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NDE Procedures

Suction Scrubber

(VS-Z6001)

Customer: BPXA / WP

Project: WRDX GPP

PO / Job No.: 10741230-0019

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ProSep TECHNOLOGIES, Inc.

ACCURATE NDE & INSPECTION, LLC

ULTRASONIC EXAMINATION ASME GENERAL PROCEDURE

ACC-UT-01-GEN

WorleyParsons resources & energy

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R. K — REVIEWED BY

2/26/08 — DATE

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1.1.6.2

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1.0 **Scope:**

1.1 This document shall govern the procedure used by Accurate NDE & Inspection, LLC personnel for the ultrasonic examination of full penetration welds and for ultrasonic thickness measurements in accordance with ASME codes, including B31.3, and in accordance with other codes, specifications, or contract requirements that specify ASME Section V for ultrasonic examination procedures.

1.2 Weld examination and thickness measurements shall be performed on unclad ferritic wrought (rolled, drawn, forged, or extruded) materials.

1.3 Weld examination shall include the detection, location, and evaluation of ultrasonic reflectors within the weld, heat affected zone, and adjacent material. This procedure shall be used for examination of ferritic welds in ferritic pipe and for welds in ferritic forms other than pipe.

2.0 **General:**

2.1 These are general procedures applicable to most examinations described in 1.0. Accurate NDE & Inspection, LLC supplemental procedures for particular cases shall be supplied as required. Specific requirements in these general procedures may be superseded by the supplemental procedures.

2.2 Acceptance criteria and extent of examinations shall be specified by customer.

3.0 **Reference Documents:**

The following documents are referenced and form a part of these procedures as applicable:

1. ASME BOILER AND PRESSURE VESSEL CODE, SECTION V
2. ASNT Recommended Practice for Nondestructive Testing Personnel Qualification and Certification SNT-TC-1A
3. Accurate NDE & Inspection, LLC WRITTEN PRACTICE (ACC-WP-01)
4. Accurate NDE & Inspection, LLC NONDESTRUCTIVE EXAMINATION LABORATORY PROCEDURES (ACC-LP-01)
5. Accurate NDE & Inspection, LLC SUPPLEMENTAL PROCEDURES

4.0 **Personnel:**

Ultrasonic examination personnel shall be minimum NDE Level II qualified and certified in accordance with Accurate NDE & Inspection, LLC WRITTEN PRACTICE ACC-WP-01, which complies with ASNT Recommended Practice SNT-TC-1A.

5.0 **Techniques:**

5.1 A combination of angle beam shear wave and straight beam longitudinal wave shall be used for weld examination.

5.2 Straight beam longitudinal wave shall be used for thickness measurement.

5.3 The manual contact method shall be used for both weld examinations and thickness measurements.

6.0 **Instrumentation and Equipment:**

6.1 Ultrasonic instrumentation used shall be Krautkramer Branson models USK-6, USK-7, USL-38, or USM-2. Acceptable instrumentation screen height linearity shall be within plus or minus 5% of the full screen height for 20% to 80% of the calibrated screen height. Acceptable instrumentation amplitude control accuracy shall be within plus or minus 20% of the nominal amplitude ratio over its useful range. Screen height linearity and amplitude control linearity shall be evaluated at least once every 3 months, upon repair, or at the beginning of each period of extended use, whichever is less. Instrumentation not conforming shall be corrected or replaced.

6.2 Angle beam shear wave transducers shall be single element from 5/8" to 1" wide and from 5/8" to 13/16" high with a maximum ratio of width to height of 1.2 to 1.0 and a minimum ratio of 1.0 to 1.0 coupled to either 45, 60, or 70 deg. lucite wedges. Transducer frequency, nominal angle, and ultrasound exit point shall be clearly marked on each search unit. Acceptable angled beam wedge angle shall be accurate within plus or minus 2 deg. Angle beam profiles shall be determined and the 6 db beam boundary noted on a plotting card for each transducer.

6.3 Angle beam transducers shall be used on material 5/16 in. thick and thicker.

6.4 Straight beam longitudinal wave transducers may be either single or dual element and shall have an active area of 1/2" to 1" sq. Single element straight beam may be used for any thickness range provided an appropriate frequency is selected. Use of dual element straight beam transducers shall be limited to materials thicker than 1/8 in. thick.

6.5 Nominal transducer frequency shall be 2.25 MHz unless variables require the use of other frequencies to assure adequate penetration or better resolution.

6.6 Cellulose based couplant shall be used on material tested. An oil couplant shall be used between transducers and wedges.

7.0 Surface Preparation:

The scanning surfaces shall be free of all scale, coating, excessive roughness, weld spatter, or other conditions that may interfere with ultrasound transmission into the metal. Unless other arrangements are made prior to examination, surface preparation shall be the fabrication contractor's responsibility.

8.0 Use of Automatic Alarm and Recording Equipment:

Use of automatic alarms are not required in the examinations described in this procedure. Recording shall be done manually. Extent and nature of data recorded shall be as specified by customer.

9.0 Rotating, Revolving, or Scanning Mechanisms:

Use of these mechanisms is not required in the examinations described in this procedure.

10.0 Angle Beam Calibration:

10.1 Basic calibration blocks for examination of both ferritic welds in ferritic pipe and welds in ferritic forms other than pipe shall conform to the requirements of T-434 of ASME Section V.

10.2 Sweep range, or distance, calibration shall be accomplished as follows with a CRT screen overlay marked in 10 divisions of the sweep line:

10.2.1 The search unit shall be placed on the appropriate calibration block directed to the 1/4 thickness side-drilled hole and the indication shall be maximized. Using the delay control, the instrument shall then be adjusted to position the left edge of the indication at sweep line 1 on the CRT.

10.2.2 The search unit shall then be directed to the 3/4 thickness side-drilled hole and the indication maximized. Using the range control, the instrument shall then be adjusted to position the left edge of the indication at sweep line 3 on the CRT.

10.2.3 Use of the delay and range controls shall be repeated as needed until the 1/4 thickness and 3/4 thickness holes maximized indications start at sweep lines 1 and 3, respectively.

10.2.4 The search unit shall then be directed to one of the notches from the opposite side of the block and the indication maximized. Sweep range calibration shall be considered accurate if the indication starts at sweep line 4. Should calibration be inaccurate, the steps above shall be repeated as necessary to produce accurate calibration.

10.2.5 One division on the sweep line shall equal 1/4 thickness of the calibration block.

10.3 Distance-Amplitude Correction (DAC) is not required when the examination is in 1/2 V-path or less in material less than 1 in. thick, in which case the amplitude level from a single reflector shall be used.

10.4 Where DAC is required for angle beam examination, DAC shall be established as follows:

10.4.1 Sweep range calibration shall first be performed as described in 10.2.

10.4.2 The search unit shall be placed on the appropriate calibration block directed to the 1/4 thickness side-drilled hole and the indication shall be maximized. The indication should appear at sweep line 1. Using the sensitivity control, the instrument shall then be adjusted to attain an 80% (plus or minus 5% of full screen height) of full screen height indication from the hole. The peak of the indication shall then be marked on the CRT screen overlay. Once this initial sensitivity has been set, it shall not be adjusted during the remainder of DAC curve construction.

10.4.3 The search unit shall then be directed to the 1/2 thickness hole and the indication maximized. The indication should appear at sweep line 2. The peak of the indication shall be marked on the CRT screen overlay.

10.4.4 The search unit shall then be directed to the 3/4 thickness hole and the indication maximized. The indication should appear at sweep line 3. The peak of the indication shall be marked on the CRT screen overlay.

10.4.5 The search unit shall then be directed to the 3/4 thickness hole with the beam bouncing from the opposite surface before obtaining an indication from the hole and the indication maximized. The indication

should appear at sweep line 5 and shall represent 5/4 thickness. The peak of the indication shall be marked on the CRT screen overlay.

10.4.6 The marks resulting from the indication peaks shall then be connected to provide the DAC curve.

10.5 For calibration correction for perpendicular reflectors at the opposite surface, the search unit shall be positioned to attain a maximized indication from the notch on the opposite surface and the peak of the indication shall be marked. The indication should appear at sweep line 4. The indication from the notch shall be considered when evaluating reflectors from the opposite surfaces.

10.6 Electronic distance-amplitude correction devices shall not be used with this procedure.

11.0 Straight Beam Calibration:

11.1 Calibration blocks for thickness measurement shall provide at least 2 calibration thicknesses covering the thickness range to be measured. A combination of blocks may be used for this calibration.

11.2 Sweep range, or distance, calibration for thickness measurements shall be accomplished as follows with a CRT screen overlay marked in 10 divisions of the sweep line:

11.2.1 The search unit shall be placed on an appropriate calibration block with a thickness at least half, but no more then the full anticipated thickness of the material to be examined. Using the delay and range controls, the instrument shall be adjusted to position the left edges of the indications at sweep lines 4 and 8 on the CRT.

11.2.2 One division on the sweep line shall equal 1/4 thickness of the calibration block.

11.2.3 Calibration accuracy shall be confirmed by placing the search unit on an appropriate calibration block ranging from 1/4 to full anticipated thickness of the material to be examined and noting indication location(s) on the sweep line. Should indication location(s) prove inaccurate calibration, steps described in 11.2.1 shall be repeated. Calibration accuracy shall then be confirmed as described in this paragraph.

11.3 Calibration blocks for straight beam examination of base metal to detect reflectors that may affect sound travel of angle beams shall conform to the requirements of T-534 of ASME Section V except that material curvature shall not be a factor in choosing a specific block when examining from the convex surface.

11.4 Sweep range, or distance, calibration for scanning base metal to detect reflectors that may affect sound travel of angle beams shall be accomplished as follows using a CRT screen overlay marked in 10 divisions of the sweep line:

11.4.1 The search unit shall be placed on the appropriate calibration block directed to the 1/4 thickness side-drilled hole and the indication shall be maximized. Using the delay control, the instrument shall then be adjusted to position the left edge of the indication at sweep line 2 on the CRT.

11.4.2 The search unit shall then be directed to the 3/4 thickness side-drilled hole and the indication maximized. Using the range control, the instrument shall then be adjusted to position the left edge of the indication at sweep line 6 on the CRT.

11.4.3 Use of the delay and range controls shall be repeated as needed until the 1/4 thickness and 3/4 thickness holes maximized indications start at sweep lines 2 and 6, respectively.

11.4.4 Two divisions on the sweep line shall equal 1/4 thickness of the calibration block.

11.5 Where DAC is required for straight beam examination, DAC shall be established as follows:

11.5.1 Sweep range calibration shall first be performed as described in 11.4.

11.5.2 The search unit shall be placed on the appropriate calibration block directed to the 1/4 thickness side-drilled hole and the indication shall be maximized. The indication should appear at sweep line 2. Using the sensitivity control, the instrument shall then be adjusted to attain an 80% (plus or minus 5% of full screen height) of full screen height indication from the hole. The peak of the indication shall then be marked on the CRT screen overlay. Once this initial sensitivity has been set, it shall not be adjusted during the remainder of DAC curve construction.

11.5.3 The search unit shall then be directed to the 1/2 thickness hole and the indication maximized. The indication should appear at sweep line 4. The peak of the indication shall be marked on the CRT screen overlay.

11.5.4 The search unit shall then be directed to the 3/4 thickness hole and the indication maximized. The indication should appear at sweep line 6. The peak of the indication shall be marked on the CRT screen overlay.

11.5.5 The marks resulting from the indication peaks shall then be connected and extended through the thickness to provide the DAC curve.

11.6 Electronic distance-amplitude correction devices shall not be used with this procedure.

12.0 Calibration Check Intervals:

12.1 Sensitivity and distance calibration checks shall be performed just prior to and at the finish of each examination or series of similar examinations. Similar examinations shall be defined as those for which equipment, system calibration, and calibration block requirements are identical.

12.2 Calibration checks shall also be performed after change of ultrasonic technicians, 4 hour maximum time intervals, or when electrical circuitry is disturbed in any way including transducer change, battery change, electrical outlet change, coaxial cable change, or power outage.

12.3 Additionally, calibration checks shall be performed at any time the technician doubts calibration accuracy.

12.4 If, upon checking calibration, a point on the DAC curve has moved on the sweep line more than 10% of the sweep reading or 5% of full sweep, whichever is greater, and/or if a point on the DAC curve has increased 20% or 2 dB of its amplitude, then all examinations made since the last calibration or calibration check shall be voided, a new calibration shall be made, and voided examinations shall be reexamined with the corrected calibration.

13.0 Scanning:

13.1 Straight and angle beam scanning shall be performed at a gain setting of at least two times the primary reference level. Evaluation of reflectors shall be performed with respect to the primary reference level.

13.2 Scanning passes shall overlap a minimum of 10% of the transducer width. Scanning speed shall not exceed 6" per second.

13.3 Prior to angle beam scanning, the entire scanning area of the base metal shall be scanned with a straight beam to establish actual metal thickness and to detect possible laminar type reflectors and/or attenuation variations that could interfere with sound wave propagation. Areas and locations containing such reflectors shall be recorded. Wedge angles and scanning techniques used during testing shall be selected so as to allow full examination of welds in these areas.

13.4 The weld metal, also, shall be scanned with a straight beam where possible.

13.5 For angle beam scanning for reflectors oriented parallel to the weld, welds shall be scanned with the angle beam directed at approximately right angles to the weld axis. Scanning shall be performed in a zig-zag path at least 1-1/4 times the skip distance with a minimum 10 deg. rotational movement of the probe.

13.6 For angle beam scanning for reflectors oriented transverse to the weld, the search unit shall be directed essentially parallel to the weld axis. Scanning shall be performed in a zig-zag path at least 1-1/4 times the skip distance with a minimum 10 deg. rotational movement of the probe. Examination shall then be repeated from the opposite direction.

13.7 Wedge angles shall be chosen to accomplish full coverage of the intended area. Additionally, angles shall be used that are nearest perpendicular to the anticipated fusion faces. This will normally require scanning with more than a single angle.

13.8 Scanning shall be performed such that the full weld volume and fusion zones are completely examined. Welds shall be scanned from all surfaces of material and both sides of welds wherever possible. It is intended that, as a minimum, scanning shall be performed such that the full weld volume and heat-affected zones are scanned in two crossing directions wherever possible. Branch connections shall be scanned from the branch, or bevelled member, from both surfaces in legs I and II wherever possible. Butt welds shall be scanned from all practical surfaces of material and sides of welds and shall also be examined in legs I and II wherever possible.

14.0 Post Examination Cleaning:

Due to use of cellulose based couplant, fabrication operations such as surface preparation for coating following examination shall normally suffice for cleaning. Should other cleaning be required, the fabrication contractor shall be responsible for cleaning unless other arrangements are made prior to examination.

15. Report
This procedure requires to be signed by authority
or NDT of the company