SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

Automated Ultrasonic Testing Procedure for Pipeline Welds

General Procedure

Shaw Pipeline Services Project # 883

Client:	**Pacific Gas and Electric**
Contractor:	**TBD**
Owner:	**Pacific Gas and Electric**
Project Name:	**Line 114 24"**
Location:	**Brentwood, CA**
Specifications and References:	**DNV-OS-F101, API 1104 20th Edition.**
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ASNT Level III #:	**203440**

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Revision Record

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1. SCOPE

This document describes the methods and procedures Shaw Pipeline Services (SPS) follows when performing ultrasonic non-destructive testing of SMAW girth welds. This section describes the inspection methodology in general terms and includes the SPS statement on HSE.

1.1 DEFINITIONS

SPS uses the terms Flowline (FL) and Steel Catenary Riser (SCR) as a way to differentiate between types of Automatic Ultrasonic Testing (AUT) inspection in terms of calibration block tolerances, AUT setup requirements, operator skills, and parent material variations.

1.1.1 FL

This is not specific to flowlines. FL in SPS terms is an AUT inspection for welds that are not fatigue sensitive.

2. METHOD OF TESTING

The inspection will be accomplished with a mechanized system utilizing pulse-echo and/or pitch-catch techniques with an ultrasonic "A" scan presentation. A separate Time of Flight Diffraction (TOFD) channel will also be used.

The system will include a fully automatic recording system to indicate the location of imperfections and the effectiveness of acoustic coupling.

Shaw Pipeline Services (SPS) shall supply the Client with a hard copy of each weld inspected, and will include a judgment of acceptability.

3. INSPECTION SYSTEM DESCRIPTIONS

3.1 ULTRASONIC INSTRUMENTATION (GENERAL)

The ultrasonic instrumentation shall provide an adequate number of inspection channels to ensure a complete examination of the weld through thickness in one ID circumferential scan, depending on the diameter and wall thickness combination. Each instrument or inspection channel will provide a linear "A" scan presentation, either independent or individually selectable.

A System Control Manual will be maintained at the inspection location covering all relevant system data.

The following table specifies SPS recertification requirements for SPS AUT instruments. The recertification intervals are specified to ensure compliance with greatest number of standards documents.

INSTRUMENT	SPS STANDARD RECERTIFICATION INTERVAL	RECERTIFICATION PROCEDURE DOCUMENT	INDUSTRY STANDARDS DOCUMENTS IN COMPLIANCE WITH
PA DAQ	6 months **	SPS Form 233	ASTM E1961 ASME Code V BS EN 12668-1
DPE	6 months **	SPS Form 232	ASTM E1961 ASME Code V BS EN 12668-1

(** Unless otherwise specified in General Procedure for the Given Project)

Screen height and horizontal linearity checks shall be performed at the beginning of each period of extended use, or as per table above, whichever is less. Linearity checks shall be carried out in accordance with ASTM E-317 – Standard Practice for Evaluating Performance Characteristics of Ultrasonic Pulse-Echo Testing Instruments and Systems without the Use of Electronic Measurement Instruments or EN 12668 – Non-destructive Testing – Characterization and verification of Ultrasonic Examination Equipment. Characterization and verification of ultrasonic examination equipment. Instrument linearity shall fall within the range indicated by the particular standard used.

A sample of the instrument linearity recording forms will appear in the Project Forms section of this document.

As a minimum, each inspection channel shall be selective for the following:

- Pulse-echo, pitch-catch mode, or through thickness mode
- Gate position and length; start and finish time for a minimum of 2 gates
- Gain
- Recording threshold between 10% and 100% of full screen height

Three recordable signal outputs per gate shall be available. They will perform the following functions:

- Indicate the presence of a signal exceeding a preset threshold limit
- Analog/digital signal height amplitude
- Analog/digital "time of flight"

3.1.1 FLAW DETECTORS

SPS utilizes independent or multi-channel flaw detectors for each transducer in the system. This system is identified as the digital phased array HDH-PA model. Each instrument or channel exhibits, but is not limited to the following:

- Independent display (for individual flaw detectors only)
- Amplitude and "time of flight" signal outputs
- Adjustable:
  - delay
  - range
  - velocity
  - gain
  - frequency
  - gate start and stop
  - pulse repetition frequency

The UT instrument(s) are positioned for unconstrained adjustment and viewing.

3.1.2 COUPLING MONITORS

SPS incorporates proprietary coupling monitors in their inspection system. Each monitor is coupled to a flaw detector pair.

SPS will utilize potable water for coupling. Environmentally safe wetting agents may be added. No residue will remain on the pipe surface after the liquid has evaporated.

The monitors incorporate independent RF amplifiers, allowing for gain control independent of the flaw detector. The couplant monitor amplifiers are linearized along with the main inspection system.

Additional signal output to the Operator Evaluation Interface is also performed.

3.2 TRANSDUCERS (GENERAL)

All transducers employed in the ultrasonic system shall meet performance requirements stipulated by the Client. The phased array transducers used by SPS are meant to emulate and work in conjunction with the pulse echo and tandem configurations that SPS has used in the past.

All transducers with the same requirements will maintain the same part number (Part # refers to a series i.e.: 740 series means 740, 741, 742 etc.).

As a minimum, each transducer shall maintain a unique serial number. This serial number will reference the following:

- Manufacturer's name
- Transducer type
- Frequency
- Crystal size and shape
-

If removable transducer wedges are utilized, each shall maintain a unique serial number. This serial number will reference the following:

- Manufacturer's name
- Wedge material and velocity
- Incident angle
- Exit point

All wedges with the same requirements will maintain the same part number.

Two part probe/wedge combination transducers are utilized. This allows for wedge only changes in the event of unacceptable wear. All wedges maintain four point carbide runners to minimize deterioration.

Transducer selection is based on optimized beam sizes for the intended target.

The project specific transducer array Primary Setup Table(s) will be submitted to the Client in the applicable Inspection and Test Plan(s) prior to the commencement of work. This information is also available in the configuration file. SPS utilizes a configuration file that summarizes the results of the aforementioned variables. This file is termed TP-XXXX where XXXX reflects the appropriate configuration number. The latest revisions of the configuration file are controlled by Shaw Pipeline Services and are available at the work site or upon request.

3.2.1 TRANSDUCER SELECTION AND UTILIZATION

For each pipe diameter, thickness, and material velocity combination a Transducer Specification for Initial Setup is produced. The configuration file identifies but is not limited to the following:

- Steel path distance to each respective reflector
- Surface position placement including:
  - index to weld center
  - clearance to bead and coating
  - spacing for transducer arrangements
- Gate settings including:
  - start
  - stop
  - distance
- Transducer/wedge angles
- Material velocities

The information on this form (203-PA) is a guideline for transducer/wedge or focal law selection and is used by the Operator for primary setup. The Operator may make adjustments from the guideline to accommodate existing field conditions. The Shaw Supervisor shall authorize these adjustments, and changes made shall be documented. Any changes shall be limited to minor modification to probe position, gate length, transducer spacing, and wedge angle. For focal law modifications shall be within the limits for the parameters shown in the table below.

3.2.2 TRANSDUCER PERFORMANCE

Prior to the project start, the following checks will be performed and recorded in order to monitor transducer or focal law performance:

- Surface position from the weld center with reference to the wedge front
- Signal to noise values in the gated (inspection) region to be at least 20 dB weaker than the signal from the reference reflector at the target distance.
- Baseline gain settings

This information will reside in the System Control Manual, which shall reside at the inspection facility.

A record of all wedge/probe changes and transducer measurements or focal law parameters shall be made available to the Client. Transducer, wedge, and carbide wear points shall be examined for wear, both physically and by monitoring calibration scans and baseline gain settings on an ongoing basis. Initial dB settings will be recorded on Form 203-PA “Scanner Transducer Parameters” prior to production, and any deviations recorded on Form 202 “Daily Master Calibration Report”. Any change of more than 6 dB will be cause for remedial action.

Any change in instrumentation delay and/or gain causing side-to-side values to be out of tolerance shall be investigated. If it is determined the cause is wedge relate, the wedge shall be adjusted, sanded, or replaced.

3.2.3 TRANSDUCER DESIGN (PE)

The manufacturer performs the following transducer criteria. The probe manufacturer provides the reporting and recording of these results with the probe certification.

3.2.3.1 TRANSDUCER ACCEPTANCE CRITERIA

3.2.3.1.1 BEAM ANGLE

The direction of the beam must be within ± 1.0° for probe angles less than or equal to 45 degrees and within ± 1.5° for probe angles greater than 45°. The beam angle for TOFD must be within ± 5°.

3.2.3.1.2 FREQUENCY

The probe frequency must remain within ± 10% of the nominal frequency.

3.2.3.1.3 BEAM WIDTH

The measured beam width shall be within ± 1 mm of the identified beam width at the intended target path for use.

3.2.3.1.4 BEAM SQUINT

The deviation from normal will not exceed 1.5° for single crystal probes or 2° for twin crystal probes. Measurements will be accomplished using a qualification wedge where removable wedges are utilized.

3.2.3.1.5 LONGITUDINAL ANGLE BEAM

The longitudinal angle beam must be at least 35 dB weaker than the shear beam when measured at a 100 mm range from the probe interface, unless the longitudinal waveform is purposely specified.

3.2.3.1.6 SURFACE WAVES

For beam angles less than 65°, the surface wave must be at least 34 dB weaker than the shear wave. For beam angles greater than or equal to 65° it must be at least 24 dB weaker, both measured at a 100 mm range.

3.2.3.1.7 SIDE LOBES

The side lobes must be at least 20 dB weaker than the main beam, except angles greater than 64° shall be at least 15 dB weaker than the main beam.

3.2.3.1.8 SUBSIDIARY MAXIMA

Fluctuations in echo amplitude shall not exceed that caused by interference grass.

3.2.3.1.9 PULSE SHAPE

The pulse shall be single peaked with any secondary peaks in the tail of the pulse at least 20 dB less than the main peaks.

3.2.3.1.10 PULSE LENGTH

The duration of the pulse measuring those amplitudes greater than 10% of the peak shall not exceed 2.5 microseconds.

3.2.4 TRANSDUCER DESIGN (PA)

The following transducer criteria are performed by the manufacturer. The probe manufacturer provides the reporting and recording of these results with the probe certification. The phased array probe is an internal SPS design, part # 115-000-525.

3.2.4.1 TRANSDUCER ACCEPTANCE CRITERIA

3.2.4.1.1 FREQUENCY

The probe frequency must remain within ± 10% of the nominal frequency.

3.2.4.1.2 PULSE SHAPE

The pulse shall be single peaked with any secondary peaks in the tail of the pulse at least 20 dB less than the main peaks.

3.2.4.1.3 PULSE LENGTH

The duration of the pulse measuring those amplitudes greater than 10% of the peak shall not exceed 2.5 microseconds.

3.2.4.1.4 ELEMENT ACTIVITY

Determines that all elements of the phased array probe are active and of uniform acoustic energy.

3.3 ULTRASONIC SCANNING HEAD

The scanning head provides, but is not limited by the following fixtures:

- Individual positioning and adjustment of each transducer required in the system
- A distance encoder for identifying flaw locations and the monitoring of scanning speeds
- Coupling flow controls

3.4 CALIBRATION STANDARDS (GENERAL)

These details can be found in the Inspection and Test Plan (ITP).

3.4.1 CALIBRATION STANDARD SPECIFICATIONS

For each pipe diameter, thickness, and material velocity combination a Calibration Standard Dimensional Layout is produced. This form identifies but is not limited to the following:

- Calibration standard position layout including:
  - reflector types
  - position
  - size
- Calibration reflector dimensions and machining tolerances

This form, along with layout drawings, will be included for each calibration standard required.

For flow line welds, the calibration block thickness shall be within ± 1.5 mm of the pipe.

For internal inspections, material shall be as similar to material to be inspected as achievable.

3.4.2 CALIBRATION STANDARD TOLERANCES

The calibration block shall have the same surface condition as that of the production weld, or production welds must have the same surface condition as the calibration block.

Calibration block surface condition shall be monitored and evaluated visually once per shift as a minimum. Changes in instrumentation gain settings from project start (monitored with daily master calibration) shall be investigated to determine if the surface condition of the calibration block (wear and/or corrosion) is the cause. If light sanding does not improve the condition, the block shall be replaced.

3.4.2.1 BEVEL TOLERANCE

Calibration block should match as close as possible the bevel geometry specified by Contractor. Variations in the bevel angle between the calibration block and production will not be greater than +/- 1 degree for J and K prep welds, or +/- 2.5 degrees for V prep welds.

3.4.2.2 MACHINING CHECKS

Calibration standards machining tolerances will be verified in accordance with SPS procedure PROC-CW-CBIP.

Machining tolerances for calibration reflectors shall be as follows:

Hole Diameter	± 0.2 mm
Flatness of FBH	± 0.1 mm
All pertinent angles (Angular Tolerance)	± 1°
Notch (slot) depth	± 0.1 mm
Notch (slot) length	+/-10%
Center Position of All Targets (Reference Reflectors)	± 0.1 mm
Hole depth	± 0.2 mm

3.4.2.3 VELOCITY CHECKS

Velocity checks are performed on each calibration standard. The checks are performed in accordance with SPS procedure PROC-CW-MVM.

For pipe with a long seam, attenuation differences between the long seam and pipe greater than 2 dB or angle changes greater than 1.5˚ require a modified inspection technique in the long seam region.

3.5 RECORDING AND DISPLAY SYSTEM (GENERAL)

The recording system shall be InFocus; the software version shall not change during the project without the approval of the Client. The recording system shall provide the following:

- Clearly indicate the location of indications relative to the marked start position of the weld, with a ±10 mm accuracy
- Distance measurement from the marked start position is in a clockwise orientation when viewing the pipeline in the downstream direction
- Each transducer shall exhibit a separate recording channel for defect evaluation
- Each transducer pair shall exhibit a recording of acoustic coupling

3.5.1 OPERATOR CONTROL PANEL

The control panel allows for the following:

- Inspection software interfacing
- Transducer pneumatic positioning
- Scanner head:
  - stop

- start
- speed control

- Acoustic coupling control

3.5.2 GRAPHICAL USER INTERFACE (GUI)

The GUI is the mechanism utilized by the operator to perform flaw evaluation. The following information is distance aligned and displayed in "real time":

- Transducer analog/digital amplitude for each required channel
- Transducer "time of flight" data for each required channel
- Transducer mapping for root and volumetric channels
- Coupling monitoring for each transducer pair
- An unrectified Time of Flight Diffraction (TOFD) channel utilizing a 256 gray scale B-scan

All flaw information can be color adjusted to expedite weld evaluation. Flaw marking is performed within the GUI.

3.5.3 DATA STORAGE

All weld inspections are stored on magnetic or optical media on two independent sources. Weld inspections can be reviewed or reprinted at any time, simulating the original.

Additionally all weld data is archived on CD.

At any time during production inspection, AUT operator shall provide Company AUT representative with an electronic copy of weld(s) being analyzed.

3.5.4 GRAPHICAL PRINTOUT

A graphical printout is produced after completion and evaluation of each inspected weld. This printout may be used by the operator to aid evaluation, and is presented to the Client for audit purposes.

3.6 SYSTEM SPARES

SPS maintains sufficient spares of all integral system components to minimize downtime in the event of equipment failure. This shall include computer, Monitor, CIM, PCM, SCM, multi-channel flaw detector, remote pulser chassis, compressor, scanner, SHC, and transducers.

4. INSPECTION PERSONNEL

Credentials of ultrasonic inspection personnel, including qualification and experience, shall be provided to the Client for prior approval.

SPS will not substitute personnel without prior approval of the Client.

For each project, SPS will designate a project Supervisor, Operators and Scanner Technicians.

The Supervisor shall meet the requirements of SNT-TC-1A Level II UT or EN 473 Level II (Manual Ultrasonic Certification) with additional with qualifications in mechanized UT in accordance with SPS

Written Practice as per ASNT SNT-TC-1A. The Supervisor will have access to technical support from SPS qualified Level III. The Supervisor shall be responsible for the following:

- Conduct of the ultrasonic personnel
- Performance of the inspection equipment
- Required part spares
- Inspection recording and records

The Operator shall meet the requirements of ASNT-SNT-TC-1A Level II or EN 473 Level II (Manual Ultrasonic Certification) with additional qualifications in mechanized UT in accordance with SPS CW-WPTR- Written Practice Training Requirements. The Operator shall be responsible for the following:

- Equipment calibration
- Perform production inspection
- Inspection results evaluation
- Inspection reports

The Scanner Technician shall be responsible for the following:

- Operator assistance
- Scanner set up
- Scanner maintenance

5. INSPECTION SET UP

5.1 TRANSDUCER POSITIONING AND PRIMARY REFERENCE SENSITIVITY

The Transducer Specification for Initial Setup sheet (the part of configuration file) determines transducer positioning and initial settings. The latest revisions of configuration file are controlled by Shaw Pipeline Services and are available at the work site or upon request.

The Operator as the basis for scanner setup uses the Transducer Specification for Initial Setup. The Transducer Specification for Initial Setup represents the calculated position for setup. It is used only as a guideline.

The system shall be optimized for field inspection using the calibration standard.

Each transducer will be positioned at its operating distance away from the simulated weld centerline on the calibration standard. The transducer or PA focal law will be adjusted to provide a peak signal from its target reflector in the transducer's inspection zone.

The peak signal response shall be adjusted to 80% of full screen height for each channel. This shall be considered the primary reference level. Instrument gain settings will then be recorded. System filter will be set, and not altered after calibration. System filter is for removal of background electronic noise, and has no effect on amplitude linearity.

All changes to the primary reference levels will be recorded. A sample form can be found in Project Forms section.

The signal to noise ratio in the gated area shall be at least 20 dB unless alternative levels are agreed to with the Client.

5.2 GATE SETTINGS

Using the calibration standard, each detection gate will be set to cover a sound path suitable to the specific inspection zone for each inspection channel. These settings are identified on the Transducer Specifications for Initial Setup Form. All detection gates shall be set to extend at least through the centerline of the weld. For certain channels, i.e. volumetric detectors, the gates must extend through the weld width. The operator shall verify, through the 2D display, that the total weld volume is covered and no gates are short of their intended coverage.

These settings may be altered if geometry indications dictate. The Shaw Supervisor shall authorize these adjustments, and changes made shall be documented.

The Client may designate specific gate settings. These settings will be identified on the Transducer Specifications for Initial Set-up Form

Gate setting tolerances are as follows:

- Amplitude gates prior to, and after interface or reflector: ±0.25 mm
- TOF gates prior to, and after interface or reflector: ±0.25 mm

5.3 GRAPHICAL USER INTERFACE RECORDING THRESHOLD

Recording threshold for all flaw evaluation channels will be 20% of full screen height for Flow line welds. Evaluation threshold levels and scanning sensitivity for all inspection channels are identified in the Inspection and Test Plan unless specifically approved in writing by the Client.

Evaluation threshold level should not exceed the amplitude that can yield a defect vertical height greater than the smallest acceptable defect height defined in the acceptance criteria for any zone.

5.4 CIRCUMFERENTIAL SCANNING VELOCITY

The maximum circumferential scanning velocity (V_c) shall be determined by:

$$V_c < W_c * \frac{PRF}{3}$$

Where:

W_c = the narrowest -6 dB beam width at the appropriate operating distance(s) of all transducers.

PRF = Effective pulse repetition rate per transducer.

Scanning speeds shall not exceed 100 mm/sec.

5.5 COUPLANT MONITORING CHANNELS

For each transducer pair instrument gain shall be adjusted to produce a transmittal signal to 40% FSH (recordable threshold level) when utilized in the through transmission mode. 10 dB should be added to bring the signal to the reference level. Minor additional gain adjustments may be required in the event of unique surface conditions that affect the reference level.

A drop in echo amplitude exceeding -10 dB from the reference level through a clean weld, over a circumferential distance exceeding the smallest rejectable linear defect length specified for the applicable height bracket in the acceptance criteria shall be re-examined. For internal inspections, drops in echo amplitude exceeding -10db shall be kept as minimal as possible, but not held to the smallest rejectable linear defect.

Re-examination of an area of loss of coupling may be accomplished by reversing the scanner over the loss of coupling area in the course of the scan.

Hi/Low and the presence of mill weld reinforcement, which is not flush with the parent material, can cause loss of signal in the coupling monitors. These geometric features can also be seen in the data channels. An attempt must be made to resolve coupling loss exceeding the smallest rejectable linear defect length by surface cleaning or sanding. TOFD may also be used to assess the area.

5.6 TIME OF FLIGHT DIFFRACTION (TOFD)

The TOFD transducer pair shall be setup according to the Transducer Specification for Initial Setup. The Transducer Specification for Initial Setup represents the calculated position for setup. It is used only as a guideline.

The TOFD transducer pair shall be setup such that the refracted longitudinal wave shall provide sufficient coverage, which shall be verified by identifying known reflectors on the calibration standard.

Each transducer will be positioned at its operating distance away from the simulated weld centerline on the calibration standard and the sensitivity shall be set such that the acoustic grain scatter is discernible on the digitizer scale over the coverage area. In addition, it shall be set so that the smallest root notches and 5 mm OD TOFD notch, if available, are clearly discernible, with a response at least 6 dB higher than the background noise.

Depending on the thickness of the test piece, there may be additional TOFD notch that is ½-wall thickness deep.

- If only one TOFD transducer pair is used, the smallest ID notch and the 5mm OD notch, if available, must be discernible and at least 6 dB greater than background.
- If an ID and an OD TOFD transducer pairs are used, the smallest ID notch and the mid wall notch must be discernible and at least 6 dB greater than background by the ID TOFD transducer pair. And the 5 mm OD notch and the mid wall notch must be discernible and at least 6 dB greater than background by the OD TOFD transducer pair.

All changes to the primary reference levels will be recorded.

6. FIELD INSPECTION

6.1 WELD NUMBER

SPS will assign a unique number to each inspected weld as specified by the Client.

6.2 SURFACE CONDITION

The Client will ensure the scanning area is free of spatter and other conditions that may interfere with the movement of the transducers, the coupling, or the transmission of acoustic energy into the material.

SPS will record any areas inconsistent with these requirements.

The surface temperature of the pipe will be between 5° C and 90°C (195°F) prior to performing weld inspections.

6.3 CALIBRATION

6.3.1 QUALIFICATION

With the system optimized, the calibration standard shall be scanned. The following dictates a successful calibration:

- An analog/digital recording of between 70% and 100% FSH for each detection channel in their correct GUI position
- Circumferential position accuracy of the recorded reflectors relative to each other, within ± 2 mm
- Position accuracy within ±10 mm of the zero start
- Amplitude and TOF gates prior to, and after interface or reflector: ±0.25 mm
- The calibration scan should be started at the same position for each subsequent pass

6.3.2 CALIBRATION FREQUENCY

For internal inspection, the frequency of calibration a minimum of one calibration scan for every 10 consecutive welds. During production, calibration intervals will not exceed two hours.

In addition, the calibration shall be verified after shutting down of any equipment, following any changes to system components, and at the beginning of each shift.

Instrument gain settings from the calibration shall be recorded if a deviation from baseline is noted. Recording will be provided on Client approved form.

Chart recordings for each calibration scan shall be included sequentially with the weld inspection charts.

In the event that a calibration scan reveals that the equipment has been out of calibration, the Client shall be advised immediately, and the equipment shall be re-calibrated and the weld rescanned.

6.3.3 CIRCUMFERENTIAL POSITION ACCURACY

The positional accuracy of the inspection system shall be verified on every calibration scan, and a minimum of once per inspection shift on the pipe.

The position check shall be performed as follows:

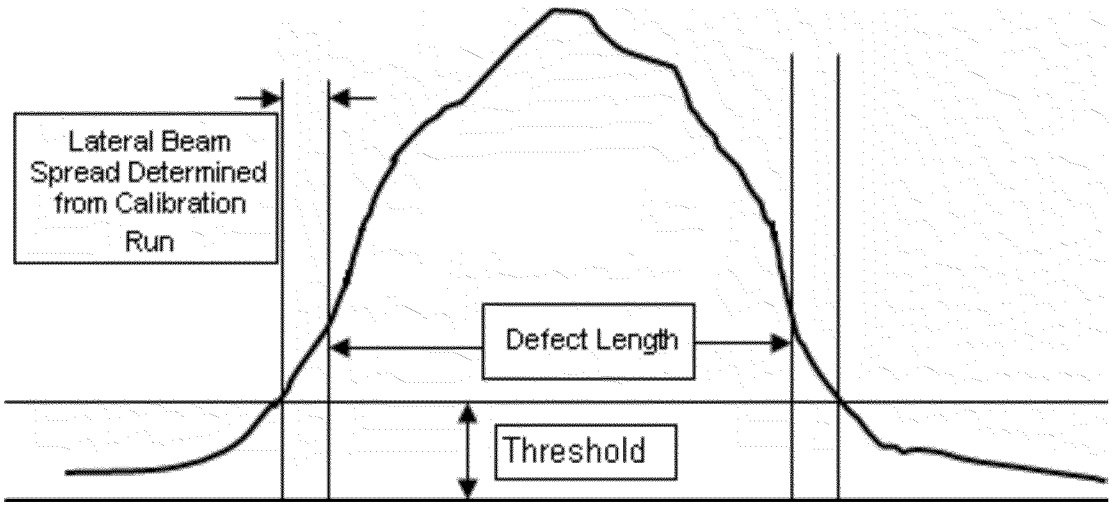
A common reference point will be identified on the ultrasonic scanner.

- Index marks will be placed on the calibration block start and stop points; the scanner stop position will be visually checked by the scanner technician after each calibration scan
- A full circumferential distance will be verified on the pipe comparing the scanner encoder reading with a manual measurement
- The actual circumference of the pipe shall be measured with an approved measuring tape

- The accuracy of the electronic measuring system shall be within ±10 mm of the actual circumference measurement of the pipe
- The accuracy of the electronic measuring system shall be within ±10 mm of the actual run distance on the calibration run
- Results will be recorded on client approved form

6.3.4 LATERAL BEAM SPREAD

Possible overestimating of defect length has not been considered in establishing allowable defect lengths and the Operator should consider lateral beam spread in defect evaluation as shown below.



To assess beam spread, the calibration reference reflector is sized based on the recordable threshold level and from this, and the actual size of the reflector is subtracted to give a correction factor for that channel. This would be repeated for each inspection channel. This correction factor will be utilized for weld evaluation.

6.3.5 TRANSDUCER SURFACE POSITION CHANGES

SPS will record any shifts in transducer position from the baseline measurements as recorded in the relevant part of the System Control Manual. These changes may include repositioning transducers because of geometry indications from a specific welding procedure.

These changes will be recorded as they occur, and will be limited to changes greater than +/- 1.0 mm.

Changing surface positions of Phased Array will require a new file set-up for the surface position changes.

6.3.6 SCANNING SENSITIVITY

Unless specifically approved by Client in writing, the Scanning Sensitivity Tables will be located in the applicable ITP (Inspection and Test Plans) part of the procedure.

6.3.7 FILL CHANNEL CONVENTIONAL TRANSDUCERS

The limits on fill-channel transducer pairs (upstream/downstream) shall be maintained with the scanner transducers during production pipe to pipe inspection as follows:

- The distance to centerline measurements shall not vary more than +/- 2 mm for SCR inspection and +/- 3 mm for Flowline inspection

The response gain shall not vary more than +/- 3 dB

6.4 RE-EXAMINATION

The Re-examination of a weld or welds may be required if a significant loss of couplant occurs or a calibration does not meet the tolerance requirements for the project. The criteria for weld re-examination are detailed below. For internal girth weld inspection, complete coverage may not be achievable based on internal pipe conditions, couplant loss shall be kept at a minimum and noted to the client where lost.

6.4.1 COUPLING MONITOR SENSITIVITY

A drop in echo amplitude exceeding -10 dB from the reference level through a clean weld, over a circumferential distance exceeding the maximum allowable linear defect length specified for the applicable height bracket in the acceptance criteria shall be re-examined.

Re-examination of an area of loss of coupling may be accomplished by reversing the scanner over the loss of coupling area in the course of the scan.

Hi/Low and the presence of mill weld reinforcement, which is not flush with the parent material, can cause loss of signal in the coupling monitors. These geometric features can also be seen in the data channels. An attempt must be made to resolve coupling loss exceeding the minimum allowable linear defect length by surface cleaning or sanding. ToFD may also be used to assess the area.

6.4.1.1 UNRESOLVED COUPLING LOSS FOR PE CHANNELS WITH TOFD BACK-UP

Coupling loss is acceptable providing that no fading of the ToFD data is seen in the same area as the coupling loss. Flaws seen in the ToFD data within the area of coupling loss shall be evaluated using ToFD to determine vertical height and length.

Coupling loss is unacceptable if fading of the ToFD data occurs in the same area as the coupling loss. MUT shall be used to examine the weld in this area as per the MUT procedure.

6.4.1.2 UNRESOLVED COUPLING LOSS FOR PE CHANNELS WITHOUT TOFD BACK-UP

For the root channel and channels (zones) either hidden by the ToFD lateral wave or too close to the lateral wave to be easily resolved; couplant loss is acceptable providing that a flaw exceeding the allowable dimensions (for height and/or length) specified in the acceptance could not be potentially masked. Full channel zone height and any

potential interaction with neighboring real indications shall be considered in defining allowable coupling loss (potential flaw) length.

Coupling loss is unacceptable if the zone height of the channel experiencing coupling loss exceeds the maximum allowable vertical height specified in the acceptance criteria. Coupling loss is also unacceptable if the combined length of the coupling loss area and the zone height exceed the allowable dimensions (for height and/or length) specified in the acceptance criteria. In both these cases, MUT shall be used to examine the weld in this area as per the MUT procedure.

6.4.2 CALIBRATION SENSITIVITY

Calibration sensitivity shall be within 70%-100% of full screen height. Channels with calibration exceeding 100% do not represent failed calibration, but the operator shall adjust gain settings, when appropriate, to ensure that the channel is not over-sensitive. The operator will ensure that at no time the sensitivity for any channel is in excess of +3 dB of 100% full screen height. For channels with sensitivity below 70% of full screen height, the channel calibration has failed.

6.4.2.1 FAILED CALIBRATION - PIPELINE PRODUCTION WELDS

Pipeline production welds examined at a sensitivity of less than 70% of full screen height shall be re-examined unless the following procedure can be satisfied.

This procedure shall be used to evaluate all welds produced since the last good calibration scan and the current failed calibration scan. These welds, numbering 5 or less, will be called “questioned” welds. The procedure will rely on the TOFD channel as an inspection safety net. The TOFD channel operates independently of the other inspection channels and will provide a reliable means of determining if full inspection coverage was achieved.

In the unlikely event of a failed calibration, interpretation of welds will cease until this procedure is executed and the inspection status of all welds, since the last good calibration have been defined. Forward pipe lay shall not resume until the inspection status of all questioned welds has been defined and appropriate action has been taken.

6.4.2.1.1 DETERMINATION OF WELD INSPECTION STATUS

The Operator shall complete the failed calibration report and define the channel or channels that failed (with sensitivities below 70% of full screen height). In addition, the depth and height of the inspection zone associated with the failed channel or channels should be determined.

6.4.2.1.2 SINGLE CHANNEL FAILURE

For single channel failure, the following steps will be executed to resolve the status of the questioned welds.

The TOFD strip chart shall be reexamined for all questioned welds. If the TOFD shows any indications with vertical height and/or length which do not meet the requirements of the acceptance criteria, the questioned weld will be re-examined or repaired.

If the failed inspection channel (zone) is not covered by the TOFD channel (the zone is obscured by the lateral wave) then the questioned weld will be re-examined and/or repaired unless the inspection channel failed calibration by less then 6dB from the reference level.

If the inspection channel failed calibration by less then 6dB from the reference level (with sensitivities above 40% of full screen height), the zone covered by the failed channel shall be reexamined and reevaluated with the recordable threshold level dropped by 6dB to insure that the minimum flaw size detection level is achieved. Every recordable indication should be sized with factor of times 2. If any indication shows rejectable size, the questioned weld will be re-examined and/or repaired.

6.4.2.1.3 MULTIPLE CHANNEL FAILURE – NON ADJACENT CHANNELS

If multiple non-adjacent channels fail the calibration, the individual channels shall be evaluated as independent single channel failures.

6.4.2.1.4 MULTIPLE CHANNEL FAILURE – TWO ADJACENT CHANNELS

If two adjacent channels fail the calibration, the couplant monitoring indicates a significant loss of couplant, and TOFD shows indication with no PE confirmation the questioned weld will be re-examined.

6.5 INTERPRETATION OF DAILY DEFECTS

SPS Operators, according to the defect acceptance criteria provided by the Client, shall evaluate indications of weld imperfections.

The AUT operator should maintain a diagram showing the weld pass zones versus the AUT zones to aid in interpretation.

Vertical height (in mm) for a single zone indication will be based on maximum signal response reading from the inspection software (InFocus). Vertical height for indications in two zones shall be calculated by adding the height from each zone, then subtracting the applicable overtrace from the lower amplitude indication. Indications in three zones shall be sized using the combined height of the upper and lower inspection zones, after subtracting overtrace from both, and adding it to the full zone height of the middle inspection zone. Overtrace shall be taken from the most recent calibration scan. If the signature in multiple channels indicates separate potential defects, overtrace corrections shall not be applied.

When evaluating indications for reject disposition, the system shall demonstrate calibration sensitivity within ±10% screen height of the 80% reference level. If a transducer's sensitivity exceeds these limits, but is still within the calibration tolerances, and the impact of the sensitivity difference may alter the evaluation, then a rescan will be required. If the sensitivity difference would not alter the evaluation, then a rescan would not be required.

Indications produced on the recording system that are present for reasons other than weld imperfections, but exceed length tolerances, shall be evaluated as to their nature. The evaluation will be recorded on the hard copy printout.

The Operator will provide a hard copy print out for each weld. Additional copies will be produced for each defective weld. Copies will be forwarded to the following:

- Client QC department
- Client NDT department

6.5.1 TOFD LINEAR INDICATIONS IN PIPELINE PRODUCTION WELDS

After analysis of all of the focused probe data, the AUT operator shall scan the total TOFD display. All TOFD indications should have some level of correlation with the focused probe data. This correlation may be subtle for indications such as inter-pass lack of fusion, or cold lap where the PE channels have little or no amplitude, TOFD produce a strong signal due to the orientation of the indication. For these types of very small height indications, the operator shall rely on the focused probe data as the primary method to assess the indication.

6.5.2 TOFD LINEAR INDICATIONS IN REPAIRED WELD

For repaired welds, all TOFD linear indications must be correlated with the focused probe data. If there is no correlation or limited correlation, due to the potential flaws exhibiting unexpected orientation because of revised or irregular geometry. Then the TOFD indicated length and height must be used to evaluate the indication

For indications such as cold lap where the PE channels have little or no amplitude, TOFD produce a strong signal due to the orientation the defect height shall be considered less than 1 mm.

6.5.3 TOFD NON-LINEAR INDICATIONS

The AUT operator shall scan for potential cracks, copper, off-bevel lack of fusion defects with significant vertical height, burn-through, or other potential injurious defects not covered in section 6.6.1 that may be visible in the TOFD display and have no correlation with the focused probe data. For these types of defects, the operator shall use the TOFD to define defect length and height if the defect is not adequately represented in the focused probe data. Each of these flaw types shall be evaluated to the appropriate criteria. If any TOFD indication has a potential of being crack-like defect, regardless of length or height shall be reported to client and assessed against current project criteria.

6.5.4 PARENT MATERIAL INDICATIONS RECORDED BY TOFD

Parent material indications, may appear in the TOFD display with little or no correlation with the PE probe data. For this type of indication, the following applies:

The cause of these indications must be investigated. This means scanning of the parent material using TOFD probes or additional manual UT. If it is confirmed that the indications originate from the parent material, the Client shall be notified immediately. An attenuation check shall be carried out as to check the reliability of the PE probe data. If attenuation losses are apparent outside of the tolerance of the AUT procedure, it may be considered to re-scan the weld with additional gain to compensate these losses.

As AUT is not specifically targeted to detect or evaluate parent material flaws, the Client shall determine which viable course of action shall be taken.

6.5.5 TOFD LINEAR INDICATIONS IN PROCEDURE AND WELDER QUALIFICATION WELDS

For qualification welds, all TOFD linear indications must be correlated with the focused probe data. If there is not correlation, then the TOFD indicated length and height must be used to evaluate the indication. If there is some correlation but the TOFD indications have greater height and/or greater length than indicated in the focused probe channel(s), then the TOFD length and/or heights shall be used to evaluate the indication to the qualification criteria. In addition, if any TOFD indication could be a potential crack-like defect, regardless of length or height, the weld must be rejected. If the TOFD indication indicates a burn-through, the weld must be rejected.

6.6 ACCEPTANCE CRITERIA

The Client provides the acceptance criteria for all production pipeline welds and repaired pipeline welds. The Client specified criteria defines all acceptance criteria and the rules of data interpretation to be followed by the Operators.

7. INSPECTION RECORD AND DOCUMENTATION SUMMARY

7.1 DAILY INSPECTION REPORTS

Shaw Pipeline Services will supply Client's QC with the following reports:

7.1.1 ULTRASONIC WELD INSPECTION REPORT – MECHANIZED WELDING (FORM 200)

This form is includes the disposition of each inspected weld.

7.1.2 INFOCUS – REPAIR REPORT (FORM 201)

Each repair is recorded on this form.

7.1.3 INFOCUS – DAILY MASTER CALIBRATION REPORT (FORM 202)

This includes a record of each calibration performed and the position in the pipelay that it occurred.

7.2 SYSTEM CONTROL MANUAL

The following information shall reside in the System Control Manual.

7.2.1 INFOCUS – SCANNER TRANSDUCER PARAMETERS (FORM 203)

This form includes all the baseline measurements for each transducer used in the system, along with changes as they occur.

7.2.2 INFOCUS – SCANNER CHANGES (FORM 204)

This form includes all the changes performed on the AUT scanner.

7.2.3 ULTRASONIC INSTRUMENT VERTICAL LINEARITY TEST (PROC-CW-VL) (FORM 206)

This form includes all the performance checks on the multi-channel flaw detector.

7.2.4 ULTRASONIC INSTRUMENT HORIZONTAL LINEARITY TEST (PROC-CW-HL) (FORM 207)

This form includes all the performance checks on the multi-channel flaw detector.

7.2.5 USIP 20 ELECTRONIC CALIBRATION TEST (PROC-CW-EC) (FORM 208)

This form includes all the performance checks on the multi-channel flaw detector.

7.2.6 ESSENTIAL EQUIPMENT CHECK LIST (FORM 210)

This checklist verifies equipment sent to the job site.

7.3 SUPPORTING DOCUMENTATION AND PROCEDURES

The following in-house procedures are utilized in preparation for AUT inspection:

7.3.1 PROC-CW-CBIP

This is the procedure for verification of calibration standard machining tolerances.

7.3.2 PROC-CW-MVM

This is the procedure for material velocity measurements of calibration standards.

7.4 TECHNICIAN QUALIFICATION MANUAL

The Technician Qualification Manual has a complete listing of all personnel used for the project including CV's and the Certification Records.

7.5 LOG BOOK

The operator shall keep a log book detailing the performance characteristics and identification of instruments, transducers, and inspection setups. All changes in gain, transducer spacing and other system changes shall be documented in the log book or equivalent.

8. HEALTH & SAFETY EXECUTIVE

Shaw Pipeline Services will carry out work in accordance with all of the relevant statutory provisions. All reasonable practical measures will be taken to avoid risk to its employees and others who may be affected by its operations.

Operations will be carried out in a safe manner taking into consideration both the company's own employees, members of the public and the environment. Working in a safe manner will minimize injuries, and ill health and hazards to everyone affected by the performance of work will be identified and addressed.

The company's Environmental, Health & Safety policy is held by the supervisor and is available to all employees and third parties at each work site, along with all EHS Procedures.

All employees will familiarize themselves and abide by all Health, Safety, and Environment rules imposed both by the company and by the relevant client on each work site. Violation of any of these rules, safe working practices and ignoring safety signs and practices will not be tolerated.

It is the responsibility of the Supervisor to carry out a risk assessment at the commencement of each project and to take the necessary measures to ensure all risks and hazards are identified are minimized. All employees have a responsibility to ensure that their actions do not constitute a hazard to themselves or others, and that any potential hazards they encounter are reported to the Supervisor.

There are a number of specific areas common to any project that must be considered by the Supervisor and all personnel:

- Equipment must be maintained in good condition and must only be used for the purpose for which it was intended
- The work areas must be maintained in a clean and tidy condition to avoid any unnecessary hazards
- It must be ensured that all personnel have received the appropriate training for the tasks they are to carry out, and in relation to the environment in which they are working
- The correct Personal Protective Equipment (PPE) must be available and used by all personnel when performing operations or whilst in an area where specific hazards have been identified
- Proper and adequate first aid facilities must be available and periodically checked to ensure that the facilities are adequate for the work environment
- One of the main areas where injuries occur is in the manual handling of equipment and materials; consideration should always be given to methods whereby manual handling can be avoided
- COSHH (Control of Substances Hazardous to Health) data sheets must be available for all hazardous materials (Chemicals, solvents etc) used or stored at the work site; all personnel must be aware of the location of these data sheets and familiarize themselves with those relevant to their own sphere of activity

9. PROJECT FORMS

The following Forms are utilized in the Project Description(s):

Description	Form Number
Ultrasonic Weld Inspection Report – Mechanized Welding	FORM 200
InFocus – Repair Report	FORM 201
InFocus – Daily Master Calibration Report	FORM 202
InFocus – Scanner Transducer Parameters	FORM 203
InFocus – Scanner Changes	FORM 204
Essential Equipment Change List	FORM 209
Phased Array Element Verification Checks	FORM 246

9.1 FORM 200 – ULTRASONIC WELD INSPECTION REPORT / MECHANIZED WELDING

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

AUT WELD INSPECTION REPORT

SCAN CONFIG:	PROJECT NO:	PROJECT:	WELDING METHOD:	FOLDER ID:	REPORT NO:
INFOCUS VERSION:	UNIT TYPE:	CLIENT:	WELDING POSITION:	TP #:	PAGE: of
HARDWARE TYPE:	CALIBRATION FREQ. (#CALS / #WELDS):	PRIME CONSTRUCTION CONTRACTOR: LOCATION:	WELD TYPE:	SHIFT:	DATE:

PRIMARY CODE:	SHIFT TOTALS >	Welds	Rejected	Cut-Out	NOMINAL DIA CONSTANT	NOMINAL DIAMETER: (Inch) (mm)	NOMINAL MATERIAL THICKNESS: (Inch) (mm)
OTHER SPECIFICATION:						ACTUAL OUTSIDE DIAMETER: (Inch) (mm)	ACTUAL PRIMARY TP THICKNESS: (Inch) (mm)

Weld ID			TOTAL NO. SCANS	LOCATION AND CATEGORY OF DEFECTS											NOMINAL (CALCULATED) CIRCUMFERENCE (mm): MATERIAL GRADE:
				RESULT		FLAW DESCRIPTION		FLAW LOCATION		FLAW DIMENSIONS (mm)					
PREFIX	#	SUFFIX		ACCEPT	REJECT	LINEAR	VOLUMETRIC	US / DS	AUT INSPECTION ZONE	START	STOP	LENGTH	HEIGHT	DEPTH	COMMENTS
TOTALS															

INTERPRETATION BY:	CLIENT REPRESENTATIVE (NAME):	OTHER REPRESENTATIVE (NAME):
UT CERTIFICATION:	AFFILIATION:	AFFILIATION:
SIGNATURE:	SIGNATURE:	SIGNATURE:

Form 200-A Rev.7 March 07, 2008 (OS Version) FORM 200-A

9.2 FORM 200 – ULTRASONIC WELD INSPECTION REPORT / MECHANIZED WELDING (LAND BASE)

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

AUT WELD INSPECTION REPORT

SCAN CONFIG:	UNIT#:	PROJECT:	PROJECT NO:	MILEAGE:	FOLDER ID:	REPORT NO:
INFOCUS VERSION:	UNIT TYPE:	CLIENT:	TP #:	HOURS WORKED:	CREW SIZE:	PAGE: of
HARDWARE TYPE:	CAL. FREQUENCY (#CALS/WELD):	PRIME CONSTRUCTION CONTRACTOR:	SPREAD:	SHIFT:	DATE:	
CODE:		LOCATION:	PIPE DIAMETER: (Inch) 0.00 (mm)	WALL THICKNESS: 0.000 (Inch) (mm)		
				CIRCUMFERENCE (mm): 0.0	GRADE: X65	

Weld ID			NO. OF SCANS ABOVE PRIMARY	LOCATION AND CATEGORY OF DEFECTS												
				DIAGNOSIS		FLAW DESCRIPTION		FLAW LOCATION		FLAW DIMENSIONS (mm)					COMMENTS	CHAINAGE (100m/300ft.)
PREFIX	#	SUFFIX		ACCEPT	REJECT	LINEAR	VOLUMETRIC	US / DS	AUT INSPECTION ZONE	START	STOP	LENGTH	HEIGHT	DEPTH		
TOTALS				0	0	0	0									

INTERPRETATION BY:	CLIENT REPRESENTATIVE (NAME):	OTHER REPRESENTATIVE (NAME):
UT CERTIFICATION:	AFFILIATION:	AFFILIATION:
SIGNATURE:	SIGNATURE:	SIGNATURE:

Form 200-B Rev.6 August 16, 2007 (LB Version) FORM 200-B

9.3 FORM 201 – INFOCUS / REPAIR REPORT

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

INFOCUS – Repair Report

PROJECT:	JOB NO:	WALL THICKNESS: 0.000 Inches 0.00 (mm)	DATE: February 13, 2010
CLIENT:	LOCATION:	DIAMETER: 0.000 Inches 0 (mm)	

Weld Number	Repair Details					Excavation Area				Comments
	Inspection Zones		Defect Type		Length	From	To	Width	Depth	
TOTAL	0									

Form 201 Rev. 4 Feb. 2010

9.4 FORM 202 – INFOCUS / DAILY MASTER CALIBRATION REPORT

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

Daily Master Calibration Report

CONTRACTOR: Allseas	PROJECT: Chevron Gorgan & Jansz	TEST PIECE NO.: TP 1234	JOB NO.: 360320	DATE: March 3, 2010
CLIENT: Allseas	LOCATION: Lorelay	PROCEDURE NO.: 45-03_G1-VE-2-UG00-L65-0102-Rev.4 PAAUT GP	DIAMETER: #### [inches] #### [mm]	WALL THICKNESS: 0.878 [inches] 22.31 [mm]
SYSTEM: MAIN	DAQ BOX: SP-DAQ-123	SCANNER SERIAL NO: SP-PA-01		

Calibration No.	Time.	UPSTREAM GAIN SETTINGS [dB]																DOWNSTREAM GAIN SETTINGS [dB]																TECH INITIALS	Ground screen Status
		RTR.1	RT1	RP																														
		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32		
Initial Gain Setting																																			
002	6:15																																		
003																																			

Technician 00:00 to 12:00: _____ Technician 12:00 to 24:00 _____

Form 202 Rev 6 Sep, 2012

9.5 FORM 203 – INFOCUS / SCANNER TRANSDUCER PARAMETERS

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

INFOCUS - Scanner Transducer Parameters

PROJECT:	TP NO:	DATE: June 2, 2012
PROJECT NO:	SCANNER:	DIAMETER (Inch): 8.625
CLIENT:	SOFTWARE VERSION:	WALL THICKNESS (mm): 30.00
CONTRACTOR:	LOCATION:	TECHNICIAN:
OWNER:	SPREAD:	SUPERVISOR:

	Transducer:	RT.5	RT1	RTHA2	CL	HP	F1 Tx	F1 Rx	F2 Tx	F2 Rx	F3 Tx	F3 Rx	F4 Tx	F4 Rx	F5 Tx	F5 Rx	F6 Tx	F6 Rx	F8 Tx	F8 Rx	CN1	CN.5	V1	V2	V3	V4	V5	TR ID	TROD	WT	ToFD 1	ToFD 2
	Shot Type:	Conv.	Conv.	Conv.	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	Conv.	Conv.	PA	PA	PA	PA	PA	Conv.	Conv.	Conv.	Conv.	Conv.
UPSTREAM	Wedge Angle:																															
	Wedge ID:																															
	Probe Part#:																															
	Probe SN #:																															
	S/N Ratio:																															
	Standoff:																															
	Tndm. Spacing:																															
	IF Gate Delay:																															
	# Elements:																															
	Element Start #:																															
	Tap In / Out:																															
	Angle Trim:																															
	Initial dB's:																															
	Transducer:	RT.5	RT1	RTHA2	CL	HP	F1 Tx	F1 Rx	F2 Tx	F2 Rx	F3 Tx	F3 Rx	F4 Tx	F4 Rx	F5 Tx	F5 Rx	F6 Tx	F6 Rx	F8 Tx	F8 Rx	CN1	CN.5	V1	V2	V3	V4	V5	TR ID	TROD	WT	ToFD 1	ToFD 2
	Shot Type:	Conv.	Conv.	Conv.	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	Conv.	Conv.	PA	PA	PA	PA	PA	Conv.	Conv.	Conv.	Conv.	Conv.
DOWNSTREAM	Wedge Angle:																															
	Wedge ID:																															
	Probe Part#:																															
	Probe SN #:																															
	S/N Ratio:																															
	Standoff:																															
	Tndm. Spacing:																															
	IF Gate Delay:																															
	# Elements:																															
	Element Start #:																															
	Tap In / Out:																															
	Angle Trim:																															
	Initial dB's:																															
	Transducer:	RT.5	RT1	RTHA2	CL	HP	F1 Tx	F1 Rx	F2 Tx	F2 Rx	F3 Tx	F3 Rx	F4 Tx	F4 Rx	F5 Tx	F5 Rx	F6 Tx	F6 Rx	F8 Tx	F8 Rx	CN1	CN.5	V1	V2	V3	V4	V5	TR ID	TROD	WT	ToFD 1	ToFD 2
	Shot Type:	Conv.	Conv.	Conv.	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	Conv.	Conv.	PA	PA	PA	PA	PA	Conv.	Conv.	Conv.	Conv.	Conv.
DOWNSTREAM	Wedge Angle:																															
	Wedge ID:																															
	Probe Part#:																															
	Probe SN #:																															
	S/N Ratio:																															
	Standoff:																															
	Tndm. Spacing:																															
	IF Gate Delay:																															
	# Elements:																															
	Element Start #:																															
	Tap In / Out:																															
	Angle Trim:																															
	Initial dB's:																															

Form 203-PA Rev.0 [07/02/2012]

9.6 FORM 204 – INFOCUS / SCANNER CHANGES

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

INFOCUS – Scanner Changes

PROJECT:	JOB NO:	WALL THICKNESS: 0.000 Inches 0.00 (mm)	DATE:
CLIENT:	LOCATION:	DIAMETER: 0.000 Inches 0 (mm)	

Weld Number	Transducer Part #	Wedge Change		Probe Change		Stand-Off Change		Surface Condition		Comments
		In	Out	In	Out	From	To			

Form 204 Rev. 5 May-2011

9.7 FORM 209 – ESSENTIAL EQUIPMENT CHANGE LIST

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

Essential Equipment Change List

PROJECT:	CONTRACTOR:	LOCATION:	DATE: February 13, 2010
CLIENT:	JOB NO:	CODE:	

#	Date	Item	Serial Number	Location	Operator	Reason for Change
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Any equipment that is on the Essential Equipment Check List that has been replaced should be added to this report. A complete description of the problem should be documented using the Problem Report. Head Office should be notified of any replacements

Form 209 Rev. 5 Feb. 2010

9.8 FORM 246 – PHASED ARRAY ELEMENT VERIFICATION CHECKS

SHAW PIPELINE SERVICES
A SHAWCOR COMPANY

Phased Array Element Verification Checks					
Location:			Data Acquisition Unit S/N:		
Date	Accept/Reject	U/S Probe S/N	D/S Probe S/N	Technicians Name	Signature

FORM 246 REV. 0 4/18/2011