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Acceptance/Operational Test Report for Tank

241-AW-101 Camera and Camera Purge Control System

R.A.Harding

Westinghouse Hanford, Richland, WA 99352

U.S. Department of Energy Contract DE-AC06-87RL10930

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Key Words: Tank 241-AW-101, Video Camera System, Video Camera Purge System, Acceptance Test Report, and Operational Test Report.

Abstract: This document contains the results of acceptance/operability testing of the 241-AW-101 Video Camera System and the Video Camera Purge Control System.

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8/14/96
Release Approval Date

Approved for Public Release

WHC-SD-WM-OTR-159, Rev.0

**ACCEPTANCE/OPERATIONAL TEST REPORT
241-AW-101 VIDEO CAMERA SYSTEM**

ETN-94-0061

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1.0 INTRODUCTION

1.1 PURPOSE

This document presents the results of Acceptance/Operability testing of tank 241-AW-101 video camera purge system and the video camera system. The camera purge system was designed and fabricated on site, and the video camera system was acquired from an offsite manufacturer to monitor in-tank activities.

1.2 SCOPE

Testing of the 241-AW-101 camera purge system and the video camera system was performed in accordance with WHC-SD-WM-OTP-159, Rev.0, "Acceptance/Operational Test Procedure for 241-AW-101 Video Camera System". This document reports the results of that testing.

1.3 OBJECTIVE

The objective of acceptance/operability testing of the 241-AW-101 video camera purge system and the video camera system was to verify that all equipment and components function in accordance with design requirements, procurement specification requirements and Original Equipment Manufacturer's (OEM) specifications.

2.0 TEST DESCRIPTION

Testing was performed on all equipment prior to shipment to 200 East area as a prerequisite (shop tests), prior to camera installation (acceptance tests), and immediately following camera installation (operability tests).

2.1 SHOP TESTS

The shop tests were conducted in the 306E facility following receipt of the camera system from the manufacturer. Shop testing consisted of:

1. Setting up and operating the color monitor, video tape recorder, and color printer in accordance with OEM instructions.
2. Verification that the camera lens zoom, iris, and focus are operable from the master control station and the local control console.
3. Verification that the camera resolution and color rendition are acceptable, and that the picture is free of image defects.
4. Verification that the camera integration unit functions in accordance with OEM instructions.

5. Verification that the pan-and-tilt is operable from the master control station and the local control console, and that the minimum required range of camera motion is obtainable.
6. Verification that the camera lighting is operable from the master control station and local control console.
7. Verification that all cabling supplied to interconnect the camera, master control station, and local control console (including cabling supplied for permanent installation in 241-AW tank farm and cabling supplied for maintenance and testing activities) allows complete control of video camera system.
8. Verification that the purge panel and purge control panel is operable per the attached Acceptance/Operational Test Procedure (OTP) .

2.2 ACCEPTANCE TESTS

Operability testing was performed at 241-AW tank farm, with the master control station equipment and the purge control panel installed in building 241-AW-271 (instrument building) and the local control console and the purge panel installed on a uni-strut rack installed just off the annulus of tank 241-AW-101. Acceptance testing consisted of performing the steps described in section 7.0 to confirm that no equipment damage occurred during transport from 306E and to ensure equipment operability. Acceptance testing was performed immediately prior to insertion into tank riser 5B, and utilized the maintenance and testing cabling and hoses.

2.3 POST INSTALLATION TESTS

Post installation testing was performed immediately following installation of the camera into tank 241-AW-101. Post installation test consisted of repeating sections described in 7.0, and ensuring proper flow was maintained as established in steps 6.3.5. Post installation testing utilized the permanent camera control cabling and purge supply hoses which are installed in underground conduit.

3.0 TEST RESULTS

All testing of the 241-AW-101 video purge system and the video system was completed satisfactorily. All equipment operates acceptably. Results may be found in Attachment 1, which is a completed copy WHC-SD-WM-OTP-159, Rev. 0.

4.0 CONCLUSIONS

Acceptance and operability testing of the 241-AW-101 video purge and camera system was successfully completed. This equipment is has been satisfactorily tested and is approved for in-tank use.

ATTACHMENT 1

**COMPLETED COPY
WHC-SD-WM-OTP-159, REVISION 0**

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ACCEPTANCE/OPERATIONAL TEST PROCEDURE
101-AW TANK CAMERA PURGE SYSTEM
AND 101-AW VIDEO CAMERA SYSTEM

1.0 PURPOSE

This procedure will document the satisfactory operation of the 101-AW Tank Camera Purge System (CPS) and the 101-AW Video Camera System. The safety interlock which shuts down all the electronics inside the 101-AW vapor space, during loss of purge pressure, will be in place and tested to ensure reliable performance. This procedure is separated into four sections (6.1, 7.1, 7.2 and 7.3) identified below:

- 1) Section 6.1 is performed in the 306 building prior to delivery to the 200 East Tank Farms. This section involves the following:
 - Leak checking all fittings on the 101-AW Purge Panel for leakage using a "Snoop" solution and resolving the leakage.
 - The following instrumentation has been calibrated and calibration stickers have been affixed.
 - Pressure Switch set to 10 ± 2 in. w.g., Pt. No. H-2-821236-11.
 - Pressure Transmitter, Pt. No. H-2-821236-10.
 - Pressure Gage, Pt. No. H-2-821236-14.
 - Pressure Gage, Pt. No. H-2-821236-15.
 - Flowmeter, Pt. No. H-2-821236-9.
 - The Relief Valve, Pt. No. H-2-821236-18 has been tested to open at $5 + 0.0/-2.0$ psig and closes with an inlet pressure of 10 ± 2.0 in. w.g. and an outlet pressure of -0.5 ± 0.2 in. w.g.
- 2) Section 7.1 verifies that PR-1, the regulator which maintains a positive pressure within the volume (cameras and pneumatic lines), is properly set. In addition the green light (PRESSURIZED) (located on the Purge Control Panel) is verified to turn on above 10 in. w.g. and after the time delay relay (TDR) has timed out.
- 3) Section 7.2 verifies that the purge cycle functions properly, the red light (PURGE ON) comes on, and that the correct flowrate is obtained to meet the requirements of the National Fire Protection Association (NFPA), Article 496, for a Class 1, Division 1, Group B atmosphere.

- 4) Section 7.3 verifies that the pan and tilt, camera, associated controls and components operate correctly. This section also verifies that the safety interlock system operates correctly during loss of purge pressure. During the loss of purge operation the illumination of the amber light (PURGE FAILED) will be verified.

2.0 TEST OBJECTIVES

- 2.1 Demonstrate the proper operation of the purge control system components, camera, pan and tilt, camera control equipment, video monitor, video recorder and video printer.

3.0 REFERENCES

P&ID	H-2-821238
Electrical Drawings	H-2-821237
Mechanical Drawings	H-2-821236

4.0 RESPONSIBILITIES

4.1 SYSTEMS SURVEILLANCE ENGINEERING

A Systems Surveillance Engineering Test Engineer shall be responsible for the coordination, scheduling, performance and documentation of the test procedure.

4.2 TEST WITNESSES

Tank Farm Operations and their Quality Assurance will provide a representative to witness the satisfactory completion and approval of pertinent steps identified in this ATP.

Witnesses are responsible for verifying that organizational requirements are met throughout the testing and documentation sequences of the procedure.

5.0 DOCUMENTATION

5.1 TEST RECORD

All personnel involved in the performance of this test including the SSE Test Engineer shall fill out a line in Section 9.0 Records.

Test results shall be recorded by the SSE Test Engineer. Unless specific data is required, the initials of the person accepting the item will be entered in each test sheet blank to indicate

compliance with the stated requirements or the successful completion of the given test step. Unacceptable conditions or readings are to be referred to Section 8.0, Exceptions.

The SSE Test Engineer will maintain a chronological test log, documenting when various phases of the test are conducted and any pertinent information not recorded in the test procedure.

5.2 EXCEPTIONS

Exceptions by step number, and other notes are to be recorded under Section 8.0. This section must be dispositioned (including the generation of any required ECNs) and signed off prior to final ATP/OTP acceptance. If no exceptions are encountered, this section may be so noted and closed out with the required signatures.

5.3 TEST EXECUTION RECORD

The final acceptance of the ATP/OTP results shall be indicated by signatures listed under Section 10.0.

NOTE: During the performance of this test, errors in text may be encountered which require correction/adjustment to complete the test. The correction is to be noted in the ATP/OTP and listed as an exception in Section 8.0.

6.0 PREREQUISITES

6.1 306 SHOP TEST PURGE PANEL

NOTE: Sequence of steps in section 6.1 can be altered per SSE Test Engineer discretion.

- 6.1.1 Pressurize each leg (supply and return side) of the 101-AW Purge Panel, H-2-821236, to approximately 2.0 psig and "Snoop" each fitting and resolve any leakage by tightening the fitting. If the leakage continues then replace the fitting. SSE Test Engineer signoff below that the Purge Panel is acceptable.

SSE Test Engineer R. A. Harding Date 12/17/94

- 6.1.2 The following instrumentation has been calibrated and calibration stickers have been affixed. SSE Test Engineer signoff below that the instrumentation listed below has been calibrated and a calibration sticker has been affixed.

- Pressure Switch set to 10 ± 2 in. w.g., Pt. No. H-2-821236-11.
- Pressure Transmitter, Pt. No. H-2-821236-10.
- Pressure Gage, Pt. No. H-2-821236-14.
- Pressure Gage, Pt. No. H-2-821236-15.
- Flowmeter, Pt. No. H-2-821236-9.

SSE Test Engineer R. C. Harding Date 10/17/94

- 6.1.3 Relief Valve, Pt. No. H-2-821236-18

- A. Setup the relief valve as shown in Figure 1 and slowly pressurize the inlet side and record below the pressure where bubbles are first noticed. Continue to increase pressure and record below the flow at $5 \pm 0.0/-2.0$ psig.

Pressure: Inlet Pressure at 12 psig Inlet Pressure at 5 psig.
Flow 5.54 cfm

Flow at $5 \pm 0.0/-2.0$ psig: 6.3 cfm at 10/18/94

- B. Setup the relief valve as shown in Figure 2 and pressurize the inlet side to a pressure of 10 ± 2.0 in. w.g. and apply an outlet pressure of -0.5 ± 0.2 in. w.g. Record below the amount of time that it takes for the inlet pressure to drop to 0.0 psig, if applicable.

Inlet Pressure/Time: 10.0 in. w.g. 11:08

Outlet Pressure/Time: 0.1 / 12:13 COULD NOT SEE ANY APPRECIABLE PRESSURE DROP IN THE LAST 10 MIN. HELD AT 0.1 PSIG. 3.0 10/18/94

SSE Test Engineer signoff below that Section 6.1 has been performed to your satisfaction.

SSE Test Engineer R. C. Harding Date 10/18/94

6.2 306 SHOP TEST - PURGE PANEL ACCEPTANCE

NOTE: Assembly - Verify purge panels, camera, pan & tilt, and tank lights are assembled on the support structures and interconnected with cables and hoses. A full K-size N₂ bottle is attached to the purge panel and power supplied to the circuits.

- 6.2.1 Open the N₂ bottle and adjust PR-2 to 45 ± 5 psig.
- 6.2.2 Adjust PR-1 to 15 ± 3 in. w.g read off of pressure transmitter, H-2-821236-10. It may be necessary to open the calibration port valve, Pt. No. H-2-821236-20 (return or supply side) to decrease pressure.
- 6.2.3 Step 6.2 is complete R.A. Harding SSE Test Engineer.

6.3 306 SHOP TEST - PURGE CONTROL PANEL ACCEPTANCE

NOTE: The volume of the camera housing, purge panel lines and the hoses is approximately 2.0 ft.³ ($1.1 + .16 + .65$ cu. ft.). Per NFPA 496 requirements, ten volumes of purge gas, 20 ft.³, must flow through the assembly. The purge pressure will be set by adjusting PR-2 so that a minimum 20 ft.³ will flow through the assembly in 10 minutes or less. The purge rate is read off of the flowmeter, FI, located in the Purge Panel.

- 6.3.1 At the Purge Control Panel set the time delay relay to 2 minutes and turn the Control Switch (CS) to "Purge" and hold for a few seconds until the red light (Purge ON) comes on indicating that the purge has just begun.
- 6.3.2 Signoff below that the red light comes "ON".

SSE Test Engineer R.A. Harding / Date 10/17/94

- 6.3.3 Slowly adjust the purge pressure at PR-2 until the flow rate is $2.3 \pm 0.4/-0.0$ CFM.
- 6.3.4 Record the pressure, off of H-2-821236-15) and the flowrate, off of H-2-821236-9, below.

Pressure/Flowrate 2.6 cfm / 10 psig

SSE Test Engineer: R.A. Harding / Date 10/17/94

- 6.3.5 Divide the flowrate into 20 ft.³ and this will be the time setting for the TDR at the Purge Control Panel. Record this number and round it up to the next minute.

Time Setting for the TDR = 20 ft.³/Flowrate (CFM) = 2.6

Time Setting rounded to the next minute: 8 minutes

SSE Test Engineer: L. A. Harding / Date 10/17/94

- 6.3.6 Plug the pan and tilt and camera control unit into failsafe receptacle system. Turn on the power switches to the pan and tilt and camera controls.
- 6.3.7 At the Purge Control Panel set the time delay relay to the time shown in step 6.3.5 and turn the Control Switch (CS) to "Purge" and hold for a few seconds until the red light (Purge ON) comes on indicating that the purge has just begun.
- 6.3.8 On the Purge Control Panel verify the green light (system pressurized above 10" w.g.) is "ON".
- 6.3.9 After the purge has completed its purge cycle verify Red light is "OFF" and that the in-tank camera lights have come "ON", and that power is being provided to the pan and tilt, and camera.
- 6.3.10 Signoff below that the amber light comes "ON".

SSE Test Engineer: L. A. Harding / Date 10/17/94

- 6.3.11 Step 6.3 is complete L. A. Harding SSE Test Engineer.

6.4 306 SHOP TEST - CAMERA AND PAN & TILT OPERATION

NOTE: During this portion of the test the SSE Test Engineer shall verify each camera control is satisfactory and will then initial in the space provided for each step.

- 6.4.1 Using remote pan and tilt controls, pan in the clockwise direction. Verify that the pan electronic break holds RAH
- 6.4.2 Pan in the opposite direction. Verify that the pan electronic break holds RAH. Verify that the panning operation has covered approximately 360°.
- 6.4.3 Tilt the camera to the extreme down position. Verify that the camera is pointing downward and that the electronic break holds RAH

- 6.4.4 Tilt camera up to the extreme upward position. Verify that the camera is approximately vertical and that the electronic break for the pan and tilt holds R.A.H.
- 6.4.5 Using remote camera zoom control, manipulate the zoom control to wide angle. Verify the zoom moves towards wide and when operated towards "wide" R.A.H.
- 6.4.6 Manipulate the zoom control to telephoto. Verify the zoom moves towards the telephoto when operated towards "tele" R.A.H.
- 6.4.7 Using the remote camera iris control, manipulate the iris control to open. Verify that the iris opens when operated towards "open" R.A.H.
- 6.4.8 Manipulate the iris control to close. Verify that the iris closes when operated towards "close" R.A.H.
- 6.4.9 Using remote camera focus control, manipulate the focus control to far. Verify that the focus adjusts to far when operated towards "far" R.A.H.
- 6.4.10 Manipulate the focus control to near. Verify that the focus adjusts to near when operated towards "near" R.A.H.
- 6.4.11 Verify that there is a color image on the 101-AW Video Camera System monitor R.A.H.. Verify that color image is acceptable per SSE Test Engineer.

SSE Test Engineer: R.A. Harding / Date 10/17/94

- 6.4.12 Step 6.4 is complete R.A. Harding SSE Test Engineer.

* 6.4.13 The interlock relay was tested by shutting down the N₂ supply. Shutdown of the electronics took place at 10 in. w.g. OK now. 10/17/94

7.0 ACCEPTANCE/OPERABILITY TEST

7.1 PURGE PANEL ACCEPTANCE IN THE 200 EAST TANK FARMS

- 7.1.1 Turn on breakers #21, #23 and #25 in the breaker box located inside the 241-AW-271 Instrument building.
- 7.1.2 Open the N₂ bottle and adjust PR-2 to 45 ± 5 psig.
- 7.1.3 Adjust PR-1 to 15 ± 3 in. w.g read off of pressure transmitter, H-2-821236-10. It may be necessary to open the calibration port valve, Pt. No. H-2-821236-20 (return or supply side) to decrease pressure.
- 7.1.4 Step 7.1 is complete R.A. Harding SSE Test Engineer.

7.2 PURGE CONTROL PANEL ACCEPTANCE

NOTE: The volume of the camera housing, purge panel lines and the hoses is approximately 2.0 ft.³ (1.1 + .16 + .65 cu. ft.). Per NFPA 496 requirements, ten volumes of purge gas, 20 ft.³, must flow through the assembly. The purge pressure will be set by adjusting PR-2 so that a minimum 20 ft.³ will flow through the assembly in 10 minutes or less. The purge rate is read off of the flowmeter, FI, located in the Purge Panel.

7.2.1 At the Purge Control Panel set the time delay relay to 2 minutes and turn the Control Switch (CS) to "Purge" and hold for a few seconds until the red light (Purge ON) comes on indicating that the purge has just begun.

7.2.2 Signoff below that the red light comes "ON".

OPS

Date 12-6-94

SSE Test Engineer:

R.C. Harding / Date 12-6-94

7.2.3 Verify the flow rate is 2.3 +0.4/-0.0 CFM as obtained from step 6.3.5.

SSE Test Engineer:

R.C. Harding / Date 12-6-94

7.2.4 Record the pressure off of H-2-821236-15 and the flowrate below.

Pressure/Flowrate

18 psi 12.3 cfm

SSE Test Engineer:

R.C. Harding / Date 12-6-94

7.2.5 Plug pan and tilt and camera control unit into failsafe receptacle system located in the 241-AW-271 Instrument building. Turn on the power switches to the pan and tilt and camera controls.

7.2.6 At the Purge Control Panel set the time delay relay to the time shown in step 6.3.5 and turn the Control Switch (CS) to "Purge" and hold for a few seconds until the red light (Purge ON) comes on indicating that the purge has just begun.

7.2.8 After the purge has completed its purge cycle verify Red light is "OFF" and that the in-tank camera lights have come "ON", and that power is being provided to the 101-AW pan and tilt and camera.

7.2.9 On the Purge Control Panel, located in the Video Shack, verify the green light (system pressurized above 10" w.g.) is "ON".

SSE Test Engineer: L.A. Harding /Date 1-6-95

7.2.10 Signoff below that the amber light comes "ON".

OPS [Signature] /Date 12-6-94

SSE Test Engineer: L.A. Harding /Date 12-6-94

7.2.11 Step 7.2 is complete L.A. Harding SSE Test Engineer.

7.3 CAMERA AND PAN AND TILT OPERATION

NOTE: During this portion of the test the SSE Test Engineer shall verify each camera control is satisfactory and will then initial the space provided with each step.

7.3.1 Using remote pan and tilt controls, pan in the clockwise direction. Verify that the pan electronic break holds L.A.H.

7.3.2 Pan in the opposite direction. Verify that the pan electronic break holds L.A.H.
Verify that the panning operation has covered approximately 360°.

7.3.3 Tilt the camera to the extreme down position. Verify that the camera is pointing down approximately vertically and that the electronic break holds L.A.H.

7.3.4 Tilt camera up to the extreme upward position. Verify that the camera is approximately vertical and that the electronic break for the pan and tilt holds L.A.H.

7.3.5 Using remote camera zoom control, manipulate the zoom control to wide angle. Verify zoom moves towards wide and when operated towards "wide" L.A.H.

7.3.6 Manipulate the zoom control to telephoto. Verify zoom moves towards telephoto when operated towards "tele" L.A.H.

7.3.7 Using the remote camera iris control, manipulate the iris control to open. Verify that the iris opens when operated towards "open" L.A.H.

7.3.8 Manipulate the iris control to close. Verify that the iris closes when operated towards "close" L.A.H.

7.3.9 Using remote camera focus control, manipulate the focus control to far. Verify that the focus adjusts to far when operated towards "far" L.A.H.

7.3.10 Manipulate the focus control to near. Verify that the focus adjusts to near when operated towards "near" L.A.H.

7.3.11 Plug the video monitor, video recorder and video printer into power source. Verify the video monitor, video recorder, frame store integrator and the video printer have power and are operational ECB.

7.3.12 Verify that there is a color image on the 101-AW Video Camera System monitor located in the Video Shack ECB. Verify that color image is acceptable per QC and Camera Cog. Engineer.

Paul Chert 11-2-6-94
QC /Date

A. Q. Harding 11-2-6-94
SSE Test Engineer /Date

7.3.13 Turn off valve PR-2 and allow the gas to bleed off to the setpoint on PS (low pressure switch) 10 ± 2 in. w.g. Verify tank lights go off and the amber light (PURGE FAIL) is "ON" and the green light goes off. Also verify that power is no longer being supplied to the 101-AW pan and tilt and camera. QC signoff below that the lights turned off and power was no longer supplied to pan and tilt and camera at 10 ± 2 in. w.g.

Paul Chert 11-2-6-94
QC /Date

7.3.14 Step 7.3 is complete A. Q. Harding SSE Test Engineer.

8.0 EXCEPTIONS

ITEM	STEP	PAGE	DESCRIPTION/REASON	DISPOSITION/ RESOLUTION

TEST APPROVED WITH EXCEPTIONS

SSE Test Engineer

Quality Control

Tank Farm Operations

9.0 RECORDS

DATA/VERIFICATION LIST

[illegible]

10.0 TEST EXECUTION RECORD

REFERENCE SECTION	ACCEPT / REJECT	REMARKS
7.1	ACCEPT	NONE
7.2	ACCEPT	NONE
7.3	ACCEPT	NONE

TEST WITNESSES:

Donald C. Harding 1-6-95
SSE Test Engineer / Date

Paul A. Dorman 1-6-95
Quality Control / Date

John E. Harvey 1-6-95
Tank Farm Operations / Date

1. FINAL ACCEPTANCE

Testing per this procedure is completed satisfactorily and the 101-AW tank camera is ready for installation and service.

John E. Harvey 1/6/95
Tank Farm Manager / Date

11.0 POST INSTALLATION TEST

Repeat sections 7.1, 7.2 and 7.3 of this procedure to ensure that the 101-AW Tank Camera Purge System and 101-AW Video Camera System are operating satisfactorily after installation of Camera into the 20" multi-flange located in riser 5B of tank 101-AW. During the performance of sections 7.2 and 7.3, verify that the flowrate is $2.3 \pm 0.4/-0.0$ CFM as established in steps 6.3.5. Any discrepancies found with the 101-AW Tank Camera Purge System and 101-AW Video Camera System in accordance with this section of the ATP/OTP shall be noted below. Section 11.0 shall not be complete without SSE Test Engineers signature.

01-11-95
SSE Test Engineer/Date

FIGURE 1

FIGURE 2

DISTRIBUTION SHEET

To Distribution	From Surveillance Systems Integration	Page 1 of 1
		Date August 9, 1996
Project Title/Work Order Acceptance/Operational Test Report 241-AW-101 Video Camera System		EDT No. 617445
		ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
R.K.Brown	H5-68	1			
R.A.Harding	N1-46	2			
T.L.Moore	H6-11	1			
R.W.Reed	S5-07	1			
D.B.Smet	N1-46	1			
K.A.White	S5-13	1			