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MANUAL ULTRASONIC EXAMINATION PROCEDUES
FOR
VESSEL NOZZLE SAFEEND AND CLOSURE HEAD
NOZZLE FLANGE WELDS

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NUCLEAR ENERGY SERVICES, INC.

MANUAL ULTRASONIC EXAMINATION PROCEDURES FOR
 VESSEL NOZZLE SAFEENDS AND CLOSURE HEAD
 NOZZLE-FLANGE WELDS

LONG ISLAND LIGHTING COMPANY
 SHOREHAM NUCLEAR POWER STATION

UNIT 1

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Prep'd by *Blentz*

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MANUAL ULTRASONIC EXAMINATION PROCEDURES FOR
VESSEL NOZZLE SAFEENDS AND CLOSURE HEAD
NOZZLE-FLANGE WELDS

1.0 SCOPE

1.1 Area of Examination

This document covers the ultrasonic examination procedures for :

- (1) Main Steam (N3) nozzle to transition piece welds.
- (2) Jet Pump Instrumentation (JPI) (N8) nozzle to safeend piece welds.
- (3) Control Rod Drive (CRD) (N9) return nozzle to cap weld.
- (4) Core Differential Pressure (ΔP) (N10) nozzle to safeend piece weld.
- (5) Closure Head Vent (N7) and Instrumentation (N6) nozzle to flange welds.

1.2 Type of Examination

1.2.1 Volumetric examination shall be performed using ultrasonic pulse echo nominal 45° (or 25°) angle beam shear wave and 0° longitudinal straight beam techniques applied to the outside surfaces of the piping, safeends, transition pieces and flanges.

1.2.2 The examination shall be performed manually using contact search units (transducers).

1.3 Time of Examination

These procedures shall govern the preservice examination and re-examination of repaired areas of the pipe welds as required by the ASME Boiler and Pressure Vessel Code, Section XI.

1.4 Weld Configuration

1.4.1 The nozzle and safeend/transition piece/flange weld configurations covered by this procedure are shown in Figures 1 through 6.

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1.4.2 Nominal weld thicknesses range from 0.28" to 1.78" and are specified in Figures 1 through 6.

1.5 Materials

The nozzles, safeends and fittings are constructed of austenitic stainless steel, carbon steel, or inconel, as designated in Figures 1 through 6.

2.0 REFERENCES

2.1 Reference Documents

The following documents form a part of this examination procedure:

- (1) ASME Boiler and Pressure Vessel Code, Section XI, 1971 Edition, and the Summer of 1972 Addenda.
- (2) ASME Boiler and Pressure Vessel Code, Section III, 1971 Edition, and the Summer of 1972 Addenda.
- (3) ASNT Recommended Practice, SNT-TC-1A, Supplement C, Third Edition (1971).
- (4) NES Procedure for Ultrasonic Instrument Linearity Verification, 80A9053.
- (5) ConAm Procedure for Certifying Inspection Personnel, CUTP-1, Rev. 5, August 1978.

2.2 Applicable Drawings

The following drawings are part of this procedure:

- (1) CE Assembly Drawing E-234-233
- (2) CE Assembly Drawing E-234-229
- (3) CE Assembly Drawing E-234-275
- (4) CE Assembly Drawing E-234-245
- (5) CE Assembly Drawing E-234-470
- (6) GE Drawings 137C5644, 137C5632

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3.0 PROCEDURE CERTIFICATION

The examination procedures described in this document comply with Section XI of the ASME Boiler and Pressure Vessel Code, 1971 Edition, including 1972 Summer Addenda, except where examination coverage is limited by part geometry or access.

4.0 PERSONNEL CERTIFICATION

4.1 Personnel Certification Requirements

4.1.1 Each person performing ultrasonic examination governed by this procedure shall be certified in accordance with References 2.1 (1), 2.1 (3) and 2.1 (5) above.

4.1.2 An examination crew shall consist of one or two members as needed. At least one member of each crew shall have a minimum qualification of Level II in accordance with the above referenced documents. The remaining member(s) shall have a minimum qualification of Level I.

4.2 Personnel Records

4.2.1 Records of personnel qualification shall be maintained by the Examination Contractor.

4.2.2 A copy of the examiner's certification summary, and a current eye test as required by SNT-TC-1A shall be filed with each permanent examination record, with a copy submitted to the plant owner or his agent, prior to performing examinations per this procedure.

5.0 EXAMINATION REQUIREMENTS

5.1 Examination Frequency

5.1.1 The nominal examination frequency shall be 2.25 MHz for all straight beam and angle beam examinations.

5.1.2 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 on the data sheets.

5.1.3 5.0MHz may be used for straight beam examination in order to achieve resolution of the side drilled holes in the calibration standards. ⚠

5.2 Examination Angles and Coverage

5.2.1 The intent of this procedure is to provide maximum examination coverage to ensure weld integrity. Each weld shall be scanned with minimum 25% overlap of the transducer element width (Diameter) for each scan pass.



- 5.2.2 The rate of search unit movement shall not exceed six (6) inches per second.
- 5.2.3 Each weld and the required volume (WRV) of metal for one (1) wall thickness on each side of the weld shall be ultrasonically examined using 45° angle beam techniques applied in two (2) directions perpendicular to the weld axis and 30° angle beam (45° for steam, CRD and ΔP nozzle piece welds only) in two (2) directions parallel with weld axis and on both sides of the weld where part geometry and access permit. ⚠
- 5.2.4 Straight beam techniques shall be applied, where part geometry permits, to all parent material through which the angle beams will pass during angle beam examinations. Indications detected are to be recorded in accordance with Section 10.1.1 of this procedure, except in areas where no back echo can be obtained. Indications detected shall be recorded and data used during evaluation of angle beam examination results.
- 5.2.5 Other beam angles or longitudinal waves may be used as determined necessary: i.e. for evaluation of reflectors, to compensate for geometric constraints, etc. All information shall be recorded on the data sheets.
- 5.2.6 In addition, straight beam techniques shall be applied to the weld and required volume where part geometry permits. Indications shall be recorded in accordance with Section 10.1.2 of this procedure. This shall include straight beam examination of parent material when no back echo is obtainable.
- 5.2.7 Where the examination surface, geometry, or other conditions (weld, contour, access, etc.) do not permit a meaningful ultrasonic examination to be performed, the examiner shall record the area of non-examination and the particular interfering condition in the space provided on the Weld Scan Data Sheet. In addition, he shall make a sketch of the weld and adjacent pipe and fitting conditions on a separate sheet of paper and attach to the Calibration Data Sheet. (See Figure 11) Photos will be taken when possible and incorporated as part of the report. ⚠
- 5.2.8 All examination weld/areas shall be entered in the space provided on the Calibration Data Sheet. If there are no recordable indications, it shall be so recorded.
- 5.2.9 Coverage for the welds specified in this procedure is shown in Figures 1 through 6.

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5.3 Liquid Couplant

- 5.3.1 The ultrasonic couplant shall be suitable for use on nuclear plant materials and be certified not to exceed 50 ppm halogen and 200 ppm sulfur.
- 5.3.2 The couplant shall be supplied in clean containers of sufficient quantity to perform the examination.
- 5.3.3 The couplant shall be applied manually with a brush or other suitable device.
- 5.3.4 Where required, the examiner shall be responsible for removing couplant from the examination surface at the conclusion of the examination.

5.4 Surface Preparation

All examination surfaces should be cleaned and free of dirt, weld spatter, etc., or any other condition which would interfere with the examination or impair proper transmission of the sound beam.

5.5 Weld Identification

Each weld shall be located and identified per appropriate weld maps in the Program Plan Book.

5.6 Datum Point

- 5.6.1 The examiner shall verify that there has been marked a reference datum point on each weld from which all examination data and reported indications shall be referenced.
- 5.6.2 Datum points shall be marked by the use of low stress stamps or vibratooling and shall not be deeper than 1/32".
- 5.6.3 The datum point for all safeend/transition piece welds in horizontal lines shall be located on the top of the pipe at weld centerline.
- 5.6.4 Closure Head nozzle to flange weld datum points shall be on the weld centerline at Closure Head 0°.
- 5.6.5 Each weld datum point, along with respective weld reference points and divisions, shall be shown on each examination report.

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6.0 EQUIPMENT REQUIREMENTS

6.1 Examination Contractor's Equipment

The following test equipment or its equivalent shall be provided by the Examination Contractor for examination of welds specified in this procedure:

- (1) Pulse echo ultrasonic instrument (in compliance with Ref. 2.1(1)).
- (2) Wedges, 45° and 30°
- (3) Search Units, 0°; 1/4" - 1" dia., 2.25MHz
- (4) Search Units, 2.25 MHz angle beam of a suitable size
- (5) Couplant
- (6) Camera
- (7) Thermometer

6.2 Plant Owner's Equipment

The Plant Owner or his Agent shall provide the following service facilities and equipment as required:

- (1) Scaffolding
- (2) Water, Air and Electricity
- (3) Temporary Lighting
- (4) Crane or Lifting Devices
- (5) Calibration Standard No. STEAM
- (6) Calibration Standard No. JPI
- (7) Calibration Standard No. CRD
- (8) Calibration Standard No. ΔP
- (9) Calibration Standard No. VENT
- (10) Test Surface Preparation (cleaning and finishing)
- (11) Drawings of Each Examination Area
- (12) Post-Examination Cleanup of Test Area

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7.0 CALIBRATION REQUIREMENTS

7.1 Calibration Standards

- 7.1.1 The calibration standards designated in 6.2.1(5) through (9) shall be used for basic instrument calibration and for establishing reference sensitivity levels for examination of the piping welds specified in this procedure. Figures 1 through 8 provide a cross-reference between the welds to be examined and the applicable standard.
- 7.1.2 The appropriate calibration standard corresponding to each respective weld shall be recorded on each Calibration Data Sheet. Figure 11 is an example of the Calibration Data Sheet to be used with this procedure.
- 7.1.3 Calibration Data Sheets shall be numbered 475-1, 475-2, 475-3, etc., at the time of calibration and shall be signed by the examiner(s) upon completion.
- 7.1.4 Calibration procedures shall be performed using the O.D. surface of the calibration standard.
- 7.1.5 The temperature of the calibration standard shall be within 25°F of the part weld temperature. Calibration standard and component temperature shall be recorded on the Calibration Data Sheet.

7.2 Reference Sensitivity Level

- 7.2.1 The reference sensitivity level shall be the distance-amplitude curve initially obtained directly from the calibration standard and shall be the sensitivity level used for evaluating and recording all indications.
- 7.2.2 During actual weld scanning, the reference sensitivity level shall be increased at least 2X (6dB).

7.3 Times of Calibration

- 7.3.1 Basic instrument calibration shall be performed using the appropriate calibration standard, search units and instrumentation immediately prior to the examination of the welds specified in this procedure.

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- 7.3.2 Instrument vertical linearity checks shall be performed at the beginning of each day of examination in accordance with the technique in the procedure reference in para. 2.1(4) using an angle beam search unit applied to a code calibration standard.
- 7.3.3 Examination system calibration checks shall be performed at least at the beginning and at the completion of each four (4) hour period of examination and/or at the change of Level II examination personnel, equipment, search units, coupler shoes, etc., and at the completion of the examination of each similar series of welds in accordance with Sections 8.2 and 8.4 of this procedure.

7.4 Calibration Response

- 7.4.1 Calibration response shall be checked at the primary reference sensitivity level.
- 7.4.2 Signal response obtained during calibration check shall be within plus or minus 20% of that established during basic instrument calibration.
- 7.4.3 If any point on the Distance Amplitude Correction (DAC) curve is below the 20% limit, the examiner shall:
- (1) Mark all weld data sheets since previous calibration "void".
 - (2) Recalibrate examination system.
 - (3) Re-examine voided areas.
- 7.4.4 If any point on the DAC curve is above the 20% limit, the examiner shall:
- (1) Recalibrate examination system.
 - (2) Re-evaluate all indications recorded since the previous calibration at the corrected sensitivity level.
- 7.4.5 If any point on the DAC curve has moved horizontally more than 5% of the sweep line from its original settings, the examiner shall:
- (1) Correct the sweep calibration and note it on the Calibration Data Sheet.
 - (2) Void any data sheets made since the previous calibration which have recorded indications and re-examine those areas.

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8.0 EXAMINATION SYSTEM CALIBRATION

8.1 Straight Beam Calibration

Straight beam calibration shall be performed as follows and as shown in Figure 9 for STEAM, VENT, ΔP and Figure 10 for CRD and JPI.

- (1) Adjust the instrument sweep controls so that the examination area is displayed on the CRT screen. Mark the horizontal screen positions selected for the hole or holes directly on the CRT screen and on the chart on the Calibration Data Sheet.
- (2) Position search unit to obtain maximum response from the side drilled ($1/4T$ if $T \geq 1''$ or $1/2T$ if $T < 1''$) calibration hole. Adjust sensitivity control to provide a signal amplitude of 80% of Full Screen Height (FSH) and mark location and amplitude on CRT screen.
- (3) This is the primary reference sensitivity. Record all sensitivity control settings on the appropriate Calibration Data Sheet.
- (4) This completes calibration for thicknesses of under one (1) inch. (No DAC is necessary for weld thicknesses under one (1) inch).

NOTE: In bi-metallic calibration blocks (CRD and JPI) the gain setting shall be checked against the equivalent response from the weld hole (\perp or $=$). If the gain setting is different, it shall be so recorded and used as the primary reference response. The difference in gain settings will establish a gain correction factor to be applied when evaluating and recording indication found during the examination.

- (5) For weld thicknesses one (1) inch and greater a distance amplitude correction (DAC) curve shall be established as follows and as shown in Figures 9 and 10.
 - (a) Without changing the sensitivity obtained in (2) above, position the search unit for maximum response from the $1/2T$ and $3/4T$ holes and mark amplitudes on the CRT screen.

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- (b) If the instrument is equipped with an electronic DAC device, the primary reference response shall be equalized at 80% of FSH over the distance range to be employed in the examination.
 - (c) Plot a DAC curve by connecting the signal response positions with a continuous line extending over the full examination range.
- (6) Record all data and instrument setting on the Calibration Data Sheet, and sign and date upon completion.
 - (7) Repeat steps (1) through (6) for each different weld thickness just prior to examination.

8.2 Straight Beam Calibration Check

Straight beam calibration check as required by Section 7.3.3 shall be performed as follows:

- (1) Adjust the sensitivity control settings to those recorded for the calibrated reference sensitivity. See Section 8.1(2).
- (2) Reposition search unit at each respective test hole and observe maximum signal response amplitudes.
- (3) See Section 7.4 for signal response requirements during calibration check.

8.3 Angle Beam Calibration

Angle beam calibration shall be performed as follows and as shown in Figure 9 for STEAM, VENT, ΔP , and Figure 10 for CRD and JPI.

- (1) Adjust the instrument sweep controls so that the examination area is displayed on the CRT screen. Mark the horizontal screen positions selected for the hole or holes directly on the CRT screen and on the chart on the Calibration Data Sheet.
- (2) Position search unit to obtain maximum response from the calibration hole ($3/4T$ if $T \geq 1''$ or $1-1/2T$ if $T < 1''$). Adjust sensitivity control to provide a signal amplitude of 80% of FSH and mark location and amplitude on CRT screen.

Note: Calibration shall be performed for both axial and circumferential scans using appropriate holes.

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- (3) This is the primary reference sensitivity. Record all sensitivity control settings on the appropriate Calibration Data Sheet.
- (4) DAC curves for angle beam examinations shall be established as follows and as shown in Figures 9 and 10:

Weid Thickness Less than One (1) Inch

- (a) Position the search unit for maximum response from the calibration hole at the 1-1/2T position. Adjust the instrument sensitivity controls to provide a signal amplitude of 80% of FSH and mark location and amplitude on the CRT screen. (See 8.3 (2)).
- (b) Without changing sensitivity, position the search unit for maximum responses from the calibration hole at 1/2T, 2-1/2T and 3-1/2T positions respectively and mark location and amplitudes on the CRT screen.

NOTE: Due to the high attenuation of the stainless steel/inconel material or stainless steel cladding, it may be necessary to divide calibration into two zones. Use an additional Calibration Data Sheet to record this information.

- (c) If the instrument is equipped with an electronic DAC device, the primary reference response shall be equalized at 80% of FSH over the distance range to be employed in the examination.
- (d) Plot a DAC curve by connecting the signal response positions with a continuous line extending over the full examination range.

NOTE: In bi-metallic calibration blocks (CRD and JPI) the gain setting shall be checked against the equivalent response from the weld hole (\perp or $=$). If the gain setting is different, it shall be so recorded and used as the primary reference response. The difference in gain settings will establish a gain correction factor to be applied when evaluating and recording indication found during the examination.

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- (e) Note position and amplitude of ID and OD notch responses through 3T calibration range, (ID at 1T and 3T, OD at 2T).

Weld Thickness One (1) Inch and Greater

- (a) Position the search unit for maximum response from the calibration hole at the 3/4T position. Adjust the instrument sensitivity controls to provide a signal amplitude of 80% of FSH and mark location and amplitude on the CRT screen. (See 8.3 (2)).
 - (b) Without changing sensitivity, position the search unit for maximum responses from the calibration hole at the 1/4T, 1-1/4T and 1-3/4T positions respectively and mark location and amplitudes on the CRT screen.
 - (c) If the instrument is equipped with an electronic DAC device, the primary reference response shall be equalized at 80% of FSH over the distance range to be employed in the examination.
 - (d) Plot a DAC curve by connecting the signal response positions with a continuous line extending over the full examination range.
 - (e) Note position and amplitude of ID and OD notch responses through 2T calibration range, (ID at 1T, OD at 2T).
- (5) Record all data and instrument settings on the Calibration Data Sheet, and sign upon completion.
 - (6) Repeat steps (1) through (5) for each different weld thickness, just prior to examination.

8.4 Angle Beam Calibration Check

Angle beam calibration check as required by Section 7.3.3 shall be performed as follows:

- (1) Adjust the sensitivity control settings to those recorded for the calibrated reference sensitivity. (See Section 8.3 (2)).
- (2) Reposition search unit at each respective test hole and observe signal response amplitudes.

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- (3) See Section 7.4 for signal response requirements during calibration check.

9.0 EXAMINATION PROCEDURES

9.1 Straight Beam Examination of Base Material for Laminations

- 9.1.1 Straight beam examination of all base material through which the angle beams will pass during angle beam examination shall be performed at a sensitivity level which gives a minimum back reflection signal amplitude of 80% of FSH.
- 9.1.2 A rectilinear scan pattern shall be used allowing a minimum of 25% overlap of the transducer element width (diameter) for each scan pass.
- 9.1.3 See Table 1 and Figures 1 through 6 for examination summary and scan path distances. Refer to the Preservice Inspection Program Plan for detailed weld locations and identifications.
- 9.1.4 Continue scanning sequences until all base material has been examined. Examination shall not be considered complete until all recordable indications have been evaluated per Section 10.1.1.

9.2 Straight and Angle Beam Examination

- 9.2.1 Straight beam and angle beam examination of the weld and required volume zone shall be performed at a minimum scanning sensitivity level of 2X (6dB) greater than the calibrated reference sensitivity level.
- 9.2.2 A rectilinear scan pattern shall be used allowing a minimum of 25% overlap of the transducer element width (diameter) for each scan pass.
- 9.2.3 See Table 1 and Figures 1 through 6 for examination summary and scan path distances. Refer to the Preservice Inspection Program Plan for detailed weld locations and identifications.
- 9.2.4 Continue scanning sequences until all welds have been examined. Examination shall not be considered complete until all recordable indications have been evaluated per Section 10.1.2.

10.0 EVALUATION CRITERIA

10.1 Recording of Indications

- 10.1.1 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) 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).

10.1.2 For straight beam and angle beam examinations of weld and required volume, all 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 and prior to removing the equipment.

- (1) Each recorded indication shall be identified as to depth (as 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).

10.1.3 Indications from all welds shall be reported in inches forward (towards the vessel or closure head) or backward (away from the vessel or closure head) from the weld centerline and in inches CW or CCW from the weld datum point when looking at the vessel or the top of the closure head.

10.2 Evaluation of Indications

10.2.1 Evaluation of all indications shall be made at the reference sensitivity and in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, IS-300. All evaluations shall be performed by a Level II or Level III examiner.

10.2.2 Results of this evaluation shall be reported to the Plant Owner or his Agent in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, IS-600. Disposition of evaluation results shall be made in accordance with the Owner's Plant Procedures.

11.0 EXAMINATION RECORDS

11.1 Certification of Records

The Examiner shall complete and sign all data sheets immediately upon the completion of each weld examination. The data sheets may be reviewed by the authorized Code Inspector.

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11.2 Filing of Records

The examiner 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 in accordance with SNT-TC-1A.

11.3 Procedure Corrections and Additions

11.3.1 All procedure corrections and/or additions required during the preservice examinations shall be made in accordance with requirements of NES QA Program Plan # NES 80A0448.

11.3.2 The examiner shall contact the LILCO representative on site to initiate all changes. All changes shall be documented in the record of revisions section of this procedure.

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LEGEND

⊥ Perpendicular to Weld

= Parallel to Weld

* Base Material

 WRV Weld and Required Volume

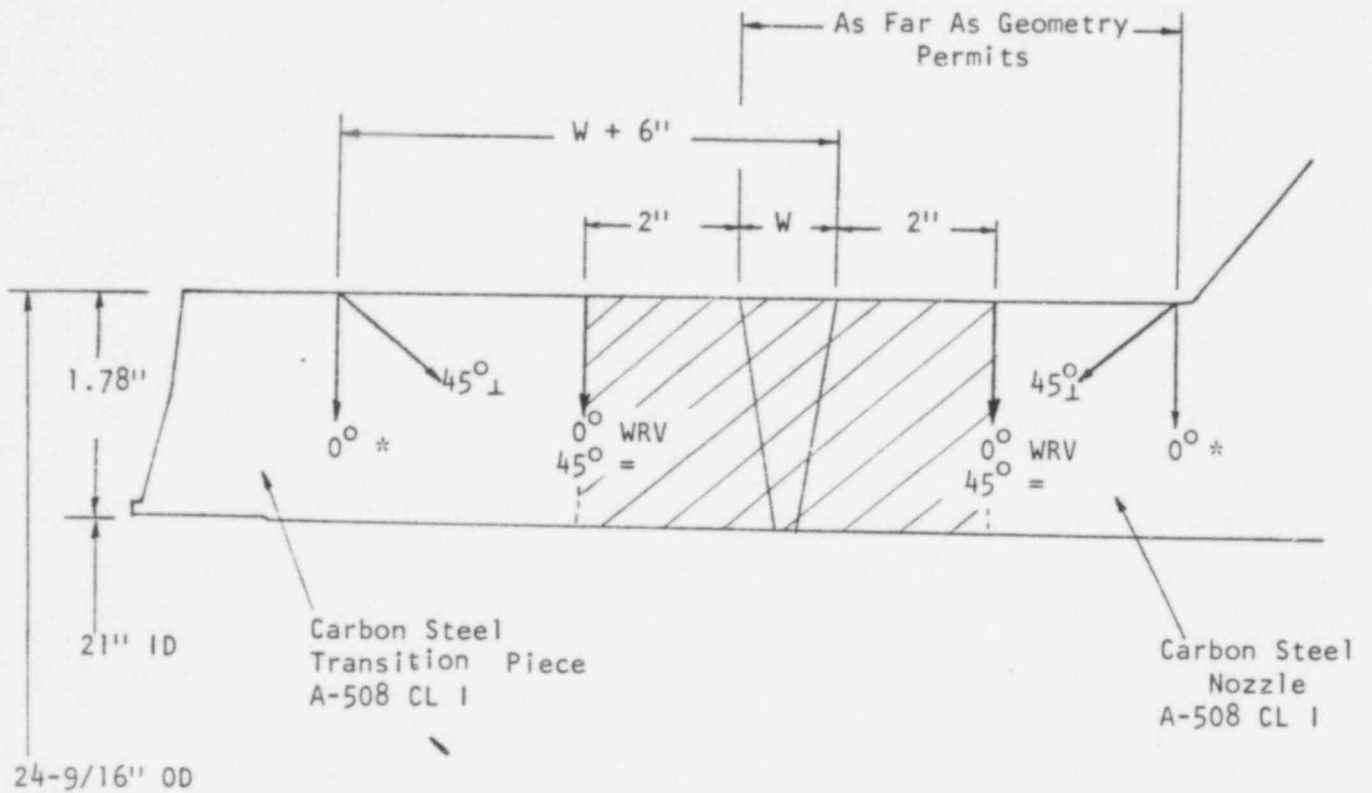



Figure 1 - Ultrasonic Examination Procedures for Main Steam (N3) Nozzle to Transition Piece Welds [Cal. Block "STEAM"]

916147

LEGEND

- ⊥ Perpendicular to Weld
- = Parallel to Weld
- * Base Material
-  WRV Weld and Required Volume

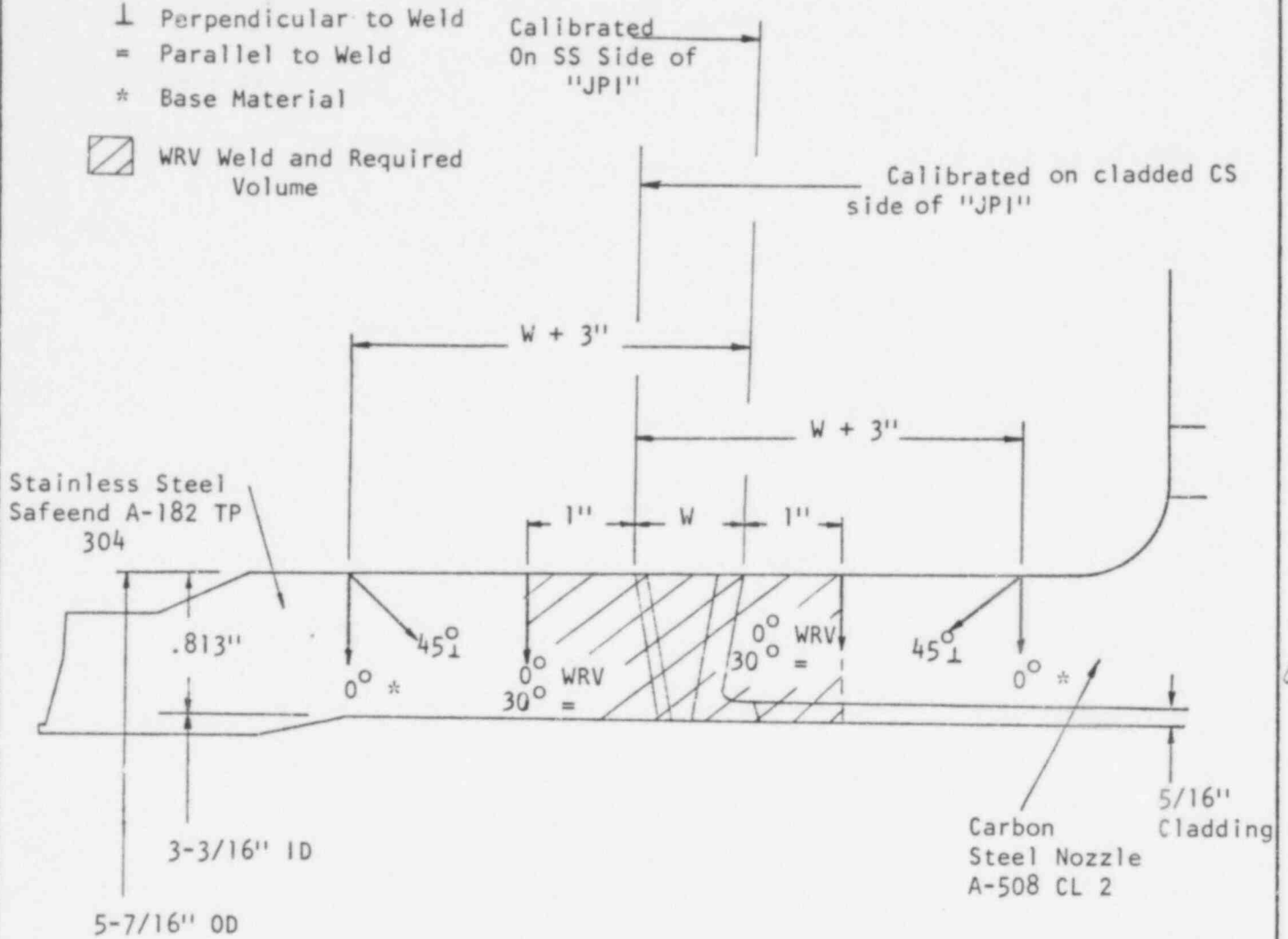


Figure 2 - Ultrasonic Examination Procedures for Jet Pump Instrumentation (N8) Nozzle to Safeend Welds [Cal. Block "JPI"]

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LEGEND

⊥ Perpendicular to Weld

= Parallel to Weld

* Base Material

 WRV Weld and Required Volume

Calibrated On Inconel Side of "CRD"

Calibrated on Cladded CS Side of "CRD"

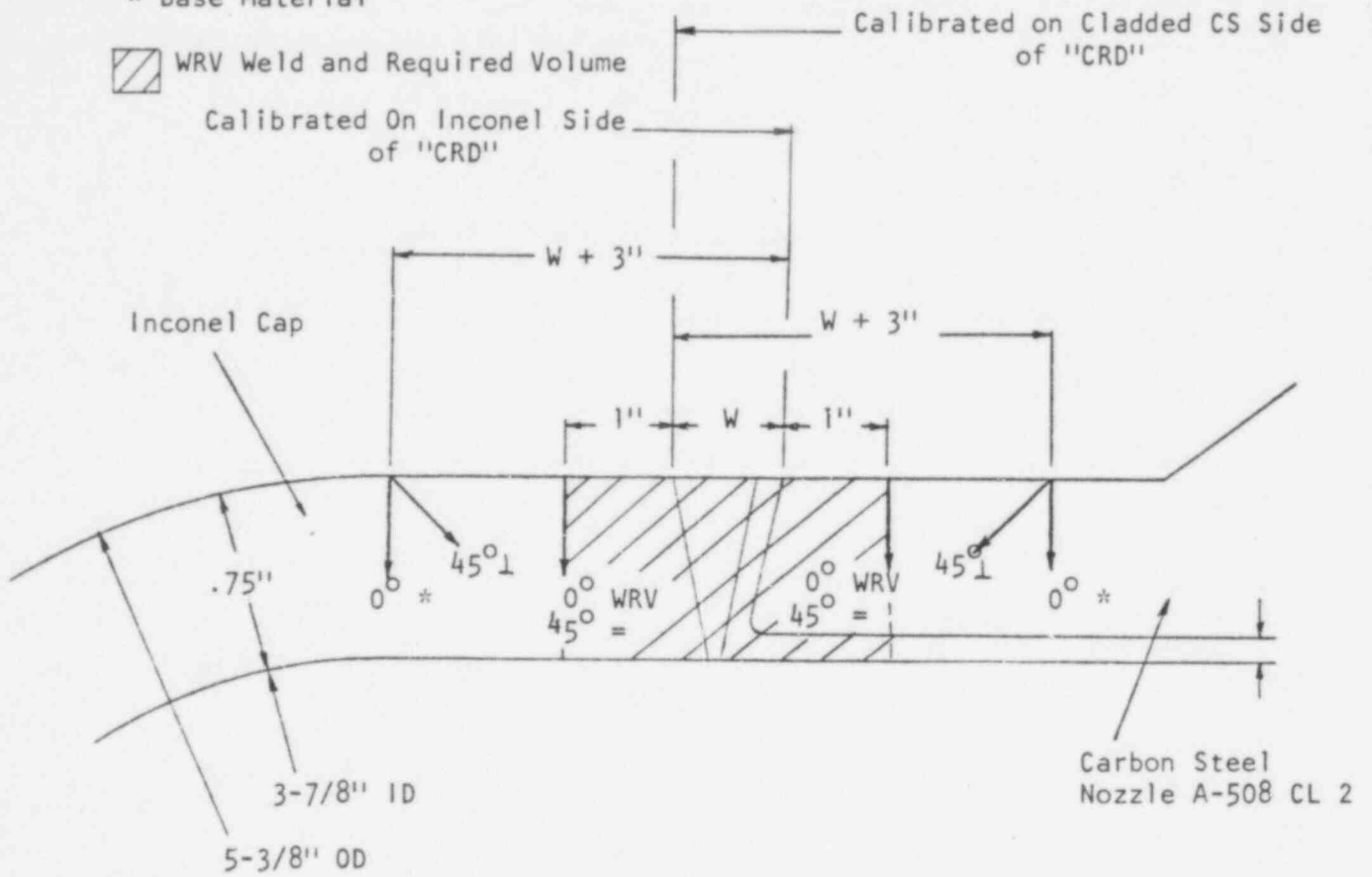


Figure 3 - Ultrasonic Examination Procedures for Control Rod Drive (N9) Nozzle to Cap Weld [Cal. Block "CRD"]

316149



LEGEND

⊥ Perpendicular to Weld

= Parallel to Weld

* Base Material

 WRV Weld and Required Volume

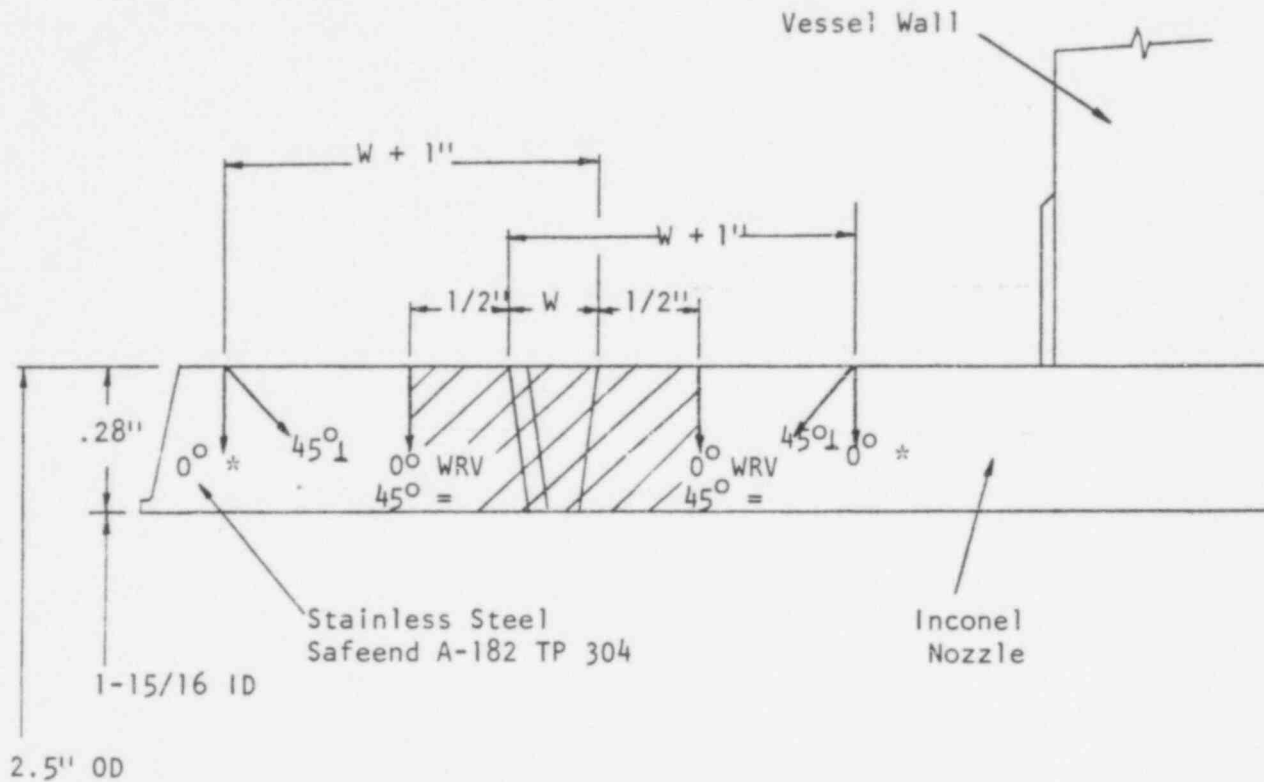


Figure 4 - Ultrasonic Examination Procedures for Pressure Differential (N10) Nozzle to Safeend Weld [Cal. Block "ΔP"]


316150

LEGEND

⊥ Perpendicular to Weld

= Parallel to Weld

* Base Material

 WRV Weld and Required Volume

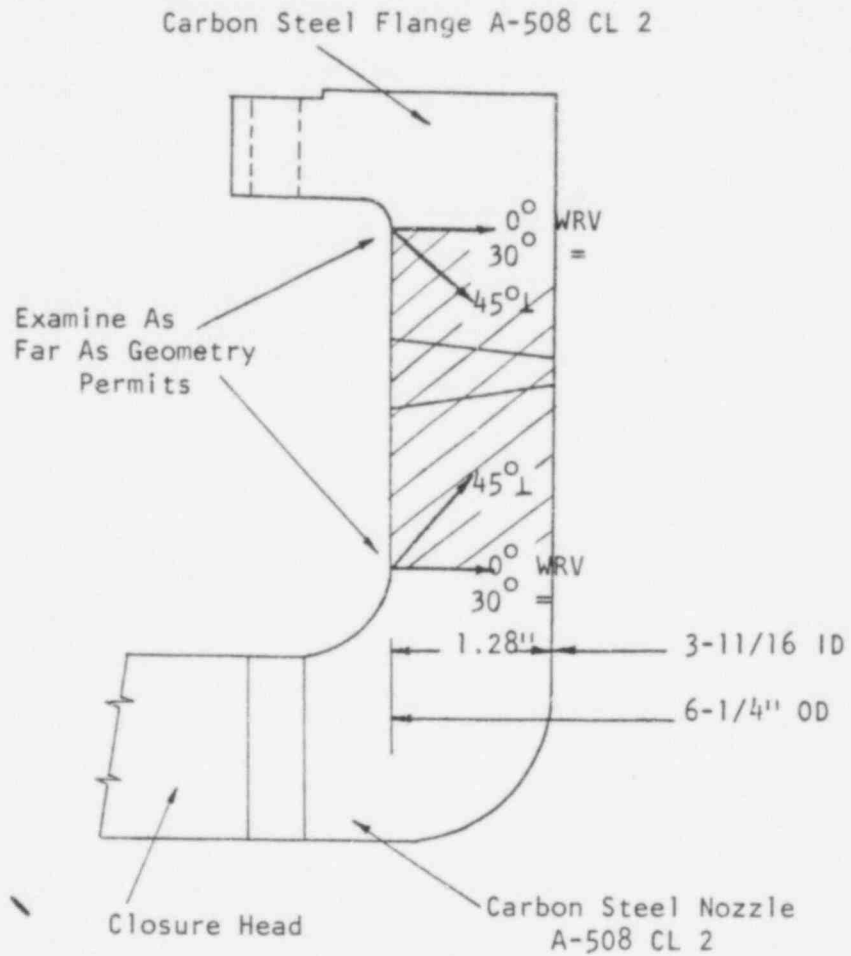


Figure 5 - Ultrasonic Examination Procedures for Closure Head Vent (N7) Nozzle to Flange Weld [Cal. Block "VENT"]

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LEGEND

- ⊥ Perpendicular to Weld
- = Parallel to Weld
- * Base Material
- ▨ WRV Weld and Required Volume

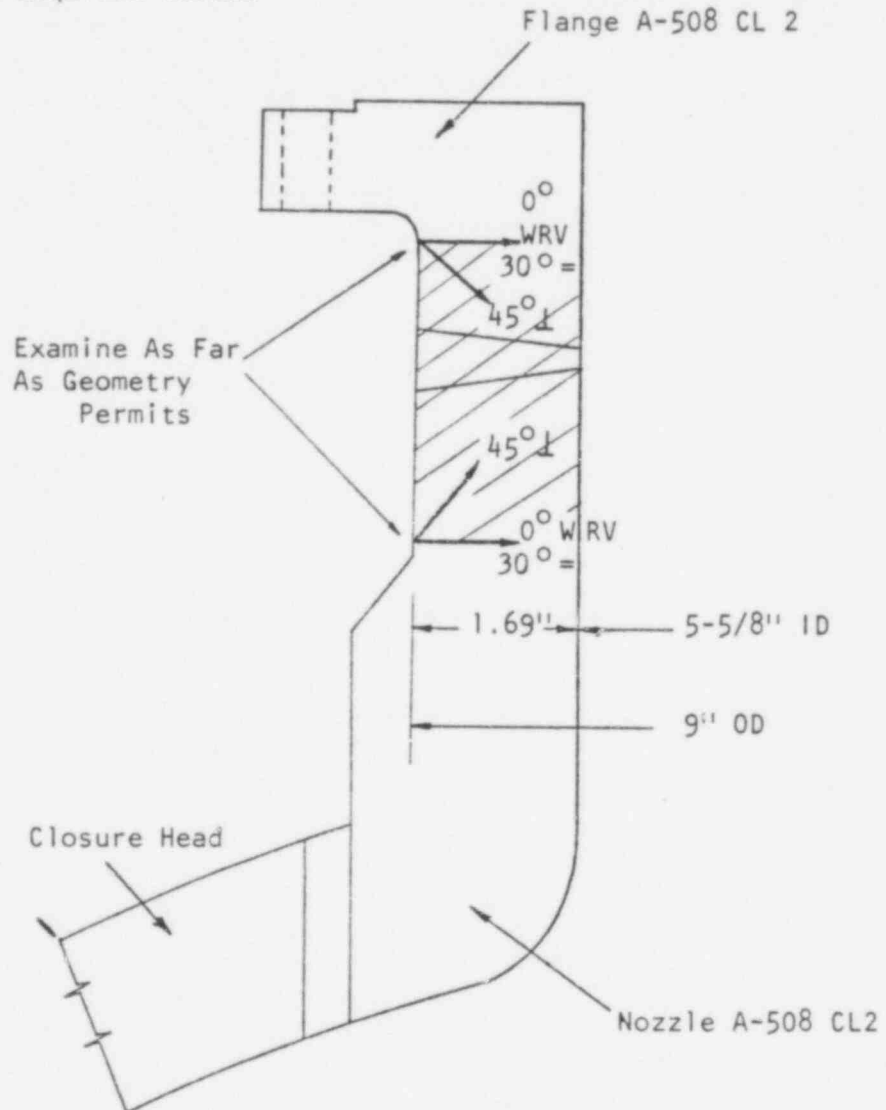
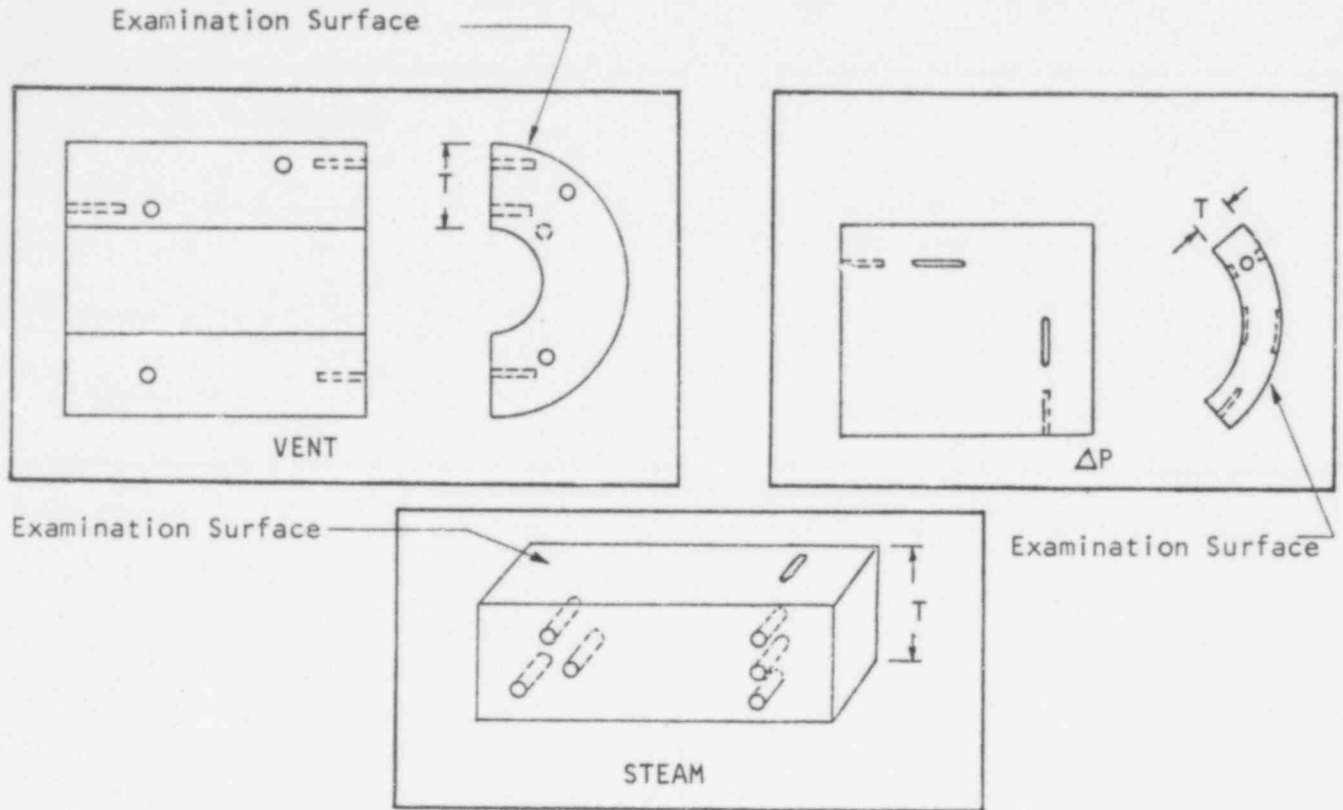


Figure 6 - Ultrasonic Examination Procedures for Closure Head Instrumentation (N6) Nozzle to Flange Welds [Cal. Block "VENT"]

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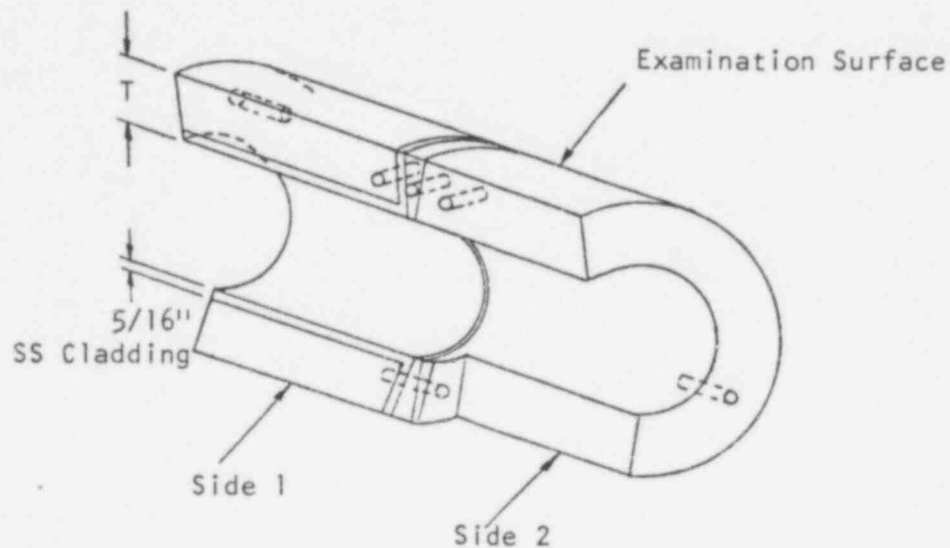


Cal. Block No.	Block T	OD	ID	1/4T	1/2T	3/4T	Hole Dia.	Hole Depth	Notch Depth
STEAM	1.78"	-	-	.445"	.89"	1.335"	1/8"	3.0"	2%T
VENT	1.50"	6.25"	3.25"	.375"	.75"	1.125"	3/32"	1.5"	2%T
ΔP	.28"	2.5"	1.94"	.070"	.140"	.210"	3/32"	1.5"	10%T

Figure 7 - Ultrasonic Calibration Blocks "STEAM", "VENT", and "ΔP"

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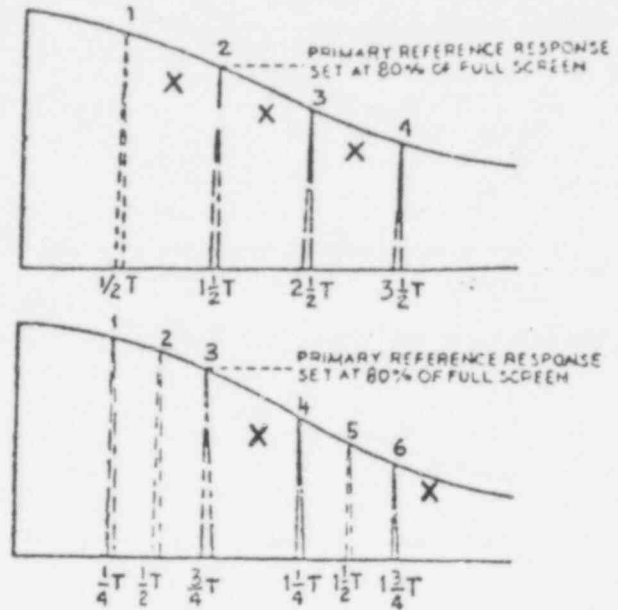
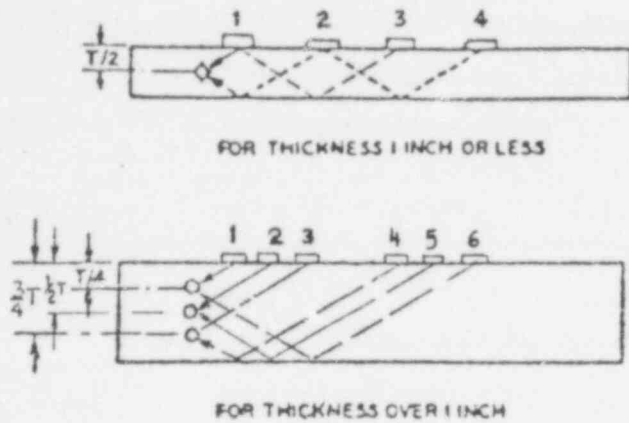




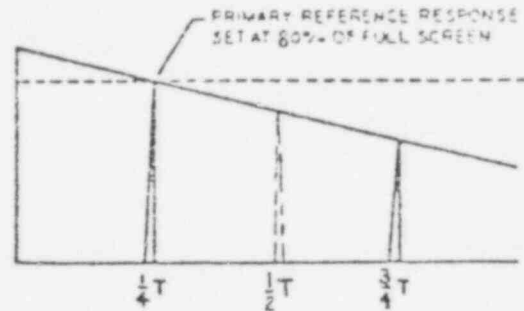
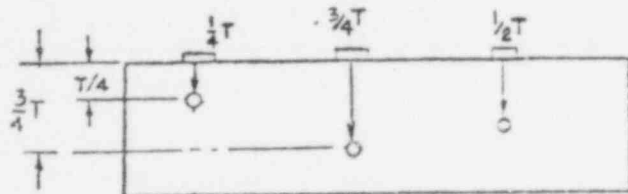
Cal. Block No.	Block T	OD	ID	1/2T	Hole Dia.	Hole Depth	Notch Depth	Side 1 MAT.	Side 2 MAT.
CRD	.75"	5-3/8"	3-7/8"	.375"	3/32"	1.5"	10%T	CS + SS Clad.	Inconel
JPI	.81"	5-7/16"	3-13/16"	.405"	3/32"	1.5"	10%T	CS + SS Clad.	SS

Figure 8 - Ultrasonic Calibration Blocks "CRD" and "JPI"

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SEARCH UNIT LOCATIONS & DAC CURVES FOR ANGLE BEAM CALIBRATION



SEARCH UNIT LOCATIONS & DAC CURVE FOR STRAIGHT BEAM CALIBRATION.

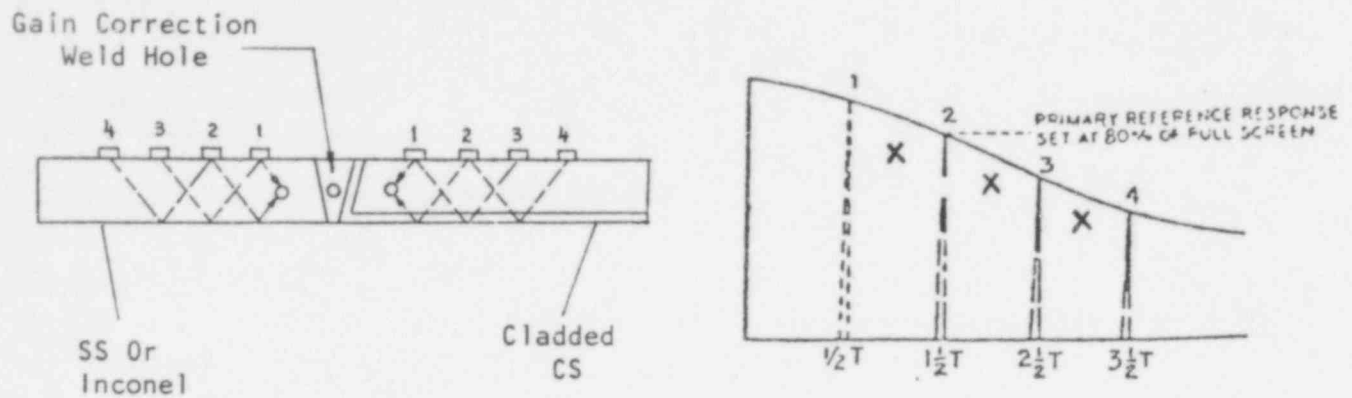
NOTE: For straight beam calibration on Welds under 1" thick, use 1/2T hole only, no DAC required.

- Step 1 - Adjust sweep controls so that the entire examination are is displayed on CRT screen.
- Step 2 - Adjust sensitivity to provide 80% FSH indication from hole giving maximum response. Mark position on screen.
- Step 3 - Position search unit for maximum response from remaining holes. Mark position on screen.
- Step 4 - Plot DAC by connecting points marked on screen with line extended to cover entire examination range.
- Step 5 - Record all sweep and sensitivity control settings on respective data sheets.
- Step 6 - Position search unit for maximum responses from the surface notches and "X" mark screen and data sheet to indicate amplitude.

Figure 9 - Reference Sensitivity and DAC Calibration Procedures for Ultrasonic Examination of Welds. Using Cal. Blocks "STEAM", "VENT" and " Δ ".

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Search Unit Locations and DAC Curves For
 Angle Beam Calibration

- Step 1 - For straight beam calibration use 1/2T hole only with 80% FSH as primary reference response. No DAC necessary.
- Step 2 - Adjust sweep controls so that the entire examination area is displayed on CRT screen.
- Step 3 - Adjust sensitivity to provide 80% FSH indication from hole giving maximum response. Mark position on screen.
- Step 4 - Position search unit for maximum response from remaining holes. Mark position on screen. Divide into two zones, if high attenuation makes it necessary.
- Step 5 - Plot DAC by connecting points marked on screen with line extended to cover entire examination range. Check gain setting against equivalent response from the weld (gain correction) hole.
- Step 6 - Record all sweep and sensitivity control settings on respective data sheets.
- Step 7 - Position search unit for maximum response from the surface notches and "X" mark screen and data sheet to indicate amplitude.

Figure 10 - Reference Sensitivity and DAC Calibration Procedures for Ultrasonic Examination of Welds using Cal. Blocks "CRD" and "JPI".

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Plant/Unit _____
 Comp/System _____

CALIBRATION DATA SHEET

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

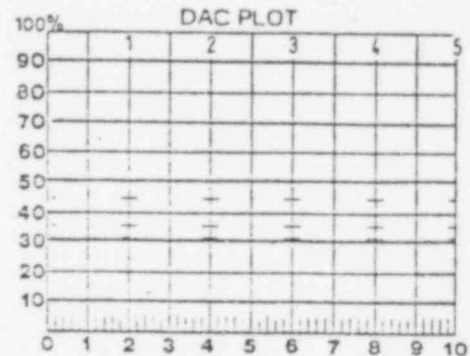
INSTRUMENT SETTINGS	
Mfg/Model No.:	
Serial No. :	
Sweep Length :	
Sweep Delay :	
Pulse Length/Damping:	
Freq.: Rep. Rate:	
Filter: Video: Jack:	
DEC/Gate Switch: Range:	
Mode Select: Reject:	
Gain (coarse): (fine):	

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:	

IDENT	DEPTH in.	AMPL. %	ATTEN. dB

INSTR. LINEARITY CAL.				
Amplitude				
	High	Low	High	Low
1			5	
2			6	
3			7	
4			8	

SCAN AREA	
0° WRV	
0° Mat'l	
↳ to Weld	
↳ to Weld	



AMPL. CONTROL LINEARITY		
Initial	Δ dB	Result
80	-6	
80	-12	
40	+6	
20	+12	

EXAMINATION WELD/AREA	RECORDABLE INDICATION		COMMENTS/REASON FOR INCOMPLETED SCAN(S)
	Yes	No	

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 _____

FIGURE 11 CALIBRATION DATA SHEET



TABLE I
 WELD IDENTIFICATION

WELD NO.	DESCRIPTION	REFERENCE BLOCK	REFERENCE FIGURE	NOTES
14-316A through D	Main Steam Nozzle (N3A through D) to transition piece welds.	STEAM	1, 7	
10-303A and B	Jet Pump Instr. Nozzle (N8A and B) to Safeend Weld	JPI	2, 8	
2-303	Control Rod Drive Nozzle (N9) to Cap Weld	CRD	3, 8	
6-315	Core Differential Pres- sure Nozzle (N10) to Safeend Weld	ΔP	4, 7	
1-317A and B	Closure Head Instr. Nozzle (N6A and B) to Flange Weld	VENT	6, 7	
3-317	Closure Head Vent Nozzle (N7) to Flange Weld	VENT	5, 7	

316161





MASTER DOCUMENT LIST NO. 80A2941 REV. 1

DATE 7-10-79 SHEET 1 OF 2

Project Title SHOREHAM PRESERVICE INSPECTION
PRO-GRAM PLAN

PROJECT NO. 5000 TASK NO. 010
PROJECT ENGINEER APPROVAL [Signature]

ITEM NO.	DOCUMENT NO.	APPROVAL DATE	LATEST REV. NO.	LATEST REV. DATE	LATEST CRA NO.	TITLE	REMARKS
1	80A2941	7-1-79	1	8-1-79	982	MASTER DOCUMENT LIST	
2	80A0444	5-16-79	6	7-10-79	864	QUALITY ASSURANCE PLAN FOR INSERVICE INSPECTION PROGRAM	
3	80A0462	6-10-75	1	12-8-75	99	MANUAL ULTRASONIC EXAM. PROC. FOR REACTOR PRESSURE VESSEL, CIRCUM. & LONG. WELDS	
4	80A0461	9-23-77	4	10-30-75	559	UT EXAM. PROC. FOR CLOSURE HEAD & FLANGE WELDS	
5	80A0465	10-31-77	0			UT EXAM. PROC. FOR REACTOR VESSEL TO FLANGE WELD & STUD LIGAMENTS	
6	80A0469	10-20-77	3	6-28-77	430	MANUAL UT EXAM. PROC. FOR CLOSURE HEAD & VESSEL NOZZLE WELDS	
7	80A0470	2-1-75	1	11-3-78	567	AUTO. UT EXAM. PROC. FOR VESSEL NOZZLE WELDS	
8	80A0471	11-19-77	0			MANUAL UT EXAM. PROC. FOR VESSEL WELDS & STABILIZER BRACKET WELDS	
9	80A0472	9-23-77	1	10-14-77	317	LIQUID PENETRANT EXAM. PROC.	
10	80A0473	9-23-77	1	10-14-77	319	VISUAL EXAM. PROC.	
11	80A0474	2-15-75	1	11-1-75	563	REMOTE UT EXAM. FOR NOZZLE SAFE END WELDS	
12	80A0475	2-15-75	1	7-27-79	972	MANUAL UT EXAM PROC. FOR VESSEL NOZZLE SAFE ENDS & CLOSURE HEAD NOZZLE FLANGE WELDS	
12	80A0476	10-17-77	0			UT EXAM PROC. FOR CLOSURE HEAD STUDS & NUTS & RECIRC. PUMP STUDS & NUTS	
14	80A0478					AUTO. UT EXAM PROC. FOR NOZZLE INNER RADIUS	
15	80A0477					MANUAL UT EXAM PROC. FOR NOZZLE INNER RADIUS	

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