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ST. LUCIE NUCLEAR PLANT, UNIT 2

FIRST INSERVICE INSPECTION INTERVAL

REQUEST

FOR

AUTHORIZATION OF

ALTERNATIVE EXAMINATION

Prepared by

Component, Support and Inspection Department
Code Programs Group

For

St. Lucie Nuclear Power Plant
6501 South Hwy. A1A
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ABSTRACT

Florida Power and Light Company (FPL) has determined, based upon the results of previous examination documentation, that we are unable to completely satisfy the requirements for augmented reactor vessel shell weld examinations specified in 10 CFR 50.55a(g)(6)(ii)(A) of the Code of Federal Regulations.

This submittal provides the information to justify FPL's determination, supplemented by documentation required by the Commission to grant FPL's Request for Alternative Examinations for satisfying the St. Lucie Nuclear Power Plant, Unit 2, Augmented Reactor Vessel Shell Weld examination.

The requirements for the augmented examination of the reactor vessel shell welds was conducted during the First Inservice Inspection Interval, which began on August 8, 1983 and ended on August 8, 1993.

The First Inservice Inspection (ISI) Program was developed based on the rules set forth in the ASME Boiler and Pressure Vessel Code, Section XI 1980 Edition through the Winter 1980 Addenda.

1.0 SCOPE

FPL has made a determination that we are unable to completely satisfy the requirements for augmented reactor vessel shell weld examinations specified in Title 10, Code of Federal Regulations, Part 50, Section 55a(g)(6)(ii)(A).

This document as required by 10 CFR 50.55a(g)(ii)(A)(5), provides the information to support the determination and the proposed alternatives to the examination requirements that provide an acceptable level of quality and safety.

2.0 EXAMINATION REQUIREMENTS

FPL shall augment our reactor vessel examination by implementing once, as part of the inservice inspection interval in effect on September 8, 1992, the examination requirements for reactor vessel shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel, " in Table WB-2500-1 of subsection IWB of the 1989 Edition of Section XI, Division 1, of the ASME Boiler and Pressure Vessel Code, subject to the conditions specified in 10 CFR 50.55a(g)(ii)(A)(3) and (4).

FPL has elected not to defer the augmented examinations in accordance with 10 CFR 50.55a(g)(ii)(A)(3), and therefore the augmented examinations were performed in accordance with the related procedures specified in 1980 Edition through the Winter 1980 Addenda of Section XI, applicable to the St. Lucie Unit 2 First Inservice Inspection Interval in effect on September 8, 1992.

Table 2.1 below provides the examination requirements for the augmented reactor vessel shell welds for Examination Category B-A, Item B1.10.

Table 2.1
EXAMINATION CATEGORY B-A
PRESSURE RETAINING WELDS IN REACTOR VESSEL

Item No.	Parts Examined	Examination Requirements	Examination Method	Extent and Frequency of Examination
B1.10	Shell Welds	N/A	Volumetric	All Welds[2]
B1.11	Circumferential	IWB-2500-1	Volumetric	All Welds[2]
B1.12	Longitudinal	IWB-2500-2	Volumetric	All Welds[2]
2	Includes essentially 100% of the weld length			

NOTE: For the purpose of the augmented examination of the reactor vessel, essentially 100 percent as used in Table IWB-2500-1 means more than 90 percent of the examination volume of each weld, where the reduction in coverage is due to interference by another component, or part geometry.

3.0 AUGMENTED EXAMINATION

The augmented examination of the reactor vessel is satisfied by an examination of essentially 100 percent of the reactor vessel shell welds specified in 10 CFR 50.55a(g)(6)(ii)(A)(2) that has been completed during the inservice inspection interval in effect on September 8, 1992.

FPL is unable to satisfy the augmented reactor vessel shell weld examination requirement to essentially perform 100 percent examination coverage of the augmented reactor vessel shell welds specified in 10 CFR 50.55a (g)(6)(ii)(A)(2), because configuration and permanent attachments prohibit essentially 100% ultrasonic examination coverage of the required examination volume.

Described below, coupled with the Tables and Figures, are details of the examination limitations by weld description. The accompanying Figures graphically depict the locations and extent of the limitations with respect to weld metal and associated base material. The Table quantifies the limitations in terms of present code required volume which was effectively covered.

3.1 CIRCUMFERENTIAL SHELL WELDS

A. LOWER SHELL TO LOWER HEAD WELD

The mechanized examination of the Lower Shell-to-Lower Head weld 201-141 of Figure IWB-2500-3, volume E-F-G-H is limited due to interference from the core support lugs and anti-rotation lugs. Figure 1.1 is a roll out view showing the inaccessible scan surfaces from the vessel inside surface and shows the volume of material not examinable from the inside surface where scanning was limited by lug interference.

B. INTERMEDIATE SHELL TO LOWER SHELL WELD

Examination of the Intermediate Shell-to-Lower Shell weld 101-171 of Figure IWB-2500-2, volume A-B-C-D is limited along the length of the weld due to interference from the material surveillance specimens. Figure 1.1 is a roll out view of weld 101-171 depicting areas where examination scans can not be performed.

C. UPPER SHELL TO MIDDLE SHELL WELD

Examination of the Upper Shell-to-Middle Shell weld 106-121, of Figure IWB-2500-1, volume A-B-C-D, volume is effectively examined 100% of the weld length without limitation.

3.2 LONGITUDINAL SHELL WELDS

A. LOWER SHELL WELDS

The examinations of the Lower Shell Vertical welds 101-142A, B and C of Figure IWB-2500-2, volume A-B-C-D, with the exception of 101-142C were essentially 100% examined for the length of the weld. The examination of weld 101-142C is limited due to interference of the surveillance capsules. The limitations are shown on Figure 1.1 and 1.5.

B. MIDDLE SHELL WELDS

Examinations of the Middle Shell Vertical welds Figure IWB-2500-2, volume A-B-C-D, welds 101-124A, and B volume is effectively examined 100% of the weld length without limitation. The examination of the Middle Shell Vertical welds 101-124C, is limited from one side by interference from the material surveillance capsules as shown on Figure 1.1.

C. UPPER SHELL WELDS

Examination of the Upper Shell Vertical welds Figure IWB-2500-2, volume A-B-C-D, welds 101-122A, B, and C is limited by interference from the inlet nozzle inner radius blend and the outlet nozzle integral extension as shown on Figure 1.1. However, the examinations are complemented by the Nozzle-to-Shell weld examinations.

4.0 DISCUSSION

10 CFR 50.55a (g) (4), recognizes that throughout the service life of a nuclear power facility, components which are classified as ASME Code Class 1 shall meet the requirements, except design and access provisions requirements, set forth in Section XI, to the extent practical within the limitations of design, geometry and materials of construction of the components.

4.1 NEW REGULATION 10 CFR 50.55a(g)(6)(ii)(A) CHANGE

The change in the regulation has little or no effect on the St. Lucie Nuclear Power Plant, Unit 2, First 10-Year Inservice Inspection Interval schedule examinations, as FPL performs essentially 100% volumetric examination of all reactor pressure vessel weld lengths, to the extent practical each inservice inspection interval.

The last mechanized (automated) examination activity was performed during the 1989 refueling outage, which was part of the first inservice inspection interval in effect on September 8, 1992 when the rule change became effective.

Because FPL inservice examinations were extended to include essentially 100% of all reactor pressure vessel welds the augmented reactor vessel examination requirements of the rule change which became effective on September 8, 1992, meet the examination requirements for reactor vessel shell welds specified in Examination Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of the 1989 Edition of Section XI, Division 1, of the ASME Boiler and Pressure Vessel Code, and subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii)(A)(3) and (4).

4.2 FIRST INSPECTION INTERVAL

During the 1989 refueling outage, of the St. Lucie Nuclear Power Plant, Unit 2, First Inservice Inspection Interval, Southwest Research Institute (SwRI) using their Enhanced Data Acquisition System performed the Reactor Pressure Vessel mechanized (automated) ultrasonic examinations. These examinations covered the essentially 100% of all Reactor Pressure Vessel shell circumferiental and longitudinal welds, to the extent practical within the design, geometry and materials of construction.

These examinations were conducted to satisfy the requirements of the 1980 Edition through the Winter 1980 Addenda of Section XI. In addition to the 80W80 Code requirements, the mechanized examination activity was extended to include all Reactor Pressure Vessel accessible weld lengths.

NOTE: It is the intent of FPL to use the First Inservice Inspection interval examinations to satisfy the augmented examination requirements of the rule change.

4.3 NDE EXAMINATION PROCEDURES

NDE examination procedures implemented during the St. Lucie Unit 2 Reactor Pressure Vessel examinations utilized the 1980 Edition through the Winter 1980 ASME Section XI Code-specified ultrasonic techniques. These techniques were augmented by special SwRI qualified examination techniques to obtain full coverage of the near surface and underclad material volumes.

4.4 EXAMINATION COVERAGE

All of the RPV welds were examined for 100% of accessible weld lengths. The flow skirt, core barrel lugs, and material specimen tubes limited full length scanning access to some welds. The outlet nozzle integral extensions and flange-to-shell weld joint configuration limited full coverage of some weld volumes by all ultrasonic examination techniques.

A full vee path calibration of the 45° shear wave scan was used to compensate for limitations encountered in the near surface and those due to geometric shadowing.

A 50/70^0 Bi-modal ultrasonic examination was used for examination of the inner 25 percent t.

Examination limitations were reported in detail as required by USNRC Regulatory Guide 1.150, Revision 1. Weld examinations where 90% or greater coverage of the volume was achieved are considered as having met essentially 100% requirement as used in Table IWB-2500-1 of the ASME Code.

Examination limitations which received less that 90% coverage, as required by Code Case N-460 were documented in the form of a Request for Relief and submitted as part of the St. Lucie Unit 2 Second Inservice Inspection Interval Update Program Submittal.

NOTE: It should be noted that electronic gating does not result in any examination limitations since the entire instrument screen presentation is monitored during the examinations, video taped, and reviewed independently following the examinations.

Attachment B provides Tables of all augmented examination percent of coverage for those welds which fall within the augmented examination requirements of the regulation. The percent of coverage included in Attachment B provides the coverage for all applicable welds, whether or not the coverage achieved was greater or less than 90% as stated in Code Case N-460.

4.5 CODE CASE N-460

Code coverage requirements, as allowed by Code Case N-460 is implemented by FPL on vessels as follows:

1. The 0^0 lamination scan is intended to be utilized once to identify conditions which may interfere with the examination of the weld and the required volume (1/2t). Coverage with this search unit is not factored into the overall calculation of weld coverage.

2. The required examination angles are 0^0, 45^0 1/2 vee path, and 60^0 1/2 vee path. Of these, the two angle beams applied in two directions parallel with the weld and in two directions perpendicular to the weld are factored into the calculation. Except in cases where the beam is oriented essentially perpendicular to the plane of postulated flaws, the 0^0 examination contributes nothing to the examinations, therefore, it is not factored into the calculation.

3. FPL elected to add enhancements to the overall examination of the reactor pressure vessel, as follows:

   a. A full vee path 45^0 to enhance the examination of the area directly under the cladding and to reduce areas of non coverage due to scan limitations.

   b. A special bi-modal scan of the cladding-base metal interface and 1/4 t under the cladding. This was not factored into the coverage calculations, except to augment weld examinations where clad roughness exhibited near surface noise.

4. The overall coverage calculation consists of an average of the 45^0 and 60^0 examinations in all four directions.

4.6 USNRC REGULATORY GUIDE 1.150

Regulatory Guide 1.150, Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations was also used during the examination activity.

FPL was one of the first utilities to implement the regulatory guide when it was still in the draft mode. FPL along with its vendor, SwRI held several meetings with the USNRC prior to implementation. The last St. Lucie mechanized Reactor Pressure Vessel Examination activity was conducted during the 1989 refueling outage, and FPL implemented Regulatory Guide 1.150, Rev. 1. Appendix A, provides FPL's position for compliance with Regulatory Guide 1.150.

4.7 OTHER CONSIDERATIONS

As required by IWB-2200, FPL determined prior to the performance of the preservice examinations that the examination of the reactor pressure vessel will be conducted from the inside surface of the vessel, utilizing mechanized ultrasonic equipment and with techniques equivalent to those that are expected to be employed for subsequent inservice examinations. This decision was made based on the following criteria:

1. access for the inspector, examination personnel and equipment necessary to conduct the examinations;
2. Sufficient space for removal and storage of structural members (vessel internals), shielding and insulation;
3. installation and support of handling equipment (e.g., hoists) to facilitate removal, disassembly and storage of equipment.

Because of the limited access between the vessel and bioshield wall, conducting the examinations from the external surface for the purpose of investigating the small amount of weld volume missed during the mechanized inside surface examinations would require the destruction of the insulation during the removal process, excessive manhours, manrem, and substantial costs without providing any substantial increase in the quality and safety of the unit.

5.0 ALTERNATIVE EXAMINATIONS OR TESTS:

The extent of examination volume achieved ultrasonically and the alternate scans performed (see Examination Coverage Table Attachment B) coupled with the system pressure tests provide assurance of an acceptable level of quality and safety. As an alternative FPL performed the following:

1) Periodic System Pressure tests per Category B-P, Table IWB-2500-1
2) Conduct essentially 100% Mechanized (automated) Ultrasonic Examinations to the extent practical on all reactor pressure vessel welds from the inside surface.
3) $50/70^0$ Bi-modal ultrasonic examination of the inner 25 percent t.
4) Conduct a full vee 45^0 shear wave examination to the extent practical to compensate for recorded limitations.
5) Employ as they become available additional examinations, inspections and/or techniques that would provide a substantial increase in the examination of areas

currently missed under current examination techniques.

6.0 IMPLEMENTATION SCHEDULE:

First Inservice Inspection Interval - August 08, 1983 to August 07, 1993

7.0 ATTACHMENTS TO THE SUBMITTAL

Attachment A Implementation of Regulatory Guide 1.150

Attachment B Percent of Coverage Tables

Attachment C Examination Limitation Drawings.

ATTACHMENT A
IMPLEMENTATION OF
REGULATORY GUIDE 1.150

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Unit 2

SECOND INSERVICE INSPECTION INTERVAL

SECOND INSPECTION PERIOD

IMPLEMENTATION OF REGULATORY GUIDE 1.150

Prepared by

Florida Power and Light Company
Code Programs Group

For

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ABSTRACT

This document provides a summary of how Florida Power and Light Company (FPL), implements the requirements of Regulatory Guide 1.150. FPL has complied, to the extent practical with the requirements of this regulatory guide for over 10 years. FPL, and our vendor Southwest Research Institute (SwRi), has conducted examinations on the reactor pressure vessels at both sites (St. Lucie and Turkey Point), and on all four units (PSL-1 and 2, PTN 3 and 4).

Where required in this document SwRi is inserted, in place of FPL, to make a distinction between equipment, techniques, or documentation unique to SwRI.

The mechanized ultrasonic examinations for the St. Lucie Nuclear Power Plant, Unit 2, Reactor Pressure Vessel is currently scheduled to be performed in the Second Inspection Period, of the Second Inspection Interval. The examinations will be conducted in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, 1989 Edition, no Addenda, and the additional requirements of Regulatory Guide 1.150 as stated within.

This document is written in a format that first identifies the regulatory guide requirement, followed by a summary of how FPL will implement that requirement.

INTRODUCTION

Ultrasonic examination of the St. Lucie, Unit 2 reactor pressure vessel welds, including the closure head will be performed during the upcoming Second Inservice Inspection Interval, in accordance with the 1989 Edition of the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code (B&PVC), Section XI, and as supplemented by the additional requirements of Regulatory Guide 1.150, Revision 1. This document summarizes the additional requirements that Florida Power and Light Company (FPL) implemented during previous examination activities in order to comply with the Regulatory Guide requirements. FPL expects that these additional requirements will not change.

1.0 INSPECTION SYSTEM PERFORMANCE CHECKS

The conduct of nondestructive examinations require that the performance characteristics of the inspection system used be well defined and documented. This is particularly true for situations which require comparisons of examination results generated during successive examinations on the same components. An inspection system comprises of the following:

a. a transducer (search unit);

b. a single-channel instrument or each channel of a multichannel instrument; and

c. a given cable type and length.

The checks described in paragraphs 1.1 and 1.2 should be made for any ultrasonic (UT) system used for inspection of reactor pressure vessel (RPV) welds.

The field performance checks described in 1.2 (with the possible exception of 1.2.c) should be conducted on a basic calibration block that represents the thickness range to be examined.

FPL agrees with the need to define and document the performance characteristics of UT systems, and we have been, and requiring our vendors (SwRI) to do so for many years. Most of the checks identified herein are considered standard operating practice. FPL applies these requirements to all reactor vessel weld examinations, whether the examinations are manual, or automated (Mechanized) from the inside surface. Since the results of the field performance checks described in 1.2 are independent of calibration block design, FPL approved vendor's procedures are required to allow the use of any calibration block that will provide the signal responses needed for the performance check.

1.1 Preexamination Performance Checks

a. Frequency of Checks

These checks should be verified within six (6) months before reactor pressure vessel examinations performed during one outage. Pulse shape and noise suppression controls should remain at the same settings during calibration and examination.

b. RF Waveform

A record of the RF (radiofrequency) pulse waveform from a reference reflector should be obtained for each search unit used in the examination in a manner which will provide frequency amplitude information. At the highest amplitude portion of the beam, the RF return signal should be recorded before it has been rectified or conditioned for display. The reflector used in generating the RF return signal as well as the electronic system (i.e., the basic ultrasonic instrument, gating, and form of gated signal) should be documented. These records should be used for comparison with previous and future records.

FPL requires vendors not only to record RF pulse waveform as identified above, but also requires the determination of the frequency spectrum and distance amplitude curve for each search unit used. Search units that do not meet strict performance tolerances are prohibited from use. Documentation of this analysis is submitted to FPL prior to the performance of the examinations and are included as part of the final report of the examination activity.

In addition to the analysis described above, FPL also requires photographs of the RF waveform in the field during initial and final calibrations. This provides a record of the RF waveform obtained using the specific system components (transducer, instrument, and cable) that are used for calibration and examination.

1.2 Field Performance Checks

a. Frequency of Checks

As a minimum, these checks should be verified on site before and after examining all the welds that need to be examined in a reactor pressure vessel during one outage. Pulse shape and noise suppression controls should remain at the same settings during examination and calibration.

b. Instrument Sensitivity During Linearity Checks

The initial instrument sensitivity during the performance of 1.2.e should be such that it falls at the calibration sensitivity or at some point between the calibration sensitivity and the scanning sensitivity.

c. RF Waveform

A record of the RF (radiofrequency) pulse waveform from a reference reflector should be obtained and recorded in a manner that will permit extraction of frequency amplitude information. At the highest amplitude portion of the beam, the RF return signal should be recorded before it has been rectified or conditioned for display. This should be determined on the same reflector as that used in 1.1.b above. This record should be retained for future reference.

d. Screen Height Linearity

Screen height linearity of the ultrasonic instrument should be determined according to the mandatory Appendix I to Article 4, Section V of the ASME Code or Appendix I to Section XI of the ASME Code.

e. Amplitude Control Linearity

Amplitude control linearity should be determined according to the mandatory Appendix II of Article 4, Section V, of the ASME Code or Appendix I of Section XI of the ASME Code.

f. Angle Beam Profile Characterization

The vertical beam profile should be determined for each search unit used during the examination by a procedure similar to that outlined in nonmandatory Appendix B-60, Article 4, Section V, of the ASME Code or Appendix I to Section XI of the ASME Code. Beam profile curves should be determined at different depths to cover the thicknesses of materials to be examined. Interpolation may be used to obtain beam profile correction for assessing flaws at intermediate depths for which beam profile has not been determined.

Beam profile measurements should be made at the sensitivity required for sizing. For example, sizing to 20-percent DAC criteria requires that the beam profile be determined at 20-percent DAC.

The field performance checks described above are performed as follows:

(1) ***RF Waveform*** *- Photographs of the RF waveform in the field during each initial and final calibration. This provides a record of the RF waveform obtained using the specific system components (transducer, instrument, and cable) that are used for calibration and examination.*

(2) ***Screen height Linearity*** *- Screen height linearity checks are performed for each instrument in accordance with the Regulatory Guide requirements. These checks are performed immediately before and after completion of the examinations.*

(3) ***Amplitude Control Linearity*** *- Amplitude control linearity checks establish a linear relationship between an adjustment of the gain, or sensitivity, controls (knobs or switches) and the corresponding signal amplitude change observed on the CRT.*

In the case of manual examinations in accordance with Regulatory Guide 1.150, amplitude control linearity is determined for each instrument in accordance with the Regulatory Guide requirements. These checks are performed in conjunction with the screen height linearity checks immediately before and after completion of the examinations.

Paragraph 1.2.b above requires that the instrument sensitivity during the performance of amplitude control linearity checks should be at the calibration sensitivity or scanning sensitivity. However, the calibration sensitivity levels (and scanning sensitivity levels) vary with the different techniques used during vessel examinations. Therefore, vendors are required to perform these linearity checks at the extreme upper and lower ends of the sensitivity range. This ensures that the instrument is linear across a wide range of calibration and screening sensitivity levels.

In the case of automated examinations, Gain Control circuity electronically compensates for the normal signal attenuation that causes a sloping DAC curve and provides a variable gain adjustment across the CRT screen such that a constant, horizontal DAC curve is attained. Gain Control performance is periodically verified on site during examinations to assure that a straight horizontal DAC is maintained. In essence, whenever the amplitude controls are used for indication amplitude measurements, amplitude control linearity checks are performed.

(4) ***Angle-Beam Profile Characterization*** *- A beam profile for each single element pulse-echo angle beam search unit is determined on site in accordance with the Regulatory Guide requirements. These profiles are generated using the 1/4, 1/2, and 3/4T side-drilled holes in a calibration block that is as thick or thicker than the component to which the search unit will be applied. Since Appendix A of the Regulatory Guide permits sizing at either 20% or 50% of DAC, Vendors are required to take both 20% and 50% beam profiles.*

With the use of tandem dual-refracted longitudinal wave units for near surface examination, typical sizing methodologies are not applicable because of the unique search unit performance. Therefore, when near surface indications are observed with these techniques, special supplemental sizing techniques may be required depending upon the observed characteristic of the flaw. These special supplemental sizing techniques have been substantiated and qualified using mockups, field experience, and research project data over many years.

2.0 CALIBRATION

System calibration should be performed to establish the DAC curve and the sweep range calibration in accordance with Article 4, Section V, of the ASME Code or Appendix I to Section XI. Calibration should be confirmed before and after each RPV examination, or each week in which the system is in use, whichever is less. Where possible, the same calibration block should be used for successive inservice examinations of the RPV.

FPL requires system calibration be performed on site in accordance with Regulatory Guide requirements on the applicable basic calibration block.

Calibration confirmation during manual examinations is performed prior to the examination; at least every four hours during the examinations; with any substitution of search unit, cable, or power source; and upon completion of the examinations.

For mechanized examinations, FPL requires calibration confirmation prior to the start of a series of examinations (a series is considered to be similar examinations performed using the same examination techniques and the same equipment configuration); with any substitution of search unit, cable, or power source; whenever the device is removed from the examination area; at least every week during the examinations; and at the completion of a series of examinations.

NOTE: While this calibration confirmation frequency is consistent with the Regulatory Guide, it sometimes does not comply with the 12-hour frequency requirements of paragraph T-432.1.2 of Section V. The acceptability of exceeding the Section V 12-hour calibration check can be demonstrated as allowed in paragraph IWA-2240 of Section XI.

2.1 Calibration for Manual Scanning

For manual sizing of flaws, static calibration may be used if sizing is performed using a static transducer. When signals are maximized during calibration, they should also be maximized during sizing. For manual scanning for the detection of flaws, reference hole detection should be shown at scanning speed and detection level set accordingly.

As required above, vendors are required to use static calibration and static sizing techniques for manual examinations, maximizing both calibration and flaw signals. Reference hole detection is verified by scanning over the calibration block at the maximum scanning speed and verifying that the signal meets or exceeds the recording level.

2.2 Calibration for Mechanized Scanning

When flaw detection is to be done by mechanized equipment, the calibration should be performed using the following guidelines:

a. The DAC curve should be established using either a moving transducer mounted on the mechanism that will be used for examination of the component or a mechanism that duplicates the critical factors (e.g., transducer mounting, weight, pivot points, couplant) present in the scanning mechanism.

b. Calibration speed should be at or higher than the scanning speed, except when correction factors established in 2.2.d are used.

c. The direction of transducer movement (forward or backward) during calibration to establish the DAC curve should be the same direction during scanning unless it can be shown that a change in scanning direction does not reduce flaw detection capability.

d. One of the following alternative guidelines should be followed to establish correction factors if static basic calibration is used:

   (1) Correction factors between dynamic and static response should be established using the basic calibration block or,

(2) Correction factors should be established using models and taking scaling factors into consideration (assumed scaling relationship should be verified) or,

(3) Correction factors should be established using full-scale mockups.

FPL complies with these requirements for calibration for mechanized scanning in accordance with 2.2.d(1) in that we have repeatedly required SwRI to demonstrate equivalency between the scanning with the PaR devices and the static calibration techniques. FPL also requires SwRi to provide a report documenting this equivalency using the equipment pertinent to FPL's application.

2.3 Calibration Confirmation

Calibration confirmation performed as midshift or interim confirmation between onsite calibrations should comply with stability requirements in T-433, Article 4, Section V, of the ASME Code.

When an electronic simulator is used for onsite calibration confirmation after a Code required block calibration performed off site, the following should also apply:

a. Complete system performance should be maintained stable prior to offsite calibrations and onsite calibration confirmation by use of target reflectors. The target reflectors should be mounted with identical physical displacement in both the offsite calibration facilities and the onsite mechanized equipment. Each onsite periodic calibration should be preceded by complete system performance verification using a minimum of two (2) target reflectors separated by a distance representing 75 percent of maximum thickness to be examined.

b. Written records of calibrations should be established for both target reflector responses and Code calibration block DAC curves for each transducer. These written records may be used to monitor drift since the original recorded calibration.

c. Measures should be taken to ensure that the different variables such as temperature, vibration, and shock limits are minimized by controlling packaging, handling, and storage.

FPL requires calibration confirmation be performed at the frequency specified in paragraph 2 above and in compliance with the stability requirements of the Regulatory Guide. Vendors are required to perform the calibration confirmation on site during using the basic calibration block, not an electronic block simulator. As such, the additional requirements identified in this paragraph for the use of an electronic block simulator do not apply.

In addition to periodic calibration confirmations functional checks of the UT instruments and the gain control circuitry system are typically performed at shift changeover. These checks utilize electronic signal generators to monitor for changes in sweep and amplitude displays. The stability criteria of paragraph T-433 of Article 4 are used for acceptability of these functional checks.

For full vessel examinations using the SwRi Fast PaR systems, two Data Acquisitions Systems are utilized in parallel. While one system is used for scanning and data acquisition, the other system is being calibrated for the next series of examinations. In effect, two separate cable system are used, one for calibration and another for examinations. SwRI's Remote Cable Calibrator system allows comparison of the difference in cable performance and also provides electronic signal generation for periodic verification that the performance of the two cable systems has not changed. These cable performance checks are performed at the same time, and using the same criteria, as the electronic functional checks described above.

2.4 Calibration Blocks

Calibration blocks should comply with Appendix I to Section XI or Article 4, Section V of the ASME Code. When an alternative calibration block or a new conventional block is used, a ratio between the DAC curves obtained from the original block and from the new block should be noted (for reference) to provide for a meaningful comparison or previous and current data.

The calibration side-drilled holes in the basic calibration block and the block surface should be protected so that their characteristics do not change during storage. These side-drilled holes or the block surface should not be modified in any way (e.g., by polishing) between successive examinations. If the block surface or the calibration reflector holes have been polished by any chemical or mechanical means, this fact should be recorded.

3.0 EXAMINATION

The scope and extent of the ultrasonic examinations should comply with IWA-2000, Section XI, of the ASME Code.

If electronic gating is used to define the examination volume within which indications are recorded the start and stop control points should include the entire required thickness including the material near each surface.

If a single gate is used, it should be capable of recording multiple indications appearing in the gate. Alternative means of recording may be used providing they do not reduce flaw detection and recording capability.

Examination should be done with a minimum 25-percent scan overlap based on the transducer element size.

The scope and extent of manual examinations are addressed in the examination plan and examination procedure in accordance with IWA-2000.

In order to assure that the scope and extent of automated examinations comply with IWA-2000 of Section XI, FPL requires the vendor to prepare a detailed Scan Plan for each automated examination activity in addition to typical examination procedures. This plan addresses device configurations, scanning parameters, calibration parameters, gate settings, and other specific information needed to perform the work. Implementation of the scan plan, as prepared for a specific application, will ensure that the full volume of the ASME examination area are examined to the extent allowed by the vessel configuration. Coverage is accomplished using a combination of several beam angles and examination techniques as specified in the scan plans.

The electronic gating system utilized by vendors does not limit the examination volume within which indications are recorded. When the standard data acquisition system is used, a video recording is made of the actual UT instruments CRT presentations with the search unit positional information superimposed in real time.

The SwRI enhanced data acquisition system has overlapping electronic gating for each UT channel such that a full volume examination is digitized, recorded, and displayed. The enhanced data acquisition system gating is capable of recording multiple simultaneous indications.

All examinations performed in accordance with the regulatory guide are performed using a 25-percent overlap, unless a greater overlap is required.

3.1 INTERNAL SURFACE

The capability to effectively detect defects at the internal clad/base metal interface shall be considered acceptable if the examination procedures(s) or techniques meet the requirements of section 6.0 of this document and demonstrates the following:

a. procedure for examination from the outer surface, or when using full vee from the inside surface, should include the use of the 2-percent notch which penetrates the internal (clad) surface of the calibration blocks, defined by Section XI, Appendix I, Figure I-3131, or Section V, Article 4, T-434-1. Procedures for examination from the internal surface when not using the full vee should conform to paragraph 3.1.b below.

b. an alternate reflector, other than the 2-percent notch described above, may be used provided (1) that it is located at the clad/base metal interface or at an equivalent distance from the surface, (2) that it does not exceed the maximum allowable defect size, and (3) that equivalent or superior results can be demonstrated.

c. the examination procedures should provide the volumetric examination of at least 1 inch of metal as measured perpendicular to the nominal location of the base metal cladding interface.

Procedures for examination from the outside surface of the vessel wall use the 2-percent notch for reference as specified in paragraph 3.1(a). These procedures also include a half vee calibration with the notch used for calibration of all indications which appear at the inside surface of the examination area.

Procedures for tandem examinations from the inside surface utilizes 1/16 inch diameter side-drilled holes at the clad/base metal interface as described in paragraph 3.1(b). In both cases, procedures provide for volumetric examination of greater than 1-inch depth below the cladding interface as required by paragraph 3.1(c). SwRI has demonstrated that the reference sensitivity established on the 1/16 inch diameter side drilled holes meets or exceeds that specified in Section XI of the ASME Code. This technique has also been demonstrated to have the capability of detecting flaws with good signal-to-noise discrimination at depths of at least 2-3/4 inches below the clad-to-base metal interface, thus overlapping the through-wall zone of calibrated sensitivity of the 45 degree and 60 degree beams. Using the tandem beam transducers, SwRI has detected flaws of minute size in the area between the clad-to-base metal interface and the first 45 degree and 60 degree dac point.

FPL has also used 70 degree dual (side-by-side mounted piezoelectric elements) search units for underclad examinations; however, the useful range is limited to approximately 1 inch of depth below the cladding with no discernible improvement over the tandem beam search unit at the clad-to-base metal interface.

3.2 Scanning Weld-Metal Interface

The beam angles used to scan welds should be based on the geometry of the weld/parent metal interface. Where feasible for welds such as those identified in Section T-441.4.2 of Article 4, Section V, of the ASME Code, at least one angle should be such that the beam is perpendicular (+ or - 15 degrees to the perpendicular) to the weld/parent metal interface, or should be demonstrated that unfavorably orientated planar flaws can be detected by UT technique being used. If this is not feasible, use of alternative volumetric NDE techniques, as permitted by the ASME Code, should be considered.

For RPV shell seam welds, FPL uses the nominal Code-specified 0-degree, 45-degree, and 60-degree, beams to examine the full volume of the wall section except for the volume of material near the beam entry point, for which we use the previously mentioned tandem search units.

Section T-441.4.2 (or T-441.3.2.2 of Article 4, Section V, states that beam angles other than 0-degree, 45-degree, and 60-degree should be used for the examination of (a) flange welds when the examination is conducted from the flange face, (b) nozzle and nozzle welds when the examination is conducted from the nozzle bore, (c) attachment and support welds, and (d) examination of double taper junctions. FPL has employed this approach for many years.

FPL and FPL approved vendors procedures, however, often provide more than Code-specified coverage where feasible. Each of the unique weld configurations noted above is evaluated to determine the best and most comprehensive coverage attainable. Where necessary, other angle and straight beam examinations are performed to assure complete coverage of nozzle-to-shell, vessel-to-flange, and attachment welds. Previously mentioned tandem beam techniques are also utilized to provide the required near surface coverage when nozzle bore examinations are performed.

4. BEAM PROFILE

Delete entire paragraph. This section included in Recommended Change 1.2.f, Angle Beam Profile Characterization.

5. SCANNING WELD-METAL INTERFACE

Delete entire paragraph. This section included in Recommended Change 3.2, Scanning Weld-Metal Interface.

6. RECORDING AND SIZING

The capability to detect, record, and size the flaws delineated by Section XI, IWB-3500, should be demonstrated. The measurement tolerance established should be applied when sizing flaws detected and recorded during scanning (see paragraph 7.a).

The difference between joint configurations, plate thicknesses, flaw locations within the weld, flaw orientations, and acoustic characteristics of the component material all contribute to the inherent variability of sizing techniques. FPL has used and will continue to use, Code and non-Code sizing techniques, the use of supplemental NDE techniques if practical, mockups of the particular configuration, and when required, consultants to fully evaluate the examination and the results.

6.1 Geometric Indications

Indications determined to be from geometric sources need not be sized. Recording of these indications should be at 50-percent DAC. When indications are evaluated as geometric in origin, the basis for that determination should be described. After recording sufficient information to identify the origin of the geometric indication, further recording and evaluation are not required.

Indication analysis and sizing are performed by FPL or FPL approved vendors. All the examination data is given an administrative and technical review by a FPL qualified NDE Level II and/or Level III, certified in that particular method.

Indications that are geometric in origin are recorded at 50-percent DAC and the nature of each such indication is documented.

6.2 Indications with Changing Metal Path

a. Indications that change metal path distances (including through-wall dimension), when scanned in accordance with the requirements of ASME Section XI for a distance greater than that recorded from the calibration reflector, should be recorded.

b. Reflectors which are at metal paths representing 25 percent and greater of the through-wall thickness of the vessel wall measured from the inner surface should be recorded in accordance with the requirements of the ASME Section XI and characterized at 50-percent DAC.

c. Reflectors which are within the inner 25 percent of the through-wall thickness should be recorded at 20 percent DAC. Characterization should be in accordance with the demonstrated methods under paragraph 6.0. When the indication is sized at 20 percent DAC, this size may be corrected by subtracting the beam width in the through-thickness direction obtained from the calibration hole (between 20 percent DAC points) which is at a depth similar to the flaw depth. If the indication exceeds 50 percent DAC, the length should be recorded by measuring the distance between 50 percent DAC levels. The determined size should be the larger of the two.

FPL believes that the intent of this paragraph is to require the examiner to determine and document the most accurate size of a reflector having through-wall dimension, to the extent practicable.

FPL typically requires both 20 percent and 50 percent beam spread measurement at the time of calibration in case the information is required during data analysis.

For tandem beam search units, the use of beam spread correction for sizing is not normally applicable because of the unique beam profile characteristics. When near surface indications are observed during a vessel examination, FPL routinely applies one or more special sizing techniques, before comparing the size to the acceptance criteria of Section XI.

In general, FPL concurs with the specified approach, but also requires application of selected alternate sizing techniques when necessary based upon a case-by-case evaluation in determining which technique is considered most appropriate for the anticipated flaw type and orientation.

6.3 Indication Without Changing Metal Path

a. Indications which do not change metal path distance when scanned in accordance with the requirements of ASME Section XI and are within the outer 75 percent of the through-wall dimension should be recorded when any continuous dimension exceeds 1 inch.

b. If the indication falls within the inner 25 percent of the through-wall dimensions, it should be recorded ar 20 percent DAC and evaluated at 50 percent DAC.

c. Precautionary note: Indications lying parallel to welds may appear nontraveling (without changing metal path) when scanned by parallel moving transducers whose beams are aimed normal to the weld, i.e., at 90 degrees. Multiple scans, however, may reveal that these indications are traveling indications. If so, recording and sizing are to be done in accordance with paragraph 6.2.

To the extent practicable, evaluation of nontraveling indications is performed in accordance with these requirements, along with the use of additional sizing techniques where appropriate.

The precautionary note of paragraph 6.3.c is appropriate. To alleviate this concern, scanning is performed in the direction of the beam component wherever possible. In those instances when this preferred mode of scanning cannot be utilized, NDE procedures address this concern by requiring additional scans (along the sound beam direction) of any nongeometric angle beam indication observed during scans made parallel to the weld. Additional scans are performed using small scan increments (or large transducer overlap) in order to develop a very accurate data set.

6.4 Additional Recording Criteria

The following information should also be recorded for indications that are reportable according to this regulatory position:

a, Indications should be recorded at scan intervals no greater than 1/4 inch.

b. The recorded information should include the indication travel (metal path distance) and the transducer position for 20 percent (where applicable), 50 percent, and 100 percent DAC and the maximum amplitude of the signal.

c. When multichannel equipment is used in the examination system such as that all examination displays are not available for simultaneous viewing, an electronic gating system should be used which will provide on-line, reportable, recorded information regarding metal path, amplitude, and position of all indications exceeding a preset level. The preset level should be the minimum recording level required. To ensure that all recordable indications are recorded, a preferred method would incorporate multigates in each channel or a single gate for each channel with multi-indication recording capability.

In reference to Paragraph 6.4.a, initial scanning is at 25 percent overlap as specified in Paragraph 3. However, data to be utilized for specific sizing or investigation of indications that exceed the allowable limits of Section XI is acquired at 1/4 inch scan intervals.

The information required in Paragraph 6.4.b is typically recorded for all vessel examinations, whether the examination is performed manually or using automated equipment.

In reference to Paragraph 6.4.c which addresses the use of multi-channel equipment, the standard data acquisition system utilized by SwRI satisfies this requirement by virtue of the video recording of the instrument screens. Since the entire screen presentation is recorded, simultaneous multiple signals are recorded as encountered. The data analysis process also includes review of all of the video tape data thereby ensuring that each recorded signal is reviewed and analyzed.

7. REPORTING OF RESULTS

Records obtained while following the recommendations of regulatory position 1.2, 3, and 6, along with discussions and explanations, if any, should be kept available at the site. If the size of an indication, as determined in regulatory position 6.2 or 6.3, exceeds the allowable limits of Section XI of the ASME Code, the indications should be reported as abnormal degradation of reactor pressure boundary in accordance with the recommendation of regulatory position 2.a(3) of Regulatory Guide 1.16.

Along with the report of ultrasonic examination test results, the following information should also be included:

a. The best estimate of the tolerances in sizing the flaws at the sensitivity required in Section 6 and the basis for this estimate.

   This estimate may be determined in part by the use of additional reflectors in the basic calibration block.

b. A description of the technique used to qualify the effectiveness of the examination procedure, including, as a minimum, material, section thickness, and reflectors.

c. The best estimates of the portion of the volume required to be examined by the ASME Code that has not been effectively examined such as volumes of material near each surface because of near-field or other effects, volumes near interfaces between cladding and parent metal, volumes shadowed by laminar defects, volumes shadowed by part geometry, volumes inaccessible to the transducer, volumes affected by electronic gating, and volumes near the surface opposite the transducer.

   Sketches and/or descriptions of the tools, fixtures, and component geometry which contribute to incomplete coverage should be included.

d. Provide sketches of equipment (i.e., scanning mechanism and transducer holders) with reference points and necessary dimensions to allow a reviewer to follow the equipment's indication location scheme.

e. When other volumetric techniques are used, a description of the techniques used should be included in the report.

In reference to Paragraph 7.a, FPL feels that the sizes obtained using Code sizing techniques should be used consistently for comparison to Code acceptance standards whenever possible. Based on experience, Code sizing techniques appear to be somewhat conservative; however, there is little evidence to support the feasibility of developing specific tolerances or correction factors for Code sizing techniques. Nor is there significant evidence of improved accuracy and consistency resulting from the use of any one alternate sizing technique. Alternate sizing methods must be used carefully and, in effect, should be used only when it can *be determined that the Code sizing techniques are, for some reason, inappropriate for the specific type of flaw encountered.*

These statements do point out that flaw sizes based on UT are estimates. FPL, of course, has varying degrees of confidence in flaw size estimates depending on pertinent examination variables. Since the ramifications of our flaw size estimates are very great, FPL will typically recommend certain actions to our vendors which can increase our confidence in flaw size estimation. These recommendations may include actions such as:

(a) placing additional holes in the calibration block

(b) constructing mockups of the examination area

(c) using other NDE equipment

(d) applying alternate NDE methods

(e) performing certain laboratory tests

(f) calling in specialists with particular experience in similar problems.

In reference to Paragraph 7.b, procedure qualifications are required and the documentation is reviewed by FPL prior to performance of the examination activity. Documentation is available for review by the enforcement and regulatory authority, and the authorized inspection agency at any time.

In reference to Paragraph 7.c, FPL requires a detailed limitations report for all reactor vessel examinations. The report is usually a combination of tables and sketches that quantify the various limitations to the Code required volume.

The information identified in Paragraph 7.d is required by FPL to be included in a final report of the examination activity.

In reference to Paragraph 7.e, when alternate techniques are utilized, either for examination or sizing purposes, a complete description of the application and results is included within the final report.

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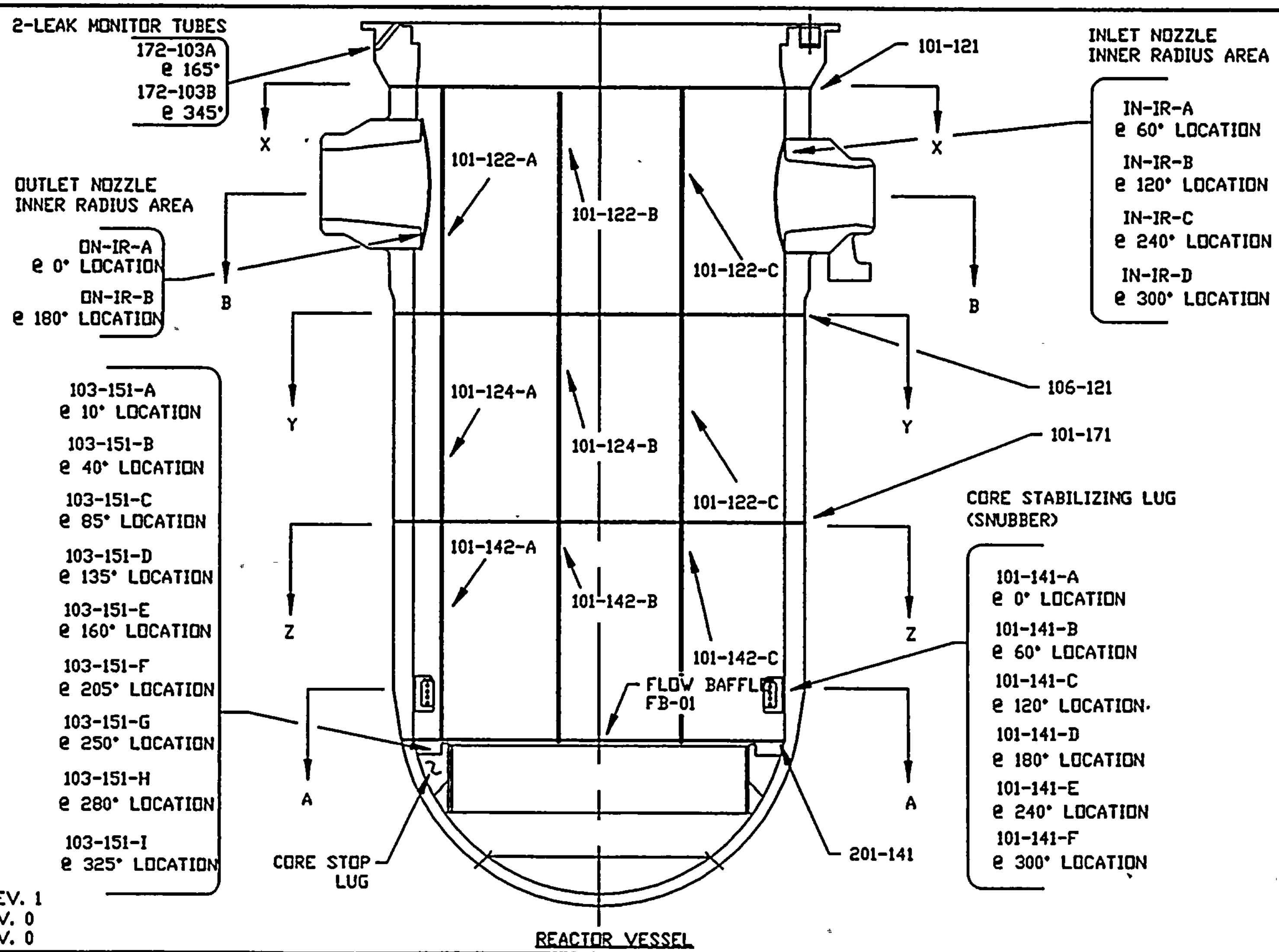
ATTACHMENT B
PERCENT OF EXAMINATION COVERAGE

Examination Area Identification	Beam Angle	Beam Direction	Percent Coverage	Figure No.	Description of Examination Coverage and Limitations
Lower Head-to-Lower Shell Circ. Weld No. 201-141	0° LAM 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 UP/DN UP/DN UP/DN CW/CCW CW/CCW CW/CCW	93% 100/86% 100/88% 100/84% 93% 93% 93% 93%	1	Examination of IWB-2500-3 E-F-G-H volume limited along length of weld below core barrel anti-rotation lugs. Claimed coverage is 93% overall
Lower Shell-to-Intermediate Shell Circ. Weld No. 101-171	0 LAM 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 UP/DN UP/DN UP/DN CW/CCW CW/CCW CW/CCW	92% 92% 92% 92% 85% 85% 85% 83%	1	Examination of IWB-2500-2 A-B-C-D volume limited along length of weld near vessel material specimen tubes. Claimed coverage is 88% overall
Upper Shell-to-Middle Shell Circ. Weld No. 106-121	0°LAM 45° 60° 50/70° 0°WRV 45°T 60°T 50/70°	 UP/DN UP/DN UP/DN CW/CCW CW/CCW CW/CCW	100% 100% 100% 100% 100% 100% 100% 100%	None None None None None None None None	IWB-2500-1 A-B-C-D- volume examined for 100% weld length without limitation. Claimed coverage is 100% overall
Intermediate Shell Long. Weld @15 Deg. No. 101-124A	0° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	100% 100% 100% 100% 100% 100% 100% 100%	None None None None None None None None	Examination of IWB-2500-2 A-B-C-D examined for 100% weld length without limitation. Claimed coverage is 100% overall

Examination Area Identification	Beam Angle	Beam Direction	Percent Coverage	Figure No.	Description of Examination Coverage and Limitations
Intermediate Shell Long. Weld @135 Deg. No. 101-124B	o° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	100% 100% 100% 100% 100% 100% 100% 100%	None None None None None None None None	Examination of IWB-2500-2 A-B-C-D examined for 100% weld length without limitation. Claimed coverage is 100% overall
Intermediate Shell Long. Weld @255 Deg. No. 101-124C	0° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	74% 100%/70% 100%/55% 100%/74% 100% 100% 100% 100%	1 & 5	Examination of IWB-2500-2 A-B-C-D volume limited from one side along length of weld near vessel material specimen tubes. Claimed coverage is 87% overall
Upper Shell Longitudinal Weld @15 Deg. No. 101-122A	0° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	95% 100%/96% 100%/96% 100%99% 97% 79% 74% 95%	1	Examination of IWB-2500-2 A-B-C-D volume was limited at intersection with the adjacent outlet nozzle integral extension. Claimed coverage is 92% overall
Upper Shell Longitudinal Weld @135 Deg. No. 101-122B	0° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	96% 100%/98% 100%/98% 100% 98% 87% 83% 97%	1	Examination of IWB-2500-2 A-B-C-D volume was limited at intersection with the adjacent inlet nozzle inner blend. Claimed coverage is 94% overall
Upper Shell Longitudinal Weld @255 Deg. No. 101-122C	0° Lam 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	96% 100%/98% 100%98% 100% 98% 87% 83% 97%	1	Examination of IWB-2500-2 A-B-C-D volume was limited at intersection with the adjacent inlet nozzle inner blend. Claimed coverage is 94% overall

Examination Area Identification	Beam Angle	Beam Direction	Percent Coverage	Figure No.	Description of Examination Coverage and Limitations
Lower Shell Longitudinal Weld @15 Deg. No. 101-142A	0° LAM 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	100% 100% 100% 100% 100% 100% 100% 100%	None None None None None None None None	Examination of IWB-2500-2 A-B-C-D examined for 100% weld length without limitation
Lower Shell Longitudinal Weld @135 Deg. No. 101-142B	0° LAM 45° 60° 50/70° 0° WRV 45°T 60°T 50/70°T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	100% 100% 100% 100% 100% 100% 100% 100%	None None None None None None None None	Examination of IWB-2500-2 A-B-C-D examined for 100% weld length without limitation
Lower Shell Longitudinal Weld @225 Deg. No. 101-142C	0° LAM 45° 60° 50/70° 0°WRV 45°T 60°T 50/70T	 CW/CCW CW/CCW CW/CCW UP/DN UP/DN UP/DN	87% 100%/85% 100%/77% 100%/87% 100% 100% 100% 100%	1 & 5	Examination of IWB-2500-2 A-B-C-D volume limited from one side along length of weld near reactor vessel material specimen tubes. Claimed coverage is 93% overall

ATTACHMENT C
EXAMINATION LIMITATION
DRAWINGS



NOTE:
SECTION A-A - SEE DWG. 02-001-B
SECTION B-B - SEE DWG. 02-001-B
SECTION X-X - SEE DWG. 02-001-C
SECTION Y-Y - SEE DWG. 02-001-C
SECTION Z-Z - SEE DWG. 02-001-C

2998-4395 REV. 1
E-71172-171-002 REV. 0
E-71172-171-008 REV. 0

REFERENCE DRAWINGS	NOTES	CALIBRATION BLOCKS AND MATERIAL		
E-71172-121-001 REV. 4 E-71172-124-001 REV. 5 E-71172-141-001 REV. 2 E-71172-141-002 REV. 6 E-71172-142-001 REV. 7 E-71172-151-001 REV. 5 E-71172-154-001 REV. 4		2-LEAK MONITOR TUBES AND FITTINGS (SB-166) UT-1, UT-2, UT-10	FPL	FLORIDA POWER & LIGHT ST. LUCIE UNIT 2
			TITLE: REACTOR PRESSURE VESSEL	
			DATE: 9/28/94 ELA	ZONE: 1
			ISI SKETCH	DRAWING NO: 02-001 / REVISION: 2

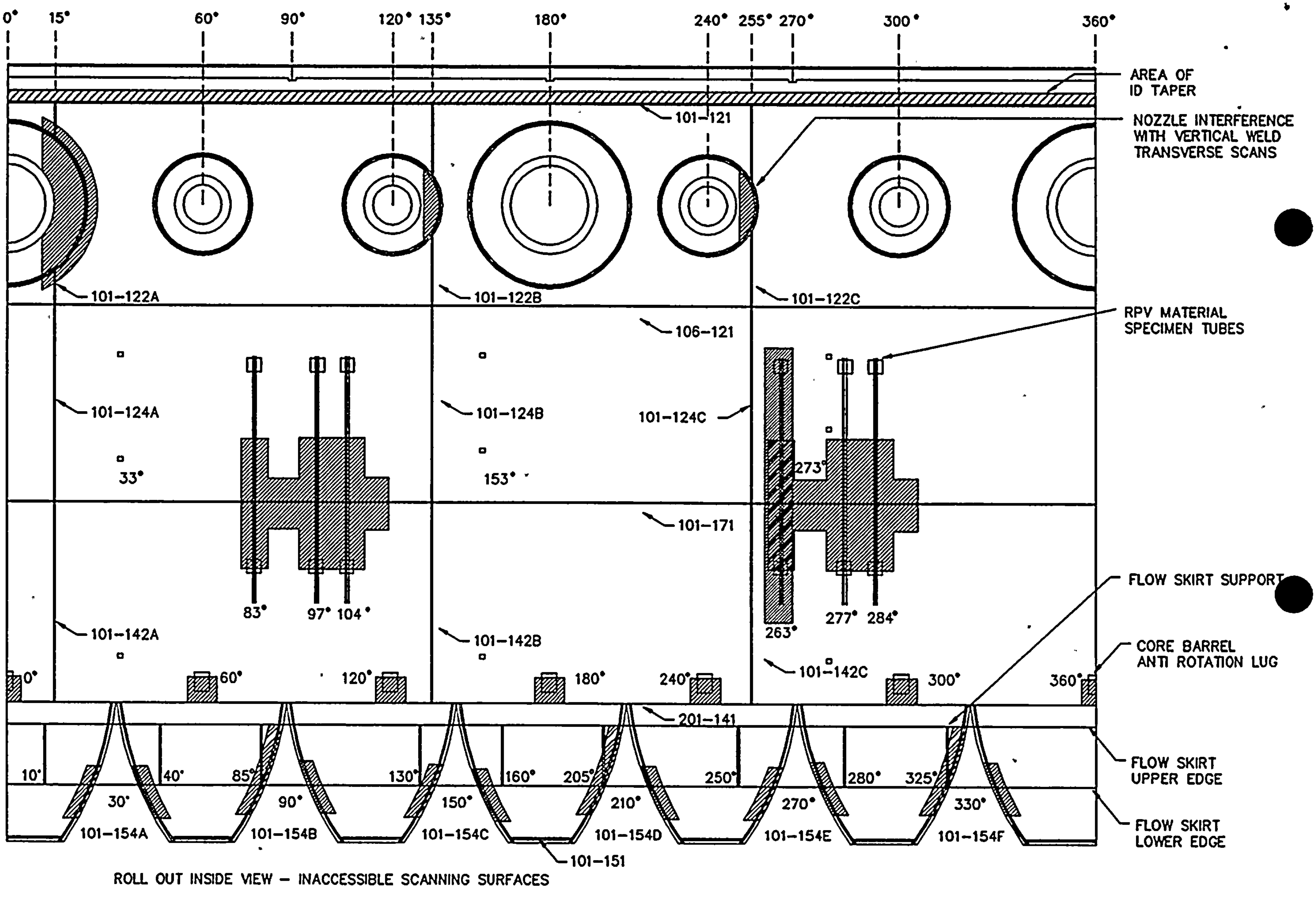


FIGURE 1.1 – REACTOR PRESSURE VESSEL ROLL OUT VIEW

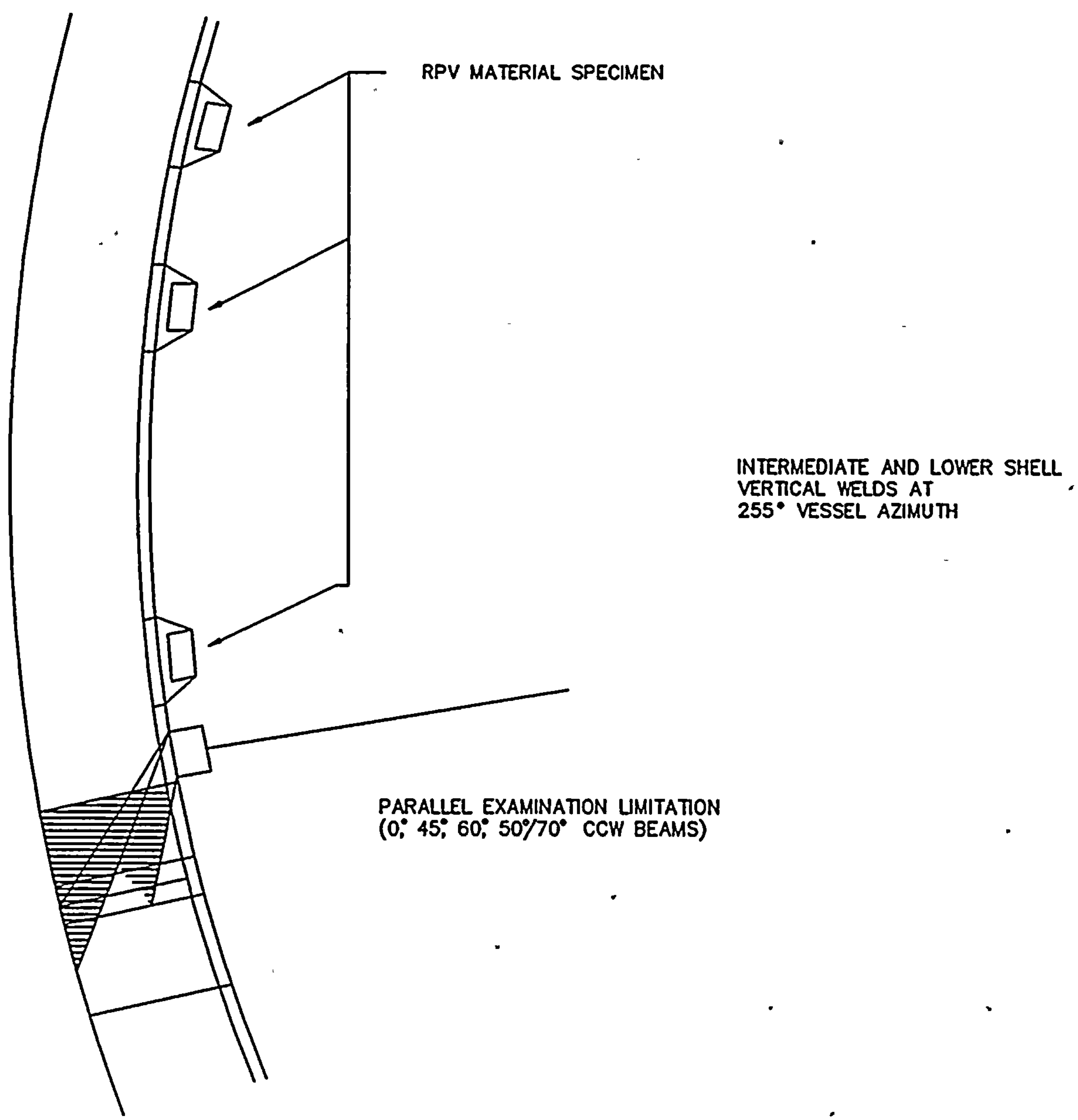


FIGURE 1.5 – VERTICAL WELD LIMITATIONS

END OF DOCUMENT