1 of 6

Contract No. DE-AC07-86ID12651

**PROTOTYPICAL ROD CONSOLIDATION
DEMONSTRATION PROJECT
PHASE III FINAL REPORT**

**VOLUME I OF IV
COLD CHECKOUT TEST REPORT
BOOK 3 OF 9**

Submitted to
**DEPARTMENT OF ENERGY
IDAHO FIELD OFFICE
Idaho Falls, Idaho**

MAY, 1993

Submitted by
**NUS
Gaithersburg, Maryland**

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DOE PROTOTYPICAL ROD CONSOLIDATION PROJECT PHASE III FINAL REPORT
PREFACE

The Phase III Final Report for the Prototypical Rod Consolidation Demonstration Project is divided into four volumes as described below:

- Volume I - Cold Checkout Test Report (9 books)
- Volume II - Design Description (2 books)
- Volume III - Drawings (Supplied separately per contract as
 ^{not} blueline copies, reproducible mylars
 _{included} and 35mm aperture cards)
- Volume IV - Operations and Maintenance Manual (5 books)

Each book of Volumes I, II, and IV contain the Table of Contents for all books of the volume.

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DOWNENDER

(WBS 1.3.1.2)

TEST RESULTS AND ANALYSIS REPORT

1.0 INTRODUCTION

This appendix addresses the System Operational Testing (SOT) for the Downender (Ref. the record copy of 9315-TP-203, Attachment 1 to this appendix). It provides an overview of the function of the equipment, procedures used for testing, results obtained during testing, and any conclusions and recommendations reached during testing. The purpose of the SOT was to verify that the as-built condition of the system met or exceeded the associated performance requirements. The primary objectives of this testing were as follows:

- Verification of system mechanical operation under loaded and unloaded conditions.
- Verification of system parts program operations with the equipment under loaded and unloaded conditions.
- Verification of software interlocks.
- Verification of motor fault response.
- Verification of system interface.

The Downender has been judged acceptable and released for normal Integrated System Testing (IST).

2.0 EQUIPMENT FUNCTION

The purpose of the Downender is to receive fuel in the vertical position from an ex-cell crane during the fuel loading shift and position it for processing. Once the fuel is contained by the Downender and released by the ex-cell crane, the Downender pivots to a horizontal position where the fuel is released onto horizontal supports. Once the fuel is supported horizontally, the Downender releases the fuel and pivots back to the vertical position, allowing access to the fuel for pickup and transfer to the Fuel Storage Racks by the Robotic Bridge Transporter (RBT) with a Fuel Assembly Handling Fixture (FAHF) attached.

The Downender is driven from the vertical to horizontal position by a linkage bar attached from the movable frame to a drive carriage, which is mounted on two 2.0 inch diameter rails through four linear ball bearings (Ref. Dwg. 9315-M-1401). The carriage is driven by a 75 mm diameter roller screw, which is powered through a gearbox by an 8.8 hp. servo-drive motor. By using a servo-drive motor, exact positioning and braking are possible through a built-in resolver and brake. These features allow for automatic operations that require exact positioning and speed control. In addition to

positioning through the built-in resolver, external proximity sensors are installed at both ends of travel to prevent the drive carriage from being overdriven into hardstops. The proximity sensors are also used to home the drive carriage and send the servo-drive built-in resolver back to a zero position.

The fuel assemblies are contained in the Downender during lowering by means of a fuel bottom support and two sets of support clamps. The fuel bottom support function is to contain the bottom of the fuel and to position the fuel at a given elevation. The fuel position is critical because it establishes the cut datum line and relative position with other interfacing systems. The bottom support is driven to the support position (dependent on fuel type) in a similar fashion as the movable frame drive system described above. Proximity sensors are also provided for homing and to prevent hardstops engagement. The support clamps consist of four L-shaped supports, two per side, which are opened when receiving fuel from the Ex-Cell Crane and closed when downending fuel to the horizontal position. The clamps are opened and closed through a drive system consisting of four spur gears and shafts which are rotated by a single linear actuator. The positioning of the clamps is controlled by an internal potentiometer in the linear actuator. Overtravel of the linear actuator is prevented by means of internal limit switches.

Two load cells are utilized by the Downender to acknowledge the presence of fuel. The first load cell is located in the bottom support. This allows the operator and Control System to know when the fuel load is taken by the Downender from the Ex-Cell Crane. The second load cell is located on one of the horizontal fuel supports. This allows the Control System to verify that the load has been taken by the horizontal supports from the Downender.

3.0 TEST PROCEDURE

The test procedure (Ref. Attachment I to this appendix) organized testing into the following sections below. These sections were repeated for each of the five fuel types utilizing fuel-specific software. With the exception of the mock-up fuel test, all other test sections were identical for each fuel type.

- Drive Systems Verification - This section tested and verified the bottom support, clamp and movable frame operating torque, travel time, and distances to the various positions utilizing the HAND and JOG modes.
- Limit Switch Verification - Proximity sensors and limit switches were tested by driving the three drive systems to each end-of-travel switch, and verifying that

hardstops were not engaged and that the Control System indicated that end of travel had been reached.

- Load Cell Verification - Both the bottom support and horizontal cradle load cells were tested to verify that the Control System registered a presence of weight.
- Interlock Verification - Control System interlocks were tested to verify that specific drive motors could not be energized if interfacing drive systems or machines were positioned to undesired locations in the HAND mode.
- SINGLE Mode Verification - The process sequence of the Downender was tested in this section to verify that the single step control function performed as desired and in the correct order.
- AUTO Mode Verification - Much like the SINGLE mode test, this section verified the automatic process sequence operated in the correct and uninterrupted order.
- Servo-Drive Fault Test - This section tested a servo-drive motor to verify that if a fault was implemented, the alarm system would deactivate the motor, notify the operator which motor was affected, list the cause of fault, print out a report of the condition, signal an audio alarm, and activate specific cameras to be called up on the control console. Additionally, this test verified that the system could be recovered from the fault condition.
- Mock-Up Fuel Test - This test section was performed for the GE 8x8 and B&W 15x15 mock-up fuels only. These fuels were chosen to represent the smallest and largest fuels used in the Downender. This section tested the process sequence using a mock-up fuel in the SINGLE mode.

The test results and data for each of these test sections are contained within the record copy (Ref. Attachment 1) of the test procedure. Each test step has been signed by appropriate personnel as required for final disposition of this SOT. Section 4.0 of this volume provides a typical format for the test procedures and includes an explanation and reference as to the location of the test data included in the various sections of the test procedure.

Two processes were implemented for making all necessary changes to the official test procedure and/or equipment. The first process is a Temporary Procedure Change Notice (TPCN). The TPCNs were used to make changes to the test procedure. For this test procedure, seven

TPCNs were issued as follows:

- TPCNs # 1, 4, and 7 were issued to delete or revise prerequisites, test steps, and acceptance criteria which could not be performed as written.
- TPCNs # 2 and 3 were issued to correct errors in the test procedure.
- TPCNs # 5 and 6 were issued to add or clarify test procedure steps.

Each TPCN identified the change to the test procedure, reason for change, and final disposition for approval. A copy of each TPCN is included in Attachment 1.

The second process is an Exception/Repair Log (ERL). The ERLs were used to document fixes to the equipment required to meet acceptance criteria or to justify acceptance of the test results that did not meet the test criteria. For this test, 11 ERLs were issued as follows:

- ERLs # 1 and 2 were issued to take exception to prerequisites not completed prior to testing.
- ERLs # 3, 4, and 11 were issued to accept results that did not meet either the requirements or acceptance criteria of the test.
- ERLs # 5, 6, 7, 8, 9, and 10 were issued to implement changes to the equipment or software necessary to meet the acceptance criteria.

Each ERL identified the problem encountered during testing, the proposed solution to the problem, and the final disposition (accept as is or fix) to close out the ERL. A copy of each ERL is included in Attachment 1.

If a change to the acceptance criteria was required, a Test Acceptance Criteria (TAC) Change Notice (TCN) was issued against the TAC document. A TPCN would then be issued to reflect changes to the procedure. For this procedure, three TCNs were issued against the TAC. The TCNs issued against the TAC documents can be found in the Test Section of the QA Records Package, which is a Phase III deliverable.

4.0 TEST RESULTS

The Downender SOT was performed prior to restructuring of the test

program which tested equipment and software associated with processing Westinghouse 17x17 fuel only. Therefore, all five fuel types were tested during this SOT. The results presented below will not be broken up by fuel types unless a specific problem was encountered that was fuel specific. This is due to the repetitive nature of the testing performed.

Prior to initiating this test, a list of prerequisites (Ref. Section 2.0 of Attachment 1) had to be satisfied. These prerequisites identified all of the requirements for initiating this test procedure and served as an informal Operational Readiness Review (ORR). As a result of this informal ORR, it was determined that two prerequisites could not be satisfied. Both prerequisites (Ref. ERL #2) could not be satisfied due to the existence of open items on the QA/QC data package. Based on an evaluation of these outstanding items by the review committee, it was determined that none would affect the operation of the equipment or the validity of the test results. Therefore, testing of the Downender was initiated.

4.1 DRIVE SYSTEM VERIFICATION

The purpose of this test was to verify that the bottom support, support clamp, and movable frame functioned as designed. Operating parameters such as torque, current, travel time, and distance were measured and verified against the acceptance criteria. Torque measurements were obtained on servo-drives by measuring power with a power monitor, then converting the reading to torque using a simple calculation. Measurements taken on both the bottom support motor (M-103B) and the movable frame motor (M-103A) were well within the acceptance criteria. However, after testing was completed, the power monitor became suspect to inaccurate readings when taking measurements on another system. When the manufacturer of the monitor was contacted about this, HALLIBURTON NUS was informed that the monitor would not work on brushless pulse width modulated motors such as were used in this design (M-103 A&B). Therefore, all torque data collected were not valid. After the discovery and further evaluation as to whether torque measurements were required, it was decided to discontinue further torque measurements and current measurements on all motors since the drive systems were both conservatively sized and tested under load (Ref. Test Sections 8.1.10 and 8.2.10).

The bottom support was driven to the home, up, and five fuel support positions using the HAND and JOG modes. Positioning was found to be within tolerance of the acceptance criteria for all but the up position. Hardstop contact prevented the bottom support from reaching the 130.00 inch up position. Although the acceptance criteria in the test procedure specified this position, no mention

of the 130 inch up position could be located in the TAC Document 9315-TAC-203 (Ref. ERL #3 and TPCN #7). Therefore, no further action was taken because the 130 inch position was not required for this test. However, if in the future the short Westinghouse fuels are to be processed by this system, further evaluation of the 130.00 inch bottom support position would be required.

The fuel assembly support clamps were tested by driving the clamps to the open and closed position using the HAND mode. Neither the open (11.60 ± 0.10 inch) or closed (3.50 ± 0.10 inch) position acceptance criteria could be met (Ref. ERL #4). This was due to drive system backlash and a tolerance band that was too tight. The acceptance criteria were reevaluated and changed per TCN 002 to an open position of ≥ 10.25 inches and ≤ 3.75 inches for the closed position. The 10.25 inch open position was based on the summation of the widest fuel width (8.54 inch), the maximum fuel assembly bow (1.5 inch), and the RBT positioning accuracy (0.25 inch). The 3.75 inch closed position was based on the maximum allowable opening to safely secure the smallest (5.20 inch) and largest (8.54 inch) fuel assembly. These clamp positions proved to be more than safe for accepting and downending both the GE 8x8 and B&W 15x15 mock-up fuels. This was verified during the mock-up fuel test sequence (Sections 8.1.10 and 8.2.10).

The movable frame was tested by driving the frame to the up and down positions utilizing the HAND mode. An up or vertical position of 90.5 ± 0.5 degrees was obtained. However, the down or horizontal position required some adjustment before the acceptance criteria could be met (Ref. ERL #5). The requirement of the down position was for the movable frame to rest against the vertical support tubes. Initially, the movable frame stopped short of resting on the support tubes, therefore; the resolver counts were changed until contact was made.

4.2 LIMIT SWITCH VERIFICATION

The purpose of this test was to verify that the bottom support, support clamp, and movable frame drives were disabled prior to hardstop engagement in the event of a drive system failure. Additionally, the Control System end-of-travel indicators were verified to be functioning upon limit switch activation. The servo-drives (bottom support and movable frame) utilize proximity sensors at each end of travel, whereas the linear actuator (support clamp) utilizes built-in limit switches to deactivate the drive. All tests were performed in the JOG mode of operation, which would allow full travel of each drive system.

All proximity sensors or limit switches tested deactivated the drives at each end of travel prior to hardstop engagement. With

the exception of the support clamp, all other end-of-travel indicators functioned in the control room. The support clamp end-of-travel indicator was corrected through software changes (Ref. ERL #6) and retested and verified for proper operation.

Although the proximity sensors functioned during testing, problems with the bottom support down sensor (ZE-103D) were encountered after testing was complete. On numerous occasions, the sensor would not function for homing or to deactivate the drive. Several sensors and controllers were replaced, which proved unsuccessful. Finally, it was discovered that by rerouting the sensor cable, the sensor would function as desired. This problem was attributed to electrical noise resulting from the proximity sensor cable and motor cable routing in close proximity to one another. Another problem that was encountered before testing was the initial adjustment of the movable frame "Down" proximity sensor (ZE-103B). Since it is required that the movable frame contact the vertical supports, the carriage must be driven further past the full down position in order to activate the proximity sensor. The problem this presents is that the only movement remaining on the carriage is any play in the drive linkage and deflection caused by driving the movable frame into the hardstop. Therefore, the proximity sensor must be set extremely close to the movable frame full down position. This increases the risk of accidentally activating the sensor, creating a fatal fault during processing and making adjustments difficult. However, to date none of these problems have been observed.

4.3 LOAD CELL VERIFICATION

The purpose of this test was to verify that the Control System acknowledged the presence of weight applied to both the bottom support load cell and horizontal support load cell. Testing consisted of placing and removing a 100 to 200 lb. weight on both load cells and verifying that a signal was received at the Control System. Both load cells functioned as designed without presenting any problems.

4.4 INTERLOCK VERIFICATION

The purpose of this test was to verify that the drives associated with the Downender could not be energized if interfacing drives or equipment were positioned to undesired locations. This test was performed using the HAND mode. In most cases, the interfacing equipment was positioned through temporary changes to the Control System data registers rather than physically moving the equipment. This was not always a straightforward task and caused problems on numerous occasions.

Once initial setup of the Control System was performed, only minor problems were encountered with the interlocks. One interlock with the movable frame up position was found to be incorrect (Ref. ERL #7). The software was corrected and the interlock retested. In addition to this, the bottom support load cell had been inadvertently left out as an interfacing condition with the movable frame down position. A new interlock test (Ref. TPCN #6) was written, incorporating the bottom support load cell as a condition. The new test was run without any problems.

4.5 SINGLE MODE VERIFICATION

The purpose of the SINGLE mode test was to verify that the Downender auto process sequence was correct and that the single step function operated as desired. Setup of the SINGLE mode test was similar to that of the interlock tests. Multiple Control System data registers were temporarily modified to "fake out" the Downender into thinking that all interlocks were satisfied and that interfacing machines were either safe or in the proper position. As with the interlock tests, this was not always a straightforward task and created problems on various occasions.

Once the interlocks were satisfied and initial setup was complete, the single-step test sequence was operated to verify proper sequential order. Part of this test was a camera view assessment of the process. The test was initially run without camera 1 installed and with camera 2 out of adjustment (Ref. ERL #8), so a proper evaluation of the camera views could not be performed. Once the cameras were installed and adjusted, the test was rerun. This resulted in unobstructed views of the fuel being loaded and downended. During the test it was found that the procedural steps involving the clamp opening were incorrect as to the way the system was designed and functioned (Ref. ERL #11 and TPCN #3). The test procedure called for the "CONTINUE" button to be pushed in order for the clamps to open and release the fuel onto the horizontal supports when downended. When in the SINGLE mode, the system was designed to open the clamps automatically once the load cell on the horizontal supports was activated.

The single step function and process sequence were verified to be correct. Based on these test results, this test sequence was judged acceptable.

4.6 AUTO MODE VERIFICATION

Similar to the SINGLE mode test, the purpose of the AUTO mode test was to verify that the Downender process sequence was correct and that the automatic function operated as desired. Since the SINGLE mode test had been operated prior to this test, temporary changes

to the Control System data registers remained the same, requiring minimal setup time.

The automatic sequence operated as anticipated without encountering any problems. The only operator intervention required was during hold points. All drives operated smoothly in each direction of travel.

4.7 SERVO DRIVE FAULT TEST

The purpose of this test was to verify that if a fault was implemented to the system in one of the automatic modes, the alarm system would function as follows:

- Motors are automatically deactivated if a fault condition is applied.
- Audio alarm is automatically activated and can be deactivated by the operator.
- Fault condition is displayed on the control console.
- Fault condition is printed out on the printer.
- Cameras 3 and 10 are activated when called up by the operator.
- System can be recovered and processing continued.

A torque fault was selected for this test sequence and was simulated to the movable frame drive motor (M-103A) by temporarily changing the Control System data registers. An attempt was made to run the Downender in the SINGLE mode. Almost immediately, the system was deactivated and the alarm system activated. The alarm system functioned as designed and provided unobstructed camera views of the Downender.

4.8 MOCK-UP FUEL TEST

The purpose of this test was to verify that the Downender would function as previously tested in the SINGLE mode loaded with a mock-up fuel assembly. This test was run using the B&W 15x15 and GE 8x8 mock-up fuels only. These two fuels represented the smallest and largest fuels both in physical dimension and weight encountered with this test program. No problems were encountered with the processing sequence for both fuels. The drive systems operated as well loaded as they did unloaded. The clamps securely held both fuels during the downending process and released the fuel once in the horizontal position. The tests were initially run

without camera 1 installed and with camera 2 out of adjustment (Ref. ERL #8); therefore, a proper camera view assessment could not be performed at this time. The cameras were installed and adjusted after the test and found to be acceptable for providing unobstructed views of the fuel and Downender. Minor procedural corrections, which involved changing the order of operations were made (Ref. TPCNs #2, 4, and 5) to the test procedure. None of these corrections had an impact on testing or the results.

Although upending the fuel was not a part of the system design or test, it would be desirable in the event the fuel cannot be processed and requires removal from the cell. The B&W 15x15 type 1, class 1 mock-up was initially loaded horizontally on the support cradles with the PWR FAHF, then upended to the vertical position by the Downender to start the test. Before the fuel was upended, an interference between the clamps and one grid spacer was encountered. The clamps would not close because of contact at this one spot. The fuel was shifted manually to enable the clamps to close, then upended to start the test. No problems were encountered when lowering or releasing the fuel; therefore, the system was judged acceptable.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

In general, the Downender performed as designed with only minor problems involving Control System adjustments. After adjustments were made and problems identified with the first fuel type, the remaining four fuel type tests were performed without difficulty. The Downender operates adequately to accept, restrain, and reposition fuels from the vertical to horizontal positions. This would include fuels with widths ranging from 5.20 inches (GE 8x8) to 8.54 inches (B&W 15x15). The following conclusions are drawn from the Downender SOT.

- All drives operated as designed under loaded and unloaded conditions.
- All control modes of operation (JOG, HAND, SINGLE, and AUTO) performed as designed.
- The interlocks performed as designed.
- The servo-fault alarm system performed as designed.

Based on these conclusions, the Downender has been judged acceptable for normal Integrated System Testing.

5.2 RECOMMENDATIONS

As a result of the SOT performed, several recommendations have been made. These recommendations, along with those identified in Section 7.0 of the main body of this report, should be implemented for the next generation system. These recommendations are as follows:

- Increase speed of movable frame and bottom support drives. Presently both are well within the acceptance criteria; however, to decrease fuel loading time, the speed of both drives could be increased. A maximum safe speed would require further evaluation. It is not recommended to increase the ramp down or deceleration speeds due to the possibility of hardstop engagement.
- Increase height of horizontal fuel supports. Due to the interference encountered while clamping on the B&W 15x15 mock-up in the horizontal position, it is recommended that the fuel elevation be raised approximately 0.25 inch to alleviate this interference. Further evaluation would be required to see how much room is available to raise the fuel without hitting the top or back of the movable frame. Additionally, the bottom support clearance between the horizontal support would have to be looked at to determine if modifications to the bottom support would be required.

Although upending the fuel is not a part of the system design, it would be desirable in the event the fuel can not be processed and requires removal from the cell.

- Provide each drive system with an absolute resolver for position control. This would eliminate the need to "Home" the system periodically and thus eliminate the error introduced by the homing process.
- Reevaluate the use of proximity sensors for end-of-travel limit switches. These sensors require extensive setup time, making them impractical for remote applications.
- Decrease backlash on clamp drive system. The existing clamp backlash causes too much clamp movement, which presents difficulties when adjusting the drive setpoints and limit switches.

ATTACHMENT 1

SYSTEM OPERATIONAL TEST PROCEDURE
FOR THE
DOWNENDER

(WBS 1.3.1.2)

DOCUMENT NO. 9315-TP-203

Record Copy
Peter V Judd

Date 12/8/91

CLIENT: DOE Idaho PROCEDURE NO.: 9315-TP-203
LOCATION: Cold Test Facility REVISION: 1
TITLE: **SYSTEM OPERATIONAL TEST PROCEDURE - DOWNENDER**

7

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TEST

SYSTEM OPERATIONAL TEST PROCEDURE FOR DOWNENDER

(WBS 1.3.1.2)

APPROVED

Frank M. Miller

DATE _____

11/11/91

APPROVED

01A PROJECT

DATE _____

11/11/91

APPROVED

QUALITY ASSURANCE

DATE _____

11/11/91

APPROVED

DISCIPLINE MANAGER

DATE _____

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REV	PREPARED	DATE	APPROVED	DATE	APPROVED	DATE	APPROVED	DATE	APPROVED	DATE

NUS CORPORATION

TEST PROCEDURE 9315-TP-203

REVISION 1

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REVISION CONTROL SHEET

Revised Page No.

Latest Revision

Date

Original
All

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11/15/91
12/13/91

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EXCEPTION

PV9

12/18/14

1.0 OBJECTIVE OF TEST

The objective of this test is to demonstrate that the downender meets its design requirements. Testing to be performed and the acceptance criteria are based on the requirements contained in Specification No. 9315-TAC-203.

For five fuel types, the downender will be tested (without mockup fuel assemblies) to:

- Demonstrate operation and operating positions of the three downender drive subassemblies.
- Demonstrate overtravel protection features of the three downender drive subassemblies.
- Demonstrate load cell operation on two downender drive subassemblies.
- Demonstrate interlock functions used to prevent mechanical interferences and erroneous motions of the three downender drive assemblies.
- Demonstrate downender automatic operational sequence in SINGLE mode.
- Demonstrate downender automatic operation in AUTO mode.
- Demonstrate downender fault response in SINGLE mode.

For two fuel types, the downender will be tested (with mockup assemblies) to:

- Demonstrate downender capability to process a B&W 15 x 15 mockup fuel assembly in the SINGLE mode of operation.
- Demonstrate downender capability to process a GE 8 x 8 mockup fuel assembly in the SINGLE mode of operation.

2.0 PREREQUISITES

- 2.1 System set-up has been performed per the instruction of Appendix A.

Test Conductor MB Haynes Date 1-8-92

QA JA Gant Date 1-8-92

- 2.2 Camera, film, lighting and personnel are available to take photographs per the instruction of Appendix C and the detailed procedure steps (Section 8.0).

Test Conductor MB Haynes Date 1-6-92

QA JA Gant Date 1-7-92

- 2.3 The QA/QC Data Package has been prepared in accordance with Specification 9315-M-200, and the applicable Bill of Material, and is acceptable.

RL# 2

Test Conductor MB Haynes Date 1-7-92

QA JA Gant Date 1-7-92

- 2.4 The system has been assembled in accordance with all applicable Drawings, DCNs and FCRs.

RL# 2

Test Conductor MB Haynes Date 1-7-92

QA JA Gant Date 1-7-92

- 2.5 The Test Conductor has been qualified and certified in accordance with QAP 2.0.

Test Conductor MB Haynes Date 1-6-92

QA JA Gant Date 1-7-92

- 2.6 All test personnel participating in this test have been trained per the instruction of Section 6.4 of reference 11.6.

Test Conductor MB Haynes Date 1-8-92

QA JA Gant Date 1-8-92

- 2.7 The checklist contained in the Control System SOT (9315-TP-601) applicable to this system must be completed and the results accepted prior to the initiation of testing under this procedure.

Test Conductor MB Hargner Date 1-8-92

QA JA Gant Date 1-8-92

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor MB Hargner Date 1-6-92

QA JA Gant Date 1-7-92

- 2.9 The system FAT has been completed and accepted by NUS. RL # 1

Test Conductor MB Hargner Date 1-7-92

QA D. McInerney for J.V. Date 1-7-92

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor MB Hargner Date 1-6-92

QA JA Gant Date 1-7-92

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor MB Hargner Date 1-6-92

QA JA Gant Date 1-7-92

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor MB Hargner Date 1-6-92

QA JA Gant Date 1-7-92

- 2.13 ~~Procedures for changeover of fuel types for the Control System are in place in the Control Room.~~ TPCN #1

Test Conductor MB Hayes Date 1-6-92

QA JA Gant Date 1-7-92

- 2.14 The following fuel assembly mockups must be available.

2.14.1 Babcock & Wilcox 15 x 15 Type ~~2~~ 1 | KBH

1-6-92

2.14.2 General Electric 8 x 8 Type I, P2

Test Conductor MB Hayes Date 1-6-92

QA JA Gant Date 1-7-92

- 2.16 FAT's complete for the RBT and FAHF with both systems operational.

3.0 INITIAL TEST CONDITIONS

3.1 TV monitors are "ON" ~~with proper crosshair alignment verified.~~ | KBH

1-6-92

Test Conductor MB Hayes Date 1-8-92

3.2 Downender drive subassemblies are in the "home" position.

3.3 RBT is set up with BWR FAHF.

3.4 Movable frame is equipped with the BWR fuel adapter plate.

4.0 ENVIRONMENTAL CONDITIONS

At least One HVAC unit for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60° to 90° and 65° to 85° respectively.

Test Conductor MB Hayes Date 1-8-92

5.0 SPECIAL PRECAUTIONS

5.1 All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

✓ 6.1 Stopwatch (calibration not required).

✓ 6.2 Tape Measure 24 ft. with 1/32 inch increments (calibration not required).

- ✓ 6.3 Tape measure 6 ft. with 1/32 inch increments (calibration not required)
- ✓ 6.4 Torque Measuring Instrument 0-10 ft-lb range
- ✓ 6.5 Ammeter 0-5 amps range
- ✓ 6.6 100 to 200 lb weight for load cell testing
- ✓ 6.7 Protractor with a range of 0-91° and accuracy of 0.1° (calibration not required).

7.0 TEST DATA RECORDING

7.1 Test Data Records

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

Each of these modifications will be handled differently. If a correction is required to the procedure, it will be made with pen and ink in the "Record Copy", as they are found. The test conductor will make the appropriate change. Once the change is made, he will initial and date the change for future reference. All modifications which are considered minor changes must be documented on "Temporary Procedure Change Notice" (TPCN) forms (refer to Appendix C). This change shall be approved by the test conductor by annotating that the test procedures are using the TPCN form. All modifications which are considered a major change must also be documented on the TPCN form. However, when a major change is required, testing shall be halted until the TPCN is approved by the responsible Test Engineer, Test Conductor, Quality Assurance and Project Engineer.

7.3 Repairs/Retesting

This section addresses the process for making necessary repairs to the equipment and retesting of the system. If during testing a problem is observed which requires repair or rework of the equipment, testing shall be halted. If the repair/rework is minor, the Test Conductor will document the problem, cause, and corrective action implemented, the faulty system will be retested. All remaining tests will continue on until conclusion. If the problem requires redesign of the faulty system, all testing of this equipment will be halted. The problem and recommended solution will be documented and submitted to the Test Review Group (TRG) for approval. Once approval and the repair is complete, testing of the equipment will be accomplished in accordance with this procedure.

8.0 DETAILED TEST STEPS

All of the sequences of tests are arranged per fuel type. All tests pertaining to a certain fuel are performed, then repeated for the next consecutive fuel type. Mockup fuel assemblies are not employed in the first nine test sequences. The order in which these tests are performed will not have an impact on the results and can therefore be performed in any order as deemed appropriate by the test conductor. The final sequence employs a mockup fuel assembly for two fuel types.

8.1 System verification for the GE 8 x 8 BWR Fuel Type.

The following series of tests are performed to verify the operation and operating positions of the Bottom Support Assembly, Fuel Assembly Clamp and the movable frame carriage drive subassemblies with the downender programmed for the GE 8 x 8 Fuel Type.

8.1.1 Fuel Assembly Bottom Support

8.1.1.1 Verify the correct elevation of the bottom support bucket in its retracted or "Home" position by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support bucket. Distance should be within the following Acceptance Criteria:

- Required distance is $182.25 \pm .50$ inches.
- .00

Measured Distance 182.50 inches

Test Conductor 91 B Hayes Date 1-8-92

QA [Signature] Date 1-8-92

8.1.1.2 Raise the bottom support bucket in the HAND mode until it is stopped at the programmed position for the GE 8 x 8 fuel type. Verify the correct elevation as in 8.1.1.1 above. Distance should be within the following Acceptance Criteria:

- Required distance is $166.74 \pm .10$ inches. ^{.47 KH 1-8-92}

Measured distance 166.50 inches

Test Conductor HB Haynes Date 1-8-92

QA JA Hunt Date 1-8-92

8.1.1.3 Verify the bottom support drive system operation as follows:

- Connect the torque measuring instrument leads to the bottom support drive motor (M103B).

- In the ^{JOG KH 1-8-92} HAND mode, drive the bottom support in the up direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

motor E per
manufacturer $\downarrow$
 $T(\text{ft-lbs}) = \frac{7040 P(\text{watts})}{\text{rpm}}$

Torque .126 ft-lbs

Travel Time not recorded seconds

Measured Distance 130.69 inches

$$Hp = \frac{\text{watts}}{746}$$

as. $Hp = .1$

$\text{rpm} = 2500$

$$T = \frac{3151 \text{ Hp}}{\text{rpm}}$$

Type of Measuring Device Power Monitor Range Variable
Identification No. S/N 13747 Calibration Due Date 10-11-92

Acceptance Criteria

Torque is 0.56 ft-lbs or less

Travel time is for information only

RL# 3 $\rightarrow$ Measured Distance is $130 \pm .00$ inches from the top of the
- .50 movable frame.
TPCN#7

Test Conductor HB Haynes Date 1-8-92

QA JA Hunt Date 1-8-92

3. Drive the bottom support in the down direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$ (see pg. 7) Torque .126 ft-lbs

rpm = 2500

meas. Hp = 0.1

Travel Time 2 min. 11 seconds

Measured Distance 182.31 inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Variable</u>
Identification No.	<u>S/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Torque is 0.56 ft-lbs or less.
- Travel time is for information only.
- Measured distance is 182.25 $\pm$.50 inches from the top of the movable frame.

Test Conductor HB Haynes Date 1-8-92

QA JA Yant Date 1-8-92

4. Repeat steps 2 and 3 two additional times.

$= \frac{(3151) \text{ Hp}}{\text{rpm}}$ (see pg. 7)

rpm = 2500

meas. Hp = 0

" " = .1

" " = 0

" " = .1

	<u>Up</u>	<u>Down</u>
Torque	<u>0 ft-lbs.</u>	<u>.126</u> ft-lbs
Travel Time	<u>2 min. 11 sec.</u>	<u>2 min. 6</u> seconds
Distance	<u>130.69 in.</u>	<u>182.31</u> inches

Torque	<u>0 ft-lbs.</u>	<u>.126</u> ft-lbs.
Travel Time	<u>2 min. 11 sec.</u>	<u>2 min. 11</u> seconds
Distance	<u>130.69 in.</u>	<u>182.31</u> inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Variable</u>
Identification No.	<u>S/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Identical to criteria in steps 2 and 3 above.

Test Conductor HB Haynes Date 1-8-92

QA JA Yant Date 1-8-92

RL # 3
TPCN # 7

8.1.1.4 Part 8.1.1 has been ^{KH 1-9-92}~~satisfactorily~~ completed.

Test Conductor KD Haynes Date 1-9-92

8.1.2 Fuel Assembly Clamp

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

8.1.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two bottom ledges of the clamp plates.

RL# 4
west 11.268
Distance east 11.460 inches

Acceptance Criteria
is ≥ 10.25 inches at the narrowest opening
• Distance ~~11.60 $\pm$ 0.10~~ inches

TCN 001
KBH 7-30

Test Conductor KB Haynes Date 1-9-92

QA JA Yates Date 1-9-92

8.1.2.2 Verify the correct closure of the clamps by driving the subassembly closed in the HAND mode and measuring the distance between the fully closed clamps.

RL# 4
west 3.725
Distance east 3.520 inches

Acceptance Criteria
is ≤ 3.75 inches at the widest opening.
• Distance ~~3.50 $\pm$ 0.10~~ inches

TCN 002
KBH 7-30-92

Test Conductor KB Haynes Date 1-9-92

QA JA Yates Date 1-9-92

8.1.2.3 Verify the fuel assembly clamp operations as follows.

1. Connect ammeter leads to the clamp drive motor (M103C) for measuring current.
2. Drive the clamp to the open position in the HAND mode and measure motor current and travel time.

Current 0.24 amps avg. KH 1-9-92

Travel Time 1.16 seconds

Type of Measuring Device Multimeter Range Various

Identification No. NUS-002 Calibration Due Date 10-30-92

Acceptance Criteria

Current is 2.30 amps or less

Travel Time is 7.0 seconds or less

Test Conductor MB Haynes Date 1-9-92

QA JA Yurt Date 1-9-92

3. Drive the clamp to the closed position and measure motor current and travel time.

Current 0.22 amps avg. KH 1-9-92

Travel Time 1.34 seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NW-DD2</u>	Calibration Due Date	<u>10-30-92</u>

Acceptance Criteria

- Identical to the criteria in step 2 above.

Test Conductor MB Haynes Date 1-9-92

QA JA Yurt Date 1-9-92

4. Repeat steps 2 and 3 two additional times.

	Open	Close	
Current	<u>0.22</u>	<u>0.09</u>	amps avg. KH 1-9-92
Travel Time	<u>1.04</u>	<u>1.09</u>	seconds
Current	<u>0.23</u>	<u>0.22</u>	amps avg. KH 1-9-9
Travel Time	<u>1.42</u>	<u>1.10</u>	seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NWS-002</u>	Calibration Due Date	<u>10-30-92</u>

Test Conductor MB Haynes Date 1-9-92

QA JA Yurt Date 1-9-92

8.1.2.4 Part 8.1.2 has been ~~satisfactorily~~ completed.

Test Conductor MB Haynes Date 1-9-92

QA _____ Date _____

QA
sig. not
required
KH
1-9-92

8.1.3 Movable Frame Carriage Drive

- 8.1.3.1 Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal downender base plate.

Angle 90.9 degrees

Acceptance Criteria

- Angle 90.5 ± 0.5 degrees

Test Conductor MB Hayes

Date 1-9-92

QA

JA Hunt

Date 1-7-92

- 8.1.3.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the HAND mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the downender base plate.

RL# 5

On the hard stop yes X no

Acceptance Criteria

- Yes

Test Conductor MB Hayes

Date 1-9-92

QA

JA Hunt

Date 1-8-92

- 8.1.3.3 Verify the carriage drive operation as follows:

1. Connect a torque measuring instrument leads to the carriage drive motor (M103A) for measuring torque.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

rpm = 2500

meas. Hp = 1.1

Torque 1.39 ft-lbs

Travel Time 3 minutes 20 sec.

Type of Measuring Device Power Monitor Range Variable

Identification No. SN 13747 Calibration Due Date 10-11-92

Acceptance Criteria

Torque is 5.1 ft-lbs or less

Travel Time is less than 4 minutes

Test Conductor HB Haynes Date 1-9-92

QA J. J. J. Date 1-9-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

rpm = 2500

meas. Hp = .85

Torque 1.07 ft-lbs

Travel Time 3 minutes 20 sec.

Note: Hardstop was not engaged.

Type of Measuring Device Power Monitor Range Variable
Identification No. s/n 13747 Calibration Due Date 10-11-92

KH
1-9-92

Acceptance Criteria

- Same as step 2 above

Test Conductor HB Haynes Date 1-9-92

QA J. J. J. Date 1-9-92

4. Repeat steps 2 and 3 two additional times

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

rpm = 2500

meas. Hp = 1.00 avg.

0.85 avg.

1.50 max

0.90 max

	Up	Down	
Torque	<u>1.26</u>	<u>1.07</u>	ft. lbs
Travel Time	<u>3.33</u>	<u>3.30</u>	minutes
Torque	<u>3.33</u>	<u>1.13</u>	ft. lbs
Travel Time	<u>1.89</u>	<u>3.33</u>	minutes

Note: Hard-stop not engaged in down position.

Type of Measuring Device Power Monitor Range Variable
Identification No. s/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Same as step 2 above

Test Conductor HB Haynes Date 1-9-92

QA J. J. J. Date 1-9-92

8.1.3.4 Part 8.1.3 has been ^{KBH 1-9-92}~~satisfactorily~~ completed.

Test Conductor HB Hayes Date 1-9-92

QA _____ Date _____

8.1.4 Limit Switch Verification Test

8.1.4.1 Verify the operation of Fuel Assembly Bottom Support Drive System (M-103B) Limit Switches (ZE-103C and ZE-103D) as follows:

1. In the JOG Mode, drive the bottom support in the up direction of travel until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103C) has been activated.
- Hard stops were not engaged.

Test Conductor HB Hayes Date 1-9-92

QA JA Yates Date 1-9-92

2. Drive the bottom support in the down direction of travel until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103D) has been activated.
- Hard stops were not engaged.

Test Conductor HB Hayes Date 1-9-92

QA JA Yates Date 1-9-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor HB Hayes Date 1-9-92

QA JA Yates Date 1-9-92

QA
sig.
not
required
KBH
1-9-92

8.1.4.2 Verify the operation of the Fuel Assembly Clamp Drive System (M-103C) Limit Switches as follows:

1. In the JOG Mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor HB Haynes Date 1-9-92

QA J. A. Hunt Date 1-9-92

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor HB Haynes Date 1-9-92

QA J. A. Hunt Date 1-9-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor HB Haynes Date 1-9-92

QA J. A. Hunt Date 1-9-92

8.1.4.3 Verify the operation of the Movable Frame Carriage Drive System (M-103A) Limit Switches (ZE-103A and ZE-103B) as follows:

1. In the JOG Mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103A) has been activated.
- Hard stops were not engaged.

Test Conductor KB Hayes Date 1-9-92

QA JA Jones Date 1-9-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103B) has been activated.
- Hard stops were not engaged.

Test Conductor KB Hayes Date 1-9-92

QA JA Jones Date 1-9-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor KB Hayes Date 1-9-92

QA JA Jones Date 1-9-92

8.1.4.4 Part 8.1.4 has been ^{KBH 1-9-92}satisfactorily completed.

Test Conductor KB Hayes Date 1-9-92

QA _____ Date _____

QA sig.
not require
KBH 1-9-92

8.1.5 Load Cell Verification Test

8.1.5.1 Verify the correct operation of the Fuel Assembly Cradle Load Cell (WE-103B) as follows:

1. Drive the movable frame to its full up position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll # 4, frame # 21, 1-9-92, 12:50pm

2. Place a 100 to 200 pound weight in the east end support cradle on the downender base frame.

Control system indicates presence of weight ~~100 + 5 lbs.~~ KBH 1-9-92

YES

Acceptance Criteria:

- Weight is indicated as present

Test Conductor MD Hayes

Date 1-9-92

QA

Ja. Yano

Date 1-9-92

3. Remove the weight from the support cradle.

KBH 1-9-92

Control system indicates absence of weight ~~no~~ YES

Acceptance Criteria:

- Weight is indicated as absent

Test Conductor MD Hayes

Date 1-9-92

QA

Ja. Yano

Date 1-9-92

4. Repeat steps 2 and 3 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor MD Hayes

Date 1-9-92

QA

Ja. Yano

Date 1-9-92

8.1.5.2 Verify the correct operation of the Fuel Assembly Bottom Support Load Cell (WE-103A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #20, 1-9-92, 1:00 pm

Control system indicates presence of weight yes

Acceptance Criteria:

- Control system indicates presence of weight

Test Conductor MB Hayes Date 1-9-92

QA JA Gant Date 1-9-92

2. Remove the weight from the bucket.

Control system indicates absence of weight yes

Acceptance Criteria:

- Control system indicates absence of weight

Test Conductor MB Hayes Date 1-9-92

QA JA Gant Date 1-9-92

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present

- (2) Weight is indicated as absent

Test Conductor MB Hayes Date 1-9-92

QA JA Gant Date 1-9-92

8.1.5.3 Part 8.1.5 is ^{KBH 1-9-92}satisfactorily completed.

Test Conductor MB Hayes Date 1-9-92

QA _____ Date _____

QA sig.
not required
KBH
1-9-92

8.1.6 Interlock Verification Test

8.1.6.1 Verify the Carriage Drive Motor (M-103A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven up by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open

<u>Test</u>	<u>A B C D E</u>					<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
						Yes	No	
i	0	0	0	0	0		✓	No
ii	1	0	0	0	0		✓	No
iii	0	1	0	0	0		✓	No
iv	0	0	1	0	0		✓	No
v	0	0	0	1	0		✓	No
vi	0	0	0	0	1		✓	No
vii	1	1	0	0	0	✓		Yes
viii	1	0	1	0	0		✓	No
ix	1	0	1	0	1		✓	No
x	1	0	0	1	0		✓	No
xi	1	0	0	1	1		✓	No
xii	1	0	0	0	1		✓	No
xiii	0	1	1	0	1		✓	No
xiv	0	1	1	0	1		✓	No
xv	0	1	0	1	0		✓	No
xvi	0	1	0	1	1		✓	No
xvii	0	1	0	0	1		✓	No
xviii	0	0	1	1	0		✓	No
xix	0	0	1	1	1		✓	No
xx	0	0	0	1	1		✓	No
xxi	1	1	1	0	0	✓		Yes
xxii	1	1	0	1	0	✓		No
xxiii	1	1	0	1	1	✓		Yes

RL# 7 →

KBH
1-10-92
KBH
1-10-92

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E) \text{ or } (F + G)]$. In this section, F is equivalent to D in the 0 condition and G is equivalent to E in the 0 condition.

 Test Conductor MB Haynes

 Date 1-9-92

QA

JA Gant

 Date 1-9-92
8.1.6.2 Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

NOTE: The devices and condition are identical to those in step 2. of part 8.1.6.1

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	—	✓	No

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	No
xxii	1	1	0	1	0	✓	—	No
xxiii	1	1	0	1	1	✓	—	Yes
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

CH 1-9-92 No-yes Typo, see logic in Note below

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E)]$.

Test Conductor MB Haynes

Date 1-9-92

QA

JA Yant

Date 1-9-92

8.1.6.3 Verify the Bottom Support Drive Motor (M-103B) up interlocks as follows:

1. Place the control system in the HAND mode.

8.1.6.2a Verify the Carriage Drive Motor (M-103A) down interlocks as follows

See TPC N #6

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open
F Bottom Support Load Cell	Load	No Load

<u>Test</u>	<u>A B C D E F</u>						<u>Motor Operates</u>		<u>Acceptance Criteria</u>
							Yes	No	
i	0	0	0	0	0	1	—	✓	No
ii	1	0	0	0	0	1	—	✓	No
iii	0	1	0	0	0	1	—	✓	No
iv	0	0	1	0	0	1	—	✓	No
v	0	0	0	1	0	1	—	✓	No
vi	0	0	0	0	1	1	—	✓	No
vii	1	1	0	0	0	1	—	✓	No
viii	1	0	1	0	0	1	—	✓	No
ix	1	0	1	0	1	1	—	✓	No
x	1	0	0	1	0	1	—	✓	No
xi	1	0	0	1	1	1	—	✓	No
xii	1	0	0	0	1	1	—	✓	No
xiii	0	1	1	0	1	1	—	✓	No
xiv	0	1	1	0	1	1	—	✓	No
xv	0	1	0	1	0	1	—	✓	No
xvi	0	1	0	1	1	1	—	✓	No
xvii	0	1	0	0	1	1	—	✓	No
xviii	0	0	1	1	0	1	—	✓	No
xix	0	0	1	1	1	1	—	✓	No
xx	0	0	0	1	1	1	—	✓	No
xxi	1	1	1	0	0	1	✓	—	No
xxii	1	1	0	1	0	1	✓	—	No
xxiii	1	1	0	1	1	1	✓	—	Yes
xxiv	1	1	0	0	1	1	—	✓	No
xxv	1	0	1	1	0	1	—	✓	No

Yes, Typo KBH
1-22-92

Test	A B C D E F						Motor Operates		Acceptance Criteria
							Yes	No	
xxvi	1	0	0	1	1	1	—	✓	No
xxvii	0	1	1	1	0	1	—	✓	No
xxviii	0	1	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	1	—	✓	No
xxx	1	1	1	1	0	1	✓	—	Yes
xxxi	1	1	1	0	1	1	✓	—	Yes
xxxii	1	1	1	1	1	1	✓	—	Yes
xxxiii	0	0	0	0	0	0	—	✓	No
xxxiv	1	0	0	0	0	0	—	✓	No
xxxv	0	1	0	0	0	0	—	✓	No
xxxvi	0	0	1	0	0	0	—	✓	No
xxxvii	0	0	0	1	0	0	—	✓	No
xxxviii	0	0	0	0	1	0	—	✓	No
xxxix	1	1	0	0	0	0	—	✓	No
xL	1	0	1	0	0	0	—	✓	No
xLi	1	0	1	0	1	0	—	✓	No
xLii	1	0	0	1	0	0	—	✓	No
xLiii	1	0	0	1	1	0	—	✓	No
xLiv	1	0	0	0	1	0	—	✓	No
xLv	0	1	1	0	1	0	—	✓	No
xLvi	0	1	1	0	1	0	—	✓	No
xLvii	0	1	0	1	0	0	—	✓	No
xLviii	0	1	0	1	1	0	—	✓	No
xLix	0	1	0	0	1	0	—	✓	No
L	0	0	1	1	0	0	—	✓	No
Li	0	0	1	1	1	0	—	✓	No
Lii	0	0	0	1	1	0	—	✓	No
Liii	1	1	1	0	0	0	✓	—	Yes
Liv	1	1	0	1	0	0	—	✓	No
Lv	1	1	0	1	1	0	—	✓	No
Lvi	1	1	0	0	1	0	—	✓	No
Lvii	1	0	1	1	0	0	—	✓	No
Lviii	1	0	0	1	1	0	—	✓	No
Lix	0	1	1	1	0	0	—	✓	No
Lx	0	1	1	1	1	0	—	✓	No
Lxi	0	0	1	1	1	0	—	✓	No
Lxii	1	1	1	1	0	0	—	✓	No
Lxiii	1	1	1	0	1	0	—	✓	No
Lxiv	1	1	1	1	1	0	—	✓	No

Test Conductor MB Harper

Date 1-22-92

QA J. Gant

Date 1-22-92

2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can be driven up by the Drive Motor. Mark the appropriate column below.

<u>Device</u>				<u>Condition</u>		
				0	1	
A Bottom Support Load Cell				Load	No Load	
B Clamps				Closed	Open	
C Movable Frame				Up	Down	
<u>Test</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
				Yes	No	
i	0	0	0	—	✓	No
ii	1	0	0	✓	—	Yes
iii	0	1	0	—	✓	No
iv	0	0	1	—	✓	No
v	1	1	0	✓	— KDH 1-10-92	Yes
vi	0	1	1	✓	—	Yes
vii	1	0	1	✓	—	Yes
viii	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.3 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A \text{ or } (B + C)$].

Test Conductor W B Hays

Date 1-10-92

QA

Date 1-10-92

- 8.1.6.4 Verify the Bottom Support Drive Motor (M-103B) down interlocks as follows:

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can driven down by the Drive Motor. Mark the appropriate column below:

<u>Device</u>	<u>Condition</u>	
	0	1
A Bottom Support Load Cell	Load	No Load
B Clamps	Closed	Open

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0	—	✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.4 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or B.

Test Conductor MB Hayes

Date 1-10-92

QA

JA

Date 1-10-92

8.1.6.5 Verify the Clamp Drive Motor (M-103C) open interlock as follows:

1. Place the control system in the HAND Mode
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the clamps can be driven open by the Drive Motor. Mark the appropriate column below.

Device	Condition	
	0	1
A Bottom Support Load Cell	Load	No Load
B Movable Frame	Up	Down

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0	—	✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.5 of Reference 11.5, Downender SOTAC. The operating interlock logic is A or B.

Test Conductor W.B. Haynes

Date 1-10-92

QA

JA Y...
KBH 1-10-92

Date 1-10-92

8.1.6.6 Part 8.1.6 is satisfactorily completed.

Test Conductor W.B. Haynes

Date 1-10-92

8.1.7 SINGLE Mode Verification Test

Place the Downender System in SINGLE mode and verify system automatic sequence. This test verifies operation of the Downender system motions and does not include the use of a mock-up fuel assembly.

8.1.7.1 With the Downender in the full up position and the clamps open, place the Control System in the SINGLE Mode.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, Frame #19, 1-10-92, 12:40 pm
Acceptance Criteria

RL #8

- "Hold Point" generated to record fuel assembly serial number
- Video images from Camera No. 1 and No. 2 displayed on monitors when "Call Camera" is touched on the screen. Complete the CCTV Assessment Form in Appendix E.
Form KBH 1-10-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the Downender movable frame.

Test Conductor W.B. Haynes

Date 1-14-92

QA

JA Y...

Date 1-14-92

- 8.1.7.2 Verify that the bottom support has assumed the programmed position for the GE 8x8 fuel type by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support.

Measured distance 166.50 inches

Acceptance Criteria KBH 1-10-92

- Distance is $166.50 \pm .10$ inches.

Test Conductor HB Hayes Date 1-10-92
QA CA Hunt Date 1-10-92

- 8.1.7.3 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the downender bottom support through temporary changes to the Data Register.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify fuel assembly is properly seated.
- Video images from Camera No. 3 and No. 10 are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
Form KBH 1-14-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor HB Hayes Date 1-14-92
QA CA Hunt Date 1-14-92

- 8.1.7.4 Press continue to close the clamps.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #18, 1-14-92, 9:25am

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the Downender
- Video images from Cameras No. 3 and No. 10 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the downender movable frame and excell crane interface.

Test Conductor HB Hayes Date 1-14-92
QA CA Hunt Date 1-14-92

8.1.7.5 Press "Continue" to downend the movable frame to the horizontal position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #17, 1-14-92, 9:30 am

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

Acceptance Criteria

- The movable frame is downended to the horizontal position.

Test Conductor MB Hayman Date 1-14-92

QA J. G. Gant Date 1-14-92

8.1.7.6 ~~Press "Continue" to open the clamps~~ Verify clamps open automatically.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #16, 1-14-92, 9:38 am

Acceptance Criteria 14 KH 42

- Clamps open

Test Conductor MB Hayman Date 1-14-92

QA J. G. Gant Date 1-14-92

8.1.7.7 Press "Continue" to retract the bottom support bucket to its most westward or "Home" position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #15, 1-14-92, 9:37 am

Acceptance Criteria 10 KH 35

- Bottom support bucket moves to its "Home" position.

Test Conductor MB Hayman Date 1-14-92

QA J. G. Gant Date 1-14-92

8.1.7.8 Press "Continue" to raise the movable frame to its up position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #14, 1-14-92, 9:42

Acceptance Criteria 15 KH 37

- Movable frame travels to its up position.
- Control system generates a signal to release the RBT.

L #11
PCN # 3
#4 1-14-92

~~KH 1-14-92 RBT with FAHF attached can be positioned to interface with
see TPCN 2 downender lower cradles for fuel removal.~~

Test Conductor MB Hayes Date 1-14-92

QA JA Yurt Date 1-14-92

8.1.7.9 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor MB Hayes Date 1-14-92

QA JA Yurt Date 1-14-92

8.1.7.10 Part 8.1.7 is ^{KH 1-14-92}satisfactorily completed.

Test Conductor MB Hayes Date 1-14-92

8.1.8 AUTO Mode Verification Test

Place the Downender in AUTO mode and verify system automatic sequence. This test verifies operation of the Downender motions and does not include the use of a mock-up fuel assembly.

8.1.8.1 With the Downender in the full up position and the clamps open, place the Downender in AUTO mode control.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.

Test Conductor MB Hayes Date 1-14-92

QA JA Yurt Date 1-14-92

8.1.8.2 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the bottom support through temporary changes to the bottom support load cell software. Press "Continue".

Acceptance Criteria

- "Hold Point" is generated to verify fuel assembly is properly seated.

Test Conductor MB Hayes Date 1-14-92

QA JA Yurt Date 1-14-92

8.1.8.3 Press "Continue" to close the clamps.

Acceptance Criteria

- Clamps close
- "Hold Point" is generated to verify excell crane is clear of the Downender.

Test Conductor W B Haynes Date 1-14-92

QA J A Yant Date 1-14-92

8.1.8.4 Press "Continue" to complete the automatic sequence.

Acceptance Criteria

- Movable frame is downended to the horizontal or down position

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

- Clamps open
- Bottom support retracts to westward most position
- Movable frame is driven to full up position
- Control system generates a signal to release the RBT

Test Conductor W B Haynes Date 1-14-92

QA J A Yant Date 1-14-92

8.1.8.5 Return the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor W B Haynes Date 1-14-92

QA J A Yant Date 1-14-92

8.1.8.6 Part 8.1.8 is ~~satisfactorily~~ completed. ^{KDA 1-14-92}

Test Conductor W B Haynes Date 1-14-92

8.1.9 Servo Drive Fault Test

WARNING

Stay clear of the Downender system while in operation

8.1.9.1 Place the Downender system in the "SINGLE" mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-103A)

8.1.9.2 Temporarily force the Data Register to indicate a torque fault with the Carriage Drive Motor (M-103A).

Acceptance Criteria:

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor MB Hayes Date 1-14-92

QA JA Hunt Date 1-14-92

8.1.9.3 Verify cameras No. 3 and No. 10 are activated and view the movable frame system when the "CAMERA CALL" button is touched

Acceptance Criteria:

- Video images from cameras No. 3 and NO. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Camera No. 3 and No. 10 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor MB Hayes Date 1-14-92

QA JA Hunt Date 1-14-92

8.1.9.4 Correct fault condition and verify the Carriage Drive Motor (M-103A) can be moved in the "SINGLE" mode.

Acceptance Criteria:

- The system can be recovered from fault condition and 'SINGLE' mode operations continued.

Test Conductor MB Hayes Date 1-14-92

QA JA Hunt Date 1-14-92

8.1.9.5 Part 8.1.9 is ^{KDH 1-14-92} ~~satisfactorily~~ completed.

Test Conductor MB Hayes Date 1-14-92

8.1.10 Downender operation Verification Test with Mock-up Fuel Assembly

This test verifies Downender operation during actual fuel assembly handling. The test sequence is done in the "SINGLE" mode to allow for increased control and verification of the Downender operation.

8.1.10.1 With the Downender in the full up position and with the clamps open, a GE 8x8 BWR mock-up fuel assembly is loaded on the excell crane. In the "SINGLE" mode, enter the command to load a fuel assembly into the cell.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***
Roll #4, frame #13, 1-14-92, 11:15 am
Acceptance Criteria:

- RL #8
- "Hold Point" is generated to record fuel assembly serial number
 - Video image from camera No. 1 and No. 2 are displayed on monitors when "CAMERA CALL" is touched on screen.
 - An unobstructed view of the fuel assembly top end fitting is provided by cameras No. 1 and No. 2.

Test Conductor MB Hayes Date 1-14-92

QA JA Grant Date 1-14-92

8.1.10.2 Using the keyboard, enter the fuel assembly serial number. Place the fuel assembly in the Downender using the excell crane. Press "Continue".

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***
Roll #4, frame #12, 1-14-92, 3:00 pm
Acceptance Criteria:

- "Hold Point" is generated to verify fuel assembly is properly seated.
- Video images from camera No. 3 and No. 10 are displayed on monitors when "CAMERA CALL" is touched on screen.
- An unobstructed view of the fuel assembly lower end fitting and lower support (Dwg 9315-M-1405, Item 22) interface is provided.
- Control system indicates presence of fuel assembly once lowered into the bottom support.

Test Conductor MB Hayes Date 1-14-92

QA JA Grant Date 1-14-92

8.1.10.3 Connect ammeter leads to the Clamp Drive Motor (M-103C) ~~press~~ **KBH**
and ~~"Continue"~~ to close the clamps. Measure motor current and time **1-14-92**
required for the clamps to close.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #11, 1-14-92, 3:15 pm

Current .17 amps

Travel Time 1.27 seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NUS-002</u>	Calibration Due Date	<u>10-30-92</u>

Acceptance Criteria:

- Current as 2.3 amps or less.
- Travel Time is 7.0 seconds or less.
- "Hold Point" is generated to verify excell crane is clear of the Downender.
- Video image is displayed from cameras No. 3 and No. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- An unobstructive view is provided of the fuel assembly/excell crane interface to verify disconnect and clearance.

Test Conductor MB Haynes Date 1-14-92

QA JA Yant Date 1-14-92

8.1.10.4 Connect the torque measuring instrument to the Carriage Drive Motor (M-103A). Press "Continue" to drive the Downender to the full down position. Measure drive motor torque and time required to reach the full down position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #10, 1-14-92, 3:20 pm

Torque .95 ft.-lbs.

Travel Time 3 minutes 21 sec

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Variable</u>
Identification No.	<u>SN13747</u>	Calibration Due Date	<u>10-11-92</u>

$$T = \frac{(3151) \text{ HP}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas.} = .75 \text{ HP}$$

Acceptance Criteria:

- Torque is 5.1 ft.-lbs. or less
- Travel Time is 4 minutes or less
- Movable frame is in the full down position
- Control system indicates transfer of weight to lower support cradles.

TPCN # 4

Test Conductor HB Hayes

Date 1-14-92

QA

Jaffar

Date 1-14-92

~~8.1.10.5 Press "Continue" to open clamps. Measure drive motor current and time to open.~~

~~Current _____ amps~~

~~Travel Time _____ seconds~~

Type of Measuring Device _____	Range _____
Identification No. _____	Calibration Due Date _____

Acceptance Criteria:

- ~~• Current is 2.3 amps or less~~
- ~~• Travel Time is 7.0 seconds or less~~
- Clamps open

Test Conductor _____ Date _____

QA _____ Date _____

8.1.10.6 Connect the torque measuring instrument to the Bottom Support Drive Motor (M-1038). Press "Continue" to retract the bottom support bucket. Measure drive motor torque.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Roll #4, frame #9, 1-14-92, 3:30 pm

Torque .38 ft.-lbs.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas.} = .30 \text{ Hp}$$

Type of Measuring Device <u>Power Monitor</u>	Range <u>Variable</u>
Identification No. <u>S/N 13747</u>	Calibration Due Date <u>10-11-92</u>

Acceptance Criteria:

- Torque is 0.56 ft.-lbs. or less
- Bottom support bucket retracts

Test Conductor HB Hayes

Date 1-14-92

QA

Jaffar

Date 1-14-92

8.1.10.7 Connect the torque measuring instrument to the Carriage Drive Motor (M-103A). Press "Continue" to drive the Downender to its full up position. Measure drive motor torque and travel time.

Torque 2.14 ft.-lbs.

Travel Time 3min. 17 seconds

$$= \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\frac{\text{eas.}}{\text{hp}} = 1.7$$

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Variable</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria:

- Torque is 5.1 ft.-lbs. or less
- Travel Time is 4 minutes or less
- Movable frame is in the full up position.

Test Conductor MB Hays

Date 1-14-92

QA

JA Yurt

Date 1-14-92

8.1.10.8 Disconnect and remove all test instrumentation.

Test Conductor MB Hays

Date 1-14-92

8.1.10.9 Part 8.1.10 is ^{KBH 1-14-92} ~~satisfactorily~~ completed.

Test Conductor MB Hays

Date 1-14-92

QA

Date

QA sig.
not
required

KBH
1-14-92

8.1.10.7.1 In the Jog mode, remove the GE 8x8 mock-up fuel assembly from the downender cradle using the RBT and BWR FAHF. Place the mock-up fuel assembly in the storage rack or other suitable location.

TPCN #2

Acceptance Criteria:

- RBT with FAHF attached can be positioned to interface with downender lower cradles for removal.

Test Conductor MB Hays Date 1-14-92

QA

JA Yurt

Date 1-14-92

2. In the ^{JOG} ~~Hand~~ KDH 1-14-92 mode, drive the bottom support in the up direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque 0 ft-lbs

Travel Time 1 min. 12 seconds

Measured Distance 130.69 inches

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = 0.0$$

Type of Measuring Device Power Monitor Range Various
Identification No. S/N 13747 Calibration Due Date 10-11-92

Acceptance Criteria

Torque is 0.56 ft-lbs or less

Travel time is for information only

RL# 3 → Measured Distance is 130 + .00 inches from the top of the
TPCN#7 - .50 movable frame.

Test Conductor W B Hayes Date 1-14-92

QA Ja Yoo Date 1-14-92

3. Drive the bottom support in the down direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .19 ft-lbs

Travel Time 2 min 5 seconds

Measured Distance 182.44 inches

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = .15$$

Type of Measuring Device Power Monitor Range Various
Identification No. S/N 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Torque is 0.56 ft-lbs or less.
- Travel time is for information only.
- Measured distance is 182.25 $\pm$.50 inches from the top
-0.00 of the movable frame.

Test Conductor MB Haynes Date 1-14-92

QA J. A. Yates Date 1-14-92

4. Repeat steps 2 and 3 two additional times.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas} = .1$$

$$\text{Hp} = .1$$

$$.1$$

$$.1$$

	<u>Up</u>	<u>Down</u>	
Torque	<u>.13</u>	<u>.13</u>	ft-lbs
Travel Time	<u>2 min. 14 sec.</u>	<u>2 min. 11</u>	seconds
Distance	<u>130.69</u>	<u>182.44</u>	inches
Torque	<u>.13</u>	<u>.13</u>	ft-lbs
Travel Time	<u>2 min. 11 sec.</u>	<u>182.44</u>	seconds incl.
Distance	<u>130.69 in.</u>	<u>2 min 11 sec inches</u>	

Type of Measuring Device Power Monitor Range Various

Identification No. 3/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Identical to criteria in steps 2 and 3 above.

Test Conductor MB Haynes Date 1-14-92

QA J. A. Yates Date 1-14-92

8.2.1.4 Part 8.2.1 has been ~~satisfactorily~~ completed.

Test Conductor MB Haynes Date 1-14-92

RL #3
TFCN #7

8.2.2 Fuel Assembly Clamp

8.2.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two bottom ledges of the clamp plates.

RL# 4 Distance 11.25 inches

Acceptance Criteria

is ≥ 10.25 inches at the narrowest opening.

- Distance ~~11.60 $\pm$ 0.10~~ inches

TCN 002
KBH 7-30-92

Test Conductor HB Haynes

Date 1-15-92

QA

JA Yantis

Date 1-15-92

8.2.2.2 Verify the correct closure of the clamps by driving the subassembly closed in the HAND mode and measuring the distance between the fully closed clamps.

Distance 3.0 inches

Acceptance Criteria

is ≤ 3.75 inches at the widest opening

- RL# 4
- Distance ~~3.50 $\pm$ 0.10~~ inches

TCN 002
KBH 7-30-92

Test Conductor HB Haynes

Date 1-15-92

QA

JA Yantis

Date 1-15-92

8.2.2.3 Verify the fuel assembly clamp operations as follows.

1. Connect ammeter leads to the clamp drive motor (M103C) for measuring current.
2. Drive the clamp to the open position in the HAND mode and measure motor current and travel time.

Current 2.08 amp - startup, .13 amps operating

Travel Time 1.2 seconds

Type of Measuring Device Multimeter Range Various

Identification No. NUS-002 Calibration Due Date 10-30-92

Acceptance Criteria

Current is 2.30 amps or less

Travel Time is 7.0 seconds or less

Test Conductor KB Haynes Date 1-15-92

QA JA Yano Date 1-15-92

3. Drive the clamp to the closed position and measure motor current and travel time.

Current 2.08 amp - startup, .13 amps operating

Travel Time 1.2 seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NUS-002</u>	Calibration Due Date	<u>10-30-92</u>

Acceptance Criteria

- Identical to the criteria in step 2 above.

Test Conductor KB Haynes Date 1-15-92

QA JA Yano Date 1-15-92

4. Repeat steps 2 and 3 two additional times.

	Open	Close
Current	<u>2.16 s-up</u> <u>.14 op.</u>	<u>2.25 s-up</u> <u>.24 op</u> amps
Travel Time	<u>1.02</u>	<u>1.24</u> seconds
Current	<u>2.16 s-up</u> <u>.21 op.</u>	<u>2.26 s-up</u> <u>.23 op</u> amps
Travel Time	<u>1.09</u>	<u>1.31</u> seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NUS-002</u>	Calibration Due Date	<u>10-30-92</u>

Test Conductor KB Haynes Date 1-15-92

QA JA Yano Date 1-15-92

8.2.2.4 Part 8.2.2 has been satisfactorily completed.

Test Conductor KB Haynes Date 1-15-92

QA _____ Date _____

QA sig. not
required
KDH 1-14-92

8.2.3 Movable Frame Carriage Drive

- 8.2.3.1 Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal downender base plate.

Angle 90.9 degrees

Acceptance Criteria

- Angle 90.5 ± 0.5 degrees

Test Conductor JB Hayes

Date 1-14-92

QA JA Yarb

Date 1-14-92

- 8.2.3.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the HAND mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the downender base plate.

On the hard stop ☒ yes ☐ no

Acceptance Criteria

- Yes

Test Conductor JB Hayes

Date 1-14-92

QA JA Yarb

Date 1-14-92

- 8.2.3.3 Verify the carriage drive operation as follows:

1. Connect a torque measuring instrument leads to the carriage drive motor (M103A) for measuring torque.
2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{as. Hp} = \frac{2.1}{1.5} \cdot 1.5 \text{ avg.}$$

Torque 1.89 ft-lbs

Travel Time 3 minutes 20 sec.

Type of Measuring Device Power Monitor Range Various

Identification No. SN 13747 Calibration Due Date 10-11-92

Acceptance Criteria

$$T = \frac{(3151) Hp}{rpm}$$

$$rpm = 2500$$

$$meas. Hp = 0.7$$

Torque is 5.1 ft-lbs or less

Travel Time is less than 4 minutes

Test Conductor MB Hayes

Date 1-14-92

QA

JA Yant

Date 1-14-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

Torque 0.88 ft-lbs

Travel Time 3 minutes 21 sec.

Type of Measuring Device Power Monitor Range Various

Identification No. S/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Same as step 2 above

Test Conductor MB Hayes

Date 1-14-92

QA

JA Yant

Date 1-14-92

4. Repeat steps 2 and 3 two additional times

$$T = \frac{(3151) Hp}{rpm}$$

$$rpm = 2500$$

$$meas. = 1.4$$

$$Hp = 0.7$$

$$1.5$$

$$0.7$$

Up

Down

Torque

1.76

0.88

ft-lbs

Travel Time

3 min. 21 sec.

3

minutes 19 sec.

Torque

1.89

0.88

ft-lbs

Travel Time

3 min. 20 sec.

3

minutes 21 sec.

Type of Measuring Device Power Monitor Range Various

Identification No. S/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Same as step 2 above

Test Conductor MB Hayes

Date 1-14-92

QA

JA Yant

Date 1-14-92

8.2.3.4 Part 8.2.3 has been ^{KBH 1-14-92}~~satisfactorily~~ completed.

Test Conductor MB Hayes Date 1-14-92

QA _____ Date _____

QA sig.
not required

8.2.4 Limit Switch Verification Test

KBH 1-14-92

8.2.4.1 Verify the operation of Fuel Assembly Bottom Support Drive System (M-103B) Limit Switches (ZE-103C and ZE-103D) as follows:

1. In the JOG Mode, drive the bottom support in the up direction of travel until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103C) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yates Date 1-14-92

2. Drive the bottom support in the down direction of travel until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103D) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yates Date 1-14-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yates Date 1-14-92

8.2.4.2 Verify the operation of the Fuel Assembly Clamp Drive System (M-103C) Limit Switches as follows:

1. In the JOG Mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yano Date 1-14-92

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yano Date 1-14-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yano Date 1-14-92

8.2.4.3 Verify the operation of the Movable Frame Carriage Drive System (M-103A) Limit Switches (ZE-103A and ZE-103B) as follows:

1. In the JOG Mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103A) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yant Date 1-14-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103B) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yant Date 1-14-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-14-92

QA JA Yant Date 1-14-92

8.2.4.4 Part 8.2.4 has been satisfactorily completed.

Test Conductor MB Hayes Date 1-14-92

QA _____ Date _____

QA sig.
not required
KBH 1-14-92

8.2.5 Load Cell Verification Test

8.2.5.1 Verify the correct operation of the Fuel Assembly Cradle Load Cell (WE-103B) as follows:

1. Drive the movable frame to its full up position.
2. Place a 100 to 200 pound weight in the east end support cradle on the downender base frame.

Control system indicates presence of weight yes

Acceptance Criteria:

- Weight is indicated as present

Test Conductor MB Hayes Date 1-14-92

QA JA Yarb Date 1-14-92

3. Remove the weight from the support cradle.

Control system indicates absence of weight yes

Acceptance Criteria:

- Weight is indicated as absent

Test Conductor MB Hayes Date 1-14-92

QA JA Yarb Date 1-14-92

4. Repeat steps 2 and 3 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor MB Hayes Date 1-14-92

QA JA Yarb Date 1-14-92

8.2.5.2 Verify the correct operation of the Fuel Assembly Bottom Support Load Cell (WE-103A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

Control system indicates presence of weight yes

Acceptance Criteria:

- Control system indicates presence of weight

Test Conductor KD Haynes Date 1-14-92

QA JA Yurt Date 1-14-92

2. Remove the weight from the bucket.

Control system indicates absence of weight yes

Acceptance Criteria:

- Control system indicates absence of weight

Test Conductor KD Haynes Date 1-14-92

QA JA Yurt Date 1-14-92

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor KD Haynes Date 1-14-92

QA JA Yurt Date 1-14-92

8.2.5.3 Part 8.2.5 1, ^{KDH 1-14-92} satisfactorily completed.

Test Conductor KD Haynes Date 1-14-92

QA _____ Date _____

QA sig.
not required
KDH 1-14-92

8.2.6 Interlock Verification Test

8.2.6.1 Verify the Carriage Drive Motor (M-103A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven up by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
3 SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open

<u>Test</u>	<u>A B C D E</u>					<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	✓	—	Yes
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	Yes
xxii	1	1	0	1	0	—	✓	No
xxiii	1	1	0	1	1	✓	—	Yes

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E) \text{ or } (F + G)]$. In this section, F is equivalent to D in the 0 condition and G is equivalent to E in the 0 condition.

Test Conductor MD Hayes Date 1-14-92

QA Ja Yant Date 1-14-92

8.2.6.2 Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

NOTE: The devices and condition are identical to those in step 2 of part 8.2.6.1

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	—	✓	No

Test	A B C D E					Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	No
xxii	1	1	0	1	0	✓	—	No
xxiii	1	1	0	1	1	✓	—	Yes
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

Typo, see logic in Note below
KBH 1-14-92

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E)]$.

Test Conductor HB Wagner

Date 1-14-92

QA

J. C. Yano

Date 1-14-92

8.2.6.3 Verify the Bottom Support Drive Motor (M-1038) up interlocks as follows:

1. Place the control system in the HAND mode.

8.2.6.2a Verify the Carriage Drive Motor (M-103A) down interlocks as follows

See TPCN #6

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open
F Bottom Support Load Cell	Load	No Load

<u>Test</u>	<u>A B C D E F</u>						<u>Motor Operates</u>		<u>Acceptance Criteria</u>
							Yes	No	
i	0	0	0	0	0	1	—	✓	No
ii	1	0	0	0	0	1	—	✓	No
iii	0	1	0	0	0	1	—	✓	No
iv	0	0	1	0	0	1	—	✓	No
v	0	0	0	1	0	1	—	✓	No
vi	0	0	0	0	1	1	—	✓	No
vii	1	1	0	0	0	1	—	✓	No
viii	1	0	1	0	0	1	—	✓	No
ix	1	0	1	0	1	1	—	✓	No
x	1	0	0	1	0	1	—	✓	No
xi	1	0	0	1	1	1	—	✓	No
xii	1	0	0	0	1	1	—	✓	No
xiii	0	1	1	0	1	1	—	✓	No
xiv	0	1	1	0	1	1	—	✓	No
xv	0	1	0	1	0	1	—	✓	No
xvi	0	1	0	1	1	1	—	✓	No
xvii	0	1	0	0	1	1	—	✓	No
xviii	0	0	1	1	0	1	—	✓	No
xix	0	0	1	1	1	1	—	✓	No
xx	0	0	0	1	1	1	—	✓	No
xxi	1	1	1	0	0	1	✓	—	No
xxii	1	1	0	1	0	1	—	✓	No
xxiii	1	1	0	1	1	1	✓	—	No
xxiv	1	1	0	0	1	1	—	✓	No
xxv	1	0	1	1	0	1	—	✓	No

~~No~~ Yes, Typo KBH
~~No~~ OK 1-22-A

Test	A B C D E F						Motor Operates		Acceptance Criteria
							Yes	No	
xxvi	1	0	0	1	1	1	—	✓	No
xxvii	0	1	1	1	0	1	—	✓	No
xxviii	0	1	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	1	—	✓	No
xxx	1	1	1	1	0	1	✓	—	Yes
xxxi	1	1	1	0	1	1	✓	—	Yes
xxxii	1	1	1	1	1	1	✓	—	Yes
xxxiii	0	0	0	0	0	0	—	✓	No
xxxiv	1	0	0	0	0	0	—	✓	No
xxxv	0	1	0	0	0	0	—	✓	No
xxxvi	0	0	1	0	0	0	—	✓	No
xxxvii	0	0	0	1	0	0	—	✓	No
xxxviii	0	0	0	0	1	0	—	✓	No
xxxix	1	1	0	0	0	0	—	✓	No
xL	1	0	1	0	0	0	—	✓	No
xLi	1	0	1	0	1	0	—	✓	No
xLii	1	0	0	1	0	0	—	✓	No
xLiii	1	0	0	1	1	0	—	✓	No
xLiv	1	0	0	0	1	0	—	✓	No
xLv	0	1	1	0	1	0	—	✓	No
xLvi	0	1	1	0	1	0	—	✓	No
xLvii	0	1	0	1	0	0	—	✓	No
xLviii	0	1	0	1	1	0	—	✓	No
xLix	0	1	0	0	1	0	—	✓	No
L	0	0	1	1	0	0	—	✓	No
Li	0	0	1	1	1	0	—	✓	No
Lii	0	0	0	1	1	0	—	✓	No
Liii	1	1	1	0	0	0	—	✓	Yes
Liv	1	1	0	1	0	0	—	✓	No
Lv	1	1	0	1	1	0	—	✓	No
Lvi	1	1	0	0	1	0	—	✓	No
Lvii	1	0	1	1	0	0	—	✓	No
Lviii	1	0	0	1	1	0	—	✓	No
Lix	0	1	1	1	0	0	—	✓	No
Lx	0	1	1	1	1	0	—	✓	No
Lxi	0	0	1	1	1	0	—	✓	No
Lxii	1	1	1	1	0	0	—	✓	No
Lxiii	1	1	1	0	1	0	—	✓	No
Lxiv	1	1	1	1	1	0	—	✓	No

Test Conductor NB Hayes

Date 1-22-92

QA

[Signature]

Date 1-22-92

2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can be driven up by the Drive Motor. Mark the appropriate column below.

	<u>Device</u>			<u>Condition</u>		
				0	1	
	A	B	C	Load Closed Up	No Load Open Down	
<u>Test</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Motor Operates</u> Yes No		<u>Acceptance Criteria</u> (See Note)
i	0	0	0	—	✓	No
ii	1	0	0	✓	—	Yes
iii	0	1	0	—	✓	No
iv	0	0	1	—	✓	No
v	1	1	0	✓	—	Yes
vi	0	1	1	✓	—	Yes
vii	1	0	1	✓	—	Yes
viii	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.3 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A \text{ or } (B + C)$.

Test Conductor RD Hagman

Date 1-14-92

QA J. A. Yarb

Date 1-14-92

- 8.2.6.4 Verify the Bottom Support Drive Motor (M-1038) down interlocks as follows:

- Place the control system in the HAND Mode.
- Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can driven down by the Drive Motor. Mark the appropriate column below:

	<u>Device</u>		<u>Condition</u>	
			0	1
	A	B	Load Closed	No Load Open
A Bottom Support Load Cell				
B Clamps				

<u>Test</u>	<u>A B</u>		<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
			Yes	No	
i	0	0	—	✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.4 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or B.

Test Conductor MD Hager

Date 1-14-92

QA Joe Y

Date 1-14-92

8.2.6.5 Verify the Clamp Drive Motor (M-103C) open interlock as follows:

1. Place the control system in the HAND Mode
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the clamps can be driven open by the Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A Bottom Support Load Cell	Load	No Load
B Movable Frame	Up	Down

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.5 of Reference 11.5, Downender SOTAC. The operating interlock logic is A or B.

Test Conductor DB Hayne Date 1-14-92

QA JA Yarb Date 1-14-92

8.2.6.6 Part 8.2.6 is satisfactorily completed.

Test Conductor DB Hayne Date 1-14-92

8.2.7 SINGLE Mode Verification Test

Place the Downender System in SINGLE mode and verify system automatic sequence. This test verifies operation of the Downender system motions and does not include the use of a mock-up fuel assembly.

8.2.7.1 With the Downender in the full up position and the clamps open, place the Control System in the SINGLE Mode.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.
- Video images from Camera No. 1 and No. 2 displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
Form EPH 1-15-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the Downender movable frame.

RL#8

Test Conductor KB Hayne Date 1-15-92

QA JA Yarb Date 1-15-92

- 8.2.7.2 Verify that the bottom support has assumed the programmed position for the B&W 15x15 fuel type by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support.

Measured distance 159.50 inches

Acceptance Criteria

- Distance is $159.57 \pm .10$ inches.

Test Conductor KB Hager

Date 1-15-92

QA

JA Yano

Date 1-15-92

- 8.2.7.3 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the downender bottom support through temporary changes to the Data Register.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify fuel assembly is properly seated.
- Video images from Camera No. 3 and No. 10 are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment ~~Form~~ ^{Form KBH 1-15-92} in Appendix E.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor KB Hager

Date 1-15-92

QA

JA Yano

Date 1-15-92

- 8.2.7.4 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the Downender
- Video images from Cameras No. 3 and No. 10 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the downender movable frame and excell crane interface.

Test Conductor KB Hager

Date 1-15-92

QA

JA Yano

Date 1-15-92

8.2.7.5 Press "Continue" to downend the movable frame to the horizontal position.

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

Acceptance Criteria

- The movable frame is downended to the horizontal position.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

L# 11

PCN #3

KBH

1-15-92

8.2.7.6 ~~Press "Continue" to open the clamps~~ Verify clamps open automatically.

Acceptance Criteria

- Clamps open

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

8.2.7.7 Press "Continue" to retract the bottom support bucket to its most westward or "Home" position.

Acceptance Criteria

- Bottom support bucket moves to its "Home" position.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

8.2.7.8 Press "Continue" to raise the movable frame to its up position.

Acceptance Criteria

- Movable frame travels to its up position.
- Control system generates a signal to release the RBT.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

- RBT with FAHF attached can be positioned to interface with downender lower cradles for fuel removal.

Test Conductor MB Hayes Date 8-3-92

QA J. Mulgrew Date 8-3-92

- 8.2.7.9 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor MB Hayes Date 8-3-92

QA J. Mulgrew Date 8-3-92

- 8.2.7.10 Part 8.2.7 is satisfactorily completed.

Test Conductor MB Hayes Date 8-3-92

8.2.8 AUTO Mode Verification Test

Place the Downender in AUTO mode and verify system automatic sequence. This test verifies operation of the Downender motions and does not include the use of a mock-up fuel assembly.

- 8.2.8.1 With the Downender in the full up position and the clamps open, place the Downender in AUTO mode control.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.

Test Conductor MB Hayes Date 8-3-92

QA J. Mulgrew Date 8-3-92

- 8.2.8.2 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the bottom support through temporary changes to the bottom support load cell software. Press "Continue".

Acceptance Criteria

- "Hold Point" is generated to verify fuel assembly is properly seated.

Test Conductor MB Hayes Date 8-3-92

QA J. Mulgrew Date 8-3-92

* Pages 53, 54 + 55 were lost after testing and signoff. Verification of the Test Log show that these test sections were completed on 1-15-92.

8.2.8.3 Press "Continue" to close the clamps.

Acceptance Criteria

- Clamps close
- "Hold Point" is generated to verify excell crane is clear of the Downender.

Test Conductor XB Hayes Date 8-3-92

QA D. S. Hughes Date 8-3-92

8.2.8.4 Press "Continue" to complete the automatic sequence.

Acceptance Criteria

- Movable frame is downended to the horizontal or down position

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

- Clamps open
- Bottom support retracts to westward most position
- Movable frame is driven to full up position
- Control system generates a signal to release the RBT

Test Conductor XB Hayes Date 8-3-92

QA D. S. Hughes Date 8-3-92

8.2.8.5 Return the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor XB Hayes Date 8-3-92

QA D. S. Hughes Date 8-3-92

8.2.8.6 Part 8.2.8 is satisfactorily completed.

Test Conductor XB Hayes Date 8-3-92

8.2.9 Servo Drive Fault Test

WARNING

Stay clear of the Downender system while in operation

8.2.9.1 Place the Downender system in the "SINGLE" mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-103A)

8.2.9.2 Temporarily force the Data Register to indicate a torque fault with the Carriage Drive Motor (M-103A).

Acceptance Criteria:

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor MB Hayes Date 8-3-92

QA D. Mulgrew Date 8-3-92

8.2.9.3 Verify cameras No. 3 and No. 10 are activated and view the movable frame system when the "CAMERA CALL" button is touched

Acceptance Criteria:

- Video images from cameras No. 3 and NO. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Camera No. 3 and No. 10 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor MB Hayes Date 8-3-92

QA D. Mulgrew Date 8-3-92

8.2.9.4 Correct fault condition and verify the Carriage Drive Motor (M-103A) can be moved in the "SINGLE" mode.

Acceptance Criteria:

- The system can be recovered from fault condition and "SINGLE" mode operations continued.

Test Conductor MB Hayes Date 8-3-92

QA D. Mulgrew Date 8-3-92

KBH 1-15-92
8.2.9.5 Part 8.2.9 is ~~satisfactorily~~ completed.

Test Conductor KB Hagen

Date 1-15-92

8.2.10 Downender Operation Verification Test with Mock-up Fuel Assembly

This test verifies Downender operation during actual fuel assembly handling. The test sequence is done in the "SINGLE" mode to allow for increased control and verification of the Downender operation.

8.2.10.1 With the Downender in the full up position and with the clamps open, a B&W 15 x 15 mock-up fuel assembly is loaded on the excell crane. In the "SINGLE" mode, enter the command to load a fuel assembly into the cell.

Photo taken, Roll #4, frame # B, 1-15-92, 10:15 am
Acceptance Criteria:

- "Hold Point" is generated to record fuel assembly serial number
- Video image from camera No. 1 and No. 2 are displayed on monitors when "CAMERA CALL" is touched on screen.
- An unobstructed view of the fuel assembly top end fitting is provided by cameras No. 1 and No. 2.

RL #8

Test Conductor KB Hagen

Date 1-15-92

QA

QA Y-5

Date 1-15-92

8.2.10.2 Using the keyboard, enter the fuel assembly serial number. Place the fuel assembly in the Downender using the excell crane. Press "Continue".

Photo taken, Roll #4, frame # 7, 1-15-92, 10:35
Acceptance Criteria:

- "Hold Point" is generated to verify fuel assembly is properly seated.
- Video images from camera No. 3 and No. 10 are displayed on monitors when "CAMERA CALL" is touched on screen.
- An unobstructed view of the fuel assembly lower end fitting and lower support (Dwg 9315-M-1405, Item 22) interface is provided.
- Control system indicates presence of fuel assembly once lowered into the bottom support.

Test Conductor KB Hagen

Date 1-15-92

QA

QA Y-5

Date 1-15-92

8.2.10.3 Connect ammeter leads to the Clamp Drive Motor (M-103C) press "Continue" to close the clamps. Measure motor current and time required for the clamps to close.

Current 2.13 amps
Travel Time 2.5 seconds

Type of Measuring Device <u>Multimeter</u> Range <u>Various</u>
Identification No. <u>NUS-002</u> Calibration Due Date <u>10-30-92</u>

Acceptance Criteria:

- Current as 2.3 amps or less.
- Travel Time is 7.0 seconds or less.
- "Hold Point" is generated to verify excell crane is clear of the Downender.
- Video image is displayed from cameras No. 3 and No. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- An unobstructive view is provided of the fuel assembly/excell crane interface to verify disconnect and clearance.

Test Conductor JB Hayes Date 1-15-92
QA JA Yant Date 1-15-92

8.2.10.4 Connect the torque measuring instrument to the Carriage Drive Motor (M-103A). Press "Continue" to drive the Downender to the full down position. Measure drive motor torque and time required to reach the full down position.

Photo taken, Roll #4, frame #6, 1-15-92, 10:45 am
Torque 1.0 ft.-lbs.
Travel Time 3 minutes 20sec.

$$T = \frac{(3151) \text{ HP}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{reas.} = .8$$
$$\text{ap}$$

Type of Measuring Device <u>Power Monitor</u> Range <u>Various</u>
Identification No. <u>s/n 13747</u> Calibration Due Date <u>10-11-92</u>

Acceptance Criteria:

- Torque is 5.1 ft.-lbs. or less
- Travel Time is 4 minutes or less
- Movable frame is in the full down position
- Control system indicates transfer of weight to lower support cradles.

Test Conductor MB Hayes Date 1-15-92
QA JA Yant Date 1-15-92

~~8.2.10.5 Press "Continue" to open clamps. Measure drive motor current and time to open.~~

Current _____ amps
Travel Time _____ seconds

Type of Measuring Device _____ Range _____
Identification No. _____ Calibration Due Date _____

Acceptance Criteria:

- ~~Current is 2.3 amps or less~~
- ~~Travel Time is 7.0 seconds or less~~
- Clamps open

Test Conductor _____ Date _____
QA _____ Date _____

8.2.10.6 Connect the torque measuring instrument to the Bottom Support Drive Motor (M-1038). Press "Continue" to retract the bottom support bucket. Measure drive motor torque.

Torque .25 ft.-lbs.

Type of Measuring Device Power Monitor Range Various
Identification No. sn 13747 Calibration Due Date 10-11-92

Acceptance Criteria:

- Torque is 0.56 ft.-lbs. or less
- Bottom support bucket retracts

Test Conductor MB Hayes Date 1-15-92
QA JA Yant Date 1-15-92

TPC.N
#4

$$P = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{Hp} = .2$$

8.2.10.7 Connect the torque measuring instrument to the Carriage Drive Motor (M-103A). Press "Continue" to drive the Downender to its full up position. Measure drive motor torque and travel time.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{Meas. Hp} = 1.2$$

Torque 1.5 ft.-lbs.
Travel Time 3min21 seconds

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria:

- Torque is 5.1 ft.-lbs. or less
- Travel Time is 4 minutes or less
- Movable frame is in the full up position.

Test Conductor MB Haynes Date 1-15-92

QA QA Yanto Date 1-15-92

8.2.10.8 Disconnect and remove all test instrumentation.

Test Conductor MB Haynes Date 1-15-92

8.2.10.9 Part 8.2.10 is ^{KBH} ~~satisfactorily~~ completed.

Test Conductor MB Haynes Date 1-15-92

QA _____ Date _____

QA sig.
not req.
KBH 1-15-92

8.2.10.7.1 In the Jog mode, remove the B+W 15x15 mock-up fuel assembly from the downender cradle using the RBT and PWR FAHF. Place the mock-up fuel assembly in the storage rack or other suitable location.

Test Conductor MB Haynes Date 1-15-92

PCN
= 5

8.3 System verification for the CE 14 x 14 Fuel Type.

The following series of tests are performed to verify the operation and operating positions of the Bottom Support Assembly, Fuel Assembly Clamp and the movable frame carriage drive subassemblies with the downender programmed for the CE 14 x 14 Fuel Type.

8.3.1 Fuel Assembly Bottom Support

8.3.1.1 Verify the correct elevation of the bottom support bucket in its retracted or "Home" position by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support bucket. Distance should be within the following Acceptance Criteria:

- Required distance is $182.25 \pm .50$ inches.
- .00

Measured Distance 182.25 inches

Test Conductor KB Hargreaves Date 1-15-92

QA JA Hunt Date 1-15-92

8.3.1.2 Raise the bottom support bucket in the HAND mode until it is stopped at the programmed position for the CE 14 x 14 fuel type. Verify the correct elevation as in 8.3.1.1 above. Distance should be within the following Acceptance Criteria:

- Required distance is $177.66 \pm .10$ inches.

Measured distance 177.60 inches

Test Conductor KB Hargreaves Date 1-15-92

QA JA Hunt Date 1-15-92

8.3.1.3 Verify the bottom support drive system operation as follows:

1. Connect the torque measuring instrument leads to the bottom support drive motor (M103B).

JOG KBH 1-14-92

2. In the "Hand" mode, drive the bottom support in the up direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .13 ft-lbs

Travel Time 2 min, 1 seconds

Measured Distance 130.69 inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

Torque is 0.56 ft-lbs or less

Travel time is for information only

RL#3 → Measured Distance is 130 + .00 inches from the top of the
TPCN#7 - .50 movable frame.

Test Conductor MD Hayes Date 1-15-92

QA JA Yano Date 1-15-92

3. Drive the bottom support in the down direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .13 ft-lbs

Travel Time 2 min 14 seconds

Measured Distance 132.44 inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

$$= \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas.} = 0.1$$

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas} = 0.1$$

$$\text{Hp}$$

Acceptance Criteria

- Torque is 0.56 ft-lbs or less.
- Travel time is for information only.
- Measured distance is 182.25 $\pm$.50 inches from the top
-.00 of the movable frame.

Test Conductor MB Hayes Date 1-15-92
QA Ja Yant Date 1-15-92
4. Repeat steps 2 and 3 two additional times.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\begin{aligned} \text{meas.} &= 0.1 \\ \text{Hp} & 0.1 \\ & 0.1 \\ & 0.1 \end{aligned}$$

	Up	Down	
Torque	.13	.13	ft-lbs
Travel Time	2 min. 14 sec.	2 min. 17	seconds
Distance	130.69	182.44	inches
Torque	.13	.13	ft-lbs
Travel Time	2 min. 15 sec.	2 min. 18	seconds
Distance	130.69	182.44	inches

Type of Measuring Device Power Monitor Range Various
Identification No. sn 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Identical to criteria in steps 2 and 3 above.

RL #3
TPCN #7

Test Conductor MB Hayes Date ^{KDH} 1-15-92
QA Ja Yant Date 1-15-92
^{KDH} 1-15-92

8.3.1.4 Part 8.3.1 has been satisfactorily completed.

Test Conductor MB Hayes Date 1-15-92

8.3.2 Fuel Assembly Clamp

- 8.3.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two bottom ledges of the clamp plates.

RL#4

Distance 11.0 inches

Acceptance Criteria

- is ≥ 10.25 inches at the narrowest opening.
• Distance ~~11.60 $\pm$ 0.10 inches~~

TCN 002
KBH 7-30-92

Test Conductor W.B. Harper

Date 1-15-92

QA

QA

Date 1-15-92

- 8.3.2.2 Verify the correct closure of the clamps by driving the subassembly closed in the HAND mode and measuring the distance between the fully closed clamps.

Distance 3.25 inches

Acceptance Criteria

- is ≤ 3.75 inches at the widest opening.
• Distance ~~3.50 $\pm$ 0.10 inches~~

TCN 002
KBH 7-30-92

RL#4

Test Conductor W.B. Harper

Date 1-15-92

QA

QA

Date 1-15-92

- 8.3.2.3 Verify the fuel assembly clamp operations as follows.

1. Connect ammeter leads to the clamp drive motor (M103C) for measuring current.
2. Drive the clamp to the open position in the HAND mode and measure motor current and travel time.

Current 2.08 amps s-up, .11 amps ^{KBH} ~~avg.~~ ~~avg.~~

Travel Time 1.1 seconds

Type of Measuring Device Multimeter Range Various

Identification No. Nus-002 Calibration Due Date 10-30-92

Acceptance Criteria

Current is 2.30 amps or less

Travel Time is 7.0 seconds or less

Test Conductor MB Haynes Date 1-15-92

QA JA Yates Date 1-15-92

3. Drive the clamp to the closed position and measure motor current and travel time.

Current 2.28 amp. S-up, .11 amps ^{KBH} ~~avg.~~

Travel Time 1.0 seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NUS-002</u>	Calibration Due Date	<u>10-30-92</u>

Acceptance Criteria

- Identical to the criteria in step 2 above.

Test Conductor MB Haynes Date 1-15-92

QA JA Yates Date 1-15-92

4. Repeat steps 2 and 3 two additional times.

	Open	Close	
Current	<u>.07</u>	<u>.21</u>	amps avg.
Travel Time	<u>1.06</u>	<u>1.14</u>	seconds
Current	<u>.25</u>	<u>.31</u>	amps avg.
Travel Time	<u>1.06</u>	<u>1.12</u>	seconds

Type of Measuring Device	<u>Multimeter</u>	Range	<u>Various</u>
Identification No.	<u>NUS-002</u>	Calibration Due Date	<u>10-30-92</u>

Test Conductor MB Haynes Date 1-15-92

QA JA Yates Date 1-15-92
_{KBH 1-15-92}

8.3.2.4 Part 8.3.2 has been ~~satisfactorily~~ completed.

Test Conductor MB Haynes Date 1-15-92

QA _____ Date _____

QA sig.
not required
KBH 1-15-92

8.3.3 Movable Frame Carriage Drive

- 8.3.3.1 Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal downender base plate.

Angle 91.0 degrees

Acceptance Criteria

- Angle 90.5 ± 0.5 degrees

Test Conductor MD Hayman

Date 1-15-92

QA JA Yarb

Date 1-15-92

- 8.3.3.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the HAND mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the downender base plate.

On the hard stop ☒ yes ☐ no

Acceptance Criteria

- Yes

Test Conductor MD Hayman

Date 1-15-92

QA JA Yarb

Date 1-15-92

- 8.3.3.3 Verify the carriage drive operation as follows:

1. Connect a torque measuring instrument leads to the carriage drive motor (M103A) for measuring torque.
2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

Torque 1.89 ft-lbs

Travel Time 3 minutes 20 sec.

rpm = 2500

Meas. = 1.5

Hp

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>SN 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

Torque is 5.1 ft-lbs or less

Travel Time is less than 4 minutes

Test Conductor MB Hayes Date 1-15-92

QA JA Galt Date 1-15-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

Torque 1.01 ft-lbs

Travel Time 3 minutes 20 sec

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = 0.8$$

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Same as step 2 above

Test Conductor MB Hayes Date 1-15-92

QA JA Galt Date 1-15-92

4. Repeat steps 2 and 3 two additional times

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = 1.4$$

0.7
1.5
0.8

	Up	Down
Torque	<u>1.76</u>	<u>.88</u> ft-lbs
Travel Time	<u>3 min. 20 sec.</u>	<u>3</u> minutes 19 sec.
Torque	<u>1.89</u>	<u>1.01</u> ft-lbs
Travel Time	<u>3 min 19 sec.</u>	<u>3</u> minutes 19 sec.

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Same as step 2 above

Test Conductor MB Hayes Date 1-15-92

QA JA Galt Date 1-15-92

QA JG Hunt Date 1-15-92

8.3.4.2 Verify the operation of the Fuel Assembly Clamp Drive System (M-103C) Limit Switches as follows:

1. In the JOG Mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA JA Yant Date 1-15-92

8.3.4.3 Verify the operation of the Movable Frame Carriage Drive System (M-103A) Limit Switches (ZE-103A and ZE-103B) as follows:

1. In the JOG Mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103A) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA J. Alfert Date 1-15-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103B) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA J. Alfert Date 1-15-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-15-92

QA J. Alfert Date 1-15-92

8.3.4.4 Part 8.3.4 has been satisfactorily completed.

Test Conductor MB Hayes Date 1-15-92

QA _____ Date _____

QA sig.
not req.
KBH 1-15-92

up ✓
down ✓
up ✓
down ✓

2 of 6

8.3.5 Load Cell Verification Test

8.3.5.1 Verify the correct operation of the Fuel Assembly Cradle Load Cell (WE-103B) as follows:

1. Drive the movable frame to its full up position.
2. Place a 100 to 200 pound weight in the east end support cradle on the downender base frame.

Control system indicates presence of weight yes

Acceptance Criteria:

- Weight is indicated as present

Test Conductor MB Harper Date 1-15-92

QA JA Yates Date 1-15-92

3. Remove the weight from the support cradle.

Control system indicates absence of weight yes

Acceptance Criteria:

- Weight is indicated as absent

Test Conductor MB Harper Date 1-15-92

QA JA Yates Date 1-15-92

4. Repeat steps 2 and 3 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor MB Harper Date 1-15-92

QA JA Yates Date 1-15-92

8.3.5.2 Verify the correct operation of the Fuel Assembly Bottom Support Load Cell (WE-103A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

Control system indicates presence of weight yes

Acceptance Criteria:

- Control system indicates presence of weight

Test Conductor KB Wagner Date 1-15-92

QA J. Affante Date 1-15-92

2. Remove the weight from the bucket.

Control system indicates absence of weight yes

Acceptance Criteria:

- Control system indicates absence of weight

Test Conductor KB Wagner Date 1-15-92

QA J. Affante Date 1-15-92

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Control system indicates presence of weight yes (1)

Control system indicates absence of weight yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor KB Wagner Date 1-15-92

QA J. Affante Date 1-15-92

8.3.5.3 Part 8.3.5 is ^{KBH 1-15-92} satisfactorily completed.

Test Conductor KB Wagner Date 1-15-92

QA _____ Date _____

QA sig. not
required
KBH
1-15-92

8.3.6 Interlock Verification Test

8.3.6.1 Verify the Carriage Drive Motor (M-103A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven up by the Carriage Drive Motor. Mark the appropriate column below.

Device	Condition	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open

Test	A B C D E					Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	✓	—	Yes
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	Yes
xxii	1	1	0	1	0	—	✓	No
xxiii	1	1	0	1	1	✓	✓	Yes

KDH
1-15-82

Test	A B C D E					Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E) \text{ or } (F + G)]$. In this section, F is equivalent to D in the 0 condition and G is equivalent to E in the 0 condition.

Test Conductor JB Harper

Date 1-15-92

QA

JA Hunt

Date 1-15-92

8.3.6.2 Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

NOTE: The devices and condition are identical to those in step 2 of part 8.3.6.1

Test	A B C D E					Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	—	✓	No

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	No
xxii	1	1	0	1	0	✓	—	No
xxiii	1	1	0	1	1	✓	—	Yes
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

yes
Type, see
logic in note
below
KBH 1-15-92

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.5. Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E)]$.

Test Conductor HD Haynes

Date 1-15-92

QA

JA Hart

Date 1-15-92

8.3.6.3 Verify the Bottom Support Drive Motor (M-103B) up interlocks as follows:

1. Place the control system in the HAND mode.

8.3.6.2a Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

See TPC N #6

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open
F Bottom Support Load Cell	Load	No Load

<u>Test</u>	<u>A B C D E F</u>						<u>Motor Operates</u>		<u>Acceptance Criteria</u>
	A	B	C	D	E	F	Yes	No	
i	0	0	0	0	0	1	—	✓	No
ii	1	0	0	0	0	1	—	✓	No
iii	0	1	0	0	0	1	—	✓	No
iv	0	0	1	0	0	1	—	✓	No
v	0	0	0	1	0	1	—	✓	No
vi	0	0	0	0	1	1	—	✓	No
vii	1	1	0	0	0	1	—	✓	No
viii	1	0	1	0	0	1	—	✓	No
ix	1	0	1	0	1	1	—	✓	No
x	1	0	0	1	0	1	—	✓	No
xi	1	0	0	1	1	1	—	✓	No
xii	1	0	0	0	1	1	—	✓	No
xiii	0	1	1	0	1	1	—	✓	No
xiv	0	1	1	0	1	1	—	✓	No
xv	0	1	0	1	0	1	—	✓	No
xvi	0	1	0	1	1	1	—	✓	No
xvii	0	1	0	0	1	1	—	✓	No
xviii	0	0	1	1	0	1	—	✓	No
xix	0	0	1	1	1	1	—	✓	No
xx	0	0	0	1	1	1	—	✓	No
xxi	1	1	1	0	0	1	✓	—	No
xxii	1	1	0	1	0	1	✓	—	No
xxiii	1	1	0	1	1	1	✓	—	Yes
xxiv	1	1	0	0	1	1	—	✓	No
xxv	1	0	1	1	0	1	—	✓	No

Yes Typo, KBH
1-22-92

Test	A B C D E F						Motor Operates		Acceptance Criteria
							Yes	No	
xxvi	1	0	0	1	1	1	—	✓	No
xxvii	0	1	1	1	0	1	—	✓	No
xxviii	0	1	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	1	—	✓	No
xxx	1	1	1	1	0	1	✓	—	Yes
xxxi	1	1	1	0	1	1	✓	—	Yes
xxxii	1	1	1	1	1	1	✓	—	Yes
xxxiii	0	0	0	0	0	0	—	✓	No
xxxiv	1	0	0	0	0	0	—	✓	No
xxxv	0	1	0	0	0	0	—	✓	No
xxxvi	0	0	1	0	0	0	—	✓	No
xxxvii	0	0	0	1	0	0	—	✓	No
xxxviii	0	0	0	0	1	0	—	✓	No
xxxix	1	1	0	0	0	0	—	✓	No
xL	1	0	1	0	0	0	—	✓	No
xLi	1	0	1	0	1	0	—	✓	No
xLii	1	0	0	1	0	0	—	✓	No
xLiii	1	0	0	1	1	0	—	✓	No
xLiv	1	0	0	0	1	0	—	✓	No
xLv	0	1	1	0	1	0	—	✓	No
xLvi	0	1	1	0	1	0	—	✓	No
xLvii	0	1	0	1	0	0	—	✓	No
xLviii	0	1	0	1	1	0	—	✓	No
xLix	0	1	0	0	1	0	—	✓	No
L	0	0	1	1	0	0	—	✓	No
Li	0	0	1	1	1	0	—	✓	No
Lii	0	0	0	1	1	0	—	✓	No
Liii	1	1	1	0	0	0	✓	—	Yes
Liv	1	1	0	1	0	0	—	✓	No
Lv	1	1	0	1	1	0	—	✓	No
Lvi	1	1	0	0	1	0	—	✓	No
Lvii	1	0	1	1	0	0	—	✓	No
Lviii	1	0	0	1	1	0	—	✓	No
Lix	0	1	1	1	0	0	—	✓	No
Lx	0	1	1	1	1	0	—	✓	No
Lxi	0	0	1	1	1	0	—	✓	No
Lxii	1	1	1	1	0	0	—	✓	No
Lxiii	1	1	1	0	1	0	—	✓	No
Lxiv	1	1	1	1	1	0	—	✓	No

Test Conductor W.B. Haynes

Date 1-22-92

QA

Haynes

Date 1-22-92

2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can be driven up by the Drive Motor. Mark the appropriate column below.

	<u>Device</u>			<u>Condition</u>		
	A	B	C	0	1	
A Bottom Support Load Cell				Load	No Load	
B Clamps				Closed	Open	
C Movable Frame				Up	Down	
<u>Test</u>	A	B	C	<u>Motor Operates</u>		<u>Acceptance Criteria</u>
				Yes	No	(See Note)
i	0	0	0		✓	No
ii	1	0	0	✓		Yes
iii	0	1	0		✓	No
iv	0	0	1		✓	No
v	1	1	0	✓		Yes
vi	0	1	1	✓		Yes
vii	1	0	1	✓		Yes
viii	1	1	1	✓		Yes

NOTE

Acceptance Criteria is based on Section 1.4.3 of Reference (1.5. Downender SOTAC. The operating interlock logic is given as A or (B + C)].

Test Conductor MB Hayes Date 1-12-92

QA JA Yurt Date 1-17-92

- 8.3.6.4 Verify the Bottom Support Drive Motor (M-103B) down interlocks as follows:

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can driven down by the Drive Motor. Mark the appropriate column below:

	<u>Device</u>			<u>Condition</u>		
	A	B	C	0	1	
A Bottom Support Load Cell				Load	No Load	
B Clamps				Closed	Open	

<u>Test</u>	<u>A B</u>		<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
			Yes	No	
i	0	0	—	✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.4 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or B.

Test Conductor MB Hayes Date 1-17-92

QA JA Yates Date 1-17-92

8.3.6.5 Verify the Clamp Drive Motor (M-103C) open interlock as follows:

1. Place the control system in the HAND Mode
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the clamps can be driven open by the Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A Bottom Support Load Cell	Load	No Load
B Movable Frame	Up	Down

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.5 of Reference 11.5, Downender SOTAC. The operating interlock logic is A or B.

Test Conductor MB Haynes

Date 1-17-92

QA

JA Yant

Date 1-17-92

8.3.6.6 Part 8.3.6 is ~~satisfactorily~~ completed. ^{KDH 1-17-92}

Test Conductor MB Haynes

Date 1-17-92

8.3.7 SINGLE Mode Verification Test

Place the Downender System in SINGLE mode and verify system automatic sequence. This test verifies operation of the Downender system motions and does not include the use of a mock-up fuel assembly.

8.3.7.1 With the Downender in the full up position and the clamps open, place the Control System in the SINGLE Mode.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number
- Video images from Camera No. 1 and No. 2 displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment ~~Form~~ in Appendix E. ^{Form 1-17-92 KDH}
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the Downender movable frame.

Test Conductor MB Haynes

Date 1-17-92

QA

JA Yant

Date 1-17-92

RL#8

- 8.3.7.2 Verify that the bottom support has assumed the programmed position for the CE 14x14 fuel type by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support.

Measured distance 177.63 inches

Acceptance Criteria

- Distance is $177.66 \pm .10$ inches

Test Conductor ND Hayes

Date 1-17-92

QA

JA Gunt

Date 1-17-92

- 8.3.7.3 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the downender bottom support through temporary changes to the Data Register.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify fuel assembly is properly seated.
- Video images from Camera No. 3 and No. 10 are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment ~~Form~~ in Appendix E.
Form KDH 1-17-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor ND Hayes

Date 1-17-92

QA

JA Gunt

Date 1-17-92

- 8.3.7.4 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the Downender
- Video images from Cameras No. 3 and No. 10 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the downender movable frame and excell crane interface.

Test Conductor ND Hayes

Date 1-17-92

QA

JA Gunt

Date 1-17-92

- 8.3.7.5 Press "Continue" to downend the movable frame to the horizontal position.

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle through temporary changes to the support cradle load cell software.

Acceptance Criteria

- The movable frame is downended to the horizontal position.

Test Conductor W B Hayes Date 1-17-92

QA J A Yant Date 1-17-92

RL #11
TPCN #3
KBH
1-17-92

- 8.3.7.6 Press "Continue" to open the clamps Verify clamps open automatically.

Acceptance Criteria

- Clamps open

Test Conductor W B Hayes Date 1-17-92

QA J A Yant Date 1-17-92

- 8.3.7.7 Press "Continue" to retract the bottom support bucket to its most westward or "Home" position.

Acceptance Criteria

- Bottom support bucket moves to its "Home" position.

Test Conductor W B Hayes Date 1-17-92

QA J A Yant Date 1-17-92

- 8.3.7.8 Press "Continue" to raise the movable frame to its up position

Acceptance Criteria

- Movable frame travels to its up position.
- Control system generates a signal to release the RBT.
- RBT with FAHF attached can be positioned to interface with downender lower cradles for fuel removal.

Test Conductor W B Hayes Date 1-17-92

QA J A Yant Date 1-17-92

- 8.3.7.9 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor W.D. Hayden Date 1-17-92

QA J.A. Hunt Date 1-17-92

KDH 1-17-92

- 8.3.7.10 Part 8.3.7 is satisfactorily completed.

Test Conductor W.D. Hayden Date 1-17-92

8.3.8 AUTO Mode Verification Test

Place the Downender in AUTO mode and verify system automatic sequence. This test verifies operation of the Downender motions and does not include the use of a mock-up fuel assembly.

- 8.3.8.1 With the Downender in the full up position and the clamps open, place the Downender in AUTO mode control.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.

Test Conductor W.D. Hayden Date 1-17-92

QA J.A. Hunt Date 1-17-92

- 8.3.8.2 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the bottom support through temporary changes to the bottom support load cell software. Press "Continue".

Acceptance Criteria

- "Hold Point" is generated to verify fuel assembly is properly seated.

Test Conductor W.D. Hayden Date 1-17-92

QA J.A. Hunt Date 1-17-92

- 8.3.8.3 Press "Continue" to close the clamps.

Acceptance Criteria

- Clamps close
- "Hold Point" is generated to verify excell crane is clear of the Downender.

Test Conductor W.D. Hayden Date 1-17-92

QA J.A. Hunt Date 1-17-92

8.3.8.4 Press "Continue" to complete the automatic sequence.

Acceptance Criteria

- Movable frame is downended to the horizontal or down position

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

- Clamps open
- Bottom support retracts to westward most position
- Movable frame is driven to full up position
- Control system generates a signal to release the RBT

Test Conductor KB Hayes Date 1-17-92

QA JA Yano Date 1-17-92

8.3.8.5 Return the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor KB Hayes Date 1-17-92

QA JA Yano Date 1-17-92

8.3.8.6 Part 8.3.8 is ^{KBH 1-17-92} satisfactorily completed.

8.3.9 Test Conductor KB Hayes Date 1-17-92
Servo Drive Fault Test

WARNING

Stay clear of the Downender system while in operation

8.3.9.1 Place the Downender system in the "SINGLE" mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-103A)

- 8.3.9.2 Temporarily force the Data Register to indicate a torque fault with the Carriage Drive Motor (M-103A).

Acceptance Criteria:

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor MB Hayes Date 1-17-92

QA JA Yount Date 1-17-92

- 8.3.9.3 Verify cameras No. 3 and No. 10 are activated and view the movable frame system when the "CAMERA CALL" button is touched

Acceptance Criteria:

- Video images from cameras No. 3 and NO. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Camera No. 3 and No. 10 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor MB Hayes Date 1-17-92

QA JA Yount Date 1-17-92

- 8.3.9.4 Correct fault condition and verify the Carriage Drive Motor (M-103A) can be moved in the "SINGLE" mode.

Acceptance Criteria:

- The system can be recovered from fault condition and "SINGLE" mode operations continued.

Test Conductor MB Hayes Date 1-17-92

QA JA Yount Date 1-17-92

- 8.3.9.5 Part 8.3.9 is ^{KBH 1-17-92} satisfactorily completed.

Test Conductor MB Hayes Date 1-17-92

8.4 System verification for the W 15 x 15 Std. Fuel Type.

The following series of tests are performed to verify the operation and operating positions of the Bottom Support* Assembly, Fuel Assembly Clamp and the movable frame carriage drive subassemblies with the downender programmed for the W 15 x 15 Fuel Type.

8.4.1 Fuel Assembly Bottom Support

- 8.4.1.1** Verify the correct elevation of the bottom support bucket in its retracted or "Home" position by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support bucket. Distance should be within the following Acceptance Criteria:

- Required distance is $182.25 \pm \begin{matrix} .50 \\ -.00 \end{matrix}$ inches.

Measured Distance 182.25 inches

Test Conductor HD Hayden Date 1-17-92

QA JA Gant Date 1-17-92

- 8.4.1.2** Raise the bottom support bucket in the HAND mode until it is stopped at the programmed position for the W 15 x 15 fuel type. Verify the correct elevation as in 8.4.1.1 above. Distance should be within the following Acceptance Criteria:

- Required distance is $156.09 \pm .10$ inches.

Measured distance 156.00 inches

Test Conductor HD Hayden Date 1-17-92

QA JA Gant Date 1-17-92

- 8.4.1.3** Verify the bottom support drive system operation as follows:

1. Connect the torque measuring instrument leads to the bottom support drive motor (M1038).

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = 0.1$$

use .1

- Jog KDH 1-14-92
2. In the "Hand" mode, drive the bottom support in the up direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .13 ft-lbs

Travel Time 1 min. 09 seconds

Measured Distance 130.62 inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>S/N 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

Torque is 0.56 ft-lbs or less

Travel time is for information only

RL#3 → Measured Distance is 130 + .00 inches from the top of the
TPCN#7 - .50 movable frame.

Test Conductor JB Harper Date 1-17-92

QA J. Lyons Date 1-17-92

3. Drive the bottom support in the down direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = .1$$

Torque .13 ft-lbs

Travel Time 2 min. 14 seconds

Measured Distance 182.225 inches

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>S/N 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Torque is 0.56 ft-lbs or less.
- Travel time is for information only.
- Measured distance is 182.25 ^{+0.50} inches from the top
-0.00 of the movable frame.

Test Conductor HB Haynes Date 1-17-92

QA JA Yant Date 1-12-92

4. Repeat steps 2 and 3 two additional times.

$$T = \frac{(3151) Hp}{rpm}$$

rpm = 2500

meas.
Hp = .1
 .1
 .2
 .1

	<u>Up</u>	<u>Down</u>	
Torque	<u>.13</u>	<u>.13</u>	ft-lbs
Travel Time	<u>2 min 14 sec.</u>	<u>2 min 14</u>	seconds
Distance	<u>130.63</u>	<u>182.38</u>	inches
Torque	<u>2 min 13 sec.</u>	<u>.13</u>	ft-lbs
Travel Time	<u>.25 ft-lb.</u>	<u>2 min 14</u>	seconds
Distance	<u>130.63</u>	<u>182.38</u>	inches

Type of Measuring Device Power Monitor Range Various
Identification No. sn 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Identical to criteria in steps 2 and 3 above.

RL# 3
TPCN# 7 Test Conductor HB Haynes Date 1-17-92

QA JA Yant Date 1-17-92
KBH 1-17-92

8.4.1.4 Part 8.4.1 has been satisfactorily completed.

Test Conductor HB Haynes Date 1-17-92

8.4.2 Fuel Assembly Clamp

- 8.4.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two bottom ledges of the clamp plates.

Distance 12.25 inches ^{12.34}

Acceptance Criteria

is ≥ 10.25 inches at the narrowest opening.

TCN 002
KBH 7-30-92

RL#4

- Distance ~~11.60 $\pm$ 0.10~~ inches

Test Conductor HB Hager

Date 1-17-92

QA

JA Yant

Date 1-17-92

- 8.4.2.2 Verify the correct closure of the clamps by driving the subassembly closed in the HAND mode and measuring the distance between the fully closed clamps.

Distance 3.63 inches

Acceptance Criteria

is ≤ 3.75 inches at the widest opening.

TCN 002
KBH 7-30-92

RL#4

- Distance ~~3.50 $\pm$ 0.10~~ inches

Test Conductor HB Hager

Date 1-17-92

QA

JA Yant

Date 1-17-92

- 8.4.2.3 Verify the fuel assembly clamp operations as follows.

1. Connect ammeter leads to the clamp drive motor (M103C) for measuring current.
2. Drive the clamp to the open position in the HAND mode and measure motor current and travel time.

Current 0.2 amps avg.

Travel Time 1.2 seconds

Type of Measuring Device Multimeter Range Various

Identification No. NUS-002 Calibration Due Date 10-30-92

TEST PROCEDURE 9315-TP-203

8.4.3 Movable Frame Carriage Drive

- 8.4.3.1 Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal downender base plate.

Angle 90.0 degrees

Acceptance Criteria

- Angle 90.5 ± 0.5 degrees

Test Conductor MB Hargreaves

Date 1-17-92

QA

JA Yant

Date 1-17-92

- 8.4.3.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the HAND mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the downender base plate.

On the hard stop ☒ yes ☐ no

Acceptance Criteria

- Yes

Test Conductor MB Hargreaves

Date 1-17-92

QA

JA Yant

Date 1-17-92

- 8.4.3.3 Verify the carriage drive operation as follows:

1. Connect a torque measuring instrument leads to the carriage drive motor (M103A) for measuring torque.
2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = 1.7$$

Torque 2.14 ft-lbs

Travel Time 3 minutes 20 sec.

Type of Measuring Device Power Monitor Range Various

Identification No. syn 13747 Calibration Due Date 10-11-92

Acceptance Criteria

Torque is 5.1 ft-lbs or less

Travel Time is less than 4 minutes

Test Conductor HB Hayes Date 1-17-92

QA JA Yates Date 1-17-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

Torque .76 ft-lbs

Travel Time 3 minutes 19 sec.

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

rpm = 2500
meas. = 0.6
Hp

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Same as step 2 above

Test Conductor HB Hayes Date 1-17-92

QA JA Yates Date 1-17-92

4. Repeat steps 2 and 3 two additional times

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

rpm = 2500
meas. = 1.6
Hp = 0.6
1.5
0.6

	Up	Down
Torque	<u>2.02</u>	<u>.76</u> ft.-lbs
Travel Time	<u>3 min. 21 sec.</u>	<u>3</u> minutes 20 sec.
Torque	<u>1.89</u>	<u>.76</u> ft.-lbs
Travel Time	<u>3 min. 20 sec.</u>	<u>3</u> minutes 20 sec.

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>s/n 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

- Same as step 2 above

Test Conductor HB Hayes Date 1-17-92

QA JA Yates Date 1-17-92

8.4.3.4 Part 8.4.3 has been ^{KBH 1-17-92} ~~satisfactorily~~ completed.

Test Conductor MB Hayes Date 1-17-92

QA _____ Date _____

QA sig.
not req.
KBH
1-17-92

8.4.4 Limit Switch Verification Test

8.4.4.1 Verify the operation of Fuel Assembly Bottom Support Drive System (M-103B) Limit Switches (ZE-103C and ZE-103D) as follows:

1. In the JOG Mode, drive the bottom support in the up direction of travel until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103C) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-17-92

QA JAY Date 1-17-92

2. Drive the bottom support in the down direction of travel until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103D) has been activated.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-17-92

QA JAY Date 1-17-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Hayes Date 1-17-92

QA JAY Date 1-17-92

up ✓
down ✓
up ✓
down ✓

8.4.4.2 Verify the operation of the Fuel Assembly Clamp Drive System (M-103C) Limit Switches as follows:

1. In the JOG Mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Haynes Date 1-17-92
QA JA Yano Date 1-17-92

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor MB Haynes Date 1-17-92
QA JA Yano Date 1-17-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor MB Haynes Date 1-17-92
QA JA Yano Date 1-17-92

open-
closed-
open-
closed-

8.4.4.3 Verify the operation of the Movable Frame Carriage Drive System (M-103A) Limit Switches (ZE-103A and ZE-103B) as follows:

1. In the JOG Mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103A) has been activated.
- Hard stops were not engaged.

Test Conductor KB Hargreaves Date 1-17-92

QA JA Yant Date 1-17-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103B) has been activated.
- Hard stops were not engaged.

Test Conductor KB Hargreaves Date 1-17-92

QA JA Yant Date 1-17-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor KB Hargreaves Date 1-17-92

QA JA Yant Date 1-17-92

8.4.4.4 Part 8.4.4 has been satisfactorily completed.

Test Conductor KB Hargreaves Date 1-17-92

QA _____ Date _____

QA sig.
not req.
KBH
1-17-92

8.4.5 Load Cell Verification Test

8.4.5.1 Verify the correct operation of the Fuel Assembly Cradle Load Cell (WE-1038) as follows:

1. Drive the movable frame to its full up position.
2. Place a 100 to 200 pound weight in the east end support cradle on the downender base frame.

Control system indicates presence of weight YIP Yes

Acceptance Criteria:

- Weight is indicated as present

Test Conductor George Cole

Date 1-17-92

QA J. A. Yant

Date 1-17-92

3. Remove the weight from the support cradle.

Control system indicates absence of weight YIP Yes

Acceptance Criteria:

- Weight is indicated as absent

Test Conductor George Cole

Date 1-17-92

QA J. A. Yant

Date 1-17-92

4. Repeat steps 2 and 3 two additional times.

Control system indicates presence of weight YES (1)

Control system indicates absence of weight YES (2)

Control system indicates presence of weight YES (1)

Control system indicates absence of weight YES (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor George Cole

Date 1-17-92

QA J. A. Yant

Date 1-17-92

8.4.5.2 Verify the correct operation of the Fuel Assembly Bottom Support Load Cell (WE-103A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

Control system indicates presence of weight Yes

Acceptance Criteria:

- Control system indicates presence of weight

Test Conductor

Date

QA

Date

2. Remove the weight from the bucket.

Control system indicates absence of weight Yes

Acceptance Criteria:

- Control system indicates absence of weight

Test Conductor

Date

QA

Date

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present

- (2) Weight is indicated as absent

Test Conductor

Date

QA

Date

8.4.5.3 Part 8.4.5 is satisfactorily completed. ^{KDH 1-17-92}

Test Conductor

Date

QA

Date

QA sig.
not required.
KDH
1-17-92

8.4.6 Interlock Verification Test

8.4.6.1 Verify the Carriage Drive Motor (M-103A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven up by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open

<u>Test</u>	<u>A B C D E</u>					<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
						Yes	No	
i	0	0	0	0	0	—	—	No
ii	1	0	0	0	0	—	—	No
iii	0	1	0	0	0	—	—	No
iv	0	0	1	0	0	—	—	No
v	0	0	0	1	0	—	—	No
vi	0	0	0	0	1	—	—	No
vii	1	1	0	0	0	—	—	Yes
viii	1	0	1	0	0	—	—	No
ix	1	0	1	0	1	—	—	No
x	1	0	0	1	0	—	—	No
xi	1	0	0	1	1	—	—	No
xii	1	0	0	0	1	—	—	No
xiii	0	1	1	0	1	—	—	No
xiv	0	1	1	0	1	—	—	No
xv	0	1	0	1	0	—	—	No
xvi	0	1	0	1	1	—	—	No
xvii	0	1	0	0	1	—	—	No
xviii	0	0	1	1	0	—	—	No
xix	0	0	1	1	1	—	—	No
xx	0	0	0	1	1	—	—	No
xxi	1	1	1	0	0	—	—	Yes
xxii	1	1	0	1	0	—	—	No
xxiii	1	1	0	1	1	—	—	Yes

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E) \text{ or } (F + G)]$. In this section, F is equivalent to D in the 0 condition and G is equivalent to E in the 0 condition.

Test Conductor

John J. Cole

Date

1-17-92

QA

Jay

Date

1-17-92

8.4.6.2 Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

NOTE: The devices and condition are identical to those in step 2 of part 8.4.6.1

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	—	✓	No

Test	A B C D E					Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	No yes
xxii	1	1	0	1	0	✓	—	No
xxiii	1	1	0	1	1	✓	—	Yes
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E)]$.

Test Conductor

Gordon Cole

Date 1-17-92

QA

J. A. Gant

Date 1-17-92

8.4.6.3 Verify the Bottom Support Drive Motor (M-1038) up interlocks is follows:

1. Place the control system in the HAND mode.

8.4.6.2a Verify the Carriage Drive Motor (M-103A) down interlocks as follows

See TPCN #6

NOTE: Movable frame must be in the up position.

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open
F Bottom Support Load Cell	Load	No Load

<u>Test</u>	<u>A B C D E F</u>						<u>Motor Operates</u>		<u>Acceptance Criteria</u>
	A	B	C	D	E	F	Yes	No	
i	0	0	0	0	0	1	—	✓	No
ii	1	0	0	0	0	1	—	✓	No
iii	0	1	0	0	0	1	—	✓	No
iv	0	0	1	0	0	1	—	✓	No
v	0	0	0	1	0	1	—	✓	No
vi	0	0	0	0	1	1	—	✓	No
vii	1	1	0	0	0	1	—	✓	No
viii	1	0	1	0	0	1	—	✓	No
ix	1	0	1	0	1	1	—	✓	No
x	1	0	0	1	0	1	—	✓	No
xi	1	0	0	1	1	1	—	✓	No
xii	1	0	0	0	1	1	—	✓	No
xiii	0	1	1	0	1	1	—	✓	No
xiv	0	1	1	0	1	1	—	✓	No
xv	0	1	0	1	0	1	—	✓	No
xvi	0	1	0	1	1	1	—	✓	No
xvii	0	1	0	0	1	1	—	✓	No
xviii	0	0	1	1	0	1	—	✓	No
xix	0	0	1	1	1	1	—	✓	No
xx	0	0	0	1	1	1	—	✓	No
xxi	1	1	1	0	0	1	✓	—	No
xxii	1	1	0	1	0	1	✓	—	No
xxiii	1	1	0	1	1	1	✓	—	Yes
xxiv	1	1	0	0	1	1	—	✓	No
xxv	1	0	1	1	0	1	—	✓	No

yes typ, KBH
1-21-92

Test	A	B	C	D	E	F	Motor Operates		Acceptance Criteria
							Yes	No	
xxv1	1	0	0	1	1	1	—	✓	No
xxv1f	0	1	1	1	0	1	—	✓	No
xxv1ff	0	1	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	1	—	✓	No
xxx	1	1	1	1	0	1	✓	—	Yes
xxx1	1	1	1	0	1	1	✓	—	Yes
xxx1f	1	1	1	1	1	1	✓	—	Yes
xxx1ff	0	0	0	0	0	0	—	✓	No
xxxiv	1	0	0	0	0	0	—	✓	No
xxxv	0	1	0	0	0	0	—	✓	No
xxxvi	0	0	1	0	0	0	—	✓	No
xxxvii	0	0	0	1	0	0	—	✓	No
xxxviii	0	0	0	0	1	0	—	✓	No
xxxix	1	1	0	0	0	0	—	✓	No
xL	1	0	1	0	0	0	—	✓	No
xLi	1	0	1	0	1	0	—	✓	No
xLii	1	0	0	1	0	0	—	✓	No
xLiii	1	0	0	1	1	0	—	✓	No
xLiv	1	0	0	0	1	0	—	✓	No
xLv	0	1	1	0	1	0	—	✓	No
xLvi	0	1	1	0	1	0	—	✓	No
xLvii	0	1	0	1	0	0	—	✓	No
xLviii	0	1	0	1	1	0	—	✓	No
xLix	0	1	0	0	1	0	—	✓	No
L	0	0	1	1	0	0	—	✓	No
Li	0	0	1	1	1	0	—	✓	No
Lii	0	0	0	1	1	0	—	✓	No
Liii	1	1	1	0	0	0	✓	—	Yes
Liv	1	1	0	1	0	0	—	✓	No
Lv	1	1	0	1	1	0	—	✓	No
Lvi	1	1	0	0	1	0	—	✓	No
Lvii	1	0	1	1	0	0	—	✓	No
Lviii	1	0	0	1	1	0	—	✓	No
Lix	0	1	1	1	0	0	—	✓	No
Lx	0	1	1	1	1	0	—	✓	No
Lxi	0	0	1	1	1	0	—	✓	No
Lxii	1	1	1	1	0	0	—	✓	No
Lxiii	1	1	1	0	1	0	—	✓	No
Lxiv	1	1	1	1	1	0	—	✓	No

Test Conductor MB Hagner

Date 1-21-92

QA

J. Clark

Date 1-21-92

TEST PROCEDURE 9315-TP-203

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.4 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or B.

Test Conductor *Lordaf. Cole* Date *1-17-92*
QA *J. A. Yates* Date *1-17-92*

8.4.6.5 Verify the Clamp Drive Motor (M-103C) open interlock as follows:

1. Place the control system in the HAND Mode
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the clamps can be driven open by the Drive Motor. Mark the appropriate column below.

Device	Condition	
	0	1
A Bottom Support Load Cell	Load	No Load
B Movable Frame	Up	Down

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0	—	✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.5 of Reference 11.5, Downender SOTAC. The operating interlock logic is A or B.

Test Conductor Jordan Cole

Date 1-17-92

QA

J. A. Young

Date 1-17-92

8.4.6.6 Part 8.4.6 is ^{KDH 1-17-92} satisfactorily completed.

Test Conductor Jordan Cole

Date 1-17-92

8.4.7 SINGLE Mode Verification Test

Place the Downender System in SINGLE mode and verify system automatic sequence. This test verifies operation of the Downender system motions and does not include the use of a mock-up fuel assembly.

8.4.7.1 With the Downender in the full up position and the clamps open, place the Control System in the SINGLE Mode.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.
- Video images from Camera No. 1 and No. 2 displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
Form KDH 1-17-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the Downender movable frame.

Test Conductor Jordan Cole

Date 1-17-92

QA

J. A. Young

Date 1-17-92

RL#8

- 8.4.7.2 Verify that the bottom support has assumed the programmed position for the W 15x15 fuel type by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support.

Measured distance 156 inches

Acceptance Criteria

- Distance is 156.09 ± .10 inches.

Test Conductor Gordon, Cole

Date 1-17-92

QA J. Alfano

Date 1-17-92

- 8.4.7.3 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the downender bottom support through temporary changes to the Data Register.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify fuel assembly is properly seated.
- Video images from Camera No. 3 and No. 10 are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
Form KBH 1-17-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor Gordon, Cole

Date 1-17-92

QA J. Alfano

Date 1-17-92

- 8.4.7.4 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the Downender
- Video images from Cameras No. 3 and No. 10 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the downender movable frame and excell crane interface.

Test Conductor Gordon, Cole

Date 1-17-92

QA J. Alfano

Date 1-17-92

8.4.7.5 Press "Continue" to downend the movable frame to the horizontal position.

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle through temporary changes to the support cradle load cell software.

Acceptance Criteria

- The movable frame is downended to the horizontal position.

Test Conductor *Gordy Cole* Date *1-17-92*
QA *J. A. Young* Date *1-17-92*

8.4.7.6 ~~Press "Continue" to open the clamps~~ Verify clamps open automatically.

Acceptance Criteria

- Clamps open

Test Conductor *Gordy Cole* Date *1-17-92*
QA *J. A. Young* Date *1-17-92*

8.4.7.7 Press "Continue" to retract the bottom support bucket to its most westward or "Home" position.

Acceptance Criteria

- Bottom support bucket moves to its "Home" position.

Test Conductor *Gordy Cole* Date *1-17-92*
QA *J. A. Young* Date *1-17-92*

8.4.7.8 Press "Continue" to raise the movable frame to its up position.

Acceptance Criteria

- Movable frame travels to its up position.
- Control system generates a signal to release the RBT.
- RBT with FAHF attached can be positioned to interface with downender lower cradles for fuel removal.

Test Conductor *Gordy Cole* Date *1-17-92*
QA *J. A. Young* Date *1-17-92*

#11
CN #3
H
7-92

- 8.4.7.9 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor *Joseph Cole* Date *1-17-92*

QA *J. A. Yant* Date *1-17-92*

- 8.4.7.10 Part 8.4.7 is ^{KDH 1-17-92} satisfactorily completed.

Test Conductor *Joseph Cole* Date *1-17-92*

8.4.8 AUTO Mode Verification Test

Place the Downender in AUTO mode and verify system automatic sequence. This test verifies operation of the Downender motions and does not include the use of a mock-up fuel assembly.

- 8.4.8.1 With the Downender in the full up position and the clamps open, place the Downender in AUTO mode control.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.

Test Conductor *Joseph Cole* Date *1-17-92*

QA *J. A. Yant* Date *1-17-92*

- 8.4.8.2 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the bottom support through temporary changes to the bottom support load cell software. Press "Continue".

Acceptance Criteria

- "Hold Point" is generated to verify fuel assembly is properly seated.

Test Conductor *Joseph Cole* Date *1-17-92*

QA *J. A. Yant* Date *1-17-92*

- 8.4.8.3 Press "Continue" to close the clamps.

Acceptance Criteria

- Clamps close
- "Hold Point" is generated to verify excell crane is clear of the Downender.

Test Conductor *Joseph Cole* Date *1-17-92*

QA *J. A. Yant* Date *1-17-92*

8.4.8.4 Press "Continue" to complete the automatic sequence.

Acceptance Criteria

- Movable frame is downended to the horizontal or down position

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

- Clamps open
- Bottom support retracts to westward most position
- Movable frame is driven to full up position
- Control system generates a signal to release the RBT

Test Conductor Gordian Cole Date 1-17-92

QA J. A. Yant Date 1-17-92

8.4.8.5 Return the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor Gordian Cole Date 1-17-92

QA J. A. Yant Date 1-17-92

8.4.8.6 Part 8.4.8 is satisfactorily completed.

Test Conductor Gordian Cole Date 1-17-92

8.4.9 Servo Drive Fault Test

WARNING

Stay clear of the Downender system while in operation

8.4.9.1 Place the Downender system in the "SINGLE" mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-103A)

- 8.4.9.2 Temporarily force the Data Register to indicate a torque fault with the Carriage Drive Motor (M-103A).

Acceptance Criteria:

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor

Date

QA

Date

- 8.4.9.3 Verify cameras No. 3 and No. 10 are activated and view the movable frame system when the "CAMERA CALL" button is touched

Acceptance Criteria:

- Video images from cameras No. 3 and NO. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Camera No. 3 and No. 10 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor

Date

QA

Date

- 8.4.9.4 Correct fault condition and verify the Carriage Drive Motor (M-103A) can be moved in the "SINGLE" mode.

Acceptance Criteria:

- The system can be recovered from fault condition and "SINGLE" mode operations continued.

Test Conductor

Date

QA

Date

- 8.4.9.5 Part 8.4.3 is satisfactorily completed.

Test Conductor

Date

- Jdg KDH 1-17-92
2. In the "Hand" mode, drive the bottom support in the up direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .252 ft-lbs

Travel Time 67.17 seconds

Measured Distance 130.625 inches

Type of Measuring Device	Power monitor	Range	Various
Identification No.	s/n 13747	Calibration Due Date	10-11-92

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = .2$$

Acceptance Criteria

Torque is 0.56 ft-lbs or less

Travel time is for information only

RL# 3 Measured Distance is 130 + .00 inches from the top of the movable frame.

Test Conductor Michael Col

Date 1-18-92

QA J. J. Jones

Date 1-18-92

3. Drive the bottom support in the down direction and measure motor operating torque, total travel time and bucket distance from the top of the movable frame.

Torque .126 ft-lbs

Travel Time 134.97 seconds

Measured Distance 182.4 inches

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas. Hp} = .1$$

Type of Measuring Device	Power Monitor	Range	Various
Identification No.	s/n 13747	Calibration Due Date	10-11-92

Acceptance Criteria

- Torque is 0.56 ft-lbs or less.
- Travel time is for information only.
- Measured distance is 182.25 $\pm$.50 inches from the top of the movable frame.

Test Conductor

Gordie Cole

Date

1-18-92

QA

J. A. Hunt

Date

1-18-92

4. Repeat steps 2 and 3 two additional times.

$$T = \frac{(351) \text{ HP}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

meas.

$$\text{HP} = \begin{matrix} .2 \\ .1 \\ .2 \\ .1 \end{matrix}$$

	Up	Down	
Torque	<u>.252</u>	<u>.126</u>	ft-lbs
Travel Time	<u>2min 15sec</u>	<u>2min 20sec</u>	seconds
Distance	<u>130.625</u>	<u>182.375</u>	inches
Torque	<u>.252</u>	<u>.126</u>	ft-lbs
Travel Time	<u>2min 14sec</u>	<u>2min 15sec</u>	seconds
Distance	<u>130.625</u>	<u>182.4</u>	inches

Type of Measuring Device Power Monitor Range Various

Identification No. s/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Identical to criteria in steps 2 and 3 above.

RL#3
TPCN#7

Test Conductor

Gordie Cole

Date

1-18-92

QA

J. A. Hunt
LDH 1-17-92

Date

1-18-92

8.5.1.4 Part 8.5.1 has been satisfactorily completed.

Test Conductor

Gordie Cole

Date

1-18-92

8.5.2 Fuel Assembly Clamp

- 8.5.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two bottom ledges of the clamp plates.

Distance 12.06 inches

RL #4

Acceptance Criteria

- is ≥ 10.25 inches at the narrowest opening.
• Distance ~~11.60 $\pm$ 0.10~~ inches

TCN 002
KBH 7-30-92

Test Conductor [Signature]

Date 1-15-92

QA [Signature]

Date 1-18-92

- 8.5.2.2 Verify the correct closure of the clamps by driving the subassembly closed in the HAND mode and measuring the distance between the fully closed clamps.

Distance 3.4 inches

Acceptance Criteria

- is ≤ 3.75 inches at the widest opening.
• Distance ~~3.50 $\pm$ 0.10~~ inches

TCN 002
KBH 7-30-92

RL #4

Test Conductor [Signature]

Date 1-18-92

QA [Signature]

Date 1-18-92

- 8.5.2.3 Verify the fuel assembly clamp operations as follows.

1. Connect ammeter leads to the clamp drive motor (M103C) for measuring current.
2. Drive the clamp to the open position in the HAND mode and measure motor current and travel time.

Current 1.6 amps

Travel Time 1.4 seconds

Type of Measuring Device Multimeter Range Various

Identification No. NUS-002 Calibration Due Date 10-30-92

Acceptance Criteria

Current is 2.30 amps or less

Travel Time is 7.0 seconds or less

Test Conductor Gordana J. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

3. Drive the clamp to the closed position and measure motor current and travel time.

Current 1.5 amps

Travel Time 1.5 seconds

Type of Measuring Device Multimeter Range Various
Identification No. NUS-002 Calibration Due Date 10-30-92

Acceptance Criteria

- Identical to the criteria in step 2 above.

Test Conductor Gordana J. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

4. Repeat steps 2 and 3 two additional times.

	Open	Close	
Current	<u>1.44</u>	<u>1.6</u>	amps
Travel Time	<u>1.6</u>	<u>1.6</u>	seconds

Current	<u>1.56</u>	<u>1.47</u>	amps
Travel Time	<u>1.4</u>	<u>1.5</u>	seconds

Type of Measuring Device Multimeter Range Various
Identification No. NUS-002 Calibration Due Date 10-30-92

Test Conductor Gordana J. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

8.5.2.4 Part 8.5.2 has been satisfactorily completed.

Test Conductor Gordana J. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

QA sig.
not Rec.
1-17-92

8.5.3 Movable Frame Carriage Drive

- 8.5.3.1** Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal downender base plate.

Angle 91 degrees

Acceptance Criteria

- Angle 90.5 ± 0.5 degrees

Test Conductor Gordy Cole

Date 1-16-92

QA J. G. G.

Date 1-18-92

- 8.5.3.2** Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the HAND mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the downender base plate.

On the hard stop ☒ yes ☐ no

Acceptance Criteria

- Yes

Test Conductor Gordy Cole

Date 1-18-92

QA J. G. G.

Date 1-18-92

- 8.5.3.3** Verify the carriage drive operation as follows:

1. Connect a torque measuring instrument leads to the carriage drive motor (M103A) for measuring torque.
2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time.

Torque 1.89 ft-lbs

Travel Time 3min 22sec minutes

$$T = \frac{(3151) \text{ Hp}}{\text{rpm}}$$

$$\text{rpm} = 2500$$

$$\text{meas Hp} = 1.5$$

Type of Measuring Device	<u>Power Monitor</u>	Range	<u>Various</u>
Identification No.	<u>SN 13747</u>	Calibration Due Date	<u>10-11-92</u>

Acceptance Criteria

Torque is 5.1 ft-lbs or less

Travel Time is less than 4 minutes

Test Conductor Jordan Cole Date 1-18-92

QA J. A. Jones Date 1-18-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

Torque 1.01 ft-lbs

Travel Time 3min 20sec minutes

$$T = \frac{(3151) HP}{rpm}$$

$$rpm = 2500$$

$$meas. HP = .8$$

Type of Measuring Device Power monitor Range Various
Identification No. s/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Same as step 2 above

Test Conductor Jordan Cole Date 1-18-92

QA J. A. Jones Date 1-18-92

4. Repeat steps 2 and 3 two additional times

$$T = \frac{(3151) HP}{rpm}$$

$$rpm = 2500$$

$$meas. HP = 1.8$$

$$.8$$

$$1.8$$

$$.7$$

	Up	Down	
Torque	<u>2.27</u>	<u>1.01</u>	ft-lbs
Travel Time	<u>3min 21sec</u>	<u>3min 21sec</u>	minutes
Torque	<u>2.27</u>	<u>.88</u>	ft-lbs
Travel Time	<u>3min 21sec</u>	<u>3min 20sec</u>	minutes

Type of Measuring Device Power monitor Range Various
Identification No. s/n 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Same as step 2 above

Test Conductor Jordan Cole Date 1-18-92

QA J. A. Jones Date 1-18-92

8.5.3.4 Part 8.5.3 has been ^{KBH 1-17-92} satisfactorily completed.

Test Conductor Gordy Cole Date 1-18-92

QA _____ Date _____

QASy.
not
seq.

8.5.4 Limit Switch Verification Test

8.5.4.1 Verify the operation of Fuel Assembly Bottom Support Drive System (M-103B) Limit Switches (ZE-103C and 103D) as follows:

KBH
1-17-92

1. In the JOG Mode, drive the bottom support in the up direction of travel until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103C) has been activated.
- Hard stops were not engaged.

Test Conductor Gordy Cole Date 1-18-92

QA J. Yates Date 1-18-92

2. Drive the bottom support in the down direction of travel until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103D) has been activated.
- Hard stops were not engaged.

Test Conductor Gordy Cole Date 1-18-92

QA J. Yates Date 1-18-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor Gordy Cole Date 1-18-92

QA J. Yates Date 1-18-92

AP
1-18-92
UP ✓
DN ✓
UP ✓
DN ✓

8.5.4.2 Verify the operation of the Fuel Assembly Clamp Drive System (M-103C) Limit Switches as follows:

1. In the JOG Mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor *Yordani Cole* Date *1-18-92*

QA *J. Yano* Date *1-18-92*

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor *Yordani Cole* Date *1-18-92*

QA *J. Yano* Date *1-18-92*

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor *Yordani Cole* Date *1-18-92*

QA *J. Yano* Date *1-18-92*

MP
1-18-92
OPEN ✓
CLOSE ✓
OPEN ✓
CLOSE ✓

8.5.4.3 Verify the operation of the Movable Frame Carriage Drive System (M-103A) Limit Switches (ZE-103A and ZE-103B) as follows:

1. In the JOG Mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103A) has been activated.
- Hard stops were not engaged.

Test Conductor Gorday Cole Date 1-18-92

QA J. H. Galt Date 1-18-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria:

- The control system indicates that the end of travel sensor (ZE-103B) has been activated.
- Hard stops were not engaged.

Test Conductor Gorday Cole Date 1-18-92

QA J. H. Galt Date 1-18-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria:

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor Gorday Cole Date 1-18-92

QA J. H. Galt Date 1-18-92

8.5.4.4 Part 8.5.4 has been satisfactorily completed.

Test Conductor Gorday Cole Date 1-18-92

QA _____ Date _____

UP ✓
DOWN ✓
UP ✓
DOWN ✓
1-18-92

KDH 1-17-92

QA sig.
not req.
KDH
1-17-92

8.5.5 Load Cell Verification Test

8.5.5.1 Verify the correct operation of the Fuel Assembly Cradle Load Cell (WE-103B) as follows:

1. Drive the movable frame to its full up position.
2. Place a 100 to 200 pound weight in the east end support cradle on the downender base frame.

Control system indicates presence of weight Yes

Acceptance Criteria:

- Weight is indicated as present

Test Conductor

Gordon Cole

Date

1-18-92

QA

J. A. Yant

Date

1-18-92

3. Remove the weight from the support cradle.

Control system indicates absence of weight Yes

Acceptance Criteria:

- Weight is indicated as absent

Test Conductor

Gordon Cole

Date

1-18-92

QA

J. A. Yant

Date

1-18-92

4. Repeat steps 2 and 3 two additional times.

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present
- (2) Weight is indicated as absent

Test Conductor

Gordon Cole

Date

1-18-92

QA

J. A. Yant

Date

1-18-92

8.5.5.2 Verify the correct operation of the Fuel Assembly Bottom Support Load Cell (WE-103A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

Control system indicates presence of weight Yes

Acceptance Criteria:

- Control system indicates presence of weight

Test Conductor Gordaf. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

2. Remove the weight from the bucket.

Control system indicates absence of weight Yes

Acceptance Criteria:

- Control system indicates absence of weight

Test Conductor Gordaf. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Control system indicates presence of weight Yes (1)

Control system indicates absence of weight Yes (2)

Acceptance Criteria:

- (1) Weight is indicated as present

- (2) Weight is indicated as absent

Test Conductor Gordaf. Cole Date 1-18-92

QA J. J. J. Date 1-18-92

8.5.5.3 Part 8.5.5 is ^{KDH 1-17-92}satisfactorily completed.

Test Conductor Gordaf. Cole Date 1-18-92

QA _____ Date _____

QA sig.
not req.

KDH
1-17-92

8.5.6 Interlock Verification Test

8.5.6.1 Verify the Carriage Drive Motor (M-103A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven up by the Carriage Drive Motor. Mark the appropriate column below.

See RL #9
JHC 1-18-92

	<u>Device</u>					<u>Condition</u>		
	A	B	C	D	E	0	1	
A RBT Position						Not Safe	Safe	
B SAW Position						Not Safe	Safe	
C Cradle Load Cell						Load	No Load	
D Bottom Support						Up	Down	
E Clamps						Closed	Open	
F Bot. Sup. Load Cell						Load	No Load	
<u>Test</u>	A	B	C	D	E	<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	✓	—	Yes
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	Yes
xxii	1	1	0	1	0	—	✓	No
xxiii	1	1	0	1	1	✓	—	Yes

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
xxiv	1	1	0	0	1	—	✓	No
xxv	1	0	1	1	0	—	✓	No
xxvi	1	0	0	1	1	—	✓	No
xxvii	0	1	1	1	0	—	✓	No
xxviii	0	1	1	1	1	—	✓	No
xxix	0	0	1	1	1	—	✓	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E) \text{ or } (F + G)]$. In this section, F is equivalent to D in the 0 condition and G is equivalent to E in the 0 condition.

Test Conductor Jordan, Cole Date 1-18-92
QA J. L. H. S. Date 1-18-92

8.5.6.2 Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

- Place the control system in the HAND mode.
- Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

NOTE: The devices and condition are identical to those in step 2 of part 8.5.6.1

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
i	0	0	0	0	0	—	✓	No
ii	1	0	0	0	0	—	✓	No
iii	0	1	0	0	0	—	✓	No
iv	0	0	1	0	0	—	✓	No
v	0	0	0	1	0	—	✓	No
vi	0	0	0	0	1	—	✓	No
vii	1	1	0	0	0	—	✓	No

Test	A	B	C	D	E	Motor Operates		Acceptance Criteria (See Note)
						Yes	No	
viii	1	0	1	0	0	—	✓	No
ix	1	0	1	0	1	—	✓	No
x	1	0	0	1	0	—	✓	No
xi	1	0	0	1	1	—	✓	No
xii	1	0	0	0	1	—	✓	No
xiii	0	1	1	0	1	—	✓	No
xiv	0	1	1	0	1	—	✓	No
xv	0	1	0	1	0	—	✓	No
xvi	0	1	0	1	1	—	✓	No
xvii	0	1	0	0	1	—	✓	No
xviii	0	0	1	1	0	—	✓	No
xix	0	0	1	1	1	—	✓	No
xx	0	0	0	1	1	—	✓	No
xxi	1	1	1	0	0	✓	—	No YES
xxii	1	1	0	1	0	✓	—	No
xxiii	1	1	0	1	1	✓	—	Yes
xxiv	1	1	0	0	1	✓	—	No
xxv	1	0	1	1	0	✓	—	No
xxvi	1	0	0	1	1	✓	—	No
xxvii	0	1	1	1	0	✓	—	No
xxviii	0	1	1	1	1	✓	—	No
xxix	0	0	1	1	1	✓	—	No
xxx	1	1	1	1	0	✓	—	Yes
xxxi	1	1	1	0	1	✓	—	Yes
xxxii	1	1	1	1	1	✓	—	Yes

YES TYPED, SEE
LOGIC BELOW
IN NOTE,
S/C 1-18-92

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as $A + B + [C \text{ or } (D + E)]$.

Test Conductor

Gordal, Col

Date

1-18-92

QA

J. Myers

Date

1-18-92

8.5.6.3 Verify the Bottom Support Drive Motor (M-103B) up interlocks as follows:

1. Place the control system in the HAND mode.

8.5.6.2a Verify the Carriage Drive Motor (M-103A) down interlocks as follows

NOTE: Movable frame must be in the up position.

See TPCN #6

1. Place the control system in the HAND mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the movable frame can be driven down by the Carriage Drive Motor. Mark the appropriate column below.

<u>Device</u>	<u>Condition</u>	
	0	1
A RBT Position	Not Safe	Safe
B SAW Position	Not Safe	Safe
C Cradle Load Cell	Load	No Load
D Bottom Support	Up	Down
E Clamps	Closed	Open
F Bottom Support Load Cell	Load	No Load

<u>Test</u>	<u>A B C D E F</u>						<u>Motor Operates</u>		<u>Acceptance Criteria</u>
							Yes	No	
i	0	0	0	0	0	1	—	✓	No
ii	1	0	0	0	0	1	—	✓	No
iii	0	1	0	0	0	1	—	✓	No
iv	0	0	1	0	0	1	—	✓	No
v	0	0	0	1	0	1	—	✓	No
vi	0	0	0	0	1	1	—	✓	No
vii	1	1	0	0	0	1	—	✓	No
viii	1	0	1	0	0	1	—	✓	No
ix	1	0	1	0	1	1	—	✓	No
x	1	0	0	1	0	1	—	✓	No
xi	1	0	0	1	1	1	—	✓	No
xii	1	0	0	0	1	1	—	✓	No
xiii	0	1	1	0	1	1	—	✓	No
xiv	0	1	1	0	1	1	—	✓	No
xv	0	1	0	1	0	1	—	✓	No
xvi	0	1	0	1	1	1	—	✓	No
xvii	0	1	0	0	1	1	—	✓	No
xviii	0	0	1	1	0	1	—	✓	No
xix	0	0	1	1	1	1	—	✓	No
xx	0	0	0	1	1	1	—	✓	No
xxi	1	1	1	0	0	1	✓	—	No yes Typo, KBH 1-21-92
xxii	1	1	0	1	0	1	—	✓	No
xxiii	1	1	0	1	1	1	✓	—	Yes
xxiv	1	1	0	0	1	1	—	✓	No
xxv	1	0	1	1	0	1	—	✓	No

Test	A B C D E F						Motor Operates		Acceptance Criteria
							Yes	No	
xxvi	1	0	0	1	1	1		✓	No
xxvii	0	1	1	1	0	1		✓	No
xxviii	0	1	1	1	1	1		✓	No
xxix	0	0	1	1	1	1		✓	No
xxx	1	1	1	1	0	1	✓		Yes -
xxxi	1	1	1	0	1	1	✓		Yes -
xxxii	1	1	1	1	1	1	✓		Yes -
xxxiii	0	0	0	0	0	0		✓	No
xxxiv	1	0	0	0	0	0		✓	No
xxxv	0	1	0	0	0	0		✓	No
xxxvi	0	0	1	0	0	0		✓	No
xxxvii	0	0	0	1	0	0		✓	No
xxxviii	0	0	0	0	1	0		✓	No
xxxix	1	1	0	0	0	0		✓	No
xL	1	0	1	0	0	0		✓	No
xLi	1	0	1	0	1	0		✓	No
xLii	1	0	0	1	0	0		✓	No
xLiii	1	0	0	1	1	0		✓	No
xLiv	1	0	0	0	1	0		✓	No
xLv	0	1	1	0	1	0		✓	No
xLvi	0	1	1	0	1	0		✓	No
xLvii	0	1	0	1	0	0		✓	No
xLviii	0	1	0	1	1	0		✓	No
xLix	0	1	0	0	1	0		✓	No
L	0	0	1	1	0	0		✓	No
Li	0	0	1	1	1	0		✓	No
Lii	0	0	0	1	1	0		✓	No
Liii	1	1	1	0	0	0	✓		Yes
Liv	1	1	0	1	0	0		✓	No
Lv	1	1	0	1	1	0		✓	No
Lvi	1	1	0	0	1	0		✓	No
Lvii	1	0	1	1	0	0		✓	No
Lviii	1	0	0	1	1	0		✓	No
Lix	0	1	1	1	0	0		✓	No
Lx	0	1	1	1	1	0		✓	No
Lxi	0	0	1	1	1	0		✓	No
Lxii	1	1	1	1	0	0		✓	No
Lxiii	1	1	1	0	1	0		✓	No
Lxiv	1	1	1	1	1	0		✓	No

KBH
1-21-92

Test Conductor MB Hayes

Date 1-21-92

QA [Signature]

Date 1-21-92

2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can be driven up by the Drive Motor. Mark the appropriate column below.

	<u>Device</u>			<u>Condition</u>		
	A	B	C	0	1	
	A Bottom Support Load Cell			Load	No Load	
	B Clamps			Closed	Open	
	C Movable Frame			Up	Down	
<u>Test</u>	<u>A B C</u>			<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
				Yes	No	
i	0	0	0		✓	No
ii	1	0	0	✓	—	Yes
iii	0	1	0	—	✓	No
iv	0	0	1	—	✓	No
v	1	1	0	✓	—	Yes
vi	0	1	1	✓	—	Yes
vii	1	0	1	✓	—	Yes
viii	1	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.3 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or (B + C).

Test Conductor

Horden J. Cole

Date

1-18-92

QA

J. A. Gant

Date

1-18-92

- 8.5.6.4 Verify the Bottom Support Drive Motor (M-103B) down interlocks as follows:

1. Place the control system in the HAND Mode.
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the bottom support can be driven down by the Drive Motor. Mark the appropriate column below:

<u>Device</u>	<u>Condition</u>	
	0	1
A Bottom Support Load Cell	Load	No Load
B Clamps	Closed	Open

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.4 of Reference 11.5, Downender SOTAC. The operating interlock logic is given as A or B.

Test Conductor Jordan Cole

Date 1-18-92

QA J. Allport

Date 1-18-92

8.5.6.5 Verify the Clamp Drive Motor (M-103C) open interlock as follows:

1. Place the control system in the HAND Mode
2. Temporarily force the Data Register to indicate the following combination of conditions as specified below and verify that the clamps can be driven open by the Drive Motor. Mark the appropriate column below.

<u>Device</u>		<u>Condition</u>			
		0	1		
A Bottom Support Load Cell		Load	No Load		
B Movable Frame		Up	Down		
<u>Test</u>	<u>A B</u>		<u>Motor Operates</u>		<u>Acceptance Criteria</u> (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓	—	Yes
iii	0	1	✓	—	Yes
iv	1	1	✓	—	Yes

NOTE

Acceptance Criteria is based on Section 1.4.5 of Reference 11.5, Downender SOTAC. The operating interlock logic is A or B.

Test Conductor Jordan Cole

Date 1-18-92

QA J. Allport

Date 1-18-92

8.5.6.6 Part 8.5.6 is ^{KDH 1-17-92} satisfactorily completed.

Test Conductor

Gordie Cole

Date

1-18-92

8.5.7 SINGLE Mode Verification Test

Place the Downender System in SINGLE mode and verify system automatic sequence. This test verifies operation of the Downender system motions and does not include the use of a mock-up fuel assembly.

8.5.7.1 With the Downender in the full up position and the clamps open, place the Control System in the SINGLE Mode.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.
- Video images from Camera No. 1 and No. 2 displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment ~~Form~~ ^{Form} in Appendix E.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the Downender movable frame.

RL # 8

Test Conductor

Gordie Cole

Date

1-18-92

QA

JL Yano

Date

1-18-92

8.5.7.2 Verify that the bottom support has assumed the programmed position for the W 17 x 17 fuel type by measuring the distance from the top of the movable frame to the top of the load cell plate in the bottom support.

Measured Distance

156.12

inches

Acceptance Criteria

- Distance is 156.13 ± .10 inches

Test Conductor

Gordie Cole

Date

1-18-92

QA

JL Yano

Date

1-18-92

- 8.5.7.3 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the downender bottom support through temporary changes to the Data Register.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify fuel assembly is properly seated.
- Video images from Camera No. 3 and No. 10 are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
Form KBH 1-17-92
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor

Date

1-18-92

QA

Date

1-18-92

- 8.5.7.4 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the Downender
- Video images from Cameras No. 3 and No. 10 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the downender movable frame and excell crane interface.

Test Conductor

Date

1-18-92

QA

Date

1-18-92

- 8.5.7.5 Press "Continue" to downend the movable frame to the horizontal position.

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

Acceptance Criteria

- The movable frame is downended to the horizontal position.

Test Conductor

Date

QA

Date

8.5.7.6 Press "Continue" to open the clamps

Verify clamps open automatically.

Acceptance Criteria

- Clamps open

Test Conductor

Date

QA

Date

8.5.7.7 Press "Continue" to retract the bottom support bucket to its most westward or "Home" position.

Acceptance Criteria

- Bottom support bucket moves to its "Home" position.

Test Conductor

Date

QA

Date

8.5.7.8 Press "Continue" to raise the movable frame to its up position.

Acceptance Criteria

- Movable frame travels to its up position.
- Control system generates a signal to release the RBT.
- RBT with FAHF attached can be positioned to interface with downender lower cradles for fuel removal.

Test Conductor

Date

QA

Date

8.5.7.9 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor MB Hayes

Date 1-20-92

QA

J. Alfano

Date 1-20-92

8.5.7.10 Part 8.5.7 is ^{KBH 1-17-92} satisfactorily completed.

Test Conductor MB Hayes

Date 1-20-92

8.5.8 AUTO Mode Verification Test

Place the Downender in AUTO mode and verify system automatic sequence. This test verifies operation of the Downender motions and does not include the use of a mock-up fuel assembly.

8.5.8.1 With the Downender in the full up position and the clamps open, place the Downender in AUTO mode control.

Acceptance Criteria

- "Hold Point" generated to record fuel assembly serial number.

Test Conductor MB Hayes

Date 1-20-92

QA

J. Alfano

Date 1-20-92

8.5.8.2 Using the keyboard, enter a fuel assembly serial number. Simulate placement of a fuel assembly on the bottom support through temporary changes to the bottom support load cell software. Press "Continue".

Acceptance Criteria

- "Hold Point" is generated to verify fuel assembly is properly seated.

Test Conductor MB Hayes

Date 1-20-92

QA

J. Alfano

Date 1-20-92

8.5.8.3 Press "Continue" to close the clamps.

Acceptance Criteria

- Clamps close
- "Hold Point" is generated to verify excell crane is clear of the Downender.

Test Conductor MB Hayes

Date 1-20-92

QA

J. Alfano

Date 1-20-92

8.5.8.4 Press "Continue" to complete the automatic sequence.

Acceptance Criteria

- Movable frame is downended to the horizontal or down position

NOTE

During the time that the movable frame is being lowered, temporarily force the Data Register to indicate placement of a fuel assembly on the downender support cradle.

- Clamps open
- Bottom support retracts to westward most position
- Movable frame is driven to full up position
- Control system generates a signal to release the RBT

Test Conductor MB Hays Date 1-20-92

QA J. G. Hays Date 1-20-92

8.5.8.5 Return the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor MB Hays Date 1-20-92

QA J. G. Hays Date 1-20-92

8.5.8.6 Part 8.5.8 is satisfactorily completed.

Test Conductor MB Hays Date 1-20-92

8.5.9 Servo Drive Fault Test

WARNING

Stay clear of the Downender system while in operation

8.5.9.1 Place the Downender system in the "SINGLE" mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-103A)

- 8.5.9.2 Temporarily force the Data Register to indicate a torque fault with the Carriage Drive Motor (M-103A).

Acceptance Criteria:

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor Gordal Cole Date 1-18-92
QA J. A. Yantis Date 1-18-92

- 8.5.9.3 Verify cameras No. 3 and No. 10 are activated and view the movable frame system when the "CAMERA CALL" button is touched

Acceptance Criteria:

- Video images from cameras No. 3 and NO. 10 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Camera No. 3 and No. 10 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor Gordal Cole Date 1-18-92
QA J. A. Yantis Date 1-18-92

- 8.5.9.4 Correct fault condition and verify the Carriage Drive Motor (M-103A) can be moved in the "SINGLE" mode.

Acceptance Criteria:

- The system can be recovered from fault condition and "SINGLE" mode operations continued.

Test Conductor Gordal Cole Date 1-18-92
QA J. A. Yantis Date 1-18-92

- 8.5.9.5 Part 8.5.9 is satisfactorily completed. ^{KDH 1-17-92}

Test Conductor Gordal Cole Date 1-18-92

9.0 POST PERFORMANCE REVIEW AND APPROVAL

The following signatures certify that the completed test, with all data collected, has been reviewed, and that the system has passed the requirements for system operational test.

<u>W B Hagan</u>	<u>9-14-92</u>
Test Engineer	Date
<u>[Signature]</u>	<u>9-15-92</u>
Quality Assurance	Date
<u>F. M. Gello</u>	<u>9/15/92</u>
Project Engineer	Date
<u>Peter V. Juchel</u>	<u>9/15/92</u>
Test Director	Date

10.0 RETENTION OF TEST RECORDS

The original working copy, including test exceptions and resolution and acceptance signatures, are to be maintained by the Test Director and stored at the HALLIBURTON NUS Gaithersburg building, Document Control Center. One copy of the original working document shall be sent to the DOE representative for their use and retention.

11.0 REFERENCES

- 11.1 Prototypical Fuel Rod Consolidation Project, Phase II: Final Report Volume 1.
- 11.2 Prototypical Fuel Rod Consolidation Project, Phase I: Final Report Volume III, Appendix G (9.2).
- 11.3 9315-E-601, Software Functional Specifications.
- 11.4 1096-M-05, Design Calculation for Downender.
- 11.5 Specification 9315-TAC-203, System Operational Test: Acceptance Criteria for the Downender Operational Test, latest revision.
- 11.6 9315-P-120, Test Administration Manual for System Operations Test and Integrated Systems Test, latest revision.

APPENDIX A
EQUIPMENT SETUP

1.0 Equipment Set-Up

Prepare the Drive Servo Controls for Operation

Note: Each of the drive motors and its controls are required to be adjusted and tuned/calibrated, one-by-one as detailed below, prior to all other system testing. In the steps described in Sections 1.1 through 1.2, ensure that only the motor under consideration in that step is being driven.

1.1 Carriage Drive Motor (M-103A)

Ensure that the carriage nut is approximately at mid travel. (Since machine motion will occur in a following step, this precaution is given in order to locate the equipment in a safe position.)

1. Verify that the Carriage Drive Motor is mechanically and electrically coupled after completion of the Control System SOT.
2. Adjust the motor control parameters for (M-103A) per instructions from Modicon, and as recorded in the following Carriage Drive Axis personality record form.
3. Record resolver counts/turn for resolver GE-103A and enter into the Control System the maximum speed for JOG mode in Resolves Counts/Sec. as noted below.

RESOLVER NUMBER	JOG SPD. (RPM)	RESOLVER COUNTS/TURN	MAX JOG SPD COUNTS/SEC
GE-103A	2500	1000	41667

4. Select the Carriage Drive at the Control Console and set JOG speed at approximately 10% of maximum JOG Speed. JOG the movable frame to the vertical position (HOME). Adjust the sensor (ZE-103A) as necessary to stop the movable frame before the carriage nut engages the hard stop. JOG toward and away from the sensor and verify sensor position.

CAUTION: Observe carefully as the machine moves and be prepared to activate emergency stop if necessary.

Sensor Position: Movable frame angle from horizontal 91.15°.

Axis personality record form:

 Machine Name/Number: Downender Carriage Drive

 Axis Number: M-103A

Personality Variable	Projected Value	Final Value
Number of Motor Poles (NPOLES)	6	
Resolution (RES)	1000	
Rate Loop Proportional Gain (RPG)	26	
Rate Loop Integral Gain (RIG)	180	
Acceleration Time Constant (ATC)	70	
Following Error Limit (FE_LIM)	100000	
Peak Current Limit (IMAX)	100	
Average Current Trip Level (IAVG_LIM)	50	
CW End-of-Travel Limit (+EOT)	0	
CCW End-of-Travel Limit (-EOT)	0	
In-Position Tolerance Band (POS_TOL)	40	
In-Sync Tolerance Band (SYNC_TOL)	500	
Linear Acceleration (ACCEL)	15000	
Linear Deceleration (DECEL)	10000	
Position Cmd Time Constant (PCTC)	N/A	
Velocity Feed Forward (VFF) on/off	N/A	
Motor Base Speed (BASE_SPD)	3000	

5. JOG the movable frame down to its horizontal position. Verify that the carriage drive motor speed reduces to zero just as the frame touches the horizontal stop.

6. Create and verify an Axis Homing Sequence (AHS) for the Carriage Drive Motor (M-103A) and resolver (GE-103A). (See "Start Program" in the Software Detail Design Document by Modicon.) AHS parameters to be as given below. At completion of AHS, record "Home Offset" and "Final Home Position" in the chart below.

Motor Tag No: M-103A Home Direction: CCW

Resolver Tag No.: GE-103A Resolver Counts/Turn: 1000

Home Speed: 100 RPM ⁵⁰⁰⁰~~1667~~ counts/sec.

Home Offset: 0 Resolver Counts

Final Home Position: 91° ± 0.5° (from horizontal)

7. Return the AHS for the Carriage Drive Motor to "Home-As-Is".

1.2 Bottom Support Drive Motor (M-103B)

Ensure that the bottom support is approximately at mid travel. (Since machine motion will occur in a following step, this precaution is given in order to locate the equipment in a safe position.)

1. Verify that the Bottom Support Drive Motor is mechanically and electrically coupled after completion of the Control System SOT.
2. Adjust the motor control parameters for (M-103B) per instructions from Modicon, and as recorded in the following Bottom Support Drive Axis personality record form.
3. Record resolver counts/turn for resolver GE-103B and enter into the Control System the maximum speed for JOG mode in Resolves Counts/Sec. as noted below.

RESOLVER NUMBER	JOG SPD. (RPM)	RESOLVER COUNTS/TURN	MAX JOG SPD COUNTS/SEC
GE-103B	2500	1000	41667

Axis personality record form:

Machine Name/Number: Downender Bottom Support Drive
Axis Number: M-103B

Personality Variable	Projected Value	Final Value
Number of Motor Poles (NPOLES)	6	
Resolution (RES)	1000	
Rate Loop Proportional Gain (RPG)	6	
Rate Loop Integral Gain (RIG)	60	
Acceleration Time Constant (ATC)	22	
Following Error Limit (FE_LIM)	32000	
Peak Current Limit (IMAX)	40	
Average Current Trip Level (IAVG_LIM)	40	
End-of-Travel Limit (+EOT)	0	
End-of-Travel Limit (-EOT)	0	
Position Tolerance Band (POS_TOL)	20	
Sync Tolerance Band (SYNC_TOL)	500	
Max Acceleration (ACCEL)	16000	
Max Deceleration (DECEL)	16000	
Position Cmd Time Constant (PCTC)	N/A	
Velocity Feed Forward (VFF) on/off	N/A	
Min Base Speed (BASE_SPD)	2100	

- 4 Select the Bottom Support Drive at the Control Console and set JOG speed at approximately 10% of maximum JOG Speed. JOG the Bottom Support in the down direction. Adjust overtravel sensor ZE-103D as necessary to stop the Bottom Support before the carriage plate engages the hard stop. JOG toward and away from the sensor and verify sensor position.

Sensor Position: 196 $\frac{7}{16}$ inches from the top of the movable frame

- 5 Repeat Step 4 at the upper mechanical stop by adjusting sensor ZE-103C.

Sensor Position: 131 $\frac{3}{16}$ inches from the top of the movable frame

- 6 Create and verify an Axis Homing Sequence (AHS) for the Carriage Drive Motor (M-103B) and resolver (GE-103B). (See "Start Program" in the Software Detail Design Document by Modicon.) AHS parameters to be as given below. At completion of AHS, record "Home Offset" and "Final Home Position" in the chart below.

Motor Tag No: M-103B Home Direction: CCW

Resolver Tag No.: GE-103C Resolver Counts/Turn: 1000

Home Speed: 100 RPM 5000
1667 counts/sec.

Home Offset: 1000 Resolver Counts

Final Home Position: $182.25 \pm .50$
00 inches (top of movable frame to load cell plate in the bottom support)

- 7 Return the AHS for the Carriage Drive Motor to "Home-As-Is".
- 8 For each fuel type, the downender bottom support must seek a prescribed elevation. Set the distance from the top of the movable frame to the stop of the load cell plate in the bottom support. Verify this distance is within the following limits listed below for each fuel.

Fuel Assembly Type	Req'd Dist.	Verification	Date
GE 8x8	166.47 $\pm$.10	<u>166.50</u>	<u>1-8-92</u>
CE 14x14	177.66 $\pm$.10	<u>177.63</u>	<u>1-8-92</u>
W 15x15 Std.	156.09 $\pm$.10	<u>156.06</u>	<u>1-8-92</u>
W 17x17 Std.	156.13 $\pm$.10	<u>156.13</u>	<u>1-8-92</u>
B&W 15x15	159.57 $\pm$.10	<u>159.60</u>	<u>1-8-92</u>

- 9 Upload part-program to supervisory program to store setpoints.

1.3 Clamp Activator (M-103C)

Calibrate the actuator position transducer (GE-103C) and set the open and close limit switches.

1. Position Transducer Calibration

- Open the fuel assembly clamps until the distance between the two bottom ledges is 11.60 ± 0.10 inches. Program the Control System to stop the actuator at this opening.
- Close the clamps until the distance between the two bottom ledges is 3.50 ± 0.10 inches.
- Upload part-program to supervisory program to store the setpoints.

2. Limit Switch Calibration

- In the JOG mode, open the clamps until they are approximately halfway between 11.60 inches and the open hard stop. Set the actuator motor open limit switch to de-energize power to the actuator motor at this opening.

Limit Switch Setting (Open) 12.55 inches

- In the JOG mode, close the clamps until that are approximately halfway between 3.5 inches and the close hard stop. Set the actuator motor close limit switch to de-energize the actuator motor at this opening.

Limit Switch Setting (Close) ^{2.24}
1.10 inches

1.4 Appendix A has been satisfactorily completed

Test Conductor W B Haynes

Date 1-8-92

APPENDIX B
SAFETY PROCEDURES

SYSTEMS OPERATIONS TEST SAFETY CONSIDERATIONS

Performance of the SOTs in a manner which precludes the injury of personnel involved in the test performance or working in the Test Facility is of paramount importance. The following steps shall be taken to minimize the possibility of personnel being injured during the performance of SOTs:

1. Contraves and NUS will advise their employees and any subcontractors to stay clear of the Test Facility when tests are being conducted unless they are involved in the test performance or have another work assignment in the Test Facility.
2. Contraves will post a warning sign at the entrance to the Test Facility when testing is in progress advising personnel of the need to stay away unless involved in the testing or have some authorized work assignment in the area.
3. When feasible and deemed advisable by the Test Conductor the machine being tested will be surrounded by a portable barrier (ropes and posts) with a Caution Sign warning individuals to stay clear of the area unless authorized to enter by the Test Conductor.
4. When machines are being moved by installed motors the NUS electrical engineer operating the motor or the Test Conductor will be located in a position which permits him/her to observe the machine operation so that the equipment can be stopped if a dangerous situation appears to be developing. Such situations could involve unanticipated machine performance or personnel entering the test area and placing themselves in jeopardy.
5. When an SOT is in progress the Test Conductor will remain in the vicinity of the test so the all personnel involved in the test are under his observation and will perform any required test support activities directly under his supervision.
6. Only Contraves personnel who have been qualified to the DOE Hoisting and Rigging Manual Rev. 10-88 will operate the Test Facility overhead crane.
7. Only NUS test engineers will operate the Robotic Bridge Transporter (RBT), the Manipulator Transporter (MT), and the RM-10A Robot Arms.
8. Slings, hooks, and chains utilized with the Test Facility overhead crane or with the RBT will be those purchased specifically for use on the DOE project and have been certified to meet the requirements of ANSI B30.9.
9. The making of all electrical connections to the various equipment will be supervised by an NUS electrical engineer.

10. Protective headgear will be worn in the Test Facility when ever the Robotic Bridge Transporter (RBT) the Manipulator Transporter (MT) are being utilized or at any time the Test Conductor deems the use of protective head gear is appropriate.
11. The NUS Test Conductor is responsible to see that all the above safety requirements are implemented during the performance of the test for which he has responsibility.
12. The Test Conductor will verify that all test specific safety prerequisites identified in test procedures are satisfied and that any precautions identified in specific procedure steps as followed.
13. The NUS Test Director will perform frequent informal surveillance of the testing operations to verify the safety requirements are being adhered to by the personnel performing the test or other work in the test area.

APPENDIX C

PHOTO DOCUMENTATION REQUIREMENTS

Photo Documentation Requirements

Photographs are required to be taken of all System Operational Tests (SOTs). The following is a bulletized list which identifies when these photographs must be taken, as a minimum. Additional photographs may be taken at any other time during the test, as specified by the Test Conductor.

- Photographs must be taken of the initial setup for each test sequence.
- Photographs must be taken of the following critical interfaces between system, as a minimum,
 - Excell Crane/Downender (Loading of Fuel)
 - RBT/Fuel Assembly Storage Rack
 - RBT/Downender
 - RBT/Staging and Cutting Station
 - RBT/Clamping Table
 - FAHF/Mockup Fuel Assembly
 - Pull-Head Gripper/Fuel Rods
 - Rod Loader/Canister
 - NFBC Loader/Canister
 - RBT/Off-Normal Table
 - MT/Off-Normal Table
 - Fuel Canister/Storage Rack
 - NFBC Canister/Storage Rack
 - RBT/FAHF and RM-10A
 - Excell Crane/Fuel Canister Upender (Loading and Unloading)
 - Excell Crane/NFBC Canister Upender (Loading and Unloading)
 - MT/RM-10A
- Photographs must be taken of any equipment damaged during testing.
- Photographs must be taken of any damage to mockup fuel rods and/or mockup fuel assemblies.
- Photographs must be taken of the cutter to fuel assembly interfaces as follows:
 - In position prior to cut
 - During cutting operation
 - Cut area of end fitting after cut operation
 - Cut area of fuel assembly after cut operation
- Photographs must be taken of each "Hold Point".
- Photographs must be taken of the problem areas of any subsystem which does not perform its expected function.
- Photographs must be taken of any component, subsystem, or system, determined by the test conductor to be operating out of the normal/expected condition (i.e., excessive deflection, vibration, etc.).

APPENDIX D

TEMPORARY PROCEDURE CHANGE NOTICE AND REPAIR LOG

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-6-92

TPCN# 1

PROCEDURE NO. 9315-TP-203

REV. 1

TITLE Downunder SOT

PROCEDURE SECTION(S) 2.13

PROCEDURE CHANGE: (Use reverse side if necessary.)

Prerequisite 2.13 stating "Procedures for changeover of fuel types for the Control System are in the Control Room" should be deleted.

REASON FOR CHANGE: Procedures for control system fuel type change overs do not exist. Fuel type change overs will be performed by personnel trained by Modicon.

CLASSIFICATION OF CHANGE

MINOR X YES X NO

MAJOR _____ YES _____ NO X

REVISION TO ORIGINAL PROCEDURE REQUIRED X YES NO

APPROVALS

MD James 1-6-92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE _____ DATE _____ (2)

PROJECT ENGINEER _____ DATE _____ (2)

TEST DIRECTOR _____ DATE _____ (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-14-92

TPCN # 2

PROCEDURE NO. 9315-TP-203

REV. 1

TITLE Downender SOT

PROCEDURE SECTION(S) 8.1.7.B, 8.1.10.7.1

PROCEDURE CHANGE: (Use reverse side if necessary.)

Last acceptance criteria bullet of step 8.1.7.B in wrong place. New step 8.1.10.7.1 written to remove fuel from downender cradles and acceptance criteria of step 8.1.7.B moved to new step.

REASON FOR CHANGE: No fuel ~~fuel~~^{KH} used in step 8.1.7; a fuel removal step was required for section 8.1.10.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

H.B. Dwyer (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE 2)

PROJECT ENGINEER DATE 2)

TEST DIRECTOR DATE 2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-14-92

TPCN # 3

PROCEDURE NO. 9315-TP-203 REV. 1 TITLE Downender SDT

PROCEDURE SECTION(S) B.1.7.6, B.2.7.6, B.3.7.6, B.4.7.6, B.5.7.6

PROCEDURE CHANGE: (Use reverse side if necessary.)

change step B.1.7.6 to read: verify clamps open automatically.

REASON FOR CHANGE:

"Continue" is not required to open clamps, clamps open automatically.

(see RL #11)

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

P/B Hanna 1-14-92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-14-92

TPCN #4

PROCEDURE NO. 9315-TP-203

REV. 1

TITLE Downender SOT

PROCEDURE SECTION(S) 8.1.10.4, 8.1.10.5, 8.2.10.4, 8.2.10.5

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete step 8.1.10.5 except third bullet of acceptance criteria; add third bullet of acceptance criteria to acceptance criteria in step 8.1.10.

REASON FOR CHANGE: Clamps open automatically as soon as weight is transferred to support cradle, not enough time to measure clamp current and opening time. Step 8.1.10.5 is part of step 8.1.10.4 but no time is available to record measure ~~both steps~~ data for both steps simultaneously.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

PHB Haynes 1-14-92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-15-92

TPCN # 5

PROCEDURE NO. 9315-TP-203

REV. 1

TITLE Downender SOT

PROCEDURE SECTION(S) B.2.10.7.1

PROCEDURE CHANGE: (Use reverse side if necessary.)

Add new step B.2.10.7.1 to remove fuel from downender cradles.

REASON FOR CHANGE:

Need a step to move fuel from downender cradles.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

P/B Hazen 1-15-92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (1)

PROJECT ENGINEER DATE (1)

TEST DIRECTOR DATE (1)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 1-21-92

TPCN # 6

PROCEDURE NO. 9315-TP-203 REV. 1 TITLE Downender SOT

PROCEDURE SECTION(S) B.1.6.2a, B.2.6.2a, B.3.6.2a, B.4.6.2a, B.5.6.2a

PROCEDURE CHANGE: (Use reverse side if necessary.)

Add the ^{above KSH} ~~following~~ new interlock verification tests to the procedure to test the bottom support load cell.

REASON FOR CHANGE: The bottom support load cell was inadvertently left out as part of the interlock tests. Software changes were required (see DCN 009) to implement the interlock, and additional tests are to be performed.

CLASSIFICATION OF CHANGE

MINOR YES NO

MAJOR ✓ YES ✓ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED ✓ YES NO

A/PROVALS

W.D. James 1-21-92 (1)(2)
TEST ENGINEER DATE

[Signature] 7/22/92 (1)
QUALITY ASSURANCE DATE

Frank M. Dally 7/22/92 (1)
PROJECT ENGINEER DATE

[Signature] 7/22/92 (1)
TEST DIRECTOR DATE

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-203

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE # 7

DATE 7-28-92

PROCEDURE NO. 9315-TP-203 REV. 1 TITLE Downender SOT

PROCEDURE SECTION(S) B.1.1.3 step 2+4, B.2.1.3 step 2+4, B.3.1.3 step 2+4,
B.4.1.3 step 2+4, B.5.1.3 step 2+4

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete measured distance acceptance criteria for the fuel bottom support (130 $\pm$.00) from procedure.

REASON FOR CHANGE:

This distance measurement is not a requirement of the TAC, and the fuel bottom support is not required to travel to the "130" position for fuel processed in this test program. (See RL # 3)

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

93D 7/28/92 7-28-92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

SPECIFICATION 9315-TP-203

REVISION 1

PAGE 1

EXCEPTION/REPAIR LOG

DATE 1-6-92

Rev # 1

PROCEDURE NO. 9315-TP-203

REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) 2.9

CLASSIFICATION OF CHANGE: REPAIR N/A REDESIGN N/A TPCN# N/A

PROBLEM AND CAUSE:

1. Section 7.2 (CRT) of Downender FAT has not been completed.

TEST CONDUCTOR W B Haynes

SOLUTION/CORRECTIVE ACTION:

The above item will not impact SO testing, and will be completed prior to Integrated Testing.

TEST CONDUCTOR W B Haynes DATE 1-6-92

QUALITY ASSURANCE _____ DATE _____ (1)

PROJECT ENGINEER _____ DATE _____ (1)

TEST DIRECTOR P V J DATE 1-6-92 (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE The above item has been transferred to the open item Tracking List

TEST CONDUCTOR W B Haynes DATE 4-28-92

SPECIFICATION 9315-TP-203

REVISION 1

PAGE 2

EXCEPTION/REPAIR LOG

DATE 1-7-92

RL # 2

PROCEDURE NO. 9315-TP-203 REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) 2.4, 2.3

CLASSIFICATION OF CHANGE: REPAIR N/A REDESIGN N/A TPCN# N/A

^{RL 1-7-92}
PROBLEM AND CAUSE: ~~THE~~ The following DCN's have been physically completed; however, final approval is not complete; therefore, the QA/QC Data Package can not be approved.

DCN # 475, 481, 816, 817, 818, 862, 863, 864, 865, 871, 644, 707, 851, 819, 867
In addition, the CRT section of the Downender FAT has not been completed (see RL#1) which will affect close out of the QA/QC Data Package.

TEST CONDUCTOR JB Haynes

SOLUTION/CORRECTIVE ACTION:

The above open items will not affect SO Testing but will require addressing prior to final sign-off of the SOT.

TEST CONDUCTOR JB Haynes

DATE 1-7-92 Jay 1/7/92

QUALITY ASSURANCE _____

DATE _____ (1)

PROJECT ENGINEER _____

DATE _____ (1)

TEST DIRECTOR PR Judd

DATE 1-7-92 (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE The above items have been transferred to the Open Item Tracking list

TEST CONDUCTOR JB Haynes DATE 4-28-92

EXCEPTION/REPAIR LOG

DATE 1-8-92

RL# 3

PROCEDURE NO. 9315-TP-203

REV 1

TITLE Downender SDT

PROCEDURE SECTION(S) 8.1.1.3.2, 8.1.1.3.4, 8.2.1.3.2, 8.2.1.3.4, 8.3.1.3.2, 8.3.1.3.4,
8.4.1.3.2, 8.4.1.3.4, 8.5.1.3.2, 8.5.1.3.4

CLASSIFICATION OF CHANGE: REPAIR n/a REDESIGN n/a TPCN# n/a

PROBLEM AND CAUSE:

Fuel bottom support hits moveable frame before specified distance is reached.

TEST CONDUCTOR JB Haynes

SOLUTION/CORRECTIVE ACTION:

No corrective action is required, fuel bottom support travel is sufficient for fuel types used at Cold Test and TAN facility. End of travel switch is set to shut motor off prior to bottom support hitting moveable frame. This acceptance criteria was not part of the TAC. KBH 7-23-92 (see TPCN # 7)

TEST CONDUCTOR JB Haynes DATE 1-8-92

QUALITY ASSURANCE _____ DATE _____ ()

PROJECT ENGINEER _____ DATE _____ ()

TEST DIRECTOR _____ DATE _____ ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Changes required for facilities processing ~~fuels~~ ^{KBH 7-23}
short Westinghouse fuels but
not for TAN.

TEST CONDUCTOR JB Haynes ^{KBH 1-9-92} DATE 1-8-92

JB Haynes

7-23-92

EXCEPTION/REPAIR LOG

DATE 1-9-92

RL # 4

PROCEDURE NO. 9315-TP-203 REV 1 TITLE Downender SOT

PROCEDURE SECTION(S) 8.1.2.1, 8.1.2.2, 8.2.2.1, 8.2.2.2, 8.3.2.1, 8.3.2.2, 8.4.2.1, 8.4.2.2, 8.5.2.1, 8.5.2.2

CLASSIFICATION OF CHANGE: REPAIR REDESIGN TPCN#

PROBLEM AND CAUSE:

Downender clamps do not open or close to distance specified in acceptance criteria. Clamp actuator potentiometer will not allow control system to set clamps within tolerance band, and excessive drive system backlash exceeds acceptance criteria tolerance band.

TEST CONDUCTOR KB Haynes

SOLUTION/CORRECTIVE ACTION:

Clamp open and closed position is sufficient to clear fuel in the open position and hold fuel in the closed position safely; therefore, no corrective action is required.

TEST CONDUCTOR KB Haynes DATE 1-9-92

QUALITY ASSURANCE DATE ()

PROJECT ENGINEER DATE ()

TEST DIRECTOR DATE ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE See TCN 002. Approval by DOE being tracked by OITL Item #209.

TEST CONDUCTOR KB Haynes DATE 7-28-92

Department of Energy

Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

August 21, 1992

G. B. B.
sub 4/7
Chen
DCC
Bh

T. F. N1
K B H (Pentagon)
SOT-203 Notchmark
T. F. N1

Peter V. Judd
NUS Project
c/o Contraves-USA
620 Epsilon Drive
Pittsburgh, PA 15238

SUBJECT: Review of Halliburton NUS System Operation Test (SOT) Test Acceptance Criteria (TAC) Change Notices (TCN) Numbers 001 and 002 for the Downender - AM/NP-WJM-92-49

REFERENCE: Halliburton NUS Corporation letter to DOE-ID, ED-DOE-PVJ-92-2418, dated July 10, 1992

Dear Mr. Judd:

DOE-ID has reviewed the subject TCNs and finds them acceptable. The TCNs are approved for implementation.

If you have further questions, please contact me (208/526-6668) or Mr. D. C. Koelsch (208/526-5930).

Sincerely,

David C. Koelsch

for Walter J. Mings, Acting Chief
Civilian Rad-Waste Branch

cc: F. G. Gallo, NUS
J. H. Clark, EG&G

910 CLOPPER ROAD • P.O. BOX 6032 • GAITHERSBURG, MARYLAND 20877-0962 • (301) 258-6000

ED-DOE-PVJ-92-2418
July 30, 1992

Mr. W.J. Mings, Chief
Civilian Rad-Waste Branch
U. S. Department of Energy
Idaho Field Office
785 DOE Place MS-1136
Idaho Falls, ID 83401-1562

Subject: Contract DE-AC07-86ID12651 - Rod Consolidation Project
Systems Operational Test--Downender Test Acceptance
Criteria Change Notice (TCN) Approval

Reference: 1. 9315-TAC-203 Rev /2

Dear Mr. Mings:

Attached are TCNs 001 and 002 to reference 1 for your approval.

If you have any questions, please contact the undersigned on
(412) 967-7304.

Very truly yours,

Peter V. Judd
Project Manager

ht

Attachments:

TCNs 001 and 002 to TAC-203 Rev. 2

cc: D.C. Koelsch--DOE-ID
J.H. Clark--EG&G

bcc: Subj 4.1
Chris N
DCC

Rgn 507-263 NGU L000L

~~REDACTED~~

Judd Chron

T. F. Muiqrew

F. G. HIO

L. HAYNS (record copy)

ices for a cleaner and safer world

TAC CHANGE NOTICE

DATE: 11/4/91CHANGE NOTICE NO. 001TAC NO: 9315-TAC-203 Rev. 2TITLE: System Operational Test Acceptance Criteria for the
Downender Operational Test (WBS 1.3.1.2)

=====

TAC CHANGES AND REASON FOR CHANGE

1. Page 1, Section 1.1.1 - Retracted Position - 173.00 ⁺⁰⁰ ₊₅₀ - .50
changed to 182.25 -00 to accommodate the handling of the CE
14x14 fuel assembly.
2. Page 1, Section 1.1.1 - Added "-CE 14x14 - 177.66 ± .10."
The CE 14x14 is one of the five fuel types that is programmed
into the control system. As such, the correct location of
the bottom support assembly for this fuel type must be
confirmed.
3. Page 6 - Add Section 1.5A as follows: "1.5A - In automatic
mode verify downender automatic operational sequence"
incorporated to respond to DOE test acceptance criteria
comment.

(If more space is needed, use additional sheets.)

=====

ENGINEER

R. P. Wilder11/4/91
Date

QUALITY ASSURANCE

A. M. Hines11/4/91
Date

PROJECT MANAGER

Frank M. Mello11/4/91
DateApproved by DOE lth 8/21/92

TAC CHANGE NOTICE

DATE: 7-30-92

CHANGE NOTICE NO. 002

TAC NO: 9315-TAC-203 Rev. 2

TITLE: System Operational Test Acceptance Criteria for the Down ender

===== TAC CHANGES AND REASON FOR CHANGE

1. Change clamp opening dimensions of Section 1.1.2 in the open and closed position from "11.60 $\pm$.10 inches" to " $\geq$ 10.25 inches at the narrowest opening." for the open position, and from "3.50 $\pm$.10 inches." to " $\leq$ 3.75 inches at the widest opening." for the closed position.

The existing tolerances for the clamp openings are too tight for this particular system. This makes limit switch adjustment difficult due to the tight tolerance band, and existing drive linkage backlash. The proposed criteria would yield a larger band for adjustment and still ~~the~~ allow the clamps to safely hold the fuel while closed and clear the fuel while open.

(If more space is needed, use additional sheets)

ENGINEER

SD Hayes

7-30-92

Date

QUALITY ASSURANCE

PJ Jahl

7-30-92

Date

PROJECT MANAGER

Frank's Mello

7/30/92

Approved by DOE Lt
8/21/92

EXCEPTION/REPAIR LOG

DATE 1-9-92

RL # 5

PROCEDURE NO. 9315-TP-203

REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) 8.1.3.2

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ n/a TPCN# n/a

PROBLEM AND CAUSE:

Downender moveable frame did not make contact with hardstops when driven down in the Hand mode. Approximately 0.25D inch of travel remained. Resolver would need to be reset if contact with the hardstop is ~~desired~~ required.

KBH
1-9-92

TEST CONDUCTOR JB Hays

SOLUTION/CORRECTIVE ACTION:

Reset resolver if hardstop contact is required, this may not be necessary if fuel can be released by clamps in the down position. Preliminary inspection indicates the fuel can be released by the clamps. Further testing will be required to verify this.

TEST CONDUCTOR JB Hays DATE 1-9-92

QUALITY ASSURANCE _____ DATE _____ ()

PROJECT ENGINEER _____ DATE _____ ()

TEST DIRECTOR _____ DATE _____ ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Resolver reset to lower movable frame to hardstop.

TEST CONDUCTOR JB Hays DATE 1-15-92

3 of 6

EXCEPTION/REPAIR LOG

DATE 1-9-92

RL # 6

PROCEDURE NO. 9315-TP-203
~~8142~~ KDH 1-4-92 REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) 8.1.4.2

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN n/a TPCN# n/a

PROBLEM AND CAUSE:

Clamp actuator limit switches worked at both ends of travel without hitting hardstops; however, control system end of travel indicator did not show end of travel had been reached.

TEST CONDUCTOR MB Haynes

SOLUTION/CORRECTIVE ACTION:

Correct EOT indicator to function, and retest to verify.

TEST CONDUCTOR MB Haynes DATE 1-9-92

QUALITY ASSURANCE _____ DATE _____

PROJECT ENGINEER _____ DATE _____

TEST DIRECTOR _____ DATE _____

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

EOT indicator corrected to function
(see DCN 008), section 8.1.4.2 retested
and functioned correctly.

TEST CONDUCTOR MB Haynes DATE 1-10-92

SPECIFICATION 9315-TP-203

REVISION 1

PAGE 7

EXCEPTION/REPAIR LOG

DATE 1-9-92

RL # 7

PROCEDURE NO. 9315-TP-203 REV 1 TITLE Downender SOT

PROCEDURE SECTION(S) B.1.6.1 (xxii)

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN n/a TPCN# n/a

PROBLEM AND CAUSE:

Interlock specified above did not function.

TEST CONDUCTOR HB Haynes

SOLUTION/CORRECTIVE ACTION:

check system software and retest.

TEST CONDUCTOR HB Haynes DATE 1-9-92

QUALITY ASSURANCE _____ DATE _____ (1)

PROJECT ENGINEER _____ DATE _____ (1)

TEST DIRECTOR _____ DATE _____ (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Interlock of step B.1.6.1 (xxii) corrected ~~and~~ to function (see DWN008) and retested; functioned correctly.

TEST CONDUCTOR HB Haynes DATE 1-10-92

EXCEPTION/REPAIR LOG

DATE 1-14-92

RL # B

PROCEDURE NO. ^{KBH 9315-TP-203}
B.1.7.1

REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) B.1.7.1, B.1.10.1, B.2.7.1, B.2.10.1, B.3.7.1, B.4.7.1, B.5.7.1

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN n/a TPCN# n/a

PROBLEM AND CAUSE:

Camera 1 is not installed, camera 2 view is of west wall and overhead beam → acceptance criteria could not be met at this time.

TEST CONDUCTOR JB Haynes

SOLUTION/CORRECTIVE ACTION:

Install Camera 1 so an assessment can be performed, readjust camera 2 view, then retest.

TEST CONDUCTOR JB Haynes DATE 1-14-92

QUALITY ASSURANCE _____ DATE _____ (1)

PROJECT ENGINEER _____ DATE _____ (1)

TEST DIRECTOR _____ DATE _____ (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Section B.1.7.1 retested, both cameras functioned with good views of the Downender.

TEST CONDUCTOR JB Haynes DATE 2-14-92

EXCEPTION/REPAIR LOG # 9

DATE 1-18-92 9315-TP-203

PROCEDURE NO. 8.5.1.2 1-18-92

REV 1

TITLE Downender SOT

PROCEDURE SECTION(S) 8.5.1.2, 8.5.4

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ n/a TPCN# n/a

PROBLEM AND CAUSE:

Did not receive "UP" indicator light while performing Step 8.5.1.2. Bucket stopped at proper position. It was noted that indicator light came on at a higher elevation during following step. Problem was also noted during interlock test. Support was jacked into position for light and interlock to make in order to continue. However auto mode did not require "UP" light.

SOLUTION/CORRECTIVE ACTION:

Have Modicon review software and fix accordingly. appropriate tests shall be made to verify that indicator and interlocks come on at correct position.

TEST CONDUCTOR Gordy Cole

DATE 1-18-92

QUALITY ASSURANCE _____

DATE _____ (1)

PROJECT ENGINEER _____

DATE _____ (1)

TEST DIRECTOR _____

DATE _____ (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE DCN-009 WAS ISSUED TO REVISE SET POINT IN REGISTER # 47143 to "DADG" for Downender bottom Support UP position.

TEST CONDUCTOR Gordy Cole

DATE 1-21-92

EXCEPTION/REPAIR LOG #10

DATE 1-18-92

PROCEDURE NO. 9315-TP-203

REV 1

TITLE DOWNENDER SOT

PROCEDURE SECTION(S) 8.5.7.7

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN# n/a

PROBLEM AND CAUSE: While lowering bottom support as part of 8.5.7.7 a down EDT was encountered. At first thought to be false since it read 165.17" instead of 182.25 which it down. It was then discovered EDT was real. Couldn't get single mode going again. Machine axis were then rehome. Everything appeared OK. Bottom support position read back 182.50. Downender was then placed into single mode. Bottom support then apparently moved on its own, going down, into the EDT. Fault was received and reading changed to 165.17" with D.E. support barely moved. Above was repeated with reading going to 170.15.

TEST CONDUCTOR

Gordon J. Cole

SOLUTION/CORRECTIVE ACTION:

Have Modicon investigate software/hardware and repair problem. Testing should then resume at Step 8.5.7.

TEST CONDUCTOR

Gordon J. Cole

DATE 1-18-92

QUALITY ASSURANCE

DATE _____ ()

PROJECT ENGINEER

DATE _____ ()

TEST DIRECTOR

DATE _____ ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

To eliminate intermittent EDT limit, M/C 1-24-92
Sensor Controller's sensitivity was turned down to eliminate false EDT fault to no occur. No software & hardware changes are required.

TEST CONDUCTOR

Gordon J. Cole

DATE 1-24-92

The problem above was discussed ^{M/C} with Modicon. It could not be repeated to show them. Modicon said the problem could not have happened as described but probably delt with operator doing a recovery at the wrong time. Problem will be watched for and additional data gathered if it reoccurs.

See update on page 10B

EXCEPTION / REPAIR LOG #10 (CONT.)

This problem was investigated further by Modicon and it was found that under the right conditions this problem could occur. The problem was in the executive program for the 3240 Automation Controller and therefore could occur as a similar problem at a later date for other machines. A change was made to the executive program to correct this problem at the same time Modicon was making revisions for the Lower Cutting System (Software DCN*10). No further reoccurrences of this problem have been seen at the Downender or any other machine.

Gordon J. Cole 7-30-92

EXCEPTION/REPAIR LOG # 11

DATE 1-21-92

PROCEDURE NO. 9315-TP-203 REV 1 TITLE Downender SDT

PROCEDURE SECTION(S) B.1.7.b, B.2.7.b, B.3.7.b, B.4.7.b, B.5.7.b

CLASSIFICATION OF CHANGE: REPAIR REDESIGN TPCN# 3

PROBLEM AND CAUSE: when the above steps were performed, the clamps opened automatically after the movable frame was down and a load indicated on the cradle support. It was believed that this operation would require the operator to press "Continue" to open the clamps, this was not the case. The operation to open the clamps automatically after receipt of fuel on the support cradles was programmed that way by design. At the present it is not possible to apply a single step to non-servo drives without extensive hardware and software changes.

TEST CONDUCTOR MB Hayes

SOLUTION/CORRECTIVE ACTION:

No corrective action is required, movements occurred as specified in TAC.

TEST CONDUCTOR MB Hayes DATE 1-21-92

QUALITY ASSURANCE DATE (1)

PROJECT ENGINEER DATE (1)

TEST DIRECTOR DATE (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

TEST CONDUCTOR MB Hayes DATE 4-28-92

APPENDIX E
CCTV ASSESSMENT FORM

CCTV Assessment

1. Operation: (describe type of operation here)

- a. Step 8.1.7.1, Single mode, Downender up to accept fuel
- b. Step 8.1.7.3, Single mode, " " " "
- c. Step 8.2.7.1, Same as "a"
- d. Step 8.2.7.3, Same as "b"
- e. Step 8.3.7.1, same as "a"
- f. Step 8.3.7.3, same as "b"
- g. Step 8.4.7.1, same as "a"
- h. Step 8.4.7.3, same as "b"
- i. Step 8.5.7.1, same as "a"
- j. Step 8.5.7.3, same as "b"

2. Camera Assessment

Camera No.

Evaluation

(describe the view that the camera is capable of providing)

- a. NO. 1 + 2 Camera 1 not installed, Camera 2 view is of west wall and overhead beam → view is unacceptable, adjustments are required.
- b. NO. 3 + 10 Good view of downender in up or down position.
- c. NO. 1 + 2 Same as "a"
- d. NO. 3 + 10 Same as "b"
- e. NO. 1 + 2 Same as "a"
- f. NO. 3 + 10 Same as "b"
- g. NO. 1 + 2 same as "a"
- h. NO. 3 + 10 same as "b"
- i. NO. 1 + 2 same as "a"
- j. NO. 3 + 10 same as "b"

3. Recommendations: (Recommend cameras that provide the best view of the system)

- a. Install camera 1 so an assessment can be performed, adjust camera 2.
- b. Cameras 3 + 10 ~~give~~ provide ~~the best~~ an adequate view.
- c. same as "a"
- d. Same as "b"
- e. same as "a"
- f. same as "b"
- g. same as "a"
- h. same as "b"
- i. same as "a"
- j. same as "b"

Test Conductor

Hordey Cole

Date 1-18-92

QA

J. Alfaro

Date 1-18-92

CCTV Assessment

1. Operation: (describe type of operation here)

Retest of Section B.1.7.1 (Single Mode) see 1a of page E-2

2. Camera Assessment

Camera No.

Evaluation

(describe the view that the camera is capable of providing)

No. 1 + 2

Both cameras provided an unobstructed view of the Downender.

3. Recommendations: (Recommend cameras that provide the best view of the system)

None

Test Conductor

PHB Hayes

Date 2-14-92

QA

W. Mulvaney for SH

Date 7/22/92

APPENDIX F
TRAINING SIGN-OFF SHEET

NAME (Print)

JOSEPH A. YOST
GUY M-F. VERNER PHILIPPE
Gordon J. Cole

SIGNATURE

Joseph A. Yost 11/9/92
Guy M-F. Verner Philippe
Gordon J. Cole

APPENDIX I-4.4
NON-FUEL-BEARING CANISTER UPENDER
(WBS 1.3.4.2)
TEST RESULTS AND ANALYSIS REPORT

1.0 INTRODUCTION

This appendix addresses the System Operational Test (SOT) performed on the Non-Fuel-Bearing Canister (NFBC) Upender (Ref. 9315-TP-204, Attachment 1 to this appendix). It provides an overview of the function of the equipment, procedures used for testing, results obtained during testing, and any conclusions and recommendations reached during testing. The purpose of the SOT was to verify that the as-built condition of the system met or exceeded the associated performance requirements. The primary objectives of the testing were as follows:

- Verification of system mechanical operation under loaded and unloaded conditions.
- Verification of system part-program operations with the equipment under loaded and unloaded conditions.
- Verification of software interlocks.
- Verification of system interface.

Due to the refocused test program, the NFBC Upender was not required for the Integrated System Tests (IST). The NFBC canister loading and unloading operational test section was not performed and therefore could not be verified.

2.0 EQUIPMENT FUNCTION

The NFBC Upender (Ref. DWG. 9315-M-4101) is designed to safely position non-fuel bearing canisters within the clean area of the cell. This system provides for the vertical to horizontal positioning of the canister during loading and unloading operations.

The NFBC Upender consists of four removable modules: 1) stationary base frame, 2) movable frame, 3) main drive system, and 4) canister clamping system. Each of these modules operates in a predefined sequence for positioning a canister.

The stationary frame provides the primary support for the NFBC Upender. This frame is a truss-type structure constructed from structural tubing. This frame is bolted to the floor through a series of base plates.

The movable frame provides the primary support for the NFBC canister. This frame is a platform fabricated from structural tubing and plate. The NFBC canister is restrained in the upender by a lower support structure and a set of clamps. The lower

support structure is a steel weldment bolted to the movable frame where a load cell resides that is utilized to verify the presence of a canister. Welded to the movable frame is a pivot shaft. This shaft is located midway along the length of the frame and is connected to the stationary base frame through two pillow block bearings.

Connected to the pivot shaft is the main drive system. This system provides for the vertical to horizontal positioning of the movable frame. This system consists of a gearbox powered by a servo-drive motor. This servo-drive motor has a built-in resolver which provides for the closed loop control of both the operating speed and positioning of the movable frame.

The canister clamping system provides restraint and support for either a 20.0 inch square NFBC canister or a 8.74 inch square fuel canister. One side of the clamp is a welded plate assembly which consists of an L-shaped bracket. The other side of the clamp is of a similar design. This clamp also consists of an L-shaped bracket with a structural angle on top. This bracket is pinned to the clamp arms. When the pins are removed, the L-shaped clamp pivots to the horizontal position and enables a fuel canister to be mounted onto the NFBC Upender for loading of a fuel assembly which cannot be processed in the cell.

3.0 TEST PROCEDURE

The test procedure (Ref. Attachment 1 to this appendix) defines the requirements and instructions for qualifying the NFBC Upender for Integrated System Testing. This testing was organized as follows:

- Travel Sensor Operation Verification Test - Proximity sensor and limit switches were tested by driving the carriage drive and the clamp drive systems to each end of travel and verified that hardstops were not engaged and the Control System indicated end of travel had been reached.
- NFBC Upender Drive System Operation Under No-Load Test - This section tested and verified the carriage and clamp drive systems operating parameters utilizing the HAND mode. Parameters such as torque, current, travel time, and distance were measured and compared to the acceptance criteria.
- Load Cell Operation Verification Test - This section verified and tested the proper operation and the correct Control System response to the presence and absence of load on the load cell.

- NFBC Canister Installation in the NFBC Upender Upper Frame - This section tested and verified the proper installation and positioning of a NFBC canister onto the upender using the Ex-Cell Crane. Load cell indications were verified for presence and absence of the canister.
- Servo Motor Drive Fault Test - This section tested the servo-drive motor to verify that if a fault was implemented, the alarm system would deactivate the motor, notify the operator as to the cause of the fault, printout a report of the condition, signal an audio alarm, and activate specific cameras to be called up on the control console. Additionally, this test verified that the system could be recovered from the fault condition.
- Drive System Interlock Verification Test - This section verified the correct machine response to all of the software interlocks designed into the system.
- SINGLE Mode Verification Test - This section verified the automatic sequence of operation in the single step performed as designed in the proper order.
- AUTO Mode Verification Test - Much like the SINGLE Mode Verification Test, this section verified the automatic process sequence operated in the correct and uninterrupted order.
- NFBC Canister Loading and Unloading Operational Test - This section verified the mechanical and Control System interfaces between the NFBC Upender and the NFBC Loader.
- SINGLE Mode Verification Under Load Test - Similar to the SINGLE Mode Verification Test, this section verified the automatic mode of operation under load in single step.

The test results and data for each of these test sections are contained within the record copy (Ref. Attachment 1) of this test procedure. Each test step has been signed by appropriate personnel as required for final disposition of this SOT. Section 4.0 of this volume provides a typical format for the test procedures and includes an explanation and reference as to the location of the test data included in the various sections of the test procedure.

Two processes were implemented for making all necessary changes to the official test procedures and/or equipment. The first process is a Temporary Procedure Change Notice (TPCN). The TPCNs were used to make changes to the test procedure. For this test procedure,

six TPCNs were issued as follows:

- TPCNs #1, 3, and 5 were issued to delete or to revise prerequisites, test steps, and acceptance criteria which could not be performed as written.
- TPCN #4 was issued to correct errors in the test procedure.
- TPCN #2 was issued to add or to clarify test procedure steps.
- TPCN #6 was issued because of the refocused Phase III test program as detailed in HALLIBURTON NUS letter ED-DOE-PVJ-92-2334, dated 5-5-92.

Each TPCN identified the change to the test procedure, reason for change, and final disposition for approval. A copy of each TPCN is included in Attachment 1.

The second process is an Exception/Repair Log (ERL). The ERLs were used to document fixes to the equipment required to meet acceptance criteria or to justify acceptance of the test results that did not meet the test criteria. For this test procedure, six ERLs were issued as follows:

- ERLs #1, 2, 3, and 6 were issued to take exception to prerequisites not completed prior to testing.
- ERL #4 was issued to accept results that did not meet the acceptance criteria.
- ERL #5 was issued to implement fixes to the equipment or software necessary to meet the acceptance criteria.

Each ERL identified the problem encountered during testing, the proposed solution to the problem, and the final disposition (accept as is or fix) to close out the ERL. A copy of each ERL is included in Attachment 1.

If a change to the acceptance criteria was required, a Test Acceptance Criteria (TAC) Change Notice (TCN) was issued against the TAC document. A TPCN would then be issued to reflect changes to the procedure. For this procedure, two TCNs were issued against the TAC. The TCNs issued against the TAC documents can be found in the Test Section of the QA Records Package, which is a Phase III deliverable.

4.0 TEST RESULTS

The design and operating parameters for the NFBC Upender are not fuel dependent. Therefore, each test sequence did not need to be performed for the different types of fuel assemblies being processed. During testing of the NFBC Upender, the Test Program was refocused to test Westinghouse 17x17 fuel only, and no fuel skeleton was processed through the NFBC system. As a result of this, the canister loading and unloading operational test section was not tested.

4.1 TRAVEL SENSOR OPERATIONAL VERIFICATION TEST

The purpose of this test was to verify that the upender movable frame and clamp system were disabled prior to hardstop engagement and that the Control System end-of-travel indicators were functioning upon sensor actuation. The servo-drive (movable frame drive) utilizes one proximity sensor at its vertical end-of-travel which also functions as its homing switch, whereas the linear actuator (clamp drive) utilizes built-in limit switches to deactivate the drive. All tests were performed in JOG mode of operation, which allowed full travel of each drive system. Each drive was operated a minimum of three times to verify repeatability. As a result of this test, all sensors were judged acceptable for continuing on to the next series of tests.

4.2 NFBC UPENDER DRIVE SYSTEM OPERATIONAL UNDER NO-LOAD TEST

The purpose of this test was to verify that the movable frame drive and the clamp drive system operated through their full programmed range of motion. Operating parameters such as torque, current, travel time, and distance were obtained. The primary objective was to demonstrate the positioning accuracy and repeatability of these drive systems.

The first drive system to be tested was the movable frame drive (M-115A). The Control System was placed in HAND mode and the movable frame was operated from set point to set point. This was done a minimum of three consecutive times to establish repeatability. During each move the position of the movable frame, drive motor torque, and travel time were measured and recorded (Ref. Attachment 1). In each case the acceptance criteria were met for the movable frame. The movable frame was successfully driven to a vertical position of 89.5 degrees and a full down position, which brought it into contact with the hardstop each time. In addition, the motor torque measurement was taken from the control screen and was continually measured at less than 5.2 ft-lbs; travel time was less than 65 seconds.

The next system to be tested was the clamping system for the NFBC Upender (M-115B). Again the Control System was placed in HAND mode and the clamps repeatedly operated through their full programmed range of motion. In each case with the clamp set up for the NFBC canister, the clamping system met the acceptance criteria. With the clamp set up for the FBC canister, the clamping system met the acceptance criteria except for the opening dimension. In this case, the opening dimension was 0.27 inch less than the acceptance criteria (Ref. ERL #4). Since the FBC canister has an outer dimension of 8.74 inches, the measured opening of the clamps of 10.73 inches provides a clearance of greater than one inch, which is sufficient to place a canister onto the upender. Therefore, both drive systems were judged acceptable for continuing on to the next series of tests.

4.3 LOAD CELL OPERATION VERIFICATION TEST

The purpose of this test was to verify that the equipment properly responded to the sensor signal and/or that the proper signals were registered at the Control System. This was repeated a minimum of three times to ensure repeatability.

The purpose of this sensor is to provide a signal to the Control System as a verification of loaded/unloaded condition of the NFBC Upender. This test consisted of placing and removing a test load of 100-200 lbs. into the bottom support and verifying that the Control System received a signal only when the load was present. In each instance, the sensor functioned as designed and met the acceptance criteria. Therefore, it was judged acceptable for continuing on to the next series of tests.

4.4 NFBC CANISTER INSTALLATION IN THE NFBC UPENDER UPPER FRAME

The purpose of this test was to verify the proper positioning, presence of a canister through the Control System, and installation of a NFBC canister onto the upender. With the clamps opened to its programmed position for an NFBC canister using the Ex-Cell Crane, an empty NFBC canister was properly positioned and lowered onto the movable frame bottom support. The Control System indicated the presence of a canister. Verification of the clamps properly supporting the canister was also verified. Therefore, it was judged acceptable for continuing on to the next series of tests.

4.5 DRIVE SYSTEM INTERLOCK VERIFICATION TEST

The purpose of this test was to verify that the movable frame drive and the clamp drive system would operate only to a predefined set of conditions. Performed in HAND mode, this test was comprised of either applying or not applying various interface conditions

through temporary changes in the Control System data registers. Once these interfacing conditions were set up, an attempt was made to operate the appropriate drive system. This test continued until every possible combination of interfaces was tested to verify that each drive system would operate only under the proper conditions.

During this test, 22 different combinations of these interfaces were verified for three different motor operations. In all, two errors were found (Ref. ERL #5) in the program logic and corrected. In addition, TPCN #3 was issued to correct the test procedure.

4.6 SERVO-MOTOR DRIVE FAULT

This test sequence consisted of implementing a servo-drive fault during the operation of the main drive system. The purpose of this test was to verify that the equipment properly responded to the fault condition and that the proper signals and error messages were displayed at the Control System. The test was executed by operating the main drive system in SINGLE mode and simulating a torque fault condition by temporarily changing the torque setting in the Control System. Once initiated, the system performed as designed, meeting all acceptance criteria as follows:

- Motor was automatically deactivated when the fault condition was applied.
- Audio alarm was automatically activated and silenced by operator.
- Fault condition was displayed on the control console.
- A report printed the fault condition.
- Cameras 11 and 12 were called up and displayed.
- System was recovered from the fault condition.

TPCN #4 was issued to correct the test procedure. TAC Change Notice #001 was issued to correct the TAC document. Based on these results, the NFBC Upender and the Control System were judged to be acceptable for continuing on to the next series of tests.

4.7 SINGLE MODE VERIFICATION

The purpose of this test was to verify that the NFBC Upender auto sequence was correct and that the single step function operated as designed. Set up of the SINGLE mode test was similar to the interlock tests. Multiple Control System data registers were temporary modified so the equipment would think that all

interfacing machines were either safe or in the proper position. Prior to initiating this test, TPCN #5 was issued to eliminate the process step to manually enter the canister serial number. In addition, an indication that the canister is full is not a prerequisite for raising the canister. TAC Change Notice #002 was issued to correct the TAC document.

Once the initial setup was completed, the single step test sequence was operated to verify proper sequential order. All drives moved to their proper positions and in their correct sequential orders. All hold points were generated and functioned at the correct process steps. Cameras 11 and 12 were called up during the test sequence, were verified to be correct, and provided an adequate view of the equipment. Based on these results, the system was judged acceptable for continuing on to the next series of tests.

4.8 AUTO MODE VERIFICATION

Similar to the SINGLE mode test, the purpose of the AUTO mode test was to verify that the NFBC Upender system sequence was correct and that the automatic function operated as designed. Since the SINGLE mode test was completed prior to this test, temporary changes to the Control System data registers remained the same; therefore, Control System setup was minimal.

The automatic sequence operated as anticipated without encountering any problems. The only operator intervention required was during hold points. All drives moved to their proper positions and in their correct sequential orders. Based on these results, the system was judged acceptable for continuing on to the next series of tests.

4.9 NFBC CANISTER LOADING AND UNLOADING OPERATION

As previously mentioned, the NFBC Loading and Unloading Operational Test was not performed due to the refocused test program; therefore, the mechanical interface between the NFBC Upender and the NFBC Loader could not be evaluated.

4.10 SINGLE MODE VERIFICATION UNDER LOAD

Similar to the SINGLE mode test, the purpose of this test was to verify that the NFBC Upender System auto sequence was again correct and the automatic function operated as designed under load.

The automatic sequence operated as anticipated without encountering any problems. All drives moved to their proper positions and in the correct sequential order. Based on these results, the system was judged acceptable for continuing on to the next series of tests.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

In general, the NFBC Upender performed as designed. The mechanical interface between the NFBC Upender and the NFBC Loader was not performed; therefore, this operation could not be evaluated. The following conclusions are drawn from the NFBC Upender SOT.

- All drives operated as designed under both loaded and unloaded conditions.
- The NFBC Upender performed successfully under all control modes of operation (JOG, HAND, SINGLE, and AUTO).
- The interlocks performed as designed.
- The NFBC Upender operated as designed under fault conditions.

Based on these conclusions, the NFBC Upender has been judged acceptable for the modes of operation tested.

5.2 RECOMMENDATIONS

As a result of the SOT performed, several recommendations, along with those identified in Section 7.0 of the main body of this report, should be implemented for the next generation system. These recommendations are as follows:

- Provide the main drive system with an absolute resolver for position control. This will eliminate the need to "HOME" the system periodically and thus eliminate the error introduced by the homing process.
- Reevaluate the use of proximity switches for end-of-travel limit switches. These switches require extensive setup time, making them impractical for remote applications.
- Reevaluate the width of the clamp opening for the FBC canister. The L-shaped bracket can be modified to provide more clearance for FBC canister loading.
- Provide tapered lead-in on clamps for greater clearance of accepting a canister during loading operations.

ATTACHMENT 1
SYSTEM OPERATIONAL TEST PROCEDURE
FOR THE
NON-FUEL BEARING CANISTER UPENDER
(WBS 1.3.4.2)
DOCUMENT NO. 9315-TP-204

HALLIBURTON NUS
Environmental Corporation

Record Copy
Signature Peter V. Juhl Date 3/14/92

TEST PROCEDURE

CLIENT: DOE Idaho SPECIFICATION NO: 9315-TP-204

LOCATION: Cold Test Facility REVISION: 2

TITLE: **SYSTEM OPERATIONAL TEST PROCEDURE - NFBC UPENDER**

RELEASED FOR:

☐

REVIEW

☒

TEST

SYSTEM OPERATIONAL TEST PROCEDURE
FOR
NFBC UPENDER

(WBS 1.3.4.2)

APPROVED F. M. Mallo
PROJECT MANAGER

DATE 10/30/91

APPROVED [Signature]
QUALITY ASSURANCE

DATE 10/30/91

APPROVED [Signature]
DISCIPLINE MANAGER

DATE 10/30/91

APPROVED [Signature]
AUTHOR

DATE 10.28.91

2	<u>[Signature]</u>	<u>10/30/91</u>	<u>[Signature]</u>	<u>11/28/91</u>	<u>[Signature]</u>	<u>11/28/91</u>	<u>[Signature]</u>	<u>11/28/91</u>		
REV	PREPARED	DATE	APPROVED	DATE	APPROVED	DATE	APPROVED	DATE	APPROVED	DATE

NUS CORPORATION

CLIENT

REVISION CONTROL SHEET

REVISED PAGE NO.

LATEST REVISION

Date

Original

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5-29-91

A11

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10-14-91

A11

2

11-20-91

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| 2

1.0 OBJECTIVE OF TEST

The objective of this Test Procedure is to demonstrate the acceptability of the NFBC Upender. These detailed test steps will demonstrate the acceptability of the equipment to satisfy design requirements.

2.0 PREREQUISITES

2.1 System set-up has been performed per the instruction of Appendix A.

Test Conductor

Date 3/21/92

QA

Date 3/21/92

2.2 Camera, film, lighting and personnel are available to take photographs and or videos per the instruction of Appendix C, and the detailed procedure steps (Section 8.0).

Test Conductor

Date 3-21-92

QA

Date 3/21/92

2.3 The QA/QC Data Package has been prepared in accordance with Specification 9315-M-200, and the applicable Bill of Material, and is acceptable.

Test Conductor

Date 3-21-92

QA

Date 3/21/92

2.4 The system has been assembled in accordance with all applicable Drawings, DCNs and FCRs of the QA/QC Data package.

Test Conductor

Date 3-21-92

QA

Date 3/21/92

2.5 The Test Conductor has been qualified and certified in accordance with QAP 2.0.

Test Conductor

Date 3-21-92

QA

Date 3/21/92

CL#01
3/21/92

- 2.6 All test personnel participating in this test have been trained per the instructions of Section 6.4 of reference 11.13. | 2

Test Conductor [Signature] Date 3/21/92
QA [Signature] Date 3/21/92

- 2.7 The checklist contained in the Control System SOT (9315-TP-601) applicable to this system must be completed and the results accepted prior to the initiation of testing under this procedure.

Test Conductor [Signature] Date 3/21/92
QA [Signature] Date 3/21/92

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor [Signature] Date 3/21/92
QA [Signature] Date 3/21/92

RL-02
3/21/92

- 2.9 The system FAT has been completed and accepted by NUS.

Test Conductor [Signature] Date 3-21-92
QA [Signature] Date 3/21/92

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor [Signature] Date 3-21-92
QA [Signature] Date 3/21/92

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor [Signature] Date 3/21/92
QA [Signature] Date 3/21/92

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor [Signature] Date 3-21-92
QA [Signature] Date 3/21/92

- 2.13 Cameras No. 11 and No. 12 have been installed and are operational.

Test Conductor [Signature] Date 3-21-92
QA [Signature] Date 3/21/92

3.0 INITIAL TEST CONDITIONS

3.1 TV Monitors are "ON".

Test Conductor

Date 3/21/92

3.2 Immediate communication between all test observers and control system operators is available.

Test Conductor

Date 3-22-92

3.3 Movable frame of NFBC Upender (Dwg. 9315-S-4109) is in vertical position (89.5 ± 0.5) degrees with respect to upender bottom frame (Dwg. 9315-S-4110) top horizontal line.

Test Conductor

Date 3-22-92

4.0 ENVIRONMENTAL CONDITIONS

The HVAC system for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60°F to 90°F and 65°F to 85°F respectively. The relative humidity in the control room shall be in the range of 45% to 85%.

Test Conductor

Date 3-22-92

5.0 SPECIAL PRECAUTIONS

All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

6.1 Test Load per Dwg. 9315-M-0010 Group 2.

6.2 Canister Handling Equipment (Grapple) available and operable.

6.3 Test Cell Crane available and meet the applicable requirements of Chapter 7.0 of the DOE Hoisting and Rigging Manual.

6.4 Measuring Tape/Scale (6 ft/2 ft) (calibration not required).

6.5 Inside micrometer or measuring device with 8-10 inches range.

6.6 Stop watch (calibration not required).

6.7 Ammeter with 0-5 amps range.

- 6.8 Protractor with range of 0 to 90 degrees with an accuracy of 0.1 degree.

2

7.0 TEST DATA RECORDING

7.1 Test Data Records

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

Each of these modifications will be handled differently. If a correction is required to the procedure, it will be made with pen and ink in the "Record Copy", as they are found. The test conductor will make the appropriate change. Once the change is made, he will initial and date the change for future reference. All modifications which are considered minor changes must be documented on "Temporary Procedure Change Notice" (TPCN) forms (refer to Appendix D). This change shall be approved by the test conductor by annotating that the test procedures are using the TPCN form. All modifications which are considered a major change must also be documented on the TPCN form. However, when a major change is required, testing shall be halted until the TPCN is approved by the responsible Test Engineer, Test Conductor, Quality Assurance and Project Engineer.

7.3 Repairs/Retesting

This section addresses the process for making necessary repairs to the equipment and retesting of the system. If during testing a problem is observed which requires repair or rework of the equipment, testing shall be halted. If the repair/rework is minor, the Test Conductor will document the problem, cause, and corrective action implemented, the faulty system will be retested. All remaining tests will continue on until conclusion. If the problem requires redesign of the faulty system, all testing of this equipment will be halted. The problem and recommended solution will be documented and submitted to the Test Review Group (TRG) for approval. Once approval and the repair is complete, testing of the equipment will be accomplished in accordance with this procedure.

8.0 DETAILED TEST PROCEDURE

8.1 Travel Sensor Operation Verification Test:

8.1.1 Verify the operation of Main Drive Motor M-115A (Dwg. 9315-M-4101, Item 20) limit switch as follows:

Take photographs and record information in photographic log ✓ | 2
Film Roll #8, Frame #14 3/22/92 @ 8:20

WARNING

Stay away from the NFBC Upender upper (movable) frame while checking the frame travel limit to prevent any injury to personnel.

1. Switch the control system to the hand mode and lower the upper frame until the Main Drive Motor M-115A automatically shuts off. ✓
2. With the frame in down position switch the control system to JOG ✓ mode and set speed at 50% of full speed.
3. JOG the frame up until the Main Drive Motor M-115A automatically ✓ shuts off.

Take photographs and record information in photographic log | 2
Film Roll #8, Frame #13 3/22/92 @ 8:35
Acceptance Criteria

- ✓ • The Control System indicates that the end of travel sensor has been activated.
- ✓ • Upper Hard stop was not engaged.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

- ✓ 4. Override limit switch and Jog the NFBC Upender upper frame down 20 to 30 degrees from vertical.

Take photographs and record information in photographic log

Film Roll # 8, Frame # 12 3/22/92 @ 8:50

- ✓ 5. Repeat Steps 3 and 4 two additional times.

NOTE

Photographs do not have to be taken of the test setup when repeating the above steps

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

6. The above steps have been completed.

Test Conductor

Date 3/22/92

8.1.2

Verify the operation of the Clamp Actuator Motor M-115B (Dwg. 9315-M-4102, Item 12) limit switch as follows:

WARNING

Stay clear of the NFBC Upender clamps while in operation.

- ✓ 1. Switch the control system to the HAND mode and open the NFBC Upender clamps until the actuator motor M-115B automatically shuts off.
- ✓ 2. With the clamp fully opened, switch the control system to the JOG mode at full speed.
- ✓ 3. JOG the clamps closed until the actuator motor M-115B automatically shuts off prior to engaging the hard stop.

Take photographs and record information in photographic log

Film Roll # 8, Frame 11 3-22-92 @ 9:00

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

- ✓ 4. JOG the clamps open until the actuator motor M-115B automatically shuts off, prior to engaging the hard stop.

Take photographs and record information in photographic log

Acceptance Criteria

- ✓ • The control system indicates that the end of travel sensor has been activated.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

5. Repeat steps 3 and 4 two additional times.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

6. The above steps have been completed.

Test Conductor

Date 3-22-92

8.2 NFBC Upender Drive System Operation under NO LOAD test:

With NO LOAD in the NFBC Canister Upender, operate and verify operational parameters for each drive system.

8.2.1 Main Drive System Operation Verification Test:

Verify the Main Drive Upper frame (Dwg. 9315-S-4109) travel limits, travel time and drive motor torque as follows:

WARNING

Stay away from the NFBC Upender upper frame while checking the frame travel limit to prevent any injury to personnel.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN PHOTOGRAPHIC LOG

Film Roll # 8, Frame 9 *off* 3/22/92 @ 9:30

1. Switch the control system to the HAND mode and lower the NFBC Upender upper (movable) frame (Dwg. 9315-S-4109) until the Main Drive Motor M-115A automatically shuts off. Measure and record the verticality (Total travel from vertical to horizontal position) of the upender upper frame, travel time to lower the frame from vertical to horizontal position and the maximum motor torque to lower the upper frame, using angular measuring device, a stop watch and verifying control screen for max. motor torque respectively.

Type of Measuring Device ^{Digital} ~~Protractor~~ Range VARIOUS

Identification Number M9-29 Calibration Due Date 09-26-92

Verticality (Total travel of upender upper frame from vertical to horizontal position) 89.5 degrees.

Time to lower the upender upper frame 5.71 seconds.

Max. motor torque 0.211 lb. ft. (control screen reading) when lowering the frame.

NOTE

Angle may be obtained by triangulation measurements and calculation of included angle.

Acceptance Criteria

- Verticality is 89.5 ± 0.5 degrees.
- Time to lower the NFBC Upender upper frame from vertical to horizontal position is 65 ± 5 seconds.
- Max. motor torque when lowering the frame is less than 5.2 lb. ft.

Test Conductor

[Signature]

Date 3-22/92

QA

[Signature]

Date 3/22/92

2. Switch the Control System to the HAND mode and raise the NFBC Upender upper frame (Dwg. 9315-S-4109) until the Main Drive Motor M-115A automatically shuts off. Measure and record the verticality (Total travel from horizontal to vertical position) of the upender upper frame, travel time to raise the frame from horizontal to vertical position and the maximum motor torque to raise the upper frame, using angular measuring device, a stop watch and verifying the control screen for maximum motor torque respectively.

Take photographs and record information in photographic log

| 2

Type of Measuring Device	<u>Digital</u>	Range	<u>Various</u>
Identification Number	<u>M9-27</u>	Calibration Due Date	<u>09-22-92</u>

Verticality (Total travel of upender upper frame from horizontal to vertical position) 89.4 degrees.

Time to raise the upender upper frame 56.76 seconds.

Max. motor torque 0.123 lb. ft. (control screen reading) when raising the frame.

Acceptance Criteria

- Verticality is 89.5 ± 0.5 degrees.
- ✓ • Time to raise the NFBC Upender upper frame from horizontal to vertical position is 65 ± 5 seconds.
- Max. motor torque when raising the frame is less than 5.2 lb. ft.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

3. Repeat Steps 1 and 2 two additional times and record data below:

Verticality (when lowering the frame) 89.4 degrees.

Time to lower the frame 58.19 seconds.

Max. motor torque (when lowering the frame) 194 ^{lb. ft} degrees. 89.4 3/22/92

Verticality (when raising the frame) 58.11 degrees.

Time to raise the frame 58.11 seconds. 3/22/92

Max. motor torque (when raising the frame) 0.132 lb. ft.

Verticality (when lowering the frame) 89.4 degrees.

Time to lower the frame 57.99 seconds.

Max. motor torque (when lowering the frame) 0.189 lb. ft.

Verticality (when raising the frame) 89.5 degrees.

Time to raise the frame 58.06 seconds.

Max. motor torque (when raising the frame) 0.123 lb. ft.

Acceptance Criteria

- Verticality when lowering the frame is 89.5 ± 0.5 degrees.
- Time to lower the frame is 65 ± 5 seconds.
- Max. motor torque when lowering the frame is 5.2 lb. ft.
- Verticality when raising the frame is 89.5 ± 0.5 degrees.
- Time to raise the frame is 65 ± 5 seconds.
- Max. motor torque when raising the frame is 5.2 lb. ft.

Test Conductor

[Signature]
[Signature]

Date 3/22/92

QA

Date 3/22/92

4. The above steps have been completed.

Test Conductor

[Signature]

Date 3/22/92

8.2.2 Clamp Drive System Operation verification test: Clamp drive system operation is verified for the following two cases:

Take photographs and record information in photographic log

Roll # 8, Frame # 8 Off 3/22/92 @ 10:00

1. With the clamps set up for a NFBC canister, cycle the clamps open and close.
Roll # 8, Frame # 7 Off 3/22/92 @ 10:07
2. With the clamps set up for FBC canister, cycle the clamps open and close.

8.2.2.1 With the clamps set up for a NFBC canister, verify the clamps actuator motor M-115B (Dwg. 9315-M-4102, Item 12) position transducer set points as follows:

WARNING

Stay away from the NFBC Upender Canister clamps while in operation

1. Switch the Control System to the HAND mode and close the NFBC canister clamps until the actuator motor M-115B automatically shuts off. Measure and record the time to close clamps and the motor current using a stop watch and ammeter.

Type of Measuring Device Multimeter Range VARIOUS

Identification Number NUS-002 Calibration Due Date 10-30-92

Motor current 2.16 amps

Closing time 1.64 seconds.

Acceptance Criteria

- Time to close the clamps is 3.00 ± 0.5 seconds.
- Max. motor current when closing the clamp arms is 2.30 amps.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

2. Measure and record the clamp opening between the clamp plate (Item 4 of Dwg. 9315-M-4107) and clamp plate (Item 5 of Dwg. 9315-M-4108) in fully closed position for both east and west end of clamps using an inside micrometer or caliper.

Take photographs and record information in photographic log

2

Type of Measuring Device Multimeter Range VARIOUS

Identification Number NUS-002 Calibration Due Date 10-30-92

Distance between clamp plates in the CLOSED position of clamps at East end 19.93 inches and West end 19.93 inches.

Acceptance Criteria

- The dimension between the clamp plates measured in fully closed position of the clamps is 20.00 ± 0.12 inches for both east and west end of clamps.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

3. Open the NFBC canister clamps until the actuator motor M-115B automatically shuts off. Measure and record the time to open clamps and the motor current using a stop watch and ammeter.

Motor current 0.42 amps
Opening time 1.56 seconds.

Acceptance Criteria

- The time to open clamps 3.00 ± 0.5 seconds.
- Max. motor current when opening the clamp arms is 2.30 amps.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

4. Measure and record the clamp opening between the Clamp plate (Item 4 of Dwg. 9315-M-4107) and clamp plate (Item 5 of Dwg. 9315-M-4108) in fully opened position for both east and west end of clamps using an inside micrometer or caliper.

Distance between the clamp plates in the Opened position of clamps at East end 22.06 inches and west end 22.06 inches.

Take photographs and record information in photographic log

2

Acceptance Criteria

- The dimension between the clamp plates measured in fully opened position of the clamps is $22.00 + 0.12 - 0.00$ inches for both east and west end of clamps.

Test Conductor

Date 3-22-92

QA

Date 3/22/92

5. Repeat steps 1 thru 4 two additional times and record data below.

NOTE

Photographs do not have to be taken of the test setup when repeating the above steps

Closing time 1.66 seconds.

Motor current (max.) during closing of clamps 0.06 amps.

Distance between clamp plates with clamps closed at East end 19.96 inches and at West end 20 inches.

Opening time 1.68 seconds.

Motor current (max.) during opening of clamps .26 amps.

Distance between clamp plates with clamps opened at East end 22.12 inches and at West end 22.12 inches.

Closing time 1.50 seconds.

Motor current (max.) during closing of clamps .06 amps.

Distance between clamp plates with clamps closed at East end 19.87 inches and at West end 19.87 inches.

Opening time 1.68 seconds.

Motor current (max.) during opening of clamps 0.16 amps.

Distance between clamp plates with clamps opened at East end 22.06 inches and at West end 22.06 inches.

Acceptance Criteria

- Time to close the clamps is 3.00 ± 0.5 seconds.
- Max. motor current during closing of clamps is 2.30 amps.
- Distance between clamp plates with clamps closed is
+ 0.00
20.00 - 0.12 inches for both east and west end of clamps.
- Time to open the clamps is 3.00 ± 0.5 seconds.
- Max. motor current during opening of clamps is 2.30 amps.
- Distance between clamps plates with clamps opened is
+ 0.12
22.00 - 0.00 inches for both east and west end of clamps.

Take photographs and record information in photographic log

Test Conductor

Date 3/22/92

QA

Date 3/23/92

6. The above steps have been completed.

Test Conductor

Date 3/22/92

8.2.2.2 Set up the clamps from NFBC canister operation to FBC canister operation as follows:

Take photographs and record information in photographic log

Roll # 5, Frame 6 of 3-22-92 @ 10:50

1. Remove two detent pins (Item 11 of Dwg. 9315-M-4102) from clamp arms (Items 7 and 21 of Dwg. 9315-M-4102).
2. Swing clamp assembly (Item 6 of Dwg. 9315-M-4102) 90° clockwise looking west.
3. Align the two detent pin holes in clamp assembly (Item 6 of Dwg. 9315-M-4102) to that in clamp arms (Items 7 and 21 of Dwg. 9315-M-4102) and insert the detent pin (Item 11 of Dwg. 9315-M-4102) two places in each clamp arm.

4. The clamping system is ready for FBC canisters.

8.2.2.3 With the clamps set up for a FBC canister, verify the clamp actuator motor M-115B (Dwg. 9315-M-4102, Item 12) position transducer set points as follows:

WARNING

Stay away from the FBC Canister clamps while in operation

1. Switch the Control System to the HAND mode and close the FBC canister clamps until the actuator motor M-115B automatically shuts off. Measure and record the time to close clamps and the motor current using a stop watch and ammeter.

Type of Measuring Device Multimeter Range VARIOUS

Identification Number NUS-002 Calibration Due Date 10-30-92

Motor current 0.21 amps

Closing time 1.45 seconds.

Acceptance Criteria

- Time to close the clamps is 3.00 ± 0.5 seconds.
- Max. motor current when closing the clamp arms is 2.30 amps.

Test Conductor

Date

QA

Date

2. Measure and record the clamp opening between the clamp plate (Item 6 of Dwg. 9315-M-4107) and clamp plate (Item 3 of Dwg. 9315-M-4108) in fully closed position for both east and west end of clamps using an inside micrometer or caliper.

Take photographs and record information in photographic log

2

Type of Measuring Device Caliper Range 12"
Identification Number NUS-001 Calibration Due Date 4-29-92

Distance between clamp plates in the CLOSED position of clamps at East end 8.62 inches and West end 8.62 inches.

Acceptance Criteria

- The dimension between the clamp plates measured in fully closed position of the clamps is 8.71 ± 0.12 inches for both east and west end of clamps.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

3. Open the NFBC canister clamps until the actuator motor M-115B automatically shuts off. Measure and record the time to open clamps and the motor current using a stop watch and ammeter.

Motor current 0.08 amps

Opening time 1.52 seconds.

Acceptance Criteria

- The time to open clamps 3.00 ± 0.5 seconds.
- Max. motor current when opening the clamp arms is 2.30 amps.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

4. Measure and record the clamp opening between the Clamp plate (Item 6 of Dwg. 9315-M-4107) and clamp plate (Item 3 of Dwg. 9315-M-4108) in fully opened position for both east and west end of clamps using an inside micrometer or caliper.

Distance between the clamp plates in the Opened position of clamps at East end 10.73 inches and west end 10.73 inches.

Take photographs and record information in photographic log

Roll # 8, Frame 5 3-22-92 @ 11:45
Acceptance Criteria

TCN # 001
RL # 04
3/22/92

- The dimension between the clamp plates measured in fully opened
+ 0.12
position of the clamps is 11.00 - 0.00 inches for both east and
west end of clamps.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

5. Repeat steps 1 thru 4 two additional times and record data below.

NOTE

Photographs do not have to be taken of the test setup when
repeating the above steps

Closing time 1.57 seconds.

Motor current (max.) during closing of clamps 0.17 amps.

Distance between clamp plates with clamps closed at east end
8.60 inches and at west end 8.60 inches.

Opening time 1.40 seconds.

Motor current (max.) during opening of clamps 0.08 amps.

Distance between clamp plates with clamps opened at east end
10.72 inches and at west end 10.72 inches.

Closing time 1.38 seconds.

Motor current (max.) during closing of clamps 0.21 amps.

Distance between clamp plates with clamps closed at east end
8.68 inches and at west end 8.68 inches.

Opening time 1.16 seconds.

Motor current (max.) during opening of clamps 0.06 amps.

Distance between clamp plates with clamps opened at east end
10.89 inches and at west end 10.89 inches.

Acceptance Criteria

- Time to close the clamps is 3.00 ± 0.5 seconds.
- Max. motor current during closing of clamps is 2.30 amps.
- Distance between clamp plates with clamps closed is
+ 0.00
8.71 - 0.12 inches for both east and west end of clamps.
- Time to open the clamps is 3.00 ± 0.5 seconds.
- Max. motor current during opening of clamps is 2.30 amps.
- Distance between clamp plates with clamps opened is
+ 0.12
11.00 - 0.00 inches for both East and West end of clamps.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

6. The above steps have been completed.

Test Conductor

Date 3/22/92

8.3

Load Cell Operation Verification Test

Take photographs and record information in photographic log

2

Load Cell (Item 7 of Dwg. 9315-M-4101) in the Bottom Support (Item 5 of Dwg. 9315-M-4101) of NFBC Upender upper frame (Item 2 of Dwg. 9315-M-4101) can be verified as follows:

1. Switch the control system to the HAND mode and raise the NFBC upender upper frame to vertical position.
2. Using test crane and grapple assembly (Dwg. 9315-M-9501) place a 100 to 200 lb weight on the bottom support top.
- ✓ 3. The load is placed on top of load cell.

Take photographs and record information in photographic log

2

Roll # B, Frame 3 off 3-22-92 @ 14:22
Acceptance Criteria

- ✓ • Control system indicates presence of Load.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

4. Remove the load from bottom support using Excell crane.

Acceptance Criteria

- ✓ • Control system indicates no Load.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

5. Repeat steps 2 thru 4 two additional times.

NOTE

Photographs do not have to be taken of the test setup when repeating the above steps

Acceptance Criteria

- Control system indicates the presence of the load when it is applied.
- Control system indicates no load when the load is removed.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

8.4 NFBC Canister Installation in the NFBC upender upper frame

Installing an empty NFBC canister using the Excell crane and grapple assembly (Dwg. 9315-M-9501) can be done as follows:

1. Start with NFBC canister upender upper frame in vertical position.

Take photographs and record information in photographic log

- ✓ 2. Remove two detent pins (Item 11 of Dwg. 9315-M-4102) from clamp arms (Item 6 of Dwg. 9315-M-4102).
- ✓ 3. Swing the clamp arm 90° outwards to NFBC canister position and insert the detent pins to lock the arm in the NFBC canister position.
- ✓ 4. Drive clamp actuator motor to OPEN position and position the empty NFBC canister approximately six (6) inches above the canister bottom support.
- ✓ 5. Move canister vertically into NFBC upender.
- ✓ 6. Verify the NFBC canister is properly positioned and lowered onto bottom support.

Take photographs and record information in photographic log

Roll #8, Frame 2 3/22/92 @ 14:47
Roll #8, Frame 1 3/22/92 @ 14:53

Acceptance Criteria

- Load cell indicates presence of NFBC canister.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

7. Drive NFBC upender with clamps closed.

Acceptance Criteria

- Canister was positioned and supported within the NFBC upender upper frame.

Test Conductor

Date 3/22/92

QA

Date 3/22/92

8. Open clamps and place canister into NFBC storage rack using Excell crane.

8.5 Drive System Interlock Verification Test:

Position NFBC upender and NFBC Loader so that no interlock of NFBC upender is satisfied. Place system in HAND mode and attempt to operate each drive as follows:

8.5.1 Main Drive motor M-115A to lower the NFBC upender upper frame:

Verify the main drive motor to lower upper frame interlocks as follows:

Take photographs and record information in photographic log

1. Place the control system in the HAND mode.
2. Impose the following combination of conditions as identified in the test and verify if the NFBC upender upper frame can be lowered down. Mark the appropriate column per the test result.

Condition

- A. NFBC Loader back.
- B. No canister in upender.
- C. NFBC canister clamp closed.

NOTE:

Zero (0) signifies condition not applied.
One (1) signifies condition applied.

Test	A	B	C	System Operates with		Expected Result
i	0	0	0	☐	yes	no
ii	1	1	1	☒	yes	no
iii	0	1	0	☐	yes	no
iv	1	0	1	☒	yes	no
v	0	1	1	☐	yes	no
vi	1	0	0	☐	yes	no
vii	0	0	1	☐	yes	no
viii	1	1	0	☒	yes	no

RL#03

6/22/92

Acceptance Criteria

- System does not operate unless the following conditions are satisfied: A+ (B or C).

Test Conductor

 Date 3-22-92

QA

 Date 3/22/92
8.5.2 Main Drive Motor M-115A to raise the NFBC upender upper frame:

Verify the Main Drive Motor to raise the upper frame interlocks as follows:

1. Place the control system in HAND mode.
2. Impose the following combination of conditions as identified in the test and verify if the NFBC upender upper frame can be raised up. Mark the appropriate column per the test result.

Take photographs and record information in photographic log

12

Condition

- A. NFBC Loader back.
- B. NFBC canister clamp closed.
- C. No canister in upender.

NOTE:

 Zero (0) signifies condition not applied.
 One (1) signifies condition applied.

Test	A	B	C	System Operates with		Expected Result
i	0	0	0	☒ yes	☒ no	no
ii	1	1	1	☒ yes	☒ no	yes
iii	0	1	0	☒ yes	☒ no	no
iv	1	0	1	☒ yes	☒ no	yes
v	0	1	1	☒ yes	☒ no	no
vi	1	0	0	☒ yes	☒ no	no
vii	0	0	1	☒ yes	☒ no	no
viii	1	1	0	☒ yes	☒ no	yes

RL#05
6/13/22/92

Acceptance Criteria

- System does not operate unless the following conditions are satisfied: A+ (B or C).

Test Conductor

Date 3-22-92

QA

Date 3/22/92

8.5.3 NFBC upender clamp drive motor M-115B to open the clamps:

Verify the clamp drive motor to open the clamp interlocks as follows:

- Place the control system in HAND mode.
- Impose the following combination of conditions as identified in the test and verify if the NFBC upender upper clamp can be opened up. Mark the appropriate column per the test result.

Take photographs and record information in photographic log

Condition

- No NFBC canister.
- Carriage down.
- Confirm by operator at "Hold Point".

TPCN#03
6/13/22/92

NOTE:

Zero (0) signifies condition not applied.
One (1) signifies condition applied.

Test	A	B	C	System Operates with		Expected Result
i	0	0	0	☒ yes	☒ no	no
ii	1	1	1	☒ yes	☒ no	yes
iii	0	1	0	☒ yes	☒ no	yes
iv	1	0	1	☒ yes	☒ no	yes
v	0	1	1	☒ yes	☒ no	yes
vi	1	0	0	☒ yes	☒ no	yes
vii	0	0	1	☒ yes	☒ no	yes
viii	1	1	0	☒ yes	☒ no	yes

TPCN#03
6/13/22/92

Acceptance Criteria

TPCN #03

6/3/22/92

- System does not operate unless the following conditions are satisfied: A or B or C.

8.6 Servo Motor Drive Fault Test

Test Conductor

QA

DATE 3/22/92

DATE 3/22/92

WARNING

Stay clear of the NFBC Upender clamps while in operation.

Take photographs and record information in photographic log

TPCN #04

6/3/22/92

1. Place the NFBC Upender System in the "HAND" mode and initiate downending operations to lower the NFBC upender upper frame.
2. Temporarily force Data Register to implement a torque fault with the NFBC upender Main Drive Servo Motor (M-115 A).
3. Press "CONTINUE" to lower the NFBC upender upper frame and verify the Main Drive Motor (M-115 A) stops and registers a fault in the control room.

Acceptance Criteria

- ✓ • Motor stops when fault condition is implemented.
- ✓ • Alarm System is activated.
- ✓ • Alarm is silenced when acknowledged by operator.
- ✓ • Control System displays fault condition on control screen.
- ✓ • A report is printed defining the fault condition when commanded by the operator.

Test Conductor

Date

QA

Date

4. Verify Cameras No. 11 and No. 12 are activated and view the NFBC Upender System when the "CAMERA CALL" button is touched. Fill out a CCTV Assessment Form in Appendix E.

Acceptance Criteria

- The system can be recovered from fault condition and "SINGLE" mode operations continued.

Test Conductor

Date

3/22/92

QA

Date

3/22/92

6. The above steps have been completed.

Test Conductor

Date

3/22/92

8.7 Single Mode Verification Test

Place the NFBC upender system in SINGLE mode and verify system automatic sequence. This test verifies the following sequence of operations of NFBC upender system:

Take photographs and record information in photographic log

WARNING

Stay clear of the NFBC Upender System while in operation.

1. Verify Empty NFBC canister loading into the NFBC upender upper (movable) frame in up (vertical) position with clamps "open".
2. Verify Empty NFBC canister is placed into loading (horizontal) position for the NFBC loader to push the skeletons (load) into the NFBC canister.
3. Verify that the fully loaded NFBC canister is upended vertically for removal of the canister from the NFBC upender after completing the canister closure operation to the NFBC storage rack.

NOTE

Operator must press "CONTINUE" between each successive motion to complete operation.

- 8.7.1 Verify NFBC Canister loading into the NFBC upender upper frame in "UP" position with clamps "open" as follows:

Take photographs and record information in photographic log

1. Place NFBC upender system in "SINGLE" mode by calling up NFBC upender in control screen and pressing "single" mode on screen.

Acceptance Criteria

- NFBC upender upper frame is positioned in full "up" position with clamps "Open" when placed in "SINGLE" mode.
- "HOLD POINT" is generated to ^{LOAD} record canister serial number.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

2. Press "CAMERA CALL" on control screen and record canister serial number. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the Control Screen.
- Pan, Tilt and Zoom are functional and cameras No. 11 and No. 12 can be positioned to obtain an unobstructed view of top end of canister.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

3. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on the screen a "HOLD POINT" is generated to verify an empty NFBC Canister is properly seated in bottom support.

Test Conductor

Date

QA

Date

4. Press "CAMERA CALL" on Control Screen. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the Control Screen.

TCN-00
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OS
GF
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TCN
002
+
TPCN
OS
GF
3/23/92

- Pan, Tilt and Zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor

Date

QA

Date

- 8. When "CONTINUE" is TOUCHED ON THE CONTROL SCREEN, LOWER CANISTER OR Simulate load on lower support load cell by temporarily forcing Data Register to verify receipt of canister.

Acceptance Criteria

- Signal received that an empty NFBC Canister is on the lower support load cell.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

- 4. Press "CONTINUE" on Control Screen.

Acceptance Criteria

- When "CONTINUE" is touched on the Control Screen the same "HOLD POINT" to verify that an empty NFBC Canister is properly seated at lower support as generated unless lower support load cell indicates presence of load.
- Clamps are closed and "Hold Point" is generated to verify excell crane is clear of NFBC upender.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

- 5. Press "CAMERA CALL" on Control Screen. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on the monitors when "CAMERA CALL" is touched on the Control Screen.

TCN-00
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2

TPCN#0:
GP
3/23/92

TPCN#05
GP
3/23/92

- Pan, Tilt and Zoom are functional and both cameras can be positioned to achieve an unobstructed view of the NFBC upender upper (movable) frame and excell crane interface.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

78. Steps 1 thru ⁶ X have been completed.

Test Conductor

Date

TPCN#05
6/3/23/92

8.7.2 Verify NFBC canister is placed into loading (horizontal) position for the NFBC Loader to push the load (skeletons) into the NFBC Canister as follows:

Take photographs and record information in photographic log

1. Press "CONTINUE" on Control Screen once crane is clear.

Acceptance Criteria

- When "CONTINUE" is touched on the Control Screen the NFBC upender upper (movable) frame is lowered to the horizontal position.
- Signal generated that an empty NFBC Canister is in place for the NFBC loader to push the skeletons (load) into the canister.

Test Conductor

Date

QA

Date

2. The above step has been completed.

Test Conductor

Date

8.7.3 Verify that the fully loaded Canister is upended vertically for removal of the Canister from the NFBC upender after completing the canister closure operation to the NFBC storage rack as follows:

Take photographs and record information in photographic log

1. Simulate full load in the canister by temporarily forcing data register to simulate canister loading.

6. PRESS "CONTINUE" ON THE CONTROL SCREEN

ACCEPTANCE CRITERIA

- When "CONTINUE" is touched on the Control Screen the NFBC UPENDER UPPER (MOVABLE) FRAME IS LOWERED TO THE HORIZONTAL POSITION.

TEST CONDUCTOR

DATE 3-23-92

QA

DATE 3/23/92

TPCN#05
6/3/23/92

Acceptance Criteria

- NFBC Canister is upended when fully loaded.
- "Hold Point" to verify canister closure operation.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

2. Press "CAMERA CALL" on control screen and verify canister closure operation. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on control screen.
- Cameras can be positioned to obtain an unobstructed view to verify "CANISTER CLOSURE OPERATION"

Test Conductor

Date 3-23-92

QA

Date 3/23/92

3. Manually attach canister lid with crane hook attached to the canister.

Acceptance Criteria

- Canister lid is attached to the canister.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

4. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on the control screen a "HOLD POINT" is generated to verify crane is attached.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

5. Press "CAMERA CALL" on control screen and verify crane is attached.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.
- Cameras can be positioned to obtain an unobstructed view to verify crane is attached.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

6. Press "CONTINUE" on Control Screen and verify clamps are opened.

Acceptance Criteria

- Clamps are opened when "CONTINUE" is touched on the control screen.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

7. ~~PRESS "CONTINUE" ON THE CONTROL SCREEN and a "HOLD POINT"~~
~~Change the software back to the original state.~~
~~IS GENERATED TO VERIFY CANISTER UNLOAD.~~

TPCN#05
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Acceptance Criteria

- Control system indicates absence of canister once removed from the NFBC upender.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

8. Steps 1 thru 7 have been completed.

Test Conductor

Date 3-23-92

8.8

Auto Mode Verification Test

Take photographs and record information in photographic log

WARNING

Stay clear of the NFBC Upender system while in operation.

Place the NFBC Upender System into AUTO mode and verify system automatic sequence. This test verifies the following automatic sequence of NFBC upender system operation:

2

1. Verifies an empty NFBC Canister loading in up position with clamps open.
2. Verifies an empty NFBC Canister is downended into loading position for the NFBC loader.
3. Verifies that the fully loaded canister is upended into canister closure operation and removal of canister into NFBC Canister Storage rack.

NOTE

Operator must press "CONTINUE" after each "HOLD POINT" to complete, automatic operation.

8.8.1 "Auto" mode verification test for the NFBC upender system may be done as follows:

1. Simulate NFBC canister placement on the load cell as performed in Section 8.7.1 Step 5 and press "GO" to initiate the automatic NFBC upender operation. Verify the NFBC upender system operation was automatically completed.

Acceptance Criteria

- NFBC Upender upper frame is positioned in full "up" position with clamps "OPEN". ✓
- "HOLD POINT" is generated to ^{LOAD} record canister serial number. ✓
- ~~When "CONTINUE" is touched on the Control Screen a "HOLD POINT" is generated to verify an empty NFBC Canister is properly seated in bottom support.~~
- Signal received that an empty NFBC Canister is on the lower support load cell ✓
- When "CONTINUE" is touched on the Control Screen the same "HOLD POINT" to verify that the empty NFBC Canister is properly seated at lower support as generated unless lower support load cell indicates presence of load. ✓
- Clamps are closed and "HOLD POINT" is generated to verify excell crane is clear of NFBC upender. ✓
- When "CONTINUE" is touched on the Control Screen the NFBC upender upper frame is lowered to the horizontal position. ✓
- Signal generated that an empty NFBC canister is in place for the NFBC loader to push the skeletons (load) into the canister. ✓

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OS
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- NFBC canister is upended when fully loaded. ✓
- "HOLD POINT" to verify canister closure operation. ✓
- When "CONTINUE" is touched on the Control Screen on "HOLD POINT" is generated to verify crane is attached. ✓
- Clamps are opened when "CONTINUE" is touched on the control screen. ✓
- Canister is removed from the NFBC upender and placed into NFBC storage rack. ✓

Test Conductor

Date 3-23-92

QA

Date 3/23/92

2. The above step has been completed for "AUTO" mode verification test.

Test Conductor

Date 3-23-92

8.9

*This section will not be performed
See TPCA 06
prgubh
9/22/92*

NFBC Canister loading and unloading operational test: NFBC Canister loading and unloading operation test is carried out in AUTO mode using 173 inches square canister as follows:

Take photographs and record information in photographic log

1. Place NFBC Upender system in "AUTO" mode by calling up NFBC upender in control screen and pressing "AUTO" mode on screen.

Acceptance Criteria

- NFBC upender upper frame is positioned in full "up" position with clamps "open" when placed in "AUTO" mode.
- Empty NFBC canister was positioned in the bottom support using the excell crane.
- "HOLD POINT" is generated to ^{Load} record canister serial number after pressing "CAMERA CALL" on control screen.
- ~~2. Press "CONTINUE" on the control screen to create a "HOLD POINT" to verify the canister is properly seated in the bottom support.~~
- 3. Close the clamps and manually disengage the canister lid and remove the lid from the area.
- 4. NFBC Canister is rotated to horizontal position when "CONTINUE" is touched on the control screen and "CRANE CLEAR" signal is given in less than 70 seconds. Using stop watch record the time to downend the canister from vertical to horizontal position.

Time to downend the canister _____ seconds.

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Max. motor torque _____ lb. ft. (control screen reading) when rotating canister.

2

Acceptance Criteria

- Empty NFBC canister is rotated from vertical to horizontal position is less than 70 seconds.
- Max motor torque when rotating canister is less than 5.2 lb. ft.

2

Test Conductor _____ Date _____

QA _____ Date _____

5. NFBC canister is to be positioned horizontally for loading as follows:

- a) Measure and record the elevation of NFBC canister inside bottom surface from a known datum.
- b) Measure and record the elevation of NFBC Loader skeleton pusher (Item 4 for BWR and Item 5 for PWR of Dwg. 9315-M-2501) bottom surface from the same datum as in Step 8a.

Elevation of NFBC canister inside bottom surface from a known datum is measured to be _____ inches. Elevation of skeleton pusher bottom surface of NFBC loader from the same datum as in Step 8a is measured to be _____ inches.

Acceptance Criteria

- The difference in elevations measured from Steps ^S8a and ^S8b should be within ± 0.030 inch.

Test Conductor _____ Date _____

QA _____ Date _____

- c) Measure and record the inside wall of NFBC canister South side inside wall distance from North wall of Test cell.
- d) Measure and record the skeleton pusher South end of NFBC Loader distance from North wall of Test cell.

NFBC canister South side inside wall distance from North wall of Test cell is measured to be _____ inches. NFBC Loader skeleton pusher South end wall from North wall distance measured to be _____ inches

Acceptance Criteria

The difference between the two readings taken per Steps 6c and 6d should be within ± 0.030 inch.

Test Conductor 5/17/92 Date 5/17/92

QA 5/17/92 Date 5/17/92

- f) NFBC canister is ready for loading.
6. Press "CONTINUE" and signal is generated that an empty canister is in place for loading by NFBC Loader.
 7. Once the canister is loaded by NFBC Loader "FULL CANISTER" signal generated in the control screen.
 8. Fully loaded canister is upended to vertical position.
 9. Record the time to upend the loaded canister from horizontal to vertical position.

NFBC canister upending time is _____ seconds.

Max. motor torque _____ lb. ft. (control screen reading) when upending canister.

Acceptance Criteria

- NFBC canister is upended to vertical position in less than 70 seconds.
- Max. motor torque when lowering the frame is less than 5.2 lb. ft.

Test Conductor _____ Date _____

QA _____ Date _____

10. Lid is positioned within the canister and latched according to DOE requirements.
11. Press "CONTINUE" once canister closure operation is acknowledged and clamps opened.
12. Canister is removed from the NFBC upender and placed into NFBC storage.

13. Control system indicates the absence of canister once it is removed from the NFBC upender.

Test Conductor _____ Date _____

QA _____ Date _____

- 8.10 Place Test Load (9315-M-0010, Group 2) into NFBC canister upender and perform NFBC canister upender automatic sequence operation in SINGLE Mode.

This test verifies the following sequence of operations of NFBC Upender System with Test Load in "Single" mode.

Take photographs and record information in photographic log

WARNING

Stay clear of the NFBC upender system while in operation.

2

1. Verify NFBC Canister with Test Load is placed into NFBC upender upper (movable) frame in "UP" (vertical) position with clamps "OPEN".
2. Verify NFBC canister with Test Load is lowered to horizontal position.
3. Verify NFBC canister with Test Load is raised into vertical position for canister removal.

2

NOTE:

Operator must press "CONTINUE" between each successive motion to complete operation.

- 8.10.1 Verify NFBC canister with Test Load loading into the NFBC upender upper frame in "UP" position with clamps "OPEN" as follows:

1. Place NFBC upender system in "SINGLE" mode by calling up NFBC upender in control screen and pressing "single" mode on screen.

Acceptance Criteria

- NFBC upender upper frame is positioned in full "UP" position with clamps "Open" when placed in "SINGLE" mode.

- "HOLD POINT" is generated to ^{Load} record canister ~~serial number~~. TRENDS
6/23/92

Test Conductor Date 3-23-92

QA Date 3/23/92

2. Press "CAMERA CALL" on control screen and record canister serial number.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor Date 3-23-92

QA Date 3/23/92

3. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on the screen a "HOLD POINT" is generated to verify NFBC canister with Test Load is properly seated in bottom support.

Test Conductor Date 3-23-92

QA Date 3/23/92

4. Press "CAMERA CALL" on control screen.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor Date 3-23-92

QA Date 3/23/92

5. Using excell crane lower Test Load (9315-M-0010, Group 2) into NFBC upender bottom support.

6. Press "CONTINUE" on control screen.

Acceptance Criteria

- Clamps are closed and "Hold Point" is generated to verify excell crane is clear of NFBC upender.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

7. Press "CAMERA CALL" on control screen.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on the monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

- 8.10.2 Verify NFBC canister with Test Load is lowered to (horizontal) position as follows:

1. Press "CONTINUE" on control screen once crane is clear.

NFBC upender frame lowering trail is 57.24 seconds. Max. motor torque 0.251 lb. ft. (control screen reading) when lowering upper frame.

Acceptance Criteria

- When "CONTINUE" is touched on the Control Screen the NFBC upender upper (movable) frame is lowered to the horizontal position.
- NFBC upender upper (movable) frame is lowered to horizontal position in less than 70 seconds.
- Max. motor torque when lowering the frame is less than 5.2 lb. ft.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

8.10.3 Verify that the canister with Test Load is upended vertically for removal of the canister from the NFBC upender after completing the canister closure operation to the NFBC storage rack as follows:

1. Simulate full load in the canister through temporary changes to the software and verify receipt of Canister with Test Load.

Acceptance Criteria

- NFBC canister is upended when fully loaded.
- "Hold Point" to verify canister closure operation.

Test Conductor [Signature] Date 3/23/92

QA [Signature] Date 3/23/92

2. Press "CAMERA CALL" on control screen and verify canister closure operation.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on control screen.

Test Conductor [Signature] Date 3/23/92

QA [Signature] Date 3/23/92

3. Manually attach crane hook to the test load.

Acceptance Criteria

- Crane hook is attached to the canister.

Test Conductor [Signature] Date 3-23-92

QA [Signature] Date 3/23/92

4. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on control screen, a "HOLD POINT" is generated to verify crane is attached.

Test Conductor [Signature] Date 3-23-92

QA [Signature] Date 3/23/92

5. Press "CAMERA CALL" on control screen and verify crane is attached.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

6. Press "CONTINUE" on control screen and verify clamps are opened.

Acceptance Criteria

- Clamps are opened when "CONTINUE" is touched on the control screen.

Test Conductor

Date 3-23-92

QA

Date 3/23/92

9.0 POST PERFORMANCE REVIEW AND APPROVAL

The following signatures certify that the completed test, with all data collected, has been reviewed, and that the system has passed the requirements for system operational test.

Test Engineer 9-24-92
Date

Quality Assurance 9/24/92
Date

Project Engineer 9/24/92
Date

Test Director 9/24/92
Date

10.0 RETENTION OF TEST RECORDS

The original working copy, including test exceptions and resolution and acceptance signatures, are to be maintained by the Test Director and stored at the NUS Gaithersburg building, Document Control Center. One copy of the original working document shall be sent to the DOE representative for their use and retention.

11.0 REFERENCE MATERIALS

- 11.1 NUS Drawings: 9315-M-4101
9315-M-4102
9315-M-4103
9315-M-4105
9315-M-4106
9315-M-4107
9315-M-4108
9315-M-4109
9315-M-4110
9315-M-2501
- 11.2 Specification 9315-TAC-204, System Operational Test Acceptance Criteria for the NFBC Upender, latest revision.
- 11.3 Fuel Rod Consolidation Project Phase II Final Report, Volume I.
- 11.4 Test Plan, Specification Number 9315-P-109 latest revision, "Prototypical Spent Fuel Rod Consolidation System Test Plan."
- 11.5 NUS Calculation Document, File No. 1096-M-09.
- 11.6 Modicon 3240 System Design and Installation Manual.
- 11.7 Modicon Software Detail Design Document.
- 11.8 Duff-Norton Electro-Mechanical Actuators Catalog.
- 11.9 9315-E-601, Software Functional Specification for Prototypical Rod Consolidation Demonstration Project.
- 11.10 9315-P-101, Design Input Requirements Document.
- 11.11 9315-M-200, Prototypical Spent Fuel Rod Consolidation Project Mechanical Systems and Equipment Technical Specification.
- 11.12 Contraves Safety manual TR-27015.
- 11.13 9315-P-120, Test Administration Manual for Systems Operational Test and Integrated Systems Tests.

APPENDIX A
EQUIPMENT SETUP

1.0 Equipment Setup**1.1 Control/Mechanical Interface Setup**

1.1.1 Prepare the Axes (Drive Servo and Controls) for the NFBC Upender Main Drive Motor (M115 A) Operation as follows:

1.1.1.1 Verify that the NFBC Upender Main Drive Motor is mechanically and electrically coupled to the system after the completion of the Control System SOT.

1.1.1.2 Ensure that the NFBC Upender movable frame (Dwg. 9315-S-4109) is at least 10° away from the mechanical end stops (Item 13 of Dwg. 9315-S-4110). (Since the machine movements will occur in a following step, this precaution is given in order to locate the equipment in a safe position.)

1.1.1.3 Adjust the motor control parameters for Main Drive Motor M115 A per instructions from Modicon 3240 System Design and Installation Manual under Reference 11.6, and record in the following NFBC Upender Main Drive/M 115A Axis Personality Record Form.

Note: The NFBC Upender Main Drive Motor and its controls are required to be adjusted and calibrated prior to all other System Testing noted in Section 8.0.

Axis Personality Record Form:

Machine Name/Number NFBC Upender Main DriveAxis Number M115A

Personality Variable	Initial Estimates	Final Value
Number of Motor Poles (NPOLES)	6	
Resolution (RES)	1000	
Rate Loop Proportional Gain (RPG)	12	
Rate Loop Integral Gain (RIG)	280	
Acceleration Time Constant (ATC)	66	
Following Error Limit (FE-LIM)	500000	
Peak Current Limit (IMAX)	120	
Average Current Trip Level (IAVG-LIM)	60	
CW End-of-Travel Limit ((+EOT)	0	
CCW End-of-Travel Limit (-EOT)	0	
In-Position Tolerance Band (POS-TOL)	40	
In-Sync Tolerance Band (SYNC-TOL)	500	
Linear Acceleration (ACCEL)	15000	
Linear Deceleration (DECEL)	15000	
Position Cmd Time Constant (PCTC)	N/A	
Velocity Feed Forward (VFF) On/Off	N/A	
Motor Base Speed (BASE-SPD)	3600	
Max Torque Limit		

Signature

Date

3-21-92

1.1.2 Set Point Storage

1.1.2.1 JOG NFBC Upender Movable Frame (Item 2 of Dwg. 9315-S-4109) to each of the positions (Horizontal and Vertical) on Table 1 and cause the Control System to store the Resolver (GE 115A) reading. Record the Controller Position Table Entry Number and the Controller register number on the Table 1.

Table 1

S. No	NFBC Upender Functional Positions	Position Table Entry Number and Memory Location (GE 115A)	Sign Off
1	Vertical Position ($89.5^\circ \pm 0.5^\circ$)	47175 = 0	<i>[Signature]</i>
2	Horizontal Position ($0^\circ \pm 0.5^\circ$)	47174 = -725000	<i>[Signature]</i>

1.1.3 Resolver GE 115A/Travel Limit Sensors ^{GP 3/21/92} (ZE115A & ZE115B) ^{GP 3/21/92} Set Up ^{TPCN #1}
 1.1.3.1 Record resolver counts/turn for Resolver GE 115A which is a part of Main Drive Motor (Item 20 of Dwg. 9315-M-4101) and enter into the Control System the maximum speed for JOG mode in Resolver Counts/sec as noted below. ^{GP 3/21/92}

Drive Motor	Resolver	Jog Speed (RPM)	Resolver Counts/turn	JOG Counts/sec
M 115A	GE-115A	750	1000	12500

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Date 3-21-92

- 1.1.3.2 Select NFBC Upender Main Drive Motor M 115A at the Control Console and Set JOG speed to approximately 10% of the JOG Speed limit.
- 1.1.3.3 JOG the NFBC Upender movable frame (Item 2 of Dwg. 9315-S-4109) to within $1/2^\circ$ of the vertical stop position (HOME Position).
- 1.1.3.4 Adjust the trip point of the Vertical Limit Sensor, ZE 115A, by physically moving the sensor.
- 1.1.3.5 JOG away and back a few times to confirm that the sensor clears properly and trips at the proper vertical position ($89.5^\circ \pm 0.5^\circ$) of NFBC Upender frame.
- ~~1.1.3.6 JOG the NFBC Upender movable frame to within $1/2^\circ$ of the horizontal stop positions ($0^\circ \pm 0.5^\circ$).~~
- ~~1.1.3.7 Adjust the trip point of the Horizontal Limit Sensor, ZE 115B, by physically moving the sensor.~~
- ~~1.1.3.8 JOG away and back a few times to confirm that the horizontal limit sensor clears and trips at the proper horizontal position ($0^\circ \pm 0.5^\circ$).~~

TPCW#1

- 1.1.4 Create and verify an Axis Homing Sequence (AHS) for the NFBC Upender Main Drive Motor, M115A, and Resolver, GE115A, addressing the Axis under test only (see "Start Program" from Reference 11.7. AHS parameters to be as recorded below:

MOTOR TAG NO: M115A

HOME Direction: CW

Resolver Counts/Turn: 1000 Resolver No: GE115A

HOME Speed: 1000 RPM 12500 Counts/Sec.

HOME Offset (HOF): -10000 Resolver Counts

Final HOME Position: Movable frame vertical ($89.5^\circ \pm 0.5^\circ$)

Test Conductor

Date 3-21-92

Return the AHS for the NFBC Upender Main Drive Motor M 115A to "HOME-AS-IS".

- 1.1.5 Prepare the NFBC Canister Clamping System Assembly (Dwg. 9315-M-4102) for operation as follows:
- 1.1.5.1 Verify that the Clamp Actuator (Item 12 of Dwg. 9315-M-4102) is mechanically and electrically coupled after completion of the Control System SOT or recouple if necessary.
- 1.1.5.2 Ensure that the movable clamp arms (Items 6 & 8 of Dwg. 9315-M-4102) are 0.50 ± 0.03 inch away from the base plate (Item 2 of Dwg. 9315-M-4102).
- 1.1.5.3 Adjust the clamp actuator limit switches to trip before the clamp arms (Items 6 & 8 of Dwg. 9315-M-4102) reach either "OPEN" or "CLOSED" positions as follows:

1. Drive clamp "OPEN" until the space between clamp arms
+ 0.12
(Items 6 & 8 of Dwg. 9315-M-4102) is 22.00 - 0.00 inches.
2. Record exact "OPEN" dimensions between clamp arms and store resolver reading of resolver (GE-115B) in designated Control System Register as shown below:

Resolver Reading 2026

Control System Register No. 47121

Distance between clamp arms in fully "OPEN" position
22.06 inches

Test Conductor Date 3-21-92

QA Date 3/21/92

Acceptance Criteria:

- Distance between clamp arms in fully "OPEN" position is
+ 0.12
22.00 - 0.00 inches.

3. Set limit switches per Manufacturer's (Duff Norton) instructions for "OPENED" position plus 0.25 inch.
4. Drive clamps "CLOSED" until the space between clamp arms is
+ 0.00
20.00 - 0.12 inches
5. Record exact "CLOSED" dimensions between clamp arms.
Distance between clamp arms in fully "CLOSED" position
20.12 inches

Test Conductor

Date 3-21-92

QA

Date 3/21/92

Acceptance Criteria:

- Distance between clamp arms in fully "CLOSED" position is
+ 0.00
20.00 - 0.12 inches
6. Set Limit Switch per manufacturer's (Duff Norton) instructions for "CLOSED" position minus 0.25 inch.

RESOLVER READING 2130

CONTROL SYSTEM REGISTER NO 47120

TPCN#2

1.1.6 Verify the clamp position in Control Screen is within 0.25 inch of actual clamp position in "Fully Opened" and "Fully Closed" positions of clamps as follows:

1. Drive Clamp to "OPEN" position
2. Measure dimension between clamp arms in full "OPEN" position.
3. Record the clamp opening dimension and the corresponding Control Screen displayed value in Table 1.

Table 1

Description	Actual	Control Screen
Clamps Fully Opened	22 1/16"	30.873

30 7/8"

30.873

Test Conductor

Date 3-21-92

QA

Date 3/21/92

Acceptance Criteria:

- The actual clamp opening dimension is 22.00 - 0.00 inches. + 0.12
- The actual clamp opening dimension and as displayed in control screen is within 0.25 inch.
- 4. Drive clamps to "CLOSED" until limit switch trips.
- 5. Measure dimension between clamp arms in full "CLOSED" position.
- 6. Record the clamp "CLOSED" dimension and the corresponding control screen displayed value in Table 2.

 #03
 EP
 3/21/92

Table 2

Description	Actual	Control Screen
Clamps Fully Closed	20 1/16"	20.278

Test Conductor

[Signature]

Date

3/21/92

QA

[Signature]

Date

3/21/92

Acceptance Criteria:

- The actual clamps "CLOSED" dimension is 20.00 - 0.12 inches. + 0.00
 - The actual clamps "CLOSED" dimension and as displayed in control screen is within 0.25 inch.
7. Repeat steps 1 thru 6 two more times and enter in Table 3.

Table 3

Description	Actual	Control Screen
Clamps Fully Opened	22 1/8 / 30.25	30.429
Clamps Fully Opened	22 1/8 / 30.25	30.485
Clamps Fully Closed	19 15/16	19.762
Clamps Fully Closed	20	19.952

#03
3/21/92

APPENDIX B

SAFETY PROCEDURES

SYSTEMS OPERATIONS TEST SAFETY CONSIDERATIONS

Performance of the SOTs in a manner which precludes the injury of personnel involved in the test performance or working in the Test Facility is of paramount importance. The following steps shall be taken to minimize the possibility of personnel being injured during the performance of SOTs:

1. Contraves and NUS will advise their employees and any subcontractors to stay clear of the Test Facility when tests are being conducted unless they are involved in the test performance or have another work assignment in the Test Facility.
2. Contraves will post a warning sign at the entrance to the Test Facility when testing is in progress advising personnel of the need to stay away unless involved in the testing or have some authorized work assignment in the area.
3. When feasible and deemed advisable by the Test Conductor, the machine being tested will be surrounded by a portable barrier (ropes and posts) with a Caution Sign warning individuals to stay clear of the area unless authorized to enter by the Test Conductor.
4. When machines are being moved by installed motors, the NUS electrical engineer operating the motor or the Test Conductor will be located in a position which permits him/her to observe the machine operation so that the equipment can be stopped if a dangerous situation appears to be developing. Such situations could involve unanticipated machine performance or personnel entering the test area and placing themselves in jeopardy.
5. When a SOT is in progress the Test Conductor will remain in the vicinity of the test so that all personnel involved in the test are under his observation and will perform any required test support activities directly under his supervision.
6. Only Contraves personnel who have been qualified to the DOE Hoisting and Rigging Manual Rev. 10-88 will operate the Test Facility overhead crane.
7. Only NUS test engineers will operate the Robotic Bridge Transporter (RBT), the Manipulator Transporter (MT), and the RM-10A Robot Arms.
8. Slings, hooks, and chains utilized with the Test Facility overhead crane or with the RBT will be those purchased specifically for use on the DOE project and have been certified to meet the requirements of ANSI B30.9.
9. The making of all electrical connections to the various equipment will be supervised by an NUS electrical engineer.

10. Protective headgear will be worn in the Test Facility whenever the Robotic Bridge Transporter (RBT), the Manipulator Transporter (MT) are being utilized or at any time the Test Conductor deems the use of protective head gear is appropriate.
11. The NUS Test Conductor is responsible to see that all the above safety requirements are implemented during the performance of the test for which he has responsibility.
12. The Test Conductor will verify that all test specific safety prerequisites identified in test procedures are satisfied and that any precautions identified in specific procedure steps are followed.
13. The NUS Test Director will perform frequent informal surveillance of the testing operations to verify the safety requirements are being adhered to by the personnel performing the test or other work in the test area.

APPENDIX C
PHOTO DOCUMENTATION REQUIREMENTS

Photo Documentation Requirements

Photographs are required to be taken of all System Operational Tests (SOTs). The following is a bulletized list which identifies when these photographs must be taken, as a minimum. Additional photographs may be taken at any other time during the test, as specified by the Test Conductor.

- Photographs must be taken of the initial setup for each test sequence.
- Photographs must be taken of the following critical interfaces between system, as a minimum,
 - Excell Crane/Downender (Loading of Fuel)
 - RBT/Fuel Assembly Storage Rack
 - RBT/Downender
 - RBT/Staging and Cutting Station
 - RBT/Clamping Table
 - FAHF/Mockup Fuel Assembly
 - Pull-Head Gripper/Fuel Rods
 - Rod Loader/Canister
 - NFBC Loader/Canister
 - RBT/Off-Normal Table
 - MT/Off-Normal Table
 - Fuel Canister/Storage Rack
 - NFBC Canister/Storage Rack
 - RBT/FAHF and RM-10A
 - Excell Crane/Fuel Canister Upender (Loading and Unloading)
 - Excell Crane/NFBC Canister Upender (Loading and Unloading)
 - MT/RM-10A
- Photographs must be taken of any equipment damaged during testing.
- Photographs must be taken of any damage to mockup fuel rods and/or mockup fuel assemblies.
- Photographs must be taken of the cutter to fuel assembly interfaces as follows:
 - In position prior to cut
 - During cutting operation
 - Cut area of end fitting after cut operation
 - Cut area of fuel assembly after cut operation
- Photographs must be taken of each "Hold Point".
- Photographs must be taken of the problem areas of any subsystem which does not perform its expected function.
- Photographs must be taken of any component, subsystem, or system, determined by the test conductor to be operating out of the normal/expected condition (i.e., excessive deflection, vibration, etc.).

FUEL ROD CONSOLIDATION PROJECT PHOTOGRAPHIC LOG

TEST PROCEDURE No. 9315-TP-204

[illegible]

APPENDIX D

TEMPORARY PROCEDURE CHANGE NOTICE AND REPAIR LOG

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

01

DATE 03-21-92

PROCEDURE NO. 9315-TP-204

REV. 2

SYSTEM OPERATIONAL TEST
TITLE Procedure for NFBC UPENDER

PROCEDURE SECTION(S) APPENDIX A Section 1.1.3

PROCEDURE CHANGE: (Use reverse side if necessary.)

- Revise to Read:

1.1.3 Resolver GE-115A/Travel Limit Sensor ZE-115A Set up.

- Delete sections 1.1.3.7, 1.1.3.8, & 1.1.3.6

3/21/92

REASON FOR CHANGE: Limit Sensor ZE-115B is no longer part of the system.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

TEST ENGINEER

3-21-92(1)(2)
DATE

QUALITY ASSURANCE

(2)
DATE

PROJECT ENGINEER

(2)
DATE

TEST DIRECTOR

(2)
DATE

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

02

DATE 03-21-92

PROCEDURE NO. 9315-TP-204 REV. 2 TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender

PROCEDURE SECTION(S) APPENDIX A Section # 1.1.5.3.5

PROCEDURE CHANGE: (Use reverse side if necessary.)

ADD THE following:

Resolver Reading _____

Control System Register No. _____

REASON FOR CHANGE:

DATA was not repeated see step 1.1.5.3.2
DOCUMENT REQUIRED WAS not included in step.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO _____

MAJOR _____ YES _____ NO _____

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES _____ NO _____

APPROVALS

TEST ENGINEER

3-21-92 (1) (2)
DATE

QUALITY ASSURANCE

DATE (2)

PROJECT ENGINEER

DATE (2)

TEST DIRECTOR

DATE (2)

Notes:

- (1) Required for minor changes
- (2) Required for major changes

TEMPORARY PROCEDURE CHANGE NOTICE

#03

DATE 03-22-92

PROCEDURE NO. 9315-TP-204 REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFEC Upender

PROCEDURE SECTION(S) 8.5.3

PROCEDURE CHANGE: (Use reverse side if necessary.)

- Delete step 8.9.3 Tests II & IV, because if no canister is not in place no "Hold Point" will be initiated. "Hold Point" is only initiated to verify Ex-Cell Crane is ATTACHED
- ADD SIGN OFF SIGNATURES TO Acceptance CRITERIA

REASON FOR CHANGE:

- REASON FOR CHANGE:
- "HOLD POINT" is only initiated to verify Ex-Cell Crane is Attached and Unloading of NFBC Canister.
 - SIGN OFF MISSING
- CLASSIFICATION OF CHANGE

CLASSIFICATION OF CHANGE

MINOR ✓ YES ✓ NO

MAJOR _____ YES _____ NO _____

REVISION TO ORIGINAL PROCEDURE REQUIRED ✓ YES NO

APPROVALS

TEST ENGINEER

DATE _____

(1)(2)

QUALITY ASSURANCE

DATE _____

(2)

PROJECT ENGINEER

DATE _____

(2)

TEST DIRECTOR

DATE _____

(2)

Notes:

- (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

#04

DATE 03-22-92

PROCEDURE NO. 9315-TP-204

REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upgrades

PROCEDURE SECTION(S) B.6

PROCEDURE CHANGE: (Use reverse side if necessary.)

REVISE OPERATION from "SINGLE" mode to "HAND" Mode.

REASON FOR CHANGE:

In Single mode you do not have the option of performing individual operations. Since it is a sequential operation from start of process to end of process. But in Hand mode you can do the individual operation ^{out of} sequence.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO

MAJOR ☐ YES ☐ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

TEST ENGINEER

DATE

3/22/92 (2)

QUALITY ASSURANCE

DATE

(2)

PROJECT ENGINEER

DATE

(2)

TEST DIRECTOR

DATE

(2)

Notes:

- (1) Required for minor changes
- (2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

#05

DATE 03-23-92

PROCEDURE NO. 9315-TP-204

REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Updater

PROCEDURE SECTION(S) 8.7.1, 8.7.3, 8.8.1 & 8.9, 8.7.2, 8.10.1

PROCEDURE CHANGE: (Use reverse side if necessary.)

REVISED ABOVE STEPS PER ATTA AS SHOWN ON ATTACHED
SHEETS.

REASON FOR CHANGE:

IN the Control system there is no "Hold Point" to verify proper seating of Canister and the recording of serial number is accomplished when the canisters are being loaded into the Canister STORAGE RACKS

CLASSIFICATION OF CHANGE

MINOR ☐ YES ☐ NO ☐

MAJOR ☒ YES ☐ NO ☐ 1/19/92

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☐ NO

APPROVALS

TCN 002 was issued on 3/23/92 and approved 9/24 by DOE on 4/17/92
See attached pages TCN 05 A11
7/24/92

TEST ENGINEER

8-23-92 (1)(2)
DATE

QUALITY ASSURANCE

9/23/92 (2)
DATE

PROJECT ENGINEER

9/23/92 (2)
DATE

TEST DIRECTOR

9/24/92 (2)
DATE

Notes:

- (1) Required for minor changes
- (2) Required for major changes

Acceptance Criteria

- NFBC upender upper frame is positioned in full "up" position with clamps "Open" when placed in "SINGLE" mode.
- "HOLD POINT" is generated to ^{LOAD}~~record~~ canister serial number.

Test Conductor _____ Date _____

QA _____ Date _____

2. Press "CAMERA CALL" on control screen and record canister serial number. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the Control Screen.
- Pan, Tilt and Zoom are functional and cameras No. 11 and No. 12 can be positioned to obtain an unobstructed view of top end of canister.

Test Conductor _____ Date _____

QA _____ Date _____

3. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on the screen a "HOLD POINT" is generated to verify an empty NFBC Canister is properly seated in bottom support.

Test Conductor _____ Date _____

QA _____ Date _____

4. Press "CAMERA CALL" on Control Screen. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the Control Screen.

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GP
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GP
3/23/9

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- Pan, Tilt and Zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor _____

Date _____

QA _____

Date _____

4. When "CONTINUE" IS TOUCHED ON THE CONTROL SCREEN, LOWER REGISTER OR Simulate load on lower support load cell by temporarily forcing Data Register to verify receipt of canister.

Acceptance Criteria

- Signal received that an empty NFBC Canister is on the lower support load cell.

Test Conductor _____

Date _____

QA _____

Date _____

4. Press "CONTINUE" on Control Screen.

Acceptance Criteria

- When "CONTINUE" is touched on the Control Screen the same "HOLD POINT" to verify that an empty NFBC Canister is properly seated at lower support as generated unless lower support load cell indicates presence of load.
- Clamps are closed and "Hold Point" is generated to verify excell crane is clear of NFBC upender.

Test Conductor _____

Date _____

QA _____

Date _____

5. Press "CAMERA CALL" on Control Screen. Fill out CCTV assessment form in Appendix E.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on the monitors when "CAMERA CALL" is touched on the Control Screen.

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OF
GP
13/23

2

TPCN#05
GP
13/23/1

- Pan, Tilt and Zoom are functional and both cameras can be positioned to achieve an unobstructed view of the NFBC upender upper (movable) frame and excell crane interface.

Test Conductor _____ Date _____

QA _____ Date _____

7. Steps 1 thru ^GX have been completed.

Test Conductor _____ Date _____

TPCN#05
G/P 3/23/91

8.7.2 Verify NFBC canister is placed into loading (horizontal) position for the NFBC Loader to push the load (skeletons) into the NFBC Canister as follows:

Take photographs and record information in photographic log

1. Press "CONTINUE" on Control Screen once crane is clear.

Acceptance Criteria

- When "CONTINUE" is touched on the Control Screen the NFBC upender upper (movable) frame is lowered to the horizontal position.
- Signal generated that an empty NFBC Canister is in place for the NFBC loader to push the skeletons (load) into the canister.

Test Conductor _____ Date _____

QA _____ Date _____

2. The above step has been completed.

Test Conductor _____ Date _____

8.7.3 Verify that the fully loaded Canister is upended vertically for removal of the Canister from the NFBC upender after completing the canister closure operation to the NFBC storage rack as follows:

Take photographs and record information in photographic log

1. Simulate full load in the canister by temporarily forcing data register to simulate canister loading.

G. PRESS "CONTINUE" ON THE CONTROL SCREEN

ACCEPTANCE CRITERIA

- When "CONTINUE" is touched on the CONTROL SCREEN the NFBC UPENDER UPPER (MOVEABLE) FRAME IS LOWERED TO THE HORIZONTAL POSITION.

TEST CONDUCTOR _____ DATE _____

QA _____ DATE _____

TPCN#05
G/P 3/23/91

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.
- Cameras can be positioned to obtain an unobstructed view to verify crane is attached.

Test Conductor _____ Date _____
QA _____ Date _____

6. Press "CONTINUE" on Control Screen and verify clamps are opened.

Acceptance Criteria

- Clamps are opened when "CONTINUE" is touched on the control screen.

Test Conductor _____ Date _____
QA _____ Date _____

7. ~~Change the software back to the original state.~~
~~is GENERATED to VERIFY CANISTER UNLOAD.~~

Acceptance Criteria

- Control system indicates absence of canister once removed from the NFBC upender.

Test Conductor _____ Date _____
QA _____ Date _____

8. Steps 1 thru 7 have been completed.

Test Conductor _____ Date _____

8.8 Auto Mode Verification Test

Take photographs and record information in photographic log

WARNING

Stay clear of the NFBC Upender system while in operation.

Place the NFBC Upender System into AUTO mode and verify system automatic sequence. This test verifies the following automatic sequence of NFBC upender system operation:

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11/3/23

2

1. Verifies an empty NFBC Canister loading in up position with clamps open.
2. Verifies an empty NFBC Canister is downended into loading position for the NFBC loader.
3. Verifies that the fully loaded canister is upended into canister closure operation and removal of canister into NFBC Canister Storage rack.

NOTE

Operator must press "CONTINUE" after each "HOLD POINT" to complete, automatic operation.

8.8.1

"Auto" mode verification test for the NFBC upender system may be done as follows:

1. Simulate NFBC canister placement on the load cell as performed in Section 8.7.1 Step 5 and press "GO" to initiate the automatic NFBC upender operation. Verify the NFBC upender system operation was automatically completed.

Acceptance Criteria

- NFBC Upender upper frame is positioned in full "up" position with clamps "OPEN".
- "HOLD POINT" is generated to ^{LOAD} record canister serial number.
- ~~When "CONTINUE" is touched on the Control Screen a "HOLD POINT" is generated to verify an empty NFBC Canister is properly seated in bottom support.~~
- Signal received that an empty NFBC Canister is on the lower support load cell
- When "CONTINUE" is touched on the Control Screen the same "HOLD POINT" to verify that the empty NFBC Canister is properly seated at lower support as generated unless lower support load cell indicates presence of load.
- Clamps are closed and "HOLD POINT" is generated to verify excell crane is clear of NFBC upender.
- When "CONTINUE" is touched on the Control Screen the NFBC upender upper frame is lowered to the horizontal position.
- Signal generated that an empty NFBC canister is in place for the NFBC loader to push the skeletons (load) into the canister.

TPCN#
05
CP/23/9

- NFBC canister is upended when fully loaded.
- "HOLD POINT" to verify canister closure operation.
- When "CONTINUE" is touched on the Control Screen on "HOLD POINT" is generated to verify crane is attached.
- Clamps are opened when "CONTINUE" is touched on the control screen.
- Canister is removed from the NFBC upender and placed into NFBC storage rack.

Test Conductor _____ Date _____

QA _____ Date _____

2. The above step has been completed for "AUTO" mode verification test.

Test Conductor _____ Date _____

8.9

NFBC Canister loading and unloading operational test: NFBC Canister loading and unloading operation test is carried out in AUTO mode using 173 inches square canister as follows:

Take photographs and record information in photographic log

2

1. Place NFBC Upender system in "AUTO" mode by calling up NFBC upender in control screen and pressing "AUTO" mode on screen.

Acceptance Criteria

- NFBC upender upper frame is positioned in full "up" position with clamps "open" when placed in "AUTO" mode.
 - Empty NFBC canister was positioned in the bottom support using the excell crane.
 - "HOLD POINT" is generated to ^{Load} record canister serial number after pressing "CAMERA CALL" on control screen.
- ~~2. Press "CONTINUE" on the control screen to create a "HOLD POINT" to verify the canister is properly seated in the bottom support.~~
 3. Close the clamps and manually disengage the canister lid and remove the lid from the area.
 4. NFBC Canister is rotated to horizontal position when "CONTINUE" is touched on the control screen and "CRANE CLEAR" signal is given in less than 70 seconds. Using stop watch record the time to downend the canister from vertical to horizontal position.

Time to downend the canister _____ seconds.

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6/21/92

TEST PROCEDURE 9315-TP-204

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- "HOLD POINT" is generated to ^{LOAD} record canister serial number. TPCN #05
Test Conductor _____ Date _____
QA _____ Date _____

2. Press "CAMERA CALL" on control screen and record canister serial number.

Acceptance Criteria

- Video images from cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor _____ Date _____
QA _____ Date _____

3. Press "CONTINUE" on control screen.

Acceptance Criteria

- When "CONTINUE" is touched on the screen a "HOLD POINT" is generated to verify NFBC canister with Test Load is properly seated in bottom support.

Test Conductor _____ Date _____
QA _____ Date _____

4. Press "CAMERA CALL" on control screen.

Acceptance Criteria

- Video images from Cameras No. 11 and No. 12 are displayed on monitors when "CAMERA CALL" is touched on the control screen.

Test Conductor _____ Date _____
QA _____ Date _____

5. Using excell crane lower Test Load (9315-M-0010, Group 2) into NFBC upender bottom support.

6. Press "CONTINUE" on control screen.

TAC CHANGE NOTICE

DATE: 03-23-92

CHANGE NOTICE NO. 002

TAC NO: 9315-TAC-204 REV 3

TITLE: *SYSTEM OPERATIONAL TESTS (SOTS)*
TEST ACCEPTANCE CRITERIA
FOR THE NFBC UPENDER

=====

TAC CHANGES AND REASON FOR CHANGE

1. REVISE ACCEPTANCE CRITERIA BASIS IN SECTION 1.5 (SINGLE MODE).
 - A) FROM: "HOLD POINT" GENERATED TO RECORD CANISTER SERIAL NUMBER
TO: "HOLD POINT" GENERATED TO LOAD CANISTER.
 - B) DELETE: When "CONTINUE" is touched on the screen a "Hold Point" is generated to verify NFBC canister is properly seated

Reason:

- A) THE RECORDING of Serial number is accomplished when the 10-102 Storage Racks are being loaded.
- B) IN THE CONTROL SYSTEM there is no "Hold Point" to verify proper SEATING of Canister.

(If more space is needed, use additional sheets)

=====

ENGINEER

[Signature]

3-23-92

Date

QUALITY ASSURANCE

[Signature]

3/23/92

Date

PROJECT MANAGER

[Signature]

3/23/92

Approved by DOE letter
dated 4/17/92

4 of 6

HALLIBURTON NUS
Environmental Corporation

TCN#5 14-273

910 CLOPPER ROAD • PO BOX 4002 • GAITHERSBURG MARYLAND 20877-0402 • (301) 254-6000

ED-DOE-PVJ-92-2315
March 30, 1992

Ms. M.W. Fisher, Chief
Civilian Rad-Waste Branch
U. S. Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, ID 83401-1562

Subject: Contract DE-AC07-86ID12651 - Rod Consolidation Project
Systems Operational Test--NFBC Upender Change Notice
(TCN) Approval

Reference: 1. 9315-TAC-204 Rev 3

Dear Ms. Fisher:

Attached are TCNs 001 and 002 to reference 1 for your approval action.

If you have any questions concerning this letter, please contact the undersigned on (412) 967-7304.

Very truly yours,

Peter V. Judd
Project Manager

ht

Attachments:
TCNs 001 and 002 to TAC 204 Rev 3.

cc: D.C. Koelsch--DOE-ID
J.H. Clark--EG&G

DEC: F. G. 110

✓ G. Jean-Philippe (Dec)

✓ T. Mulgrew (Dec)

Aug 4.1

McNiron

Agm
✓ ~~DOE~~ ~~ENRON~~

✓ DOE ENRON

Mo Judd ENRON

services for a cleaner and safer world

Department of Energy

Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

April 17, 1992

CLM

SECRET - SUBJECT
REF ID: A101

DEC

FILE

Peter V. Judd
NUS Project
c/o Contraves-USA
620 Epsilon Drive
Pittsburgh, PA 15238

FILED
SECRET
SOT BOOK
SECRET

SUBJECT: Review of Halliburton NUS System Operation Test (SOT) TAC Change Notices (TCN), Nos. 001 and 002, for the Non-Fuel Bearing Components (NFBC) Upender TP-204

Sup Engr - GJP

REFERENCE: Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2315, dated March 30, 1992

Dear Mr. Judd:

DOE-ID has reviewed the subject TCNs under the REVIEW/APPROVAL provision of the contract and finds it acceptable. The TCN is approved for implementation.

If you have further questions, please contact me (208) 526-1466 or D. C. Koelsch (208) 526-5930.

Sincerely,

Margaret W. Fisher
Margaret W. Fisher, Chief
Civilian Rad-Waste Branch

cc: F. G. Gallo, NUS
J. H. Clark, EG&G

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

TPCN-06

DATE 9/22/92

PROCEDURE NO. 9315-TP-204 REV. 2 TITLE NFBL Upender

PROCEDURE SECTION(S) 8.9

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete Section 8.9.

Added 6/17/92.

REASON FOR CHANGE: The re-focused Phase III test program as detailed in HWS letter ED-DBE-PVJ-82-2334 dated 5/5/92 deleted the completion of 9315-TP-204. This program was approved by DOE letter #

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO

MAJOR ☐ YES ☐ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☐ NO

APPROVALS

Peter J. Dahl 9/22/92 (1)(2)
TEST ENGINEER Test Director DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

DATE _____

PROCEDURE NO. _____ REV. _____ TITLE _____

PROCEDURE SECTION(S) _____

PROCEDURE CHANGE: (Use reverse side if necessary.) _____

REASON FOR CHANGE: _____

CLASSIFICATION OF CHANGE

MINOR _____ YES _____ NO _____

MAJOR _____ YES _____ NO _____

REVISION TO ORIGINAL PROCEDURE REQUIRED _____ YES _____ NO

APPROVALS

TEST ENGINEER _____ DATE _____ (1)(2)

QUALITY ASSURANCE _____ DATE _____ (2)

PROJECT ENGINEER _____ DATE _____ (2)

TEST DIRECTOR _____ DATE _____ (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

DATE _____

PROCEDURE NO. _____ REV. _____ TITLE _____

PROCEDURE SECTION(S) _____

PROCEDURE CHANGE: (Use reverse side if necessary.) _____

REASON FOR CHANGE: _____

CLASSIFICATION OF CHANGE

MINOR ____ YES ____ NO ____

MAJOR ____ YES ____ NO ____

REVISION TO ORIGINAL PROCEDURE REQUIRED ____ YES ____ NO

APPROVALS

TEST ENGINEER DATE (1)(2)

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

DATE _____

PROCEDURE NO. _____ REV. _____ TITLE _____

PROCEDURE SECTION(S) _____

PROCEDURE CHANGE: (Use reverse side if necessary.) _____

REASON FOR CHANGE: _____

CLASSIFICATION OF CHANGE

MINOR ____ YES ____ NO ____

MAJOR ____ YES ____ NO ____

REVISION TO ORIGINAL PROCEDURE REQUIRED ____ YES ____ NO

APPROVALS

TEST ENGINEER _____ DATE _____ (1)(2)

QUALITY ASSURANCE _____ DATE _____ (2)

PROJECT ENGINEER _____ DATE _____ (2)

TEST DIRECTOR _____ DATE _____ (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

DATE _____

PROCEDURE NO. _____ REV. _____ TITLE _____

PROCEDURE SECTION(S) _____

PROCEDURE CHANGE: (Use reverse side if necessary.)

REASON FOR CHANGE:

CLASSIFICATION OF CHANGE

MINOR _____ YES _____ NO _____

MAJOR _____ YES _____ NO _____

REVISION TO ORIGINAL PROCEDURE REQUIRED _____ YES _____ NO

APPROVALS

TEST ENGINEER DATE (1)(2)

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 03

EXCEPTION/REPAIR LOG

DATE 03-21-92

LOG RL# 01

PROCEDURE NO. 9315-TP-204 REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender

PROCEDURE SECTION(S) 2.3 & 2.4

CLASSIFICATION OF CHANGE:

REPAIR ☒

REDESIGN ☐

TPCN#

PROBLEM AND CAUSE:

Incomplete QA/QC Data package. DCN's not verified AS
Complete, See ATTACHED

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION:

No impact on Testing. Visual inspection must performed.
Transfer attached open items to ORR Tracking list.

TEST CONDUCTOR

3-21-92

DATE

QUALITY ASSURANCE

DATE

(1)

PROJECT ENGINEER

DATE

(1)

TEST DIRECTOR

DATE

(1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Transfer to ORR Tracking list.

TEST CONDUCTOR

DATE

3-21-92

REVIEW OF NFBC CANISTER UPENDER
ASSEMBLY PROCEDURE SECTION 6.2 THRU 6.2.3.2

The following steps of the procedure require sign off:

- 6.2.1.16
- 6.2.1.26

The following FCR's/DCN's are missing from Data Pkg:

- DWG M-4105 F023, D556, D701, D843
- DWG M-4106 D887
- DWG M-4108 D548

There is no objective evidence that the following DCN's were completed:

- DWG M-4101 D124, D213, D702, D887, D884
- DWG M-4102 D125, D373, D396, D701, D904, D906
- DWG M-4105 F023, D556, D701, D843
- DWG M-4106 D887
- DWG M-4107 D267
- DWG M-4108 D548
- DWG M-4110 D488

From the review it could not be verified that the following items were installed:

- DWG M-4101 ITEMS 10, 41, 42, 43
- DWG M-5102 ITEMS 16, AND 26 THRU 34
- DWG M-4105 ITEMS 16 AND 17

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE D3

EXCEPTION/REPAIR LOG

DATE 03-21-92

LOG RL# 02

PROCEDURE NO. 9315-TP-204 REV. 2 TITLE SYSTEM OPERATIONAL TEST
PROCEDURE for NFBC Upender

PROCEDURE SECTION(S) 2.9

CLASSIFICATION OF CHANGE:

REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

Section 7.2 Component Replacement Test (CRT) of the
Factory Acceptance Test Spec.*9315-TP-200-1342 is not
complete.

Lifting bails not installed at this time.

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION:

- No impact on testing. CRT testing to be completed at a later
Date.
- Transfer open item to ORR Tracking list.

TEST CONDUCTOR

3-21-92
DATE

QUALITY ASSURANCE

 (1)
DATE

PROJECT ENGINEER

 (1)
DATE

TEST DIRECTOR

 (1)
DATE

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Transferred to ORR Tracking list.

TEST CONDUCTOR

DATE 3-21-92

TEST PROCEDURE

9315-TP-204

REVISION

2

PAGE 03

EXCEPTION/REPAIR LOG

DATE 03-21-92

LOG RL# 03

PROCEDURE NO. 9315-TP-204 REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender

PROCEDURE SECTION(S) APPENDIX A, Section 1.1.6

CLASSIFICATION OF CHANGE:

REPAIR N/A REDESIGN N/A TPCN# N/A

PROBLEM AND CAUSE:

Measurements required by the test does not take in consideration the different resolver positions to actual measurement location @ "B".

FROM TEST PROCEDURE

TEST CONDUCTOR

RESOLVER
READING

SOLUTION/CORRECTIVE ACTION:

NONE REQUIRED

[Signature]
TEST CONDUCTOR

3/21/92
DATE

QUALITY ASSURANCE

DATE (1)

PROJECT ENGINEER

DATE (1)

TEST DIRECTOR

DATE (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

NO CORRECTIVE ACTION REQUIRED.

TEST CONDUCTOR

[Signature]

DATE

3/21/92

PAGE 03

EXCEPTION/REPAIR LOG

LOG RL#04

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender.

CLASSIFICATION OF CHANGE:

REPAIR N/A REDESIGN N/A TPCN# N/A

Dimension not met. Measured opening dimension is 10.73" but Acceptance Criteria is $11" \begin{pmatrix} +.12 \\ -.00 \end{pmatrix}$.

Evaluate measurements against Acceptance Criteria and Coaster's dimension.

Solution:- Issue TCN to TAC-204 to Change Acceptance Criteria to read 10.50 ~~10.50~~

3/22/92
DATE

DATE (1)

DATE (1)

DATE (1)

CORRECTIVE ACTION: COMPLETE / ISSUE TCN#001

TCN 001 issued on 3/22/92
and approved by DOE on 4/17/92

DATE **3-22-92**

TAC CHANGE NOTICE

DATE: 03-22-92

CHANGE NOTICE NO. 001

TAC NO: 9315-TAC-204 REV. 3

TITLE: SYSTEM OPERATIONAL TESTS (SOTS)
 TEST ACCEPTANCE CRITERIA
 FOR THE NFBC UPENDER

=====

TAC CHANGES AND REASON FOR CHANGE

1. REVISE OPENING DISTANCE REQUIREMENT IN SECTION 1.1.3 FROM
 11.00 ± 0.12 inches TO 10.50 ± 0.50 inches

- Since the FBC Canister has an outer dimension of 8.83 inches (less than 9 inches), a clearance of greater than one inch is sufficient to place a canister onto the Upender.

2. REVISE section 1.8 from "SINGLE" mode to "HAND" mode.

- In single mode, you do not have the option of individual operation or movement since it is sequential from start of process to end of process. In "Hand" mode you do have the option of individual operation or sequence. As the test procedure is written step could not have been performed.

(If more space is needed, use additional sheets)

=====

ENGINEER

3-22-92

Date

QUALITY ASSURANCE

3/23/92

Date

PROJECT MANAGER

3-22-92

Approved by DOE letter dated 4/17/92

HALLIBURTON NUS
Environmental Corporation

910 CLOPPER ROAD • P.O. BOX 6032 • GAITHERSBURG, MARYLAND 20877-0962 • (301) 258-6000

ED-DOE-PVJ-92-2315
March 30, 1992

Ms. M.W. Fisher, Chief
Civilian Rad-Waste Branch
U. S. Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, ID 83401-1562

Subject: Contract DE-AC07-86ID12651 - Rod Consolidation Project
Systems Operational Test--NFBC Upender Change Notice
(TCN) Approval

Reference: 1. 9315-TAC-204 Rev 3

Dear Ms. Fisher:

Attached are TCNs 001 and 002 to reference 1 for your approval action.

If you have any questions concerning this letter, please contact the undersigned on (412) 967-7304.

Very truly yours,

Peter V. Judd
Project Manager

ht

Attachments:
TCNs 001 and 002 to TAC 204 Rev 3.

cc: D.C. Koelsch--DOE-ID
J.H. Clark--EG&G

cc: F. G. 110

✓ G. Jean-Philippe (cc)

✓ T. Mulgrew (cc)

✓ Aug 4.1

McNish

ASD
✓ ~~SECRET~~

✓ DOE McNish

McJudd McNish

Department of Energy

Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

April 17, 1992

6.6.92
36191 ADJ - Supp 2U
- RPOH
DCC

FILED
SYSTEM
SOT BOOK
JAC 80001

Peter V. Judd
NUS Project
c/o Contraves-USA
620 Epsilon Drive
Pittsburgh, PA 15238

SUBJECT: Review of Halliburton NUS System Operation Test (SOT) TAC Change Notices (TCN), Nos. 001 and 002, for the Non-Fuel Bearing Components (NFBC) Upender TP-204

Sup Engr - GJP

REFERENCE: Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2315, dated March 30, 1992

Dear Mr. Judd:

DOE-ID has reviewed the subject TCNs under the REVIEW/APPROVAL provision of the contract and finds it acceptable. The TCN is approved for implementation.

If you have further questions, please contact me (208) 526-1466 or D. C. Koelsch (208) 526-5930.

Sincerely,

Margaret V. Fisher
Margaret V. Fisher, Chief
Civilian Rad-Waste Branch

cc: F. G. Gallo, NUS
J. H. Clark, EG&G

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE D3

EXCEPTION/REPAIR LOG

DATE 03-22-92

LOG RL#05

PROCEDURE NO. 9315-TP-204 REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender

PROCEDURE SECTION(S) 8.5.1 & 8.5.2

CLASSIFICATION OF CHANGE:

REPAIR ☒

REDESIGN ☐

TPCN#

PROBLEM AND CAUSE:

- Interlocks in section 8.5.1 allowed moveable frame to lower when the NFBC loader is extended (where A = 0)
- Interlock in section 8.5.2 (IV) is in conflict with control system.

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION:

Add new interlocks to prevent above from happening.

Solution - Issue DCN against the software (Control System) to add these interlocks

TEST CONDUCTOR

3/22/92
DATE

QUALITY ASSURANCE

DATE (1)

PROJECT ENGINEER

DATE (1)

TEST DIRECTOR

DATE (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Issue DCN #018 against software (Control System) DCN was incorporated.

TEST CONDUCTOR

DATE 3/22/92

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE 03

EXCEPTION REPAIR LOG

DATE 03-23-92

LOG RL*OC6

PROCEDURE NO. 9315-TP-204

REV. 2

TITLE SYSTEM OPERATIONAL TEST
Procedure for NFBC Upender

PROCEDURE SECTION(S) 8.9

CLASSIFICATION OF CHANGE:

REPAIR N/A REDESIGN N/A TPCN# N/A

PROBLEM AND CAUSE:

*SKIPPING OVER 8.9, DUE TO NFBC LOADING not yet installed
this section will be performed upon completion/installation of
NFBC LOADER*

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION:

- NONE*
- To be tested upon completion of NFBC LOADER machine installation.*

TEST CONDUCTOR

3-23-92
DATE

QUALITY ASSURANCE

DATE (1)

PROJECT ENGINEER

DATE (1)

TEST DIRECTOR

DATE (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

TEST CONDUCTOR

DATE

APPENDIX E
CCTV ASSESSMENT FORM

CCTV Assessment

1. Operation: (describe type of operation here)

Step 8.6.

2. Camera Assessment

Camera No.

Evaluation

(describe the view that the camera is capable of providing)

12

provide a good view of moveable frame when it is in the up position and partial view when in down position due to canister when the storage rack block the view.

11.

provide a better view of the couple frame in both up & down position

3. Recommendations: (Recommend cameras that provide the best view of the system)

Test Conductor

Date

QA

Date

APPENDIX F
TRAINING SIGN-OFF SHEET

2

TEST PROCEDURE 9315-TP-204

REVISION 2

PAGE F-2

NAME (Print)

G. JEAN-PHILIPPE
T. MULGREW
C.R. Clagett

SIGNATURE

C.R. Clagett

APPENDIX I-4.5
FUEL ASSEMBLY HANDLING FIXTURE
(WBS 1.3.1.8)
TEST RESULTS AND ANALYSIS REPORT

1.0 INTRODUCTION

This appendix addresses the System Operational Testing (SOT) for the Fuel Assembly Handling Fixture (Ref. the record copy of 9315-TP-205, Attachment 1 to this appendix). It provides an overview of the function of the equipment, procedures used for testing, results obtained during testing, and any conclusions and recommendations reached during testing. The purpose of the SOT was to verify that the as-built condition of the system met or exceeded the associated performance requirements. The primary objectives of this testing were as follows:

- Verification of system mechanical operation under loaded and unloaded conditions.
- Verification of system parts program operations with the equipment under loaded and unloaded conditions.

The PWR Fuel Assembly Handling Fixture (FAHF) has been judged acceptable and released for normal Integrated Systems Testing (IST). However, due to the restructured test program, the PWR FAHF was the only one tested. Therefore, the BWR FAHF will not be discussed further in this report.

2.0 EQUIPMENT FUNCTION

The purpose of the FAHF is to securely hold the fuel assemblies in the horizontal position while the Robotic Bridge Transporter (RBT) positions the fuel to the various processing stations. Two fixtures were designed and fabricated, one for handling BWR type fuels, the other for PWR type fuels. Both are identical in design except that the PWR clamps open further and are taller than the BWR clamp assemblies. This is due to the PWR fuel assemblies being larger than BWR type fuels.

The FAHF consists of a main support strongback to which are mounted two clamp assemblies, a clamp drive, and RBT adapter flange (Ref. Dwg. 9315-M-7201).

The FAHF is remotely fastened to the end of the RBT telescoping tube by a stainless steel adapter flange that is bolted to the FAHF main support plate. The adapter flange has four cone-shaped guide pins mounted 90 degrees apart. The guide pins fit through holes located on a similar flange attached to the end of the RBT telescoping tube. The guide pins not only align the mating flanges but also serve as the locking device to connect the FAHF to the RBT. Locking is possible by a motor-driven locking ring attached to the RBT adapter flange. The adapter flanges also house male and female electrical connectors that make contact when the flanges are

connected. These electrical connectors are required for powering the clamp drive.

The main support plate consists of a 7.00" x 93.50" x 1.00" thick stainless steel plate that acts both as a strongback to support the fuel and as a mounting structure for the clamp assemblies and associated drive components.

The clamp assemblies consist of two side clamps and one L-shaped bottom support located at each end of the FAHF which are operated by a single linear actuator. Each set of side clamps is designed and sized to apply a clamping force to at least one fuel assembly grid spacer, while the bottom supports prevent the fuel assembly from slipping out. The side clamps and bottom supports are each mounted to two 1.250 inch diameter hardened steel shafts which move in and out of a bearing block assembly perpendicular to the fuel. The bearing block assemblies utilize ball bushings for the side clamp shafts and solid bronze bushings for the bottom support shafts. The side clamp and bottom support shafts are moved within the bushings by means of slotted cam plates which are attached to each clamp and bottom support plate. Cam followers which are attached to two follower mounting plates move within the cam slots, causing the cam plates to move perpendicular (north-south) to the follower mounting plates which are orientated in the east-west direction. The follower mounting plates are driven east-west by a connecting rod attached to a common linear actuator.

The linear actuator (M-121G) has a 6.0 inch drive screw which is extended to close the clamps and retracted to open them. Positioning of the clamp openings is controlled by means of a potentiometer mounted within the linear actuator. End-of-travel engagement is prevented by internal limit switches.

The clamps were designed to open at least 10.30 inches in the automatic modes. This opening was selected to allow for a fuel width of 8.54 inches (widest fuel B&W 15x15), with a maximum bow of 1.50 inches and an RBT positioning accuracy of ± 0.13 inch. The clamps open further to enable the limit switch set point to be established prior to the hardstops. The clamps were designed to close down to 8.12 inches in the automatic mode to securely hold the narrowest fuel (CE 14x14). Further closure is possible so that the limit switch set point can be established prior to the hardstops. The clamps were also designed to apply a clamping force of no greater than 500 lbs. to the fuel assembly grid spacer.

3.0 TEST PROCEDURE

The test procedure was originally written to test both the BWR and PWR FAHFs for the five fuel types associated with the original test

program. The test program was restructured to test the W 17x17 PWR fuel type only; therefore, the BWR FAHF and PWR test sections not associated with the W 17x17 fuel type were eliminated from the test procedure and will not be discussed in this report.

The test procedure (Ref. Attachment I to this appendix) organized testing into the following sections below:

- Limit Switch Verification - Limit switches were tested by driving the linear actuator to each end-of-travel switch and verifying that hardstops were not engaged and that the Control System indicated that end of travel had been reached.
- Drive Systems Verification - This section tested and verified the clamp assembly operating time, open and closed positioning, and clamp force utilizing the HAND mode of operation.

The test results and data for each of these test sections are contained within the record copy (Ref. Attachment 1) of the test procedure. Each test step has been signed by appropriate personnel as required for final disposition of this SOT. Section 4.0 of this volume provides a typical format for the test procedures and includes an explanation and reference as to the location of the test data included in the various sections of the test procedure.

Two processes were implemented for making all necessary changes to the official test procedure and/or equipment. The first process is a Temporary Procedure Change Notice (TPCN). The TPCNs were used to make changes to the test procedure. For this test procedure, 11 TPCNs were issued as follows:

- TPCNs #1, 3, 4, 6, and 8 were issued to delete or revise prerequisites, test steps, and acceptance criteria which could not be performed as written. However, due to the restructured test plan, these TPCNs were not incorporated into the procedure as tested.
- TPCNs #2, 5, 7, 9, 10, and 11 were issued to change test procedure steps and acceptance criteria per the restructured test program and equipment performance requirements.

Each TPCN identified the change, reason for change, and final disposition for approval. A copy of each TPCN is included in Attachment 1.

The second process is an Exception/Repair Log (ERL). The ERLs were

used to document fixes to the equipment required to meet acceptance criteria or to justify acceptance of the test results that did not meet the test criteria. For this test, five ERLs were issued as follows:

- ERL #1 was issued to take exception to prerequisites not completed prior to testing.
- ERLs #2 and 3 were issued to change equipment set points which did not meet the acceptance criteria of the test. ERLs #2 and 3 were later superseded by ERL 5.
- ERL #5 was issued to implement changes to the equipment or set points necessary to meet the systems performance requirements.
- ERL #4 was issued to retest the PWR FAHF after repairs were made and performance requirements were finalized.

Each ERL identified a problem encountered during testing, the proposed solution to the problem, and the final disposition (accept as is or fix) to close out the ERL. A copy of each ERL is included in Attachment 1.

If a change to the acceptance criteria was required, a Test Acceptance Criteria (TAC) Change Notice (TCN) was issued against the TAC document. A TPCN would then be issued to reflect changes to the procedure. For this procedure, one TCN was issued against the TAC. The TCNs issued against the TAC documents can be found in the Test Section of the QA Records Package, which is a Phase III deliverable.

4.0 TEST RESULTS

Testing of the FAHF was postponed shortly after it was initiated to implement modifications required to increase the opening of the clamps. These modifications were made to both the PWR and BWR FAHFs. Prior to reinitiating the test, the test program was restructured. The restructured test program tested equipment related to processing the W 17x17 fuel only; therefore, the BWR FAHF was not tested.

The PWR FAHF was tested for the W 17x17 fuel type. During this test the FAHF failed to meet clamp opening acceptance criteria (Ref. ERL #2 and 3). The test remained open while the acceptance criteria were reevaluated. During this time one of the steel shafts attached to the L-shaped bottom support snapped. The cause was attributed to stress concentrations created by a diameter reduction at the fastening point. In addition to this, the ball

bearings were observed to be dropping out of the L-shaped bottom support shaft ball bushings. This was caused by the shafts moving out of one of two ball bushings in the open position. When closing, the shaft would not reenter the ball bushing centered. This would cause the shaft to push on the bearings while realigning itself, thus pushing the bearings out of the retainers. These problems were not encountered with either side clamp assembly due to the shafts being fully supported both open and closed.

Modifications were performed to both the bottom support shafts and bushings to alleviate any further problems. New support shafts were installed which maintained a constant diameter to eliminate stress concentrations, and the noncontinuous ball bushings were replaced by continuous solid bronze bushings.

Retesting of the PWR FAHF was initiated after new clamp opening criteria were established (Ref. TCN #003, ERL #4, and TPCNs #9 and 11) and equipment modifications were completed. Prior to reinitiating the test, a list of prerequisites (Ref. Section 2.0 of Attachment 1) had to be satisfied. These prerequisites identified all of the requirements for initiating this test sequence and served as an informal Operational Readiness Review (ORR). As a result of this informal ORR, it was determined that two prerequisites could not be satisfied. Both prerequisites (Ref. ERL #1) could not be satisfied due to the existence of open items on the QA/QC data package. Based on an evaluation of these open items by the review committee, it was determined that none would affect the operation of the equipment or the validity of the test results. Therefore, retesting of the FAHF was initiated.

4.1 LIMIT SWITCH VERIFICATION

The purpose of this test was to verify that the clamp drive (M-121G) limit switches were adjusted to deactivate the motor prior to hardstop engagement in the open and closed positions utilizing the JOG mode of operation. Additionally, the Control System end-of-travel indicators were verified to be functioning upon limit switch activation.

The clamps were opened and closed a minimum of three times to verify repeatability. The limit switches deactivated the drive prior to hardstop engagement, and the end-of-travel indication was verified at the control console successfully. Based on these results, this test section was judged acceptable.

4.2 DRIVE SYSTEM VERIFICATION

The purpose of this test was to verify that the clamp positioning in the open and closed positions met design requirements.

Additionally, the clamp force and closing time were measured and verified against the design requirements. This test sequence was performed in the HAND mode of operation to verify that the resolver positions and drive current were correct. The clamps were operated in each direction of travel a minimum of three times to verify repeatability.

Current measurements were originally called to be taken. However, due to problems encountered with obtaining torque measurements on other pieces of equipment, and the fact that all drives were overcurrent protected, a decision was made to delete all torque and current measurements from all test procedures (Ref. TPCN #5).

Clamp opening and closing times were measured and found to range between 5.9 - 6.6 seconds. These results were well within the 11 second acceptance criterion.

As previously mentioned, the clamp opening requirements were reestablished (Ref. TPCN #9 and 11) to allow a greater positioning tolerance. The original criterion limited the open position to 10.35 ± 0.06 inch and the closed position to $8.43 + 0.03, - 0.00$ inch. This criterion could not be met due to the Control System's relatively slow sampling time and slight dimensional differences between clamp openings. As a result of this, the criterion was changed to > 10.30 inches without contacting the limit switch for an open position and < 8.43 inches without contacting the limit switch for a closed position. The open position was based on a clamp opening large enough to pass over the widest fuel (8.54 inches, B&W 15x15), with a maximum bow of 1.50 inches, and an RBT positioning accuracy of ± 0.13 inch. The closed position was based on the width of the W 17x17 fuel type (8.43 inches). The idea behind the closed position was for the clamps to close on the fuel and exert a clamping force not to exceed 500 lbs. In order to apply a clamp force, the clamp position had to be set to close at less than 8.43 inches and the drive (M-121G) peak current value had to be set to shut the drive off when the clamp force was obtained.

The clamps were operated in the open and closed positions three times to verify repeatability. The clamp positioning was verified to be correct for both the open and closed positions at the east and west clamp assembly. However, when the clamp force was verified, it was found that the east clamp would not apply a clamp force to the test fixture. This was due to a slight dimensional difference between the east and west clamp assembly that caused the west clamp to close down slightly further. The position set point was changed to close the clamps down further (Ref. ERL #5) and reverified to be correct for positioning before checking the clamp force.

The clamp force was obtained three times for the east and west clamp assembly to verify repeatability. Both clamp assemblies met the acceptance criterion of not exceeding a 500 lb. clamp force. Clamp forces varied from 180 - 350 lbs. for the east clamp and from 240 - 470 lbs. for the west clamp. The variation between east and west clamp forces was due to the west clamp closing down further than the east clamp.

This concluded testing on the PWR FAHF. Based on these test results, the PWR FAHF was judged acceptable for the normal IST.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

In general, the PWR FAHF performed as designed. The PWR FAHF was tested and judged acceptable for the W 17x17 fuel type only. However, only minor set point changes would be required to make the FAHF functional to accept the other PWR fuels originally associated with this test program. The following conclusions are drawn from this SOT.

- The clamp drive system operated as designed under loaded and unloaded conditions.
- All control modes of operation (JOG and HAND) performed as designed.
- Clamp forces were generated but did not exceed 500 lbs.

Based on these conclusions, the PWR FAHF has been judged acceptable for the normal IST.

5.2 RECOMMENDATIONS

As a result of the SOT performed, one recommendation has been made. This recommendation, along with those identified in Section 7.0 of the main body of this report, should be implemented for the next generation system. The recommendation is as follows:

- Provide a means to adjust the FAHF both level and parallel with interfacing equipment. Slight misalignments with the RBT and interfacing equipment required the FAHF to be shimmed and offset in order to line up properly with the fuel assemblies and equipment.

ATTACHMENT 1

SYSTEM OPERATIONAL TEST PROCEDURE

FOR THE

FUEL ASSEMBLY HANDLING FIXTURE

(WBS 1.3.1.8)

DOCUMENT NO. 9315-TP-205

NUS
CORPORATION
ENGINEERING DIVISION

OFFICIAL TEST COPY

Record Copy

Signature

Peter V. Juhl

Date

11/15/91

TEST PROCEDURE

CLIENT: DOE-IDAHO

SPECIFICATION NO.: 9315-TP-205

LOCATION: COLD TEST FACILITY

REVISION NO.: 2

TITLE: SYSTEM OPERATIONAL TEST PROCEDURE FOR THE FUEL HANDLING FIXTURES WBS 1.3.1.8

RELEASED FOR:

☐

REVIEW

☒

TEST

SYSTEM OPERATIONAL TEST PROCEDURE
FOR
THE FUEL ASSEMBLY HANDLING FIXTURE

WBS 1.3.1.8

APPROVED

Joseph J. Caporelli
PROJECT MANAGER

DATE

8/5/91

APPROVED

Mike S. ...
QUALITY ASSURANCE

DATE

6/3/91

APPROVED

R. Mychajko
DISCIPLINE MANAGER

DATE

6/3/91

APPROVED

Kenneth Hayner
AUTHOR

DATE

5-17-91

1	<i>Kenneth Hayner</i>	<i>9-25-91</i>	<i>R. Mychajko</i>	<i>10/1/91</i>	<i>Chapman</i>	<i>10/2/91</i>	<i>F. M. Deller</i>	<i>10/2/91</i>
2	<i>Kenneth Hayner</i>	<i>11-12-91</i>	<i>R. Mychajko</i>	<i>11/13/91</i>	<i>Chapman</i>	<i>11/13/91</i>	<i>F. M. Deller</i>	<i>11/13/91</i>
REV	PREPARED	DATE		DATE		DATE	APPROVED	DATE

NUS CORPORATION

TEST PROCEDURE **9315-TP-205****REVISION** **2****PAGE** **1 of 11**

REVISION CONTROL SHEET**Revised Page No.****Latest Revision****Date****Original****0****5-17-91****A11****1****9-23-91****A11****2****11-1-91**

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rye
4/22/12

1.0 OBJECTIVE OF TEST

^{BWR and PWR}
 The objective of this Test Procedure is to demonstrate the acceptability of the Fuel Assembly Handling Fixtures (FAHF). These detailed test steps will demonstrate the acceptability of the equipment to satisfy design requirements.

2.0 PREREQUISITES

^{For the PWR FAHF}
 2.1 A System set-up has been performed per the instruction of Appendix A.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

2.2 Camera, film, lighting and personnel are available to take photographs per the instruction of Appendix C and the detailed procedure steps (Section 8.0).

Test Conductor Kenneth B. Hayes ^{File} Date 4/22/92
12-3-91

QA W. M. J. J. J. Date 12/3/91

2.3 The QA/QC Data Package has been prepared in accordance with Specification 9315-M-200, and the applicable Bill of Material, and is acceptable.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

2.4 The system has been assembled in accordance with all applicable Drawings, DCNs and FCRs, of the QA/QC Data Package.

Test Conductor Kenneth B. Hayes ^{File} Date 4/22/92
12-3-91

QA W. M. J. J. J. Date 12/3/91

2.5 The Test Conductor has been qualified and certified in accordance with QAP 2.0:

Test Conductor Fred G. Coleman Date 4-22-92
Kenneth B. Hayes Date 12-3-91

QA W. M. J. J. J. Date 12/3/91

2.1 B System set-up for the BWR FAHF has been performed per the instruction of Appendix A.

Test Conductor _____

QA _____

File
4/22/92

TPCN

4

RL#1

TPCN#1

TPCN

4

- 2.6 All test personnel participating in this test have been trained per the instruction of Section 6.4 of Reference 11.1.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

- 2.7 The checklist contained in the Control System SOT (9315-TP-601) applicable to this system must be completed and the results accepted prior to the initiation of testing under this procedure.

Test Conductor Kenneth B. Hansen Date 12-3-91

QA Dr. M. J. G. G. G. Date 12/3/91

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

- 2.9 The system FAT_A has been completed and accepted by ^{For the PWR FAHR approved} HNUS ~~TPCN #4~~ ^{for 4/22} TPCN #4

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor Fred G. Coleman Date 4/22/92 TPCN 5

QA Joseph Alfano Date 4/22/92

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor Fred G. Coleman Date 4/22/92

QA Joseph Alfano Date 4/22/92

- 2.9 A The system FAT for the BWR FAHR has been completed and approved by HNUS.

Test Conductor _____ Date _____

QA _____ Date _____

TPCN
4

- 2.13 Procedures for changeover of fuel types for the Control System are in place in the Control Room.

Test Conductor Fred G. Coleman Date 4/24/92

QA Joseph A. Yates Date 4/22/92

- 2.14 The RBT has been accepted by its FAT and is operational. ✓

Test Conductor Kenneth B. Hays ^{78E} Date 4/22/92
12-3-91

QA G. Mulgrew Date 12/3/91

3.0 INITIAL TEST CONDITIONS

- 3.1 The RBT is coupled both electrically and mechanically to the BWR FAHF.

Test Conductor Fred G. Coleman Date 4/22/92

- 3.2 The FAHF is set up to accept ^{PWR} ~~BWR~~ fuel types and positioned in the laydown area at a height of approximately 60 inches off the floor.

Test Conductor Joseph A. Yates Date 4/22/92

1 TPCN
5
6

4.0 ENVIRONMENTAL CONDITIONS

At least one HVAC unit for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60° to 90°F and 65° to 85°F.

Test Conductor Fred G. Coleman Date 4/22/92

5.0 SPECIAL PRECAUTIONS

All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

6.1 Compression Load Test Fixture - Dwg. 9315-M-0016, Group 2 and 3.

6.2 Inside micrometer or measuring device with a range of 5-10 inches.

6.3 Stopwatch

~~6.4 Ampmeter with a 0-5 amp range.~~

TPCN 5

7.0 TEST DATA RECORDING

7.1 Test Data Records

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

Each of these modifications will be handled differently. If a correction is required to the procedure, it will be made with pen and ink in the "Record Copy", as they are found. The test conductor will make the appropriate change. Once the change is made, he will initial and date the change for future reference. All modifications which are considered minor changes must be documented on "Temporary Procedure Change Notice" (TPCN) forms (refer to Appendix D). This change shall be approved by the test conductor by annotating that the test procedures are using the TPCN form. All modifications which are considered a major change must also be documented on the TPCN form. However, when a major change is required, testing shall be halted until the TPCN is approved by the responsible Test Engineer, Test Conductor, Quality Assurance and Project Engineer.

7.3 Repairs/Retesting

This section addresses the process for making necessary repairs to the equipment and retesting of the system. If during testing a problem is observed which requires repair or rework of the equipment, testing shall be halted. If the repair/rework is minor, the Test Conductor will document the problem, cause, and corrective action implemented, the faulty system will be retested. All remaining tests will continue on until conclusion. If the problem requires redesign of the faulty system, all testing of this equipment will be halted. The problem and recommended solution will be documented and submitted to the Test Review Group (TRG) for approval. Once approval and the repair is complete, testing of the equipment will be accomplished in accordance with this procedure.

8.0 DETAILED TEST STEPS

8.1 System Verification for the GE 8 x 8 BWR Fuel Type

The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the GE 8 x 8 BWR fuel type. Prior to initiating testing, verify the control system is programmed for the GE 8 x 8 BWR fuel type.

Test Conductor _____ Date _____

~~8.1.1 Sensor Operation Verification Test~~

~~8.1.1.1 Verify the operation of the clamp actuator motor M-121G (Dwg. 9315 M-7201, Item 14) limit switch as follows:~~

~~— WARNING —~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.~~
- ~~2. With the clamps fully opened, switch the control system to the "JOG" mode.~~
- ~~3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

TPCN
#3
xpe
4/17/92

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Jog the clamps open until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~5. Repeat Steps 3 and 4 two additional times.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~6. The above steps have been completed.~~

~~Test Conductor _____ Date _____~~

TPCN
#3
782
4/17/92

FEN
803
8/9
8/2/92

8.1.2 Drive System Operation Verification Test

- 8.1.2.1 Verify the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) position transducer setpoints as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and close the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to close clamps and the motor current using a stopwatch and ammeter.

Type of Measuring Device	Range
Identification No.	Calibration Due Date

~~Motor Current~~ ~~///~~ ~~///~~ ~~///~~ ~~///~~ ~~///~~ Closing Time _____

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~

Test Conductor _____ Date _____

QA _____ Date _____

2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7210, Item 3) and clamp plate (Dwg. 9315-M-7211, Item 3) for both east and west clamps using a micrometer or caliper.

Type of Measuring Device	Range
Identification No.	Calibration Due Date

East Clamp Opening _____ West Clamp Opening _____

Acceptance Criteria

- Clamp opening in the closed position shall be 5.52 ± 0.03 in.
- 0.00

Test Conductor _____ Date _____

QA _____ Date _____

TPCN # 5
792 4/17/92

TPCN # 5
792 4/17/92

TCN # 002
792 4/17/92

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- Time to open clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~
- Clamp opening in the closed position shall be $5.52 + 0.03$ in.
- 0.00
- Clamp opening in the open position shall be 7.33 ± 0.06 in.

TCN 002
79K 4/17/92

Test Conductor _____ Date _____

QA _____ Date _____

6. The above steps have been completed.

Test Conductor _____ Date _____

8.1.2.2 Verify the clamp force exerted by the actuator motor M-121G (Dwg. 9315-M-7201, Item 14) as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and open the clamps until the actuator motor automatically shuts off.
2. Insert the compression load test fixture (Dwg. 9315-M-0016, Group 2) in the east clamp assembly. Temporarily support the fixture in the clamp so it will remain contained until the clamps close.
3. Close the clamps until the actuator motor M-121G automatically stops. Measure and record the ~~motor current using an ammeter,~~ and force exerted by the clamps using the compression load fixture.

TPCN
#45
79K
4/17/92

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

Type of Measuring Device _____ Range _____
Identification No. _____ Calibration Due Date _____

~~Type of Measuring Device _____ Range _____~~
~~Identification No. _____ Calibration Due Date _____~~

~~Motor Current~~ _____ ~~Clamp Force~~ _____

TPCN #45
79K
4/17/92

TAN 002
732 4742

- QA _____ Date _____

- TPCN #⁵
792
4117192

~~Motor Current~~ Clamp Force

Photographs do not need to be taken when repeating the above steps.

TCN 002
72e 4/17/92

- QA _____ Date _____

- TCN #A⁵
4/17/92 JJE

~~Motor Current~~ _____ Clamp Force _____

Acceptance Criteria

TCN 001
JHE H1742

- ~~• Motor current shall be $\leq$ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor _____ Date _____

QA _____ Date _____

8. The above test steps have been completed.

Test Conductor _____ Date _____

8.2 System Verification for the B&W 15 x 15 PWR Fuel Type

Prior to initiating testing for all PWR fuel types (Section 8.2-8.5), ~~the B&W FAHF must be removed and replaced by the PWR FAHF.~~ TPCN 6
PWR in place.

~~The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the B&W 15 x 15 PWR fuel type. Prior to initiating testing, verify the control system is programmed for the B&W 15 x 15 PWR fuel type.~~

~~Test Conductor _____ Date _____~~

~~8.2.1 Sensor Operation Verification Test~~

~~8.2.1.1 Verify the operation of the clamp actuator motor M 121G (Dwg. 9315-M-7201, Item 14) limit switch as follows:~~

~~— WARNING —~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M 121G automatically shuts off.~~
- ~~2. With the clamps fully opened, switch the control system to the "JOG" mode.~~
- ~~3. Jog the clamps closed until the actuator motor M 121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

TPCN
#82
JHE
H1742

~~Acceptance Criteria~~

- ~~The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

4. ~~Jog the clamps open until the actuator motor M 121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

5. ~~Repeat Steps 3 and 4 two additional times.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

6. ~~The above steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

TPCN
#82
JHR
4/17/92

TCN
003
Jg
8/12/92

- ~~3. Open the FAHF clamps until the actuator motor M 121G automatically shuts off. Measure and record the time to open clamps and the motor current using a stopwatch and ammeter.~~

~~Motor Current _____ Opening Time _____~~

~~Acceptance Criteria~~

- ~~• Time to open clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.~~

~~East Clamp Opening _____ West Clamp Opening _____~~

~~Acceptance Criteria~~

- ~~• Clamp opening in the open position shall be 10.35 ± 0.06 inches.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~5. Repeat Steps 1 through 4 two additional times and record data below.~~

~~Motor Current _____ Closing Time _____~~

~~East Clamp Opening _____ West Clamp Opening _____~~

~~Motor Current _____ Opening Time _____~~

~~East Clamp Opening _____ West Clamp Opening _____~~

~~Motor Current _____ Closing Time _____~~

~~East Clamp Opening _____ West Clamp Opening _____~~

~~Motor Current _____ Opening Time _____~~

~~East Clamp Opening _____ West Clamp Opening _____~~

TPW
#2
7/9/92
11/1/92
TCW
003

~~Acceptance Criteria~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Open the clamps until the actuator motor M-121G automatically stops.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

- ~~5. Repeat Steps 3 and 4 two additional times and record data below.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~—NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~6. Remove the compression load test fixture from the east clamp assembly and insert into the west clamp assembly. Temporarily support the test fixture as in Step 2.~~

- ~~7. Repeat Steps 3 through 5 for the west clamp assembly and record data below.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

TPCN
2
4/17/92
JJE
TCN
003

~~Acceptance Criteria~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

~~8. The above test steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~8.3 System Verification for the CE 14 x 14 PWR Fuel Type~~

~~The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the CE 14 x 14 PWR fuel type. Prior to initiating testing, verify the control system is programmed for the CE 14 x 14 PWR fuel type.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~8.3.1 Sensor Operation Verification Test~~

~~8.3.1.1 Verify the operation of the clamp actuator motor M-121G (Dwg. 9315 M-7201, Item 14) limit switch as follows:~~

~~WARNING~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.~~
- ~~2. With the clamps fully opened, switch the control system to the "JOG" mode.~~
- ~~3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

TPCN
#2
77R
#192
TCN
003

- ~~4. Jog the clamps open until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~5. Repeat Steps 3 and 4 two additional times.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~6. The above steps have been completed.~~

~~Test Conductor _____ Date _____~~

~~8.3.2 Drive System Operation Verification Test~~

- ~~8.3.2.1 Verify the clamp actuator motor M 121G (Dwg. 9315 M 7201, Item 14) position transducer setpoints as follows:~~

~~WARNING~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and close the FAHF clamps until the actuator motor M 121G automatically shuts off. Measure and record the time to close clamps and the motor current using a stopwatch and ammeter.~~

~~Type of Measuring Device _____ Range _____~~

~~Identification No. _____ Calibration Due Date _____~~

~~Motor Current _____ Closing Time _____~~

TPCN
#2
382
4/11/12

TCN
003

~~Acceptance Criteria~~

- ~~• Time to close clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.~~

Type of Measuring Device _____	Range _____
Identification No. _____	Calibration Due Date _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Acceptance Criteria~~

- ~~• Clamp opening in the closed position shall be 8.12 ± 0.03 in.~~
~~_____ 0.00~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~3. Open the FAHF clamps until the actuator motor M 121G automatically shuts off. Measure and record the time to open clamps and the motor current using a stopwatch and ammeter.~~

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~Acceptance Criteria~~

- ~~• Time to open clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) for both clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.~~

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

TPCN

2
7/9/92
4/17/92
TCN
003

~~Acceptance Criteria~~

- ~~• Clamp opening in the open position shall be 10.35 ± 0.06 inches.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~5. Repeat Steps 1 through 4 two additional times and record data below.~~

~~Motor Current~~ _____ ~~Closing Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Closing Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Acceptance Criteria~~

- ~~• Time to close clamps shall be ≤ 11 seconds.~~
- ~~• Time to open clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp opening in the closed position shall be 8.12 ± 0.03 in. - 0.00~~
- ~~• Clamp opening in the open position shall be 10.35 ± 0.06 in.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~6. The above steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

TCN

2
JHE
4/17/92
TCN
003

- ~~8.3.2.2 Verify the clamp force exerted by the actuator motor M-121G (Dwg. 9315-M-7201, Item 14) as follows:~~

~~WARNING~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the clamps until the actuator motor automatically shuts off.~~
- ~~2. Insert the compression load test fixture (Dwg. 9315-M-0016, Group 3) in the east clamp assembly. Temporarily support the fixture in the clamp so it will remain contained until the clamp closes.~~
- ~~3. Close the clamps until the actuator motor M-121G automatically stops. Measure and record the motor current using an ammeter, and force exerted by the clamps using the compression load fixture.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Type of Measuring Device _____ Range _____~~
~~Identification No. _____ Calibration Due Date _____~~

~~Type of Measuring Device _____ Range _____~~
~~Identification No. _____ Calibration Due Date _____~~

~~Motor Current _____ Clamp Force _____~~

~~Acceptance Criteria~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Open the clamps until the actuator motor M-121G automatically stops.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

TPCN
2
29X
4/17/92
TCN
003

~~5. Repeat Steps 3 and 4 two additional times and record data below.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Acceptance Criteria _____~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

~~6. Remove the compression load test fixture from the east clamp assembly and insert into the west clamp assembly. Temporarily support the test fixture as in Step 2.~~

~~7. Repeat Steps 3 through 5 for the west clamp assembly and record data below.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Acceptance Criteria _____~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

~~8. The above test steps have been completed.~~

~~Test Conductor _____ Date _____~~

TPCN
2
7/9/92
4/17/92
TCN
003

~~8.4 System Verification for the Westinghouse 15 x 15 PWR Fuel Type~~

~~The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the Westinghouse 15 x 15 PWR fuel type. Prior to initiating testing, verify the control system is programmed for the Westinghouse 15 x 15 PWR fuel type.~~

~~Test Conductor _____ Date _____~~

~~8.4.1 Sensor Operation Verification Test~~

~~8.4.1.1 Verify the operation of the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) limit switch as follows:~~

~~— WARNING —~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.~~
- ~~2. With the clamps fully opened, switch the control system to the "JOG" mode.~~
- ~~3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Jog the clamps open until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

TPCN
#2

782
4/11/12

TCN
003

~~Acceptance Criteria~~

- ~~The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~5. Repeat Steps 3 and 4 two additional times.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~6. The above steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~8.4.2 Drive System Operation Verification Test~~

- ~~8.4.2.1 Verify the clamp actuator motor M 121G (Dwg. 9315-M-7201, Item 14) position transducer setpoints as follows:~~

~~WARNING~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and close the FAHF clamps until the actuator motor M 121G automatically shuts off. Measure and record the time to close clamps and the motor current using a stopwatch and ampmeter.~~

~~Type of Measuring Device~~ _____ ~~Range~~ _____

~~Identification No.~~ _____ ~~Calibration Due Date~~ _____

~~Motor Current~~ _____ ~~Closing Time~~ _____

TPCN
#2
7/92
4/17/92
TCN
003

~~Acceptance Criteria~~

- ~~• Time to close clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.~~

Type of Measuring Device _____	Range _____
Identification No. _____	Calibration Due Date _____

~~Acceptance Criteria~~

- ~~• Clamp opening in the closed position shall be 8.43 ± 0.03 in. - 0.00~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~3. Open the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to open clamps and the motor current using a stopwatch and ammeter.~~

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~Acceptance Criteria~~

- ~~• Time to open clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.~~

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

TPCN
2
7/17/92
TCN
003

~~Acceptance Criteria~~

- ~~• Clamp opening in the open position shall be 10.35 ± 0.06 inches.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~5. Repeat Steps 1 through 4 two additional times and record data below.~~

~~Motor Current~~ _____ ~~Closing Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Closing Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Motor Current~~ _____ ~~Opening Time~~ _____

~~East Clamp Opening~~ _____ ~~West Clamp Opening~~ _____

~~Acceptance Criteria~~

- ~~• Time to close clamps shall be ≤ 11 seconds.~~
- ~~• Time to open clamps shall be ≤ 11 seconds.~~
- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp opening in the closed position shall be 8.43 ± 0.03 in. - 0.00~~
- ~~• Clamp opening in the open position shall be 10.35 ± 0.06 in.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~6. The above steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

TPCN
#2
798
4/1/97
TCN
003

~~8.4.2.2 Verify the clamp force exerted by the actuator motor M-121G (Dwg. 9315-M-7201, Item 14) as follows:~~

~~—WARNING—~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the clamps until the actuator motor automatically shuts off.~~
- ~~2. Insert the compression load test fixture (Dwg. 9315-M-0016, Group 3) in the east clamp assembly. Temporarily support the fixture in the clamp so it will remain contained until the clamp closes.~~
- ~~3. Close the clamps until the actuator motor M-121G automatically stops. Measure and record the motor current using an ammeter, and force exerted by the clamps using the compression load fixture.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Type of Measuring Device _____ Range _____~~

~~Identification No. _____ Calibration Due Date _____~~

~~Type of Measuring Device _____ Range _____~~

~~Identification No. _____ Calibration Due Date _____~~

~~Motor Current _____ Clamp Force _____~~

~~—Acceptance Criteria—~~

- ~~• Motor current shall be ≤ 2.3 amps.~~
- ~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Open the clamps until the actuator motor M-121G automatically stops.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

TPCN
#2
7/2
4/17/92
TCN
003

~~5. Repeat Steps 3 and 4 two additional times and record data below.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Acceptance Criteria~~

~~• Motor current shall be ≤ 2.3 amps.~~

~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

~~6. Remove the compression load test fixture from the east clamp assembly and insert into the west clamp assembly. Temporarily support the test fixture as in Step 2.~~

~~7. Repeat Steps 3 through 5 for the west clamp assembly and record data below.~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Motor Current _____ Clamp Force _____~~

~~Acceptance Criteria~~

~~• Motor current shall be ≤ 2.3 amps.~~

~~• Clamp exerts a force not to exceed 500 lbs.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

~~8. The above test steps have been completed.~~

~~Test Conductor _____ Date _____~~

TPCN
#2
7/28
9/6/92
TCN
003

8.5 System Verification for the Westinghouse 17 x 17 PWR Fuel Type

The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the Westinghouse 17 x 17 PWR fuel type. Prior to initiating testing, verify the control system is programmed for the Westinghouse 17 x 17 PWR fuel type.

Test Conductor Fred G. Coleman Date 4/22/92

~~8.5.1 Sensor Operation Verification Test~~

- ~~8.5.1.1 Verify the operation of the clamp actuator motor M 121G (Dwg. 9315-M-7201, Item 14) limit switch as follows:~~

~~— WARNING —~~

~~Stay clear of the FAHF clamps while in operation.~~

- ~~1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.~~
- ~~2. With the clamps fully opened, switch the control system to the "JOG" mode.~~
- ~~3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor _____ Date _____~~

~~QA _____ Date _____~~

- ~~4. Jog the clamps open until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.~~

~~***TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG***~~

TPCN
#3
782
4/14/92
Test
8/3
8/9
8/10/92

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~5. Repeat Steps 3 and 4 two additional times.~~

~~NOTE~~

~~Photographs do not need to be taken when repeating the above steps.~~

~~Acceptance Criteria~~

- ~~• The control system indicates that the end of travel sensor has been activated.~~

~~Test Conductor~~ _____ ~~Date~~ _____

~~QA~~ _____ ~~Date~~ _____

- ~~6. The above steps have been completed.~~

~~Test Conductor~~ _____ ~~Date~~ _____

8.5.2 Drive System Operation Verification Test

- 8.5.2.1 Verify the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) position transducer setpoints as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and close the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to close clamps and the motor current using a stopwatch and ammeter.

Type of Measuring Device	Range
Identification No.	Calibration Due Date

~~Motor Current~~ _____ Closing Time 5.89 sec.

TPCN
#3
JHE
4/17/92
JHE

Item #5
JHE 4/17/92

TPCN #5
JHE 4/17/92

Acceptance Criteria

TCN 002
782 4/17/92

- Time to close clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~

Test Conductor Fred G. Coleman Date 4/22/92

QA J. Alfano Date 4/22/92

2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

Type of Measuring Device	<u>Caliper</u>	Range	<u>0-12"</u>
Identification No.	<u>NUS-001</u>	Calibration Due Date	<u>4/29/92</u>

East Clamp Opening 8.50" West Clamp Opening 8.44" RL#2

Acceptance Criteria

- Clamp opening in the closed position shall be 8.27 + 0.19 in. ~~8.43 + 0.03 in.~~ ^{TPCN #8}
 $- 0.00$

Test Conductor Fred G. Coleman Date 4/22/92

QA J. Alfano Date 4/22/92 R

3. Open the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to open clamps ~~and the motor current~~ using a stopwatch ~~and ammeter~~.

~~Motor Current~~ ||||| Opening Time 5.75 sec.

TPCN #5
782
4/17/92

Acceptance Criteria

TCN 002
782
4/17/92

- Time to open clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~

Test Conductor Fred G. Coleman Date 4/22/92

QA J. Alfano Date 4/22/92

4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

East Clamp Opening 10.56" West Clamp Opening 10.49" RL #3

Acceptance Criteria

- Clamp opening in the open position shall be ~~10.35 ± 0.06 inches~~ ^{> 10.3 inches without} contacting the overtravel switch. TPCN #9

Test Conductor Fred G. Coleman Date 4/22/92

QA [Signature] Date 4/22/92

5. Repeat Steps 1 through 4 two additional times and record data below.

7912 TPCN #5
4/22/92

~~Motor Current~~ / / / / / Closing Time 5.88 sec
East Clamp Opening 8.43" West Clamp Opening 8.37" RL #2

7912 TPCN #5
4/22/92

~~Motor Current~~ / / / / / Opening Time 5.57 sec
East Clamp Opening 10.58" West Clamp Opening 10.60" RL #3

7912 TPCN #5
4/22/92

~~Motor Current~~ / / / / / Closing Time 5.61 sec
East Clamp Opening 8.44" West Clamp Opening 8.38" RL #2

7912 TPCN #5
4/22/92

~~Motor Current~~ / / / / / Opening Time 5.75 sec
East Clamp Opening 10.54" West Clamp Opening 10.48" RL #3

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.

- Time to open clamps shall be ≤ 11 seconds.

- ~~Motor current shall be ≤ 2.3 amps.~~

- Clamp opening in the closed position shall be ~~8.43 ± 0.03 in.~~ ^{8.27 + 0.19 in} TPCN #8
- 0.00

- Clamp opening in the open position shall be ~~10.35 ± 0.06 in.~~ ^{> 10.3 inches without contacting the overtravel switch.} TPCN #9

Test Conductor Fred G. Coleman Date 4/22/92

QA [Signature] Date 4/22/92

TCN 002
7912 4/17/92

6. The above steps have been completed.

Test Conductor Fred G. Coleman Date 4/22/92

8.5.2.2 Verify the clamp force exerted by the actuator motor M-121G (Dwg. 9315-M-7201, Item 14) as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and open the clamps until the actuator motor automatically shuts off.
2. Insert the compression load test fixture (Dwg. ~~9315-M-0016~~, Group TPCN ~~3~~) in the east clamp assembly. Temporarily support the fixture #7 in the clamp so it will remain contained until the clamp closes.
3. Close the clamps until the actuator motor M-121G automatically stops. Measure and record the ~~motor current using an ammeter,~~ and force exerted by the clamps using the compression load fixture.

TPCN 45
792
4/11/92

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

Type of Measuring Device _____ Range _____
Identification No. _____ Calibration Due Date _____

TPCN 45
792
4/11/92

~~Type of Measuring Device _____ Range _____~~
~~Identification No. _____ Calibration Due Date _____~~

~~Motor Current~~ ||||| Clamp Force 100 lbs (-7m)

Acceptance Criteria

- ~~• Motor current shall be ≤ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

TCN 002
792
4/11/92

Test Conductor SIS Fawcett Date 4/27/92

QA JN MAGNUM Date 4/27/92

4. Open the clamps until the actuator motor M-121G automatically stops.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

22
21

5. Repeat Steps 3 and 4 two additional times and record data below.

NOTE

Photographs do not need to be taken when repeating the above steps.

TPCN #5
792
4/17/92

~~Motor Current~~ ~~Clamp Force~~ 68 lbs (1.5 mm)
~~Motor Current~~ ~~Clamp Force~~ 68 lbs (1.5 mm)

Acceptance Criteria

TCN 002
792
4/17/92

- ~~Motor current shall be ≤ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor 213 Forest Date 4/27/92

QA SV/Agnew Date 4/27/92

6. Remove the compression load test fixture from the east clamp assembly and insert into the west clamp assembly. Temporarily support the test fixture as in Step 2.
7. Repeat Steps 3 through 5 for the west clamp assembly and record data below.

TPCN #5
792
4/17/92

~~Motor Current~~ ~~Clamp Force~~ 232 lbs (1.5 mm)
~~Motor Current~~ ~~Clamp Force~~ 316 lbs (1.9 mm)
~~Motor Current~~ ~~Clamp Force~~ 350 lbs (2.1 mm)

Acceptance Criteria

TCN 002
792
4/17/92

- ~~Motor current shall be ≤ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor 213 Forest Date 4/27/92

QA SV/Agnew Date 4/27/92

8. The above test steps have been completed.

Test Conductor 213 Forest Date 4/27/92

9.0 POST PERFORMANCE REVIEW AND APPROVAL

The following signatures certify that the completed test, with all data collected, has been reviewed, and that the system has passed the requirements for system operational test.

*See RL #4
for Disposition
of Testing.*

Test Engineer Date

Quality Assurance Date

Project Engineer Date

Test Director Date

10.0 RETENTION OF TEST RECORDS

The original working copy, including test exceptions and resolution and acceptance signatures, are to be maintained by the Test Director and stored at the NUS Gaithersburg building, Document Control Center. One copy of the original working document shall be sent to the DOE representative for their use and retention.

11.0 REFERENCES

- 11.1 Document 9315-P-120, Test Administration Manual for System Operational Test and Integrated Systems Tests, latest revision.
- 11.2 NUS Drawings: 9315-M-7201
9315-M-7202
9315-M-7203
9315-M-7204
9315-M-7205
9315-M-7206
9315-M-7207
9315-M-7210
9315-M-7211
9315-M-7212
9315-M-7215
- 11.3 Specification 9315-TAC-205, System Operational Test Acceptance Criteria for the Fuel Handling Fixtures, latest revision.
- 11.4 Fuel Rod Consolidation Project Phase II Final Report, NUS Corporation, 12-21-87.
- 11.5 9316-88-46, NUS Letter, dated 3-13-88.
- 11.6 Duff-Norton Mechanical Design Guide, dated 1990.
- 11.7 9315-P-101, Design Input Requirements Document, dated 1987.

APPENDIX A
EQUIPMENT SETUP

1.0 EQUIPMENT SET UP

1.1 Control System/BWR FAHF Mechanical Integration Tests

1.1.1 Limit Switch Calibration (BWR FAHF)

1. Open the FAHF clamps using the jog mode to 7.45 ± 0.06 inches and stop. Set the actuator motor (Dwg. 9315-M-7201, Item 14) limit switch to deactivate the motor at this opening.
2. Close the FAHF clamps using the jog mode to 5.34 ± 0.06 inches and stop. Set the actuator motor (Dwg. 9315-M-7201, Item 14) limit switch to deactivate the motor at this opening.

1.1.2 Position Transducer Calibration (GE 8 x 8 BWR fuel type)

1. Verify that the Control System is set for the GE 8x8 BWR fuel type.
2. Open the FAHF clamps using the jog mode to 7.33 ± 0.06 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
3. Close the FAHF clamps using the jog mode to 5.52 inches, $+0.03$, - 0.00 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
4. Upload part-program to supervisory program to store setpoints.

1.2 Control System/PWR FAHF Mechanical Integration Tests

1.2.1 Limit Switch Calibration (PWR FAHF)

Changeover from the BWR FAHF to the PWR FAHF must be performed before proceeding on.

1. Open the FAHF clamps using the jog mode to 10.47 ± 0.06 inches and stop. Set the actuator motor (Dwg. 9315-M-7201, Item 14) limit switch to deactivate the motor at this opening.
2. Close the FAHF clamps using the jog mode to 7.94 ± 0.06 inches and stop. Set the actuator motor (Dwg. 9315-M-7201, Item 14) limit switch to deactivate the motor at this opening.

1.2.2 Position Transducer Calibration (B&W 15 x 15 PWR fuel type)

1. Verify that the Control System is set for the B&W 15x15 PWR fuel type.
2. Open the FAHF clamps using the jog mode to 10.35 inches $\pm$ 0.06 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
3. Close the FAHF clamps using the jog mode to 8.54 inches, +0.03, - 0.00 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
4. Upload part-program to supervisory program to store setpoints.

~~1.2.3 Position Transducer Calibration (W 15x15 PWR fuel type)~~

- ~~1. Verify that the Control System is set for the W 15x15 PWR fuel type.~~
- ~~2. Open the FAHF clamps using the jog mode to 10.35 inches $\pm$ 0.06 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.~~
- ~~3. Close the FAHF clamps using the jog mode to 8.43 inches, +0.03, - 0.00 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.~~
- ~~4. Upload part program to supervisory program to store setpoints.~~

TPCN

2
278
4/12/02

1.2.4 Position Transducer Calibration (W 17 x 17 PWR fuel type)

1. Verify that the Control System is set for the W 17x17 PWR fuel type.
2. Open the FAHF clamps using the jog mode to 10.35 inches $\pm$ 0.06 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
3. Close the FAHF clamps using the jog mode to 8.43 inches, +0.03, -0.00 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.
4. Upload part-program to supervisory program to store setpoints.

~~1.2.5 Position Transducer Calibration (CE 14x14 PWR fuel types)~~

- ~~1. Verify that the Control System is set for the CE 14x14 PWR fuel type.~~
- ~~2. Open the FAHF clamps using the jog mode to 10.35 inches $\pm$ 0.06 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.~~
- ~~3. Close the FAHF clamps using the jog mode to 8.12 inches, $\pm$ 0.03, -0.00 inches and stop. Program the Control System to shut down the actuator (Dwg. 9315-M-7201, Item 14) at this opening.~~
- ~~4. Upload part program to supervisory program to store setpoints.~~

The following signature certifies that the equipment setup contained in Appendix A, Sections 1.2.1, 1.2.2, 1.2.4 have successfully been completed.

Signature Fred G. Coleman Date 4/24/92

The following signature certifies that the equipment setup contained in Appendix A, Sections 1.1.1 and 1.1.2 have successfully been completed.

Signature _____ Date _____

TPCN

2
JAE
4/17/92

TPCN

2
JAE
4/17/92

TPCN
4

APPENDIX B
SAFETY PROCEDURES

SYSTEMS OPERATIONS TEST SAFETY CONSIDERATIONS

Performance of the SOTs in a manner which precludes the injury of personnel involved in the test performance or working in the Test Facility is of paramount importance. The following steps shall be taken to minimize the possibility of personnel being injured during the performance of SOTs:

1. Contraves and NUS will advise their employees and any subcontractors to stay clear of the Test Facility when tests are being conducted unless they are involved in the test performance or have another work assignment in the Test Facility.
2. Contraves will post a warning sign at the entrance to the Test Facility when testing is in progress advising personnel of the need to stay away unless involved in the testing or have some authorized work assignment in the area.
3. When feasible and deemed advisable by the Test Conductor the machine being tested will be surrounded by a portable barrier (ropes and posts) with a Caution Sign warning individuals to stay clear of the area unless authorized to enter by the Test Conductor.
4. When machines are being moved by installed motors the NUS electrical engineer operating the motor or the Test Conductor will be located in a position which permits him/her to observe the machine operation so that the equipment can be stopped if a dangerous situation appears to be developing. Such situations could involve unanticipated machine performance or personnel entering the test area and placing themselves in jeopardy.
5. When an SOT is in progress the Test Conductor will remain in the vicinity of the test so the all personnel involved in the test are under his observation and will perform any required test support activities directly under his supervision.
6. Only Contraves personnel who have been qualified to the DOE Hoisting and Rigging Manual Rev. 10-88 will operate the Test Facility overhead crane.
7. Only NUS test engineers will operate the Robotic Bridge Transporter (RBT), the Manipulator Transporter (MT), and the RM-10A Robot Arms.
8. Slings, hooks, and chains utilized with the Test Facility overhead crane or with the RBT will be those purchased specifically for use on the DOE project and have been certified to meet the requirements of ANSI B30.9.
9. The making of all electrical connections to the various equipment will be supervised by an NUS electrical engineer.

10. Protective headgear will be worn in the Test Facility when ever the Robotic Bridge Transporter (RBT) the Manipulator Transporter (MT) are being utilized or at any time the Test Conductor deems the use of protective head gear is appropriate.
11. The NUS Test Conductor is responsible to see that all the above safety requirements are implemented during the performance of the test for which he has responsibility.
12. The Test Conductor will verify that all test specific safety prerequisites identified in test procedures are satisfied and that any precautions identified in specific procedure steps as followed.
13. The NUS Test Director will perform frequent informal surveillance of the testing operations to verify the safety requirements are being adhered to by the personnel performing the test or other work in the test area.

APPENDIX C
PHOTO DOCUMENTATION REQUIREMENTS

Photo Documentation Requirements

Photographs are required to be taken of all System Operational Tests (SOTs). The following is a bulletized list which identifies when these photographs must be taken, as a minimum. Additional photographs may be taken at any other time during the test, as specified by the Test Conductor.

- Photographs must be taken of the initial setup for each test sequence.
- Photographs must be taken of the following critical interfaces between system, as a minimum,
 - Excell Crane/Downender (Loading of Fuel)
 - RBT/Fuel Assembly Storage Rack
 - RBT/Downender
 - RBT/Staging and Cutting Station
 - RBT/Clamping Table
 - FAHF/Mockup Fuel Assembly
 - Pull-Head Gripper/Fuel Rods
 - Rod Loader/Canister
 - NFBC Loader/Canister
 - RBT/Off-Normal Table
 - MT/Off-Normal Table
 - Fuel Canister/Storage Rack
 - NFBC Canister/Storage Rack
 - RBT/FAHF and RM-10A
 - Excell Crane/Fuel Canister Upender (Loading and Unloading)
 - Excell Crane/NFBC Canister Upender (Loading and Unloading)
 - MT/RM-10A
- Photographs must be taken of any equipment damaged during testing.
- Photographs must be taken of any damage to mockup fuel rods and/or mockup fuel assemblies.
- Photographs must be taken of the cutter to fuel assembly interfaces as follows:
 - In position prior to cut
 - During cutting operation
 - Cut area of end fitting after cut operation
 - Cut area of fuel assembly after cut operation
- Photographs must be taken of each "Hold Point".
- Photographs must be taken of the problem areas of any subsystem which does not perform its expected function.
- Photographs must be taken of any component, subsystem, or system, determined by the test conductor to be operating out of the normal/expected condition (i.e., excessive deflection, vibration, etc.).

FUEL ROD CONSOLIDATION PROJECT PHOTOGRAPHIC LOG

TEST PROCEDURE NO. TP-

[illegible]

APPENDIX D

EXCEPTION

TEMPORARY PROCEDURE CHANGE NOTICE AND [^]REPAIR LOG

792
4/24/02

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

DATE 12-3-91

TPCN # 1

PROCEDURE NO. 9315-TP-205 REV. 2

TITLE FAHF SOT

PROCEDURE SECTION(S) 2.4

PROCEDURE CHANGE: (Use reverse side if necessary.)

Step 2.4, add the following at the end of paragraph:
"of the QA/QC Data Package"

REASON FOR CHANGE:

DOE comment

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☒ NO

APPROVALS

Fred G. Coleman 4/17/92
Kenneth B. Hayes 12-3-91 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEMPORARY PROCEDURE CHANGE NOTICE #2

DATE 4/17/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE FAHF SOT

PROCEDURE SECTION(S) 8.3, 8.4, 8.2 App. A (1.2.3, 1.2.5)

PROCEDURE CHANGE: (Use reverse side if necessary.)

DELETE TEST SECTIONS 8.3 and 8.4 and 8.2
DELETE APPENDIX A, SECTIONS 1.2.3 and 1.2.5

REASON FOR CHANGE: A SHORTENED TEST PROGRAM HAS ELIMINATED THE
1ST'S OF ~~B+W~~ CE 14X14 ^{PWR} FUEL TYPE (SECTION 8.3) AND WESTINGHOUSE
15X15 PWR FUEL TYPE (SECTION 8.4), AND B+W 15X15 PWR FUEL TYPE (SECT. 8.2)

CLASSIFICATION OF CHANGE

MINOR _____ YES _____ NO _____

MAJOR ✓ YES ✓ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED _____ YES ☒ NO

APPROVALS

Fred G. Coleman 4/17/92 (1)(2)
TEST ENGINEER DATE

Joseph A. Gars 4/24/92 (2)
QUALITY ASSURANCE DATE

PROJECT ENGINEER _____ DATE _____ (2)

TEST DIRECTOR _____ DATE _____ (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE D2

TEMPORARY PROCEDURE CHANGE NOTICE # 3

DATE 4/17/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE SOT-FAHF

PROCEDURE SECTION(S) 8.1.1, 8.5.1

PROCEDURE CHANGE: (Use reverse side if necessary.)

DELETE SENSOR OPERATION VERIFICATION TESTS FOR GE
8x8 BWR FUEL TYPE (SECTION 8.1.1) AND WESTINGHOUSE
17x17 PWR FUEL TYPE (SECTION 8.5.1)

REASON FOR CHANGE:

SENSOR SETTINGS ARE ESTABLISHED IN ATTACHMENT A, EQUIP-
MENT SETUP, AND WILL BE CHECKED DURING SOT TP-50T, 601
CONTROL SYSTEM. ^{SAP}

CLASSIFICATION OF CHANGE

MINOR ☐ YES ☐ NO ☐

MAJOR ☒ YES ☒ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Fred G. Coleman 4/17/92 (1)(2)
TEST ENGINEER DATE

Joseph A. V. [Signature] 4/22/92 (2)
QUALITY ASSURANCE DATE

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE #4

DATE 4/22/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE SOT-FAHF

PROCEDURE SECTION(S) App. A, 2.1, 2.9

PROCEDURE CHANGE: (Use reverse side if necessary.)

and FAT completion
Break up Equipment Setup into two separate sections for the BWR and PWR Fixture

REASON FOR CHANGE:

Modified fixtures are arriving on site at different times and expediency requires testing to begin before the arrival of both.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Fred G. Coleman 4/22/92 (2)(2)
TEST ENGINEER DATE

Joseph H. Hart 4/24/92 (2)
QUALITY ASSURANCE DATE

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE #5

DATE 4/22/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE SOT - FAHF

PROCEDURE SECTION(S) 2.10, 6.4, ~~8.1.2, 8.1.2.3~~, 8.1.2, 8.5.2
7/22/92

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete ampmeter as part of Special Equipment Required
Delete requirements to record motor current throughout SOT.

REASON FOR CHANGE: *All ^{one} motor current measurements have been eliminated from the SOT Procedure. Refer to TCN 002.*

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Fred G. Coleman 4/22/92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TAC CHANGE NOTICE

DATE: 4-22-92

CHANGE NOTICE NO. 002

Note 001
was against
Rev 2 and is
included in
Rev 3

TAC NO: 9315-TAC-205

REV. 3

TITLE: Fuel Handling Fixtures

=====

TAC CHANGE AND REASON FOR CHANGE

Delete references to motor current acceptance criteria in Sections 1.1.1, 1.2, 1.3.2, and 1.4.

Delete references to motor current measurement in Sections 1.2 and 1.4.

The requirement to measure non-servomotor current in Sections 1.1, 1.2, 1.3, and 1.4 has been deleted. These readings were originally included to be taken so that they could be compared to the manufacturers motor design specifications to ensure that the load specifications for the motor were not being exceeded. However, even though we are not taking these readings, it does not mean the motors are any less protected. Each non-servo motor is protected against overcurrent and any mechanical problem relating to these motors will be uncovered in the set-up and adjusting of these motors and their various parameters. See Attachment A, which discusses the protection provided for the motors.

(If more space is needed, use additional sheets)

=====

ENGINEER

Fred L. Coleman4/22/92

Date

QUALITY ASSURANCE

Joseph A. Yates4/22/92

Date

PROJECT MANAGER

Peter V. Jochel4/22/92

Date

Approved by DOE ltr dtd 7/10/92

TAC NO: 205

PAGE 2 OF 2

CHANGE NOTICE NO: 002

TAC CHANGE NOTICE (Cont'd)

ATTACHMENT A TO TCN 002 TO
9315-TAC-205 REV. 3

Each non-servomotor is protected against overcurrent in accordance with the National Electric Code (NEC) by the use of fuses or circuit breaker and thermal overload blocks on the motor starters. In addition, these non-servomotors are also monitored by the PLC for overcurrent via a current transducer. In most cases, the setting in the PLC for these motors will be just high enough to operate as it is used for clamping and will shut the motor off prior to fuses or circuit breakers tripping if there is a fault.

Department of Energy

Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

July 10, 1992

Peter V. Judd
NUS Project
c/o Contraves-USA
620 Epsilon Drive
Pittsburgh, PA 15238

Distribution
G. Rung
Sub. 11 (Jung)
Schw
DCC
Pgh
PV Judd
TAC Tracking Book
V. Chapman
DOE-IN
SUT-202 Book

SUBJECT: Review of Halliburton NUS System Operation Test (SOT) TAC Change Notice (TCN), Number 003, for the Manipulator Transporter, Numbers 002, 003, and 004 for the Clamping Table, Number 002 for the Off-Normal Table, Number 002 for the Fuel Assembly Handling Fixture, and Number 001 for the Robotic Bridge Transporter

- REFERENCE:
- (a) Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2353, dated June 3, 1992
 - (b) Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2354, dated June 3, 1992
 - (c) Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2355, dated June 3, 1992
 - (d) Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2356, dated June 3, 1992
 - (e) Halliburton NUS Corporation Transmittal to DOE-ID, ED-DOE-PVJ-92-2358, dated June 4, 1992

Dear Mr. Judd:

DOE-ID has reviewed the subject TCNs under the REVIEW/APPROVAL provision of the contract and finds them acceptable. The TCNs are approved for implementation.

If you have further questions, please contact me (208) 526-1466 or D. C. Koelsch (208) 526-5930.

Sincerely,

Margaret W. Fisher
Margaret W. Fisher, Chief
Civilian Rad-Waste Branch

HALLIBURTON NUS
Environmental Corporation

910 CLOPPER ROAD • P.O. BOX 6032 • GAITHERSBURG, MARYLAND 20877-0962 • (301) 258-6000

ED-DOE-PVJ-92-2355
June 3, 1992

Ms. M.W. Fisher, Chief
Civilian Rad-Waste Branch
U. S. Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, ID 83401-1562

Subject: Contract DE-AC07-86ID12651 - Rod Consolidation Project
Systems Operational Test--Fuel Assembly Handling
Fixture Test Acceptance Criteria Change Notice
(TCN) - Approval

Reference: 1. 9315-TAC-205 Rev 3 - Fuel Assembly Handling Fixture

Dear Ms. Fisher:

Attached for your approval is TCN 002 to reference 1.

If you have any questions, please call the undersigned on
(412) 967-7304.

Very truly yours,

Peter V. Judd
Project Manager

ht

Attachment:
TCN 002

cc: D.C. Koelsch - DOE-ID
J.H. Clark - EG&G

DCC: Subj 4.1 - what
chron - what
DCC - what

pgn R. Coleman ^{TP} ^{what} ^{what}
DoE chron - what
Judd chron - what
SOT book - what
TCN Trolling book what

TEST PROCEDURE

9315-TP-205

REVISION

2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE # 6

DATE 4/22/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE SOT - FAHF

PROCEDURE SECTION(S) 3.2, 8.2

PROCEDURE CHANGE: (Use reverse side if necessary.)

Begin SOT Testing with PWR fuel types

REASON FOR CHANGE:

The BWR FAHF has not arrived on site after repairs. Expediency requires testing begin with PWR FAHF.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO ☐

MAJOR ☐ YES ☐ NO ☒

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Fred S. Coleman 4/22/92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE D2

TEMPORARY PROCEDURE CHANGE NOTICE #7

DATE 4/23/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE SOT-FAHF

PROCEDURE SECTION(S) 8.5.2.2.2

PROCEDURE CHANGE: (Use reverse side if necessary.)

DELETE DRAWING REFERENCE (9315-M-0016, Gr. 3) FOR
COMPRESSION LOAD TEST FIXTURE

REASON FOR CHANGE:

A DIFFERENT LOAD CELL WAS EMPLOYED.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO

MAJOR ☐ YES ☒ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Fred S. Coleman 4/23/92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE D2

TEMPORARY PROCEDURE CHANGE NOTICE #8

DATE 4/25/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE Fuel Assembly Handling Fixture

PROCEDURE SECTION(S) 8.5.2.1.2

PROCEDURE CHANGE: (Use reverse side if necessary.)

Change TAC for clamp opening in the closed position from
" 8.43 + 0.03 in " to " 8.27 + 0.19 "
- 0.00 - 0.00

REASON FOR CHANGE: Observations of operation of the FAHF with fuel assemblies indicate a small compressive force should be applied to the fuel to assure the fuel assembly is clamped securely. A TCN will be submitted to

CLASSIFICATION OF CHANGE

DOE-TR to cover the TAC change.

MINOR ☐ YES ☐ NO ☐

MAJOR ☒ YES ☐ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Disapproved See TPCN #11 Jgg 8/10/92

TEST ENGINEER DATE (1)(2)

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

Notes: (1) Required for minor changes
(2) Required for major changes

10

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE #9

DATE 4/25/92

PROCEDURE NO. 9315-TP-205 REV. 2 TITLE Fuel Assembly Handling Fixture

PROCEDURE SECTION(S) 8.5.2.1.4 and 8.5.2.1.5

PROCEDURE CHANGE: (Use reverse side if necessary.)

Change TAC to clamp opening in the open position
from "10.35 ± 0.06 inches"
to >10.30 inches without contacting the over travel switch

REASON FOR CHANGE: The TAC is being changed to eliminate an unnecessary
restricting clearance. The above opening is adequate for the largest
BWR fuel type - the B & W assembly. A TCN is being sent to DOE-ID

CLASSIFICATION OF CHANGE

MINOR ☐ YES ☐ NO ☐

MAJOR ☒ YES ☐ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☒ YES ☐ NO

APPROVALS

<u>P. V. Juhl</u>	<u>4/25/92</u> (1)(2)
TEST ENGINEER	DATE
<u>K. W. Juhl</u>	<u>8/10/92</u> (2)
QUALITY ASSURANCE	DATE
<u>F. M. Juhl</u>	<u>8/10/92</u> (2)
PROJECT ENGINEER	DATE
<u>P. V. Juhl</u>	<u>4/25/92</u> (2)
TEST DIRECTOR	DATE

- Notes:
- (1) Required for minor changes
 - (2) Required for major changes

Department of Energy

Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

August 21, 1992

Peter V. Judd
NUS Project
c/o Contraves-USA
620 Epsilon Drive
Pittsburgh, PA 15238

10/11/92 am
G/Rung
Subj 417
Chm
D/C
P/L

TFM
~~TFM~~
SOT-205-Notation
TCN Tracking log

SUBJECT: Review of Halliburton NUS System Operation Test (SOT) Test
Acceptance Criteria (TAC) Change Notice (TCN) Number 003 for the
Fuel Assembly Handling Fixture - AM/NP-WJM-92-47

REFERENCE: Halliburton NUS Corporation letter to DOE-ID, ED-DOE-PVJ-92-2424,
dated August 5, 1992

Dear Mr. Judd:

DOE-ID has reviewed the subject TCN and finds it acceptable. The TCN is
approved for implementation.

If you have further questions, please contact me (208/526-6668) or
Mr. D. C. Koelsch (208/526-5930).

Sincerely,

David C. Koelsch

for

Walter J. Mings, Acting Chief
Civilian Rad-Waste Branch

cc: F. G. Gallo, NUS
J. H. Clark, EG&G

910 CLOPPER ROAD • P.O. BOX 6032 • GAITHERSBURG, MARYLAND 20877-0962 • (301) 258-6000

ED-DOE-PVJ-92-2424
August 5, 1992

Mr. W.J. Mings, Chief
Civilian Rad-Waste Branch
U. S. Department of Energy
Idaho Field Office
785 DOE Place MS-1136
Idaho Falls, ID 83401-1562

Subject: Contract DE-AC07-86ID12651 - Rod Consolidation Project
Systems Operational Test--Fuel Assembly Handling
Fixture Test Acceptance Criteria Change Notice (TCN)
Approval

References: 1. 9315-TAC-205 Rev. 3 - Fuel Assembly Handling
Fixture

Dear Mr. Mings:

Attached is TCN-003 to reference 1 for your approval.

If you have any questions, please contact the undersigned on
(412) 967-7304.

Very truly yours,

Peter V. Judd
Project Manager

ht

ATTACHMENT:

1. TCN 003 to TAC-205 Rev. 3

cc: D.C. Koelsch - DOE-ID w/atts
J.H. Clark - EG&G w/atts

cc: DC - w/att
Subj 4.1 - w/att
Chron - w/out

Pgh DOE chron - w/out
Judd chron - w/out
SOT 205 book - w/att
TCN Tracking log - w/att
Test record copy - w/att

services for a cleaner and safer world

5 of 6

TAC CHANGE NOTICE

DATE: 08-03-92 CHANGE NOTICE NO. 003
TAC NO: 9315-TAC-205 REV. 3
TITLE: Fuel Handling Fixtures

=====

TAC CHANGE AND REASON FOR CHANGE

Change clamp opening requirement in Section 1.3 (All PWR Fuel Types - 17X17).

Old Criteria "10.35 $\pm$ 0.06"
New Criteria ">10.30 without contacting the overtravel switch"

Reason for Change:

An opening of greater than 10.30 inches is sufficient to allow acceptance of all fuel types with 1.5 inch bow and a $\pm$ 0.125 inch positioning deviation of the RBT. This is based upon the B&W fuel assembly (8.54 inches across grid) being the largest fuel type.

Change clamp opening in Section 1.3.2 as follows:

B&W 15X15 Fuel Type

Old Criteria "8.54 $\pm$ 0.03", -0.00"
New Criteria "<8.54 inches but did not engage the end of travel limit switch"

CE 14X14 Fuel Type

Old Criteria "8.12 $\pm$ 0.03"-0.00"
<8.12 inches but did not engage the end of travel limit switch

(If more space is needed, use additional sheets)

ENGINEER

Frank M. Galle

8/5/92

Date

QUALITY ASSURANCE

Thomas A. Mulgrew

8/5/92

Date

PROJECT MANAGER

Peter J. Galle

8/5/92

Date

TAC CHANGE NOTICE (Cont'd)

Westinghouse 15X15
17X17

Old Criteria 8.43+0.03", -0.00"

New Criteria <8.43 inches but did not engage the end of travel
limit switch

Reason for Change:

The distance the assembly closes is established by the 300 to 500 pound preload clamping force required to support the fuel. Therefore, it is only necessary to verify during this test that the fuel handling assembly can close down to a dimension less than the cross section of the fuel.

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

TPCN # 10

DATE 8-10-92

PROCEDURE NO. 9315-TP-205 REV. 2

SYS. OPERATIONAL TEST PROCEDURE
TITLE FOR FUEL ASS. HANDLING FIXTURE

PROCEDURE SECTION(S) 1.0, 2.1, & 9.0

PROCEDURE CHANGE: (Use reverse side if necessary.)

SECTION 1.0 - ADD "PWR" PRIOR TO... FUEL ASSEMBLY HANDLING FIXTURE (FAHF).

SECTION 2.0 -

2.1 ~~ADD~~ REVISE TO: SYSTEM SET-UP FOR THE PWR FAHF HAS BEEN PERFORMED....
Ref: 10/12

SECTION 9.0 REVISES FOR THE DISPOSITION OF 17X17.

REASON FOR CHANGE:

RETEST IS FOR PWR FAHF ONLY.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☒ NO

MAJOR ☐ YES ☐ NO

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

TEST ENGINEER 8-10-92 (1)(2)
DATE

QUALITY ASSURANCE (2)
DATE

PROJECT ENGINEER (2)
DATE

TEST DIRECTOR (2)
DATE

- Notes:
- (1) Required for minor changes
 - (2) Required for major changes

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE

TPCN# 11

DATE 8-10-92

PROCEDURE NO. 9315-TP-205 REV. 2

TITLE SYS. OPERATIONAL TEST Procedure
for FUEL ASS. HANDLING Fixture

PROCEDURE SECTION(S) 8.5.2.1.2 & 8.5.2.1.5

PROCEDURE CHANGE: (Use reverse side if necessary.)

Change TAC for Clamp Closure in the Closed Position
from: 8.43 +0.03 in
- 0.00

To: < 8.43 inches but did not engage the end of travel limit
SWITCH.

REASON FOR CHANGE: *The TAC WAS REVISED by TCM#003*

CLASSIFICATION OF CHANGE

MINOR ☐ YES ☐ NO ☐

MAJOR ☒ YES ☒ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

TEST ENGINEER		8-10-92(1)(2)
		DATE
QUALITY ASSURANCE		8/10/92(2)
		DATE
PROJECT ENGINEER		8/10/92(2)
		DATE
TEST DIRECTOR		8/18/92(2)
		DATE

- Notes:
- (1) Required for minor changes
 - (2) Required for major changes

SPECIFICATION 9315-TP-205

REVISION 2

PAGE D3

RL # 1

EXCEPTION/REPAIR LOG

DATE 12/3/91

PROCEDURE NO. 9315-TP-205 REV 2 TITLE FUEL HANDLING FIXTURE
SOT

PROCEDURE SECTION(S) 2,3

CLASSIFICATION OF CHANGE: REPAIR N/A REDESIGN N/A TPCN# N/A

EXCEPTION: QA/QC DATA PACKAGE IS INCOMPLETE

PROBLEM AND CAUSE: THE FOLLOWING ITEMS OF THE QA/QC DATA PACKAGE ARE INCOMPLETE:

1. FAT SECT 7.2 (CRT)
2. ASSEMBLY PROCEDURE
3. 7201-41 AND DCN 813 REQUIRE FINAL INSPECTION
4. BARS 7203-2, 7204-2, 7210-2 AND 7215-2 REQUIRE UT
5. SUPER 20 BEARING NEEDS REPAIR
6. MACHINING FOR DETAIL D 7201
7. PINS NOT INSTALLED IN ACTUATOR BRACKET
8. FIXTURE REQUIRES DISASSEMBLY TO COMPLETE WORK ABOVE

TEST CONDUCTOR Glenn B. Hayes

SOLUTION/CORRECTIVE ACTION:

THE ABOVE ITEMS WILL NOT IMPACT COMPLETING OF SOT.

TEST CONDUCTOR	<u>Glenn B. Hayes</u>	DATE	<u>12/3/91</u>
QUALITY ASSURANCE	_____	DATE	_____ (1)
PROJECT ENGINEER	_____	DATE	_____ (1)
TEST DIRECTOR	_____	DATE	_____ (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Transferred open items to
ORR Tracking List Item # 0189. 1/14/92

TEST CONDUCTOR Fred G. Coleman DATE 4/22/92

EXCEPTION/REPAIR LOG #2

DATE 4/2PROCEDURE NO. 9315-TP-205 REV 2 TITLE SOT FAHFPROCEDURE SECTION(S) 8.5.2.1.2, 8.5.2.1.5CLASSIFICATION OF CHANGE: REPAIR NA REDESIGN NA TPCN# NA

PROBLEM AND CAUSE:

West & East Clamp Opening did not meet acceptance criteria
of 8.43 ± 0.03 " on closing.

TEST CONDUCTOR

Jul G Coleman

SOLUTION/CORRECTIVE ACTION:

8.27 to 8.46

Suggest accept as is.

This suggestion is not accepted by the Test Director. A revised
TAC to set the opening to $8.27 + 0.19$ will be processed.
- 0.00

new TCN 003. ~~TPCN~~ TPCN 48 issued to revise the procedure.

TEST CONDUCTOR Jul G ColemanDATE 4/22/92

QUALITY ASSURANCE

DATE ()

PROJECT ENGINEER

DATE ()

TEST DIRECTOR PR JuhlDATE 4/25/92 ()

Notes: (1) Required for redesign

CORRECTIVE ACTION COMPLETE

Retest completed per RL #4

TEST CONDUCTOR

J. D. Bulb

DATE

8/10/92

* A retest of 8.5.2.1.2 and 8.5.2.1.5 will be performed
to verify the new setting. See attached pages for retesting.

Retest of 8.5.2.1, 2
Per Repair Log #2

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- Motor current shall be ≤ 2.3 amps.

Test Conductor _____

Date _____

QA _____

Date _____

2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

Type of Measuring Device _____

Range _____

Identification No. _____

Calibration Due Date _____

East Clamp Opening 8.411 West Clamp Opening 8.332

Acceptance Criteria

- Clamp opening in the closed position shall be 8.43 ± 0.19 in. TPCN #8
 $- 0.00$

Test Conductor EPB Farnest

Date 4/27/92

QA JVA Dagnan

Date 4/27/92

3. Open the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to open clamps and the motor current using a stopwatch and ammeter.

Motor Current _____

Opening Time _____

Acceptance Criteria

- Time to open clamps shall be ≤ 11 seconds.
- Motor current shall be ≤ 2.3 amps.

Test Conductor _____

Date _____

QA _____

Date _____

TEST # 8.5.2.1.5
Per Repair Log #2

TEST PROCEDURE 9315-TP-205

REVISION 2

PAGE 32 of 36

4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

East Clamp Opening _____ West Clamp Opening _____

Acceptance Criteria

- Clamp opening in the open position shall be 10.35 ± 0.06 inches.

Test Conductor _____ Date _____

QA _____ Date _____

5. Repeat Steps 1 through 4 two additional times and record data below.

TPCN #5 Motor Current _____ Closing Time _____

East Clamp Opening _____ West Clamp Opening _____

TPCN #5 Motor Current _____ Opening Time _____

East Clamp Opening _____ West Clamp Opening _____

TPCN #5 Motor Current _____ Closing Time _____

East Clamp Opening _____ West Clamp Opening _____

TPCN #5 Motor Current _____ Opening Time _____

East Clamp Opening _____ West Clamp Opening _____

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- Time to open clamps shall be ≤ 11 seconds.
- Motor current shall be ≤ 2.3 amps.
- Clamp opening in the closed position shall be 8.27 ± 0.19 in.

8.27 ± 0.19 in
 $8.27 - 0.00$ in
 $8.27 + 0.03$ in

TPCN #8

- Clamp opening in the open position shall be 10.35 ± 0.06 in.

> 10.3 inches without contacting the overtravel switch.

Test Conductor

EV3 Fanest

Date 4/27/92

QA

SVH/Aggman

Date 4/27/92

TPCN #9

6. The above steps have been completed.

Test Conductor

EBFurnest

Date

4/27/97

8.5.2.2 Verify the clamp force exerted by the actuator motor M-121G (Dwg. 9315-M-7201, Item 14) as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and open the clamps until the actuator motor automatically shuts off.
2. Insert the compression load test fixture (Dwg. 9315-M-0016, Group 3) in the east clamp assembly. Temporarily support the fixture in the clamp so it will remain contained until the clamp closes.
3. Close the clamps until the actuator motor M-121G automatically stops. Measure and record the motor current using an ammeter, and force exerted by the clamps using the compression load fixture.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Motor Current _____ Clamp Force _____

Acceptance Criteria

- Motor current shall be ≤ 2.3 amps.
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor

Date

QA

Date

EXCEPTION/REPAIR LOG #3

DATE 4/24/92PROCEDURE NO. 9315-TP-205 REV 2 TITLE SOT-FAHFPROCEDURE SECTION(S) 8.5.2.1.3 8.5.2.1.5CLASSIFICATION OF CHANGE: REPAIR N/A REDESIGN N/A TPCN# N/A

PROBLEM AND CAUSE:

East & West clamp opening did not meet acceptance
criteria of 10.35 ± 0.06 in. on opening

TEST CONDUCTOR

JJ Coleman

SOLUTION/CORRECTIVE ACTION:

Suggest accept as is. A TCN will be issued
to change the TAC from " 10.35 ± 0.06 " to " > 10.30
inches without contacting the over travel switch

TEST CONDUCTOR

JJ Coleman

DATE

4/24/92

QUALITY ASSURANCE

DATE

PROJECT ENGINEER

DATE

TEST DIRECTOR

DATE

Notes: (1) Required for redesign

CORRECTIVE ACTION COMPLETE

TEST CONDUCTOR

DATE

EXCEPTION/REPAIR LOG

RL #4

DATE 8-4-92

PROCEDURE NO. 9315-TP-205 REV 2

SYS. OPERATIONAL Test Proc.
TITLE Fuel Assembly Handling
Fixture

PROCEDURE SECTION(S) 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.5, & 9.0

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

TPCN'S #8 & 9 REQUIRED TAC CHANGE NOTICES. THE TPCN'S WERE NOT ISSUED NOR WERE THE TPCN'S COMPLETED BY THE TEST CONDUCTOR. THE TEST SECTIONS WERE NOTATED WITH TPCN'S #8 & 9.

BOTH OF THE FUEL ASSEMBLY HANDLING FIXTURES WERE REPAIRED AFTER TESTING WAS COMPLETED.

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION:

RETEST PER ATTACHED SECTIONS. THE FOLLOWING TPCN'S ^{if done} do not APPLY to the RETEST OF SECTION 8.5. ~~THEY ARE TPCN #3, TPCN #8, & TPCN #9. 8/10/92~~
They are TPCN #3 & TPCN #8. ~~IT IS~~

TEST CONDUCTOR

DATE 8-10-92

QUALITY ASSURANCE

DATE

PROJECT ENGINEER

DATE

TEST DIRECTOR

DATE

Notes: (1) Required for redesign

CORRECTIVE ACTION COMPLETE

all retesting completed

TEST CONDUCTOR

DATE

8/10/92

1.0 OBJECTIVE OF TEST

[PWR]

The objective of this Test Procedure is to demonstrate the acceptability of the Fuel Assembly Handling Fixture (FAHF). These detailed test steps will demonstrate the acceptability of the equipment to satisfy design requirements.

PCW
10
8/10/92

2.0 PREREQUISITES

[FOR THE PWR]

2.1 System set-up has been performed per the instruction of Appendix A.

Test Conductor

Date 8-10-92

QA

Date 8/10/92

PCW
10
8/10/92

2.2 Camera, film, lighting and personnel are available to take photographs per the instruction of Appendix C and the detailed procedure steps (Section 8.0).

Test Conductor

Date 8-10-92

QA

Date 8/10/92

2.3 The QA/QC Data Package has been prepared in accordance with Specification 9315-M-200, and the applicable Bill of Material, and is acceptable.

Test Conductor

Date 8-10-92

QA

Date 8/10/92

RL#
8/10/92

2.4 The system has been assembled in accordance with all applicable Drawings, DCNs and FCRs.

Test Conductor

Date 8-10-92

QA

Date 8/10/92

2.5 The Test Conductor has been qualified and certified in accordance with QAP 2.0.

Test Conductor

Date 8-10-92

QA

Date 8/10/92

- 2.6 All test personnel participating in this test have been trained per the instruction of Section 6.4 of Reference 11.1.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.7 The checklist contained in the Control System SOT (9315-TP-601) applicable to this system must be completed and the results accepted prior to the initiation of testing under this procedure.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.9 The system FAT has been completed and accepted by NUS.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor Date 8-10-92

QA Date 8/10/92

- 2.13 Procedures for changeover of fuel types for the Control System are in place in the Control Room.

Test Conductor

Date 8-10-92

QA

Date 9/10/92

- 2.14 The RBT has been accepted by its FAT and is operational.

Test Conductor

Date 8-10-92

QA

Date 9/10/92

3.0 INITIAL TEST CONDITIONS

- 3.1 The RBT is coupled both electrically and mechanically to the BWR FAHF.

Test Conductor

Date _____

- 3.2 The FAHF is set up to accept BWR fuel types and positioned in the laydown area at a height of approximately 60 inches off the floor.

Test Conductor

Date 8-10-92

4.0 ENVIRONMENTAL CONDITIONS

At least one HVAC unit for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60° to 90°F and 65° to 85°F.

Test Conductor

Date 8-10-92

5.0 SPECIAL PRECAUTIONS

All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

6.1 Compression Load Test Fixture - Dwg. 9315-M-0016, Group 2 and 3.

6.2 Inside micrometer or measuring device with a range of 5-10 inches.

6.3 Stopwatch

~~6.4 Ampmeter with a 0-5 amp range.~~

TRC
10
4/2/94

7.0 TEST DATA RECORDING

7.1 Test Data Records

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

Each of these modifications will be handled differently. If a correction is required to the procedure, it will be made with pen and ink in the "Record Copy", as they are found. The test conductor will make the appropriate change. Once the change is made, he will initial and date the change for future reference. All modifications which are considered minor changes must be documented on "Temporary Procedure Change Notice" (TPCN) forms (refer to Appendix D). This change shall be approved by the test conductor by annotating that the test procedures are using the TPCN form. All modifications which are considered a major change must also be documented on the TPCN form. However, when a major change is required, testing shall be halted until the TPCN is approved by the responsible Test Engineer, Test Conductor, Quality Assurance and Project Engineer.

7.3 Repairs/Retesting

This section addresses the process for making necessary repairs to the equipment and retesting of the system. If during testing a problem is observed which requires repair or rework of the equipment, testing shall be halted. If the repair/rework is minor, the Test Conductor will document the problem, cause, and corrective action implemented, the faulty system will be retested. All remaining tests will continue on until conclusion. If the problem requires redesign of the faulty system, all testing of this equipment will be halted. The problem and recommended solution will be documented and submitted to the Test Review Group (TRG) for approval. Once approval and the repair is complete, testing of the equipment will be accomplished in accordance with this procedure.

8.0 DETAILED TEST STEPS

8.1 System Verification for the GE 8 x 8 BWR Fuel Type

The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the GE 8 x 8 BWR fuel type. Prior to initiating testing, verify the control system is programmed for the GE 8 x 8 BWR fuel type.

Test Conductor _____ Date _____

8.1.1 Sensor Operation Verification Test

8.1.1.1 Verify the operation of the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) limit switch as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.
2. With the clamps fully opened, switch the control system to the "JOG" mode.
3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.

8.5 System Verification for the Westinghouse 17 x 17 PWR Fuel Type

The following series of tests are performed to verify the operability of the Fuel Assembly Handling Fixture (FAHF) specific to the Westinghouse 17 x 17 PWR fuel type. Prior to initiating testing, verify the control system is programmed for the Westinghouse 17 x 17 PWR fuel type.

Test Conductor

P. M. Bally

Date

8/10/92**8.5.1 Sensor Operation Verification Test**

- 8.5.1.1 Verify the operation of the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) limit switch as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and open the FAHF clamps until the actuator motor M-121G automatically shuts off.
2. With the clamps fully opened, switch the control system to the "JOG" mode.
3. Jog the clamps closed until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.

Test Conductor

P. M. Bally

Date

8/10/92

QA

L. M. Bally

Date

8/10/92

4. Jog the clamps open until the actuator motor M-121G automatically shuts off, prior to engaging the hardstop.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.

Test Conductor P. D. Bullo Date 8/10/92

QA A. S. Mulgrew Date 8/10/92

5. Repeat Steps 3 and 4 two additional times.

NOTE

Photographs do not need to be taken when repeating the above steps.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.

Test Conductor P. D. Bullo Date 8/10/92

QA A. S. Mulgrew Date 8/10/92

6. The above steps have been completed.

Test Conductor P. D. Bullo Date 8/10/92

8.5.2 Drive System Operation Verification Test

- 8.5.2.1 Verify the clamp actuator motor M-121G (Dwg. 9315-M-7201, Item 14) position transducer setpoints as follows:

WARNING

Stay clear of the FAHF clamps while in operation.

1. Switch the control system to the hand mode and close the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to close clamps and the motor current using a stopwatch and ammeter.

Type of Measuring Device	Range
Identification No.	Calibration Due Date

Motor Current /// Closing Time 6.6 sec

Place at 5
B/P
8/10/92

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~

Test Conductor F. M. Hall

Date 8/10/92

QA [Signature]

Date 8/10/92

2. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

Type of Measuring Device <u>Caliper</u>	Range <u>0-12"</u>
Identification No. <u>6900547</u>	Calibration Due Date <u>5/24/92</u>

East Clamp Opening 8.42

West Clamp Opening 8.384

Acceptance Criteria

- Clamp opening in the closed position shall be 8.43 in but ~~8.43 $\pm$ 0.03 in.~~
- ~~did not engage the end of TRAVEL limit Switch. -0.00~~

Test Conductor F. M. Hall

Date 8/10/92

QA [Signature]

Date 8/10/92

3. Open the FAHF clamps until the actuator motor M-121G automatically shuts off. Measure and record the time to open clamps and the motor current using a stopwatch and ammeter.

~~Motor Current~~ |||||

Opening Time 6.24

Acceptance Criteria

- Time to open clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~

Test Conductor F. M. Hall

Date 8/10/92

QA [Signature]

Date 8/10/92

* RL #5

TPCN #5
8/10/92

* RL #5

TPCN #5
003
8/10/92

TPCN #5
8/10/92

TPCN #5
8/10/92

4. Measure and record the clamp opening between the rear clamp plate (Dwg. 9315-M-7203, Item 3) and clamp plate (Dwg. 9315-M-7204, Item 3) for both east and west clamps using a micrometer or caliper.

East Clamp Opening 10.437 West Clamp Opening 10.627

Acceptance Criteria

- Clamp opening in the open position shall be ~~10.35 ± 0.06~~ inches. ^{> 10.30 in without} contacting the overtravel switch.

Test Conductor J. Brullo Date 8/10/92

QA _____ Date _____

TPCN #
9
TCN #
003
8/10/92

5. Repeat Steps 1 through 4 two additional times and record data below.

Motor Current / / / / / Closing Time 6.06

East Clamp Opening 8.43 ^{8.32} West Clamp Opening 8.384 ^{8.26}

Motor Current / / / / / Opening Time 5.95

East Clamp Opening 10.447 West Clamp Opening 10.655

Motor Current / / / / / Closing Time 5.94

East Clamp Opening 8.432 ^{8.351} West Clamp Opening 8.387 ^{8.302}

Motor Current / / / / / Opening Time 6.05

East Clamp Opening 10.447 West Clamp Opening 10.511

Acceptance Criteria

- Time to close clamps shall be ≤ 11 seconds.
- Time to open clamps shall be ≤ 11 seconds.
- ~~Motor current shall be ≤ 2.3 amps.~~ ^{< 8.43 in but}
- Clamp opening in the closed position shall be ~~8.43 ± 0.03 in.~~ ^{did not engage the end of Travel limit Switch.}
- Clamp opening in the open position shall be ~~10.35 ± 0.06 in.~~ ^{> 10.30 in.}

WITHOUT contacting the overtravel switch.

Test Conductor J. Brullo Date 8/10/92

QA M. Murphy Date 8/10/92

TPCN's #
5.9911
TCN #
003
8/10/92

* RL #5

Date 8/10/92

Date 8/10/92

PCN
7
4/8/10

TPC R
II
5
8/19

4. Open the clamps until the actuator motor M-121G automatically stops.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

5. Repeat Steps 3 and 4 two additional times and record data below.

NOTE

Photographs do not need to be taken when repeating the above steps.

Motor Current	<u> </u>	Clamp Force	<u>380</u>
Motor Current	<u> </u>	Clamp Force	<u>280</u>

Acceptance Criteria

- ~~Motor current shall be $\leq$ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor F. M. Dello Date 8/10/92

QA A. M. Dello Date 8/10/92

6. Remove the compression load test fixture from the east clamp assembly and insert into the west clamp assembly. Temporarily support the test fixture as in Step 2.

7. Repeat Steps 3 through 5 for the west clamp assembly and record data below.

Motor Current	<u> </u>	Clamp Force	<u>240</u>
Motor Current	<u> </u>	Clamp Force	<u>470</u>
Motor Current	<u> </u>	Clamp Force	<u>340</u>

Acceptance Criteria

- ~~Motor current shall be $\leq$ 2.3 amps.~~
- Clamp exerts a force not to exceed 500 lbs.

Test Conductor F. M. Dello Date 8/10/92

QA A. M. Dello Date 8/10/92

8. The above test steps have been completed.

Test Conductor F. M. Dello Date 8/10/92

TPCN#
5
8/10/92

TPCN#
5
8/10/92

9.0 POST PERFORMANCE REVIEW AND APPROVAL

The following signatures certify that the completed test, with all data collected, has been reviewed, and that the system has passed the requirements for system operational test.

PWR FAHF

W17x17

see
TPCN 10
and RL #4
8/10/92

[Signature] 8-10-92
Test Engineer Date

[Signature] 8/10/92
Quality Assurance Date

[Signature] 8/10/92
Project Engineer Date

[Signature] 8/18/92
Test Director Date

EXCEPTION/REPAIR LOG

RL #5

DATE 8/10/92PROCEDURE NO. 9315-TP-205 REV 2TITLE SOT For The Fuel Assembly Handling SystemPROCEDURE SECTION(S) 8.5.2CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

FAHF would not close down sufficient to apply preload on the east clamp

TEST CONDUCTOR

F. D. Mello

SOLUTION/CORRECTIVE ACTION:

Reset Reset close position Register NO 47130 to 2510 from 2496. and Register NO 47131 to 1875 from 1905
NOTE: set points changed during testing and tested. all criteria met

TEST CONDUCTOR

F. D. Mello

DATE

8/10/92

QUALITY ASSURANCE

DATE

()

PROJECT ENGINEER

DATE

()

TEST DIRECTOR

DATE

()

Notes: (1) Required for redesign

39

CORRECTIVE ACTION COMPLETE

DCN - 39 issued to implementSet point changes 8/9/92

TEST CONDUCTOR

F. D. Mello

DATE

8/10/92

APPENDIX E

TRAINING SIGN-OFF SHEET

NAME (Print)

SIGNATURE

FRED G. COLEMAN

Kristjan T. Gunnarsson

JOSEPH A YOST

E. B. FORREST

W. A. DAGUCCI

T. F. MULLER

G. JEAN PHILIPPE

F. G. GALLO

Fred G. Coleman

Kristjan T. Gunnarsson

Joseph A. Yost

E. B. Forrest

W. A. Dagucci

T. F. Muller

G. Jean Philippe

Frank Gallo

APPENDIX I-4.6

FUEL CANISTER UPENDER, FUEL CANISTER CLOSURE SYSTEM,
AND FUEL CANISTER GRAPPLE

(WBS 1.3.3.1, 1.3.3.2, 1.3.3.4)

TEST RESULTS AND ANALYSIS REPORT

1.0 INTRODUCTION

This appendix addresses the System Operational Testing (SOT) performed on the Fuel Canister Upender, Canister Grapple, and Canister Closure System (Ref. SOT Test Procedure 9315-TP-206). It provides an overview of the function of the equipment, procedures used during testing, results obtained, and conclusions and recommendations. The purpose of the SOT was to verify that the as-built condition of these systems met or exceeded the associated performance requirements. The primary objectives of this testing were as follows:

- Verification of system mechanical operation under unloaded and loaded conditions.
- Verification of system part-programs with the equipment under unloaded and loaded conditions.
- Verification of system interfaces.

In all cases, the Fuel Canister Upender, Canister Grapple, and Canister Closure System have been judged acceptable and released for normal Integrated System Testing (IST).

2.0 EQUIPMENT FUNCTION

The Fuel Canister Upender (Ref. Dwg. 9315-M-3101), the Fuel Canister Grapple (Ref. Dwg. 9315-M-9501), and Canister Closure System (Ref. U.S. Tool & Die, Inc. Dwg. 8904-1) comprise the Fuel Canister Processing System for the facility. The Fuel Canister Upender provides for the safe positioning of a canister for loading operations, the Canister Grapple provides for the safe transport of the canister within the cell, and the Canister Closure System provides for the latching/unlatching of the canister lid. Each of these systems has been designed with a safety factor of 2 to 5, for performing respective functions under worst case load conditions.

2.1 FUEL CANISTER UPENDER

The Fuel Canister Upender consists of a stationary base frame, movable frame, main drive system, and canister clamping system. Each of these subassemblies operates in a predefined sequence for positioning a fuel canister from the vertical to horizontal orientation for rod loading operations and back again for canister closure and removal operations. The stationary base frame provides the primary support for the upender. This subassembly is a structural steel weldment which is mounted to the floor to react to all normal and off-normal loads. Mounted to this frame through a pair of pillow block bearings is the movable frame. This frame is

also a structural steel weldment which provides a strongback for the support of the thin-walled fuel canister during vertical to horizontal positioning. In addition, this frame reacts to all horizontal forces developed during rod loading operations.

The movable frame is positioned through a linkage bar. This linkage bar is attached from the movable frame to a drive carriage which is mounted via linear bearings to guide rails fixed to the stationary base frame. This carriage is driven by a roller screw which is powered through a gearbox by a servo-drive motor. This drive motor has a built-in resolver which provides for the closed loop control of both the operating speed and position of the movable frame.

The fuel canister is restrained in the upender by a lower support structure and a set of clamps. The lower support structure is a steel weldment bolted to the movable frame. The canister is set in to the lower support which provides for the proper positioning of the canister to interface with the Rod Loading System. The canister is restrained from movement during all operations by a clamp arrangement. This clamping system consists of the drives, bearings, and structure needed to rotate the clamps open to receive the fuel canister and closed to secure the canister after placement. Control of the opening and closing of the clamps is provided by a built-in potentiometer in its linear drive system.

A load cell is utilized in the upender to verify the presence of the fuel canister. This load cell is located in the bottom support. It consists of an off-the-shelf sensor mounted between two steel plates. These plates are designed to move with respect to each other enabling the load cell to register the presence of the fuel canister.

2.2 FUEL CANISTER GRAPPLE

The Fuel Canister Grapple (Ref. Dwg. 9315-M-9501) is designed to safely support either an unloaded fuel canister, a loaded fuel canister, an unloaded NFBC canister, or a loaded NFBC canister during all transfer operations to and from the appropriate storage rack and upender. This assembly is a steel weldment with a lifting hook on one end. The other end is provided with a lifting bail so that it may be suspended from a standard crane. In addition to these standard lifting features, the Fuel Canister Grapple is provided with two friction pads for supporting an empty fuel canister. These pads are mounted on opposite sides of the grapple attached through linkages to a power screw. When this power screw is rotated in a clockwise direction, the friction pads are retracted while a lock is moved into position over the grapple's lifting hook. The exact opposite occurs when the screw is rotated in the counterclockwise direction. Each of these operations is performed manually using a

standard ratchet and socket.

2.3 CANISTER CLOSURE SYSTEM

The Canister Closure System is a mechanical assembly built into each lid. The closure system for the fuel canister consists of four dogs, one per side, which are cammed into or out of slots in the wall of the fuel canisters. This action is accomplished by manually rotating the center lifting knob on the canister lid. Closure of the NFBC canister is accomplished by threading two captive bolts mounted on the lid into the canister webbing.

3.0 TEST PROCEDURE

The record copy of the test procedure (Ref. Document No. 9315-TP-206) is provided as Attachment 1. This procedure defines the requirements and step-by-step instructions for qualifying the Fuel Canister Upender, Fuel Canister Grapple, and Canister Closure System for Integrated System Testing. This testing has been divided into the following sections:

- Drive System Verification - This section verified the proper operation and machine/Control System interface for each of the drive systems (main drive system and clamp drive system) for the upender.
- Sensor Verification - This section verified the proper operation and correct Control System response to all of the sensors (proximity switches and load cells).
- Interlock Verification - This section verified the correct machine response to all of the software interlocks designed into the system.
- SINGLE Mode and AUTO Mode Verification - This section verified the proper sequence of operation and Control System part-program interfaces.
- System Fault Test - This section verified the proper operation of the equipment and Control System under failure conditions.

The test results and data for each of these test sections are contained within the record copy (Ref. Attachment 1) of the test procedure. Each test step has been signed by appropriate personnel as required for final disposition of this SOT. Section 4.0 of this volume provides a typical format for the test procedures and includes an explanation and reference as to the location of the test data included in the various sections of the test procedure.

Two processes were implemented for making all necessary changes to the official test procedures and/or equipment. The first of these processes is called a Temporary Procedure Change Notice (TPCN). The TPCNs were used to make changes to the test procedures. For this test procedure, seven TPCNs were issued as follows:

- TPCNs #1 and 6 were issued to delete or revise test criteria that could not be verified as written.
- TPCNs #2, 3, 4, and 5 were issued to correct errors in the test procedure.
- TPCN #7 was issued to clarify a test procedure step.

Each TPCN identified the change, reason for change, and final disposition for approval of the test results. A copy of each TPCN is included in Attachment 1.

The second process is an Exception/Repair Log (ERL). The ERLs were used to document fixes to the equipment to meet acceptance criteria or to justify acceptance of the test results that did not meet the acceptance criteria. For this test procedure, six ERLs were issued as follows:

- ERLs #1, 2, and 4 were issued to accept test results that did not meet the acceptance criteria.
- ERLs #3, 5, and 6 were issued to implement fixes to the equipment in order to meet the acceptance criteria.

Each of these ERLs identified a problem encountered during testing, the proposed solution to the problem, and the final disposition (accept as is or fix) to close out the ERL. A copy of each ERL is included in Attachment 1.

If a change to the acceptance criteria was required, a Test Acceptance Criteria (TAC) Change Notice (TCN) was issued against the TAC document. A TPCN would then be issued to reflect changes to the procedure. For this procedure, five TCNs were issued against the TAC. The TCNs issued against the TAC documents can be found in the Test Section of the QA Records Package, which is a Phase III deliverable.

4.0 TEST RESULTS

The design and operating parameters for the Fuel Canister Upender, Fuel Canister Grapple, and Canister Closure System are not fuel

dependent. Therefore, each test sequence did not need to be performed for the different types of fuel assemblies being processed. As a result, the requirements for the refocused test program had no effect on this test procedure. The following sections provide a discussion of the results obtained during this SOT.

Prior to initiating this test, a list of prerequisites had to be satisfied (Ref. Section 2.0 of Attachment 1). These prerequisites identified all of the requirements for initiating this test sequence and served as an informal Operational Readiness Review (ORR). As a result of this informal ORR, it was determined that all of the requirements except one had been satisfied. Three Design Change Notices (DCNs) had not been completed (Ref. ERL #1). Based on an evaluation of these outstanding DCNs by the review committee, it was determined that none would affect the operation of the equipment or the validity of the test results. Therefore, testing of the Fuel Canister Upender, Fuel Canister Grapple, and the Canister Closure System was initiated.

4.1 DRIVE SYSTEM VERIFICATION

This test sequence consisted of operating each drive system (one at a time) through its full programmed range of motion. The purpose of this test sequence was to verify that the main drive system and the clamping system functioned as designed. The primary objective was to demonstrate the positioning accuracy and repeatability of these drive systems in meeting their requirements. Secondary operating parameters such as torque and travel time were also evaluated.

The first drive system to be tested was the main drive system (M-116A). The Control System was placed in HAND mode and the movable frame was operated from set point to set point. This was done a minimum of three consecutive times to establish repeatability. During each move, the position of the movable frame, drive motor torque, and travel time were measured and recorded (Ref. Attachment 1). In each case the acceptance criteria were met for the main drive system. The movable frame was successfully driven to a vertical position of between 85.0 to 86.0 degrees and a full down position, which brought it into contact with the hardstops each time tested. In addition, the motor torque was continually measured at less than 4.21 ft-lbs., and the travel time was less than 5.0 minutes. Based on these results, the main drive system was judged acceptable for continuing on to the next series of tests.

After all testing of the Fuel Canister Upender had been completed, the power monitor used to measure the drive system torque became suspect of bad output when testing other systems. The manufacturer of this device was contacted about the problem. As a result of this

inquiry, it was learned that the power monitor would not work on brushless pulse width modulated motors. Since these are the types of motors being used in this design, all torque data collected were invalid. Further conversation revealed that no instrumentation exists at this time which could be used for this purpose. An engineering evaluation was conducted as a result of this new information to determine the importance of this parameter. It was decided that since the drive systems were conservatively sized and were tested at 125% of their design loads during the Factory Acceptance Tests (FAT) and the SOT, any problems with the drive systems would be flushed out. Therefore, no further action was taken to remeasure the motor torques.

The next system to be tested was the clamping system for the fuel canister (M-116B). Again the Control System was placed in HAND mode and the clamps repeatedly operated through their full programmed range of motion. In each case, the clamping system met the acceptance criteria with the exception of the open position. In this case the measured opening of the clamp exceeded the acceptance criteria by .025 inch (Ref. ERL #2). Since the clamp opening was larger than expected providing a greater clearance for loading a fuel canister the clamp open set point was judged acceptable. The closed position of between 2.875 and 3.125 inches and travel time of less than 10 seconds were both achieved. Based on these results, the clamp system was judged acceptable for continuing on to the next series of tests.

4.2 SENSOR VERIFICATION

This test sequence consisted of actuating each sensor to verify that they performed their intended function. The purpose of this test sequence was to verify that the equipment properly responded to the sensor signal and/or that the proper signals were registered at the Control System. Each test was repeated a minimum of three times to ensure consistency.

The first sensors to be tested were the drive system (main drive system and clamp system) limit switches. Each drive system is provided with either proximity switches or limit switches at each end of travel. The purpose of these switches is to deactivate the drive motors under a fault (motor run away) condition or in the event of over travel when operated in the JOG mode. This test sequence consisted of placing each drive system (one at a time) in JOG mode and operating them in each direction of travel until the motor was deactivated. Once the motor stopped, it was verified that the switches deactivated the motors prior to engaging a hardstop and that the proper signal and error message were received at the Control System. In each case, for the main drive system and clamp system, the end-of-travel limit switches performed as designed.

Therefore, each was judged acceptable for continuing on to the next series of tests.

The next sensor to be tested was the load cell mounted in the lower support. The purpose of this sensor is to provide a signal to the controllers as a verification of the loaded/unloaded condition of the Fuel Canister Upender. This test sequence consisted of repeatedly placing and removing a test load (100-200 lbs) into the bottom support and verifying that the Control System received a signal only when the load was present. In each instance the sensor functioned as designed to meet the acceptance criteria. Therefore, it was judged acceptable for continuing on to the next series of tests.

4.3 INTERLOCK VERIFICATION

This test sequence consisted of setting up various interface conditions for the Fuel Canister Upender and attempting to operate either the main drive or the clamp system through its range of motion. The purpose of this test was to verify that the drive systems would operate only when a predefined set of conditions was satisfied. This test consisted of either applying or not applying various interface conditions through temporary changes in the Control System data registers. Once these interface conditions were set up, an attempt was made to operate the appropriate drive system in the HAND mode. This test series continued until every practical combination of these interfaces was tested to verify that each drive system would operate only under the proper conditions.

During this test, 20 different combinations of these interfaces were verified for three different motor operations. In all, four errors were found in the program logic and corrected (Ref. TPCN #2). In addition, TPCN #3 had to be issued to correct an error in the test procedure which incorrectly identified the acceptance criteria. TAC Change Notice #002 was issued to correct the TAC document. Based on these results, the system was judged acceptable for continuing on to the next test series.

4.4 SINGLE AND AUTO MODE VERIFICATION

This test sequence consisted of three separate tests for verification of the automatic sequencing of the Fuel Canister Upender and the interfacing of the Fuel Canister Grapple and Canister Closure System as follows:

- 1) SINGLE Mode Verification Test
- 2) AUTO Mode Verification Test

3) SINGLE Mode Verification Test at 125% of Design Load

The purpose of these tests was to verify that the Fuel Canister Upender operating sequence was correct, that the proper hold points were implemented, and that the manual operations for the Fuel Canister Grapple and Canister Closure System were compatible with canister process operations. Each test executed all process steps from loading of a canister into the upender through removal of the canister to the storage rack. In each test, the system operated as designed with some minor modifications. The software had been updated prior to initiating this test to automatically track the movement of the fuel canister for accountability. As a result, TPCN #4 had to be issued to eliminate the process step to manually enter the canister serial number. In addition, an indication that the canister is full is not a prerequisite for raising the canister. Therefore, TPCN #5 was issued to remove this step from the procedures. No design updates were required for either of these two conditions. Therefore, based on the results of these tests, the Fuel Canister Upender and Fuel Canister Grapple were judged acceptable for the normal IST.

During the course of these tests, two problems were observed (Ref. ERLs #3 and 5). Both of these problems dealt with interfacing equipment and had no effect on the operation of the Fuel Canister Upender. The first problem concerns the installation of the Rod Loading System discharge funnel. The funnel had been improperly installed, and the position of the canister opening with respect to the funnel could not be verified. Since this problem was outside the scope of this test, the problem was documented and verification transferred to the tests performed on the Rod Loading System (9315-TP-207). The second problem addressed the size of the gap between the fuel canister lid and canister wall (Ref. ERL #5). After an inspection of the lid/canister interface, it was believed that a loaded canister could not be safely transported. As a result, eight tabs (two per side) were welded to the canister lid restricting its movement with respect to the canister. Once this fix was implemented, the Canister Closure System was retested. Based on this retesting, the Canister Closure System was judged acceptable for continuing on to the next series of tests.

4.5 SYSTEM FAULT TEST

This test sequence consisted of implementing a servo-drive fault during the operation of one of the drive systems. The purpose of this test was to verify that the equipment properly responded to the fault condition and that the proper signals and error messages were displayed at the Control System. The test was executed by operating the main drive system in the SINGLE mode and simulating a torque fault condition by temporarily changing the Control System

data register. A problem was identified when this test sequence was initiated. Because camera 12 was not functioning, all of the test acceptance criteria could not be verified. Since the problem affected only a small part of the test, enabling the majority of the test acceptance criteria to be verified, this test was continued. Once camera 12 was fixed, those sections which could not be completed were tested (Ref. ERL #6). Based on the results of this test and ERL #6, the system performed as designed, meeting all acceptance criteria as follows:

- Power to the motor was deactivated
- Alarm was sounded
- Error message was displayed and printed
- The proper cameras were called up and displayed
- The system was recovered from the fault condition

Therefore, the upender was judged to be acceptable for continuing on to the next series of tests.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

In general, the Fuel Canister Upender, Fuel Canister Grapple, and Canister Closure System performed as designed with minor modifications. Each of these systems operated adequately to accept, transport, retain, and position either a fuel canister or fuel canister lid. The following conclusions are drawn from this SOT.

- All drives operated as designed under both loaded and unloaded conditions.
- The Fuel Canister Upender operated as designed for all modes (JOG, HAND, SINGLE, and AUTO) of operations.
- All interface requirements were met or exceeded.
- The Fuel Canister Upender operated as designed under fault conditions.
- The Fuel Canister Grapple and Canister Closure System performed as designed.

Based on these conclusions, the Fuel Canister Upender, Fuel Canister Grapple, and Canister Closure System have been judged

acceptable for the normal IST.

5.2 RECOMMENDATIONS

As a result of the SOT performed, several recommendations have been identified. These recommendations, along with those identified in Section 7.0 of the main body of this report, should be implemented for the next generation system. These recommendations are as follows:

- Increase the width of the clamp opening from 9.0 inches to a minimum of 12.0 inches. This will provide a greater clearance for loading the fuel canisters into the upender.
- Provide a generous (~2.0 inches) tapered lead-in on each clamp arm. This will greatly simplify canister loading operation when using a standard overhead crane.
- Provide each drive system with an absolute resolver for position control. This will eliminate the need to "HOME" the system periodically and thus eliminate the error introduced by the homing process.
- Reevaluate the use of proximity switches for end-of-travel limit switches. These switches require extensive setup time, making them impractical for remote applications.

ATTACHMENT 1
SYSTEM OPERATIONAL TEST PROCEDURE
FOR THE
FUEL CANISTER UPENDER, FUEL CANISTER CLOSURE SYSTEM
AND FUEL CANISTER GRAPPLE
(WBS 1.3.3.1, 1.3.3.2, 1.3.3.4)
DOCUMENT NO. 9315-TP-206

ORIGINAL TEST COPY

Record Copy
 Signature Peter V. J. [Signature] Date 1/6/92

TEST PROCEDURE

CLIENT: DOE IDAHO PROCEDURE NO: 9315-TP-206
 LOCATION: COLD TEST FACILITY REVISION: 1

TITLE: **SYSTEM OPERATIONAL TEST PROCEDURE - FBC UPENDER**

RELEASED FOR:

☐

REVIEW

☒

TEST

SYSTEM OPERATIONAL TEST PROCEDURE

FOR THE

FUEL CANISTER UPENDER AND

(WBS 1.5.2.2.10)

FUEL CANISTER GRAPPLE AND

(WBS 1.5.2.2.15)

FUEL CANISTER CLOSURE

(WBS 1.5.2.2.11)

APPROVED	<u>R. D. [Signature]</u>	DATE	<u>11/21/91</u>
	PROJECT MANAGER		
APPROVED	<u>[Signature]</u>	DATE	<u>11/26/91</u>
	QUALITY ASSURANCE		
APPROVED	<u>R. [Signature]</u>	DATE	<u>11/21/91</u>
	DISCIPLINE MANAGER		
APPROVED	<u>R. D. [Signature]</u>	DATE	<u>11/21/91</u>
	AUTHOR		

1	R. D. Wilder	12/14/91	R. Mayhew	1/8/92	1/13/92	1/13/92	J. [Signature]	1/13/92
REV	PREPARED	DATE	APPROVED	DATE	APPROVED	DATE	APPROVED	DATE

NUS CORPORATION

REVISION CONTROL SHEET

REVISED PAGE NO.

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1.0 OBJECTIVE OF TEST

The objective of this test is to demonstrate that the FBC upender and the fuel canister grapple meet their design requirements. Testing to be performed and the acceptance criteria are based on the requirements contained in Specification No. 9315-TAC-206.

The upender will be tested to:

- TPC 21
PVG
3/3/92*
- Demonstrate operation and operating positions of the ~~two~~ upender drive subassemblies *and the upender clamp assembly.* *Rev 1 11/7/92*
 - Demonstrate overtravel protection features of the ~~two~~ upender drive and subassemblies. *Clamp assemblies* *Rev 1 11/7/92*
 - Demonstrate load cell operation on the upender bottom support subassembly.
 - Demonstrate interlock functions used to prevent mechanical interferences and erroneous motions of the two upender drive assemblies.
 - Demonstrate upender automatic operational sequence in SINGLE mode.
 - Demonstrate upender automatic operation in AUTO mode with an unloaded square canister.
 - Demonstrate upender automatic operation in AUTO mode with a test load.
 - Demonstrate upender fault response in SINGLE mode.
 - Demonstrate satisfactory interface of the fuel canister grapple with the fuel canister, the Ex-cell Crane and the canister closure lid.
 - Verify satisfactory interface of the fuel canister closure lid with the fuel canister.

2.0 PREREQUISITES

2.1 System set-up has been performed per the instruction of Appendix A.

Test Conductor RW Fell Date 1/22/92

QA J. A. Yount Date 1-22-92

2.2 Camera, film, lighting and personnel are available to take photographs per the instruction of Appendix C and the detailed procedure steps (Section 8.0).

Test Conductor RW Fell Date 1/22/92

QA J. A. Yount Date 1-22-92

2.3 The QA/QC Data Package has been prepared in accordance with Specification 9315-M-200, and the applicable Bill of Material, and is acceptable.

Test Conductor RW Fell Date 1/22/92

QA J. A. Yount Date 1-22-92

2.4 The system has been assembled in accordance with all applicable Drawings, DCNs and FCRs of the QA/QC data package.

SEE
REPAIR LOG
pg 1

Test Conductor RW Fell Date 1/22/92

QA J. A. Yount Date 1-22-92

2.5 The Test Conductor has been qualified and certified in accordance with QAP 2.0.

Test Conductor RW Fell Date 1/7/92

QA J. A. Yount Date 1-22-92

2.6 All test personnel participating in this test have been trained per the instructions of section 6.4 of reference 11.6.

Test Conductor RW Fell Date 1/23/92

QA J. A. Yount Date 1-23-92

2.7 The checklist contained in the Control System SOT (9315-TP-601) applicable to this system must be completed and the results accepted prior to the initiation of testing under this procedure.

Test Conductor RW Fell Date 1/22/92

QA J. A. Yount Date 1-22-92

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor RW Fell Date 1/22/92

QA J A Yant Date 1-22-92

- 2.9 The system FAT has been completed and accepted by NUS.

Test Conductor RW Fell Date 1/22/92

QA Joseph A Yant Date 1-22-92

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor RW Fell Date 1/22/92

QA J A Yant Date 1-22-92

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor RW Fell Date 1/23/92

QA J A Yant Date 1-23-92

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor RW Fell Date 1/22/92

QA J A Yant Date 1-22-92

3.0 INITIAL TEST CONDITIONS

- 3.1 TV monitors are "On" with proper crosshair alignment verified.

Test Conductor RW Fell Date 1/23/92

- 3.2 Upender drive subassemblies are in the "Home" position.

RW Fell 1/23/92

4.0 ENVIRONMENTAL CONDITIONS

At least One HVAC unit for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60° to 90° and 65° to 85° respectively.

Test Conductor RW Fell Date 1/23/92

5.0 SPECIAL PRECAUTIONS

- 5.1 All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

- 6.1 Test load per 9315-M-0010, Group 3

- 6.2 171 inch long square canister

- 6.3 Stop Watch (calibration not required)

- 6.4 Tape Measure, 6 ft. with 1/32 inch increments (calibration not required)

- ~~6.5 Torque measuring instrument 0-10 ft-lb range~~ Motor Power Meter

- 6.6 100 to 200 lb. weight for load cell testing

- 6.7 Protractor with a range of 0-90° and accuracy of 0.1° (calibration not required)

7.0 TEST DATA RECORDING**7.1 Test Data Records**

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

Each of these modifications will be handled differently. If a correction is required to the procedure, it will be made with pen and ink in the "Record Copy", as they are found. The test conductor will make the appropriate change. Once the change is made, he will initial and date the change for future reference. All modifications which are considered minor changes must be documented on "Temporary Procedure Change Notice" (TPCN) forms (refer to Appendix D). This change shall be approved by the test conductor by annotating that the test procedures are using the TPCN form. All modifications which are considered a major change must also be documented on the TPCN form. However, when a major change is required, testing shall be halted until the TPCN is approved by the responsible Test Engineer, Test Conductor, Quality Assurance and Project Engineer.

7.3 Repairs/Retesting

This section addresses the process for making necessary repairs to the equipment and retesting of the system. If during testing a problem is observed which requires repair or rework of the equipment, testing shall be halted. If the repair/rework is minor, the Test Conductor will document the problem, cause, and corrective action implemented, the faulty system will be retested. All remaining tests will continue on until conclusion. If the problem requires redesign of the faulty system, all testing of this equipment will be halted. The problem and recommended solution will be documented and submitted to the Test Review Group (TRG) for approval. Once approval and the repair is complete, testing of the equipment will be accomplished in accordance with this procedure.

8.0 DETAILED TEST STEPS

8.1 The following Sections 8.1.1 through 8.1.9, contain the detailed test procedural steps required to demonstrate that the FBC upender meets the objectives of this test defined in Section 1.0.

8.1.1 Movable Frame Carriage Drive (M-116A) Operational Verification Test

8.1.1.1 Verify the correct position of the movable frame in the vertical or full up position by measuring the angle between the vertical movable frame and the horizontal upender base plate.

Angle 85.5 degrees

Acceptance Criterion

- Angle 85.5 ± 0.5 degrees ✓

Test Conductor

Date

QA

Date

8.1.1.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the "Hand" mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the upender base plate.

On the hard stop ☒ yes ☐ no

Acceptance Criterion

- Yes

Test Conductor RW Fell

Date 1/23/92

QA JA Gantt

Date 1-23-92

8.1.1.3 Verify the carriage drive operation as follows:

1. ~~Connect a torque measuring instrument leads to the carriage drive motor (M-116A) for measuring torque.~~

CONNECT THE MOTOR POWER METER PER
*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure ~~torque~~ ^{power} and travel time.

MAX POWER as determined from motor
Torque 0.5 horse power or 373 WATTS

Travel Time 34.2 seconds = 5.7 minutes
MAX TORQUE 1.3 ft-lbs

Type of Measuring Device PPM-1 Range VARIOUS

Identification No. 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Torque is 4.21 ft-lbs or less ☒ YES
- Travel Time is less than 5 minutes ☒ YES

Test Conductor RW Fell

Date 1/23/92

QA JA Gantt

Date 1-23-92

Estimate the torque by applying the following formula

$$T(\text{ft-lb}) = \frac{7.040 \times \text{MOTOR POWER (WATTS)}}{\text{MOTOR RPM (rev/min)}}$$

Repeat Section 8.1.3.2 AT A RAISED MOTOR
SPEED FROM ¹²⁰⁰~~900~~ RPM TO ¹⁵⁰⁰~~1200~~ RPM PER 1/23/92

Torque 1.05 lb-ft

Raise time 259 seconds < 5 Minutes

MAX Motor Power .5 HP = 373 WATTS

$$T = \frac{2.070 \times 373 \text{ WATTS} \times .60}{1500 \text{ RPM}} = 1.05 \text{ lb-ft}$$

RW Field 1/23/92

Sigs 1-23-92

MOTOR operating RPM will now be
operating at 1500 rpm for the rest of this test
unless otherwise specified.

RW Field 1/23/92

Field 1-23-92

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time, and estimate motor torque *

TPCN #1
see 3/14/92

Torque 0.63 ft-lbs

Travel Time 2.59 seconds = 4.3 minutes

~~MAX MOTOR POWER~~ 348 = 223.8 WATTS

Type of Measuring Device PPM-1 Range VARIOUS

Identification No. 13747 Calibration Due Date 10-11-92

Acceptance Criterion

- Same as step 2 above

Test Conductor RW Felt Date 1/23/92

QA JL Gant Date 1-23-92

4. Repeat steps 2 and 3 two additional times

	Up	Down
Torque	<u>1.47 ft-lb</u>	<u>.63</u> ft-lbs
Travel Time	<u>2.59 sec</u> <u>4.3 minutes</u>	<u>2.59 sec</u> <u>4.3 minutes</u>
Torque	<u>1.47 ft-lb</u>	<u>.63</u> ft-lbs
Travel Time	<u>2.59 sec</u> <u>4.3 min</u>	<u>2.59 sec</u> <u>4.3 minute</u>

Type of Measuring Device PPM-1 Range VARIOUS

Identification No. 13747 Calibration Due Date 10-11-92

Acceptance Criterion

- Same as step 2 above

Test Conductor RW Felt Date 1/23/92

QA JL Gant Date 1-23-92

8.1.1.4 Part 8.1.1 has been satisfactorily completed.

Test Conductor RW Felt Date 1/23/92

TPCN #1
see 3/14/92 * MOTOR TORQUE, T (ft-lb), is ~~Approximately~~
estimated by $T = \frac{7.040 \times \text{Power (WATTS)}}{\text{RPM}} \times \text{MOTOR EFFICIENCY}$

8.1.2 Canister Clamp (M-116B) Operational Verification Test

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

8.1.2.1 Verify the correct opening of the clamps by measuring the distance between the clamps in the fully open position. The distance is the opening between the two top ledges of the clamp plates.

Distance 9 1/8 ± 9 3/16 inches
West East

Acceptance Criterion

- Distance 9.00 inches + 0.10
- 0.00

Note: 9 1/8 inch is acceptable to permit canister insertion and removal

Test Conductor RW Zell

Date 1/23/92

QA J. Lyons

Date 1-23-92

8.1.2.2 Verify the correct closure of the clamps by driving the subassembly closed and measuring the distance between the fully closed clamps.

Distance 3 1/16 ± 3.0 inches
West East

Acceptance Criterion

- Distance 3.00 ± 0.125 inches

Test Conductor Robert Zell

Date 1/23/92

QA J. Lyons

Date 1-23-92

8.1.2.3 Verify the clamp operations as follows.

1. Drive the clamp to the open position in the HAND mode and measure travel time.

Travel Time 7 seconds seconds

Acceptance Criterion

- Travel Time is 10.0 seconds or less

Test Conductor RW Zell

Date 1/23/92

QA J. Lyons

Date 1-23-92

2. Drive the clamp to the closed position and measure travel time.

Travel Time 8 seconds

Acceptance Criterion

- Identical to the criterion in step 1 above.

Test Conductor RW Shell Date 1/23/92

QA JL Jones Date 1-23-92

3. Repeat steps 1 and 2 two additional times.

	Open	Close	
Travel Time	<u>7</u>	<u>7</u>	seconds
Travel Time	<u>7</u>	<u>7</u>	seconds

Acceptance Criterion

- Identical to the criterion in step 1 above.

Test Conductor RW Shell Date 1/23/92 ^{2 Ret}

QA JL Jones Date 1-23-92

- 8.1.2.4 Part 8.1.2 has been satisfactorily completed.

Test Conductor RW Shell Date 1/23/92

8.1.3 Limit Switch Verification Test

- 8.1.3.1 Verify the operation of the canister clamp drive system (M-116B) limit switches as follows:

1. In the JOG mode, drive the clamps to the open position until they are automatically stopped.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor RW Shell Date 1/23/92

QA JL Jones Date 1-23-92

2. Drive the clamps closed until they automatically shut off.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated.
- Hard stops were not engaged.

Test Conductor RW Field Date 1/23/92
QA J. Alfano Date 1-23-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated in each direction.
- Hard stops were not engaged.

Test Conductor RW Field Date 1/23/92
QA J. Alfano Date 1-23-92

8.1.3.2 Verify the operation of the movable frame carriage drive system (M-116A) limit switches (ZE-116A and ZE-116B) as follows:

1. In the JOG mode, drive the movable frame up to its vertical position until it is automatically stopped.

Acceptance Criteria

- The control system indicates that the end of travel sensor (ZE-116A) has been activated.
- Hard stops were not engaged.

Test Conductor RW Field Date 1/23/92
QA J. Alfano Date 1-23-92

2. Drive the movable frame downward until it automatically shuts off.

Acceptance Criteria

- The control system indicates that the end of travel sensor (ZE-116B) has been activated.

- The Screw RW 1/23/92
- Hard stops were not engaged.

Test Conductor RW Fell

Date 1/23/92

QA J. Lyons

Date 1-23-92

3. Repeat steps 1. and 2. two additional times.

Acceptance Criteria

- The control system indicates that the end of travel sensor has been activated in each direction.

- Hard stops were not engaged.

Test Conductor RW Fell

Date 1/23/92

QA J. Lyons

Date 1-23-92

8.1.3.3 Part 8.1.3 has been satisfactorily completed.

Test Conductor RW Fell

Date 1/23/92

8.1.4 Load Cell Verification Test

8.1.4.1 Verify the correct operation of the bottom support load cell (WE-116A) as follows:

1. With the movable frame in the full up position, place a 100 to 200 pound weight into the bottom support assembly bucket

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Control system indicates presence of weight YES

Acceptance Criterion

- Control system indicates presence of weight

Test Conductor RW Fell

Date 1/23/92

QA J. Lyons

Date 1-23-92

2. Remove the weight from the bucket.

Control system indicates absence of weight NO

Acceptance Criterion

- Control system indicates absence of weight

Test Conductor RW Fell Date 1/23/92

QA S. Adams Date 1-23-92

3. Repeat steps 1 and 2 two additional times.

Control system indicates presence of weight YES (1)

Control system indicates absence of weight NO (2)

Control system indicates presence of weight YES (1)

Control system indicates absence of weight NO (2)

Acceptance Criteria

- (1) Weight is indicated as present

- (2) Weight is indicated as absent

Test Conductor RW Fell Date 1/23/92

QA S. Adams Date 1-23-92

8.1.4.2 Part 8.1.4 is satisfactorily completed.

Test Conductor RW Fell Date 1/23/92

8.1.5 Interlock Verification Test

8.1.5.1 Verify the carriage drive motor (M-116A) up interlocks as follows:

NOTE: Movable frame must be in the down position.

1. Place the control system in the HAND mode.

2. Temporarily force the Data Register to ^{represent} indicate the following combination of conditions as specified below and verify that the movable frame can be driven up ~~by the Carriage Drive Motor~~. Mark the appropriate column below. *not prevented from moving*

Device	Condition	
	0	1
A Rod Loader *	Closed	Open
B Canister in Place	Yes	No
C Clamps	Closed	Open

Test	A B C			Motor Operates		Acceptance Criteria (See Note)
	A	B	C	Yes	No	
i	0	0	0	☒	☐	No
ii	1	0	0	☒	☐	No <i>yes RW7 1/23/92</i>
iii	0	1	0	☒	☐	No
iv	0	0	1	☒	☐	No
v	1	1	0	☒	☐	Yes
vi	0	1	1	☒	☐	No
vii	1	0	1	☒	☐	Yes <i>no RW7 1/23/92</i>
viii	1	1	1	☒	☐	Yes

NOTE

Acceptance Criteria is based on Section 1.4.1 of Reference 11.2, Upender SOTAC. The operating interlock logic is given as A + (B or C).

Test Conductor *RA 7 Feb*

Date *1/23/92*

QA *GA 1/23/92*

Date *1-23-92*

8.1.5.2 Verify the carriage drive motor (M-116A) down interlocks as follows:

1. Place the control system in the HAND mode.
2. Drive the movable frame to its full up position.

* Rod Loader "Closed" position means the rod pusher ^{extended} into the canister. "Open" position is when rod pusher is retracted

TRIN #7
Prg
8/3/92

3. Temporarily force the Data Register to ^{represent} indicate the following combination of conditions as specified below and verify that the movable frame can be driven down ^{or prevented from moving as specified.} by the drive motor. Mark the appropriate column below:

Device	Condition	
	0	1
A Rod Loader	Closed	Open
B Canister in Place	Yes	No
C Clamps	Closed	Open

Test	A B C			Motor Operates		Acceptance Criteria (See Note)
				Yes	No	
i	0	0	0		✓	No
ii	1	0	0	✓		No YES P07 1/23/92
iii	0	1	0	✓		No
iv	0	0	1	✓		No
v	1	1	0	✓		Yes
vi	0	1	1	✓		No
vii	1	0	1	✓		Yes NO P07 1/23/92
viii	1	1	1	✓		Yes

See Test Procedure Change note #2 and TACEN #002 7/23/92

See Test Procedure Change note #2 and TACEN #002 7/23/92

NOTE

Acceptance Criteria is based on Section 1.4.2 of Reference 11.2, Upender SOTAC. The operating interlock logic is given as A + (B or C).

Test Conductor W. Jell

Date 1/23/92

QA J. Jell

Date 1-23-92

8.1.5.3 Verify the clamp drive motor (M-116B) open interlock as follows:

- Place the control system in the HAND mode
- Temporarily force the Data Register to ^{represent} indicate the following combination of conditions as specified below and verify that the clamps can be driven open ^{or prevented from moving as specified.} by the drive motor. Mark the appropriate column below:

Device	Condition	
	0	1
A Canister in Place	Yes	No
B Movable Frame	Up	Down

TRIN #7
Prg
8/3/92

Test	A B		Motor Operates		Acceptance Criteria (See Note)
			Yes	No	
i	0	0		✓	No
ii	1	0	✓		Yes
iii	0	1	✓		Yes
iv	0	0	✓		Yes

TYPE ERROR
RWJ
1/23/92
1/23/92
1/23/92

See Test Procedure
Change #3

NOTE

Acceptance Criteria is based on Section 1.4.3 of Reference 11.2, Upender SOTAC. The operating interlock logic is given as A or B.

These changes are consistent with the TAC

Test Conductor RWJell

Date 1/23/92

QA Filgans

Date 1-23-92

8.1.5.4 Part 8.1.5 is satisfactorily completed.

Test Conductor RWJell

Date 1/23/92

8.1.6 SINGLE Mode Verification Test

Place the upender system in SINGLE mode and verify system automatic sequence. This test verifies unloaded operation of the upender system motions.

8.1.6.1 With the upender in the full up position and the clamps open, place the Control System in the SINGLE mode.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- "Hold Point" generated to load canister, and record canister serial number. Serial # is recorded in log to the system when a canister is removed from its storage cell.
- Video images from Camera No. 11 and No. 12 displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the canister.

Test Conductor RWJell

Date 1/23/92

QA Filgans

Date 1-23-92

* Note Camera 12 is out of service. no affect on function of upender

See Test Procedure
Change #4
and TACN #003
22 July 92
See Exception
Repair #6

cut wire and change filter #4
8.1.6.2 ~~Using the keyboard, enter a canister serial number.~~ Temporarily force the Data Register to indicate placement of a canister on the upender bottom support. *reprint*

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify canister is properly seated. ✓
- Video images from Camera No. 11 and No. 12^{*} are displayed on monitors when "Call Camera" is touched on the screen. Complete a CCTV Assessment Form in Appendix E. ✓
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support. ✓

Test Conductor RW Fell

Date 1/23/92

QA JL Yount

Date 1-23-92

8.1.6.3 Press continue to close the clamps.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Clamps Close ✓
- "Hold Point" is generated to verify excell crane is clear of the Downender ✓
- Video images from Cameras No. 11 and No. 12^{*} are displayed on the monitors when "Call Camera" is touched on the screen. ✓
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the upender movable frame and excell crane interface. ✓

Test Conductor RW Fell

Date 1/23/92

QA JL Yount

Date 1-23-92

* Camera 12 is out of service. No effect on upender performance

The context is give not ask for a canister serial number on previous a hold point. He will #

EXCEPTION REPAIR LOG #6

EXCEPTION REPAIR LOG #6

8.1.6.4 Press "Continue" to downend the movable frame to the horizontal position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criterion

- The movable frame is downended to the horizontal position. ✓

Test Conductor PW Field

Date 1/23/92

QA J. A. Yantis

Date 1-23-92

NOTE

~~Temporarily force the Data Register to indicate the compaction system sequential steps that result in the generation of a "canister full" signal.~~

SAC
Tinto, conduct
change ratios
#5 and
JACCN #004
3/24/92

8.1.6.5 Press "Continue" to raise the movable frame to its up position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Movable frame travels to its up position. ✓
- Control system generates a "Hold Point" signal to verify manual canister closure and attachment of excell crane hook. ✓
- Video images from Cameras No. 11 and 12 are displayed on the monitor when "Call Camera" is touched on the screen. ✓
- Cameras can be positioned to obtain an unobstructed view to verify crane is attached. ✓

Test Conductor PW Field

Date 1/23/92

QA J. A. Yantis

Date 1-23-92

EXOSATION
REPAIR LOG
#6

8.1.6.6 Press "Continue" to open the clamps.

Acceptance Criterion

- Clamps open ✓

Test Conductor PW Field

Date 1/29/92

QA J. A. Yantis

Date 1-23-92

* Camera 12 is out of service.

8.1.6.7 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor RW Felt

Date 1/23/92

QA JAC/mt

Date 1-23-92

8.1.6.8 Part 8.1.6 is ~~satisfactorily~~ completed. RW Felt 1/23/92

Test Conductor RW Felt

Date 1/23/92

8.1.7 AUTO Mode Verification Test

Place the upender in AUTO mode and verify system automatic sequence. This test verifies operation of the upender motions and includes the use of a canister. The empty 171-inch long square canister is initially in one of the storage cells of the fuel canister storage rack. The fuel canister grapple is on the hook of the Ex-cell Crane.

8.1.7.1 Manually engage the grapple with the empty canister. Raise the Ex-cell Crane approximately 2-inches and stop for inspection.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Grapple successfully interfaces (mechanically) with the canister and with the Ex-cell Crane.
- Canister remains attached to the grapple when raised.

Test Conductor RW Felt

Date 1/28/92

8.1.7.2 With the upender in the full up position and the clamps open, place the 171 inch square canister in the upender.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria^a

- Load cell indicates weight of canister ✓
- ~~"Hold Point" generated to record canister serial number.~~ ✓ *done automatically*

Test Conductor RW Felt

Date 1/28/92

QA JAC/mt

Date 1-28-92

TPCN #4,
FACON #003
7/12
3/24/92

8.1.7.3 See 3/25/92
Using the keyboard, enter the canister serial number.
"Continue".

DONE AUTOMATICALLY
Press

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Clamps close ✓
- "Hold Point" is generated to verify canister grapple is disengaged and removed from the area. ✓

Test Conductor RW Felt

Date 1/28/92

QA J. Alfano

Date 1-28-92

8.1.7.4 Manually disengage the canister grapple from the canister and remove the grapple/Ex-cell Crane from the Upender area. ✓

Acceptance Criteria

- Grapple is successfully removed from the canister.

8.1.7.5 Press "Continue". RW Felt 1/28/92

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Movable frame is downended to the horizontal position, in less than 5 minutes. ✓
- The centerline of the canister is positioned within $\pm .030$ inches of the centerline through the hopper when in the canister loading position in less than 5 minutes. ✓
- The projection of the funnel discharge perimeter is within the opening of fuel canister. ✓

- Signal is generated that empty canister is in place. ✓

All criteria met.

Yes ☒ No

Test Conductor RW Felt

Date 1/28/92

QA J. Alfano

Date 1-28-92

NOTE

Temporarily force the Data Register to indicate the compaction sequential steps that result in the generation of a "canister full" signal.

see PEN #4

See TPCW #6 and also

see Exception Report #3

Such a message or signal does not occur. See Exception Report #4 TPCW #6 1/28/92

NO - See Exception Report #4 and TACCN #001 1/28/92

See TPCW #5 RW 1/28/92

OK as per 1/28/92

8.1.7.6 Receive "Canister Full" signal.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Canister is rotated to the vertical position in less than 5 minutes. ✓
- "Hold Point" is generated to verify that manual canister closure and crane hook attachment have been completed. ✓

All criteria met. Yes No

Test Conductor RW Field Date 1/28/92

QA J. Alfano Date 1-28-92

8.1.7.7 Manually attach the closure lid to the canister. Manually engage the lid with the canister grapple.

Acceptance Criterion

- Lid successfully interfaces (mechanically) with the canister.
- Grapple successfully interfaces (mechanically) with the closure lid. ✓

Test Conductor RW Field Date 1/28/92

QA J. Alfano Date 1-28-92

8.1.7.8 Press "Continue."

Acceptance Criteria

- Clamps open. ✓
- "Hold Point" generated to verify that the canister is unloaded overhead crane is clear. ✓

Test Conductor RW Field Date 1/28/92

QA J. Alfano Date 1-28-92

see 1/28/92

NO see exception/repair #5

TPC #7 1/28/92

RW Field 1/28/92

8.1.7.9 Using the Ex-cell Crane, raise the canister vertically to clear the upender bottom support and move horizontally to clear the upender area.

Acceptance Criterion

- Canister remains attached when raised. ✓
- Load cell indicates absence of canister weight. ✓

8.1.7.10 Part 8.1.7 is satisfactorily completed. *rwf 1/28/92*

Test Conductor RW Fell

Date 1/28/92

8.1.8 Operational Verification Test with Load

22
not Exception
#1 TFCN #1
1 RW 7
1/7/92
~~This test verifies loaded operation of the upender system motions. Connect a torque measuring instrument leads to the carriage drive motor (M-116A).~~ *connect the motor power meter to motor M-116A.*

8.1.8.1 With the upender in the full up position and the clamps open, place the test load specified in Section 6.1 in the upender. Place the Control System in the SINGLE mode. ✓

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- "Hold Point" generated to load canister, and record canister serial number. *see 3/15/92*
- Load cell indicates presence of the test load. ✓
- Video images from Camera No. 11 and No. 12[†] displayed on monitors when "Call Camera" is touched on the screen. ✓
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the canister. *test Load RW 7 1/28/92* ✓

Test Conductor RW Fell

Date 1/28/92

QA Calvert

Date 1-28-92

* Camera 12 not functional

me 3/25/92
8.1.8.2 ~~Using the keyboard, enter a canister serial number.~~

Press "Continue."

*Does not
Apply
See TPCN #4*

Acceptance Criteria

- "Hold Point" generated to verify canister is properly seated. ✓
- Video images from Camera No. 11 and No. 12^{*} are displayed on monitors when "Call Camera" is touched on the screen. ✓
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support. ✓

*EXCEPTION
REPAIR LOG
#6*

Test Conductor RW Hall

Date 1/28/92

QA J. Ayers

Date 1-28-92

8.1.8.3 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the ~~Downender~~ *UPENDER me 3/25/92* ✓
- Video images from Cameras No. 11 and No. 12^{**} are displayed on the monitors when "Call Camera" is touched on the screen. ✓
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the upender movable frame and excell crane interface. ✓

*TPC #1
me 3/25/92
EXCEPTION
REPAIR LOG
#6*

Test Conductor RW Hall

Date 1/28/92

QA J. Ayers

Date 1-28-92

8.1.8.4 Press "Continue" to downend the movable frame to the horizontal position. Measure ~~torque and travel time.~~

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

motor power, motor rpm, and travel time
MAX POWER 0.6 HP

Torque 1.24 ft-lbs

Travel Time 4.3 minutes

MOTOR RPM 1500

*Estimate
the maximum
motor
torque.*

Type of Measuring Device PPM-1 Range Various

Identification No. 13747 Calibration Due Date 10-11-92

** MOTOR TORQUE (F6-H) = $\frac{7.040 \times \text{MOTOR POWER (WATTS)}}{\text{MOTOR RPM}}$*

*See Foot
Exception
#1A 1/17/92
Camera 12
not functional*

Acceptance Criteria

- Torque is 4.21 ft-lbs or less ✓
- Travel Time is less than 5 minutes ✓
- The movable frame is downended to the horizontal position. ✓

Test Conductor R. J. Hill

Date 1/28/92

QA J. J. Hill

Date 1-28-92

NOTE

Temporarily force the Data Register to indicate the compaction system sequential steps that result in the generation of a "canister full" signal.

8.1.8.5 Press "Continue" to raise the movable frame to its up position.

TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG

MAX MOTOR POWER 1.3 WATTS HP
Torque* 2.73 ft-lbs

Travel Time 259 seconds = 4.3 minutes
MOTOR RPM 1500 RPM

Type of Measuring Device PPM-1 Range VARIOUS

Identification No. 13747 Calibration Due Date 10-11-92

Acceptance Criteria

- Torque is 4.21 ft-lbs or less ✓
- Travel Time is less than 5 minutes ✓
- Movable frame travels to its up position. ✓
- Control system generates a "Hold Point" signal to verify manual canister closure and attachment of excell crane hook. ✓
- Video images from Cameras No. 11 and 12 are displayed on the monitor when "Call Camera" is touched on the screen. ✓
- Cameras can be positioned to obtain an unobstructed view to verify crane is attached. ✓

Test Conductor R. J. Hill

Date 1/29/92

QA J. J. Hill

Date 1-29-92

TORQUE = $\frac{7070 \text{ MAX MOTOR POWER (WATTS)}}{\text{MOTOR RPM}} \times \text{MOTOR EFFICIENCY}$

See Foot
Exception #1
R. J. Hill
1/27/92

EXCEPTION
REPAIR LOG
#6

Camera 12
Not working

8.1.8.6 Press "Continue" to open the clamps.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Attach the excell crane to the test load. ✓

Acceptance Criterion

- Clamps open

Test Conductor

RW Hill

Date

1/29/92

QA

J. J. J.

Date

1-29-92

8.1.8.7 Remove the test load from the upender.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criterion

- Load cell shows absence of test weight

Test Conductor

RW Hill

Date

1/29/92

QA

J. J. J.

Date

1-29-92

8.1.8.8 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor

RW Hill

Date

1/29/92

QA

J. J. J.

Date

1-29-92

8.1.8.9 Part 8.1.8 is satisfactorily completed.

Test Conductor

RW Hill

Date

1/29/92

8.1.9 Servo Drive Fault Test

WARNING

Stay clear of the upender system while in operation

8.1.9.1 Place the upender system in the SINGLE mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-116A)

- 8.1.9.2 Temporarily force the Data Register to ^{represent} ~~indicate~~ a torque fault with the carriage drive motor (M-116A).

Acceptance Criteria

- Motor stops when fault condition is implemented. ✓
- Alarm system is activated. ✓
- Alarm is silenced when acknowledged by operator. ✓
- Control system displays fault condition on control screen. ✓
- A report is printed defining the fault condition when commanded by the operator. ✓

Test Conductor

Reid Full

Date

1/29/92

QA

J. Adams

Date

1-29-92

- 8.1.9.3 Verify cameras No. 11 and No. 12^{*} are activated and view the movable frame system when the "Call Camera" button is touched ✓

EXCEPTION
REPAIR LOG
#6

Acceptance Criteria

- Video images from cameras No. 11 and NO. 12^{*} are displayed on monitors when "Call Camera" is touched on control screen. ✓
- Camera No. 11 and No. 12^{*} can be positioned to provide an unobstructed view of the movable frame. ✓

Test Conductor

Reid Full

Date

1/29/92

QA

J. Adams

Date

1-29-92

- 8.1.9.4 Correct fault condition and verify the carriage drive motor (M-116A) can be moved in the SINGLE mode.

Acceptance Criterion

- The system can be recovered from fault condition and SINGLE mode operations continued.

Test Conductor

Reid Full

Date

1/29/92

QA

J. Adams

Date

1-29-92

- 8.1.9.5 Part 8.1.9 is satisfactorily completed.

Test Conductor

Reid Full

Date

1/29/92

* Camera 12 is out of service

9.0 POST PERFORMANCE REVIEW AND APPROVAL

The following signatures certify that the completed test, with all data collected, has been reviewed, and that the system has passed the requirements for system operational test.

Frank M. Gallo 9/1/92
Test Engineer Date

M. J. [Signature] 9/1/92
Quality Assurance Date

Frank M. Gallo 9/1/92
Project Engineer Date

Peter J. [Signature] 9/10/92
Test Director Date

10.0 RETENTION OF TEST RECORDS

The original working copy, including test exceptions and resolution and acceptance signatures, are to be maintained by the Test Director and stored at the NUS Gaithersburg building, Document Control Center. One copy of the original working document shall be sent to the DOE representative for their use and retention.

11.0 REFERENCES

- 11.1 Design Drawings
- 11.2 Specification 9315-TAC-206, System Operational Test Acceptance Criteria for the Fuel Canister Upender, latest revision.
- 11.3 Fuel Rod Consolidation Project Phase II Final Report, Volume 1.
- 11.4 Diff-Norton Mechanical Design Guide, dated 1990.
- 11.5 9315-E-601, System Software Specification.
- 11.6 9315-P-120, Test Administration Manual for System Operations Test and Integrated Systems Test, latest revision.

APPENDIX A
EQUIPMENT SETUP

1.0 Equipment Set-Up

Prepare the Drive Servo Controls for Operation

Note: The drive motor and its controls are required to be adjusted and tuned/calibrated, as detailed below, prior to all other system testing.

1.1 Carriage Drive Motor (M-116A)

Ensure that the carriage nut is approximately at mid travel. (Since machine motion will occur in a following step, this precaution is given in order to locate the equipment in a safe position.)

1. Verify that the Carriage Drive Motor is mechanically and electrically coupled after completion of the Control System SOT.
2. Adjust the motor control parameters for (M-116A) per instructions from Modicon, and as recorded in the following Carriage Drive Axis personality record form.
3. Record resolver counts/turn for resolver GE-103A and enter into the Control System the maximum speed for JOG mode in Resolves Counts/Sec. as noted below.

Initial Setup

RESOLVER NUMBER	JOG SPD. (RPM)	RESOLVER COUNTS/TURN	MAX JOG SPD COUNTS/SEC
GE-116A	<i>1200</i> 900	1000	15000

20,000

- Final Setup*
4. Select the Carriage Drive at the Control Console and set JOG speed at approximately 10% of maximum JOG Speed. JOG the movable frame to the vertical position (HOME). Adjust the sensor (ZE-116) as necessary to stop the movable frame before the carriage nut engages the hard stop. JOG toward and away from the sensor and verify sensor position.

CAUTION: Observe carefully as the machine moves and be prepared to activate emergency stop if necessary.

Sensor Position: Movable frame angle from horizontal 70.6°

Axis personality record form:

 Machine Name/Number: FBC UPENDER
~~Downender~~ Carriage Drive

 Axis Number: M-116 A

Personality Variable	Projected Value	Final Value
Number of Motor Poles (NPOLES)	6	
Resolution (RES)	1000	
Rate Loop Proportional Gain (RPG)	20	
Rate Loop Integral Gain (RIG)	200	
Acceleration Time Constant (ATC)	70	
Following Error Limit (FE_LIM)	100000	
Peak Current Limit (IMAX)	100	100
Average Current Trip Level (IAVG_LIM)	30	40
CW End-of-Travel Limit (+EOT)	0	
CCW End-of-Travel Limit (-EOT)	0	
In-Position Tolerance Band (POS_TOL)	40	
In-Sync Tolerance Band (SYNC_TOL)	500	
Linear Acceleration (ACCEL)	5000	
Linear Deceleration (DECEL)	10000	
Position Cmd Time Constant (PCTC)	N/A	
Velocity Feed Forward (VFF) on/off	N/A	
Motor Base Speed (BASE_SPD)	3600

TEST PROCEDURE 9315-TP-206

REVISION 1

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5. JOG the movable frame down to its horizontal position. Verify that the carriage drive motor speed reduces to zero just as the frame touches the horizontal stop.
6. Create and verify an Axis Homing Sequence (AHS) for the Carriage Drive Motor (M-116) and resolver (GE-116). (See "Start Program" in the Software Detail Design Document by Modicon.) AHS parameters to be as given below. At completion of AHS, record "Home Offset" and "Final Home Position" in the chart below.

Motor Tag No: M-116 ^A Home Direction: CW

Resolver Tag No.: GE-116 Resolver Counts/Turn: 1000

Home Speed: 100 RPM 1667 counts/sec.

Home Offset: -5000 Resolver Counts

Final Home Position: 90.5° ± 0.5° (from horizontal)

7. Return the AHS for the Carriage Drive Motor to "Home-As-Is".

1.3 Clamp Activator (M-116)¹¹⁶¹³

Calibrate the actuator position transducer (GE-116B) and set the open and close limit switches.

1. Position Transducer Calibration

- Open the fuel assembly clamps until the distance between the two top ledges is 9.0 ± 0.10 inches. Program the Control System to stop the actuator at this opening.
- Close the clamps until the distance between the two top ledges is 3.00 ± 0.125 inches.
- Upload part-program to supervisory program to store the setpoints.

2. Limit Switch Calibration

- In the JOG mode, open the clamps until they are approximately halfway between 9.00 inches and the open hard stop. Set the actuator motor open limit switch to de-energize power to the actuator motor at this opening.

Limit Switch Setting (Open) 11 inches

- In the JOG mode, close the clamps until that are approximately halfway between 3.00 inches and the close hard stop. Set the actuator motor close limit switch to de-energize the actuator motor at this opening.

Limit Switch Setting (Close) 1.5 inches

1.4 Appendix A has been satisfactorily completed

Test Conductor

Ralph F. Hill

Date

1/22/92

APPENDIX B
SAFETY PROCEDURES

SYSTEMS OPERATIONS TEST SAFETY CONSIDERATIONS

Performance of the SOTs in a manner which precludes the injury of personnel involved in the test performance or working in the Test Facility is of paramount importance. The following steps shall be taken to minimize the possibility of personnel being injured during the performance of SOTs:

1. Contraves and NUS will advise their employees and any subcontractors to stay clear of the Test Facility when tests are being conducted unless they are involved in the test performance or have another work assignment in the Test Facility.
2. Contraves will post a warning sign at the entrance to the Test Facility when testing is in progress advising personnel of the need to stay away unless involved in the testing or have some authorized work assignment in the area.
3. When feasible and deemed advisable by the Test Conductor the machine being tested will be surrounded by a portable barrier (ropes and posts) with a Caution Sign warning individuals to stay clear of the area unless authorized to enter by the Test Conductor.
4. When machines are being moved by installed motors the NUS electrical engineer operating the motor or the Test Conductor will be located in a position which permits him/her to observe the machine operation so that the equipment can be stopped if a dangerous situation appears to be developing. Such situations could involve unanticipated machine performance or personnel entering the test area and placing themselves in jeopardy.
5. When an SOT is in progress the Test Conductor will remain in the vicinity of the test so the all personnel involved in the test are under his observation and will perform any required test support activities directly under his supervision.
6. Only Contraves personnel who have been qualified to the DOE Hoisting and Rigging Manual Rev. 10-88 will operate the Test Facility overhead crane.
7. Only NUS test engineers will operate the Robotic Bridge Transporter (RBT), the Manipulator Transporter (MT), and the RM-10A Robot Arms.
8. Slings, hooks, and chains utilized with the Test Facility overhead crane or with the RBT will be those purchased specifically for use on the DOE project and have been certified to meet the requirements of ANSI B30.9.
9. The making of all electrical connections to the various equipment will be supervised by an NUS electrical engineer.

10. Protective headgear will be worn in the Test Facility when ever the Robotic Bridge Transporter (RBT) the Manipulator Transporter (MT) are being utilized or at any time the Test Conductor deems the use of protective head gear is appropriate.
11. The NUS Test Conductor is responsible to see that all the above safety requirements are implemented during the performance of the test for which he has responsibility.
12. The Test Conductor will verify that all test specific safety prerequisites identified in test procedures are satisfied and that any precautions identified in specific procedure steps as followed.
13. The NUS Test Director will perform frequent informal surveillance of the testing operations to verify the safety requirements are being adhered to by the personnel performing the test or other work in the test area.

APPENDIX C
PHOTO DOCUMENTATION REQUIREMENTS

Photo Documentation Requirements

Photographs are required to be taken of all System Operational Tests (SOTs). The following is a bulletized list which identifies when these photographs must be taken, as a minimum. Additional photographs may be taken at any other time during the test, as specified by the Test Conductor.

- Photographs must be taken of the initial setup for each test sequence.
- Photographs must be taken of the following critical interfaces between system, as a minimum,
 - Excell Crane/Downender (Loading of Fuel)
 - RBT/Fuel Assembly Storage Rack
 - RBT/Downender
 - RBT/Staging and Cutting Station
 - RBT/Clamping Table
 - FAHF/Mockup Fuel Assembly
 - Pull-Head Gripper/Fuel Rods
 - Rod Loader/Canister
 - NFBC Loader/Canister
 - RBT/Off-Normal Table
 - MT/Off-Normal Table
 - Fuel Canister/Storage Rack
 - NFBC Canister/Storage Rack
 - RBT/FAHF and RM-10A
 - Excell Crane/Fuel Canister Upender (Loading and Unloading)
 - Excell Crane/NFBC Canister Upender (Loading and Unloading)
 - MT/RM-10A
- Photographs must be taken of any equipment damaged during testing.
- Photographs must be taken of any damage to mockup fuel rods and/or mockup fuel assemblies.
- Photographs must be taken of the cutter to fuel assembly interfaces as follows:
 - In position prior to cut
 - During cutting operation
 - Cut area of end fitting after cut operation
 - Cut area of fuel assembly after cut operation
- Photographs must be taken of each "Hold Point".
- Photographs must be taken of the problem areas of any subsystem which does not perform its expected function.
- Photographs must be taken of any component, subsystem, or system, determined by the test conductor to be operating out of the normal/expected condition (i.e., excessive deflection, vibration, etc.).

FUEL ROD CONSOLIDATION PROJECT PHOTOGRAPHIC LOG

TEST PROCEDURE No. 206

ENTRY NO.	FILM ROLL #	FRAME NO.	DATE/TIME	TEST NUMBER	EQUIPMENT/PURPOSE
1	5	24	1/23/92 9:50	206	Upender raised in Hard mode
2	5	23	1/23/92 "	206	" " " " "
3	5	22	1/23/92 1:18	206	Upender vertical with clamps open ^{closed}
4	5	21	" "	206	Upender vertical with clamps closed
5	5	20	1/23/92 2:30	206	Test Load on Load Cell in bucket
6	5	19	1/23/92 3:55	206	Took Picture of Vertical Position clamps ^{open}
7	5	18	1/23/92 4:30	206	Vertical Position Clamps closed
8	5	17	1/23/92 4:40	206	Horizontal position Clamps closed
9	5	16	1/28/92 8:10	206	Canister grapple
10	5	15	1/28/92 8:30	206	Raise Canister out of storage cell
11	5	14	1/28/92 8:33	206	" " " " "
12	5	13	1/28/92	206	Canister Lowering to Horizontal Pos.
13	5	12	1/28/92 13:20	8.1.7.7	Closure lid to canister
14	5	11	1/28/92 16:10	8.1.8.1	Upender With Test Load
15	5	10	1/28/92 16:22	8.1.8.7	Lower Test Load
16	5	9	1/29/92 08:30	8.1.8.5	Raising Test Load
17	5	8	1/29/92 8:40	8.1.8.6	Test Load with clamps open
18	5	7	1/29/92 8:45	8.1.8.7	Test Load being raised out of upender

TEST APPENDIX D
TEMPORARY PROCEDURE CHANGE NOTICE AND REPAIR LOG

TEST PROCEDURE 9315-TP-206

REVISION 1

APPENDIX D-2

~~7/17/92~~ ~~7/24/92~~ ~~TEST~~
TEMPORARY PROCEDURE CHANGE NOTICE # / (page 1 of 2)
re 3/24/92

DATE 1/7/92

SOT for Fuel Canister

PROCEDURE NO. 9315-TP-206 REV. 1 TITLE Upender et al

PROCEDURE SECTION(S) 6.5, 8.1.1.3, 8.1.8, 8.1.8.4, 8.1.8.5

8/3/92 | 1.0, 2.9, 3.1, 8.1.8.3 and A-2 Section 1.1.3

8/13/92 |
PROCEDURE CHANGE: (Use reverse side if necessary.)

A MOTOR POWER METER IS SUBSTITUTED
FOR A TORQUE MEASURING INSTRUMENT

REASON FOR CHANGE:

SEE NEXT PAGE
8/13/92 | pre added marking pages for clarification.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO ☐

MAJOR ☐ YES ☐ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO

APPROVALS

Rahel W. Fell 1/7/92
TEST ENGINEER DATE (1)(2)

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

MOTOR

A TORQUE MEASURING INSTRUMENT THAT CAN MEASURE MOTOR TORQUE WHILE ^{THE MOTOR} ~~OPERATING~~ THE OPERATES THE MACHINE WAS NOT FOUND IN ANY ELECTRONIC EQUIPMENT CATALOG. AS A SUBSTITUTE, A MOTOR POWER METER MANUFACTURED BY HOAD CONTROLS INCORPORATED, PORTABLE POWER MONITOR, MODEL PPM-1, WITH A CALIBRATION CERTIFICATE DATE 10/11/91 IS TO BE USED TO MEASURE POWER CONSUMED BY THE MOTOR. THE MOTOR TORQUE WILL THEN BE ESTIMATED USING THE FOLLOWING FORMULA

$$\text{TORQUE (FT-LB)} = \frac{7.040 \times \text{MOTOR POWER} \times \text{MOTOR EFF.}}{\text{MOTOR RPM}}$$

WHERE MOTOR POWER IS IN WATTS.

MOTOR EFFICIENCY ~~IS~~ IS ASSUMED TO BE 60%.

THE TORQUE CAN NOT BE ESTIMATED WITH THE MOTOR RPM AT ZERO, USING THE ABOVE EQUATION.

1.0 OBJECTIVE OF TEST

The objective of this test is to demonstrate that the FBC upender and the fuel canister grapple meet their design requirements. Testing to be performed and the acceptance criteria are based on the requirements contained in Specification No. 9315-TAC-206.

The upender will be tested to:

- Demonstrate operation and operating positions of the ~~two~~ upender drive subassemblies *and the upender clamp assembly.*
- Demonstrate overtravel protection features of the ~~two~~ upender drive and subassemblies *clamp assemblies.*
- Demonstrate load cell operation on the upender bottom support subassembly.
- Demonstrate interlock functions used to prevent mechanical interferences and erroneous motions of the two upender drive assemblies.
- Demonstrate upender automatic operational sequence in SINGLE mode.
- Demonstrate upender automatic operation in AUTO mode with an unloaded square canister.
- Demonstrate upender automatic operation in AUTO mode with a test load.
- Demonstrate upender fault response in SINGLE mode.
- Demonstrate satisfactory interface of the fuel canister grapple with the fuel canister, the Ex-cell Crane and the canister closure lid.
- Verify satisfactory interface of the fuel canister closure lid with the fuel canister.

- 2.8 A limited access area with warning signs has been established around the equipment being tested.

Test Conductor _____ Date _____

QA _____ Date _____

- 2.9 The system ~~QA~~ *Operations and Test portion of the* FAT has been completed and accepted by NUS.

Test Conductor _____ Date _____

QA _____ Date _____

- 2.10 All equipment required to support this test as defined in Section 6.0 of this procedure is operational and calibrated as required.

Test Conductor _____ Date _____

QA _____ Date _____

- 2.11 A visual inspection of the system being tested has been performed to verify there are no obstructions and/or damage to the equipment that may impact testing.

Test Conductor _____ Date _____

QA _____ Date _____

- 2.12 The environmental conditions as defined in Section 4.0 are met.

Test Conductor _____ Date _____

QA _____ Date _____

3.0 INITIAL TEST CONDITIONS

- 3.1 TV monitors are "On" with proper crosshair alignment verified. *Cameras 11 & 12 operational*

Test Conductor _____ Date _____

- 3.2 Upender drive subassemblies are in the "Home" position.

4.0 ENVIRONMENTAL CONDITIONS

At least One HVAC unit for the control room and the air circulation system for the Test Cell should be operating and maintaining the test cell and control room temperatures in the ranges 60° to 90° and 65° to 85° respectively.

Test Conductor _____ Date _____

5.0 SPECIAL PRECAUTIONS

- 5.1 All precautions, warnings and notes are addressed in the Detail Test Steps (Section 8.0), prior to the step to which they apply.

6.0 SPECIAL EQUIPMENT REQUIRED

- 6.1 Test load per 9315-M-0010, Group 3
- 6.2 171 inch long square canister
- 6.3 Stop Watch (calibration not required)
- 6.4 Tape Measure, 6 ft. with 1/32 inch increments (calibration not required)
- 6.5 MOTOR POWER METER!
~~Torque measuring instrument 0-10 ft-lb range~~
- 6.6 100 to 200 lb. weight for load cell testing
- 6.7 Protractor with a range of 0-90° and accuracy of 0.1° (calibration not required)

7.0 TEST DATA RECORDING**7.1 Test Data Records**

The test conductor shall designate one copy of the test procedure and its attachments as the "Record Copy" and shall ensure that this copy is maintained current. All test data, significant events, and observations must be recorded in this document. Additional sheets may be used as necessary, but must be permanently affixed to this report by staples and/or tape.

7.2 Test Procedure Modification

This section addresses the process for making modifications to the approved Test Procedure. These modifications will fall into one of three categories, as follows:

- Corrections are modifications to the procedure due to typos or incorrect information.
- Minor Changes are modifications which do not affect functional intent or acceptance criteria of the test.
- Major Changes are changes that affect functional intent or acceptance criteria.

- 8.1.1.2 Verify the correct position of the movable frame in the horizontal or full down position by driving the movable frame down in the "Hand" mode until it stops. Observe the frame position and determine if it is in contact with the lower hard stops attached to the upender base plate.

On the hard stop ____ yes ____ no

Acceptance Criterion

- Yes

Test Conductor _____ Date _____

QA _____ Date _____

- 8.1.1.3 Verify the carriage drive operation as follows:

- THE MOTOR POWER METER PER VENDOR INSTRUCTIONS ~}
1. Connect ~~a torque measuring instrument leads to the carriage drive motor (M-116A) for measuring torque.~~

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

2. Drive the movable frame in the HAND mode from the full down position to the full up position and measure torque and travel time. POWER

Torque _____ ft-lbs

Travel Time _____ minutes

MAX MOTOR POWER _____ WATTS

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Acceptance Criteria

- Torque is 4.21 ft-lbs or less
- Travel Time is less than 5 minutes

Test Conductor _____ Date _____

QA _____ Date _____

ESTIMATE THE TORQUE BY APPLYING THE FOLLOWING FORMULA:
$$T (FT-LB) = \frac{7.040 \times \text{MOTOR POWER (WATTS)}}{\text{MOTOR RPM (REV/MM)}} \times \text{MOTOR EFFICIENCY}$$

3. Drive the movable frame from the full up position to the full down position and measure torque and travel time

Torque _____ ft-lbs

Travel Time _____ minutes

MAX MOTOR POWER _____ WATTS

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Acceptance Criterion

- Same as step 2 above

Test Conductor _____ Date _____

QA _____ Date _____

4. Repeat steps 2 and 3 two additional times

Up

Down

Torque _____ ft-lbs
Travel Time _____ minutes

Torque _____ ft-lbs
Travel Time _____ minutes

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Acceptance Criterion

- Same as step 2 above

Test Conductor _____ Date _____

QA _____ Date _____

8.1.1.4 Part 8.1.1 has been satisfactorily completed.

Test Conductor _____ Date _____

- 8.1.7.9 Using the Ex-cell Crane, raise the canister vertically to clear the upender bottom support and move horizontally to clear the upender area.

Acceptance Criterion

- Canister remains attached when raised.
- Load cell indicates absence of canister weight.

- 8.1.7.10 Part 8.1.7 is satisfactorily completed.

Test Conductor _____ Date _____

- 8.1.8 Operational Verification Test with Load

Connect the MOTOR POWER METER TO MOTOR (M-116A).
~~This test verifies loaded operation of the upender system motions. Connect a torque measuring instrument leads to the carriage drive motor (M-116A).~~

- 8.1.8.1 With the upender in the full up position and the clamps open, place the test load specified in Section 6.1 in the upender. Place the Control System in the SINGLE mode.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- "Hold Point" generated to load canister and record canister serial number.
- Load cell indicates presence of the test load.
- Video images from Camera No. 11 and No. 12 displayed on monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the top end of the canister.

Test Conductor _____ Date _____

QA _____ Date _____

8.1.8.2 Using the keyboard, enter a canister serial number.

Press "Continue."

Acceptance Criteria

- "Hold Point" generated to verify canister is properly seated.
- Video images from Camera No. 11 and No. 12 are displayed on monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the bottom support.

Test Conductor _____ Date _____

QA _____ Date _____

8.1.8.3 Press continue to close the clamps.

Acceptance Criteria

- Clamps Close
- "Hold Point" is generated to verify excell crane is clear of the ~~Downender~~ *UPENDER*
- Video images from Cameras No. 11 and No. 12 are displayed on the monitors when "Call Camera" is touched on the screen.
- Pan, tilt and zoom are functional and both cameras can be positioned to achieve an unobstructed view of the upender movable frame and excell crane interface.

Test Conductor _____ Date _____

QA _____ Date _____

AX MOTOR POWER, MOTOR RPM
8.1.8.4 Press "Continue" to downend the movable frame to the horizontal position. Measure torque and travel time.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Torque _____ ft-lbs

Travel Time _____ minutes

MAX MOTOR POWER _____ WATT
MOTOR RPM _____

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Acceptance Criteria

- Torque is 4.21 ft-lbs or less
- Travel Time is less than 5 minutes
- The movable frame is downended to the horizontal position.

Test Conductor _____ Date _____

QA _____ Date _____

NOTE

Temporarily force the Data Register to indicate the compaction system sequential steps that result in the generation of a "canister full" signal.

8.1.8.5 Press "Continue" to raise the movable frame to its up position.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Torque _____ ft-lbs

Travel Time _____ minutes
MAX METER POWER WATTS
MOTION KPH

Type of Measuring Device _____ Range _____

Identification No. _____ Calibration Due Date _____

Acceptance Criteria

- Torque is 4.21 ft-lbs or less
- Travel Time is less than 5 minutes
- Movable frame travels to its up position.
- Control system generates a "Hold Point" signal to verify manual canister closure and attachment of excell crane hook.
- Video images from Cameras No. 11 and 12 are displayed on the monitor when "Call Camera" is touched on the screen.
- Cameras can be positioned to obtain an unobstructed view to verify crane is attached.

Test Conductor _____ Date _____

QA _____ Date _____

1.0 Equipment Set-Up

Prepare the Drive Servo Controls for Operation

Note: The drive motor and its controls are required to be adjusted and tuned/calibrated, as detailed below, prior to all other system testing.

1.1 Carriage Drive Motor (M-116A)

Ensure that the carriage nut is approximately at mid travel. (Since machine motion will occur in a following step, this precaution is given in order to locate the equipment in a safe position.)

1. Verify that the Carriage Drive Motor is mechanically and electrically coupled after completion of the Control System SOT.
2. Adjust the motor control parameters for (M-116A) per instructions from Modicon, and as recorded in the following Carriage Drive Axis personality record form.
3. Record resolver counts/turn for resolver GE-103A and enter into the Control System the maximum speed for JOG mode in Resolves Counts/Sec. as noted below.

RESOLVER NUMBER	JOG SPD. (RPM)	RESOLVER COUNTS/TURN	MAX JOG SPD COUNTS/SEC
GE-116A	900	1000	15000

4. Select the Carriage Drive at the Control Console and set JOG speed at approximately 10% of maximum JOG Speed. JOG the movable frame to the vertical position (HOME). Adjust the sensor (ZE-116) as necessary to stop the movable frame before the carriage nut engages the hard stop. JOG toward and away from the sensor and verify sensor position.

CAUTION: Observe carefully as the machine moves and be prepared to activate emergency stop if necessary.

Sensor Position: Movable frame angle from horizontal _____ °

TEST PROCEDURE 9315-TP-206

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE #2

Page 1 of 2
(Rev 3/24/92)

DATE 1/23/92

SOI FUV
Fuel Converter Upgrades

PROCEDURE NO. 9315-TP-206 REV. 1 TITLE

PROCEDURE SECTION(S) 8.1.5.1 & 8.1.5.2

PROCEDURE CHANGE: (Use reverse side if necessary.)

Acceptance Criteria Interlock logic was changed at the following test operations

Test	A	B	C	MOTOR CRITERIA	ACCEPTANCE CRITERIA
IC	1	0	0		YES (THIS WAS PREVIOUSLY NO)
VLE	1	0	1		NO (THIS WAS PREVIOUSLY YES)

SEE NEXT PAGE

REASON FOR CHANGE: THE ACCEPTANCE CRITERIA LOGIC WAS IN ERROR.

CLASSIFICATION OF CHANGE

MINOR ☒ YES ☐ NO
MAJOR ☒ YES ☐ NO

TAC CHANGE IS REQUIRED TO CORRECT ERROR

REVISION TO ORIGINAL PROCEDURE REQUIRED YES ☐ NO ☒

(TACCN #002)
7/22/92

APPROVALS

TAC Change Notice #2 to TAC, 9315-TAC-206 Rev 3, was written to correct TAC.

RW Hall 1/23/92 (1)(2)
TEST ENGINEER DATE
Joseph A. Galt 1-24-92 (2)
QUALITY ASSURANCE DATE
P. B. Pallas 3/24/92 (2)
PROJECT ENGINEER DATE
P. V. Jach 3/24/92 (2)
TEST DIRECTOR DATE

- Notes: (1) Required for minor changes
(2) Required for major changes

6 of 6

SPECIFICATION 9315-TP-206

REVISION 1

PAGE TPCN #2

Page 12
2 of 2
79K 3/1/92

TPCN #2 continued.

The Note on Page 13 and page 14
was changed. The Logic Formula
was changed to $A + (B \text{ or } \text{not } C)$
INSTEAD OF $A + (B \text{ or } C)$

TEST PROCEDURE 9315-TP-2

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE #3
TPCN#3

DATE 1/23/92

PROCEDURE NO. 9315-TP-206 REV. 1

TITLE Fuel Converter Upender

PROCEDURE SECTION(S) 8.1.5.3

PROCEDURE CHANGE: (Use reverse side if necessary.)

Interlock test logic was changed as follows
A computer to convert a typo - no
operator graphical error. 3/12/92

Test	1	3	Criteria
1.0	1	0	YES (WHS removed NO)
1.1	0	1	YES (" " ")
1.2	1	1	YES (" " ")

REASON FOR CHANGE: REVISED ACCEPTANCE CRITERIA
IS CONSISTENT WITH THE TPC REQUIREMENT
AND THE LOGIC FORMULA ON PAGE 15

CLASSIFICATION OF CHANGE

MINOR YES NO

MAJOR YES NO

REVISION TO ORIGINAL PROCEDURE REQUIRED YES NO

APPROVALS

Rei Zell 1/23/92 (1)(2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

- Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-206

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE #4

DATE 1/23/92

PROCEDURE NO. 9315-TP-206 REV. 1

TITLE Fuel Canister Upgrade

PROCEDURE SECTION(S) 8.1.6.1, 8.1.6.2, 8.1.7.2, 8.1.7.3, 8.1.8.1, 8.1.8.2
the above

PROCEDURE CHANGE: (Use reverse side if necessary.)

8.1.6.1 ADD UNDER ACCEPTANCE CRITERIA "HOLD POINT
serial number is recorded internal to the system
when a fuel canister is removed from its storage cell."

8.1.6.2, 8.1.7.3, 8.1.8.2 Delete: "Using the keyboard, enter a canister
serial number."

8.1.6.1, 8.1.7.2, 8.1.8.1 delete hold point requirement to record canister S/N.
the above

REASON FOR CHANGE: The present control system enters the
canister serial number internally to the accounting system
and updates screen when a fuel canister is removed from its
storage cell. Canister serial #'s are entered when loading the
fuel canister storage racks with empty
canisters.

CLASSIFICATION OF CHANGE

MINOR YES ☒ NO

MAJOR ☒ YES NO

TAC CHANGE IS REQUIRED
ON HOLD POINT REQUIREMENT.
(TACCN #003)

REVISION TO ORIGINAL PROCEDURE REQUIRED YES NO

APPROVALS

TAC Change Notice
#3 was written
to 9315-TAC-206
Rev 3 to reflect
the above change.

<u>Red Zell</u>	<u>1/23/92</u>	(1)(2)
TEST ENGINEER	DATE	
<u>Joseph A. Gant</u>	<u>3/24/92</u>	(2)
QUALITY ASSURANCE	DATE	
<u>J. Maller</u>	<u>3/24/92</u>	(2)
PROJECT ENGINEER	DATE	
<u>R. J. Gant</u>	<u>3/31/92</u>	(2)
TEST DIRECTOR	DATE	

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-206

REVISION 1

APPENDIX D-2

TEMPORARY PROCEDURE CHANGE NOTICE #5
TPCN # 5

DATE 1/23/92

PROCEDURE NO. 9315-TP-206 REV. 1 TITLE Fuel Canister Upender

PROCEDURE SECTION(S) 8.1.6.4

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete the "NOTE" under acceptance criteria that says to enter a "canister full" signal

Explanation: A "Canister Full" signal is not a machine requirement to raise the upender when it is loaded with a canister in the "single step" mode.

REASON FOR CHANGE: ① NOT required to continue with the operation of the upender in the single step mode. ② A "canister full" signal can not be generated without the system operating (or simulating) the well extraction and compression and accounting system.

CLASSIFICATION OF CHANGE

MINOR YES ☒ NO

MAJOR ☒ YES NO

REVISION TO ORIGINAL PROCEDURE REQUIRED YES ☒ NO

REQUIRES A CHANGE IN TAC TO REFLECT THAT A FULL CANISTER IS NOT A CONDITION FOR RAISING

(TACCN#004)

APPROVALS

[Signature] 1/23/92 (1)(2)
TEST ENGINEER DATE
[Signature] 3/24/92 (2)
QUALITY ASSURANCE DATE
[Signature] 3/24/92 (2)
PROJECT ENGINEER DATE
[Signature] 3/31/92 (2)
TEST DIRECTOR DATE

Notes: (1) Required for minor changes
(2) Required for major changes

TEST PROCEDURE 9315-TP-~~206~~ ²⁰⁷ REVISION 2 / PW PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE #6

DATE Feb 14 1992
PROCEDURE NO. 9315-TP-206 REV 1 TITLE Fuel Canister Upender
PROCEDURE SECTION(S) 8.1.2.5

PROCEDURE CHANGE: (Use reverse side if necessary.)

Delete checking to see if the projection of the funnel discharge perimeter is within the opening of the fuel canister.

REASON FOR CHANGE: *Funnel was installed backwards. The part of the test will be performed in the rod compaction test procedure, 9315-TP-207, after the funnel position is corrected. TPC #1 to*

REASON FOR CHANGE: *The rod compaction test procedure is written to incorporate this testing operation into and into TPC #1 SOT-9315-TP-207. **

Classification of
MINOR ☒ YES ☐ NO ☒
MAJOR ☒ YES ☐ NO ☐

REVISION TO ORIGINAL PROCEDURE REQUIRED ☐ YES ☒ NO.

APPROVALS

Robert Zell Feb 14 1992 (1) (2)
TEST ENGINEER DATE

QUALITY ASSURANCE DATE (2)

PROJECT ENGINEER DATE (2)

TEST DIRECTOR DATE (2)

NOTES: (1) Required for minor changes
(2) Required for major changes

* SOT-TP-207 section 8.5.15.7
on page 241 checked operation
of funnel-canister interface.
No. TPCN 001 was necessary.
Project 2/3/92

TEST PROCEDURE

9315-TP-2010

REVISION

1

PAGE 02

TEMPORARY PROCEDURE CHANGE NOTICE ~~7~~ 7

DATE 8/3/92

PROCEDURE NO. 9315-TP-207 REV. 1

TITLE Fuel Converter Upgrade
Grippe and Closure

PROCEDURE SECTION(S) 8.1.5.1.2, 8.1.5.1.3, 8.1.5.3.2, 8.1.6.1 and 8.1.7.8 ^{or Apple and Closure}

PROCEDURE CHANGE: (Use reverse side if necessary.)

For 9.1, 5.1, 2, 8.1, 5.1, 3 and 8.1, 5.1, 3, 2, 1, 1

Change "indirect" to "represent".

Delete "by the carriage drive motor" and make this sentence read - "or prevent it from moving."

Fr 8.1.6.1

Reason for change: In the acceptance criteria change "From" to "Form"
For 8.1.1.7.8 - In 2nd bullet change "Overhead crane is clear" to "Comaster is
unloaded"

REASON FOR CHANGE:

change procedure.

CLASSIFICATION OF CHANGE

MINOR YES ☒ NO ☐

MAJOR YES NO X

REVISION TO ORIGINAL PROCEDURE REQUIRED _____ YES _____ NO

APPROVALS

TEST ENGINEER DATE 8/3/92 (1)(2)

QUALITY ASSURANCE _____ DATE _____ (2)

PROJECT ENGINEER _____ DATE _____ (2)

TEST DIRECTOR _____ DATE _____ (2)

Notes: (1) Required for minor changes
(2) Required for major changes

SPECIFICATION 9315-TP-206

REVISION

PAGE

EXCEPTION/REPAIR LOG #1

DATE 1/22/92

PROCEDURE NO. 9315-TP-206

REV 1

TITLE SOT for Fuel Converter Upgrade

PROCEDURE SECTION(S) 2.4

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE: Three DCN's are still open: DCN 428, DCN 762 and DCN 867. DCN 428 adds shim plates for proper upender elevation at front. DCN 762 attaches shims under pillow blocks with flat cap screws. DCN 867 modifies the pivot pin for remote removal.

TEST CONDUCTOR

RW Field

SOLUTION/CORRECTIVE ACTION: The justification for starting this SOT with the open DCN's is provided as follows:
DCN 428 temporary shim in the front are provided. This SOT will verify the shim dimensions.

DCN 762: The future addition of flat head screws to the pillow block spacer bar shims will not affect the performance of the upender.
DCN 867: Modification to pivot pin for remote removal will not affect upender performance.

TEST CONDUCTOR RW Field

DATE 1/23/92

QUALITY ASSURANCE A. Mulgrew

DATE 7/23/92 (1)

PROJECT ENGINEER P. D. Dallo

DATE 9/1/92 (1)

TEST DIRECTOR P. J. J. J.

DATE 1/23/92 (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Transferred to Open Items Tracking List
Item # 007019 0132
slip

TEST CONDUCTOR Fred G. Coleman

DATE 3/31/92

SPECIFICATION 9315-TP-206

REVISION 1

PAGE 1

EXCEPTION/REPAIR LOG #2

DATE 1/23/92

PROCEDURE NO. 9315-TP-206 REV 1

TITLE Fuel Control Upgrades

PROCEDURE SECTION(S) 8.1.2.1

CLASSIFICATION OF CHANGE: REPAIR REDESIGN TPCN#

PROBLEM AND CAUSE:

Clamps open greater than 9.00 ± 0.100 inch
Clamp open dimension is 9 1/8 and 9 3/16 inch

TEST CONDUCTOR Robert W. Hall

SOLUTION/CORRECTIVE ACTION:

Change test acceptance criteria
to clamps open greater than or
equal to 9.00 inches * See Note Below | prg
2/13/92

TEST CONDUCTOR RW Hall DATE 1/23/92

QUALITY ASSURANCE DATE ()

PROJECT ENGINEER DATE ()

TEST DIRECTOR DATE ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Director
TEST CONDUCTOR Peter V. Juhl DATE 2/13/92

* The "as found" condition is conservative
and is acceptable, no further action to
revise the TAC will be taken. | prg
2/13/92

EXCEPTION/REPAIR LOG #3

DATE 1/28/92

PROCEDURE NO. 9315-TP-207 REV 1

TITLE Fuel Canister Upender

PROCEDURE SECTION(S) 8.1.7.5

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN# ☒

PROBLEM AND CAUSE: The Rod Hopper Discharge Funnel is installed backwards. Therefore the projection of the funnel discharge perimeter into the open end of the fuel canister is difficult to appraise. Also, the funnel may not work properly.

TEST CONDUCTOR Robert W. Zell 1/28/92

SOLUTION/CORRECTIVE ACTION:

Repair by switching 180° the location of guide pins and threaded holes in the hopper frame supporting the discharge Funnel. Then Retest to determine projection of Funnel discharge perimeter into open end of fuel canister.

TEST CONDUCTOR Robert W. Zell DATE 1/28/92

QUALITY ASSURANCE _____ DATE _____ (1)

PROJECT ENGINEER _____ DATE _____ (1)

TEST DIRECTOR _____ DATE _____ (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

SOT-TP-207 Section 8.5.13.7 on page 241 checked operation of the funnel-canister interface. A TPCN to 207 was not required.

TEST CONDUCTOR Robert W. Zell DATE 8/3/92

A TPCN #6 will be written to transfer this testing to the ROD COMPARISON SOT, 9315-TP-207, and TPCN #6 TO this test procedure will be written to delete this test from this procedure.

EXCEPTION/REPAIR LOG # 4

DATE 1/28/92

PROCEDURE NO. 9315-TP-206 REV 1

TITLE Fuel Canister Upender

PROCEDURE SECTION(S) 8.1.7.5

CLASSIFICATION OF CHANGE: REPAIR REDESIGN TPCN# ✓ 6007

~~TAC CHANGE NOTICE~~ ✓ 7/21/92

PROBLEM AND CAUSE:

PROBLEM: DO NOT MEET TEST ACCEPTANCE CRITERIA, "SIGNAL IS GENERATED THAT EMPTY CANISTER IS IN PLACE"

CAUSE: CONTROL SYSTEM SOFTWARE LOGIC DOES NOT PROVIDE FOR SUCH A MESSAGE OR SIGNAL TO OCCUR

TEST CONDUCTOR Robert W. Zell

SOLUTION/CORRECTIVE ACTION:

(TACCN # 001) 7/21/92
CHANGE TEST PROCEDURE AND TAC TO DELETE FROM THE ACCEPTANCE CRITERIA THE REQUIREMENT, ~~THAT~~ "Signal is generated ~~when~~ ^{that} an empty canister is in place" after the upender has lowered the canister to the horizontal position.

TEST CONDUCTOR Robert W. Zell DATE 1/28/92

QUALITY ASSURANCE Joseph A. Ciferri DATE 3/24/92 (1)

PROJECT ENGINEER R. J. Dello DATE 3/24/92 (1)

TEST DIRECTOR P. J. Guld DATE 8/13/92 (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

TEST CONDUCTOR Peter V. Guld DATE 8/13/92

SPECIFICATION 9315-TP-206

REVISION 1

PAGE 1

EXCEPTION/REPAIR LOG #5

DATE 1/28/92

PROCEDURE NO. 9315-TP-206 REV 1 TITLE Fuel Canister Upender

PROCEDURE SECTION(S) 8.1.7.7

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

Problem: DOE Lid does not properly engage with the DOE fuel canister

Cause: Lid slides inside canister and thus reduces tab engagement area with slot

TEST CONDUCTOR RWHell

SOLUTION/CORRECTIVE ACTION:

DOE TO RESOLVE AND FIX PROBLEM
AFTER THE LID IS FIXED, RETEST LID TO CANISTER ENGAGEMENT, ~~the~~ grapple to lid attachment, and then followed by canister insertion and removal from upender. Repeat step 8.1.7.7, 8.1.7.8 and 8.1.7.9

TEST CONDUCTOR RWHell DATE 1/28/92

QUALITY ASSURANCE DATE (1)

PROJECT ENGINEER J. M. Mallo DATE 3/24/92 (1)

TEST DIRECTOR DATE (1)

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE

Retest being tracked on OITL Item # 0135. Note Sections 8.1.7.8 & 8.1.7.9 do not require to be retested. They were tested initially and met the acceptance criteria.

TEST CONDUCTOR Frank D. Ball DATE 8/10/92

8.1.7.6 Receive "Canister Full" signal.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criteria

- Canister is rotated to the vertical position in less than 5 minutes.
- "Hold Point" is generated to verify that manual canister closure and crane hook attachment have been completed.

All criteria met. ☐ Yes ☐ No

Test Conductor _____ Date _____

QA _____ Date _____

8.1.7.7 Manually attach the closure lid to the canister. Manually engage the lid with the canister grapple.

Acceptance Criterion

- Lid successfully interfaces (mechanically) with the canister.
- Grapple successfully interfaces (mechanically) with the closure lid.

Test Conductor E. J. Dello Date 8/10/92

QA H. M. L. Jones Date 8/10/92

8.1.7.8 Press "Continue."

Acceptance Criteria

- Clamps open.
- "Hold Point" generated to verify that the overhead crane is clear.

Test Conductor _____ Date _____

QA _____ Date _____

EXCEPTION/REPAIR LOG #6

DATE 1/29/92

PROCEDURE NO. 9315-TP-206 REV 1 TITLE Fuel Canister Upends

PROCEDURE SECTION(S) 8.1.6.1, 8.1.6.3, 8.1.6.5, 8.1.8.1, 8.1.8.3, 8.1.8.5
8.1.9.3

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

Problem: Camera 12 is not functional and is listed ^{2x still} as a test acceptance criteria to view the upender.

Cause: Camera is broken (reason is unknown at this time)

TEST CONDUCTOR R. D. Felt

SOLUTION/CORRECTIVE ACTION:

Fix camera and retest to show it views the upender acceptably

TEST CONDUCTOR R. D. Felt DATE 1/29/92

QUALITY ASSURANCE DATE ()

PROJECT ENGINEER DATE ()

TEST DIRECTOR DATE ()

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Retest being tracked by OITL # 233

Section 8.1.9 retested see attached sheets

TEST CONDUCTOR P. M. Dullo DATE 2/10/92

See page 2 of 2
P. M. Dullo
2/31/92

TEST PROCEDURE

9315-TP-206

REVISION

1

PAGE 2 of 2

EXCEPTION/REPAIR LOG

DATE 8/31/92

LOG #6

PROCEDURE NO. 9315-TP-206 REV. 1

TITLE Fuel Converter Upender

PROCEDURE SECTION(S) See page 1 of 2

CLASSIFICATION OF CHANGE: REPAIR ☒ REDESIGN ☐ TPCN#

PROBLEM AND CAUSE:

See Page 1 of 2

TEST CONDUCTOR

SOLUTION/CORRECTIVE ACTION: Section 8.1.9 was completed, verifying that both cameras #1 and #12 are functioning and a CCTV assessment form was completed (see attachments). All other steps (8.1.6.1, 8.1.6.3, 8.1.6.5, 8.1.8.1, 8.1.8.3, and 8.1.8.5) test that the system calls the appropriate cameras and that these cameras can be accessed. This criteria was satisfactory completed on 1/28/92 and 1/29/92 even though camera #12 was out of service and all acceptance criteria was satisfied. Therefore since section 8.1.9 verifies the proper operation of the cameras and

TEST CONDUCTOR J. D. Galle

DATE 8/31/92

the other sections verified the

QUALITY ASSURANCE

DATE

(1) auto sequence and proper camera

PROJECT ENGINEER

DATE

(1) call ups no additional

TEST DIRECTOR

DATE

(1) testing is required

Notes: (1) Required for redesign

CORRECTIVE ACTION: COMPLETE Satisfactory completion of Section 8.1.9 verifies the proper operation of cameras #1 and #12. No additional testing is required

TEST CONDUCTOR J. D. Galle

DATE 8/31/92

8.1.8.6 Press "Continue" to open the clamps.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Attach the excell crane to the test load.

Acceptance Criterion

- Clamps open

Test Conductor _____ Date _____

QA _____ Date _____

8.1.8.7 Remove the test load from the upender.

*** TAKE PHOTOGRAPHS AND RECORD INFORMATION IN LOG ***

Acceptance Criterion

- Load cell shows absence of test weight

Test Conductor _____ Date _____

QA _____ Date _____

8.1.8.8 Restore the control system to normal by removing all temporary changes made to the Data Register.

Test Conductor _____ Date _____

QA _____ Date _____

8.1.8.9 Part 8.1.8 is satisfactorily completed.

Test Conductor _____ Date _____

8.1.9 Servo Drive Fault Test

WARNING

Stay clear of the upender system while in operation

8.1.9.1 Place the upender system in the SINGLE mode and initiate operations to lower movable frame using the Carriage Drive Motor (M-116A)

- 8.1.9.2 Temporarily force the Data Register to indicate a torque fault with the carriage drive motor (M-116A).

Acceptance Criteria

- Motor stops when fault condition is implemented.
- Alarm system is activated.
- Alarm is silenced when acknowledged by operator.
- Control system displays fault condition on control screen.
- A report is printed defining the fault condition when commanded by the operator.

Test Conductor

F. M. MalloDate 8/10/92

QA

A. MulgrewDate 8/10/92

- 8.1.9.3 Verify cameras No. 11 and No. 12 are activated and view the movable frame system when the "Call Camera" button is touched

Acceptance Criteria

- Video images from cameras No. 11 and NO. 12 are displayed on monitors when "Call Camera" is touched on control screen.
- Camera No. 11 and No. 12 can be positioned to provide an unobstructed view of the movable frame.

Test Conductor

F. M. MalloDate 8/10/92

QA

A. MulgrewDate 8/10/92

- 8.1.9.4 Correct fault condition and verify the carriage drive motor (M-116A) can be moved in the SINGLE mode.

Acceptance Criterion

- The system can be recovered from fault condition and SINGLE mode operations continued.

Test Conductor

F. M. MalloDate 8/10/92

QA

A. MulgrewDate 8/10/92

- 8.1.9.5 Part 8.1.9 is satisfactorily completed.

Test Conductor

F. M. MalloDate 8/10/92

APPENDIX E
CCTV ASSESSMENT FORM

CCTV Assessment

1. Operation: (describe type of operation here)

viewing of Fuel Canister Upender due to a fault condition

2. Camera Assessment

Camera No. 11 & 12

Evaluation

(describe the view that the camera is capable of providing)

view ^{from} Camera 11 was restricted (~50% of the FOCU) due to the NFBC canisters in storage. Camera 12 has a very clear view of the full FCU except for the drive motor. This motor is restricted by the support frame. No change would be possible to improve overall view.

3. Recommendations: (Recommend cameras that provide the best view of the system)

provide a portable camera for the RM-10A which can be used to view under the FCU frame as required.

Test Conductor

P. D. Dallas

Date

8/10/92

QA

M. M. M. M. M.

Date

8/10/92

APPENDIX F

TRAINING SIGN-OFF SHEET

RW Zell - Test Conductor

NAME (Print)

R. W. Fell
Guy M-F. Featherman

Gordon J. Cole

KEITH FULLMER

JOSEPH A YOST

SIGNATURE

R. W. Fell
~~Guy M-F. Featherman~~
Gordon J. Cole
Keith Fullmer
Joseph A. Yost 1/23/92

**DATE
FILMED**

11 / 3 / 93

END