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Westinghouse Astronuclear Laboratory

NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING
HELD WITH SNPO AT WANL ON APRIL 28, 1966

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NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING
HELD WITH SNPO AT WANL ON APRIL 28, 1966

(Title Unclassified)

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SPECIAL DETERMINATION	Class. <u>U</u>	Date <u>4-22-82</u>
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GROUP-1
Excluded From Automatic Downgrading
and Declassification

Classification cancelled (or changed to)
by authority of DOC
by H. J. C. TIC, date SEP 10 1973

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Notes of Monthly Development Test Program Review Meeting
Held With SNPO at WANL on April 28, 1966

Attendees:

N. J. Bifano	WANL	A. I. Miller	WANL
E. A. DeZubay	WANL	R. L. Ramp	WANL
H. J. Fix	WANL	W. G. Roman	WANL
R. Gagne	SNPO-C	W. J. Rowan	WANL
H. Hoffman	SNPO-C	J. J. Schreiber	WANL
G. Kalvin	SNPO-C	D. C. Thompson	WANL
V. G. Kelly	WANL	E. A. Watjen	WANL
J. S. Olinger	WANL	R. C. Wilke	SNPO-C
G. F. Mader	AGC		

The Monthly Development Test Program Review Meeting was held on April 28, 1966 at WANL.

Lists of the tests performed and planned by the Engineering Mechanics and Fluid Flow Laboratories were distributed to those in attendance. These schedules are shown in Tables I and II.

The individual tests were discussed in the order as shown in the tables.

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TABLE I

Engineering Mechanics Test Schedule

PERFORMED THIS PERIOD	PLANNED NEXT PERIOD
Tests for NRX-A5 and XE EML-55 XECF Resonant Survey EML-76 Control Drum Scram Spring Tests Completed Test Fixture Fabrication EML-94 Radial Expansion Tests Completed Testing	Continue Preliminary Studies Initiate Testing
Tests for NRX-A6 EML-69 Support Block Testing Corrosion Cup Load Tests Interlock Shear Tests EML-70 Blockless Cluster Testing Braze Key Testing EML-76 Retaining Latch Tests Completed Testing EML-78 Seal Testing Simulated Forward Seal Tests EML-86 Lateral Support System Tests Completed Test Fixture Fabrication	Room Temperature Crack Initiation Tests Elevated Temperature Creep Tests Tie Rod Collar Tests Bayonet and Center Element Tests Cap Seal Tests and Radial Seal Tests Continue Test Hardware Procurement
General Development EML-60 Fuel Element Porosity Tests EML-61 Graphite Tie Rod Testing Continue Fabrication EML-69 Support Block Crack Tests Testing of Blocks EML-82 Be Reflector Testing Thermal Shock Testing Notched Specimen Tests	Conduct Pinhole Effect Test and conduct Radial Inflow Test Initiate Testing Testing of Blocks with Large Fillet Radius Continue Thermal Shock Testing Strain Cycling Testing

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TABLE II
Fluid Flow Test Schedule

PERFORMED THIS PERIOD

PLANNED NEXT PERIOD

Tests for NRX-A5

HHT-4 Skirtless Block - Seven Minutes
HHT-7 New Chuck and Stainless Steel Jacket
FFL-27 Purge Boot Seal Completed

Forty (40) Minute Test
Test Model
No Activity

Test for XE-1

HHT-4 Exit Gas Thermocouple - 30 Minutes
Exit Gas Thermocouple - Failed
Exit Gas Thermocouple - In Second Cycle

Continue for Another Cycle

Tests for NRX-A6

HHT-2 Qualification - Life Tests
HHT-4 Skirtless Block
FFL-8 Drum Bearing Impedance Tests Completed on
Alternate Design
FFL-29 NRX-A6 Single Seal - Fabrication Continues
FFL-31 Baffle Effectiveness - Tested With Hydrogen
and Helium
FFL-32 Capsule Impedance Tests - Completed on Small
Holes

Continue Life Tests
Additional 20 for NRX-A6

No Activity
Initiate Testing

Complete Testing

Conduct Flow Test on Modified Models

Tests for NERVA

HHT-2 High Void Fraction Elements Tested (Unfueled)
FFL-32 Capsule Impedance Model Design Completed

Test First Fueled Elements
Fabricate and Initiate Test

TABLE II (CONTINUED)

PERFORMED THIS PERIOD	PLANNED NEXT PERIOD
General Development	
HHT-2 Pinholing Test	Parametric Testing Continuing
HHT-6 Isothermal Gap Test at Two Pressure Levels	Complete Pressure Effect Test
HHT-7 Continue Hardware Procurement on Gas Injection Design	
Special Test - Beryllium Chill-Down Loop Assembled	Initiate Testing
Facilities	
Large Site Vaporizer - Two Runs Completed for Qualification	Complete Qualification
Thermocouple Furnace Tested at 4500°R with Helium	Conduct Hydrogen Test

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TESTS FOR NRX-A5 AND XE

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EML-76   Reactor Hardware Static and Dynamic Tests

Additional testing is being planned for the XE-1 control drum scram spring. This new series of tests will incorporate the "soft" stop feature that occurs when the control drum is scrambled during reactor operation. There is a requirement for this type design to protect the supporting hardware and control drum from damage during a scram operation.

EML-94   Buffer Periphery Testing

Tests runs were completed using the partial length core to study the gap effects from thermal expansion in a composite periphery. In the NRX-A5 reactor two sectors of the existing core periphery configuration have been replaced by two sectors of the buffer periphery design. Therefore, it was necessary to perform tests to determine any gap effects at the joints of the different configurations from thermal expansion of the core. Figure 1 shows the partial length core in the test rig.

Thermal expansion of the periphery in two adjacent sectors of the composite designs was simulated by using 1.5 and 3.0 mil shims. The smaller size shim was used to simulate a thermal condition at station 35 during a scram operation. Although no gap paths were formed, measurable gaps were apparent between a few of the filler strips and elements.

The three mil shim was used in an off-design effort to force a gap path to be formed so that a more detailed analysis could be made of core stability. In this case, some of the filler strips were slightly cocked, forming some gaps between seal segments and filler strips.

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FIGURE 1
PARTIAL LENGTH CORE TEST RIG
EML-94

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HHT-4 Single Cluster Development Tests

A chuck development test was conducted in an attempt to improve the cold end chuck design. The cold end chuck configuration consisted of an "O"-ring seal with the gap between the chuck and the retainer being opened to 15 mils. Four braided leads were inserted between the chuck and the electrode in order to prevent arcing (Figure 2). The test was terminated after seven minutes because of element breakage at the hot end chuck. The cold end chuck and braided leads were not damaged and no arcing was observed. The cold end chuck problem has evidently been solved by this redesign.

An attempt to test a skirtless block for 60 minutes is planned for the near future. The test will be conducted in three 20 minute cycles. This will satisfy the requirements for both NRX-A5 and NRX-A6

HHT-7 Filler Strip Corrosion Test

The assembly of the Build 4 Test 2 model has been completed and a pre-test facility preparation plan has been released. The test will be performed when facility test time becomes available. The redesigned stainless steel jacket and upper insulating chuck described in the March minutes have been installed on the model.

FFL-27 NRX-A5 Instrumentation Port Qualification Tests

The purge boot seals, which had been leak tested in March, were cryogenically cycles for 12 cycles and found to be satisfactory. This completes the activity.

FIGURE 2

COLD END CHUCK WITH FOUR BRAIDED LEADS

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HHT-4   Single Cluster Development Tests

Two exit gas thermocouple tests were attempted in April. The first test was conducted with holes drilled in the side of the cup, which allowed the gas to pass over the outside of the cup in order to cool it. The test was successfully completed attaining a full power temperature of approximately 4000°R for 30 minutes. The thermocouple was still reading at the end of the test. An attempt to conduct another test, using the same thermocouple, had to be abandoned when the thermocouple broke as it was being inserted in the furnace.

The second test was terminated after five minutes at full power. The thermocouple failed when full power of 4100°R was reached. It is planned to conduct a 20 minute cycle using the same hardware.

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TESTS FOR NRX-A6

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EML-69   Support Block Mechanical and Thermal Tests

Two NRX-A6 type corrosion cups made from PO3 graphite were tested against a skirtless block in the cycled temperature test. Coated ATJ support washers were used to load the cups. The first cup was tested at 1500 lb and the washer welded solidly to the cup. The second cup was tested with a single piece of pyrofoil between the washer and cup and welding was effectively prevented. No cracks had developed at 1700 lb loading.

A series of tests were run to determine the load-carrying capability of the short interlock design of the NRX-A6 skirtless blocks. In general, blocks failed by means of the interlocking ledge chipping off the block to which the load was applied. However, on the single hexagon or aft end of the block the shear force carried away the whole face of the hexagon. In a regular block of previous reactor designs, the increased face length of the interlock is enough to limit the damage to chipping of the ledge. The force required to shear the face of the block is not materially different from that to chip off a corner. The average failure loadings were between four and five hundred lb regardless of the direction of the loading. A comparison of the damage to the regular support block and A6 block after testing is shown by Figure 3a and 3b.

EML-70   Blockless Support System and Components

Initial shear tests on keys brazed on short fuel element sections were conducted in a short seven cluster test apparatus. Two keyed elements were located 180 degrees apart in the central test cluster. The load was applied to the keys through the sleeve support hanger simulating the loading condition anticipated in the backup support system in the event of failure of the primary support system. Under a bundling pressure of approximately twelve psi, cracks were initiated in the elements at loads of 154 lb/element. Crack initiation was indicated by strain gages cemented in the critically stressed region of

FIGURE 3a
REGULAR SUPPORT BLOCK
EML-69

FIGURE 3b
A6 SUPPORT BLOCK
EML-69

the element. The cracks originated in the element at the key load interface and progressed across the element on an angle of approximately 45 degrees.

Because of the fracture mode, it was suspected that bending was the primary cause of failure. To establish this effect, additional strain gages were located on the element opposite the key at the level of the key load interface. The pair of elements were then loaded in a manner similar to that described above. Crack initiations were detected at 132 lb in each of the elements. Origin and progression of cracks were the same as in the test of the first pair. Failure was due to bending rather than shear as indicated by the strain gages. Load was gradually increased to 192 lb/element when the crack propagated across one of the elements.

The short seven cluster test assembly is currently undergoing modifications to minimize the relative movement of elements and, therefore, minimizing introduction of bending. A method for applying uniform bundling pressure is being substituted for the present method which would improve the load-carrying capability of the keyed elements.

EML-76   Reactor Hardware Static and Dynamic Tests
Outer Seal Segment Latch Test

A test of the outer seal segment latch was performed to establish the capability of the latch to support the maximum design load (36 lb) without permanent set. The load-deflection characteristics and overload capability of the latch were also determined in this test.

The latch was assembled with supporting hardware which simulated the geometry and materials of the reactor components and load-deflection measurements were made for loads up to 99 lb (see Figure 4). The applied load was increased in small increments, and returned to zero after each increment was added so that maximum elastic load could be established. The results obtained

FIGURE 5

LOAD DEFLECTION CURVE
MOLYBDENUM RETAINING LATCH
EML-76

FIGURE 4

RETAINING LATCH TEST SPECIMEN
AND ATTACHING HARDWARE
EML-76

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are shown in Figure 5. The load required to produce permanent set was about 70 lbs, almost twice as large as the maximum design load. The spring rate of the latch for loads up to 70 lb was 25,500 lb/in. The permanent set after loading to 95 lb was about 0.00075 inches.

EML-78 Dome End Seal Test

A test of a simulated NRX-A6 forward end seal was performed to determine the accuracy of the procedure used in the stress analysis of this seal. Loads required to deflect the seal and resulting stresses were measured for axial displacements up to 0.5 inches. In order to expedite the procurement of the test seal, the shallow conical seal geometry was simulated with a flat disk. It was felt that the results obtained with the test seal should closely approximate the results that would be obtained with the axial seal for axial loads which would not cause buckling of the test seal outer edge.

The test was performed by bolting the inner periphery of the seal to the stationary part of the test rig. The outer periphery of the seal was supported by a rigid ring which could be displaced axially so that relative deflection between the inner and outer periphery of the seal was obtained. The test assembly is shown in Figure 6. The loads required to deflect the seal were determined by three load cells assembled integral with the loading jacks. Seal stresses were determined from strain gages mounted in a radial and circumferential direction on forward and aft seal faces.

One complete axial displacement cycle was made by deflecting the seal in 0.025 inch increments until a total displacement of 0.500 inches was obtained. Then the displacement cycle was completed by returning the seal to the undeflected position in 0.050 inch increments. Measurements of the load required to deflect the seal and strains were recorded at each displacement increment.

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FIGURE 7
LOAD DEFLECTION CURVES
EML-78

FIGURE 6
FORWARD END SEAL TEST RIG
EML-78

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When the seal was deflected to approximately 0.375 inch, the edge began to buckle. The buckled seal is shown in Figure 6. As the stress analysis is only valid in the range of elastic stability, comparison of the experimental and calculated values of load and stresses were made to 0.300 inch deflection of the seal. Good agreement is indicated between the experimental and calculated values, as shown in Figure 7.

EML-86   Lateral Support System Testing

Preparation is continuing on static, dynamic and seal leakage tests of the NRX-A6 lateral support system configuration. The object of this test is to evaluate the characteristics of this support system which is significantly different from previous reactor designs.

During this period, fabrication of test fixture hardware was completed. The reactor grade test hardware is presently in the fabrication stage.

HHT-2 Single Element Process Development and Evaluation Tests

During the period March 29, 1966 through April 26, 1966, a total of 78 corrosion tests were conducted. The tests consisted of 26 sixty minute life tests and 52 process control tests. Of the 26 sixty minute life tests, the following results were obtained:

<u>No. of Elements</u>	<u>Total Test Time</u>
10	60 Min.
4	50 to 60 Min.
5	40 to 50 Min.
2	30 to 40 Min.
1	20 to 30 Min.
3	Less Than 20 Min.
1	Aborted
<u>26</u>	

Lobes and blocks were tested with the elements.

HHT-4 Single Cluster Development Tests

Testing of an A-5 skirtless block for 40 minutes has not yet been completed. The test requirements for NRX-A6 show that a total test time of 60 minutes on a skirtless block will be required. It is planned to conduct this test in three 20 minute cycles.

FFL-8 Control Drum Flow Tests

The double step impedance ring was retested with 0.050 inch overhang compared to previous tests of 0.104 inch overhang. The clearances between the impedance ring and the bearing were set at 0.003 inch radially and 0.030 inch

FFL-8 axially. No appreciable change in pressure drop was experienced from the com-
(Cont.) parable test with 0.104 inch overhang. It has been decided to use the impedance
ring with the 0.050 inch overhang in the reactor.

A test was conducted using air with the bearing flow test assembly to determine
the flow rate pressure drop characteristics of the drum bearing itself. The test data
is being reduced.

FFL-29 NRX-A6 Single Seal Tests

Fabrication of the test assembly for the May milestone is continuing.

FFL-31 Baffle Effectiveness

Tests were conducted using hydrogen and helium as the gas media, and water
and liquid nitrogen as the coolant to determine the overall heat transfer coefficient
for the test specimens at gas pressures of 50, 100, 150, 200, and 250 psig. The two
dimensional symmetric model shows some difference between the two heat transfer
paths on each side of the heat source. Side "1" has yielded a higher heat transfer
coefficient, and this result may be due to the thermocouple in the heater plate of
Side "2" being peened to obtain better thermal contact. Better thermal contact
would result in a higher indicated temperature of the heater plate thereby increasing
the temperature difference between the heat source and sink and also yielding a
lower coefficient. The following table shows the heat transfer coefficient obtained
with various combinations. All measured values are less than the $200 \text{ BTU/hr-ft}^2\text{-}^\circ\text{R}$
set as the highest value which could be permitted for the contemplated design.

Hydrogen ($h = \text{BTU/hr-ft}^2\text{-}^\circ\text{R}$)				Helium ($h = \text{BTU/hr-ft}^2\text{-}^\circ\text{R}$)			
LN ₂		H ₂ O		LN ₂		H ₂ O	
Side "1"	Side "2"	Side "1"	Side "2"	Side "1"	Side "2"	Side "1"	Side "2"
115	112	191	163	110	110	170	147
-	-	-	-	-	-	158	139

FFL-31
(Cont.)   At liquid nitrogen temperature the thermal conductivity of hydrogen and helium are about the same whereas at room temperature (represented by the water coolant) the thermal conductivity of hydrogen is larger than that of helium. The model is being cleaned, all thermocouples are being peened and will be reassembled for a final reproducibility test.

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TESTS FOR NERVA

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HHT-2 Single Element Process Development and Evaluation Tests

Two single element tests were conducted on externally coated high void fraction elements with 115 mil channels. The elements were unfueled. Both tests were conducted with a standard hot end chuck. The first element failed after 3.5 minutes at temperature and the second failed after 2.5 minutes at temperature. Both elements failed at approximately 25 inches from the cold end from axial cracking in the webs. The elements exhibited a 3.4 gram and a 3.1 gram weight loss respectively. It is planned to test the first fueled elements next month using both 110 and 115 mil channels.

FFL-32 Plunger Pin Capsule Leakage and Flow Impedance

A new test fixture for plunger pin capsule flow impedance tests has been designed and is being fabricated. In this model the axis of the flow hole will be offset from the axis of the capsule.

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GENERAL DEVELOPMENT

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EML-60   Core Effective Gap Tests

A facility has been established to obtain porosity measurements made on fueled and unfueled elements. This is done by taking automatic plots of external and bore pressure of elements vs time on an X-Y Recorder. Figure 8 shows the equipment used in the testing program.

At present, the facility is being used to obtain permeability data on elements used in various test programs. These programs include the effective gap test program, fluid flow corrosion tests and developmental work being done by the Materials Department.

EML-69   Support Block Mechanical and Thermal Tests

Continuous load with temperature cycle type tests were run on two support block designs of larger fillet radius than the standard NRX-A5 design. One used a 0.125 inch radius and the other a 0.312 in. radius spherical seat. Support washers modified to a mating spherical surface were used in conjunction with ten pyrofoils. The 0.125 inch fillet radius block developed a circumferential crack at 1500 lb loading but the 0.312 in. spherical seat showed no damage until 1700 lb when a very small axial crack was visible where the tie rod bore hole met the spherical surface. An impressed ledge under the washer showed that the washer and block surface were not very well mated so the test will be repeated in the hope of attaining 2000 lb of loading without cracking in the temperature cycle.

EML-82   Outer Reflector Sector Tests

a.   Beryllium Thermal Shock Test

A test was performed to determine the stress required to re-initiate cracking in a beryllium specimen that had been cracked initially by means of a thermal shock. The specimen used was similar to the one

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FIGURE 8
FUEL ELEMENT POROSITY TEST EQUIPMENT
EML-60

used in previous tests to investigate the transient thermal strains in the reflector thin webs.

The thermal shock cracks were produced by preheating the test specimen to 710°R and then suddenly flowing helium at 140°R through it. The test rig used to produce the thermal shock cracks is shown in Figure 9. The helium was obtained from a tank trailer supply and chilled to the test temperature in a liquid nitrogen heat exchanger. The instantaneous high gas mass flow through the specimen was developed by opening an air-operated valve downstream of the specimen.

Inspection of the specimen after thermal shocking revealed that the thermal shock produced three transverse cracks in the specimen webs. These cracks were about $1\frac{1}{8}$ inches apart and were in a plane normal to the axes of the specimen and direction of gas flow. A longitudinal crack in the direction of gas flow occurred at one end of the specimen webs.

After the thermal shock test, the specimen was modified so that a tensile load could be applied at the ends. The cross-sectional area was also reduced to insure that tensile fracture would occur at one of the thermal shock cracks. A sketch of these modifications is shown in Figure 10. The specimen was then chilled to 140°R and loaded mechanically to failure in tension. Failure occurred at one of the transverse thermal shock cracks at 1575 lb. The stress at fracture was estimated to lie between 7000 and 20,000 psi depending on the assumed shape of the thermal shock crack. Although a dye was forced through the thermal shock crack prior to tensile testing in order to identify the geometry of the crack, it was not possible to distinguish the shape of the initial crack after the initial test.

FIGURE 9
 THERMAL SHOCK TEST SETUP
 EML-82

FIGURE 10
 THIN WEB THERMAL SHOCK SPECIMEN
 EML-82

b. Tensile Test of Notched Specimens

A tensile test of a notched beryllium specimen was performed to obtain data which will be used in establishing strain limits for scheduled tension-compression strain cycling tests of similar specimens. The specimen gage section was 0.750 inches in diameter and 4 inches long. A 60° V-notch with root radius of 0.004 inches and a root diameter of 0.5322 was machined in the center of the gage length. The K_t factor for the notch was 6.5. Figure 11 shows the broken specimen and an untested specimen.

Special adapters were machined for the 2-1/2 inch threaded ends of the specimen with extra precautions being taken to obtain concentricity of the loading threads. The pull rod linkage in the Wiedemann Testing Machine included universal joints and spherical washers at each end.

To check the alignment, 4 strain gages were mounted on the major diameter of the specimen. These were spaced 90° apart 1-1/2 inches from the notch. The alignment check was carried out at ambient temperature since no adjustments could be made after the specimen was submerged in LN_2 . With room temperature loading to 1000 lb, the indicated bending was approximately four and two percent in the two strain gage planes.

The results obtained were as follows:

- 1) Notched Tensile strength at 140°R - 20,600 psi
- 2) Modulus of Elasticity at 140°R - 40.0×10^6 psi
- 3) Stress-strain at major diameter linear to fracture

Only two of the strain gages functioned properly during the test, and these were in planes 90° apart, so no indication could be obtained of the actual bending. However, it was concluded from the stress-strain curve slopes that three to five percent bending was present.

FIGURE 11
SPECIMEN BEFORE AND AFTER TESTING
EML-82

HHT-2   Single Element Process Development and Evaluation Tests

Two tests were conducted using argon in place of helium in the furnace atmosphere. Difficulty was encountered in reading the temperatures with the optical pyrometer. Further tests to evaluate the use of argon are planned.

Two pinhole tests were conducted in April. The first test was with standard graphite hardware at each end of the element, Figure 12, and direct gas inlet. The test lasted approximately 20 minutes at steady state before the element broke near the mid-point. The element suffered a 21 gram weight loss. The second test was set-up the same as the first but used an aluminum inlet chuck in place of graphite, Figure 13. The test was operated for 15 minutes at steady state and shut down normally. The aluminum chuck appeared to perform satisfactorily. The element suffered a 7.4 gram weight loss. Inspection of the element showed three pin holes at the 26 inch position and four pin holes at the 48 inch position. These tests will be continued next month.

HHT-6   Interstitial Corrosion Tests

Two isothermal gap tests were conducted to determine the pressure effect on the corrosion reaction. The first test was conducted for 30 minutes at 50 psig inlet pressure. Corrosion in the flow slot was very light. The specimen showed a weight loss of 0.187 grams. The second test was conducted for 30 minutes with an inlet pressure of 150 psig and had a weight loss of 0.443 grams. Corrosion in the flow slot was heavier and extended for a greater distance than that observed in the 50 psig inlet pressure test. It is planned to conduct two more tests, one at 250 and one at 350 psig inlet pressure.

HHT-7   Filler Strip Corrosion Tests

Hardware procurement for the gas injection design is proceeding as scheduled. The core components have been ordered and should be received in May 1966. The raw material for the reflector is out for bids.

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FIGURE 12

STANDARD GRAPHITE DIRECT GAS INLET CHUCK

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FIGURE 13

ALUMINUM DIRECT GAS INLET CHUCK

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Special Test - Beryllium Chill-Down Loop

A beryllium chill-down loop, Figure 14, using liquid hydrogen, has been prepared and installed on a test cart. An aluminum test specimen has been installed and instrumented with four thermocouples in the test loop. Checkout of the test loop will be conducted in cell nine using liquid nitrogen prior to testing with liquid hydrogen.

Large Site Vaporizer

Two qualification tests were made on the pump vaporizer system. The first operated for 1 hour and 4 minutes at a discharge pressure of 2450 psig and a discharge temperature of 80°F with an average flow rate of 0.019 lb/sec. The test was terminated because of a lack of liquid hydrogen. The output from the pump was used to pump the tube banks up to 600 psig. The second test operated for 1 hour and 20 minutes but had to be terminated because of a leak in the seal on the high pressure discharge valve. This same seal had been repaired just prior to the beginning of the test. A new seal design has been fabricated and will be installed by the supplier representative.

The third storage tube bank is completed and ready for delivery. The supplier has agreed to store it until preparations for installation are completed.

Thermocouple Furnace

The furnace was operated for 93 minutes including a period of 30 minutes above 4000°F. The nine shield radiation heat shield assembly was used in this operation. At maximum temperature, 53.6 KW was used with a total helium flow of 0.02 lb/sec.

WANHES

The installation of the second single element furnace at WANHES has been initiated. The second furnace loop should be completed during July 1966 unless, additional fuel element testing would preempt the manpower allotted to this installation.

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FIGURE 14

LIQUID HYDROGEN COOL DOWN TEST ON MATERIALS