

EASTERN SERVICE
DEPARTMENT

LIMERICK NUCLEAR GENERATING STATION
UNIT #1

REGULATORY GUIDE 1.150
METHOD FOR COMPLIANCE

SUBJECT

No. LIM-UT-1 REV. 1 PAGE 1 OF 7

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1.0 SCOPE

- 1.1 The equipment certification methods described herein are applicable to both remote automatic and manual ultrasonic equipment when used to perform preservice examination of "Reactor Vessel Welds" at Limerick Unit #1.
- 1.2 In this procedure, "Reactor Vessel Welds" are those assembly welds in the Limerick RPV that are categorized as either BA or BD under the rules of ASME Section XI.

2.0 APPLICABLE DOCUMENTS, CODES, AND STANDARDS

- 2.1 Codes and Standards The following codes and standards form a part of this procedure to the extent specified herein.

- 2.1.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

- 2.1.1.1 Section V "Nondestructive Examination," 1980 Edition, Winter 1980 Addenda.

- 2.1.1.2 Section XI "Inservice Inspection of Nuclear Power Plant Components" 1980 Edition, Winter 1980 Addenda.

- 2.1.2 United States Nuclear Regulatory Commission (USNRC).

- 2.1.2.1 Regulatory Guide 1.150, Revision 1, February 1983, "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examination" * alternate method.

Note: In this procedure asterisk refers to sections of the alternate method.

3.0 PURPOSE

- 3.1 The purpose of this procedure is to assure that activities described herein are performed and that records specified by Reg. Guide 1.150 are generated, gathered, stored, and reported in a manner consistent with both Reg. Guide and General Electric Company Quality Assurance Requirements.
- 3.2 It is NOT the purpose of this procedure to provide definitive instructions to the operator of the analysis and recording equipment used to generate the required records. It is, however, a requirement of this procedure that all analysis and recording equipment used be operated in accordance with the manufacturer's recommendations.

4.0 METHOD(S) OF COMPLIANCE

The method(s) of compliance with Reg. Guide 1.150 are delineated in the sub-paragraphs that follow. Each sub-paragraph corresponds with a section of Reg. Guide 1.150 alternate method. *(Note that Sections 4 and 5 have been deleted from Revision 1 of Reg. Guide 1.150.)

4.1 Inspection System Performance Checks

4.1.1 Pre-Exam Performance Checks specified in Paragraph *1.1 will not be performed separately. These checks are identical to the checks required in 4.1.2 below, and the reliability of checks performed up to six months prior to the examination does not satisfy the quality assurance requirements of the General Electric Company.

4.1.2 Field Performance Checks specified in Paragraph *1.2 shall be performed before, during, and after the examination of Reactor Vessel welds as specified below.

4.1.2.1 RF Waveform and frequency amplitude information shall be recorded for each transducer involved with the examination. These records may be photographic, computer generated, or a combination of both. The reflector used to generate the required information shall be a calibration hole in one of the Owner's RPV calibration standards. Identification of the calibration standard and the reflector used shall be documented to allow future RF Waveform data to be gathered from the same reflector.

4.1.2.2 Screen Height Linearity Information shall be recorded daily during the first calibration performed on each ultrasonic examination system. The data shall be gathered in accordance with the requirements specified in the procedure being used during calibration. The record of screen height linearity shall be the calibration data sheet.

4.1.2.3 Amplitude Control Linearity Information shall be recorded daily during the first calibration performed on each ultrasonic examination system. The data shall be gathered and sensitivity set in accordance with the requirements specified in the procedure being used during calibration. The record of amplitude control linearity shall be the calibration data sheet.

4.1.2.4 Angle Beam Profile Characterization shall be performed for each transducer/wedge combination used to examine reactor vessel welds. The profiling shall be performed both before the search unit is used to examine the first weld and after the search unit is used to examine the last weld during the examination. The data shall be gathered in accordance with the requirements of the applicable examination procedure. The record of vertical beam profile determinations shall be per the requirements of the procedure(s) used during the examination.

4.2 Calibration

4.2.1 Calibration for Manual Examinations shall be performed in accordance with the applicable manual ultrasonic examination procedure. Calibration checks shall be performed at the intervals specified in the applicable examination procedure. The record of manual ultrasonic calibrations shall be the calibration data sheet.

4.2.2 Calibration for Mechanized Scanning shall be performed in accordance with the applicable remote ultrasonic examination procedure. Calibration checks shall be performed at the intervals specified in the applicable examination procedure. The record of remote ultrasonic calibrations shall be the calibration data sheet.

4.2.3 Calibration Confirmation shall be as specified in the applicable ultrasonic examination procedure (Ref.4.2.1 - 4.2.2).

4.2.4 Calibration Blocks used during the preservice examination of the Limerick Unit #1 Reactor Vessel Welds shall be those furnished by the Owner. Where possible, the same calibration block(s) should be used to perform successive RPV examinations. Where use of the same block(s) is not possible, the provisions of Section *2.4 shall apply.

4.3 Examination scope and extent shall be in accordance with Reference 2.1.1.2. The use of electronic gating is addressed in the applicable ultrasonic examination procedure(s).

4.3.1 Internal Surface examination requirements per Section *3.1 are demonstrated during each ultrasonic examination system angle beam calibration. The demonstration shall document the ability of the ultrasonic examination system to differentiate between an indication from "clad roll" and an indication from the ID notch in the calibration standard. The record of this demonstration shall be the calibration data sheet.

4.3.2 Scanning Weld-Metal Interface The ultrasonic examination procedures developed by General Electric for preservice inspection of the Limerick Unit #1 RPV utilize the ASME Section V Article 4 specified beaming angles of 0°, 45°, and 60°. These search unit angles are not based on weld preparation geometry; therefore, the ability of these beaming angles to detect an unfavorably oriented planar flaw must be demonstrated. The record of this demonstration will be included in the "Reporting of Results" required by Paragraph 4.5.

4.4 Recording and Sizing The capability of General Electric examination procedures to detect and size flaws during the Limerick Unit #1 preservice inspection must be demonstrated. The record of this demonstration will be included in the "Reporting of Results" required by Paragraph 4.5.

The procedures developed by General Electric for preservice inspection of the Limerick Unit #1 Reactor Vessel Welds require all data to be recorded to 20% DAC end points and, if the indication amplitude equals or exceeds 50% DAC, the 50% DAC data is also recorded. All data is recorded at scanning intervals of 1/4" or less. Determination of the adequacy of the recorded data and data evaluation will be made by a certified Level III individual other than the one performing the examination.

4.4.1 Geometric Indications All indications will be evaluated by a certified Level III individual. If Level III analysis of the data determines that the indication is geometric in nature, the basis for the determination will be described in the report of the examination.

4.4.2 Indications with Changing Metal Path All indications will be evaluated by a certified Level III individual. The Level III will determine the location, through-wall dimension, and proper DAC evaluation. No determinations need to be made by the examination teams since, by procedural requirements, all data shall be recorded if it equals or exceeds 20% DAC in amplitude.

4.4.3 Indications Without Changing Metal Path See explanation in 4.4.2 above. Also, see precautionary note in *6.3 C for consideration.

4.4.4 Evaluation of Indications All indications without changing metal path and all indications in the outer 75% of the RPV wall thickness shall be sized using 50% DAC end point data.

All indications with changing metal path in the inner 25% of the RPV wall thickness shall be sized using both 20% DAC and 50% DAC end point data. The determined size of these indications shall be the larger of:

a) Indication size determined using 50% DAC end point data,

- OR -

b) Indication size determined using 20% DAC end point data minus the predetermined 20% DAC beam spread.

4.5 Reporting of Results The records detailed in Section *7 become a part of the report of the preservice examination. Retention of these records is the responsibility of the Owner. Any indication that exceeds the allowable limits detailed in Section XI will be reported to the Owner in accordance with contractual and General Electric Quality Assurance Manual requirements. The reporting of any indication(s) indicative of "Abnormal Degradation of Reactor Pressure Boundary" is the responsibility of the Owner.

4.5.1 The best estimate of the tolerances (error band) in sizing flaws will be determined using standards developed by the General Electric Company for this purpose. The two blocks, (GE drawing 160-83C-17 for manual equipment and DP Block # for Automated equipment) together represent the range of thicknesses to be examined on the Limerick Unit #1 RPV. The data and engineering analyses used to develop these error bands will be included as a part of a report documenting the requirements of Section *7.

4.5.2 The effectiveness of the ultrasonic examination procedures will be demonstrated on the standards used for error band determinations (4.5.1 above). Documentation of these demonstrations will be included in the Section *7 report.

- 4.5.3 The actual volumes that have not been examined due to vessel configuration, such as nozzle interferences or volumes that are shadowed by vessel flaws, will be documented in the report of the examination. Volumes not effectively examined due to near field effects, cladding to base material interface, electronic gating, or opposite surface interferences will be determined using the standards discussed in Paragraph 4.5.1. Calculations for determination of these effects will be included in the Section *7 report.

The calculated effect of these items will be applied to the results of the preservice examination. Areas not examined (configuration) or not effectively examined (near field, etc.) will be reported to the Owner in accordance with contractual and General Electric Quality assurance Manual requirements. Any "Relief Requests" necessitated by these items will be the Owner's responsibility.

- 4.5.4 Sketches to clarify the effect of vessel configuration on the preservice examination of the Limerick Unit #1 RPV will be included in the report of the examination.
- 4.5.5 Sketches of mechanized scanning equipment with necessary reference points and dimensions will be furnished with the Section *7 report. These sketches will allow the Owner to follow the mechanized scanning equipment's indication location method.
- 4.5.6 Alternative volumetric examination, if used, will be documented, and the results of such examinations will be included in the report of the examination.

5.0 PERSONNEL

All calculations and reporting required by Reg. Guide 1.150 will be performed by a certified Level III individual. Data required to perform these calculations and evaluations may be gathered by either a certified Level II or a certified Level III individual.