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* NAME	MAIL ADDR	This document provides the general instructions for performing acceptance test number eleven as indicated in the Acceptance Test Index (TI-022-130-003). Also indicated are the plant conditions and special equipment required to conduct the test. The acceptance criteria for each portion of the test are specified.				
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TEST NUMBER 11SODIUM SYSTEM FILLING, HEATUP, PRESSURIZATION AND DRAIN TEST1.0 Purpose

Test Number 11 is an integral test of the sodium systems with regard to their performance in achieving the required status for sodium/water testing. The water system will be preheated for this test but will not contain water. The test will simulate the normal approach to test conditions. It will include the normal pre-sodium fill checks to ensure appropriate system conditions, the system preheat operation, the sodium-filling operation including freeze section activation, heatup to test conditions including the establishment of a temperature gradient in the AMSG, the system pressurization using the liquid expansion technique, and quick draining through the large drain line. The performance characteristics of the effected systems will be compared to the requirements of this specification to determine acceptability.

2.0 Test Requirements

Perform all normal system checks to verify the system readiness for sodium fill. These should include control system activation, valve condition checks, sodium system pressure boundary checks and gas inventory checks as indicated in the Operations Manual (TI-022-130-015).

Starting with the sodium systems inert (<2% oxygen) and filled with nitrogen to 2 psig, begin the normal preheat operation to establish a temperature level in all systems of $350 \pm 50^{\circ}\text{F}$. The operation shall be done in accordance with the requirements of the Operations Manual.

Verify that the freeze stems on valves V222B, V223A, V222A, and V130A are sufficiently cold ($<150^{\circ}\text{F}$) to promote sodium freezing.

With the secondary sodium system which includes the AI-MSG, 10-inch piping, 18-inch piping, and some smaller interfacing piping, and fill system connected through lines 261, 265, 239, and 110, vent the excess nitrogen pressure caused by preheating to 2 psig. Then, with V265A and V222A closed, and V222B and V223A open, pressurize the DT to 4 psig to drive sodium into lines 224, 221, 222, and 223. Note: a blind flange shall be in place at the decanter connection on line 223. When sodium flow stops as indicated on flowmeter F222, wait approximately 10 minutes, then open V222A to continue filling lines 132, 109, and 130. V130A must be closed during the activities to this point. Monitor the fill flowmeter and continue filling under these conditions until 15 ± 5 cubic feet have been loaded. At that point, all freeze stems should be set. Close V222A and drain the sodium from the secondary system through V130A. Then begin the normal filling procedure as specified in the Operations Manual. This normal procedure shall begin with evacuation of the secondary sodium system to 1 mm Hg.

With the freeze sections of lines 110 and 111 frozen and the fill line open to the drain tank which is at 15 psig, following the filling operation, begin the heatup of the secondary sodium system to $750 \pm 20^{\circ}\text{F}$. Simultaneously heat the water system to $600 \pm 20^{\circ}\text{F}$. This heating shall be done in accordance with the Operations Manual and in full observance of the limitations therein. After reaching the isothermal condition indicated above, proceed to generate a temperature gradient in the MSG of 900°F at the top, and 600°F at the bottom. The acceptable deviations from a linear gradient are given in Section 5. Simultaneous with this gradient establishment, the drain line (130) should be permitted to cool to 600°F . Hold the fully developed temperature gradient for at least one hour.

Proceed to heat the secondary sodium system to a 900°F isothermal condition ($900 \pm 20^{\circ}\text{F}$) except the 130 line which will be used for

system pressurization. It should be maintained at 600°F. Monitor all freeze sections (except line 132 which shall remain unfrozen) for acceptable temperature levels, i.e., less than 150°F.

After the 900°F condition has been reached, increase the DT pressure to 40 psig which will simultaneously pressurize the secondary sodium to 40 psig plus hydrostatic head variations. Close the fill valve, V222A, and conduct the system pressurization operation. Before the temperature of line 130 is advanced to increase the pressure above the 40 psig level, monitor the secondary system pressure for one hour to determine the magnitude of pressure swings as a result of the system preheat control action. The acceptable pressure swings are indicated in Section 5. Proceed to increase the line 130 temperature by 50°F. The acceptable change in pressure per degree F change in line 130 temperature is given in Section 5. Continue to increase the line 130 temperature until a nominal pressure level of 100 psig is achieved. Continually monitor the system pressure on PI 509 (control panel display on ST-1) for one hour. If the pressure exceeds 175 psig due to heater control action, crack V222A to relieve the pressure back to the DT.

Depressurize the secondary system by opening V222A and venting the DT to 10 ± 1 psig. Open lines 261, 265, and 239 to permit pressure communication between the DT and the line 110 freeze section. Close V261B and further vent the DT to 5 psig. With V222A full open, and the NS supply set at 10 psig and in communication with line 110, begin to melt the sodium in the line 110 and line 111 freeze sections. Monitor both the freeze section temperature, TE 110A, and the sodium fill flowmeter F222 for indication of freeze section 110 being open. Also monitor TE111C on temperature controller 28 for indication of freeze section 111 being cleared ($>350^\circ\text{F}$). When both freeze sections are cleared and 5 ± 2 cubic feet of sodium has drained back to the drain tank, close V222A, open V261B to allow pressure communication between the DT and the top of the MSG. Set the NS supply pressure at 5 psig and open V261A. The system is now in a condition to be quick drained.

With the RPT and line 131 preheated to $350 \pm 50^{\circ}\text{F}$ and the drain valve preheated to $850 \pm 50^{\circ}\text{F}$, open V130A completely. Monitor the pressure gage temporarily attached to the RPT- O_2/H_2 sample line at the sample manifold. The indication of the draining being completed will be a sudden increase in pressure of about 1 psi. Record the time of valve V130A opening and the time of draining completion. The acceptable draining time is shown in Section 5.

Terminate the heating throughout the system (except the DT) and start the fan on the RPT cooling system. Observe all system cooldown requirements specified in the Operations Manual. Depressurize the sodium system to approximately 2 psig and maintain in an inert condition.

Following complete cooldown to ambient temperature, remove the flanges from inspection ports N2 and N8 on lines 102 and 106, respectively. Inspect these lines for residual sodium indicating incomplete draining. The acceptable residue is given in Section 5.

3.0 Plant Conditions

The complete system shall be operational for this test including the data acquisition systems. The test system shall have successfully passed acceptance tests 1 through 10. It shall be in an inert condition ($<2\% \text{O}_2$) at ambient pressure. The stack shall be inert ($<2\% \text{O}_2$) with the HSC and V141A closed and the stack rupture disc bypass valve shall be closed to maintain inert conditions in the system. The stack rupture disc shall have a 200 psid rating for this test.

The "sodium in system" switch shall be in the "YES" condition, and the "water in system" switch shall be in the "off" position. The water system shall be completely void of water and shall be backfilled with nitrogen ($<2\% \text{O}_2$) or evacuated.

4.0 Special Equipment

The special equipment required for this test is listed below:

1. Portable temperature measuring device with a range of 0 to 500°F.
2. Pressure gage with a range of 0 to 5 psig suitable for attachment to 1/2 NPT connection.

5.0 Acceptance Criteria

The general acceptance criteria for the various normal operations required in this test shall be their implementation in accordance with the requirements of the Operations Manual and in the time frames indicated in Table 5.1.

TABLE 5.1

Acceptable Time Frames for Normal Operations

OPERATION	TIME-HOURS
1. Preheat to 350°F	<12
2. Evacuate secondary sodium system	<8
3. Sodium Filling	<6
4. Establish Freeze Sections	<3
5. Heatup to 750°F	<26
6. Establish MSG Gradient (600 to 900°F)	<12
7. Heatup to 900°F from 750°F	<12
8. System Pressurization	<4
9. Melt Sodium in Freeze Sections	<4
10. System Draining	<1/60

The acceptable deviation from a linear temperature gradient in the MSG sodium shall be less than $\pm 10^{\circ}\text{F}$ over the vertical portion.

With the system in the "solid" condition, the pressure swings due to preheat control shall be less than ± 25 psi.

The system pressure change per degree of temperature rise in line 130 shall be 0.4 ± 0.2 psi.

The draining of the system shall be completed in less than one minute.

The acceptable sodium thickness remaining in the bottom of the 18-inch headers following the draining operation shall be less than 1/2 inch.

6.0 Data Required

For all operations involved in this test, a complete log shall be kept which indicates the time at which each individual operation was initiated and terminated along with any difficulties encountered during the operations.

To determine the adequacy of the MSG temperature gradient, all preheat thermocouples on the MSG shall be recorded either on the data logger or the multipoint recorder. The control thermocouple reading shall be manually recorded every five minutes during the one-hour gradient stability test.

Record the sodium system pressure from PI509 at one minute intervals during the one-hour pressure stability test. This pressure may be continuously recorded on a recording device as an alternative.

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