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Acceptance test procedure for DST inspection robot package.

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DOUBLE-SHELL TANK INSPECTION SYSTEM PERFORMANCE TEST PROCEDURE

1.0 PURPOSE

This procedure establishes requirements to administer a performance demonstration test. The test is to demonstrate that the double-shell tank inspection system (DSTIS) supplied by the contractor (refer to 4.0) performs in accordance with the WHC-S-4108, *Double-Shell Tank Ultrasonic Inspection Performance Specification*, Rev. 2-A, January 1995. The inspection system is intended to provide ultrasonic (UT) and visual data to determine integrity of the Westinghouse Hanford Company (WHC) site underground waste tanks.

2.0 TEST ITEM DESCRIPTION

The robotic inspection system consists of the following major sub-systems (modules) and components.

2.1 MOBILE CONTROL CENTER

The mobile control center (MCC) provides a central location for the operation of the robotic control system and collection of ultrasonic (UT) and visual examination (VT) data. The MCC consists of an office trailer, robot operator console, UT console, VT console, and back-up generator. The trailer is the communications center for the system. Hard-wired head sets are available for communication with operators inside the tank farm as well as cellular phones for site-wide communications.

The MCC can be located up to 500 ft from the tank access risers. To accomplish this, 500 ft of MCC tether is stored and deployed from a tether housing.

2.2 DEPLOYMENT MODULE

The deployment module (DPM) is required for support deployment and operation of the robotic inspection system. The DPM consists of a housing, electrical enclosure, and pneumatic distribution system. The DPM is configured to be moved by forklift, crane or flatbed truck.

The electrical enclosure houses the robot controller, the power distribution unit for the deployment housing and the VT equipment. The power distribution unit distributes power to all robot subsystems including pneumatic, UT couplant, visual inspection, cable management assembly and the robot controller.

The pneumatic supply system supplies pressurized air to the robot at all times during operation. The pneumatic components are shock mounted to the deployment housing to prevent damage during operation and handling.

2.3 CABLE MANAGEMENT ASSEMBLY

The cable management assembly (CMA) is used to lower the scan carriage (robot) into the tank annulus. It also serves as the temporary storage and shipping container for the robot and its tether. The CMA consists of a structural frame to support the robot and its components, the tether reel to manage tether feed to the robot, the cable hoist to raise and lower the robot, a grapple mechanism to couple and decouple from the hoist cable, and the couplant supply system.

2.4 ROBOT MECHANISM

The robotic mechanism (scan carriage) performs visual examination and UT inspection of the primary and secondary tank walls and the air vents with two different tooling packages. The scan carriage also deploys cleaning equipment for preparation of the walls for UT examination. The scan carriage is constructed of materials that can withstand a total radiation dose of 1E6 RADs. Electronics on the robot are being kept to a minimum. No on-board electronics are used for components needed for recovery of the robot. The sub-systems include the vehicle which deploys the cleaning and inspection tools; the tank wall inspection package which includes the tooling for cleaning, VT, and UT of the tank; and the knuckle and air slot inspection package which includes the tooling for cleaning, VT, and UT of the primary tank bottom and the primary tank knuckle.

2.5 ULTRASONIC TESTING SYSTEM

The UT system has the capability to examine the primary and secondary tank walls, the lower tank knuckle area and the tank bottom via the air slots via two separate transducer arrangements. The purpose of the UT system is to determine tank wall thickness, and to detect and size pitting and stress corrosion cracking.

The UT system consists of the Ultrasonic Testing Console, P-Scan Ultrasonic System, Tank Wall UT Module, Knuckle & Air Slot UT Module, and UT Calibration Standards.

2.6 VISUAL TESTING SYSTEM

The VT system has the capability to examine the primary and secondary tank, the lower tank knuckle area, and the tank bottom via the air slots. The purpose of the VT system is to evaluate the surface condition, monitor cleaning and UT operations, provide video image feedback to the robot positioning systems, provide navigation data, and provide a general area overview to assist in the robot movement.

The VT system consists of the visual testing console, cameras, lighting, monitors, and recorders.

2.7 PNEUMATIC SYSTEM

The pneumatic system consists of several components that supply clean, dry air to the robot at all times. The primary source of air is a duplex air compressor connected to a single 80 gallon tank. The controller in the DPM handles the compressor operation.

2.8 ELECTRICAL SYSTEM

The electrical system is comprised of the power wiring, the control wiring and the robot wiring.

2.9 CONTROL SYSTEM

The robot control system consists of software and hardware components. These components consist of the robot operator console, located in the MCC, and the controller located in the DPM. The robot operator console provides remote operation of the scan carriage. The controller provides computing hardware to run the system and consists of a BME card rack housing the central processing unit, motion control, motor amplifiers, interface boards, and Ethernet communication.

3.0 SCOPE

This procedure applies to the inspection system hardware and software, written procedures, calibration standards, and personnel.

3.1 The Performance Demonstration will provide verification and validation (V&V) of the software used for the examinations and control of the robot. This shall be documented in accordance with Reference 12.8.

3.2 The performance demonstration test will be conducted indoors using the contractor's tank annulus mockup; test temperature will be room temperature without inclement conditions or darkness. The only illumination of the mockup annulus during the test will be the light source(s) delivered by the video system. Some ambient light may be unavoidable.

3.3 The contractor shall be allowed to repair his equipment if it fails during the test, but the individual part of the performance test that has been affected must be redone.

3.4 The contractor's examination personnel shall not be allowed to enter the mockup annulus during the performance demonstration test.

4.0 TERMS/DEFINITIONS

This procedure uses terminology that is similar to the WHC *Final System Design Specification and Operating Procedure* (Ref. 12.3)

4.1 Contractor - Raytheon Engineers & Constructors, Inc. and RedZone Robotics, Inc., (the inspection system suppliers).

4.2 Test Witness - Personnel designated by WHC.

4.3 Personnel using this procedure should be familiar with all terms.

5.0 RESPONSIBILITY

5.1 The contractor shall provide the tank annulus mockup, equipment, detailed written procedures, qualified calibration standards, and personnel to operate the inspection system during the performance test.

5.2 WHC will provide the performance demonstration samples.

5.3 The contractor will provide personnel to operate lifting devices as needed.

5.4 WHC will oversee and evaluate the performance test.

5.5 Access into annulus of the mockup during Performance Test shall be under RedZone Robotics control.

5.6 The contractor will be responsible for compliance with safety requirements applicable to the mockup building and specified throughout this document.

5.7 The contractor shall maintain control of the inspection system in accordance with the *Double-Shell Tank Inspection Project Change Control Procedure* (Ref. 12.9).

6.0 PERSONNEL QUALIFICATION REQUIREMENTS

6.1 Personnel responsible for UT instrument calibration, UT data analysis, and issuing reports shall be certified in accordance with SNT-TC-1A for thickness, pitting, and flaw detection; and by EPRI (Electric Power Research Institute) in intergranular stress corrosion cracking (IGSCC) flaw detection and sizing using P-Scan (Ref. 12.1).

6.2 Personnel whose responsibilities are limited to specific equipment set up and data collection shall be qualified in accordance with the *Ultrasonic Testing System Inspection and Data Analysis Procedure*, Section 3.0 (Ref. 12.5).

6.3 Personnel involved in an activity associated with visual examination shall be qualified in accordance with the *Visual Testing System Inspection and Data Analysis Procedure*, Section 3.0 (Ref. 12.6).

6.4 Robot operator shall be qualified to operate the robot in accordance with Ref. 12.4.

7.0 UT SYSTEM PERFORMANCE TEST DESIGN

7.1 GENERAL

The UT system performance test is to be conducted in a manner that simulates the way in which examination is conducted in the field and shall be performed in accordance with written procedures provided by the contractor.

7.2 CALIBRATION BLOCKS

7.2.1 Basic calibration blocks for detection of planar discontinuities shall meet requirements of the ASME Boiler and Pressure Vessel Code, Section V, Article 4 and 5, 1992 Edition through 1992 Addenda.

7.2.2 Additional qualified reference blocks may be used for through-wall depth sizing, wall-thickness measurement, pitting, and calibration checks provided they meet requirements of ASME code mentioned in 7.2.1.

7.2.3 To verify the temperature detectors, two areas, 6 in. high by 12 in. long, will be of different temperatures. The temperature shall be monitored by thermocouple. The high reading should be 200 ±10 °F. Locations and actual temperature readings shall be revealed to the contractor.

7.3 UT INSTRUMENT CALIBRATION/VERIFICATION

An initial calibration and calibration documentation shall be performed in accordance with the contractor's written procedures.

7.4 REQUIREMENTS FOR SAMPLE INDICATION DETECTION AND SIZING

7.4.1 Performance demonstration samples shall be fabricated from the same DST wall material or equivalent materials.

7.4.2 Performance demonstration samples shall have sufficient area to minimize spurious reflections.

7.4.3 Performance demonstration samples shall include thickness, pitting, and IGSCC crack samples.

7.4.4 Performance demonstration samples shall be divided into grading units. A grading unit is defined as a minimum of 3 in. of continuous vertical or horizontal length.

7.4.5 Orientation of the cracks shall be either perpendicular or parallel to the major axis of the performance demonstration specimen.

7.4.6 Flawed and unflawed grading units shall be randomly mixed.

7.4.7 Performance demonstration samples shall be embedded in the primary tank wall with their access surface facing the annulus; the access surface of the samples shall be flush with the surrounding wall surface; exposed back surface of the samples shall be masked. WHC may request some of the flawed surfaces face the annulus.

7.4.8 The same performance demonstration samples may be used for both detection and through-wall sizing.

7.4.9 WHC shall have documentation that characterizes the flaws, but the information shall not be disclosed to the contractor before or during the test.

7.5 SYSTEM DETECTION PERFORMANCE DEMONSTRATION TEST

7.5.1 General

a. Two or more individuals may participate as a team for data acquisition, data analysis, acquisition and analysis, or a combination.

b. WHC will approve test plate installation plan developed by the contractor.

c. The test plates described in the paragraph above shall contain unflawed areas (unflawed grading units).

d. All information acquired during the Performance Test, including forms, disks, tapes, or any other form of collected data, become the property of WHC and will not be returned to the contractor.

7.5.2 Preparation for Data Acquisition

a. Before data acquisition begins, WHC will provide the data acquisition team a package containing grid sheets and information on test plate location, and identification.

b. The following items are not included in the acquisition time:

- Initial UT system calibration or calibration check.
- Positioning scan carriage at the scan start on the first and subsequent performance demonstration specimens.

7.5.3 Data Analysis and Reporting

7.5.3.1 Stress Corrosion Cracking. The orientation (perpendicular or parallel) location and size of cracks shall be reported on the SCC detection grid sheets as described below:

a. Each cell represents one 1 in. of plate.

b. The centerline of the grid corresponds to the major axis.

c. A "C" should be recorded in each 1 in. cell corresponding to a crack location.

d. If a crack is less than 1 in. long, the entire cell is considered cracked.

e. Uncracked regions are denoted by the absence of "C's".

f. Tag crack measurements greater than 0.5 in..

g. The following documentation shall be completed:

- Ultrasonic Calibration Sheet (Ref. 12.5) shall be completed before data acquisition begins).
- Ultrasonic Test Data Report.(Ref. 12.5)
- Detection Grid Sheets, *Attachment 2* and *Attachment 3* or the contractor's grid sheets.
- P-scan data presentation printout (other modes of presentation may be acceptable).

7.5.3.2 Pitting Samples. The orientation (perpendicular or parallel) location and size of pitting shall be reported on the contractor's pitting detection grid sheets as described below:

a. Each cell represents one (1) in. of plate.

b. The centerline of the grid corresponds to the major axis.

c. A "C" should be recorded in each 1 in. cell corresponding to a pit location.

d. If a pit is found, the entire cell is considered pitted.

e. Unpitted regions are denoted by the absence of "C's".

f. An allowance of 0.5 in. is permitted in one direction or the other from the actual pit location.

g. Tag pits greater than 0.35t.

h. The following documentation shall be completed:

- Ultrasonic Calibration Sheet (Ref. 12.5) shall be completed before data acquisition begins).
- Ultrasonic Test Data Report. (Ref. 12.5)
- Detection Grid Sheets, *Attachment 2* and *Attachment 3* or the contractor's grid sheets.
- P-scan data presentation printout (other modes of presentation may be acceptable).

7.5.3.3 Wall Thinning

a. Each cell represents one (1) in. of plate.

b. The centerline of the grid corresponds to the major axis.

c. A "C" should be recorded in each 1 in. cell corresponding to a thinning location.

d. If thinning is found (less than 0.875t), the entire cell is considered thinned.

e. Un-thinned regions are denoted by the absence of "C's".

f. An allowance of 0.5 in. is permitted in one direction or the other from the actual thinning location.

g. Tag wall thickness measurements less than 0.875t.

h. The following documentation shall be completed:

- Ultrasonic Calibration Sheet (Ref. 12.5) shall be completed before data acquisition begins).
- Ultrasonic Test Data Report.(Ref. 12.5)
- Detection Grid Sheets, *Attachment 2* and *Attachment 3* or the contractor's grid sheets.
- P-scan data presentation printout (other modes of presentation may be acceptable).

7.5.4 Performance Criteria for Flaw Detection

7.5.4.1 To complete the detection performance test successfully, the system must perform in accordance with Table 2.

TABLE 2

Detection Test Acceptance Criteria			
Detection Criteria		False Call Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum No. of False Calls
6	6	12	1
7	6	14	1
8	7	16	2
9	7	18	2
10	8	20	3

Failure to complete the detection performance test successfully shall be evaluated by WHC to determine if the detection performance test is to be repeated or accepted as-is.

7.5.4.2. A false call is defined as calling an unflawed grading unit flawed (i.e. cracked, pitted).

7.6 SYSTEM SIZING PERFORMANCE TEST

7.6.1 General

a. Data acquired during the data acquisition process in Section 7.5.3 shall be used for this activity.

b. All information acquired during the system sizing performance test become the property of WHC.

c. The Summary Report (Attachment 4) shall be used for reporting the flaws.

7.6.2 Performance Criteria for Sizing

All detected flaws shall be sized to the following requirements:

a. For circumferential and longitudinal flaws, the minimum detected flaw shall be t in length +/- 0.5 in. and 0.5t in depth +/- 0.050 in.;

b. Flaws 12 in. and greater in length, the requirements for sizing shall be +/- 0.5 in. in length and 0.2t +/- 0.050 in. in depth;

c. For Pitting, the minimum detectable pit shall be 0.7t in diameter and 0.35t in depth +/-0.02 in..

d. For thinning, the sizing shall be t +/- 0.0025 in. and documented on Attachment 4.

8.0 VISUAL SYSTEM PERFORMANCE TEST DESIGN

The Resolution Chart, *Attachment 5*, shall be used in five different locations in the annulus, and situated or attached as follows:

8.1 On the outside wall of the adjacent 24 in. riser extension, with center of the chart in direct view of the overview camera;

8.2 In center of the length of the first primary tank horizontal weld under the 24 in. riser, with center of the chart on the weld centerline;

8.3 At the same horizontal location as the chart in 8.2 but placed on next horizontal weld below;

8.4 Placed flat at the annulus bottom, with center of the chart at the projected center of 3 in. (overview system deployment) riser;

8.5 On the primary tank knuckle, below the wall bottom weld, with center of the chart aligned vertically with center of 2.5 by 2.5-in. tapered air slot.

8.6 There are two (2) additional resolution charts of different patterns as illustrated on *Attachment 6*. They are located in the 2.5 in. by 2.5 in. tapered air slot, situated and oriented as follows:

8.7 Attached flat to the bottom of primary tank, with center of the chart 2 in. from air slot entrance;

8.8 Vertically inside the air slot at a distance of 2 feet from the slot entrance.

8.9 The general-area camera shall be capable of viewing up to 5 feet from the inspection zone in all directions parallel to the tank wall. To confirm the camera viewing capability, four test charts shall be placed 5 foot above, below, and on each side of the camera.

9.0 CONDUCT OF PERFORMANCE TEST

The test sequence is organized into nineteen (19) sections; each section has its own performance checklist; the checklists are identified as attachments in Section 13.0.

The WHC representative may determine certain portions of the checklists to be "not applicable" and will identify this on the checklists with an "N/A".

9.1 SYSTEM PRE-DEPLOYMENT (use checklist on *Attachment 7*)

9.1.1 The contractor shall set site-support utilities for the test and make all connections between site utilities, and DSTIS components and for communications. The DSTIS communication cables shall be at the maximum deployment length during the performance demonstration.

9.1.2 The contractor shall perform functional checks on the system components per system deployment checklist provided by contractor's operating procedure.

9.1.3 The contractor shall demonstrate performance of robot calibration per the *Double-Shell Tank Inspection System, Operating Procedure*, Section 8.0 (Ref. 12.4).

9.1.4 The contractor shall demonstrate the Visual System sensitivity per Section 5.2 in the *Visual Testing System Inspection and Data Analysis Procedure* (Ref. 12.6).

9.1.5 The contractor shall perform initial calibration on the knuckle and air slot transducer array module (KASTAM) in accordance with the *Double-Shell Tank Inspection System, Ultrasonic Testing System Inspection and Data Analysis Procedure* (Ref. 12.5).

9.1.6 The contractor shall perform initial calibration on the tank wall ultrasonic transducer array module (TWUTAM) in accordance with the *Double-Shell Tank Inspection System, Ultrasonic Testing System Inspection and Data Analysis Procedure* (Ref. 12.5).

9.1.7 The contractor shall install the resolution charts as required in 8.0.

9.2 DEPLOYMENT (use checklist on *Attachment 8*)

9.2.1 Safety requirements for the tank mockup building shall be followed.

9.2.2 WHC shall verify that mockup annulus is clear, interior lighting turned off and access to the mockup corridor secured.

9.2.3 The contractor shall install overview system through a 3 in. riser.

9.2.4 The contractor shall lower the overview system so that the camera directly views Chart 8.1; focus the camera on the chart and evaluate camera's far distance resolution on video monitor(s) used by the system; verify operability of camera's zoom, pan, tilt, iris, and lighting from visual console.

9.2.5 The contractor shall rotate the system so that the camera views the annulus bottom and focuses on Chart 8.4; verify camera's near distance resolution.

9.2.6 The TWUTAM and cleaning tool shall be mounted to the robot by the contractor.

9.2.7 The contractor shall perform UT calibration check on the TWUTAM in accordance with the *Double-Shell Tank Inspection System, Ultrasonic Testing System Inspection and Data Analysis Procedure* (Ref. 12.5).

9.2.8 The contractor shall install the CMA over the riser.

9.2.9 The contractor shall verify that robot is rotated so that the UT inspection package faces primary tank wall.

9.2.10 The contractor shall visually examine space around 24 in. riser with the overview camera for potential obstacles.

9.2.11 Record deployment time of steps 9.2.12, 9.2.13, and 9.2.14.

9.2.12 The contractor shall lower robot to the first horizontal weld on primary tank wall that the video system is capable of detecting.

9.2.13 The contractor shall actuate the robot to a walking position and extend telescoping cylinders to engage tank walls.

9.2.14 The contractor shall level the scan carriage.

9.3 **PRIMARY TANK WALL CLEANING** (use checklist on *Attachment 9*)

9.3.1 The contractor shall clean, visually identify and document the position identified in Step 9.2.13 above by the machine vision system. This is the primary tank home position.

9.3.2 The contractor shall move robot along the horizontal weld in direction designated by WHC to locate Chart 8.2 with the inspection camera.

9.3.3 The contractor shall focus the camera on center of the 5 in. by 5 in. image on the chart. The image shall cover a minimum of a 5 in. by 5 in. area on the 13 in. S-Video monitor.

9.3.4 The contractor shall move robot until reference position established in 9.3.1 has been reached.

9.3.5 The contractor shall maneuver the robot in a direction specified by WHC along the horizontal weld to detect a intersection with the nearest ⫫ vertical weld.

9.3.6 The contractor shall move the robot upward along the vertical weld until the intersection with the ⫪ weld has been located.

9.3.7 The contractor shall clean and visually identify this position by the machine vision system. This is the primary tank inspection origin (0,0) for the wall inspection path.

9.3.8 The contractor and WHC shall Check alignment of the robot with the weld within target window of the vision system.

9.3.9 The contractor shall send the robot down a vertical weld to the nearest intersection with a horizontal ⊥ weld; proceed along the horizontal weld in direction specified by WHC until another intersection with vertical ⊤ weld is detected; move the robot along the same path back to 0,0 origin; touch the TWUTAM to the wall again.

9.3.10 WHC shall compare position of the UT inspection zone identified in 9.3.7 with the current position; the robot's horizontal and vertical positioning accuracy shall be within ±1.0 in.; check alignment of robot with the weld.

9.3.11 The contractor shall clean a 2.5 in. wide zone of base metal adjacent to each side of the weld along a path and to a pattern determined by WHC.

9.3.12 WHC shall visually examine the effectiveness of the cleaning process.

9.4 PRIMARY TANK WALL VT INSPECTION (use checklist on *Attachment 10*)

9.4.1 The contractor shall demonstrate performance of a remote visual examination on primary tank wall in accordance with the visual inspection system procedure along the inspection path set by WHC in 9.3.11, and visual activity using the applicable charts in 8.0.

9.4.2 The contractor shall record the inspection on a videotape.

9.4.3 The contractor shall demonstrate data review, analysis, handling, and reporting.

9.4.4 The contractor shall return robot to the inspection origin 0,0.

9.5 PRIMARY TANK WALL UT EXAMINATION (use checklist on *Attachment 11*)

9.5.1 WHC will time the analysis of 3 flaws for the UT Examination.

9.5.2 WHC shall provide, documentation and locations of test plates for an SCC detection performance test as described in Sections 7.4 and 7.5, respectively.

9.5.3 The contractor shall demonstrate the system SCC, pitting, and wall thickness detection capability per WHC instructions and written requirements in Section 7.5.

9.5.4 WHC shall provide test plates for an SCC, pitting, and wall thickness sizing performance test as described in Sections 7.5 and 7.6.

9.5.5 The contractor shall demonstrate the capability of the system to size SCC, pitting, and wall thickness per WHC instructions and written requirements in Section 7.6.

9.5.6 The contractor shall provide documentation and locations for the temperature detector(s) functional checks (see 7.2.3).

9.5.7 The contractor shall demonstrate that system operating personnel identify and respond to temperature changes.

9.5.8 The contractor shall demonstrate performance of a remote ultrasonic examination of primary tank wall, along a 5 in. wide inspection path set by WHC.

9.5.9 The contractor shall demonstrate the P-Scan system UT data display, recording and storage.

9.5.10 The contractor shall demonstrate data review, analysis, handling and reporting; all data shall be reviewed prior to removing robot from the annulus.

9.5.11 The contractor shall after completion of UT inspection performance test, return the robot to the primary tank wall home position for retrieval.

9.5.12 The contractor shall retrieve robot from the annulus as described in the Operating Procedure (Ref. 12.4).

9.5.13 The contractor shall determine the couplant flow rate during the performance demonstration.

9.6 SECONDARY TANK WALL CLEANING (use checklist on *Attachment 12*)

9.6.1 The contractor shall rotate the robot so that the inspection package faces the secondary tank wall.

9.6.2 The contractor shall lower robot through 24 in. riser to the first horizontal weld on secondary tank wall that the video system can detect.

9.6.3 The contractor shall actuate robot to a walking position and extend telescoping cylinders to engage tank walls.

9.6.4 The contractor shall level the scan carriage.

9.6.5 The contractor shall clean and visually identify this robot position by the machine vision system. This position is the <u>secondary tank wall home position</u>.

9.6.6 The contractor shall move the robot along the horizontal weld in the direction designated by WHC to locate the nearest ⊥ vertical weld. Proceed by moving robot upward along the vertical weld

until it locates the ⊤ weld intersection.

9.6.7 The contractor shall clean and visually identify this position by the machine vision system. This position is the secondary tank wall inspection origin (0,0) for the inspection path.

9.6.8 The contractor shall clean the surface along a 5 in. wide path set by WHC from the tank haunch to the knuckle area.

9.7 SECONDARY TANK WALL VT EXAMINATION (use checklist on *Attachment 13*)

9.7.1 The contractor shall perform a remote visual examination of the secondary tank wall in accordance with the Visual Inspection System Procedure along inspection path set in 9.6.8.

9.7.2 The contractor shall record the inspection on a videotape.

9.7.3 The contractor shall demonstrate the review, analysis, handling, and reporting data.

9.8 SECONDARY TANK WALL UT EXAMINATION (use checklist on *Attachment 14*)

9.8.1 The contractor shall perform a remote ultrasonic wall-thickness measurement on secondary tank wall in accordance with the Ultrasonic Inspection System Procedure (Ref. 12.5) along a 5 in. wide inspection path set by WHC. The inspection path shall include examination within 8 in. of the annulus bottom.

9.8.2 The contractor shall record and store UT data using the P-Scan system.

9.8.3 The contractor shall review, analyze, handle and report data.

9.8.4 The contractor shall review all data before removing robot from the annulus.

9.8.5 After the UT wall thickness measurement performance test, the contractor shall send the robot to the secondary tank wall home position for retrieval.

9.8.6 The contractor shall retrieve robot from the annulus as described in the Operating Procedure.

9.8.7 The contractor shall perform final UT calibration on TWUTAM.

9.8.8 The contractor shall determine the couplant flow rate during the performance demonstration.

9.9 PRIMARY TANK BOTTOM CLEANING (use checklist on *Attachment 15*)

9.9.1 The contractor shall remove TWUTAM and mount the KASTAM to the secondary slide of the robot. Attach the cleaning tool to the secondary slide.

9.9.2 The contractor shall perform UT calibration check on the KASTAM.

9.9.3 The contractor shall rotate the robot so that the inspection package faces primary tank wall.

9.9.4 The contractor shall reposition robot in the riser for the primary tank bottom inspection. WHC shall verify that mockup annulus is clear, interior lighting turned off and access to the mockup corridor secured.

9.9.5 The contractor shall actuate robot to a walking position and navigate the robot down the primary tank wall to the 2.5 in. square tapered air slot.

9.9.6 The contractor shall align the inspection camera with the air slot.

9.9.7 The contractor shall index the tooling to the inspection camera so that the camera is aligned with the air slot and insert the camera approximately 24 in. into the slot.

9.9.8 The contractor shall clean the tank bottom along the full reach of the tool in a 5 in. path on the knuckle and a 1 in. wide path in the slots.

9.9.9 The contractor shall retract the cleaning tool from the air slot and clean the primary tank knuckle from the tank bottom to a point on the knuckle 8 in. from tank bottom.

9.9.10 The contractor shall repeat steps 9.9.6 to 9.9.9 on the other air slot configuration.

9.10 PRIMARY TANK BOTTOM VT EXAMINATION (use checklist on *Attachment 16*)

9.10.1 The contractor shall index the tooling to the inspection camera so that the camera is aligned with the air slot specified by WHC and verify visual sensitivity using the appropriate charts in 8.0.

9.10.2 The contractor shall visually inspect the primary tank bottom and knuckle with the inspection camera.

9.10.3 The contractor shall record the inspection on a videotape.

9.10.4 The contractor shall repeat steps in 9.10.1 through 9.10.3 for the other slot configuration.

9.10.5 The contractor shall review, analyze, handle and report data.

9.11 PRIMARY TANK BOTTOM UT EXAMINATION (use checklist on *Attachment 17*)

9.11.1 The contractor shall perform a remote UT examination of primary tank bottom from either air slot configuration (1 in. wide path) and along the tank knuckle (5 in. wide path) in accordance with the *Ultrasonic Testing System Inspection and Data Analysis Procedure*.

9.11.2 The contractor shall review, analyze, handle and report data; all data shall be reviewed before robot is removed from the annulus.

9.11.3 After UT examination performance test, the contractor shall send the robot either to the primary tank home position for retrieval or to a location designated by WHC for a task in Section 9.12 below.

9.11.4 The contractor shall record the couplant flow rate during the performance demonstration.

9.11.5 WHC shall decide whether the current inspection package is desirable for obstacle negotiation performance test. If the package is desirable, skip the rest of this section (9.11). If it is not, continue with steps 9.11.6 through 9.11.10 below.

9.11.6 The contractor shall send robot to the primary tank wall home position for retrieval.

9.11.7 The contractor shall retrieve robot from the annulus.

9.11.8 The contractor shall perform final UT calibration on KASTAM.

9.11.9 The contractor shall remove KASTAM and mount the TWUTAM, with the cleaning tool, to the robot.

9.11.10 The contractor shall rotate the robot so that the inspection package faces desired tank wall.

9.11.11 The contractor shall reposition the robot in the riser for the obstacle negotiation performance test.

9.12 COOLING PIPE NEGOTIATION (use checklist on *Attachment 18*)

The cooling pipe shall be installed. Other obstacles of the kind that will be encountered in the actual waste tanks shall be simulated or installed as found in the tanks. The activities described in this section shall be performed twice: once with the robot set up to negotiate cooling pipes near the primary wall and once with the cooling pipes close to the secondary tank wall.

9.12.1 The contractor shall maneuver the robot to negotiate the vertical cooling pipes and simulated objects in the annulus mockup in accordance with the contractor's procedure and videotape the maneuvers.

9.12.2 The contractor shall perform final UT calibration on KASTAM.

9.12.3 The contractor shall remove KASTAM and mount the TWUTAM with cleaning tool to the robot.

9.12.4 The contractor shall maneuver the robot with the TWUTAM to negotiate the vertical cooling pipes and simulated objects in the annulus mockup in accordance with the contractor's procedure and videotape the maneuvers.

9.12.5 The contractor shall perform final UT calibration on TWUTAM.

9.13 HAUNCH NEGOTIATION (use checklist on *Attachment 19*)

9.13.1 WHC shall verify that mockup annulus is clear, interior lighting turned off, and access to the mockup corridor secured.

9.13.2 The contractor shall reposition the robot in the riser for the haunch negotiation.

9.13.3 The contractor shall maneuver the robot to the highest point possible in the haunch area per the operating procedure (Ref. 12.4).

9.13.4 The contractor shall position the robot for cleaning of the primary tank haunch wall and demonstrate the cleaning process by maneuvering the robot along a straight vertical path from the point where the straight tank wall meets the curved portion on up to the highest point possible along a 5 in. wide path; videotape the negotiation performance test.

9.13.5 The contractor shall record the negotiation on videotape.

9.13.6 The contractor shall perform Visual and UT examination of the primary and secondary tank haunch along a path designated by WHC.

9.13.7 The contractor shall review, analyze, handle and report data.

9.14 POWER RECOVERY (use checklist on *Attachment 20*)

The contractor shall maneuver the robot to the position specified by WHC.

9.14.1 The contractor shall trip off the electrical breaker supplying power to the entire inspection system. The contractor's backup generator should start automatically and the controller run on an uninterruptable power supply to assure that the robot does not crash. The robot should stay in the safe mode until normal

electrical power is restored.

9.14.2 The contractor shall restore normal electrical power to the inspection system.

9.14.3 The contractor shall trip off the electrical breaker supplying power to the entire inspection system. WHC shall observe for 10 minutes and record any effects of having both electrical and air service interrupted simultaneously.

9.14.4 The contractor shall restore both electrical and air service.

9.15 ROBOT RECOVERY (use checklist on *Attachment 21*)

9.15.1 The contractor shall turn off one of the two air supply lines through the robot tether.

9.15.2 The contractor shall retrieve the robot per operating/emergency procedure.

9.15.3 The contractor shall restore air supply through the tether.

9.15.4 The contractor shall disconnect the air supply to the lower vertical foot package.

9.15.5 The contractor shall demonstrate the ability to rotate the robot about its center with one foot package disabled.

9.15.6 The contractor shall retrieve the robot per operating/emergency procedure.

9.15.7 The contractor shall reconnect the air supply to the lower vertical foot package.

9.16 DATA COLLECTION, RECORDING, DISPLAY AND STORAGE

9.16.1 The position of the UT head relative to the weld and along the axis of the weld is required and shall be recorded with the UT data.

9.16.2 Video of the tank surface shall be marked with the position data of the scan carriage and an identification code (header).

9.16.3 Video information, UT data, and position data shall be collected, recorded, and displayed in real time.

9.16.4 However the UT data is processed, it and the scanner position shall be displayed in real time as a graphical image display. Top, side, and end view images of the scan area shall be displayed coincident with the position and camera display.

9.16.5 All processed UT data collected during the performance test shall be stored digitally on a removable medium.

9.16.6 Video data shall be stored on magnetic tape.

9.17 ERROR MESSAGES

Error messages shall be tested and documented as required by WHC in accordance with Ref. 12.8.

9.18 SIGNATURE/INITIAL RECORD (use checklist on *Attachment 24)*

Record printed name, written initials, and signature of all parties involved in the performance test.

9.19 EVALUATION OF THE PERFORMANCE TEST

WHC shall perform an evaluation of the Performance Test using this procedure and Reference 12.7. This will determine the success or failure of the Performance Test, and shall be documented in a report.

10.0 DOCUMENTATION

In addition to documentation responsibilities cited throughout this performance demonstration test procedure, the following requirements shall be met:

- The contractor shall supply all documentation forms necessary for a complete field tank inspection.

10.1 PERSONNEL QUALIFICATIONS

a. Ultrasonic Examiner Certifications (SNT-TC-1A, EPRI IGSCC).

b. Ultrasonic equipment setup and data collection.

c. Visual Examiner Qualifications.

10.2 EQUIPMENT QUALIFICATIONS

a. Calibration block certifications.

b. Initial calibration and calibration data for all equipment.

c. Data sheets from Performance Test Procedure.

d. Incident reports.

e. Other certifications and required information.

10.3 SYSTEM IDENTIFICATION

The contractor shall supply the description of system identification and the tank mockup weld layout.

10.4 WHC INFORMATION

a. WHC shall provide additional documentation as follows:

b. Documentation on test plates as follows:

- Identification and location
- Base material specifications
- Dimensions, sketches and designation of acquisition areas.

c. Assessment and evaluation of the performance demonstration test.

11.0 SAFETY

- Facility safety requirements shall be followed.
- Test safety requirements are the responsibility of the contractor.

12.0 REFERENCES

12.1 EPRI Nondestructive Evaluation Center, *Utility Industry Personnel Qualification Guidelines for Detection and Sizing of Intergranular Stress-Corrosion Cracking (IGSCC)*, December 1987.

12.2 ETR-1001, *Ebasco Nuclear Quality Assurance Program*, and *The Ebasco Team Quality Assurance Program Plan*.

12.3 WHC-4375-SP-3.0, *Double-Shell Tank Inspection, Final System Design Specification*, Rev. 2, Draft, December 1, 1994.

12.4 WHC-4375-PR-3.1, *Double-Shell Tank Inspection System, Operating Procedure*, Rev. Draft 2, August 30, 1994.

12.5 WHC-4375-PR-3.2, *Double-Shell Tank Inspection System, Ultrasonic Testing System Inspection and Data Analysis Procedure*, Rev. Draft 2, September 16, 1994.

12.6 WHC-4375-PR-3.3, *Double-Shell Tank Inspection System, Visual Testing System Inspection and Data Analysis Procedure*, Rev. Draft 2, August 31, 1994.

12.7 WHC-S-4108, *Double-Shell Tank Ultrasonic Inspection, Performance Specification*, Rev. 2-A, January 1995.

12.8 WHC-SD-WM-QAPP-024, *Double-Shell Tank Inspection Program, Quality Assurance and Configuration Management Plan*, Rev. 0, January 1994.

12.9 WHC-4375-PR-3.7, *Double-Shell Tank Inspection Project Change Control Procedure*, Draft 1, November 1994.

12.10 WHC-4375-PR-3.8, *Double-Shell Tank Inspection Operator Interface Concept*, Draft 2, August 31, 1994.

13.0 ATTACHMENTS

Attachment 1 - Performance Test Incident Report
Attachment 2 - IGSCC Detection Grid Sheet - Horizontal **(Example)**
Attachment 3 - IGSCC Detection Grid Sheet - Vertical **(Example)**
Attachment 4 - Depth Sizing of IGSCC Summary Report
Attachment 5 - Resolution Chart
Attachment 6 - Resolution Charts
Attachment 7 - System Pre-Deployment Checklist
Attachment 8 - Deployment Checklist
Attachment 9 - Primary Tank Wall Cleaning Checklist **(2 Pages)**
Attachment 10 - Primary Tank Wall Visual Inspection Checklist
Attachment 11 - Primary Tank Wall UT Inspection Checklist
Attachment 12 - Secondary Tank Wall Cleaning Checklist
Attachment 13 - Secondary Tank Wall Visual Inspection Checklist
Attachment 14 - Secondary Tank Wall UT Inspection Checklist
Attachment 15 - Primary Tank Bottom Cleaning Checklist
Attachment 16 - Primary Tank Bottom Visual Inspection Checklist
Attachment 17 - Primary Tank Bottom UT Inspection Checklist
Attachment 18 - Cooling Pipe Negotiation Checklist
Attachment 19 - Haunch Negotiation Checklist
Attachment 20 - Power Recovery Checklist
Attachment 21 - Robot Recovery Checklist
Attachment 22 - Data Collection Recording, Display and Storage Checklist
Attachment 23 - Error Messages Checklist
Attachment 24 - Signature/Initial Record

Attachment 1
Performance Test Incident Report

Incident No.	Test Case Test Item	Date
Originator/Name	Organization	Date
SubSystem/Module	Component	Time
Incident Description		
[ ] Occurred before Test Case Start [ ] Fixed before Test Case Start	[ ] Occurred during Test Case [ ] Fixed during Test Case	[ ] Occurred after Test End [ ] Fixed after Test End
Action Taken		
Impact on Previous Test Case		[ ] Previous Test Case Repeated
Impact on Following Test Case		[ ] Current Test Case Repeated
Test Performer/Signature	Organization	Date
Test Witness/Signature	Organization	Date

Attachment 1 (Cont.)

Instructions for Preparing the Performance Test Incident Report

1. **Incident Number** - Use a sequential numbering system, such as 1, 2, 3,...

2. **Test Case** - This is the Case identified on the Performance Test Checklist.
   a. **Test Item** - Procedural step number.

3. **Date** - Date the incident occurred.

4. **Originator/Name** - The name of the person initially preparing this report.

5. **Organization** - Company name and department.

6. **Date** - Date the report is prepared.

7. **Subsystem/Module** - Identify which subsystem and module is affected.

8. **Component** - Identify which component is affected.

9. **Time** - State the time the incident occurred.

10. **Incident Description** - Describe what happened.

11. **Check boxes** - Check the appropriate box(es).

12. **Action Taken** - Describe the actions or corrective actions to resolve the incident.

13. **Impact on Previous Test Case** - Describe the affect of this incident on any previous test cases.

14. **Impact on Following Test Case** - Describe the affect of this incident on any following test cases.

15. **Test Performer/Signature** - The person performing the test shall sign the incident report.

16. **Organization** - The test performer's organization.

17. **Date** - Date test performer signs report.

18. **Test Witness/Signature** - The person witnessing the test shall sign the incident report.

19. **Organization** - The witnesses' organization.

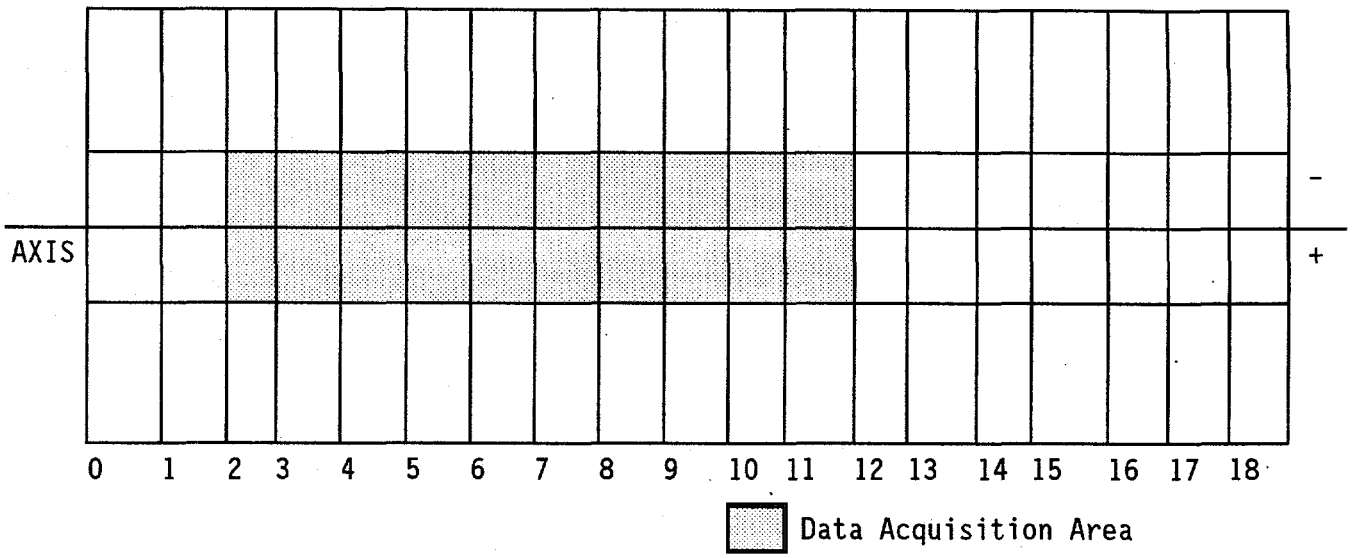
20. **Date** - The date the witness signs the report.

Attachment 2

Ultrasonic Automated System Performance Test

Test Plate No. _____ *Major Axis Orientation Horizontal*

Detection Grid Sheet



Test Performer/Signature_____ Date _____

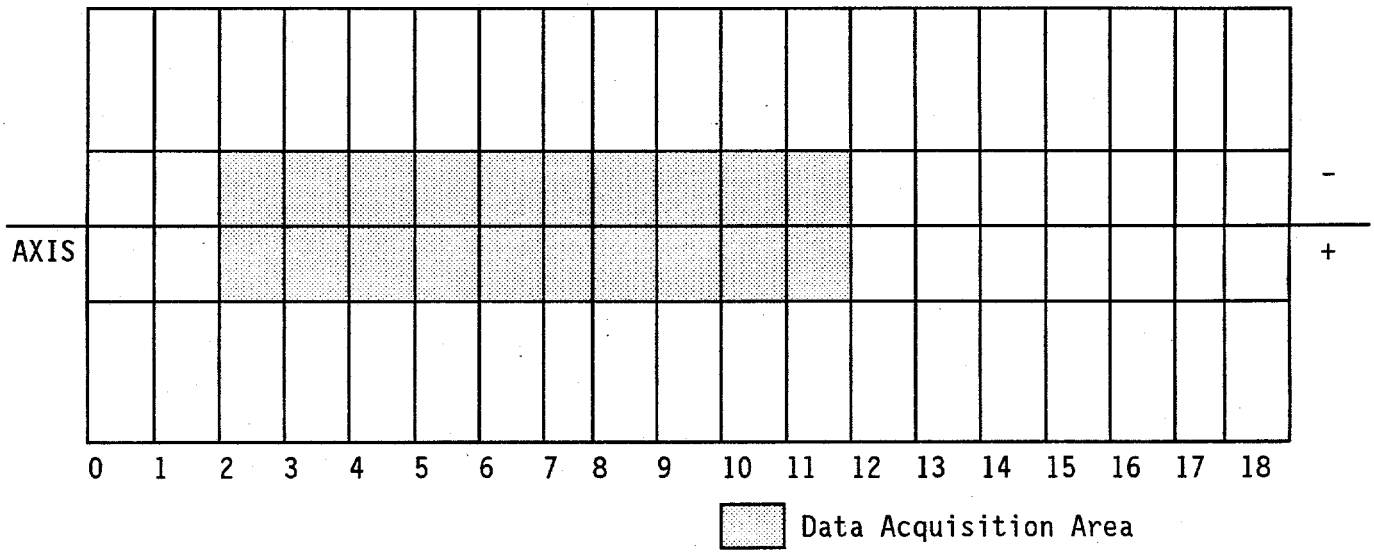
Test Witness/Signature _____ Date _____

Attachment 3

Ultrasonic Automated System Performance Test

Test Plate No. _____ *Major Axis Orientation Vertical*

Detection Grid Sheet



Test Performer/Signature_____ Date _____

Test Witness/Signature _____ Date _____

Attachment 4

Ultrasonic Automated System Performance Test

Sizing

Summary Report

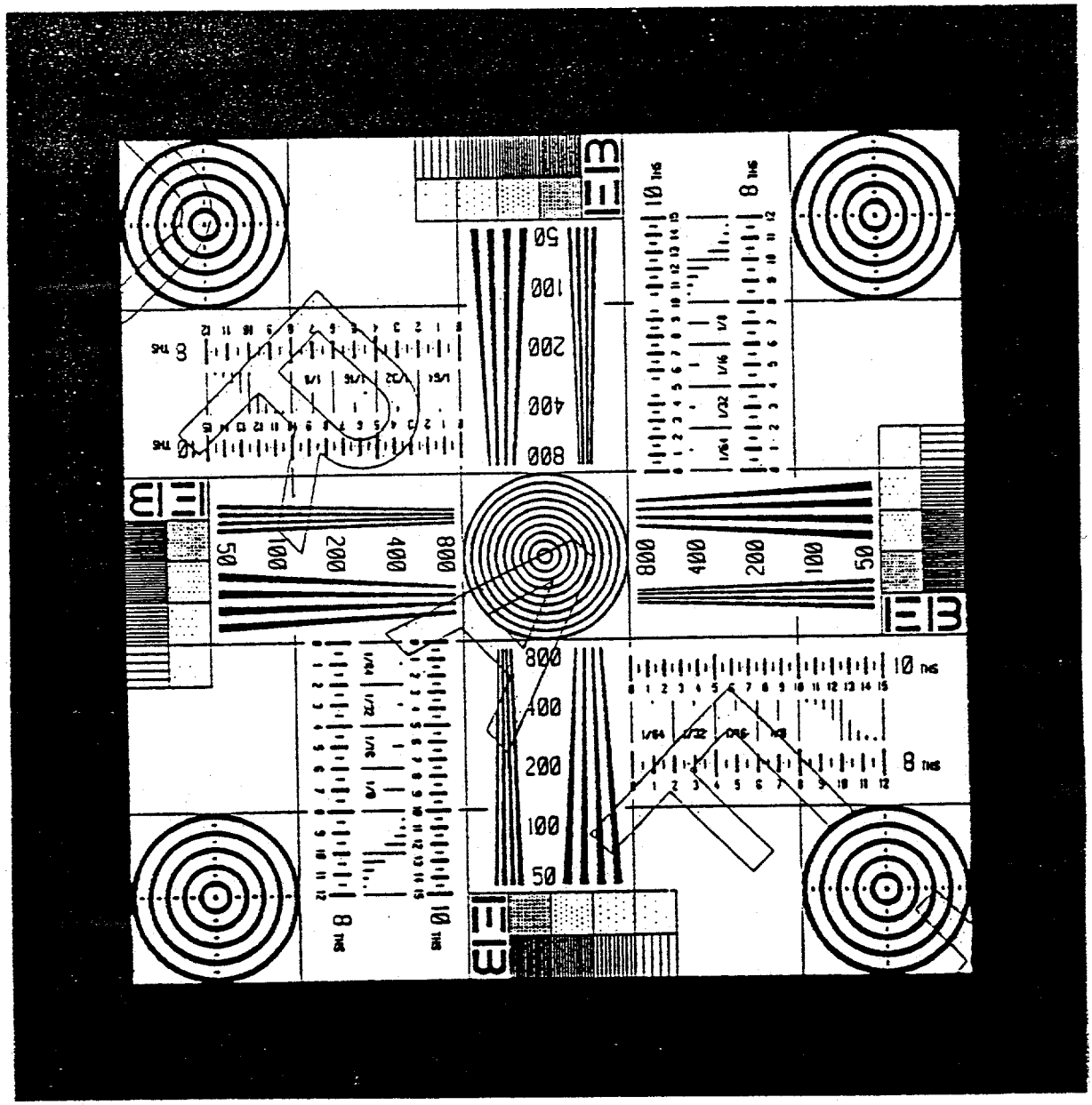
Test Plate Number	Reported Depth, Length or Wall Thickness (inches)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Test Performer/Signature_____ Date _____

Test Witness/Signature _____ Date _____

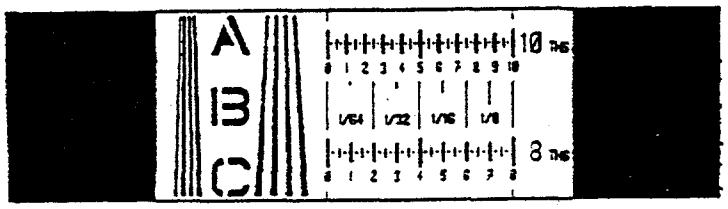
Attachment 5

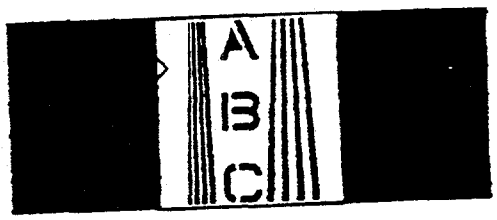
Resolution Chart used in Section 8.0



Attachment 6

Resolution Charts used in Section 8.0





Attachment 7

Performance Test Checklist

Section 9.1		Test Case System Pre-Deployment			Date	
Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.1.1					Test Performer	
					Test Witness	
9.1.2					Test Performer	
					Test Witness	
9.1.3					Test Performer	
					Test Witness	
9.1.4					Test Performer	
					Test Witness	
9.1.5					Test Performer	
					Test Witness	
9.1.6					Test Performer	
					Test Witness	
9.1.7					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Witness	
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					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 8

Performance Test Checklist

Section 9.2		Test Case Deployment			Date	Page 1 of 1
Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.2.1					Test Performer	
					Test Witness	
9.2.2					Test Performer	
					Test Witness	
9.2.3					Test Performer	
					Test Witness	
9.2.4					Test Performer	
					Test Witness	
9.2.5					Test Performer	
					Test Witness	
9.2.6					Test Performer	
					Test Witness	
9.2.7					Test Performer	
					Test Witness	
9.2.8					Test Performer	
					Test Witness	
9.2.9					Test Performer	
					Test Witness	
9.2.10					Test Performer	
					Test Witness	
9.2.11					Test Performer	
					Test Witness	
9.2.12					Test Performer	
					Test Witness	
9.2.13					Test Performer	
					Test Witness	
9.2.14					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 9

Performance Test Checklist

Section 9.3	Test Case Primary Tank Wall Cleaning	Date	Page 1 of 2

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.3.1					Test Performer	
					Test Witness	
9.3.2					Test Performer	
					Test Witness	
9.3.3					Test Performer	
					Test Witness	
9.3.4					Test Performer	
					Test Witness	
9.3.5					Test Performer	
					Test Witness	
9.3.6					Test Performer	
					Test Witness	
9.3.7					Test Performer	
					Test Witness	
9.3.8					Test Performer	
					Test Witness	
9.3.9					Test Performer	
					Test Witness	
9.3.10					Test Performer	
					Test Witness	
9.3.11					Test Performer	
					Test Witness	
9.3.12					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 10

Performance Test Checklist

Section 9.4	Test Case Primary Tank Wall Visual Inspection				Date	Page 1 of 1
Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.4.1					Test Performer	
					Test Witness	
9.4.2					Test Performer	
					Test Witness	
9.4.3					Test Performer	
					Test Witness	
9.4.4					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
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					Test Witness	
					Test Performer	
					Test Witness	

Attachment 11

Performance Test Checklist

Section 9.5	Test Case Primary Wall UT Inspection	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.5.1					Test Performer	
					Test Witness	
9.5.2					Test Performer	
					Test Witness	
9.5.3					Test Performer	
					Test Witness	
9.5.4					Test Performer	
					Test Witness	
9.5.5					Test Performer	
					Test Witness	
9.5.6					Test Performer	
					Test Witness	
9.5.7					Test Performer	
					Test Witness	
9.5.8					Test Performer	
					Test Witness	
9.5.9					Test Performer	
					Test Witness	
9.5.10					Test Performer	
					Test Witness	
9.5.11					Test Performer	
					Test Witness	
9.5.12					Test Performer	
					Test Witness	
9.5.13					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 12

Performance Test Checklist

Section 9.6	Test Case Secondary Tank Wall Cleaning	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.6.1					Test Performer	
					Test Witness	
9.6.2					Test Performer	
					Test Witness	
9.6.3					Test Performer	
					Test Witness	
9.6.4					Test Performer	
					Test Witness	
9.6.5					Test Performer	
					Test Witness	
9.6.6					Test Performer	
					Test Witness	
9.6.7					Test Performer	
					Test Witness	
9.6.8					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
					Test Witness	

Attachment 13

Performance Test Checklist

Section 9.7	Test Case Secondary Tank Wall Visual Inspection	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.7.1					Test Performer	
					Test Witness	
9.7.2					Test Performer	
					Test Witness	
9.7.3					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
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					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 14

Performance Test Checklist

Section 9.8	Test Case Secondary Tank Wall UT Inspection	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.8.1					Test Performer	
					Test Witness	
9.8.2					Test Performer	
					Test Witness	
9.8.3					Test Performer	
					Test Witness	
9.8.4					Test Performer	
					Test Witness	
9.8.5					Test Performer	
					Test Witness	
9.8.6					Test Performer	
					Test Witness	
9.8.7					Test Performer	
					Test Witness	
9.8.8					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
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					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 15

Performance Test Checklist

Section 9.9	Test Case Primary Tank Bottom Cleaning	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.9.1					Test Performer	
					Test Witness	
9.9.2					Test Performer	
					Test Witness	
9.9.3					Test Performer	
					Test Witness	
9.9.4					Test Performer	
					Test Witness	
9.9.5					Test Performer	
					Test Witness	
9.9.6					Test Performer	
					Test Witness	
9.9.7					Test Performer	
					Test Witness	
9.9.8					Test Performer	
					Test Witness	
9.9.9					Test Performer	
					Test Witness	
9.9.10					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 16

Performance Test Checklist

Section 9.10	Test Case Primary Tank Bottom Visual Inspection	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.10.1					Test Performer	
					Test Witness	
9.10.2					Test Performer	
					Test Witness	
9.10.3					Test Performer	
					Test Witness	
9.10.4					Test Performer	
					Test Witness	
9.10.5					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
					Test Witness	

Attachment 17

Performance Test Checklist

Section 9.11	Test Case Primary Tank Bottom UT Inspection	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.11.1					Test Performer	
					Test Witness	
9.11.2					Test Performer	
					Test Witness	
9.11.3					Test Performer	
					Test Witness	
9.11.4					Test Performer	
					Test Witness	
9.11.5					Test Performer	
					Test Witness	
9.11.6					Test Performer	
					Test Witness	
9.11.7					Test Performer	
					Test Witness	
9.11.8					Test Performer	
					Test Witness	
9.11.9					Test Performer	
					Test Witness	
9.11.10					Test Performer	
					Test Witness	
9.11.11					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 18

Performance Test Checklist

Section 9.12	Test Case Cooling Pipe Negotiation	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.12.1					Test Performer	
					Test Witness	
9.12.2					Test Performer	
					Test Witness	
9.12.3					Test Performer	
					Test Witness	
9.12.4					Test Performer	
					Test Witness	
9.12.5					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
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					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 19

Performance Test Checklist

Section 9.13	Test Case Haunch Negotiation	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.13.1					Test Performer	
					Test Witness	
9.13.2					Test Performer	
					Test Witness	
9.13.3					Test Performer	
					Test Witness	
9.13.4					Test Performer	
					Test Witness	
9.13.5					Test Performer	
					Test Witness	
9.13.6					Test Performer	
					Test Witness	
9.13.7					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
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					Test Witness	
					Test Performer	
					Test Witness	

Attachment 20

Performance Test Checklist

Section 9.14		Test Case Power Recovery			Date	Page 1 of 1
Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.14.1					Test Performer	
					Test Witness	
9.14.2					Test Performer	
					Test Witness	
9.14.3					Test Performer	
					Test Witness	
9.14.4					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
					Test Witness	

Attachment 21

Performance Test Checklist

Section 9.15	Test Case Robot Recovery	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.15.1					Test Performer	
					Test Witness	
9.15.2					Test Performer	
					Test Witness	
9.15.3					Test Performer	
					Test Witness	
9.15.4					Test Performer	
					Test Witness	
9.15.5					Test Performer	
					Test Witness	
9.15.6					Test Performer	
					Test Witness	
9.15.7					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	

Attachment 22

Performance Test Checklist

Section 9.16	Test Case Data Collection, Recording, Display and Storage	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.16.1					Test Performer	
					Test Witness	
9.16.2					Test Performer	
					Test Witness	
9.16.3					Test Performer	
					Test Witness	
9.16.4					Test Performer	
					Test Witness	
9.16.5					Test Performer	
					Test Witness	
9.16.6					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
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					Test Performer	
					Test Witness	

Attachment 23

Performance Test Checklist

Section 9.17	Test Case Error Messages	Date	Page 1 of 1

Test Item	Test Start Time	Test End Time	Test Halted Time	Incident Report No.	Completion Signature or Initials	
9.17					Test Performer	
					Test Witness	
					Test Performer	
					Test Witness	
					Test Performer	
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					Test Performer	
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					Test Performer	
					Test Witness	

Attachment 24

Signature/Initial Record		
Name	Initial	Signature