UNCLASSIFIED

OAK RIDGE NATIONAL LABORATORY
 Operated By
 UNION CARBIDE NUCLEAR COMPANY

POST OFFICE BOX P
 OAK RIDGE, TENNESSEE

EXTERNAL TRANSMITTAL AUTHORIZED

ORNL
CENTRAL FILES NUMBER

56-4-65

DATE: April 10, 1956
 SUBJECT: Blanket Storage Tanks and Reflux Condenser
 Items 49a,b and 39
 TO: R. Van Winkle
 FROM: J. L. Gory

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission to the extent that such employee or contractor prepares, handles or distributes, or provides access to, any information pursuant to his employment or contract with the Commission.

Photostat Price \$ 3.30Microfilm Price \$ 2.40

Available from the
 Office of Technical Services
 Department of Commerce
 Washington 25, D. C.

UNCLASSIFIED

444 001

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

BLANKET STORAGE TANKS AND REFLUX CONDENSER

Items 49a,b and 39

HRT Test No. IV A

1.0 Objective

1.1 The blanket storage tanks serve to store solution when it is not being used in the blanket high- and low-pressure systems. By means of evaporators on the storage tanks, the liquid in the tanks can be pressurized and, with proper valving, transferred to several points. The storage tanks are equipped with a reflux condenser to condense steam produced by fission product heat when storing UO_2SO_4 blanket solution following operation at power for extended periods of time. The objectives of this test will be to (a) measure the volume of the blanket storage tanks, (b) check the operation of the liquid level indicator and make a calibration of liquid volume vs liquid level indicator reading, (c) note the time required to get up sufficient pressure in the storage tanks to transfer solution to the dump tanks at approximately 5 gpm, (d) determine for several different blanket storage tank pressures flows from the blanket storage tanks to the storage tank sampler, blanket dump tanks, and to the fuel storage tanks, and (e) check the operability and heat removal capacity of the reflux condenser.

2.0 General Description

2.1 The storage tanks' liquid level indicator will be checked and the tanks calibrated while the volume of the tanks is being measured. The volume of the tanks will be measured by filling the tanks with a weighed amount of demineralized water (approximately 700 gal). While filling the tanks, liquid level readings vs amount of water added will be recorded at different intervals. To add water to the blanket storage tanks it will be necessary to remove HCV-438 and attach a 1/2-in. side entry flange to the lower 1/2-in. valve flange (see Fig. 1 for a sketch of the fill apparatus).

After filling and calibrating the storage tanks they will be too full to operate the evaporators, so it will be necessary to remove some of the water to get the level in the tanks down to an operating level of approximately 60 to 70 percent of capacity. This can be done by removing HCV-732 in the reflux condenser vent line and putting pressure on the storage tanks through the vent line. If it is desired the evaporators can be turned on slowly and steam used to force the water out but this may cause considerable jarring and vibration of the equipment. The water that is taken out can be drained to the cell sump and jetted to the waste pond.

After draining approximately 30 to 40 percent of the water from the storage tanks the pressure in the tanks can be varied and flow rates to the storage tank sampler, blanket dump tanks, and fuel storage tanks can be measured as a function of pressure. The pressure in the storage tanks will be varied by closing HCV-732 in the reflux condenser vent

line and shutting off the condenser cooling-water flow while operating the evaporators. The time required to get up sufficient pressures to make the above transfers will be noted.

The heat removal capacity of the reflux condenser will be determined using the cooling-water flow rate and inlet and outlet temperatures. The cooling-water flow rate has been calibrated at 23.5 gpm with V-437 open wide, and thermocouples have been installed in the cooling water inlet and outlet lines.

3.0 Apparatus Required

3.1 HRT Instruments and Valves

- A. PI-452
- B. Blanket storage tank float level indicator
- C. TE-478, 470, 489, and 766, 881, and 881.1
- D. HCV-438 and controls
- E. HCV-439 and controls
- F. HCV-441 and controls
- G. PCV-252 installed and closed
- H. HCV-437 and controls
- I. HV-443 and storage tank sampler
- J. HCV-440 and controls
- K. HCV-936 and controls
- L. HCV-341 and controls
- M. HCV-339 and controls
- N. HCV-338 and controls
- O. FI-822 and controls
- P. PI-855a and 855b
- Q. HCV-732 and controls

3.2 Equipment Required

- A. One 55-gal stainless-steel drum equipped with a 1/2-in. drain line and valve.
- B. One scale (600 lb capacity)
- C. Approximately 100 ft of 5/8-in tygon tubing

4.0 Test Procedure

- 4.1 Measuring the volume and calibrating the blanket storage tanks.
Note: Be sure that all equipment used to add filtered potable water to the storage tanks is flushed and clean.

- A. Assemble fill apparatus as shown in Fig. 1.
- B. Fill and weigh the 55-gal stainless-steel drum.
- C. Determine the liquid level heel (the weight of water added before any response is seen on the liquid level instrument) and record on data sheet.
- D. Begin adding water in approximately 20-gal (167 lb) increments until a total of 100 gal (833 lb) has been added. Then increase the increments from 20 to 50 gal (416 lb) until a total of approximately 600 gal (5000 lb) has been added.

Reduce the increments again to 20 gal until the tanks are full (approximately 6100 lb). For each addition to the tanks, record on the data sheet the weight of water added and the corresponding liquid level. Observe and record water temperature.

- E. Empty approximately 30 to 40% of the water in the storage tanks to the cell drain and jet to the waste pond. This can be done either of two ways, (1) remove HCV-732 and apply pressure to the water through the reflux condenser vent line, using a 1/2-in. side entry flange for the air line connection, or (2) close the vent valve HCV-732, slowly start the storage tank evaporators and force the water out with steam pressure.
- F. Make the following valve check to insure that the reflux condenser vent line is open to the stack, then begin the flow rate tests.
Open HCV-732 (set air supply to 15 lb).

4.2 Flow Rate Tests

- A. Blanket storage tanks to the blanket dump tanks (with approximately 5000 lb H₂O in storage tanks initially)

- a. Make the following valve check:

Open

HCV-438 (set supply air to 0 lb).

HCV-439 (set supply air to 0 lb).

Close

HCV-441 (set air supply to 15 lb)

HCV-437 (set air supply to 0 lb).

PCV-252 (check that full air is on HIC-3500).

Plug line 237 in the sample station with a rubber stopper.

HCV-732 (set supply air to 0 lb).

Set recombiner condenser cooling-water flow at approximately 10 gpm.

- b. Turn the evaporators on (open V-439A and B in the steam supply lines) and begin heating up the water in the storage tanks using approximately 30 psig heating steam pressure. Continue heating until the internal pressure in the tanks (as indicated by PI-452) is 5 psig. Record on the data sheet the time required to heat and bring the storage tanks up to this pressure. Adjust heating steam pressure to maintain 5 psig in the storage tank.
- c. When the pressure is steady determine the flow rate to the dump tanks by recording on the data sheet the increase in dump tank weight for a 10-min. period.

- d. Increase the storage tanks' pressure to 10 psig by increasing heating steam pressure, and repeat Step c.
- e. Repeat Step d. at 15 psig.
- f. Repeat Step d. at 20 psig.
- g. Repeat Step d. at 30 psig.
- h. When the storage tank is empty, its pressure will drop quickly. Then close HCV-438.
- i. Drain and weigh the "heel" remaining in the storage tank through the liquid level line. Record amount recovered.

B. Blanket storage tanks to the fuel storage tanks.

- a. Make the following valve check:

Open

HCV-438 (set air supply to 0 lb).
 HCV-441 (set air supply to 0 lb).
 HCV-936 (set air supply to 15 lb).
 HCV-341 (set air supply to 0 lb).
 HCV-338 (set air supply to 0 lb).

Close

HCV-339 (set air supply to 15 lb).
 HV-343 (in fuel storage tank sample station).
 HV-443 (in blanket storage tank sample station).
 HCV-734 (set air supply to 0 lb).
 HCV-439 (set air supply to 15 lb).
 HCV-440 (set air supply to 0 lb).

- b. Close the reflux condenser vent valve HCV-732, control evaporator steam pressure at approximately 30 psig, open the evaporator steam supply, turn off the condenser cooling water flow and heat until the pressure in the storage tanks is 5 psig. Adjust heating steam pressure to hold the dump tanks at this pressure.
- c. Repeat Steps c. through i. of Section A., above.

C. Blanket storage tanks to the storage tank sampler.

- a. Make the following valve check:

Open

HCV-438 (set air supply to 0 lb).
 HV-443
 HCV-734 (set air supply to 15 lb).

Close

HCV-439 (set air supply to 15 lb).

- b. Remove HCV-441, blank off the bottom valve flange, and attach a side entry flange to the top valve flange. A piece of tygon tubing running from the side entry flange to the floor drain will be used to drain the blanket transfer tank and measure the flow rate through the sampler.
- c. Close the reflux condenser vent valve HCV-732, open the steam supply to the evaporators, turn off the reflux condenser cooling water and heat until the storage tank pressure is just sufficient to start flow through the sampler. Then adjust the heating steam pressure to hold the storage tanks at this pressure.
- d. When the pressure is steady determine the flow rate through the sampler by measuring the flow from the blanket transfer tank drain for two one-minute intervals. Record results on the data sheet.
- e. Increase the storage tank pressure 10 psi by increasing the heating steam pressure, then repeat step d.
- f. Repeat Step e.
- g. Repeat Step e.
- h. Repeat Step e.
- i. Turn on full reflux condenser cooling water, cut back on the evaporator steam supply, and open vent valve HCV-732.

4.3 Heat removal capacity of the reflux condenser.

- A. Close HCV-438 and open HCV-732.
- B. With full cooling water (23.5 gpm with V-437 open wide) on the reflux condenser and 90 psig steam on the evaporators, let the system come to equilibrium. If at these conditions the system tends to pressurize (any pressure above atmospheric) cut back on the steam to the evaporators until the storage tank pressure, as indicated by PI-452, can be maintained at atmospheric pressure.
- C. After a short period of steady operation at the above conditions, begin taking the following readings at 15-min intervals for one-half hour: reflux condenser cooling water inlet and outlet temperatures, cooling-water flow rate (23.5 gpm with V-437A open wide and 60 psig header pressure), and evaporator steam pressure.
- D. Shut off the steam and cooling water. Empty the storage tanks to the drain.

J. L. Gory
J. L. Gory

Fig. 1 - Fill Apparatus

Test No. IVA Flowchart

DATA SHEET
HRT Test No. IV A
Items 49a,b and 39

Date _____

Storage Tank Calibration and Volume Measurement

1.0 Instrument Heel _____ lbs. water

2.0

lbs. of Water Added	Liquid Level Reading

3.0 Time required to heat up and begin to pressurize water in the storage tanks.

Volume of water in storage tanks _____

Time steam turned on _____

Time storage tanks began to pressurize _____

Flow Rate Tests:

1.0 Blanket Storage Tanks to Blanket Dump Tanks

Storage Tank Press. (PI-452)	Begin Liquid Level	Time	Begin Liquid Level	Time

2.0 Blanket Storage Tanks to Fuel Storage Tanks

Storage Tank Press. (PI-452)	Begin Liquid Level	Time	Begin Liquid Level	Time

3.0 Blanket Storage Tank to the Storage Tank Sampler

Vol. Collected (1)	Collection Time	Storage Tank Press. (PI-452)

4.0 Reflux Condenser Heat Removal Capacity

Time	Condenser Cooling Water		Steam	
	Flow	Temp. Inlet TE-881.1	Temp. Outlet TE-881	Pressure PI-855 A and B