Regulatory File Cy.

Commonwealth Edison Company
ONE FIRST NATIONAL PLAZA ★ CHICAGO, ILLINOIS
Address Reply to:
POST OFFICE BOX 767 ★ CHICAGO, ILLINOIS 60690

August 31, 1971

Dr. Peter A. Morris, Director
Division Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Proposed Change No. 14 to Appendix A, DPR-19, AEC Dkt 50-237

Dear Dr. Morris:

In a letter dated May 12, 1971, we requested a temporary substitution of a fixed 120 percent APRM Scram for the Flow Biased APRM Scram. The purpose of this letter is to change our request to request a change to the technical specifications.

Pursuant to Section 50.59 of 10 CFR Part 50 and paragraph 3.B of the Facility License DPR-19, Commonwealth Edison Company hereby submits Proposed Change No. 14 to Appendix A of DPR-19 (Dresden Unit 2). The purpose of this change is to request a fixed 120 percent High Flux APRM Scram during start-up testing to determine the warranted load response capability of Dresden Unit 2. This test is discussed in Start-up Test Procedure No. 17. This change will be in effect only during the time when the tests are being run. The specific change to the technical specifications is included in the attached page.

The safety evaluation provided in our letter of May 12 is the same for this change.

Attached is an evaluation of the transients to be run during this test. These analyses are being provided at the request of members of your staff. These analyses show that if a Flow Biased Scram for the APRM were maintained during the testing, a scram would occur and negate the results of the testing program.

Proposed Change No. 14 has been reviewed and approved by Commonwealth Edison's Nuclear Review Board.

In addition to three signed originals, 19 copies of this Proposed Change No. 14 are also submitted.

Very truly yours,

Byron Lee Jr.

B. Lee, Jr.
Assistant to the President

SUBSCRIBED and SWORN to
before me this 2ND day
of SEPTEMBER, 1971.

John J Husing
Notary Public

221.2

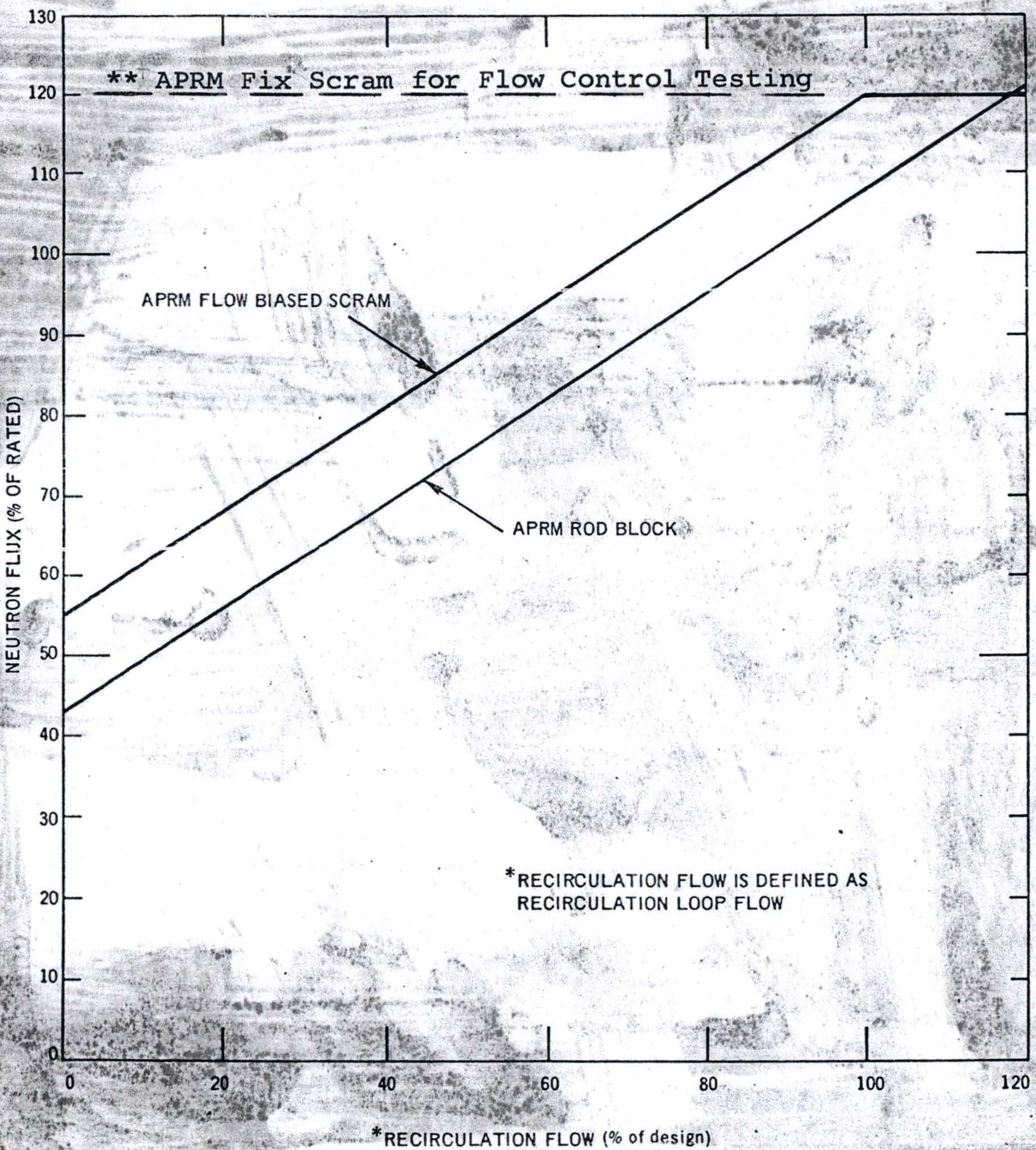

Figure 2.1.1. APRM Flow Reference Scram and APRM Rod Block Settings

** The 120% fixed scram will be utilized only during the warranted load response test (see start-up test 17). Following completion of this test the flow bias scram will be utilized.

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Received w/Ltr Dated 8-31-71

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TRANSIENT ANALYSES OF PROPOSED TESTS FOR WHICH A TEMPORARY WAIVER OF FLOW REFERENCED SCRAM IS REQUESTED AND A FIXED 120% APRM FLUX SCRAM IS PROVIDED

The tests to be performed are of the type which could not be satisfactorily completed because of the flow referenced flux scram are indicated herein as items 1 - 4. These are the test types referred to in the letter from Byron Lee, Jr. of CECO to Dr. Peter A. Morris of DRL dated May 12, 1971. Following each test type is a discussion of the test and of the transient analysis of same.

1. 10% speed increases will be made in both recirculation drive flow loops via step demand changes introduced at the master flow controller with the controller in tne manual control mode.

Discussion:

10% speed increases have been made in the recirculation drive loops of Dresden Unit No. 2 many times during the startup of the plant at several selected power levels. However, speed increase tests have not been performed along the 100% load line because it was determined that the slope of the flow referenced flux scram (0.75 slope at that time) was much too steep and such tests would result in reactor scram. Since then, the slope of the flow referenced scram was adjusted (to 0.65) such that it essentially paralleled the expected 100% load line. Flow referenced scram will still, however, prevent the performance of speed increase tests at the analytically determined optimum settings of the individual loop speed controllers. (Refer to Figure 1.E.1 of Amendment 9/10 of Dresden 2/3 for a block diagram of the Recirculation Flow Control System). The proportional gain settings of the individual speed controllers at the plant are currently adjusted at less than the 0.4%/% value indicated by analyses. The reset gain values have already been adjusted to the expected optimum value but some slight adjustment might still be required. The proposed tests of the speed control loops involves the adjustment of the proportional gain of the speed controllers to the expected optimum value and then checking the plant response against analyses performed by making 10% near step demand increases in speed via the Master Flow Controller in the manual control mode.

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Figures 1A-1 and 1A-2, (attached), show the expected plant response to such a speed demand increase when initiated from the low 20% speed end of the 100% load line. Initial reactor power is approx 58% of 2527 MWt (61% of 2418 MWt). Figures 1B-1 and 1B-2 show the expected plant response to a 10% speed increase demand from the initial condition of 70% of 2527 MWt on the 100% load line. On the bottom plots of both Figures 1A-2 and 1B-2, note the proximity of neutron flux to the flow referenced scram line and the lag of actual power (indicated by the average surface heat flux trace) which essentially proceeds upward along the 100% load line.

2. 10% and 20% load increases will be made via step demand changes introduced by test circuitry attached to the load set unit of the electro-hydraulic control system used to position the turbine control valves, bypass valves, and intercept valves.

Discussion:

After the response of the flow control system to manual speed demand increases has been verified to be adequate and essentially the same as predicted by transient analyses, the Master Flow Controller will be placed in the automatic mode. The initial settings of Master Flow Controller proportional and reset gain will be significantly below the optimum values expected such that testing can proceed in an orderly and safe fashion. The gain of the transient pressure set point adjustor will initially be set at a zero value such that it is not in the control loop. After the proportional and reset gain of the Master Flow Controller have been raised to near the expected optimum values, adjustment will be made to the gain and time constant of the transient setpoint adjustor to bring these settings to their expected optimum value. The proposed tests of the automatic operation of the Master Flow Controller involve 10% and 20% load demand increase steps performed with the plant initially at 70% of 2527 MWt on the 100% load line. These step increases in load demand will be made at various settings of the master flow controller and transient setpoint adjuster up to the expected values of these settings.

Figures 2A-1 and 2A-2 show the expected plant response to a 10% step load demand increase with no transient setpoint adjuster action and with master flow controller proportional gain setting at 1/2 of the expected optimum value and reset gain at 1/4 of the expected optimum setting.

Figures 2B-1 and 2B-2 show the expected response to a 10% load demand step without transient setpoint adjuster and with Master Flow Controller proportional gain setting increased to 1/2 of the expected optimum value and reset gain increased to the expected optimum value.

Figures 2C-1 and 2C-2 show the expected response without transient setpoint adjuster with both proportional gain and reset gain of the Master Flow Controller at the expected optimum values. Note that interference by flow referenced scram is predicted by this analysis. This analysis is also significant as it shows the response of the plant for the case of a failure of the transient setpoint adjuster in an "as is" failure mode. Plant response is sufficiently damped such that if such a failure should occur while the plant is operating in the automatic flow control mode, the operator can easily transfer to the manual mode of operation. The final settings of the Master Flow Controller will be such that the decay ratio of the response will 1/2 or lower without a transient setpoint adjuster as shown in the analysis.

Prior to placing the transient setpoint adjuster into service, the proportional gain of the Master Flow Controller will be reduced to 1/2 of the expected optimum value. Tests will then be performed while bringing the settings of gain and time constant of the transient setpoint adjuster to their expected optimum values. Figures 2D-1 and 2D-2 show the response of the plant to a 10% load demand increase step with near optimum settings of the transient setpoint adjuster, and with master flow controller reset gain at expected optimum value and proportional gain at 1/2 of expected optimum value.

Figures 2E-1 and 2E-2 show the expected response to a 10% load demand step increase with the settings of both the master flow controller and the transient setpoint adjuster at the expected optimum values. On the top plots of Figure 2E-2, note that the turbine steamflow response, (the parameter being optimized in these tests), is such that the 10% increase is reached within the desired 20 seconds.

Figures 2F-1 and 2F-2 show the expected plant response to a 20% load demand step increase with the settings of both the Master Flow Controller and the transient setpoint adjuster at the expected optimum values. The dashed lines on the top plots of Figure 2F-2 represents the desired minimum response to a 20% load demand step of approximately 1.0% per second for the first five seconds with a following rate of 0.5% per second for the next 30 seconds until the full 20% increase is achieved. Flow referenced scram interference is predicted for this transient. Note on the bottom plots of Figure 2F-2 that average surface heat flux lags behind the neutron flux increase and proceeds upward along the 100% load line with only a slight overshoot (approx. 5%). This transient represents the fastest increase in power expected to be reached in the proposed test program. Reference should be made to the analyses of the failure of a recirculation loop speed controller which appears in Section 4.3.3.1 in the Dresden Unit No. 2 FSAR and to Figures 4.3.9a and 4.3.9b in the FSAR. Note that the 20% load demand increase transient falls well within the analysis of the speed controller failure. The latter transient was shown in the FSAR and shows the reactor to be adequately protected by the action of a fixed 120% APRM flux scram.

Figures 2G-1 and 2G-2 show the expected response to a 20% load demand step increase with the settings of proportional and reset gain of the master flow controller at the expected optimum values but with the gain and time constant of the transient setpoint adjuster at values that just barely result in a response that satisfies the desired 1.0% per second for the first five seconds with a 0.5% per second following rate. Again, the proximity of the flow referenced scram line should be noted.

3. 30% load increases will be made via ramp demand changes in load introduced by driving the load reference motor in the load set unit of the electro-hydraulic control system continuously until the full 30% load demand is achieved. This will demonstrate the capability of the plant for a 0.5% per second load response.

Discussion:

When the plant is in the automatic mode of flow control, the load demand changes imposed upon the flow control system originate from either of two sources; manual load reference changes introduced by operator action via the load reference motor or load demand changes introduced by the speed governor in response to changes in grid frequency. The load reference motor can cause a load demand change at a maximum rate of less than 2 1/3% per second. It cannot cause step load demand changes. Changes in grid frequency can cause near step load demand changes. A 20% load demand increase from this source requires a 1.0% drop in grid system frequency which could only result from very large grid disturbances. Expected grid frequency variations very rarely exceed 0.1%.

Figures 3A-1 and 3A-2 show the plant response to a 30% ramp increase in load demand at a demand rate of 2 1/2% per second. The dsched (dashed) line on the top plots of Figure 3A-2 shows the minimum desired response to a 30% ramp demand of 0.5% per second. Again, note the proximity of the flow referenced scram line.

4. ±3% per minute load changes will be made throughout the load range from 15% to 100% with the base condition for the test at rated power and flow and at Xenon equilibrium.

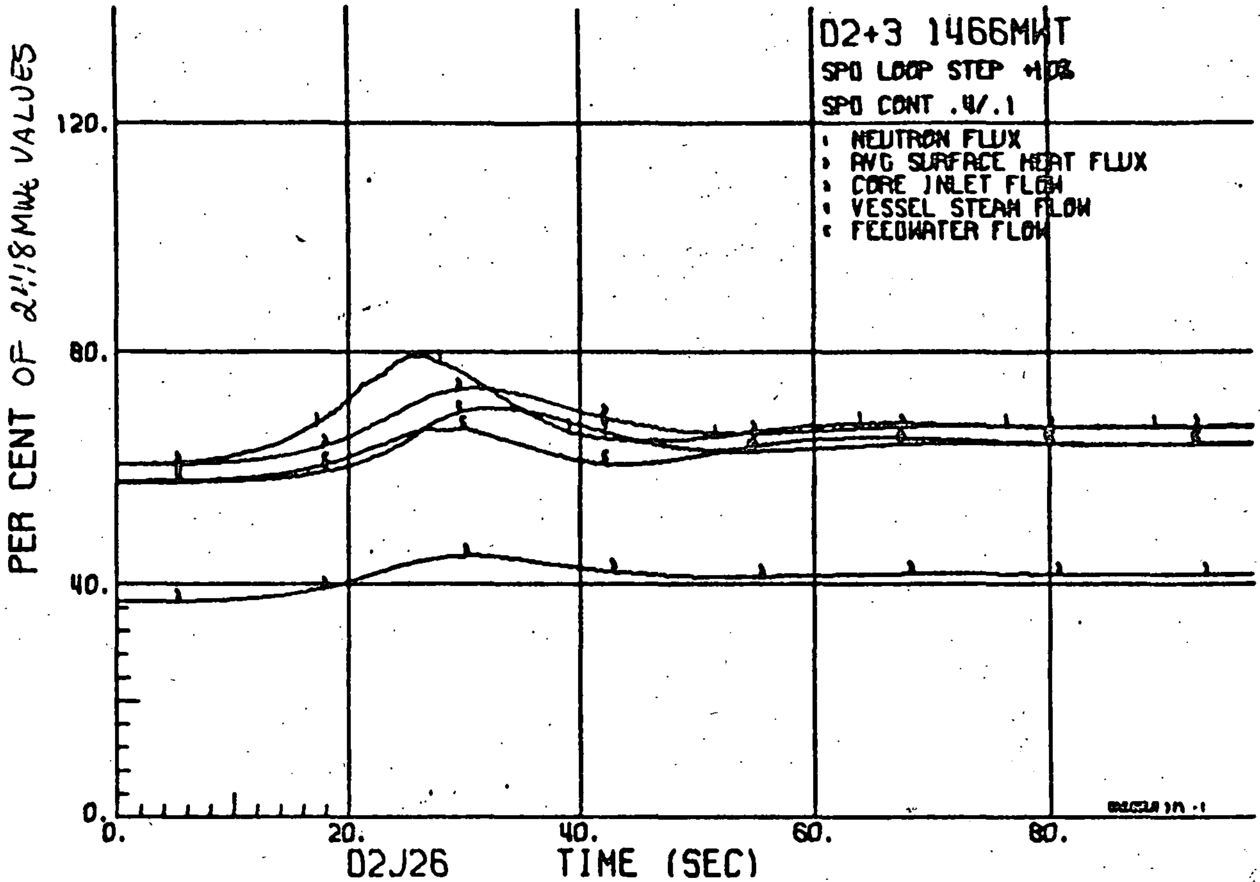
Discussion:

The ±3% per minute load changes are at a rate much less than the capability of the flow control system. As seen on Figures 3A-1 and 3A-2 the response rate can be as large as 0.5% per second or 30% per minute. All tests performed to demonstrate the ±3% per minute capability over the load range from 15% to 100% will have responses that fall well within the analysis of the 30% per minute response shown on Figures 3A-1 and 3A-2. Only those tests that approach the 30% per minute response rate are expected to show interference by flow referenced scram.

Conclusion:

The rates of change of flow and reactor power for all the proposed tests fall well within those values shown to be safe in the analyses of the speed controller failures, both zero demand and full demand, that appear in Section 4.3.3.1 of the Dresden Unit No. 2 FSAR. These FSAR transients were shown to be relatively mild and the reactor was shown to be more than adequately protected by fixed 120% APRM flux scram. Therefore the flow referenced flux scram can be temporarily deleted for these tests.

Fig 1A-



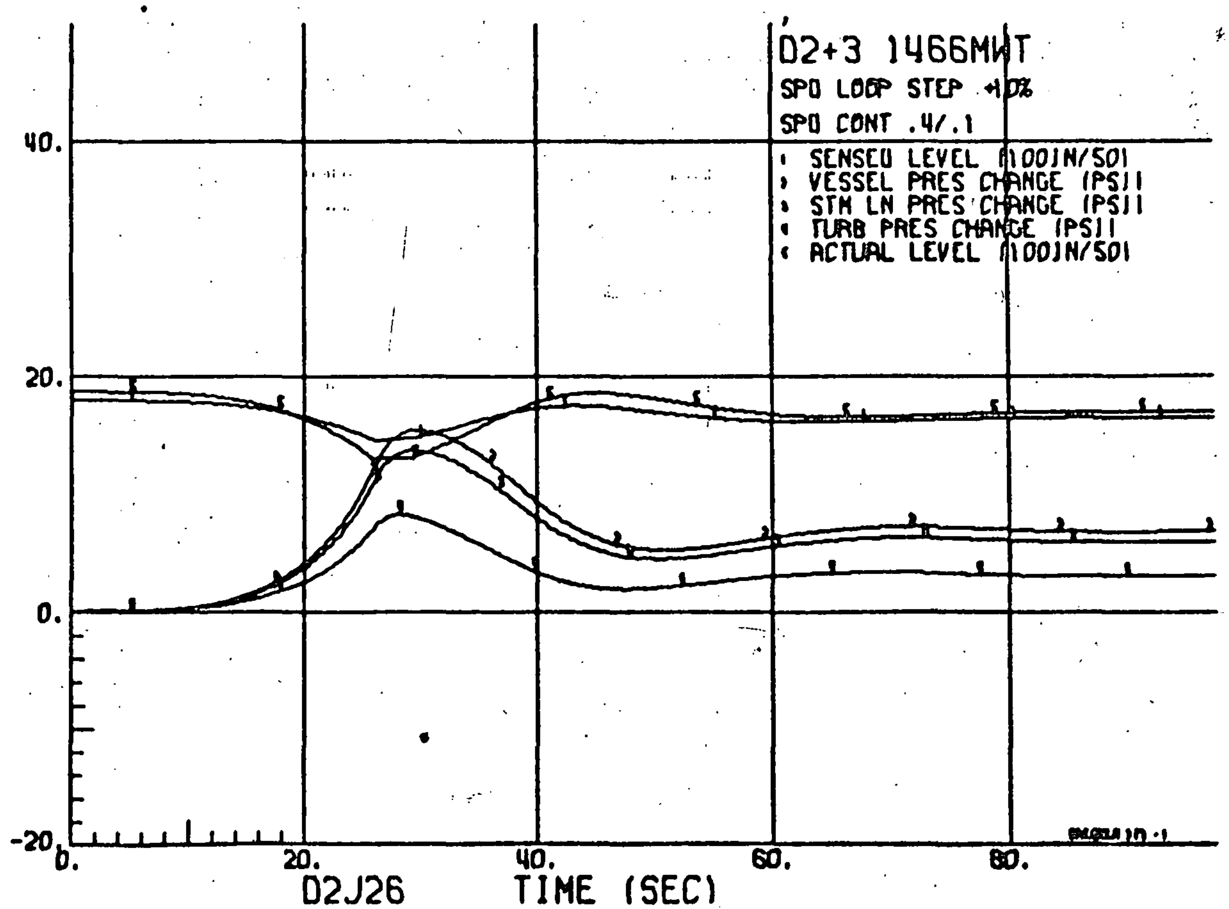
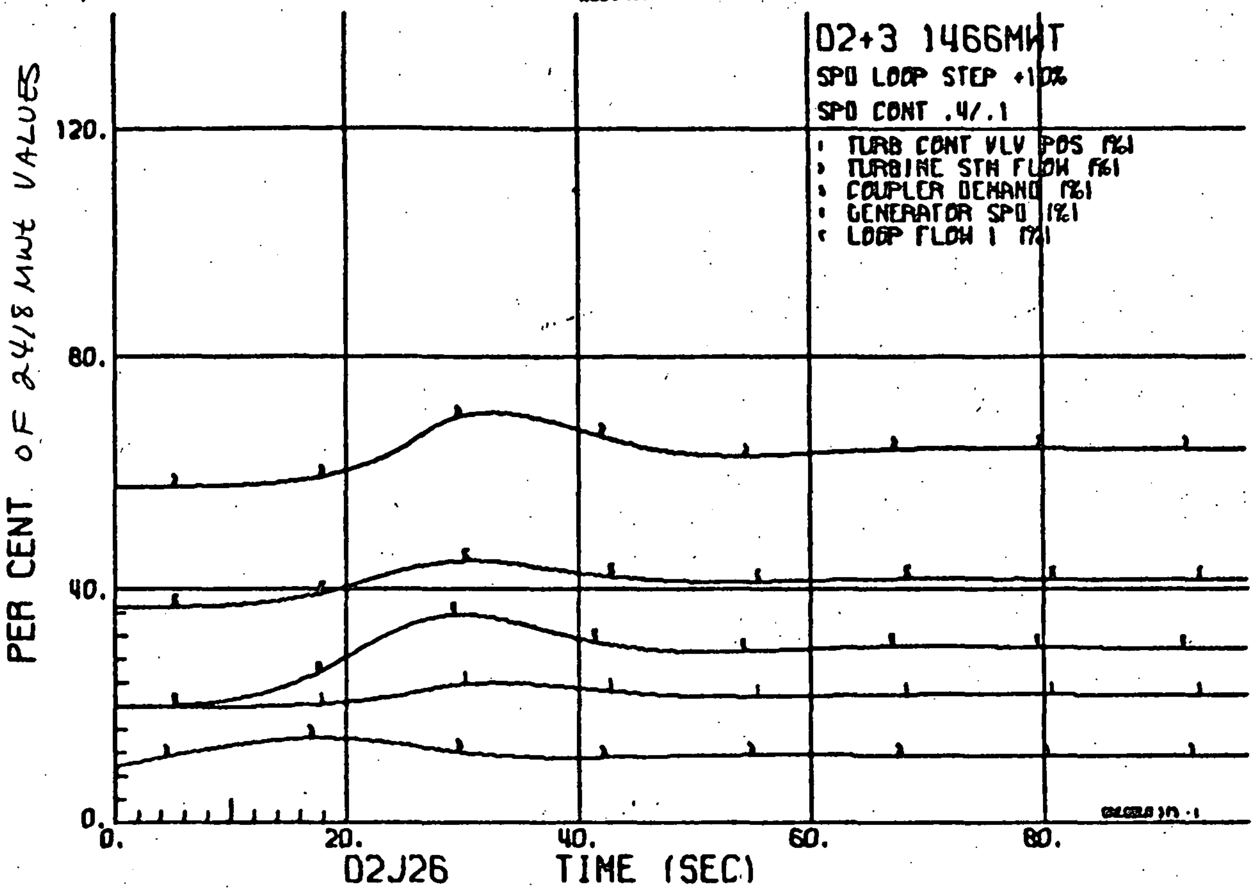


FIGURE 113. 61% Power, 37% Core Flow, +10% Speed Loop Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%

Fig 1A-1



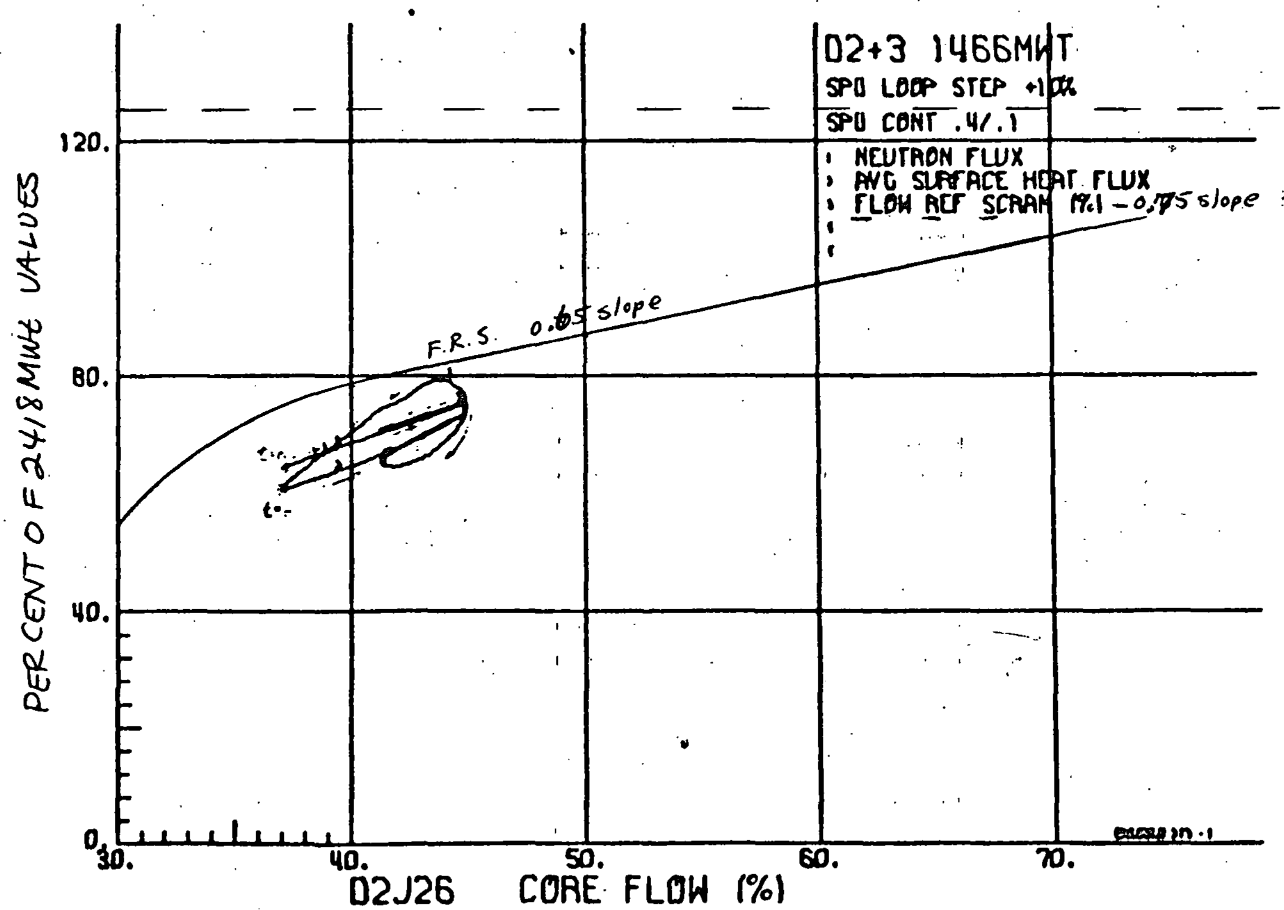
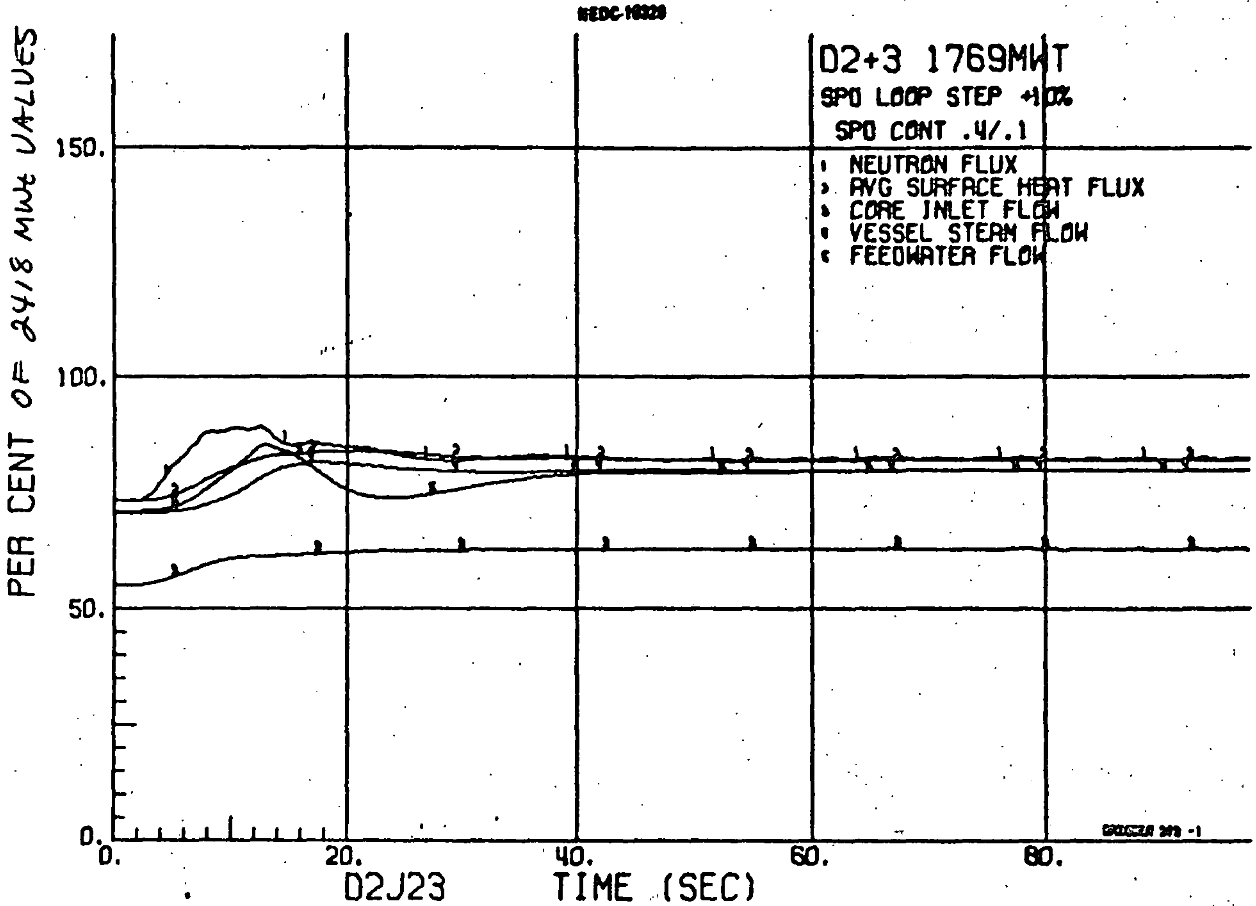


FIGURE 113. 61% Power, 37% Core Flow, +10% Speed Loop Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%

Fig. 1B-



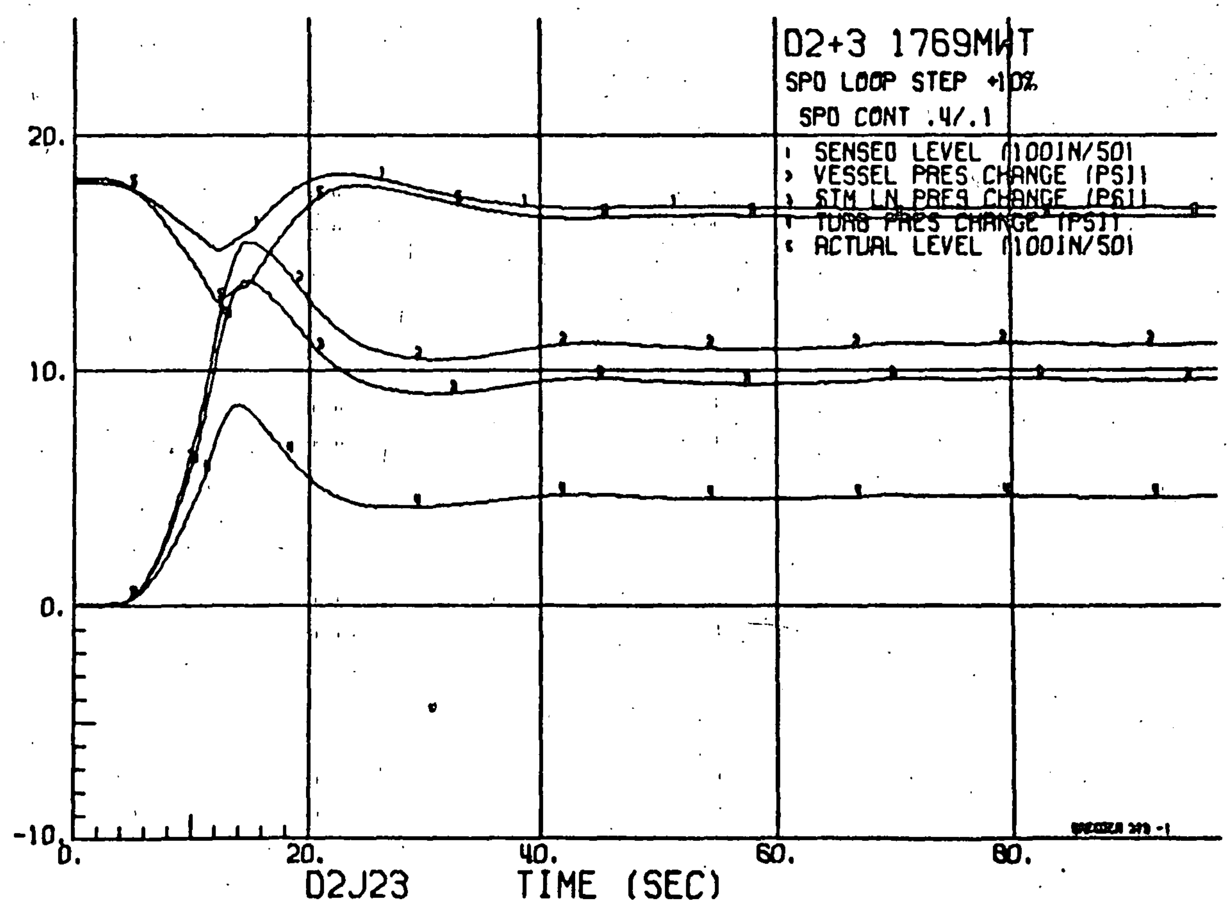
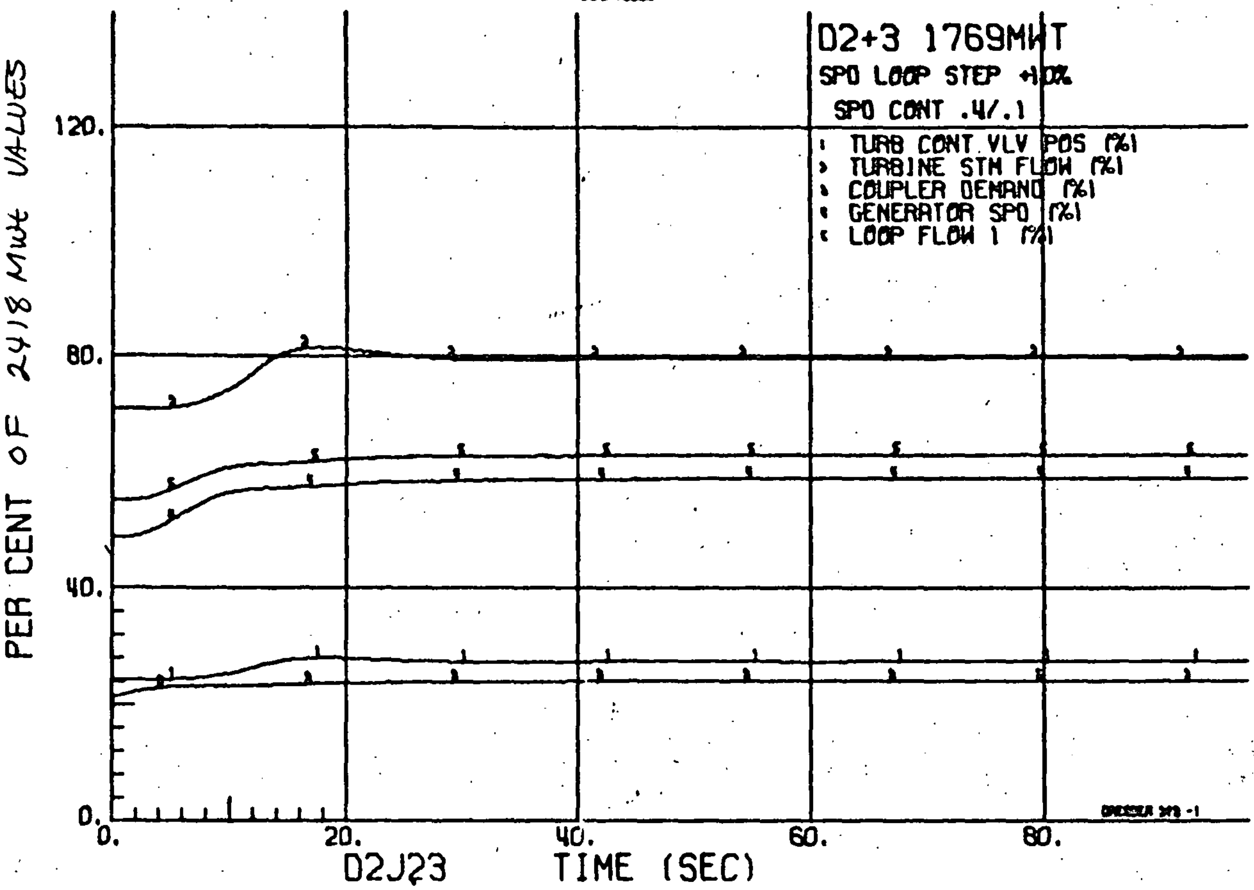


FIGURE 114. 73% Power, 35% Core Flow, +10% Speed Loop Step, K(PROP) = .4%/%, K(reset) = .1%/sec/% 5-228

221.11

Fig 1B-1

Fig 1B-2



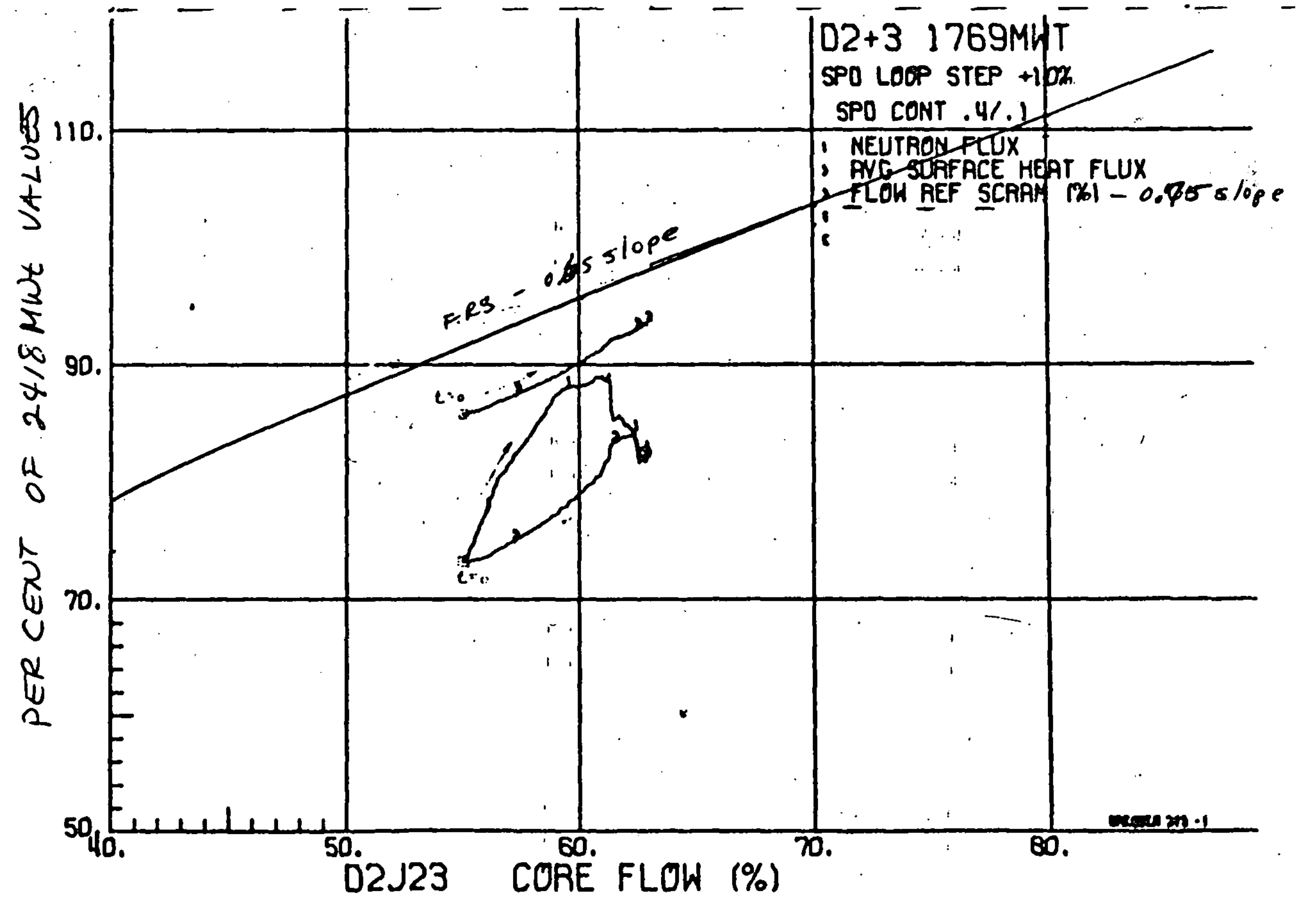


FIGURE 114. 73% Power, 55% Core Flow, +10% Speed Loop Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%

Fig 1B-2

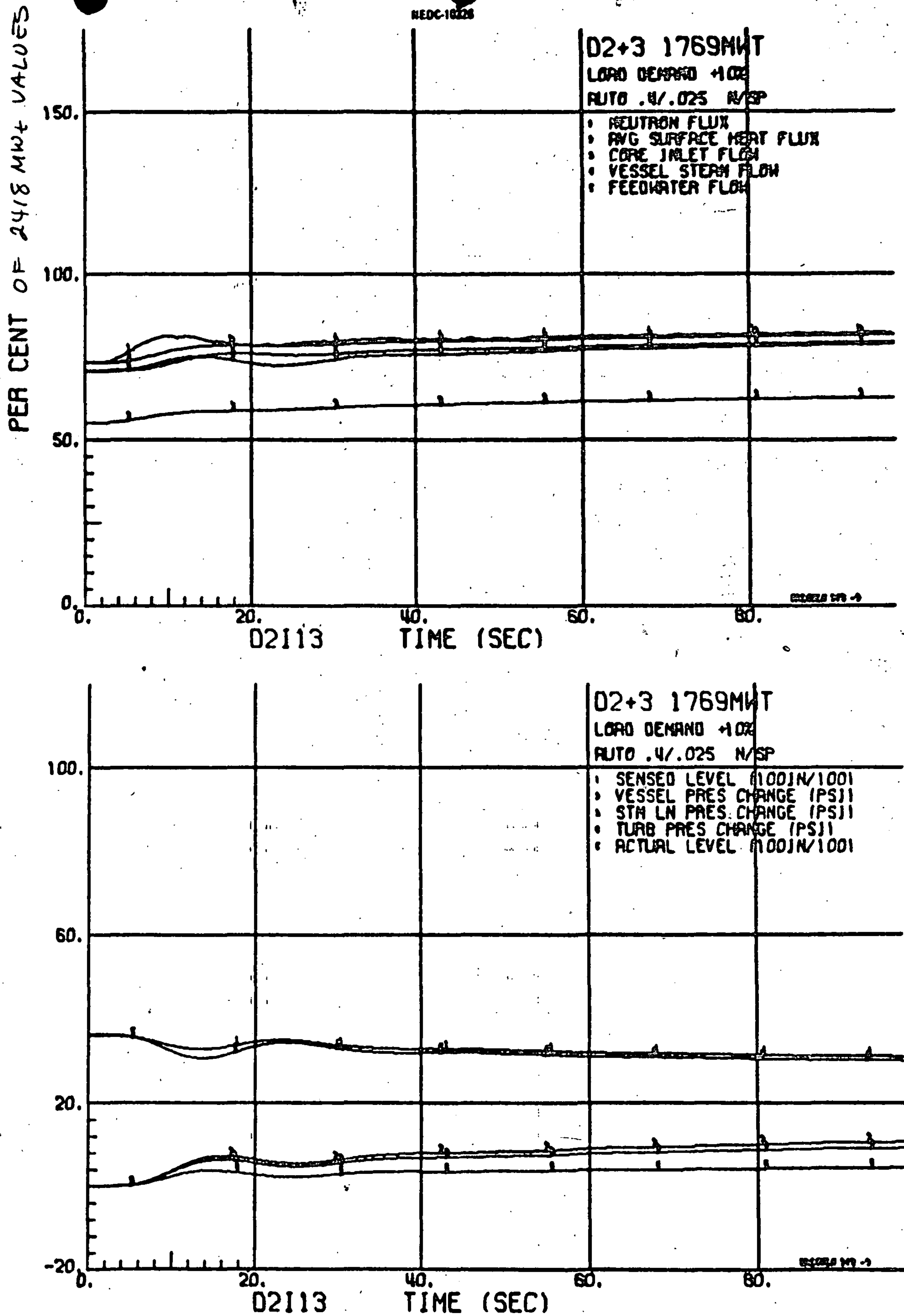
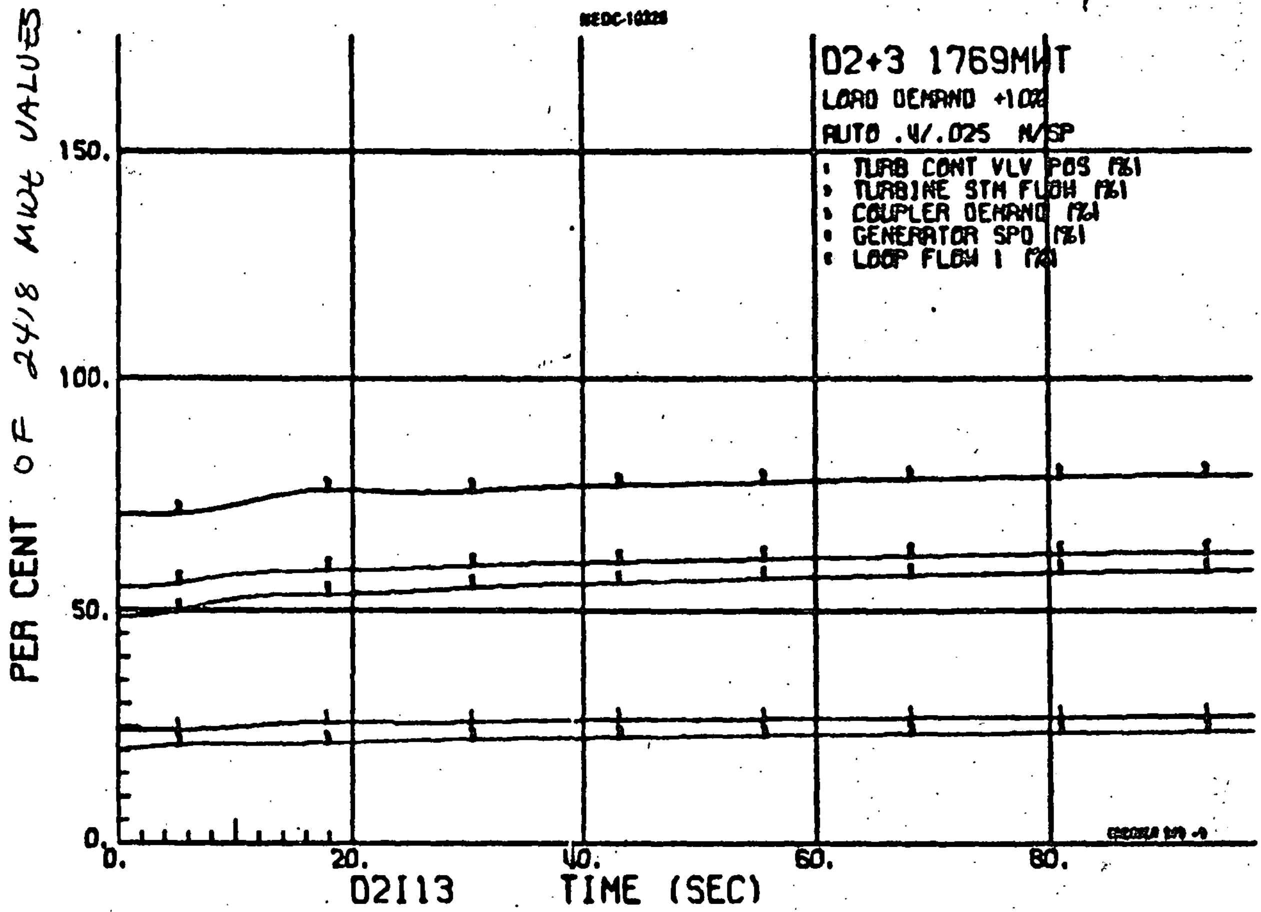


FIGURE 117. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .025%/sec/%

Fig 2A-1

221.13

Fig 2A-2



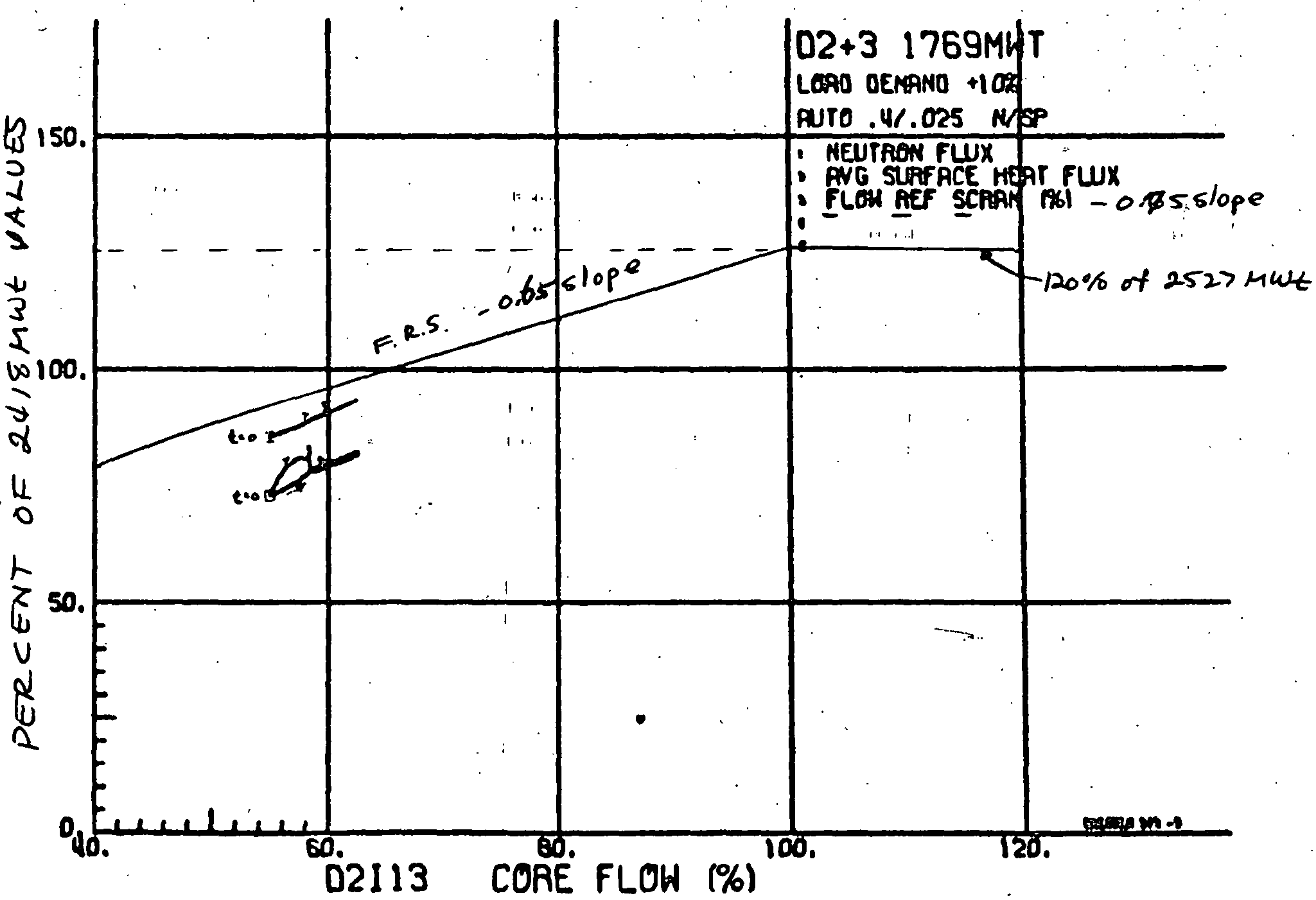
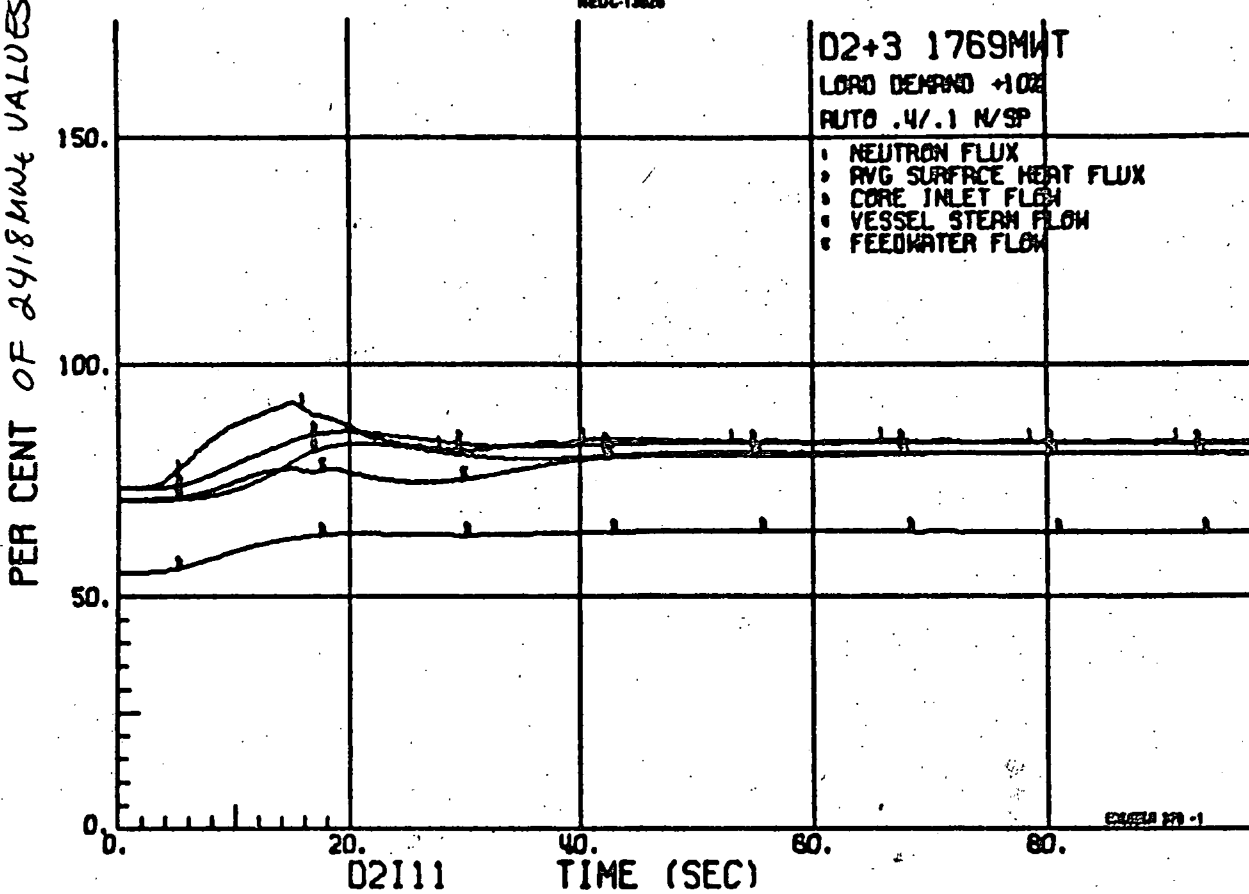


FIGURE 117. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .025%/sec/%

Fig 2A-2

Fig. 2B-1



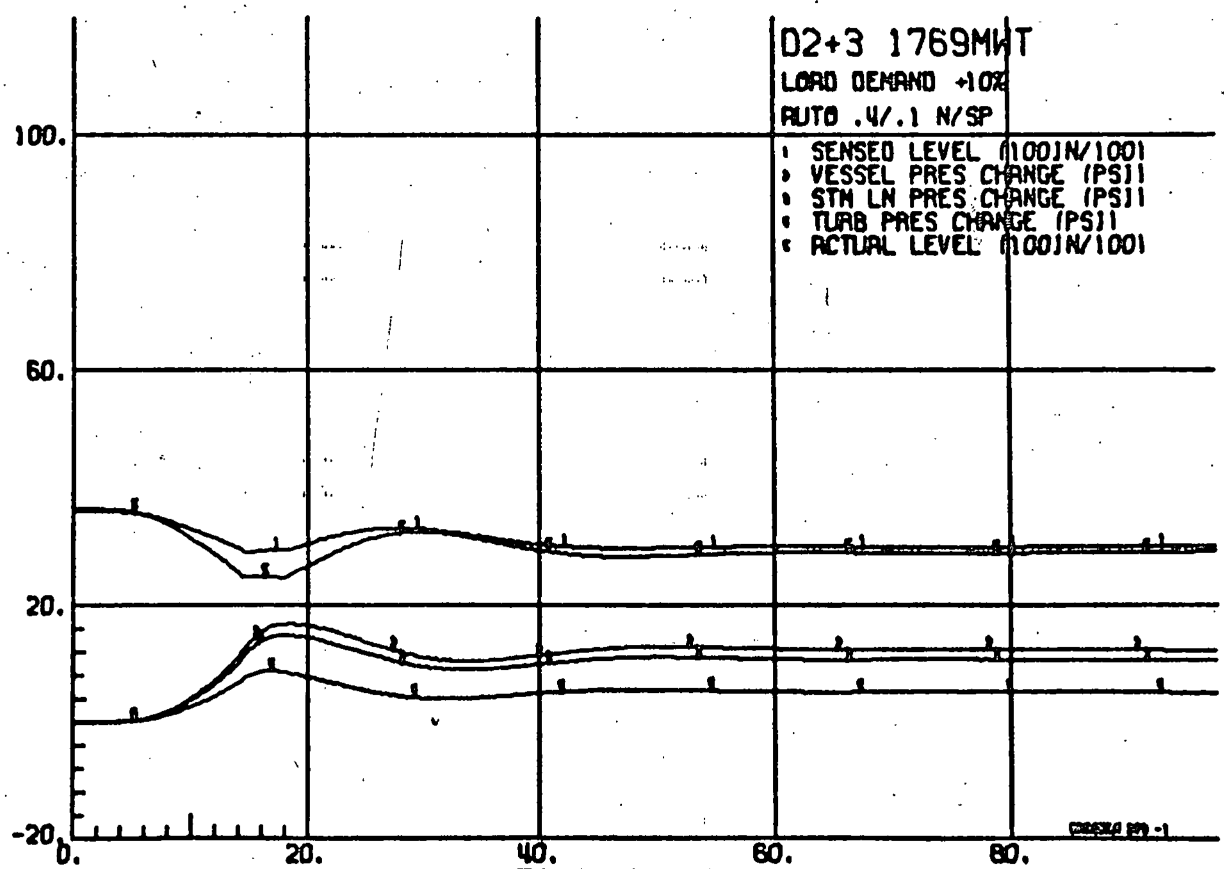
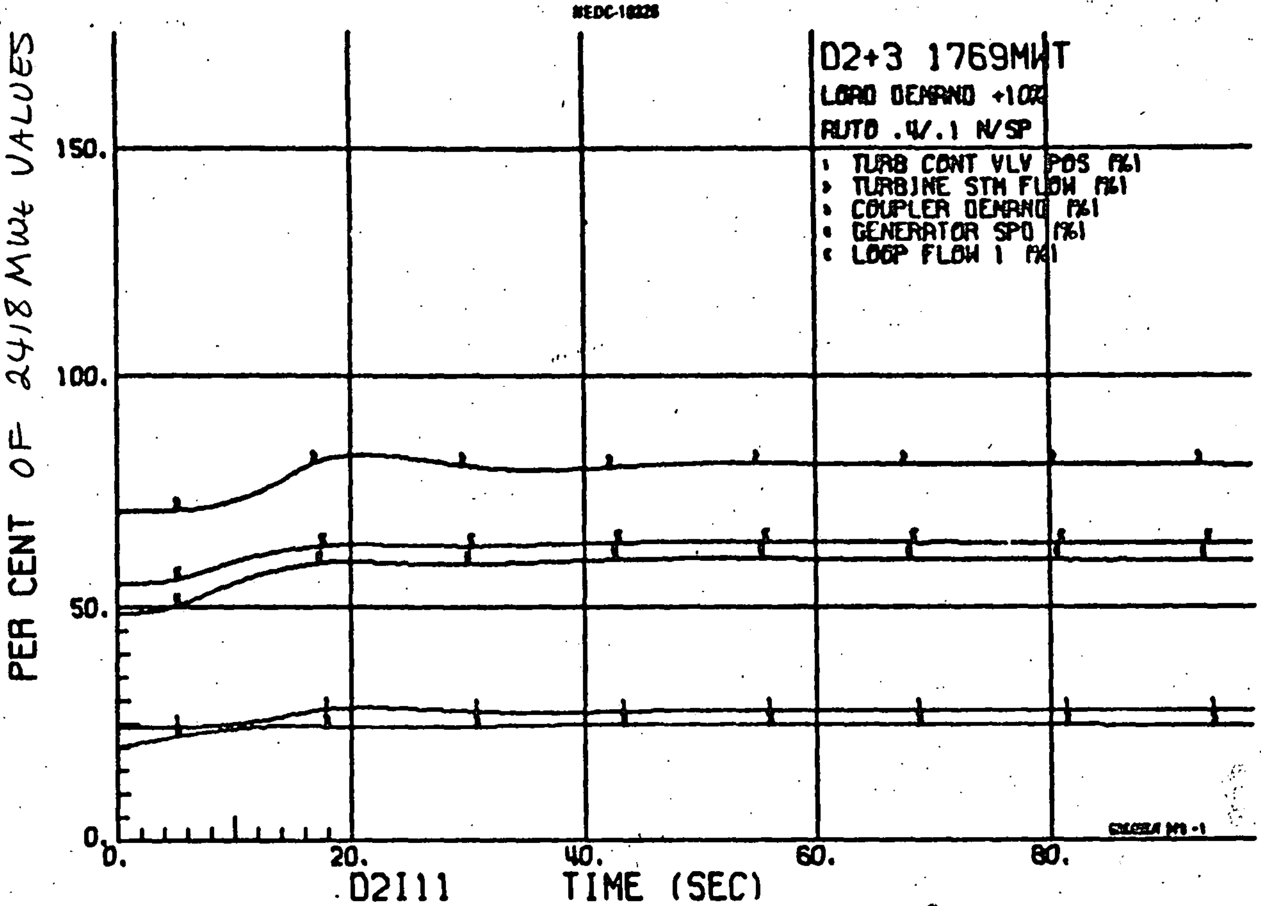


FIGURE 119. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%

Fig 2B-1

221.15

Fig 2B-2



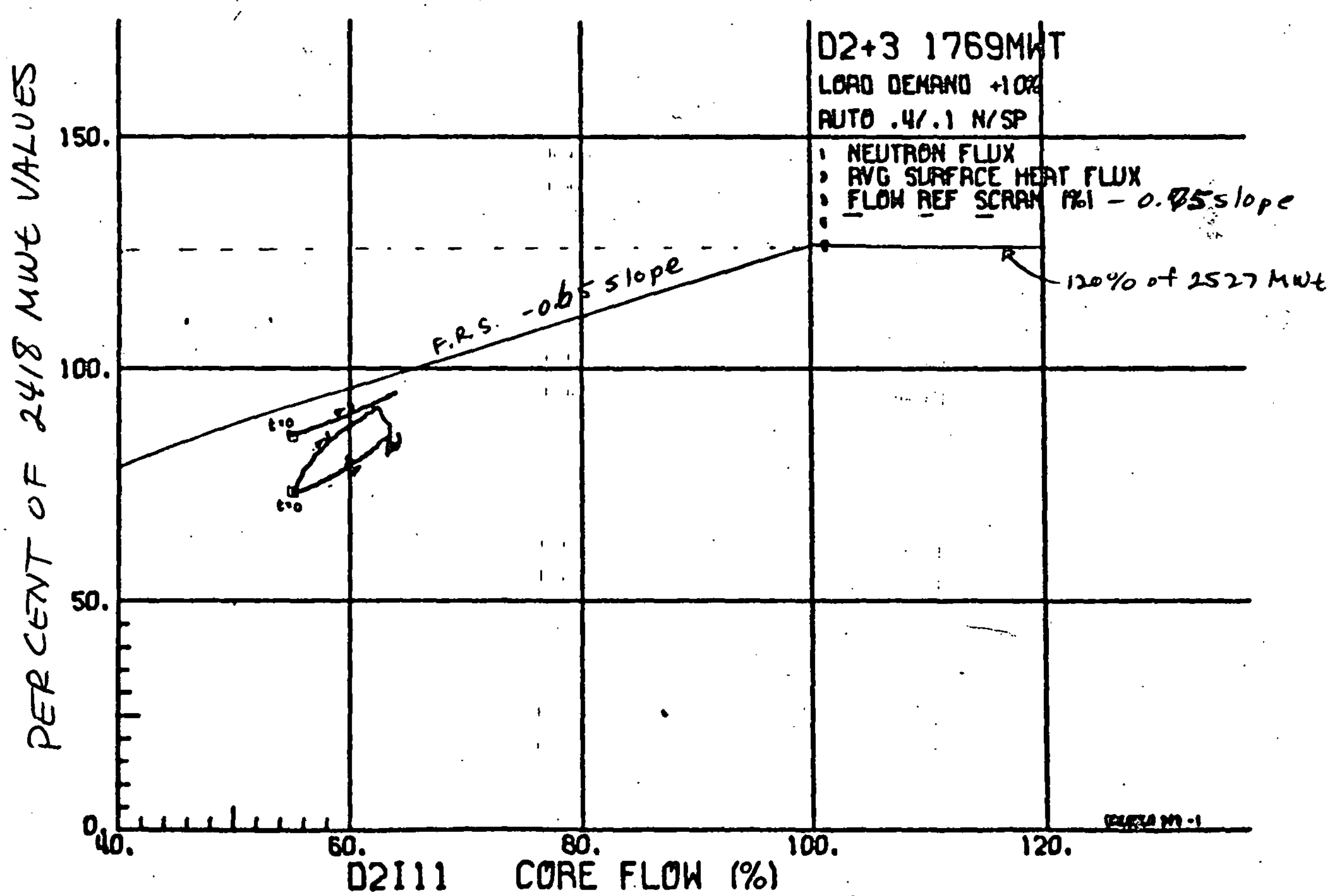
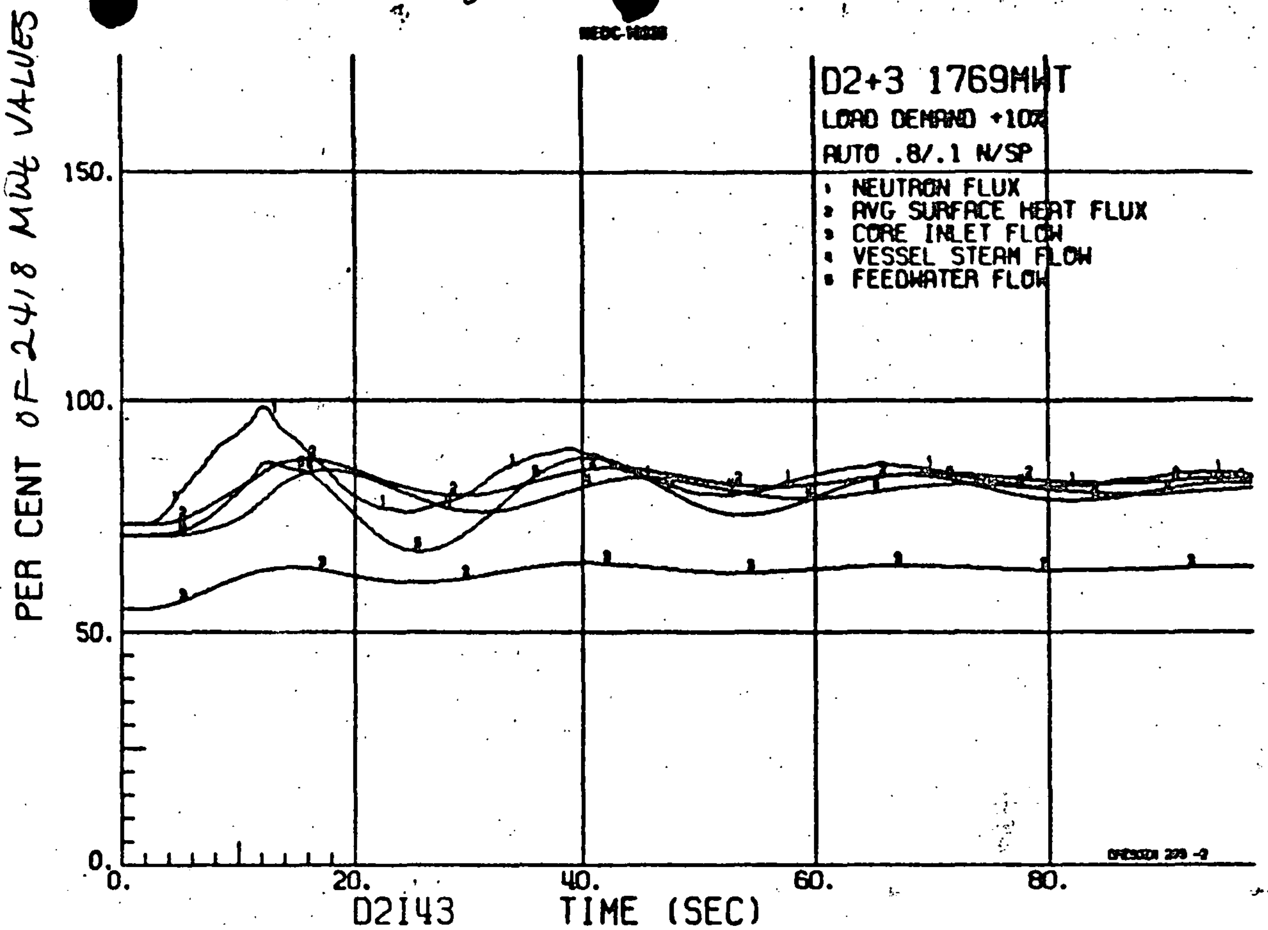


FIGURE 119. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%

Fig 2B-2



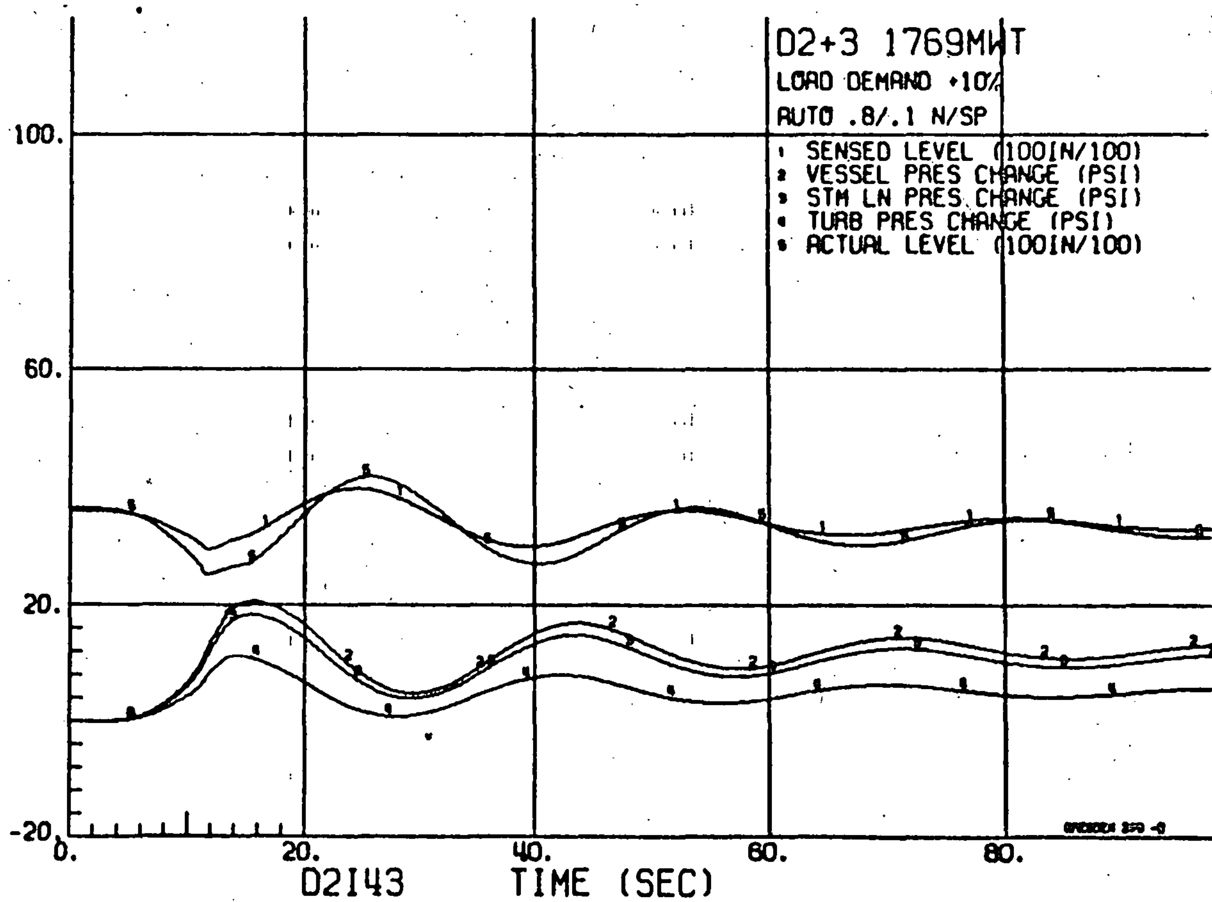
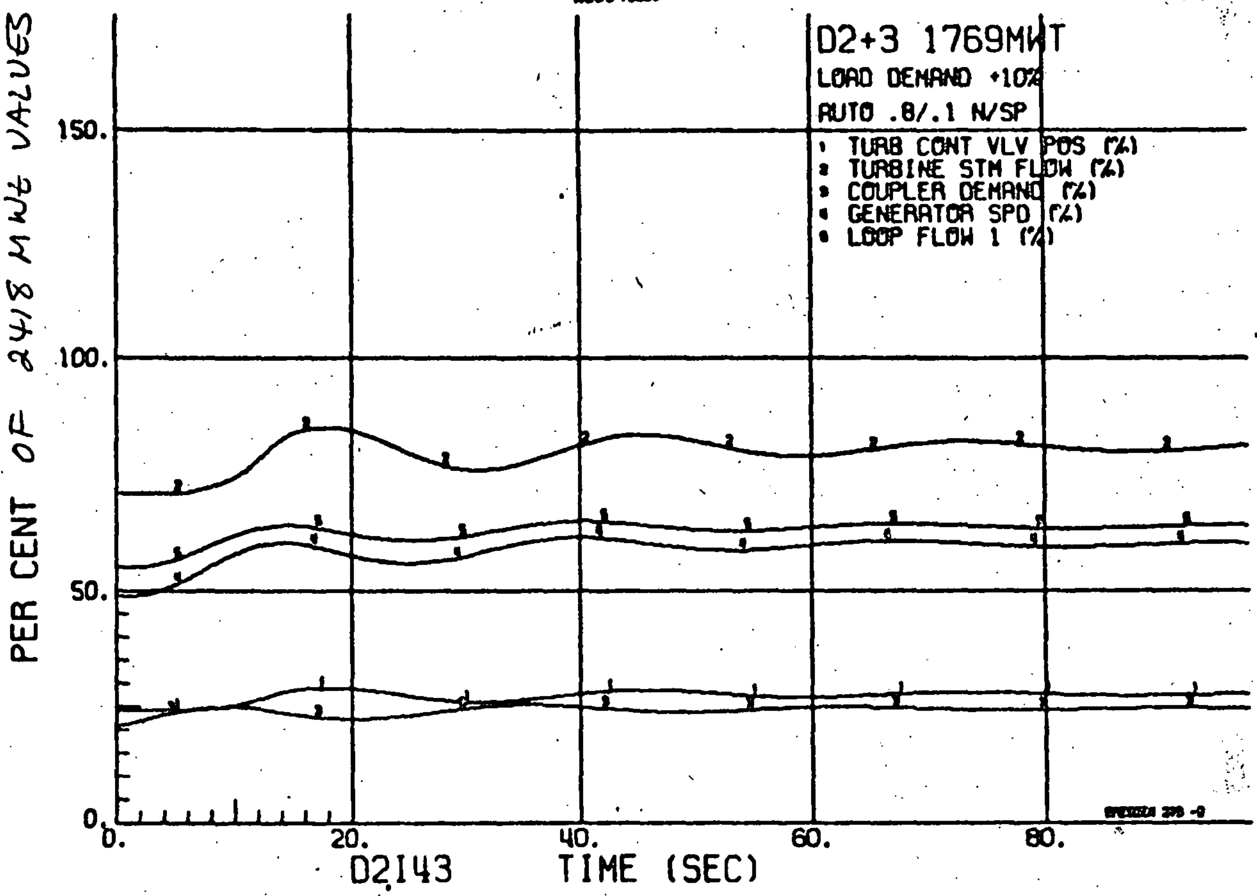


FIGURE 121. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%

Fig 2C-1

Fig 2C-2



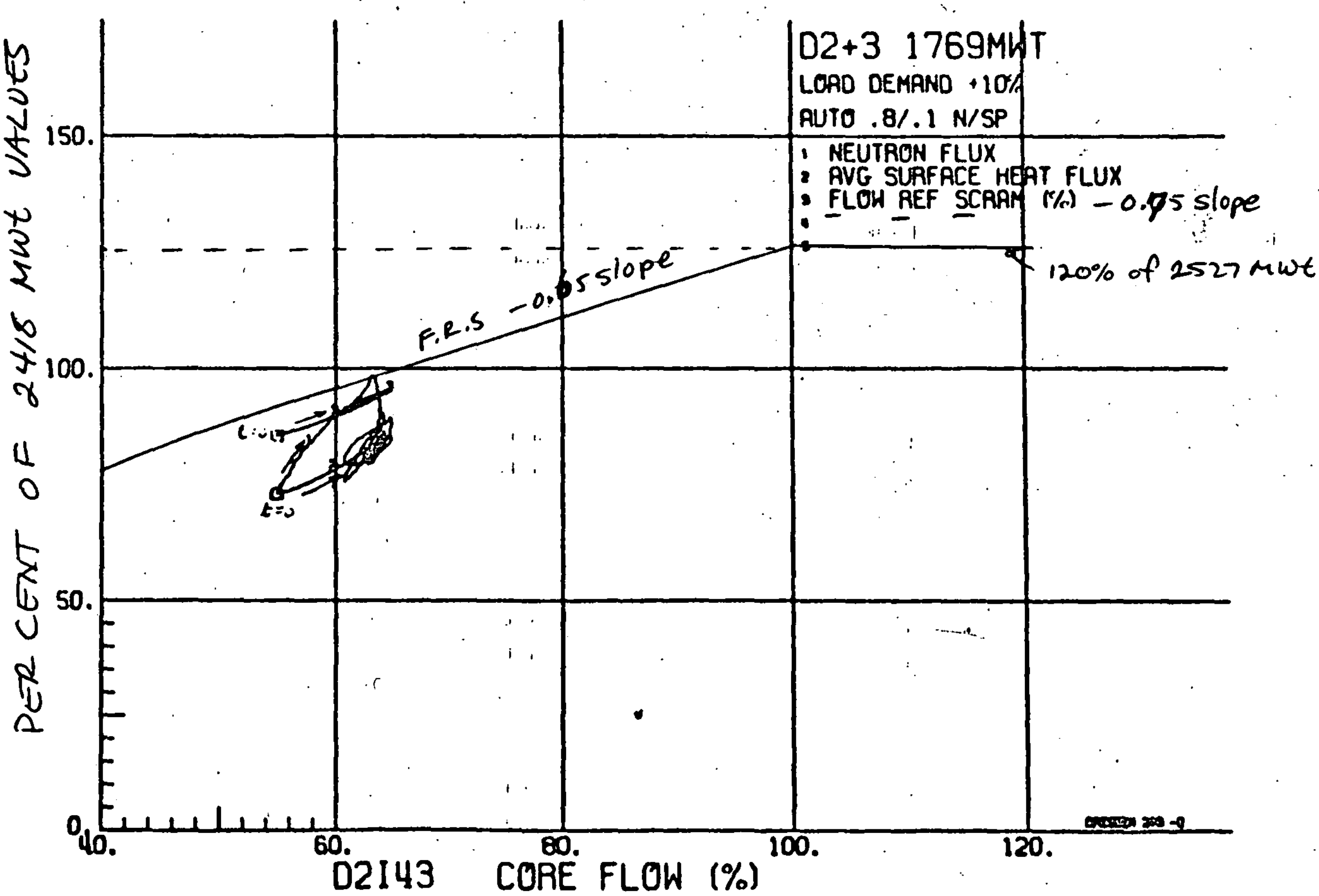


FIGURE 121. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%

Fig 2C-2

221.18

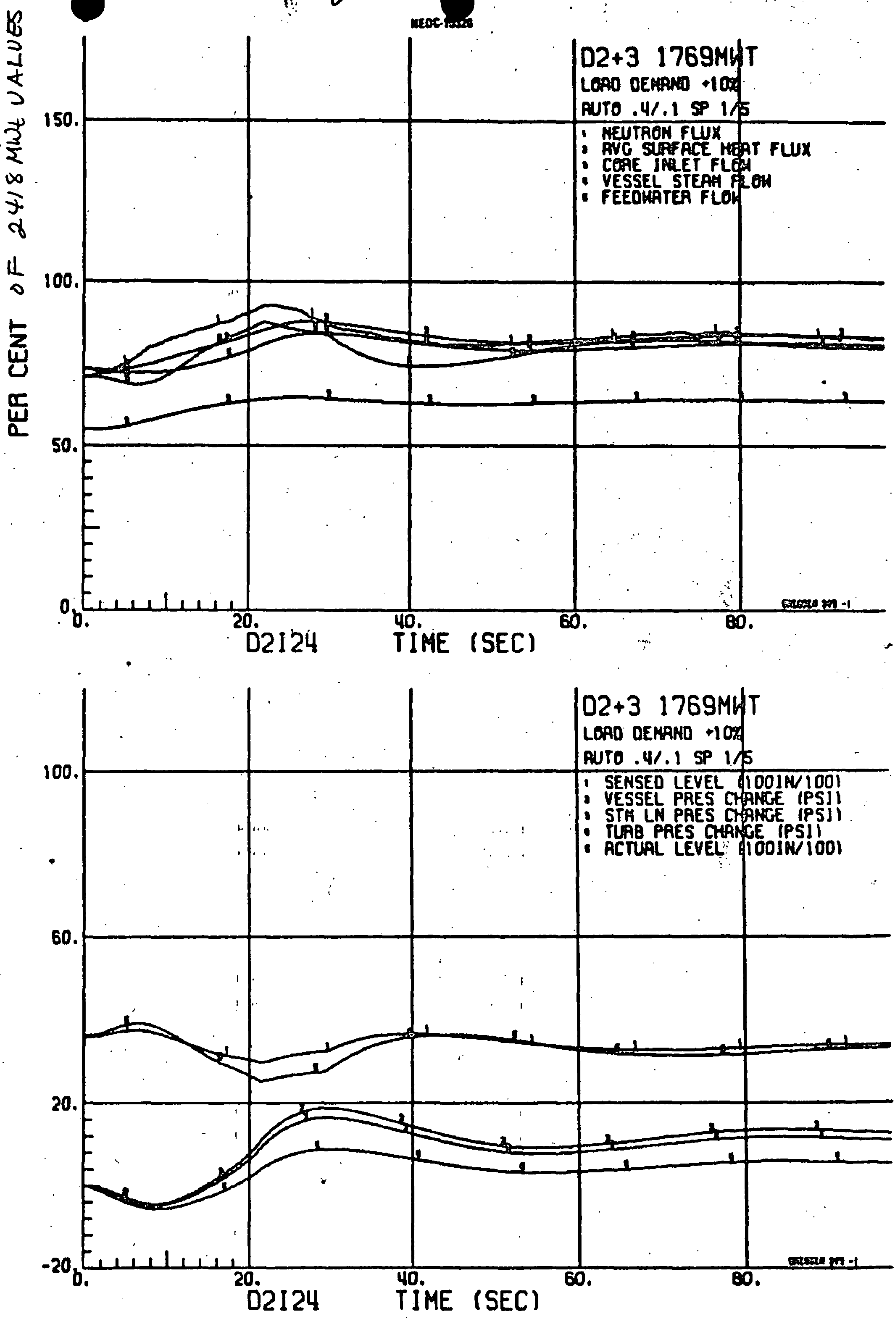


FIGURE 123. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1.0 psi/%, Adjuster Time Constant = 5 sec

Fig 20-1

Fig 20-2

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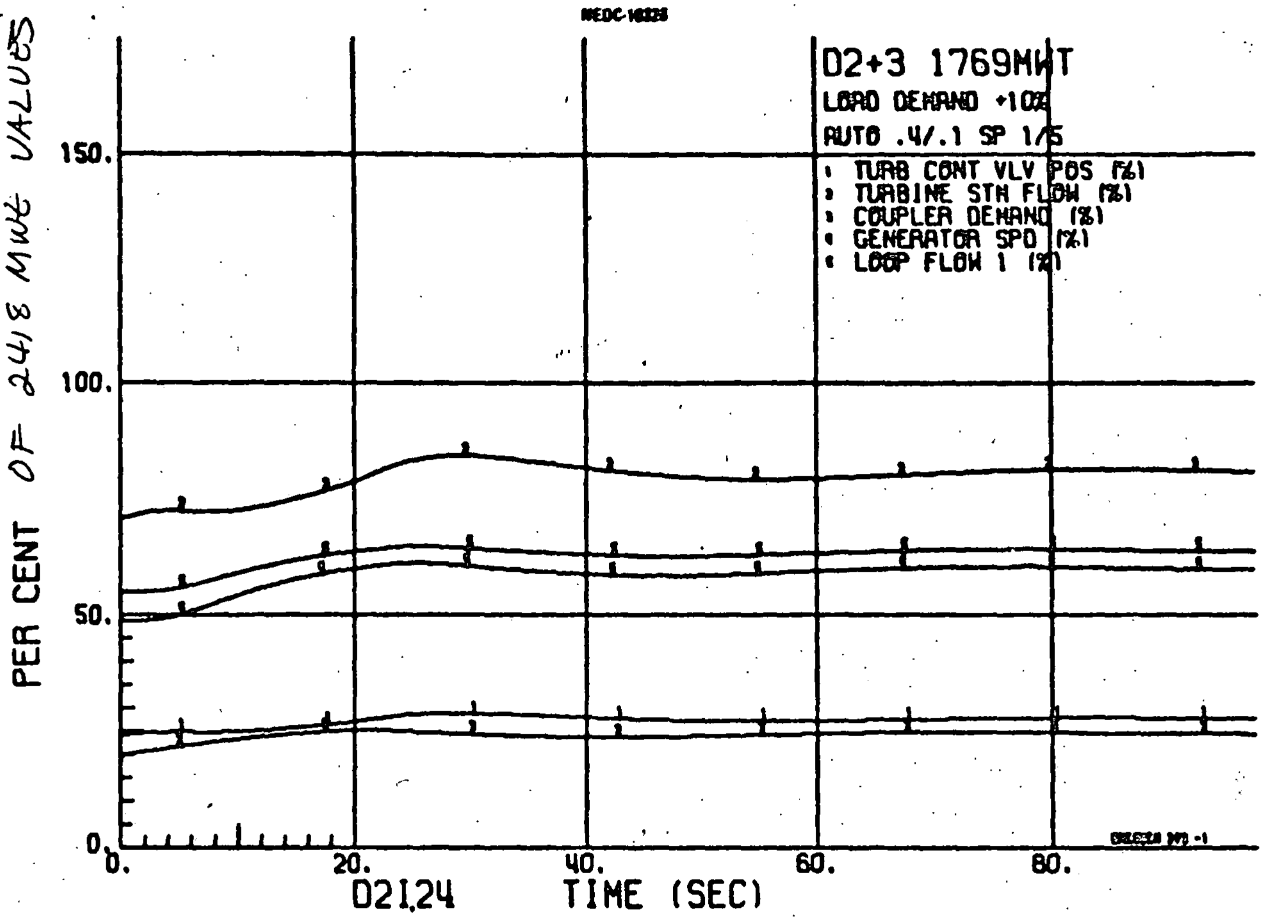


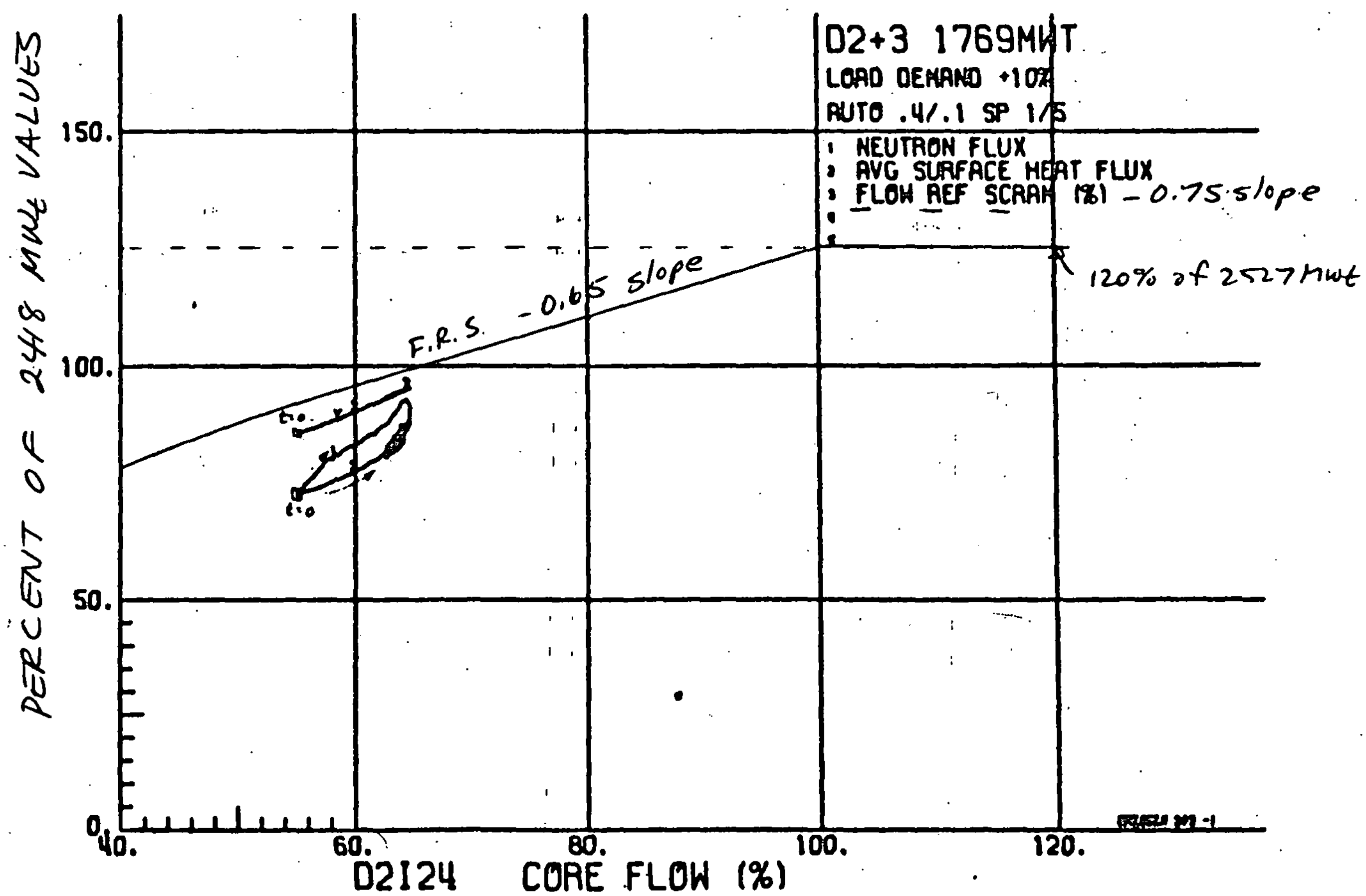


FIGURE 123. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .4%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1.0 psi/%, Adjuster Time Constant = 5 sec

Fig 20-2

221.20

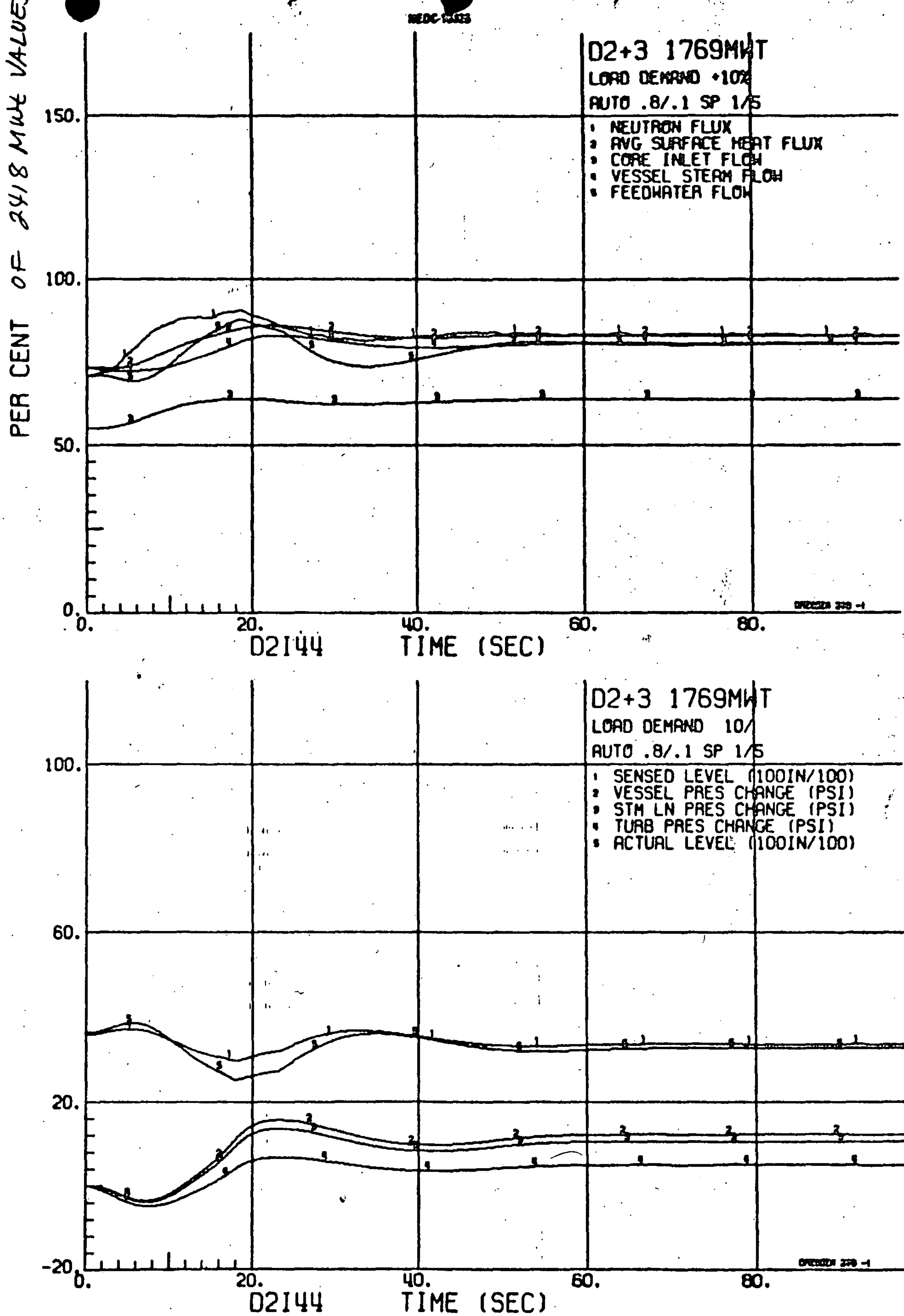
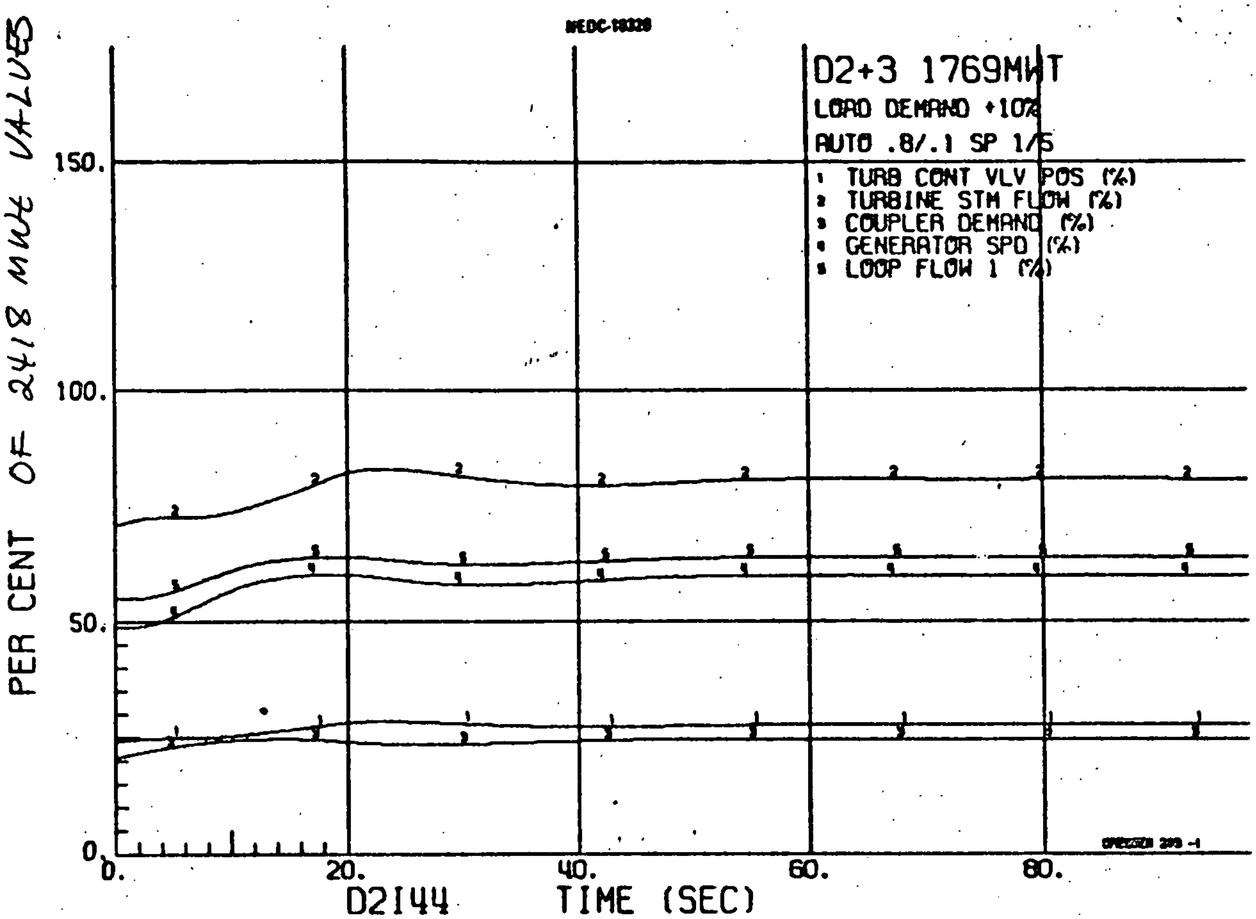


FIGURE 131. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1 psi/%, Adjuster Time Constant = 5 sec

Fig 2E-1



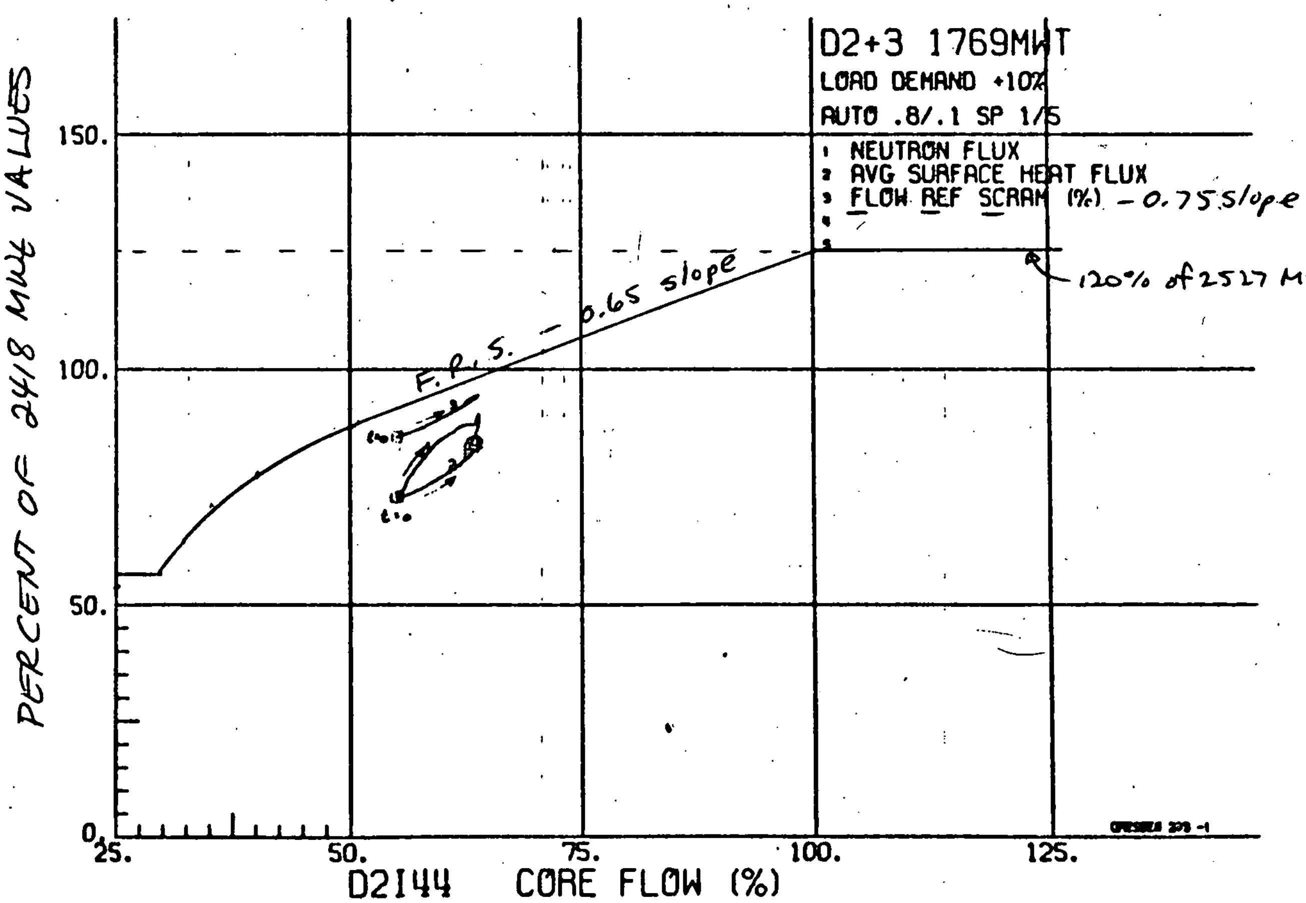


FIGURE 131. 73% Power, 55% Core Flow, +10% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1 psi/%, Adjuster Time Constant = 5 sec

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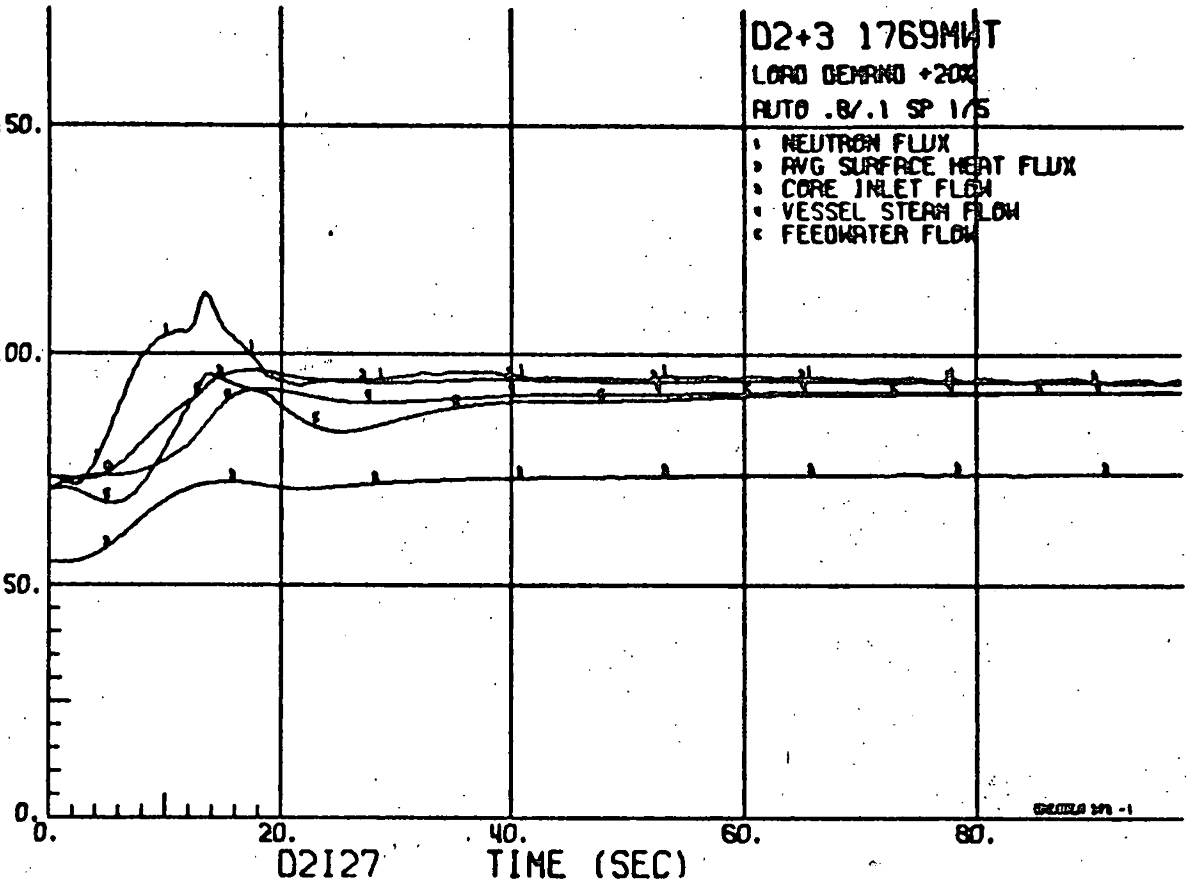


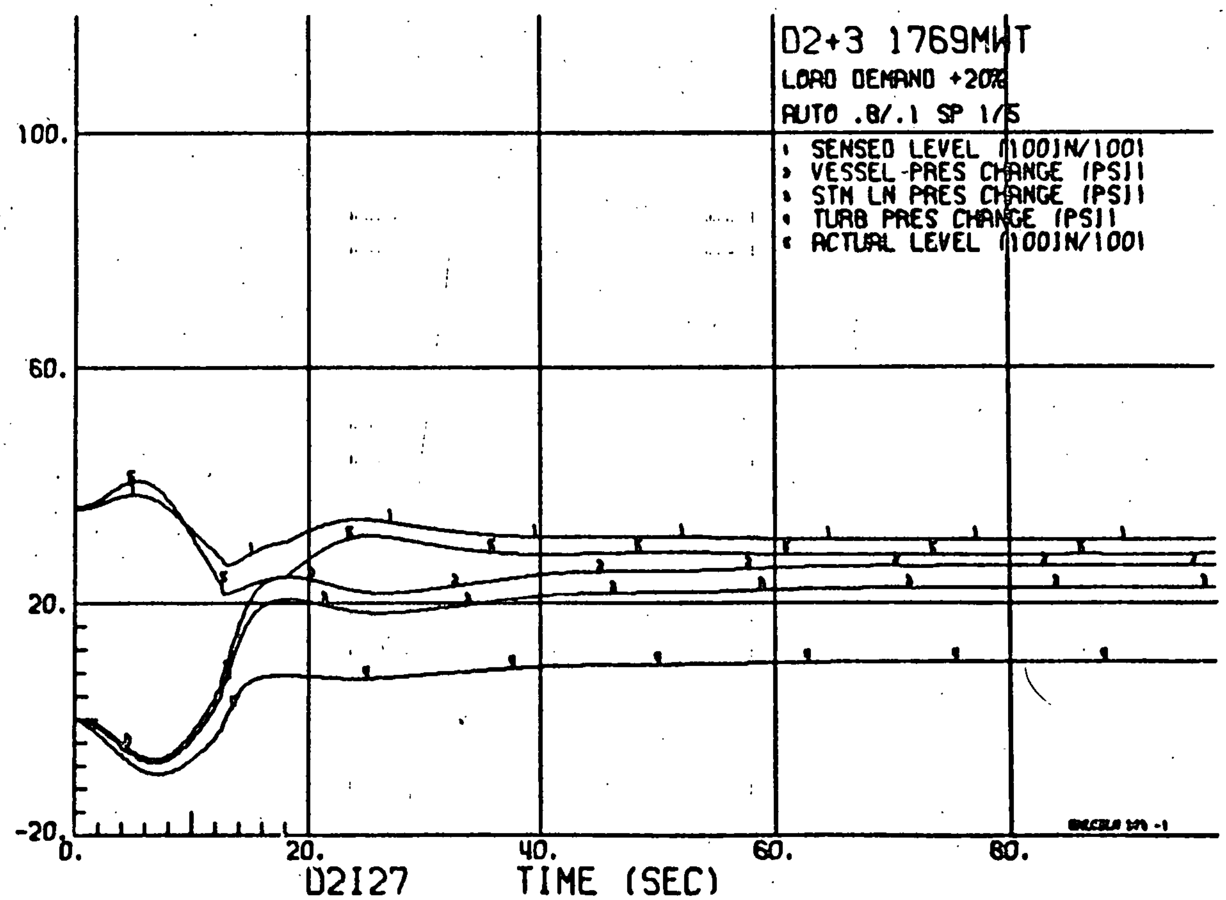


FIGURE 136. 73% Power, 55% Core Flow, +20% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1 psi/%, Adjuster Time Constant = 5 sec

Fig 2F-1

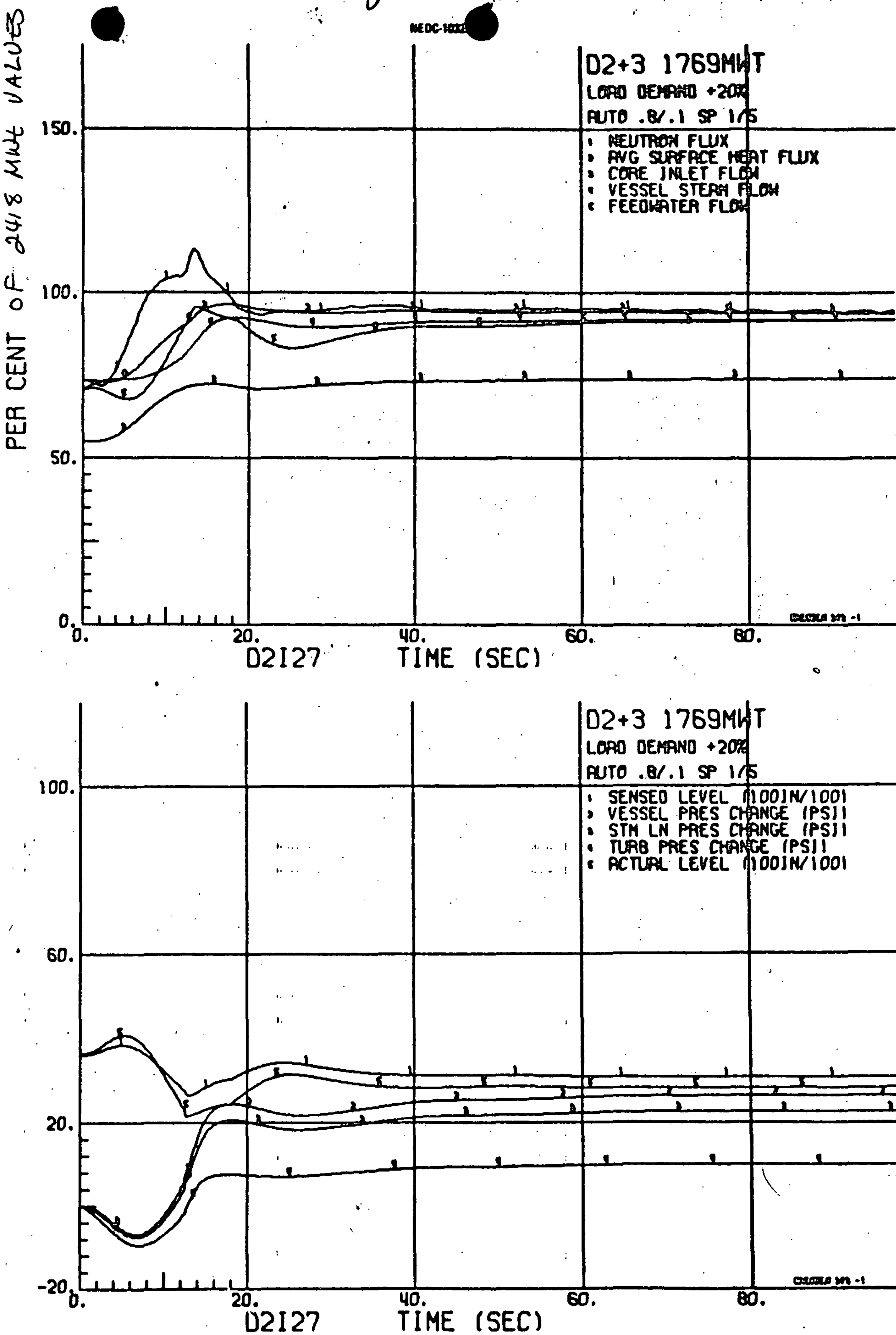
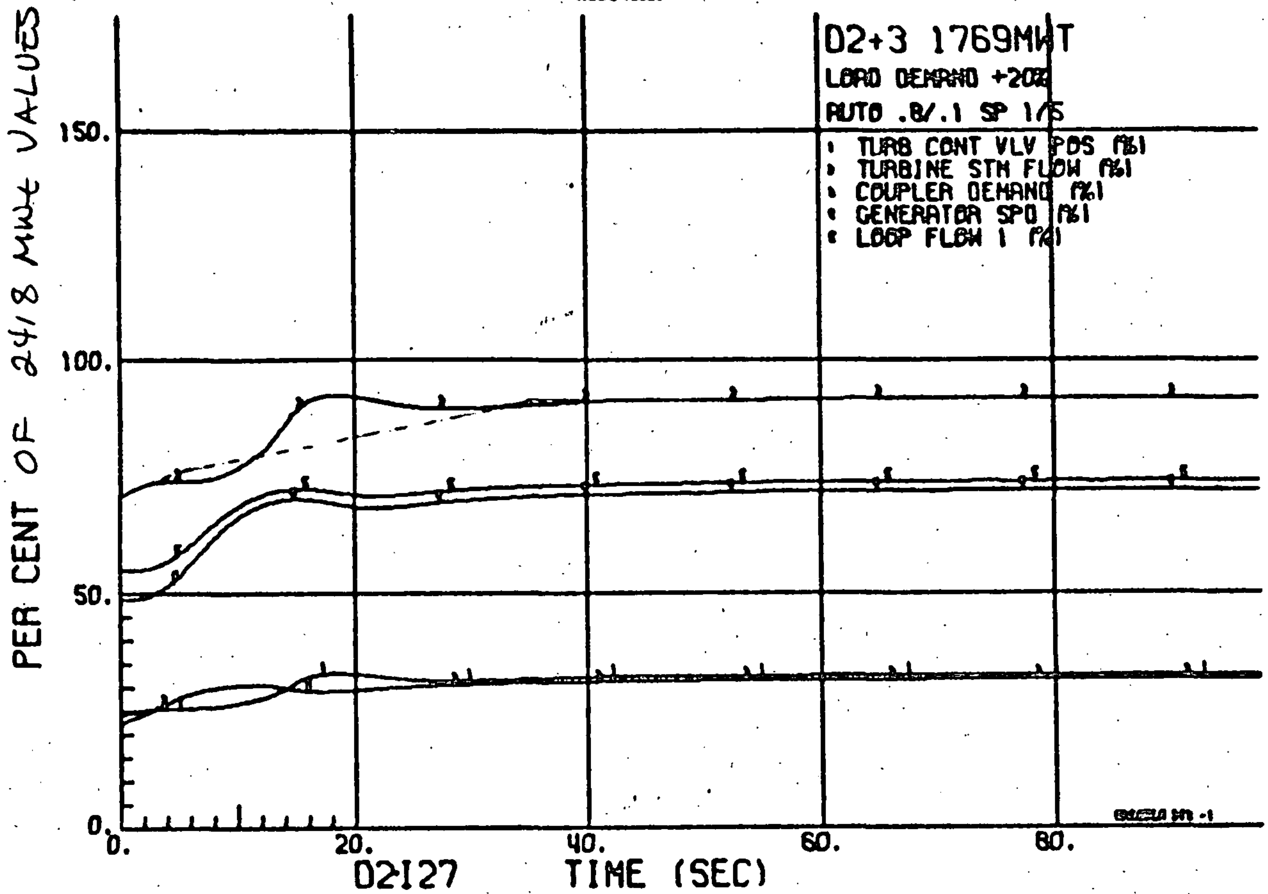


FIGURE 136. 73% Power, 55% Core Flow, +20% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1 psi/%, Adjuster Time Constant = 5 sec

Fig 2F-1

Fig 2F-2



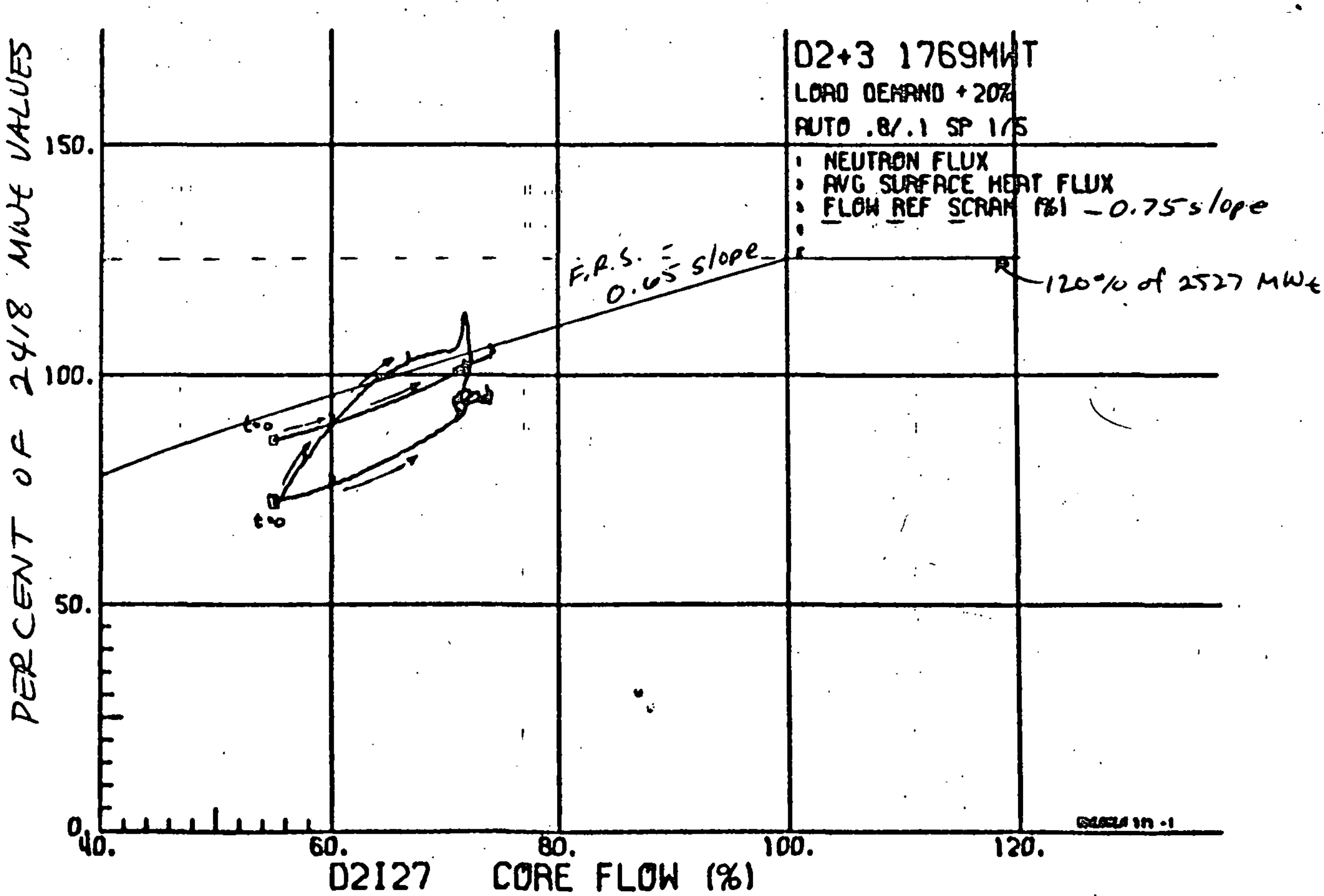
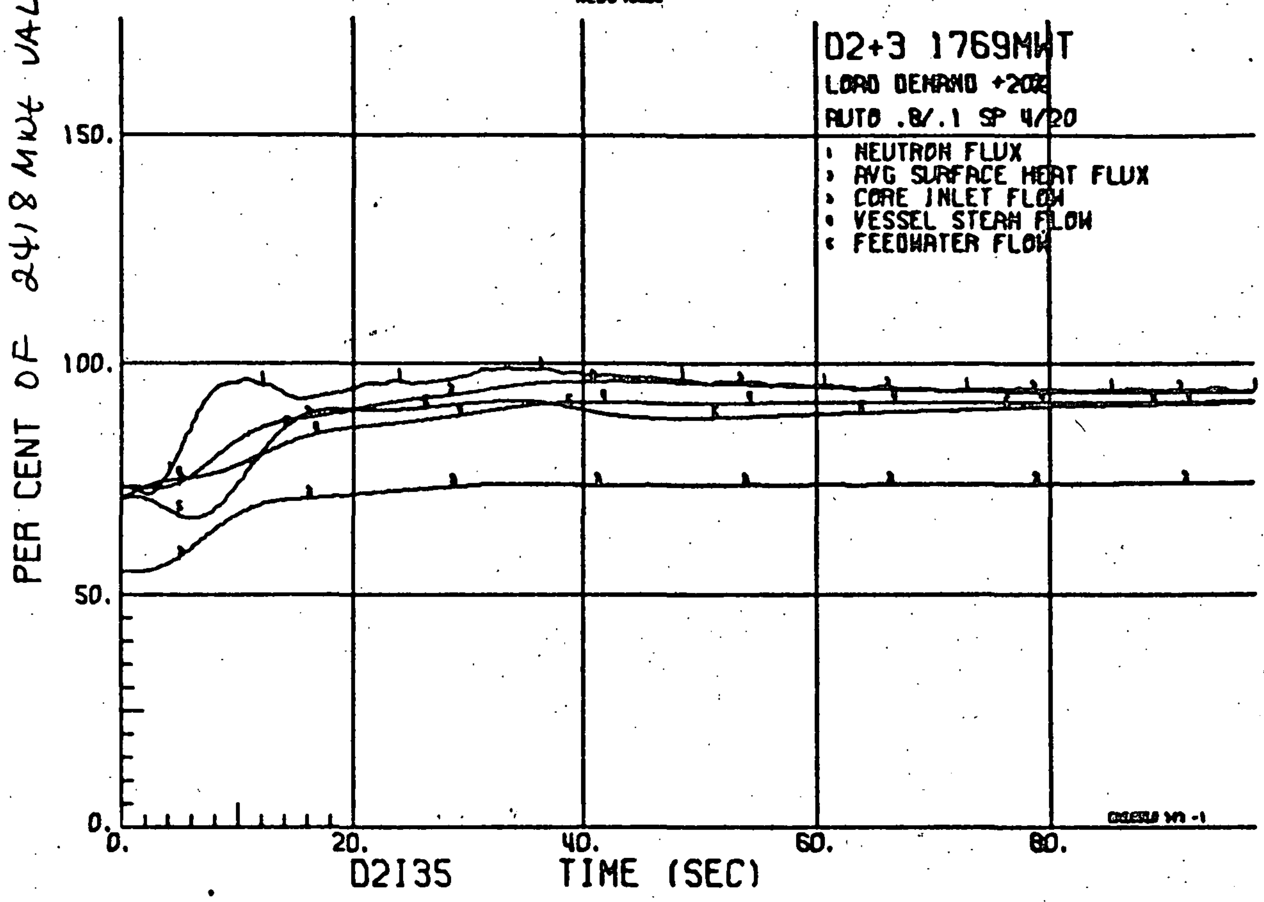


FIGURE 136. 73% Power, 55% Core Flow, +20% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 1 psi/%, Adjuster Time Constant = 5 sec

Fig 2F-2

221.25

Fig 26-1



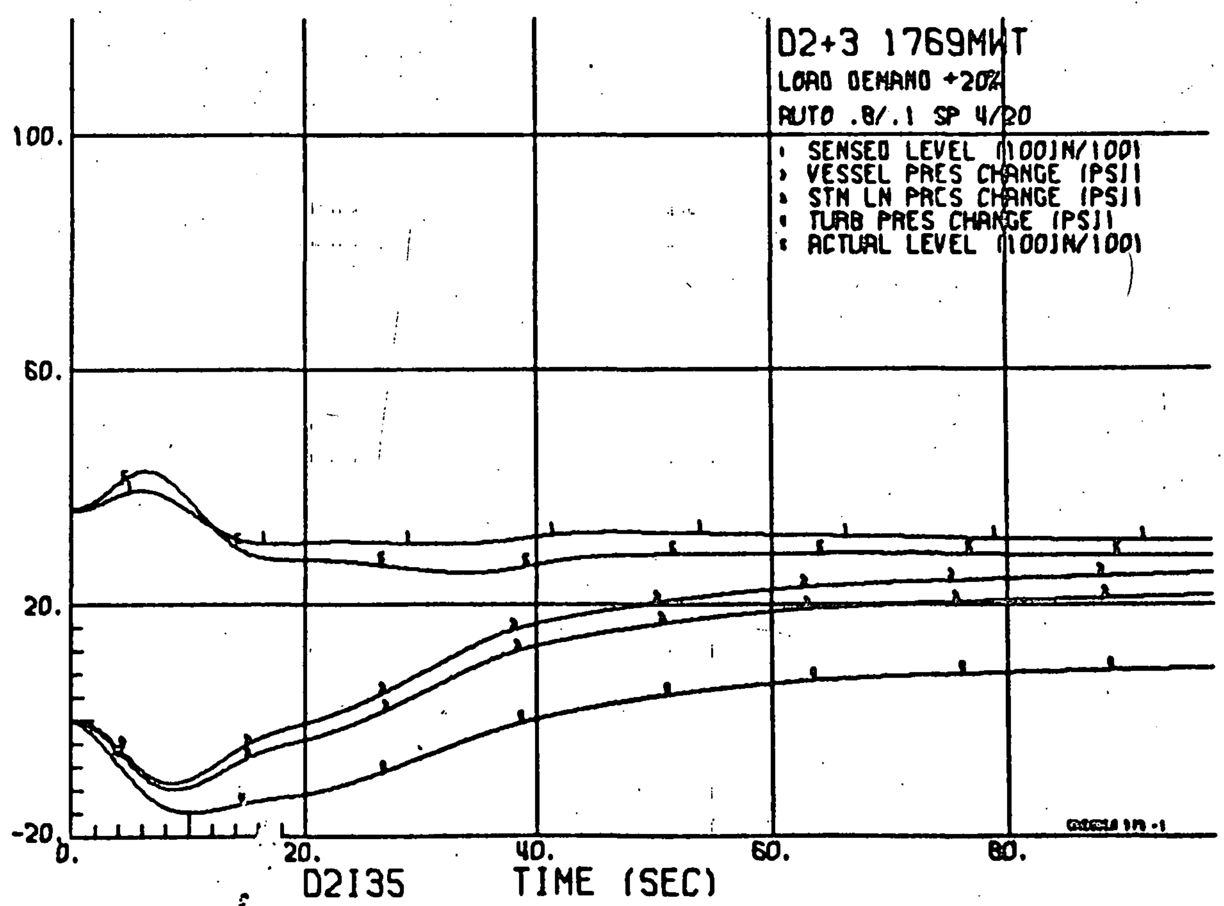
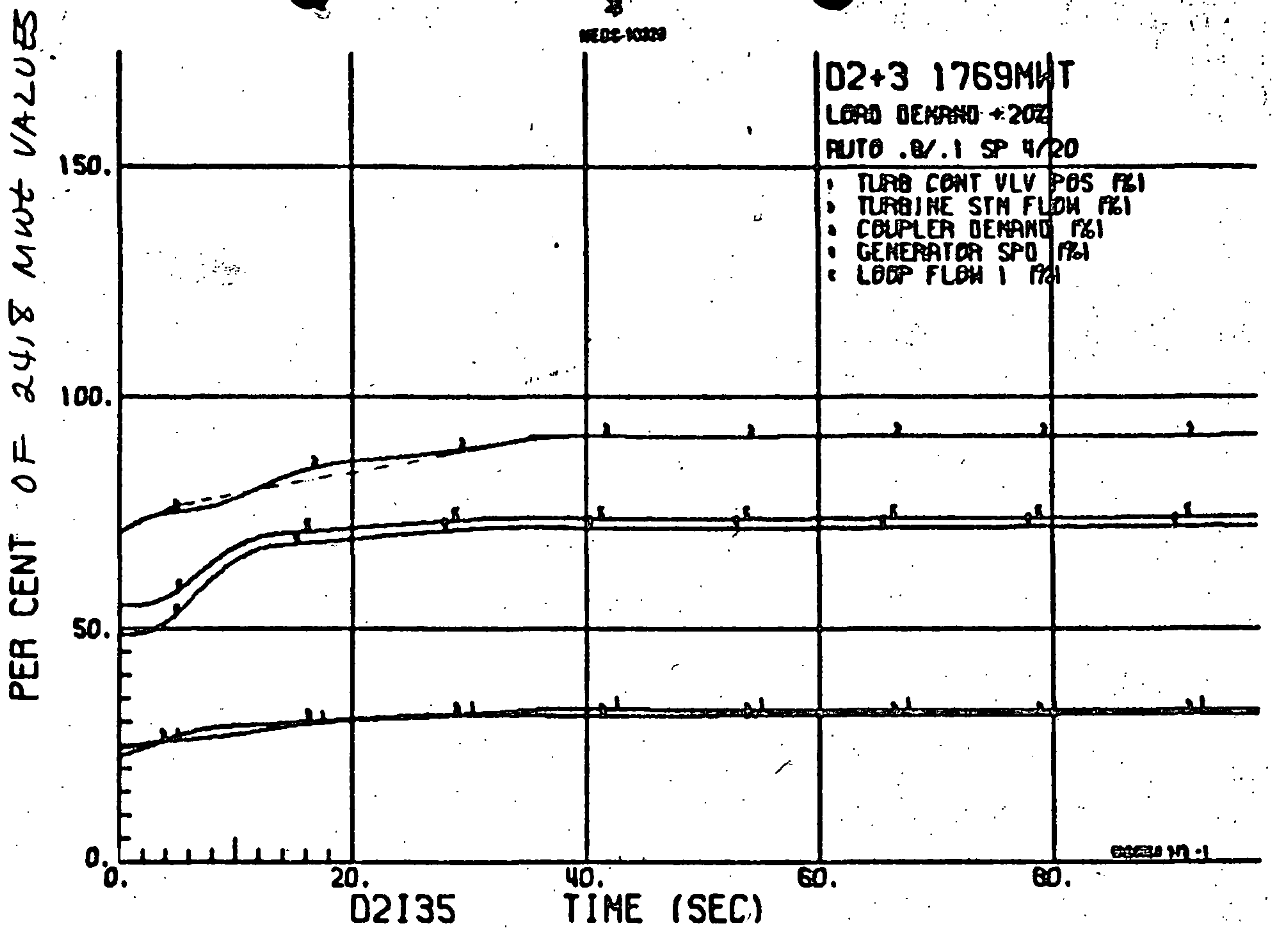


FIGURE 138. 73% Power, 55% Core Flow, +20% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 4 psi/%, Adjuster Time Constant = 20 sec

Fig 26-1



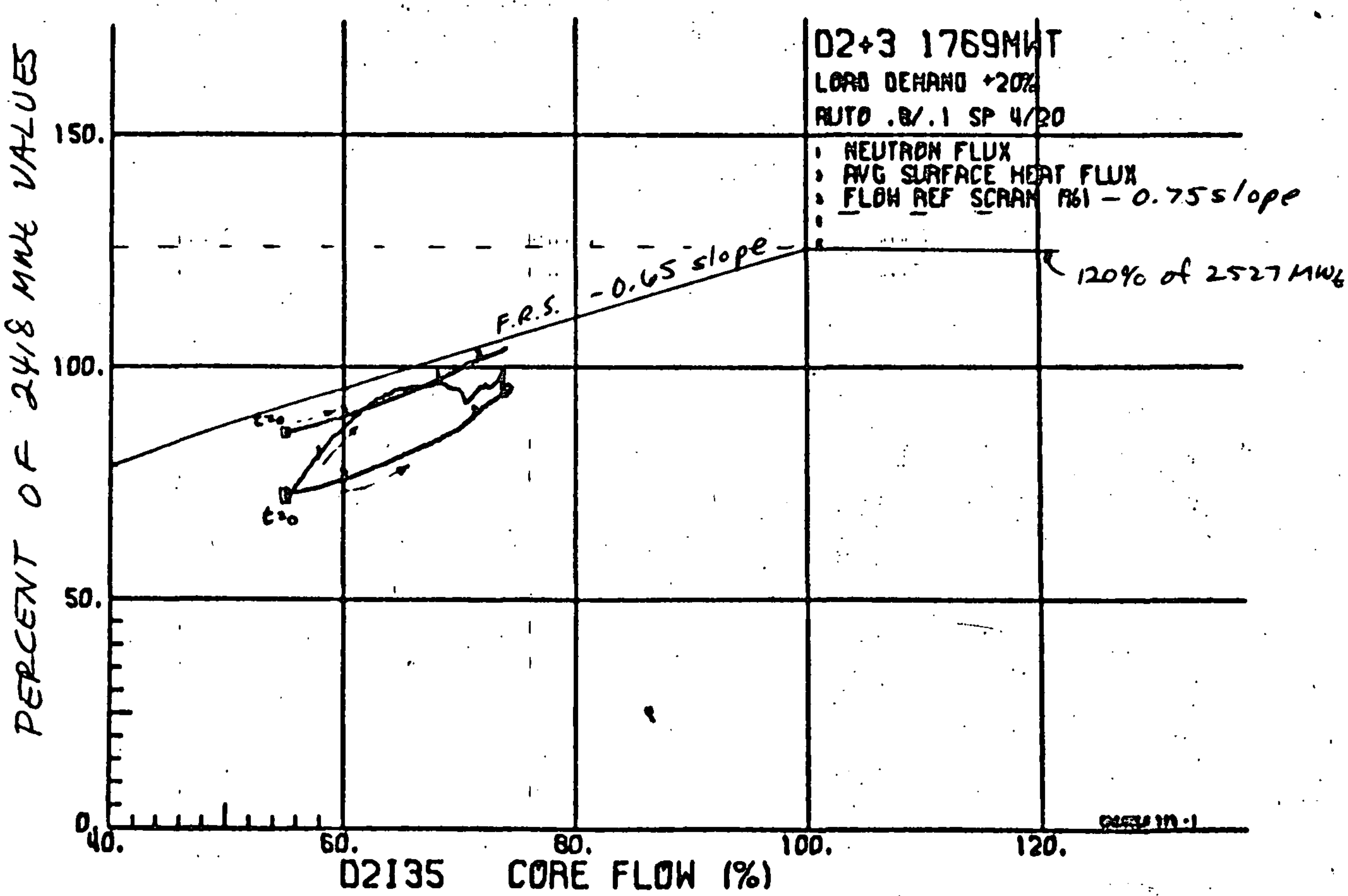
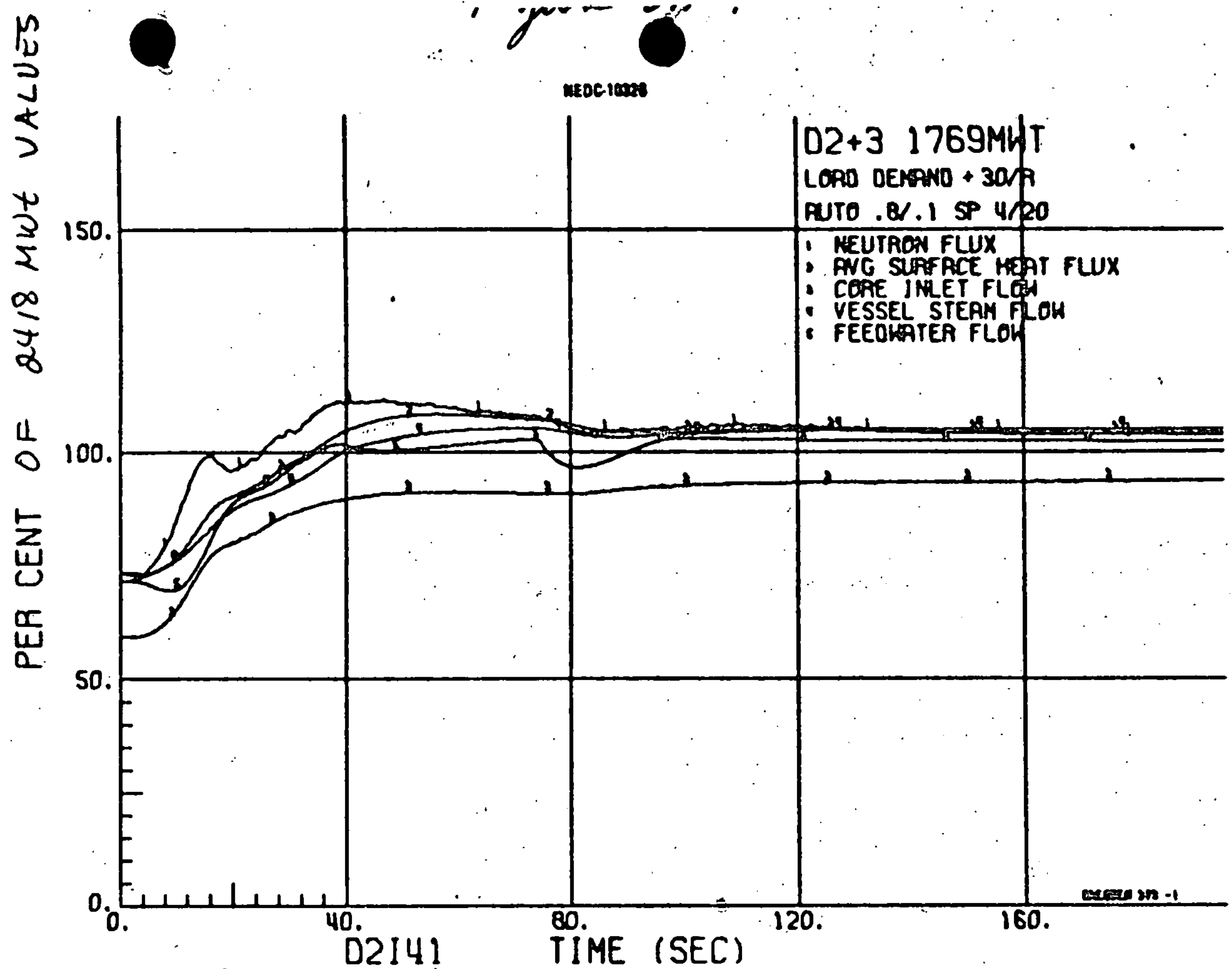


FIGURE 138. 73% Power, 55% Core Flow, +20% Master Controller Step, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 4 psi/%, Adjuster Time Constant = 20 sec



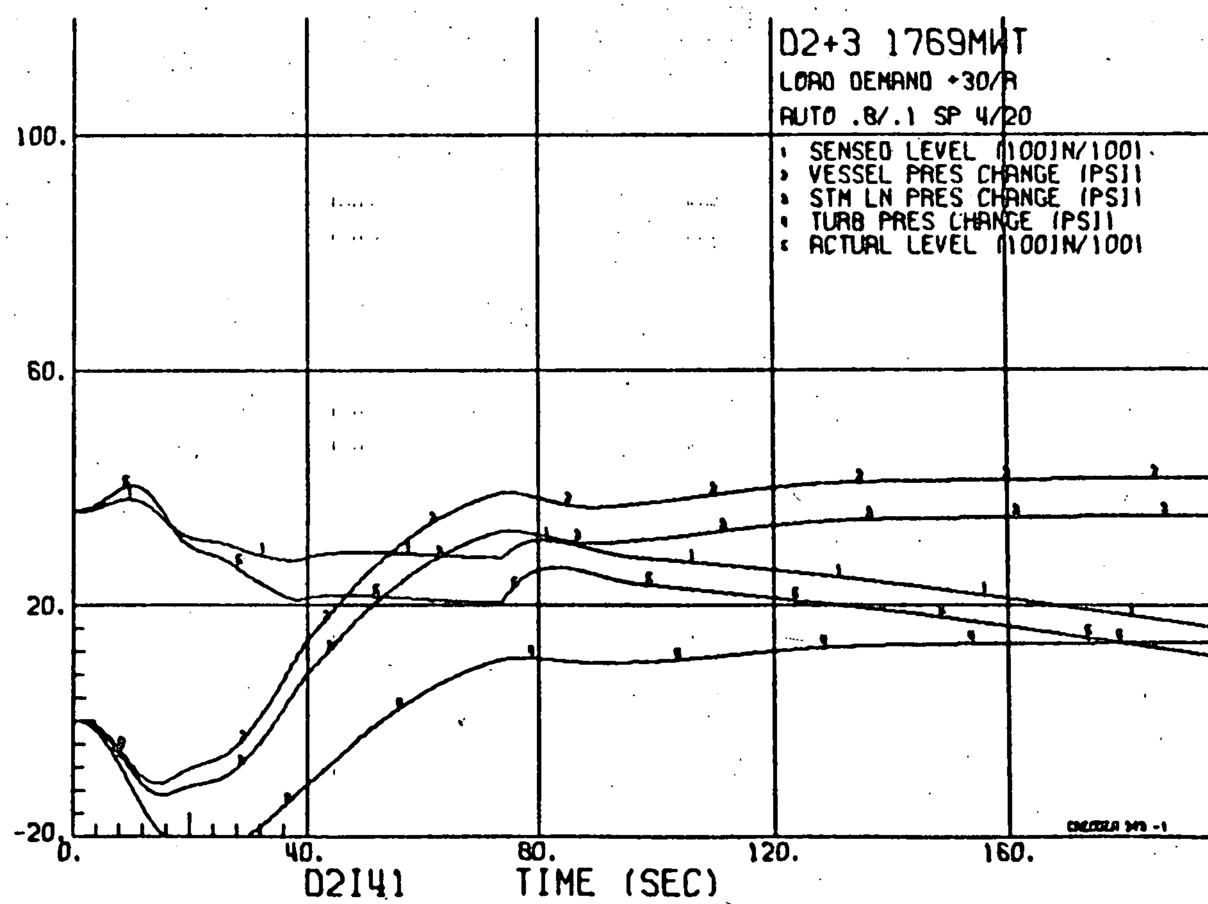


FIGURE 141. 73% Power, 55% Core Flow, +30% Master Controller Ramp, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 4 psi/%, Adjuster Time Constant = 20 sec

Fig 3A-1

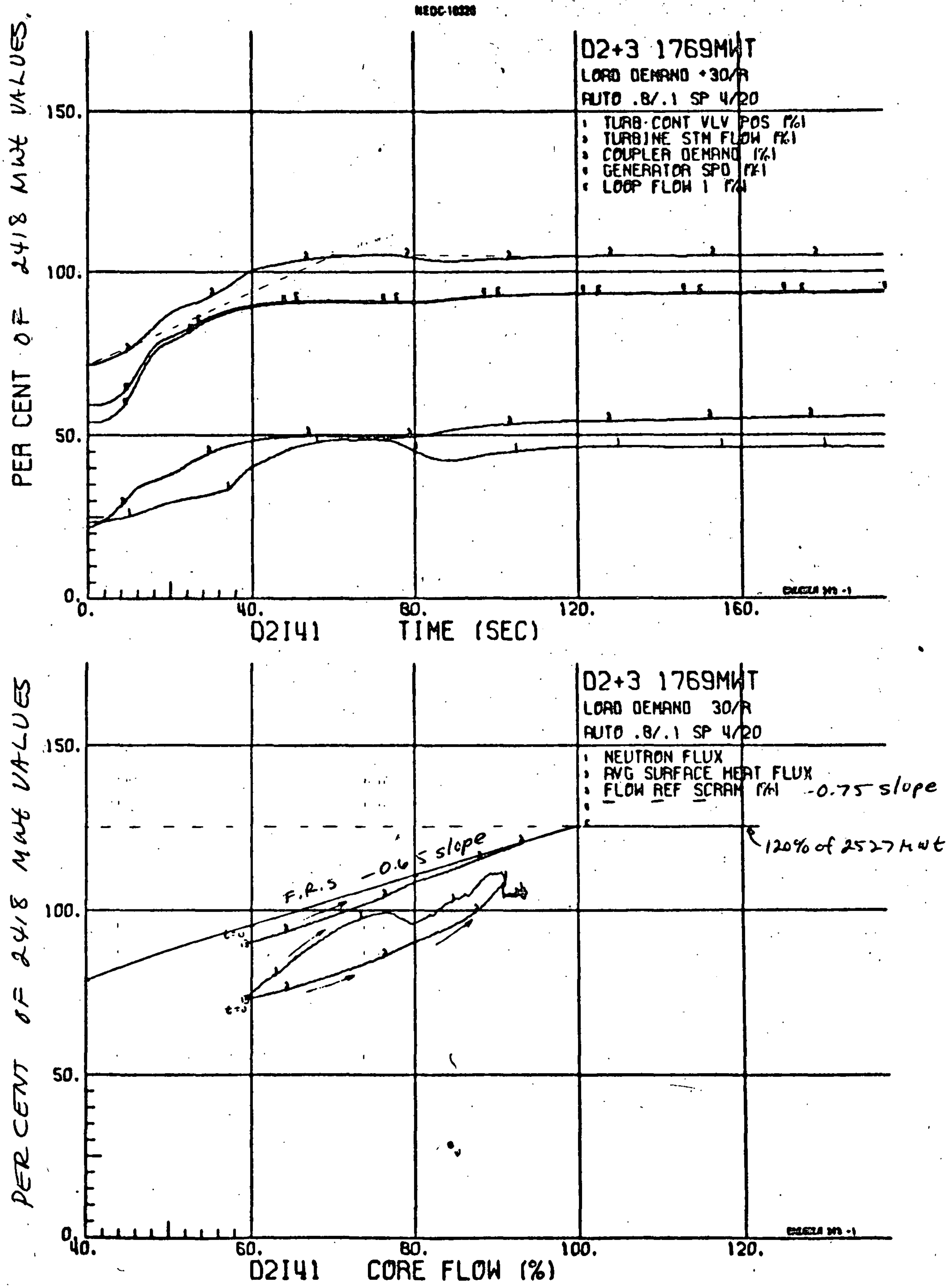


FIGURE 141. 73% Power, 53% Core Flow, +30% Master Controller Ramp, K(PROP) = .8%/%, K(reset) = .1%/sec/%, Adjuster Gain = 4 psi/%, Adjuster Time Constant = 20 sec

Fig 3A-2