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Westinghouse Astronuclear Laboratory

NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING
HELD WITH SNPO AT WANL ON MAY 26, 1966

(Title Unclassified)

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HELD WITH SNPO AT WANL ON MAY 26, 1966

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Westinghouse Electric Corporation
Astronuclear Laboratory
P. O. Box 10864
Pittsburgh, Pennsylvania 15236

SPECIAL REEVIEW FINAL DETERMINATION	Reviewers	Class.	Date
	TR U	U	4-15-82
Class: U			

E. A. DeZubay

E. A. DeZubay, Manager
Fluid Flow Laboratory

W. J. Rowan

W. J. Rowan, Manager
Engineering Mechanics

INFORMATION CATEGORY
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~~*E. A. DeZubay* 6/13/66~~
~~Authorized Classifier Date~~

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NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING
HELD WITH SNPO AT WANL ON MAY 26, 1966

Attendees:

Bifano, N. J.	WANL	Kanter, I. E.	WANL
DeZubay, E. A.	WANL	Kelly, V. G.	WANL
Fix, H. J.	WANL	Olinger, J. S.	WANL
Gagne, R.	SNPO-C	Rowan, W. J.	WANL
Havener, W. J.	WANL	Schreiber, J. J.	WANL
Helms, I.	SNPO-W	Watjen, E. A.	WANL
Kalvin, G.	SNPO-C		

The Monthly Development Test Program Review Meeting was held on May 26, 1966.

Lists of the tests performed and planned next period 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 then discussed in the order as shown.

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TABLE I
Fluid Flow Test Schedule

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PERFORMED THIS PERIOD

PLANNED NEXT PERIOD

Tests for NRX-A5	
HHT-2 Profile Test Started	
HHT-7 Installation Started and Heater Tests	Complete
Tests for XE-1	
HHT-4 Exit Gas Couple Tests - Complete	No further activity
Tests for NRX-A6	
HHT-2 Qualification and Life Tests	
HHT-7 Gas Injection Design Started	
FFL-8 Flow Rate - Pressure Drop of Bearing	No Activity
FFL-29 NRX-A6 Single Seal Fabrication Complete	Continue Testing - Fabricate Filler Strip Builds
Initiated Testing	
FFL-31 Baffle Effectiveness Testing Complete	No Activity
FFL-32 Capsule Seal Leakage Tests	Continue Leakage Tests
Tests for NERVA	
FFL-32 Fabrication Incomplete	
General Development	
HHT-6 Isothermal Gap Test for Pressure Effect	Continue Testing
Special Test - Initiated Testing	
Facilities	
New Nine Port Furnace and All Moly Shield	
Cryosonics Unit Returned for Cylinder Rebuild	

TABLE II
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	Initiate "Soft Stop" Testing
Tests for NRX-A6	
EML-69 Support Block Tests	
Tungsten Cup Tests	Elevated Temperature Creep Tests
EML-70 Dome End Backup Support System	
Braze Keys Shear Tests	Tie Rod Collar Tests
Corrosion Cup Tests	Bayonet and Center Element Tests
EML-78 Seal Testing	Radial Seal Tests
Cup Seal Tests	Continue Cap Seal Tests
EML-86 Lateral Support System Tests	
Continue Test Hardware Procurement	Complete Test Hardware Procurement
General Development	
EML-60 Full Core Friction Tests	
Initiate Hardware Procurement	Procurement of Test Hardware
EML-61 Graphite Tie Rods	
Fabrication Completed	Initiate Testing
EML-82 Beryllium Reflector Testing	
Notched Specimen Tests, Thermal Shock Tests, Fracture Toughness Tests	Continue Notched Specimen, Thermal Shock and Fracture Toughness Tests
Facility	
Thermal Gradient Facility	
Vacuum Test Facility	

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TESTS FOR NRX-A5

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HHT-2 Single Element Process Development and Evaluation Tests

There were five tests conducted simulating power tests of the NRX-A4 and A5 reactors. Single elements of NRX-A4 and A5 vintage were tested on time schedules reproducing total reactor operating programs and at temperature profiles representative of those experienced by central, peripheral, and nominal fuel element samples. The first test was an NRX-A5 nominal profile test. The test was successfully completed with a weight loss of 14.3 grams. The second test was an NRX-A4 nominal profile test. This test was also successfully completed with a total weight loss of 12.5 grams. There was no external evidence of pinholing in either element but the tip of the A4 element showed a high degree of corrosion. The third and fourth tests were conducted with A5 elements and at planned A5 temperature-time history at core centerline temperatures. The third test failed at approximately 28 minutes at power with a weight loss of 20.4 grams. The failure was caused by corrosion at the mid-point. The post examination showed pinholing from the mid-point and signs of bore enlargement. The fourth test was conducted in three cycles for a total operation of 53 minutes. The total weight loss of the element was 20.9 grams. Post examination of the element showed pinholing from the 26 inch position. The fifth test was an A4 peripheral profile test using an A4 element. The test operated for approximately three hours including all ramps and suffered a weight loss of 20.4 grams. Post examination of the element showed that the end of the element had vanished but otherwise the element looked very good. No external pinholing was observed. Several times during the test the element showed a surface temperature of approximately 5000°R.

All of the above tests were performed in the new furnace. This furnace features nine view ports and a molybdenum shield in place of the full length graphite radiation shield as used in the old furnace.

HHT-7 Filler Strip Corrosion Test

Installation of Build 4 Test 2 has begun. The heater element performance tests have been completed. These included a test to measure the profile at various

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HHT-7 Filler Strip Corrosion Test (Continued)

power levels and a 45 minute endurance test. The results of the 45 minute endurance test indicate a longer model test time than the 20 minute duration per heater established earlier. A one cycle longer duration hot hydrogen test is more favorable from the test stand point.

A conceptual layout drawing of the metal reflector, for Build 5 Tests 1 and 2, has been completed and detail drawings are being prepared. A partial shipment of the filler strips should be received the week of May 29, 1966. Coating of the first set of filler strips should be completed in June.

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TESTS FOR XE-1

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HHT-4 Single Cluster Development Tests

The qualification testing of the exit gas thermocouple assembly was completed on May 31, 1966. This series of tests included three different configurations. The first test was assembled with an NRX-A5 regular block and related hardware. A standard NRX-A5 insulating cup was used in place of the extended pyrolytic graphite cup previously employed. There were two rows of holes near the base of the molybdenum protection cup to allow cool gas from the tie rod channel to flow outward into the annulus between the insulating cup and the molybdenum cup. A flanged thermocouple support was used with a W/W-Re-26% thermocouple sheath. The cluster was held at a steady-state for a period of 30 minutes. Post test examination of the cluster showed that the insulating cup had lost most of the coating on its outer surface. There was, however, very little corrosion observed. There were no cracks observed in the molybdenum cup but the thermocouple sheath and support were blistered on and near the flange of the support. The second test was assembled the same as the first except that a tungsten thermocouple sheath was used with a non-flanged thermocouple support. This test was conducted in two cycles. In the first cycle the power control was based on the exit gas thermocouple until it indicated a temperature of 3850°R . At that point, the output of the thermocouple decreased instantly to zero and furnace control was shifted to power correlations from previous tests. The resulting temperature level at steady-state was estimated at 4000°R . This temperature level was maintained for eight minutes and then decreased slowly to zero. During the power decrease the thermocouple started to record again at 2480°R and followed the power decrease smoothly to zero. During the second cycle the thermocouple output was smooth and continuous up to 3750°R at which point it again dropped to zero. Furnace control was shifted to the furnace outlet thermocouple and the test was continued for about 16 minutes at a temperature of 4000°R . During this portion of the test a high helium leak rate developed making it necessary to adjust the power up and down in an attempt to stop the leak. The

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HHT-4 Single Cluster Development Tests (continued)

test was finally terminated after 16 minutes when it was discovered that the leak was the result of broken elements. As a result of the cycling of power, temperatures in the gas stream varied between 2900°R and 4200°R . Post test examination revealed that several elements were broken. The thermocouple, molybdenum cup and thermocouple support were slightly melted. In addition to the melting, the molybdenum protection cup was cracked from the slot in the trailing edge to the first row of holes. The graphite support hardware was essentially intact with the exception of coating removal on the insulating cup. The third test was assembled the same as the first except for a non-flanged thermocouple support and using the same insulating cup that had been used in the first test. Thermocapsules were inserted into the center element at approximately the 52 inch station in order to define the maximum gradient for this test. The cluster assembly was successfully held at full power for 21.5 minutes before the power supply overheated, automatically shutting down the test. The steady-state temperature level was about 4260°R and the thermocouple recorded smoothly throughout the test. The thermocapsule data indicated that the temperature on the inner surface of the elements at station 52 was from 4500°R to 4600°R . This indicated that a gradient of approximately 200°R to 300°R could have existed from the tip of the thermocouple to the thermocouple support. Thus, the support may have reached a temperature of 4600°R which could explain the localized blistering on the thermocouple sheath in all three tests. Post test examination showed that very little damage occurred except for corrosion of the insulating cup and slight blistering of the thermocouple sheath near the support. This completed the testing in this area and at this time no further activity is planned.

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EML-55 XECF Resonant Survey

A meeting was held between WANL and AGC representatives to review the Resonant Survey tests to be conducted on the XECF in the Engine Test Stand in Nevada. Current test stand configurations were examined and their effect on the original test plan determined. Action items covering instrumentation, fixturing and test sequence were resolved.

The instrumentation required for this test will be assembled and checked out at WANL. It will then be added to a trailer-type vehicle and taken to the test site next spring when the tests are scheduled to be conducted.

EML-76 Reactor Hardware Static and Dynamic Tests

Preparations are continuing for control drum scram tests with the XE-1 high torque scram spring and simulated actuator soft stop. The test assembly will be subjected to 500 scrams; 400 at room temperature and 100 at cryogenic conditions.

A revision in the design of the actuator soft stop spring necessitates a change in the test rig that had been assembled for the testing. These tests are scheduled to be initiated during the next period.

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TESTS FOR NRX-A6

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HHT-2 Single Element Process Development and Evaluation Tests

During the period of April 27, 1966 through May 24, 1966 a total of 131 corrosion tests were conducted. The tests consisted of 68 sixty minute life tests, 12 high power density, high flow corrosion tests, 6 special process tests and 45 process control tests. Of the 68 sixty minute life tests, the following results were obtained.

<u>No. of Elements</u>	<u>Total Test Time</u>
44	60 Min.
4	50 to 60 Min.
11	40 to 50 Min.
2	30 to 40 Min.
1	20 to 30 Min.
3	Less than 20 Min.
<u>3</u>	Aborted
68	

It was noted during the month that a larger percentage of the tests were operating for a longer period of time than in prior months. Figure 1 shows the comparison between the months of April and May. The 12 high power density, high flow corrosion tests were conducted with molybdenum coated elements. They were tested at 3000°R for 2 minutes, then shut down and retested for 60 minutes at 2B conditions. Of the 6 special process tests completed during the period, 3 were conducted at a flow rate of 642 SCFM with an element exit pressure of 540 psig, and three at 762 SCFM with an exit pressure of 490 psig. The tests were controlled by adjusting the power to give a 4650°R surface temperature on the element at the 48.6 inch station. All of the elements tested were from the same batch. In addition to obtaining the standard pre and post data on the elements, reaction weights on each end of the elements were obtained before and after testing by supporting the element on a knife edge in an attempt to determine the area of maximum corrosion.

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PERCENT OF ELEMENTS TESTED VERSUS TIME

FIGURE 1

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HHT-2 Single Element Process Development and Evaluation Tests (continued)

An analysis of the data obtained from these tests indicates that elements tested at the intermediate power level (960 KW - 672 SCFM), exhibit only slightly higher weight losses than elements tested at standard conditions. The analysis also showed that the weight loss was higher at the hot end than in the mid-band region. The elements tested at the higher level (1080 KW - 762 SCFM), exhibited definitely higher weight losses with apparent increased corrosion toward the cold end of the element.

HHT-7 Filler Strip Corrosion Test

The gas injection design has been completed for Build 5 Tests 1 and 2. The filler strips are due in but will have to be reworked. The sharp corners will be rounded at the hot end section. The rework and coating should be completed in June.

FFL-8 Control Drum Flow Tests

The bearing flow tests to check the pressure drop across the nozzle end control drum bearing have been completed. The data is being reduced and a report is being written. This completes the activity in this area.

FFL-29 NRX-A6 Single Seal Tests

Tests were conducted with four combinations of two types of spacers and seal segments, Figure 2. The following table describes the configurations which were tested.

<u>Case</u>	<u>Seal Segment</u>	<u>Spacer Ring</u>
1	Solid	Solid
2	Jointed	Solid
3	Solid	Jointed
4	Jointed	Jointed

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FIGURE 2

SEAL SEGMENTS AND SPACERS USED IN NRX-A6 SINGLE SEAL TESTS

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FFL-29 NRX-A6 Single Seal Tests (continued)

Figure 3 shows the spacer ring with the extra scarf joint in position in the simulated reflector. The hardware described as "solid" is identical except that the center scarf joint is omitted. Figures 4 and 5 show the seal segment with the extra scarf joint in position against the simulated filler strip block. The views are upstream and downstream and as in the case of the spacer ring, the seal segments described as solid do not have the extra scarf joint in the center. The initial tests are being repeated to check the data for reproducibility and consistency.

FFL-31 Baffle Effectiveness

The model was retested 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. The junctions, of the thermocouples in the heater plates, were peened into the groove guides to insure correct measurement of the copper surface temperature. Data was obtained for 50, 100, 150, 200, and 250 psig media pressures and found to be independent of pressure. The following table shows the heat transfer coefficient obtained with various combinations.

	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"
Experimental	93.2	98.8	147	144.6	92.4	97.4	142	124
Calculated Geometry	452		755		439		716	
Calculated All Gas	114		177		87		130	

Note that the values listed as calculated geometry and calculated all gas do not include contact resistance which when included would lower these values, and bracket the experimental values.

FIGURE 3
SPACER RING IN POSITION IN SIMULATED REFLECTOR

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FIGURE 4

SEAL SEGMENT IN POSITION AGAINST SIMULATED FILLER STRIP BLOCK

FIGURE 5
SEAL SEGMENT IN POSITION AGAINST SIMULATED FILLER STRIP BLOCK

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FFL-32 Plunger Pin Capsule Leakage and Flow Impedance Tests

Two seal leakage tests were conducted using double diamond seals, Figure 6. The first test was operated using one set of seals at 700 psig with 535°R hydrogen. The leak rate ranged from 1×10^{-4} lb/sec at a pressure drop of 200 psi to 0.6×10^{-4} lb/sec at a pressure drop of 10 psi. On disassembly, one of the seals was found to be .040 inch undersized. The second test was attempted with the proper seal sizes and the leak rate was found to be higher than in the first test. These tests will be continued in order to find a satisfactory seal.

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FIGURE 6
PLUNGER PIN CAPSULE SEAL LEAKAGE ASSEMBLY

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EML-69 Support Mechanical and Thermal Tests

a. A6 Dual Cup Testing

Dual, NRX-A6, uncoated corrosion cups for irregular support blocks were tested for ultimate strength and mode of failure at room temperature. Coated ATJ graphite support washers were used in each side of the dual cup. Loading was simultaneous and equal on each half of the specimen. In all cases where ATJ washers were used, it was the first item to fail. This occurred at approximately 1800 lb individual loading and caused no damage to the corrosion cup itself. These washers were 150 mils thick with a 70 mil edge radius and the 1800 lb is typical of all failure loadings on this washer design.

In order to reach ultimate strength of the cup, pyrographite washers were substituted for the ATJ specimens and an ultimate of 2700 lb was reached for each individual loading. This loading compared favorably with similar failures of single cups which tend to occur at 2500 lb. A special dual plunger with strain gages was used to adjust and distribute the load equally on both halves of the dual cup. Figure 7 shows the mode of cup failure.

b. Metallic Cup Testing

Two special designs of ATJ support washers for possible use with open ended metallic cups were tested for ultimate strength. The major design difference was a small rabbet around the outer periphery of the washer. Tests were run with the rabbet against and away from the block. Failure loadings were approximately 1800 lb which is the normal value for unaltered ATJ support washers.

A 60 mil wall thickness tungsten cup was held at 4500°R for ten minutes at 800 lb loading against a coated A6 type skirtless support block. Loading was applied to the cup through a standard A5 coated support washer. Hydrogen was passed through the block while at temperature and the loading was held through the warmup and cooldown cycles. Both the coated washer and support

block welded to the tungsten cup during the test. When these were removed for post-test examination, the niobium carbide coatings were cleanly pulled away from the two coated components where contact with the tungsten had been made. Results from sectioning of the cups showed 14-15 mils of carbide penetration into the tungsten where contact had been made. Microscopic examination of the cup prior to sectioning had revealed no surface cracks or imperfections. No graphite damage such as cracks was observed in the areas from which the coating had been broken away.

EML-70 Blockless Support System and Components

a. Strength of Brazed Keys in Shear

Shear tests were performed on brazed keys employing hardware initially designed for the dome end backup support system. The shear load was transmitted to the keys by a threaded sleeve hanger located in the central cluster of a short (10 inch) seven cluster test assembly. Two, six inch keyed elements (unfueled) located 180° apart were uniformly loaded simultaneously by application of axial loads on the dome end of each of the test elements under a bundling pressure of 12 psi. Each of the specimens was instrumented with strain gages in the critically stressed areas to provide a measure of stress and load distribution as well as an accurate and sensitive means of detecting crack initiation.

As stated above, the loads were transmitted to the keys by a sleeve hanger which was subsequently modified. Tests were conducted with the unmodified hanger because of similarity and availability.

Tests were run on keyed elements with various radii at the key and element interface at the supporting edge of the key. Results from the tests indicated that the crack initiation load appears to be independent of the radii. The crack initiation load with no radius varied from 132 to 154 lb or an average of 145 lb per key. The load for the five specimens with radius ranged from

A6 DUAL CUP AFTER TESTING
EML-69

PROTECTION CUP AFTER TESTING
EML-70

FIGURE 7

100 to 176 lb for an average of 128 lb. Several of the specimens were loaded to ultimate and the data shows that the ultimate strength is approximately 1.5 times greater than the crack initiation load. Furthermore, it was learned that the mode of failure is that of bending.

b. Strength of Uncoated Corrosion Cups

Two uncoated corrosion cups one each fabricated from PO-3 and TS 699 graphite for use with the tab tip design were loaded at room temperature in a manner as anticipated in the reactor with existing tie rod hardware. The cups were placed on a skirtless support block and loaded to failure. The PO-3 graphite cup failed at 4045 lb whereas the support washer in the TS-699 cup failed at a load of 4060 lb. The corrosion cup was examined under the microscope and found to be free of any defects. (See Figure 7).

EML-78 Seal Tests

Lateral Support Spring cavity caps with both unplated and silver-plated "O" ring seals were assembled in a test block with several simulated spring cavities as shown in Figure 8. Tests were performed at ambient conditions with a differential pressure of 200 psi to investigate the influence of the following on the leakage into the spring cavities:

- a. Silver plating on "O" ring seal
- b. Cap locking ring
- c. Surface finish of cavity counterbore surface in contact with "O" ring seal

The results were as follows:

- a. The silver plating reduced the leakage more than 90 percent.
- b. The cap locking ring had no effect on the leakage.
- c. About the same leakage was obtained with counterbore finishes of 20, 32 and 45 RMS.

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CAP SEAL RINGS AND TEST BLOCK

EML-78

CAP SEAL TEST ASSEMBLY

EML-78

FIGURE 8

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- d. An estimate of the leakage at reactor temperature conditions from the ambient measurements indicates that the actual leakage should be less than the maximum design value. Figure 8 shows the test assembly used in the series of tests.

EML-86 Lateral Support System Tests

Preparation is continuing on the test program to evaluate the characteristics of the NRX-A6 Lateral Support System. Static, dynamic and seal leakage tests will be performed on this configuration which is significantly different from the previous NRX-A reactor designs.

Fabrication of the test hardware is in progress with delivery scheduled for early in July.

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TESTS FOR NERVA

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FFL-32 Plunger Pin Capsule Leakage and Flow Impedance Tests

The fabrication of the flow impedance test fixture is incomplete but should be delivered in June, 1966.

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GENERAL DEVELOPMENT

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HHT-6 Interstitial Corrosion Tests

The isothermal gap tests to determine pressure effect have been initiated. Tests were conducted at 3500°R at hydrogen pressures of 50, 150, and 250 psig, and data is being evaluated.

Special Test

The liquid hydrogen chill-down tests on the beryllium specimen were initiated but the available dewar did not have a supply line large enough to provide a step change in temperature on the test specimen. Provisions are being made to use a larger dewar for the same test.

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EML-60 Core Effective Gap Tests

A test program is being planned to investigate the various cluster support systems under full length full core conditions. The Core Effective Gap Test rig is being utilized for this effort. A schematic of the pressure vessel and core cross-section is shown in Figure 9.

It is planned to make individual fuel element friction and key loading measurement of the dome end backup support system. The components will be tested at several locations within a section of the core under specified differential axial pressure loads and bundling loads.

An investigation will be made of the redistribution of loads involved in the event of tie rod failures.

EML-61 Tie Rod Evaluation Tests

Five graphite tie rods with two new end designs were received at WANL during this period. These rods are presently being instrumented prior to being tested. Testing of the rods is scheduled in the next period.

EML-82 Outer Reflector Tests

a. Thermal Shock Tests

Two tests were performed to determine the propagation of thermal stress cracks through beryllium test specimens with initial temperatures of 530 and 450°R. The test specimens were basically similar to the ones used in previous thermal stress tests but incorporated longitudinal grooves and transverse notches in the thin webs. These modifications were made to both increase the maximum thermal stress that could be developed in a thermal shock and reduce the stress required to initiate the crack. A typical specimen is shown in Figure 10.

The test with an initial specimen temperature of 530°R was performed by flowing helium gas at 140°R and through the center of the specimen. The coolant gas was chilled to the test temperature by means of a

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TEST RIG SCHEMATIC

EML-60

INSTRUMENTED CLUSTER LOCATIONS IN
CROSS-SECTION OF TEST RIG

EML-60

FIGURE 9

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liquid nitrogen heat exchanger. Transverse cracks similar to those observed in previous tests were produced in the thin webs. An X-ray inspection of the specimen after the test revealed that the cracks arrested after they had propagated about halfway into the heavy sections of the specimen adjacent to the thin webs.

The test with an initial specimen temperature of 450°R was performed by flowing helium at 10°R through the center of the specimen. The extremely low helium gas temperature was obtained by immersing a coil in a liquid helium bath, filling the coil with liquid helium and then forcing the helium in the coil through the test specimen with helium gas at 140°R at high pressure. The test rig is shown schematically in Figure 10. Transverse cracks similar to those obtained in the previous tests were produced in the thin webs. A preliminary X-ray inspection of the specimen after testing revealed that the cracks had propagated into the heavy sections adjacent to the thin webs, however, it was not possible to clearly establish the boundary of the cracks. Additional X-ray photographs are being made to better define the crack boundary.

b. Notched Tensile Tests

A second test of the notched tensile tests of beryllium reported last month duplicating the conditions of the original test was performed. The strengths obtained in both tests are as follows:

<u>Test</u>	<u>Tensile Strength (Psi)</u>
1st	20,600
2nd	25,600

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TYPICAL THERMAL SHOCK SPECIMEN
EML-82

THERMAL SHOCK TEST RIG SCHEMATIC
EML-82

FIGURE 10

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WANL-TME-1435

The tensile strengths measured are approximately 300 percent greater than the values reported in TME-1281. However, a comparison of the results with Brush Beryllium Corporation data reported in TME-1106, shows a fairly good agreement. The average strength measured in the Brush tests in the transverse direction at 300°R was 34,700 psi. The higher notch strength values reported by Brush Beryllium can be attributed to the etching procedure in finishing the Brush specimens and to the smaller size of those specimens.

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FACILITIES

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WANL-TME-1435

The new nine view port furnace with a molybdenum shield has been completed and placed in use.

The pump vaporizer unit was returned to Cryosonics to be rebuilt. The unit should be returned May 31 when it will be retested.

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Astronuclear
Laboratory

WANL-TME-1435

The pressure vessel to be used in the Thermal Gradient Facility was delivered during this period.

Fabrication is continuing on a cryogenic pump to be used with the pressure vessel in the evaluation of Lateral Support Systems. Delivery of the pump is scheduled for June.

An order was placed with Consolidated Vacuum Corporation for a Hi-Vacuum System to be used for environmental testing. The system is scheduled for delivery late in June.

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