

Guidelines for the Review of Revisions to Previously Qualified Procedures

OBJECTIVE:

Provide guidance to PDI personnel who are responsible for review and maintenance of procedures.

Instruction:

When reviewing procedures revisions against the essential variable checklist, it is necessary that you determine what level of requalification is necessary. The Code and the checklist provide general guidance. However there are many instances where the finale judgment may be in question. To assist in providing a degree of continuity among the Level III and managers performing these reviews, a list of examples are provided for guidance.

EXAMPLES:

The following are examples of procedures changes or revisions which warrant creating a new procedure (which would require qualification of the procedure and personnel), requalification of the procedure, or no requalification required:

Require A New Procedure and Candidate Re-Qualification

Changing from backwards scattering tip diffraction to forward scattering tip diffraction, i.e. time of flight

Scanning parallel to flaws rather than perpendicular as the primary detection scan

Changing from manual, semi-automatic, or automatic

Introducing an imaging technique, e.g. SAFT or Holography

Adding amplitude drop as an alternative sizing procedure

Changing sizing or detection algorithms to use principles not previously qualified

Requires Procedure Re-Qualification and no Candidate Re-Qualification

Changes in essential variables as defined by Appendix VIII IWA-2100

Changes in the Procedure Scope

Changes in the Calibration method

Change from a single element to dual element transducer

Change in propagation mode

Revising values used in sizing or detection algorithms, but still using the same principles, e.g. changing from .5 to .75 amplitude drop

No Re-Qualifications of Procedure or Personnel Required

Site specific requirements, e.g. couplant, data recording sheet,

Errata

Changes in variables not defined as essential

Clarifications

Changes to other procedure variables other than those specifically listed above will be evaluated by the PDA and could require further qualification of either the procedure or both the procedure and personnel.

MASTER GENERIC UT PROCEDURE REGISTRY / ESSENTIAL VARIABLE REVIEW

Procedure Title: PDI Generic Procedure for the Ultrasonic Examination of Ferritic Pipe Welds

PROCEDURE NUMBER	REV.	MASTER REGISTRY #.	SUMMARY OF CHANGES	PROCEDURE ESSENTIAL VARIABLE EVALUATION PERFORMED BY:	RE-QUALIFICATION REQUIRED
PDI-UT-1	1	PDI-UT-1-M1	N/A	Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
PDI-UT-1	2	PDI-UT-1-M2	N/A (Initial Procedure Qualification)	Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
PDI-UT-1	3	PDI-UT-1-M3	See Attached Summary	Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PDI-UT-1	4	PDI-UT-1-M4	See Attached Summary	Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
PDI-UT-1	5	PDI-UT-1-M5	See Attached Summary	Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
PDI-UT-1	A	PDI-UT-1-M6	See Attached Summary	Signature: Attached Letter of Explanation: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
				Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO
				Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO
				Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO
				Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO
				Signature: Attached Letter of Explanation: <input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO

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April 12, 1996

Subject: Acceptance of the PDI Generic Ultrasonic Procedures

During 1994 and 1995, the EPRI NDE Center (Performance Demonstration Administrator) was involved in the process of administering procedure and personnel qualifications in accordance with the requirements of ASME, Section XI, Appendix VIII as modified by the PDI Program Description Document, Rev. 0, issue date September 14, 1994. Those activities have also included the qualification of the PDI Generic Ultrasonic procedures. The following is a list of PDI Generic Piping and Bolting procedures that have undergone an extensive qualification process:

- PDI-UT-1, Rev. A PDI Procedure for the Ultrasonic Examination of Ferritic Piping Welds.
- PDI-UT-2, Rev. A PDI Procedure for the Ultrasonic Examination of Austenitic Piping Welds.
- PDI-UT-3, Rev. A PDI Generic Procedure for Ultrasonic Through Wall Flaw Sizing in Pipe Welds
- PDI-UT-4, Rev. A PDI Generic Procedure for Ultrasonic Examination of Studs and Bolts from the Bore
- PDI-UT-5, Rev. A PDI Generic Procedure for Ultrasonic Examination of Studs and Bolts.

All of the above listed procedures have been reviewed and the qualification demonstrations witnessed to our satisfaction. We have determined that all of the procedures were qualified in accordance with the ASME Code, Section XI, Appendix VIII, 1992 Edition, 1993 Addenda and exceptions as stated in the PDI Program Description Document.

We have further determined that the qualification process administered by the Performance Demonstration Administrator, for the above listed procedures, meets the requirements of IWA-2240. The results of the qualification process has demonstrated that the methods described in the generic ultrasonic procedures are equivalent or superior to those specified in the ASME Code, Section XI, Division 1.

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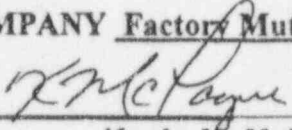
PDI-UT-4, Rev. A PDI Generic Procedure for Ultrasonic Examination of Studs and Bolts from the Bore

The above listed procedure has been reviewed and the qualification demonstrations witnessed to our satisfaction. We have determined that the procedure was qualified in accordance with the ASME Code, Section XI, Appendix VIII, 1992 Edition, 1993 Addenda and exceptions as stated in the PDI Program Description Document.

We have further determined that the qualification process administered by the Performance Demonstration Administrator, for the above listed procedure, meets the requirements of IWA-2240. The results of the qualification process has demonstrated that the methods described in the generic ultrasonic procedure are equivalent or superior to those specified in the ASME Code, Section XI, Division 1.

AIA REVIEW COMPANY Factory Mutual Engineering

Reviewed By: _____


Kevin M. McTague

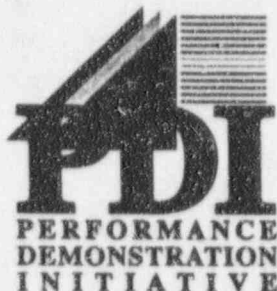
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- PDI-UT-1, Rev. A PDI Procedure for the Ultrasonic Examination of Ferritic Piping Welds.**
- PDI-UT-2, Rev. A PDI Procedure for the Ultrasonic Examination of Austenitic Piping Welds.**
- PDI-UT-3, Rev. A PDI Generic Procedure for Ultrasonic Through Wall Flaw Sizing in Pipe Welds**
- PDI-UT-5, Rev. A PDI Generic Procedure for Ultrasonic Examination of Studs and Bolts.**

All of the above listed procedures have been reviewed and the qualification demonstrations witnessed to our satisfaction. We have determined that all of the procedures were qualified in accordance with the ASME Code, Section XI, Appendix VIII, 1992 Edition, 1993 Addenda and exceptions as stated in the PDI Program Description Document.

We have further determined that the qualification process administered by the Performance Demonstration Administrator, for the above listed procedures, meets the requirements of IWA-2240. The results of the qualification process has demonstrated that the methods described in the generic ultrasonic procedures are equivalent or superior to those specified in the ASME Code, Section XI, Division 1.

AIA REVIEW COMPANY Factory Mutual Engineering

Reviewed By: _____

A handwritten signature in dark ink, appearing to read 'Timothy B. Rhodes'.

Timothy B. Rhodes

Title: ISI Supervisor

Procedure / Code Comparison Breakdown of Essential Variable Implementation Compliance

The following table applies to PDI Generic procedure **PDI-UT-1, Revision A** which is for the manual ultrasonic examination of ferritic pipe welds. The first column breaks down the defined essential variables listed in Section XI, Appendix VIII-2100 of the ASME Code into related group items which are required to be addressed by the procedure. The second column list the procedure section(s) and paragraph(s) where the required implementation is addressed. The third column contains pertinent notes, comments, and/or observations which enhance or clarify the preceding text.

ASME Section XI, Appendix VIII 2100 - Procedure requirements	Procedural Implementation Section and paragraph	PDA Notes, Comments, and Observations
(a) The examination procedure shall contain a statement of scope that specifically defines the limits of procedure applicability (e.g. materials, thickness, diameter, product form).	Section 1.0 - Scope Paragraphs 1.1 through 1.5	This procedure specifically applies to Ferritic steel piping welds that range from 4.0" to 50" in diameter and have a nominal thickness range of .337" to 3.85"
(b) The examination procedure shall specify a single value or a range of values for the variables listed in VIII-2100 (d).	See the referenced procedure section(s) and paragraph(s) listed below for each of the specific essential variables designated for procedure implementation	Takes in to account the minimum and maximum values designated for the essential variable items defined in the 10 subparagraphs under paragraph (d) in VIII-2100
(c) Any calibration method may be used provided it is described and complies with VIII-2100(d)(5)	Section 5.0 - Calibration Paragraphs 5.1 through 5.9	Initial linear screen calibrations and calibration confirmation checks are described
(d) The examination procedure shall specify the following essential variables:	See the referenced procedure section(s) and paragraph(s) listed below for each of the specific essential variables designated for procedure implementation	Takes in to account the items listed in the 10 subparagraphs (1 through 10) under paragraph (d) in VIII-2100
(1) System, including manufacturer and model or series of pulser, receiver, and amplifier.	Section 4.0 - Equipment Paragraph 4.2 Table 1 & 2 attachments	An Analog-to-Digital converter , if present, and Pulser/Receiver units are internal hardware components of manual ultrasonic scopes and are not interchanged or replaced by the operator before, during, or after examinations. Therefore the scope manufacturer and model designations meet the intent of the code for manual ultrasonic equipment. Any ultrasonic scope may be used with this procedure provided it is qualified during a successful PDI performance demonstration or meets the requirements of ASME Section XI, Article VIII-4000. Options for previously qualified ultrasonic equipment are designated by manufacturer and model in Tables 1 & 2 which are living documents attached to this procedure.

(2) search units, including:

See the referenced procedure section(s) and paragraph(s) listed below for each of the specific essential variables designated for procedure implementation

See comments directly below related to center frequency and bandwidth or wave form duration; size, shape, and number of elements and wedges required for procedure designated search units

(a) center frequency and either bandwidth or wave form duration as defined in VIII-4000

Section 4.0 - Equipment
Paragraph 4.1
subparagraphs 4.1.4 and 4.1.5

Table 1 Attachment

Transducers must have a bandwidth greater than 30% and have the procedure designated nominal frequency based on mode of propagation with considerations for component thickness. See procedure Table 1 for the list of search units which have been qualified through demonstration

(b) mode of propagation and nominal inspection angles:

Section 4.0 - Equipment
Paragraph 4.1
subparagraphs 4.1.1, 4.1.2, 4.1.8 and 4.1.9

Table 1 Attachment

This procedure designates 45° as the primary detection and length sizing search unit angle. A 60° angle shall be used when geometric conditions prohibit the effective use of the 45° angle. A 70° angle shall be used when geometric conditions prohibit the effective use of the 60° angle. When scanning in the circumferential direction, the examination angle must be equal to or less than the inverse sine of the nominal ID divided by the nominal OD. Refracted longitudinal wave search units may also be used in lieu of or as supplemental confirmation of the shear wave exam. See procedure Table 1 for the list of search units which have been qualified through demonstration

(c) number, size, shape and configuration of active elements and wedge or shoes:

Section 4.0 - Equipment
Paragraph 4.1
subparagraphs 4.1.1, 4.1.2, and 4.1.6

Table 1 Attachment

This procedure is limited to single element, round, square, or rectangle shear wave and dual element, square or rectangle refracted longitudinal wave search units, with specific sizes designated for specific pipe diameter ranges. See procedure Table 1 for the list of search units which have been qualified through demonstration

ASME Section XI, Appendix VIII
2100 - Procedure requirements

Procedural Implementation
Section and paragraph

PDA Notes, Comments,
and Observations

(3) search unit cable, including:	See the referenced procedure section(s) and paragraph(s) listed below for each of the specific essential variables designated for procedure implementation	See comments directly below related to type, length, and connectors.
(a) type	Section 4.0 - Equipment Paragraph 4.4	RG-58 and RG-174 are the only cable types allowed by this procedure
(b) maximum length	Section 4.0 - Equipment Paragraph 4.4	Procedure allows a maximum of 25 feet
(c) maximum number of connectors	Section 4.0 - Equipment Paragraph 4.4	Procedure allows a maximum of 1 intermediate connector.
(4) detection and sizing techniques, including:	Section 6.0 - Examination Paragraphs 6.2 through 6.4	The detection and length sizing techniques employed are detailed throughout the Examination section of the procedure. Certain recording and evaluation criteria must be considered as technique related and implemented during the detection phase of the examination process.
	Section 7.0 - Recording of Reflectors Paragraphs 7.4 and 7.5	
	Section 8.0 - Evaluation Paragraphs 8.1 through 8.7	
(a) scan pattern and beam directions;	Section 6.0 - Examination Paragraph 6.3 subparagraphs 6.3.1, 6.3.2, 6.3.4, and 6.3.5	Procedure designates axial and circumferential scans with $\pm 20^\circ$ oscillation and bi-directional coverage of the required examination volume from both sides if possible and one side as a minimum for the detection of flaws parallel and perpendicular to the weld. The minimum scan pattern overlap must be 10% of the search unit element size. If oscillation is not possible the scan overlap must be increased to 50% of the search unit element size.
(b) maximum scan speed;	Section 6.0 - Examination Paragraph 6.3 subparagraph 6.3.3	Procedure allows a maximum of 3" per second
(c) minimum and maximum pulse repetition rate;	Section 5.0 - Calibration Paragraph 5.4 subparagraph 5.4.2	The pulse repetition rate setting on all instruments shall be the highest option available with one exception, Staveley's Sonic 137. The procedure designated pulse repetition rate equipment settings for all qualified instruments are listed in Table 2

(d) minimum sampling rate.

This is not an essential variable for manual examination procedures

The Sampling rate is not an applicable essential variable for examinations performed with typical manual ultrasonic scopes with analog A-scan displays. Since the digitizing rate which usually equates to the sampling rate is an internal system function of some scopes and is only used to store select A-scan signal presentation images as snap shots in time, there is no need to address this item as an essential variable within a manual ultrasonic procedure.

(e) extent of scanning and action to be taken for access restrictions;

Section 6.0 - Examination
Paragraphs 6.3 and 6.4
subparagraphs 6.3.1, 6.3.2, 6.3.4, and 6.3.5

By procedure the required examination volume is to be scanned with the sound beam directed perpendicular and parallel to the weld from both sides if possible and any limitations must be recorded, reported, and dealt with using alternative techniques in a manner which will allow as much of the required exam volume as possible to be examined. Single side access conditions were present on selected samples during the procedure / personnel demonstration qualification

(5) methods of calibration for detection and sizing (e.g., actions required to insure that the sensitivity and accuracy of the signal amplitude and time outputs of the examination system, whether displayed, recorded, or automatically processed, are repeated from examination to examination)

Section 5.0 - Calibration
Paragraphs 5.1 through 5.9

By procedure after the search unit beam angle and index point are checked and recorded, an initial linear screen calibration must be performed, followed by the establishment of an 80% FSH signal response reference sensitivity using a notch in the designated calibration block, prior to the start of any examination. Calibration shall include the complete ultrasonic system and any change in search units, cables, ultrasonic instruments, or any other part of the examination system shall be cause for a calibration check. Reference blocks are allowed for calibration checks.

ASME Section XI, Appendix VIII 2100 - Procedure requirements	Procedural Implementation Section and paragraph	PDA Notes, Comments, and Observations
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(6) inspection and calibration data to be recorded.

Section 5.0 - Calibration
Paragraphs 5.3, 5.7, and 5.9

Section 6.0 - Examination
Paragraph 6.2 and 6.4
subparagraph 6.2.4

Section 7.0 - Recording of Reflectors
Paragraphs 7.1 through 7.5

Section 8.0 - Evaluation of Recorded
Indications
Paragraph 8.5

Section 9.0 - Reports
Paragraphs 9.1 through 9.3

The procedure requires that specific Calibration and Examination **data forms** must be completely filled out for each examination as per the recording criteria in Section 9.0.

(7) method of data recording.

Section 5.0 - Calibration
Paragraphs 5.3, 5.7, and 5.9

Section 6.0 - Examination
Paragraphs 6.2 and 6.4
subparagraph 6.2.4

Section 7.0 - Recording of Reflectors
Paragraphs 7.1 through 7.5

Section 8.0 - Evaluation of Recorded
Indications
Paragraph 8.5

Section 9.0 - Reports
Paragraphs 9.1 through 9.3

The procedure requires that specific Calibration and Examination **data forms** must be filled out completely for each examination. Some of the UT scopes qualified and designated for use with this procedure have an internal function which allows the system to digitize and store select A-scan signal presentation images to an internal drive memory which can be printed out at the operators convenience to enhance the report documentation.

(8) recording equipment (e.g., strip chart, analog tape, digitizing) when used;

This is not an essential variable for manual examination procedures

Some of the qualified UT scopes designated for use with this procedure have an internal function which allows the system to digitize and store select A-scan signal presentation images to an internal drive memory. These snap shots in time may be printed out at the operators convenience to enhance documentation, but since these printouts are not used in the evaluation process, the internal Analog-to-Digital converter hardware in this type instrument is not considered to be essential variable recording equipment.

**ASME Section XI, Appendix VIII
2100 - Procedure requirements**

**Procedural Implementation
Section and paragraph**

**PDA Notes, Comments,
and Observations**

(9) method and criteria for the discrimination of indications (e.g., geometric versus flaw indications and for length and depth sizing of flaws);

Section 8.0 - Evaluation of Recorded Indications
Paragraphs 8.1 through 8.7

Indications are divided into two categories [**geometric or flaw (non-geometric)**] based on the basic discrimination evaluation criteria stated in the procedure

(10) surface preparation requirements.

Section 1.0 - Scope
Paragraph 1.3

Section 6.0 - Examination
Paragraphs 6.1, 6.3, and 6.4
subparagraph 6.3.5

The procedure states that examinations will be performed from the outside diameter surface of the piping component to be examined with a surface free of irregularities, loose material, or any other extraneous matter which might inhibit the transmission of ultrasonic energy.

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Reviewed By: Timothy B. Rhodes Date: 4-17-96

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