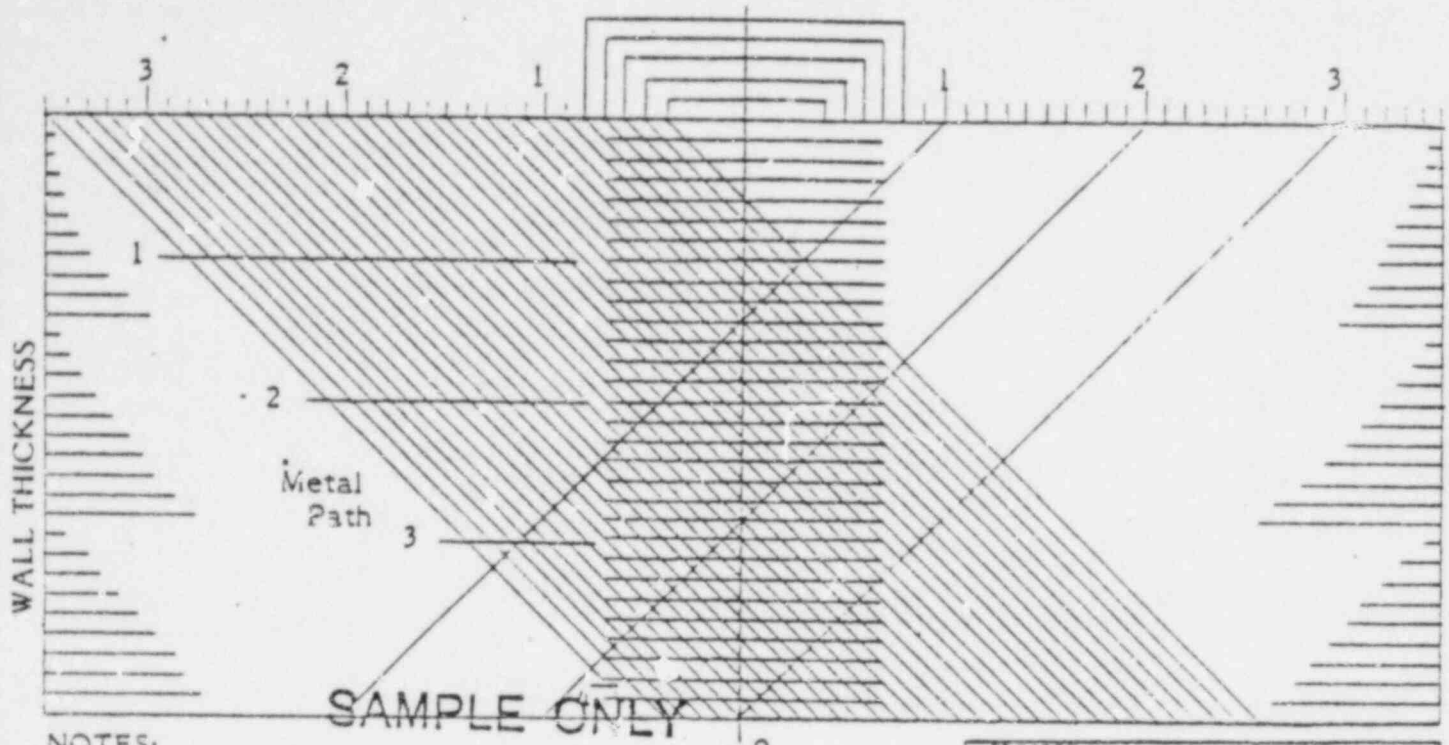
All dimensions in inches
Line divisions in 1/10 inches
Scale: full

INDICATION PLOT SHEET
Calibration Data Sheet _____
Page _____ of _____

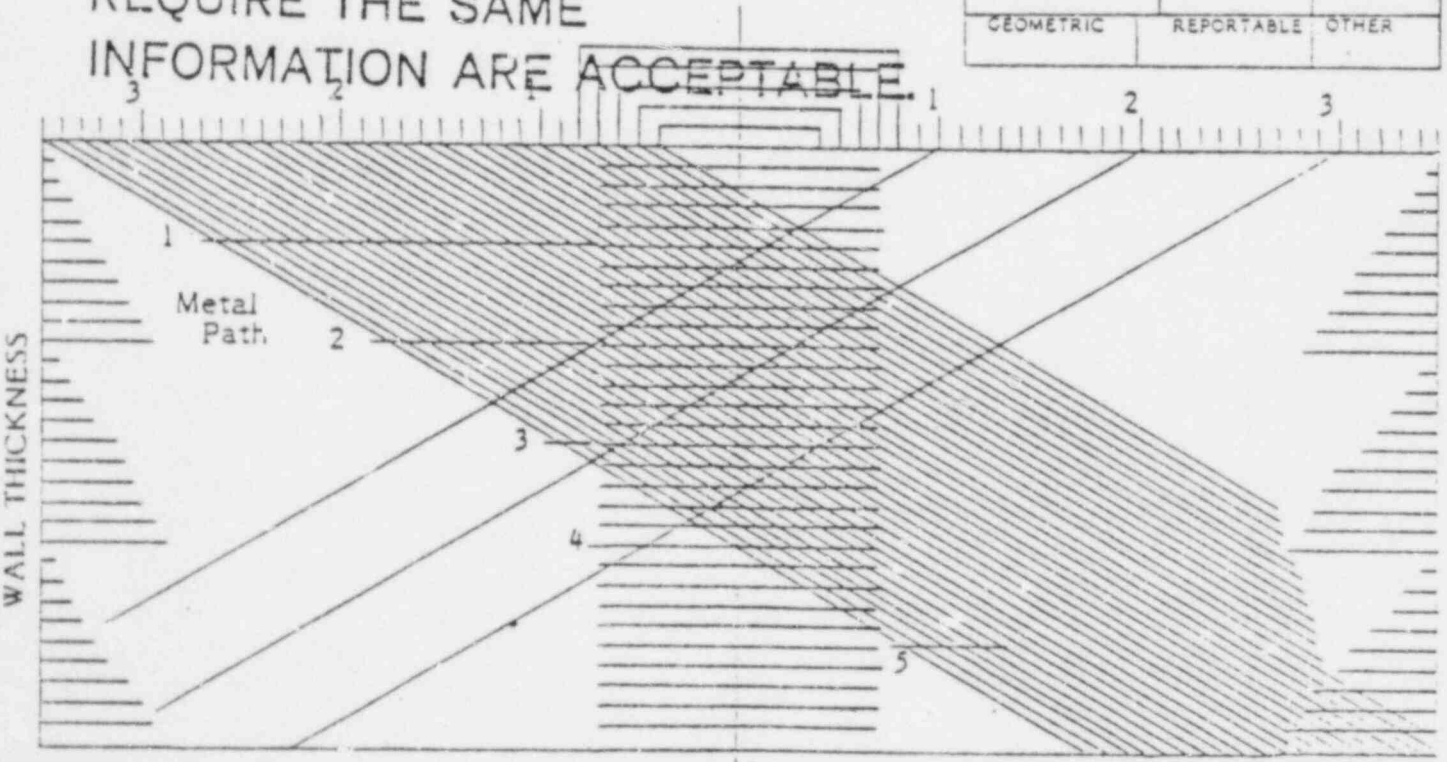



SAMPLE ONLY

NOTES:

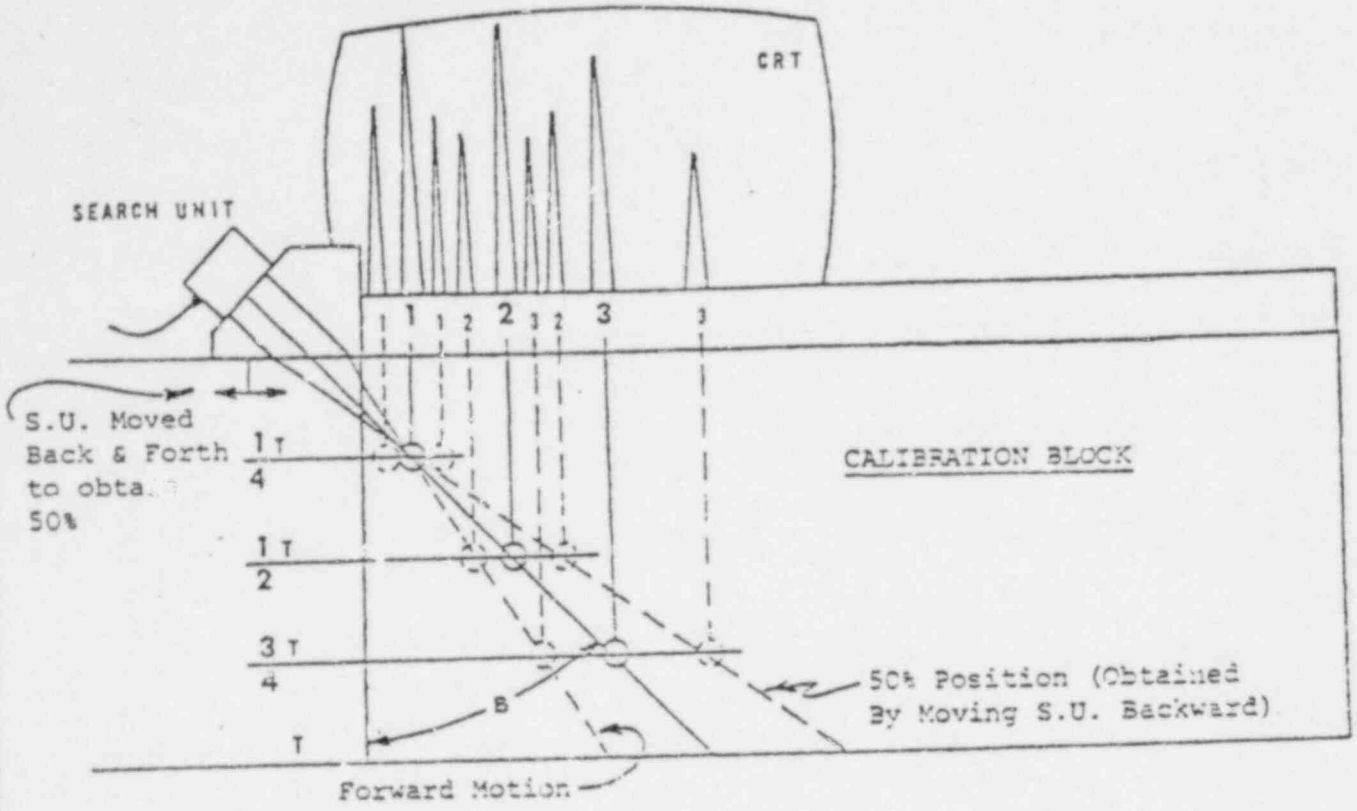
SIMILAR VERSIONS WHICH REQUIRE THE SAME INFORMATION ARE ACCEPTABLE.

| PROJECT NO. | SITE | |
|---|---|---|
| WELD NO. | | |
| EXAMINER | SNT LEVEL | DATE |
| GEOMETRIC | REPORTABLE | OTHER |




NOTES:

| PROJECT NO. | SITE | |
|---|---|---|
| WELD NO. | | |
| EXAMINER | SNT LEVEL | DATE |
| GEOMETRIC | REPORTABLE | OTHER |




1. Fabricate indication location strip as per section

2. Mark 50% DAC amplitude points on strip per section

3. Plot graphically all points fron strip per section

NOTE: Use form 85D236 ( or other suitable paper ) for beam plots on standards with vessel curvature.

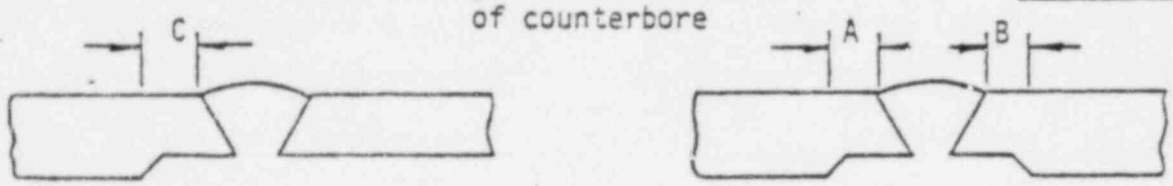
FIGURE 9 ANGLE BEAM CALIBRATION - POSITION CALIBRATION AND BEAM SPREAD MEASUREMENT.

Procedure No. _____
Subject: _____
Page _____ of _____

WELD THICKNESS PROFILE DATA SHEET

Plant/Unit _____ Comp/System _____
Weld No. _____
Scan Increment _____ Transducer Size _____ Freq. _____
Examiner _____ Date _____

C _____ NOTE: Locate and note precise location of counterbore A _____ B _____




Comments _____

_____ TO _____

| Datum Point | WELD PROFILE ℄ WELD PROFILE | Thickness Readings |
|---|---|---|
| 0° | | |
| 90° | | |
| 180° | | |
| ° | | |

SAMPLE ONLY

SIMILAR VERSIONS WHICH REQUIRE THE SAME INFORMATION ARE ACCEPTABLE.

Procedure No. _____
Subject: _____
VESSEL Page _____ of _____

## WELD THICKNESS SPOT CHECK DATA SHEET

TRANSDUCER IDENTIFICATION - 0° COMPONENT: _____

SIZE: _____ FREQ: _____ _____

CALIBRATION STANDARD: _____ _____

# _____ DATE _____

A) Apply a 0° straight beam transducer to the surface of the applicable calibration standard in an area free of calibration holes.

B) Adjust the instrument calibration controls to display two (2) back reflections,

C) Position the back reflections to align at CRT Screen divisions which represent inches of sound path (each major CRT division equals one (1) inch). Example: Calibration Standard thickness of 3.5 inches; back reflections will be positioned at CRT divisions of 3.5 and 7.

D) To verify the thickness of component item; place the transducer on the component and using the delay control only, position the first back reflection at CRT position. 0. Next, read the CRT Location of the second back reflection to the nearest minor CRT division.

E) Repeat step D for additional thickness readings.

F) Spot thickness checks shall be taken on the weld ℄ and 4" approximately on each side of weld. A minimum of 4 sets of readings each consisting of 3 readings will be taken on each weld, where possible.

| Weld Identification | Location | Thickness 1 | ℄ | 2 |
|---|---|---|---|---|
| | | | | |
| | SAMPLE ONLY | | | |
| SIMILAR | VERSIONS WHICH | | | |
| REQUIRE | THE SAME | | | |
| INFORMATION | ARE ACCEPTABLE. | | | |
| | | | | |
| | | | | |

(Circle One)
1 = UP, DN, CW, CCW
2 = UP, DN, CW, CCW

Examiner: _____

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