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10-28-80

COMPILATION OF DATA FROM EBR-II NATURAL-CIRCULATION-TEST PROCEDURE EX-140, SECTION IV, ADDENDUM 8A

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EBR-II PROJECT
ARGONNE NATIONAL LABORATORY
Argonne, Illinois - Idaho Falls, Idaho

May 1980

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ABSTRACT

The transition from forced to natural-circulation flow of primary coolant after loss of primary pumping power with concomitant reactor scram has been experimentally examined in Experimental Breeder Reactor No. II. In addition, the electrical power to the secondary-system pump was cut off several seconds after the loss of primary-system pumping power. Before the transient, the reactor was operated at 21.8 MWt (36.3% of the normal full-power value) and 40.0% of normal full primary flow. All electrical power to the primary pumping system was abruptly cut off, thereby causing the flow rate of the primary-system coolant to coast down. The loss of primary pumping power caused a scram, which immediately shut down the reactor. About 17 s after the primary pumps were tripped, the secondary-system pump was also tripped, causing the flow in the secondary system to coast down. The decrease in secondary-system flow reduced the net buoyant driving force for natural circulation in the primary coolant system. As a result, the flow in the primary system was lowered and the peak temperatures increased from the levels that would have existed if the secondary pump had been tripped later or not at all. Data were collected by the EBR-II data-acquisition system from the usual plant process instrumentation and instrumented subassembly XX08. The method used to correct the data for signal offsets is discussed. The corrected test data are presented graphically in the appendix.

I. INTRODUCTION

For liquid-metal fast breeder reactors (LMFBR's) to make a commercial-scale contribution to the electric-power needs of the United States, the regulatory agencies and the public must be assured of the operating safety of such plants. Experimental verification of a smooth transition into natural-circulation flow after a protected loss of all plant pumping power could be a significant factor in providing this assurance. To provide information on the natural-circulation phenomenon in an LMFBR, several tests have been conducted in Experimental Breeder Reactor No. II (EBR-II) as part of the experimentation with instrumented subassembly XX08.[1]

This program consisted of two different types of tests. The first type consisted of tests[2-6] initiated from low reactor decay power levels (a maximum of 1.26% of the full operational power). All but one of these tests consisted of coastdowns from the flow level (approximately 5.5% of normal full flow) provided by the auxiliary electromagnetic (EM) primary pump, which is in the reactor outlet pipe. The auxiliary-pump-coastdown tests, summarized in Ref. 7, were intended to provide data on the dependence of minimum natural-circulation flow rates and maximum coolant temperatures on (1) the fission-product-decay power level and (2) the initial temperature distribution in the intermediate heat exchanger (IHX). This temperature distribution is determined by the ratio of primary-system to secondary-system flow rates through the IHX and affects natural-circulation flow by creating an initial buoyancy distribution within the primary-system coolant. Generally speaking, with a fixed initial primary-system flow rate, a higher secondary-system flow rate will result in a higher minimum natural-circulation flow and lower maximum temperatures in the primary system. These effects result from the greater average primary-sodium density (because of the lower average temperature) in the IHX with the increase in secondary-sodium flow rate.

The remaining test that was initiated at low fission-product-decay power is referred to as XX08 Test 10.[6] This test differed from the others in that the initial flow rates before the coastdown were provided by the two mechanical pumps in the primary system rather than by the auxiliary EM pump. Four separate coastdowns were run in this test, with the first three initially at 100% of normal full operating flow and the fourth at approximately 34% of normal ful flow. This test thus provided additional data on the effects of different primary-to-secondary flow ratios and also provided a base-case coastdown for use as a reference curve in the next type of test.

The second type of test in the XX08 natural-circulation program was initiated with the reactor operating at some substantial fission power and flow rate. This type of test would be more similar to a loss-of-pumping-power accident in an operating LMFBR. The first test of this type is referred to as XX08 Test 7A and is discussed in Ref. 8. The coastdown was initiated at a reactor power of 17.1 MWt (28.5% of the normal full-power value) and 32.1% of the normal full operational flow. The secondary-system flow was set at 29.9% of full flow and was held at that level through the major portion of the transient. After the temperatures in the primary system reached their peak transient values, they began to decrease to their near-equilibrium values as natural circulation was established. At this time (approximately 3 min after the primary-pump trip), the secondary-system pump was turned off. All transient temperatures observed during Test 7A remained below their corresponding values reached under full-power and full-flow operating conditions. The flow coastdown exhibited the expected behavior, with a smooth transition from forced to natural-circulation flow.

The second natural-circulation test initiated from fission-power conditions was designated as XX08 Test 7C and is described in Ref. 9. The initial conditions of this test were slightly more severe than for Test 7A, with a power level of 22.0 MWt (36.7% of normal full power) and 39.0% of the normal primary-system flow rate. The secondary-system flow rate was 37.4% of its full-scale value and was, as before, held constant during the transient period. During the transient, the flow and temperature responses showed no adverse characteristics and, in fact, closely followed the predicted behavior. The effect of the more severe initial conditions for Test 7C was reflected in higher transient temperatures, but the maximum values were still below their corresponding full-power values.

The next phenomenon to be examined in the XX08 effort was the dynamic effects of a secondary-system-flow coastdown on the natural-circulation behavior of the primary system. As was observed previously in the program, a higher secondary-system flow rate through the IHX will create a temperature distribution in the primary system that induces higher natural-circulation flow and lower temperatures. For this reason, the first two tests initiated at fission power--i.e., Tests 7A and 7C--were designed so that the secondary-system flow would remain at its initial value throughout the transient, thereby reducing the transient temperatures in the primary system. In a true loss-of pumping-power accident, however, a coastdown could be initiated in the secondary system as well as in the primary system, and the temperatures in the primary system would be adversely affected.

One of the earlier XX08 tests[3] consisted of a simultaneous loss of electrical power to the auxiliary EM pump in the primary system and to the secondary-system pump. The effects of the simultaneous loss of electrical power was observed to be benign in this test because of a combination of factors including low initial power, low initial flow rates, and the different rates of flow coastdown in the two systems. Analyses have shown, however, that under initial conditions more typical of those in an operational LMFBR, a coastdown in the secondary system could have more significant effects on temperatures in the primary system. For EBR-II, analyses presented in Ref. 10 indicate that the maximum primary-coolant temperature is strongly dependent on the time delay between reactor scram and loss of pumping power to the secondary-system pump until the delay is approximately 30 s. Any additional delay was shown to have virtually no affect on maximum in-core temperatures, because the maximum values would have already been reached before the secondary-system coastdown.

Based on the results obtained thus far in the XX08 program and the analyses in Ref. 10, the next test was designed to be initiated at the same initial conditions as Test 7C, but the secondary-system flow would be tripped approximately 30 s after the primary-pump trip. This test would therefore show the effects of a secondary-system coastdown, but these effects would not be as severe as those expected with a shorter delay between pump trips.

Reference 11 presents the data for this test, which is referred to as XX08 Test 8. The initial conditions for this transient included a steady-state power level of 22.3 MWt (37.2% of normal full power) and 39.3% of the normal full primary-system flow rate. The secondary-system flow was at 37.9% of its full value. Electrical power to the primary-system pumps was terminated with the simultaneous opening of the 2400-V breakers and the clutch breakers on the motor-generator set. The reactor was scrammed about 1.8 s after the breakers were opened. Thirty-two seconds after the breakers were opened, the electrical power to the secondary-system pump was tripped, thereby causing a flow coastdown in this system. As was anticipated, the effect of the secondary-system trip after a 32-s delay on the maximum primary-system temperature was relatively modest. As compared to Test 7C, which was essentially the same transient without the secondary-system coastdown, the top-of-core and subassembly outlet coolant temperatures in Test 8 were only about 5-15°F (3-8°C) higher, and the minimum convective flow rate as measured in instrumented subassembly XX08 was decreased from 2.8% in Test 7C to 2.4% of normal full flow in Test 8.

With these experimental results and the analytical capabilities that had evolved over the test program, we believed that we had a firm basis for conducting a more severe natural-circulation test. The analytical models indicated that a delay of approximately 15 s between the primary- and secondary-system trips would result in peak core temperatures about 45°F (25°C) higher than those realized in Test 7C and a minimum convective flow in the primary system of about 1.7% of normal full flow compared to the 2.8% minimum flow in Test 7C. As the expected peak temperatures remained below the overall limits set on the XX08 test program, we decided that the next, and last, XX08 natural-circulation test would incorporate a 15-s delay between the pump trips.

EBR-II Test Procedure EX-140, Section IV, Addendum 8A (hereafter called XX08 Test 8A) was written, and the test was conducted on March 29, 1979. As with the three previous tests initiated from fission power, Test 8A included operation of the reactor at the desired power and flow conditions for approximately 3 h to build up a near-equilibrium inventory of fission products. The procedures called for the primary-system pumps to be tripped in the same manner as in each of the previous tests, i.e., the simultaneous opening of the 2400-V breakers and the clutch breakers. However, because of a misunderstanding on the part of the operator who opened the switches, the coastdown for Test 8A was initiated by opening only the clutch breakers. This mode of pump trip produces a greater frictional drag on the pump shafts, and as a result the coastdown progressed more rapidly than in the previous tests. Although this feature makes a direct comparison of the experimental data somewhat more difficult, the qualitative features of the shorter time delay between pump trips can be ascertained. The analytical model describing flow coastdowns and natural-circulation phenomena in EBR-II is capable of handling both types of coastdown so that all experimental measurements can be directly compared with analytical results.

II. PLANT CONDITIONS

Before reactor startup for Test 8A, the configuration shown in Fig. 1 was loaded into the first seven rows of the reactor. The subassemblies shown in the figure were surrounded by stainless steel reflector subassemblies in rows 8-10 and depleted-uranium blanket subassemblies in rows 11-16. The temperature of the primary-tank sodium had been reduced from the normal operating temperature of 700°F (371°C) to approximately 665°F (352°C) to provide a greater margin to the maximum allowable test temperatures. An approach to power was begun by establishing a primary-system flow rate of approximately 40.7% of the normal operating value and then increasing the reactor power. A final steady-state power of 21.8 MWt (36.3% of the normal full-power value) was eventually reached. This power is consistent with the 22.0-MWt value for Test 7C, which serves as a reference case for Test 8A. The reactor power was held at 21.8 MWt for approximately 3 h to establish a near-equilibrium state of the fission-product inventory throughout the reactor. During this time, the secondary and steam systems also reached near-equilibrium conditions.

After the 3-h period of steady-state operation, the electrical power to the auxiliary EM pump was removed, causing the primary-system flow rate to decrease slightly to 40.0%. The mixed mean reactor outlet coolant temperature increased from 838°F ($\sim$448°C) to 839°F ($\sim$449°C). The conditions in the secondary and steam systems were not affected by turning off the auxiliary pump. Table I lists several of the significant parameters just before the initiation of the primary-pump trip.

Comparison of the data in Table I with the corresponding data in Ref. 9 for Test 7C and Ref. 11 for Test 8 shows that the initial conditions for all three tests were quite similar. The steady-state power and flow levels are slightly different, but the differences can be easily handled in the analyses of the test data. Furthermore, the differences are small enough that they will have no substantive effect on a direct comparison of the experimental data. As noted earlier, however, the actual pump-trip mode used in Test 8A resulted

C = Control rod

D = Driver fuel

K = Structural dummy

P = ½ driver fuel, ½ SS

PLUG = Instrumented-subassembly plug

R = SS reflector

S = Safety rod

SSDR = Stainless steel drop rod

X = Experimental subassembly

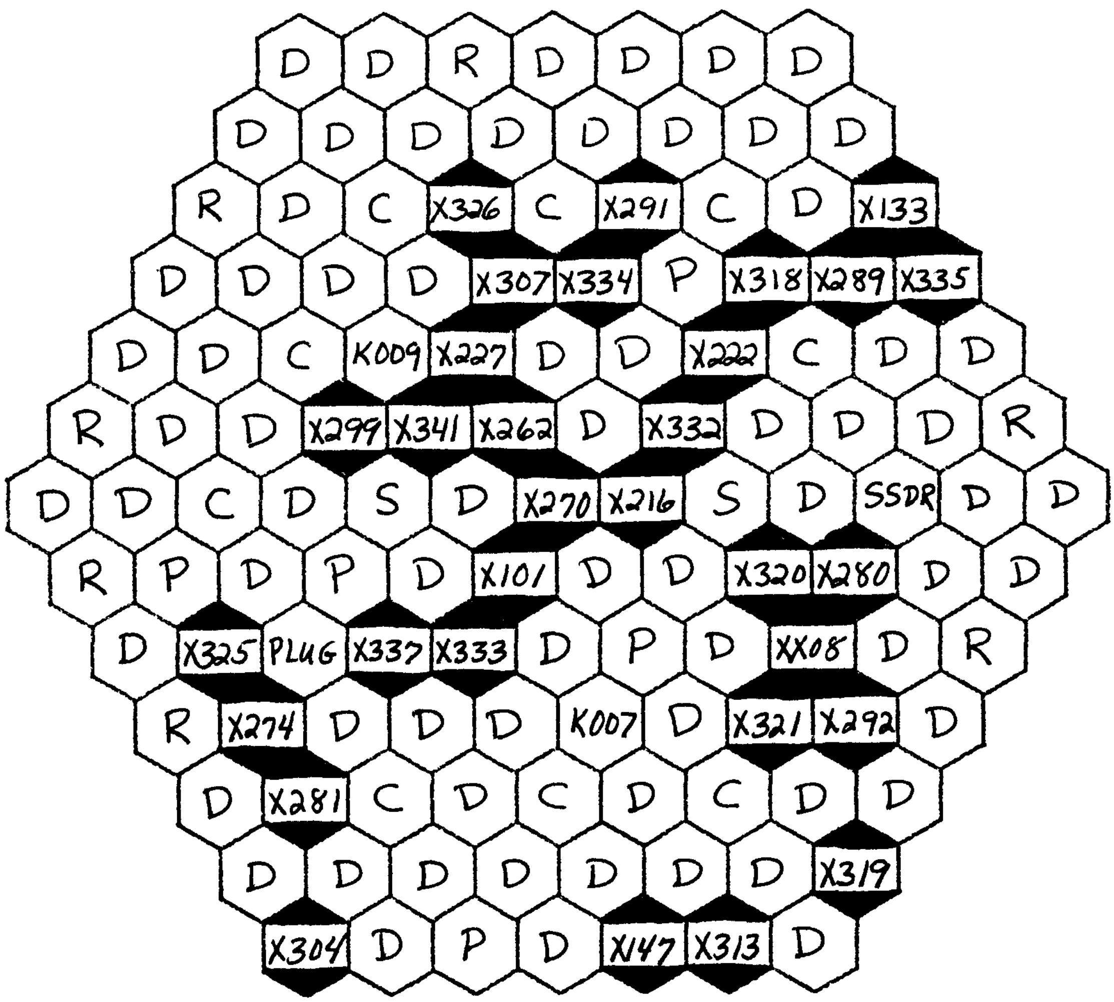


Fig. 1. Core Loading for Test 8A

in a more rapid flow coastdown than was experienced in the earlier tests. The faster flow coastdown would cause the in-core temperatures to reach higher maximum values than would have otherwise been attained. The magnitude of this effect will be ascertained when the test is studied with the applicable analytical models.

TABLE I. Reactor Conditions before Coastdown of Test 8A

Reactor power	21.8 ± 0.5 MWt
Primary-system flow	3157 gpm[a] (40.0% of normal full flow)
Primary pump No. 1 speed	317 rpm
Primary pump No. 2 speed	316 rpm
Reactor inlet coolant temperature	664°F (351°C)
Mixed mean reactor outlet coolant temperature	839°F (449°C)
Secondary-system flow	2253 gpm[a] (37.6% of full flow[b])
IHX secondary-inlet temperature	577°F (303°C)
IHX secondary-outlet temperature	826°F (441°C)

[a] 1 gpm = 6.31 x 10^{-5} m^3/s.

[b] A typical value during full-power operation is ∿86%.

III. TEST SEQUENCE

The rise to power for the steady-state portion of Test 8A was begun at approximately 8:03 p.m. on March 28, 1979. The shutdown of the preceding reactor run was at approximately 2:00 a.m. on March 27, so about 42 h had elapsed between operating cycles. The fission-product-decay power level at the time of the rise to power was approximately 0.16 MWt. At about 10:45 p.m. the steady-state power level of 21.8 MWt was reached. After about 2 h and 45 min of steady-state operation at 21.8 MWt, the electrical power to the auxiliary EM pump was cut off at about 1:30 a.m. on March 29. Reactor operation continued in this manner for approximately 25-1/2 min (until 1:55

a.m.). At this time the electrical power to the primary-system pumps was cut off by opening the clutch breakers on the motor-generator set. The termination of electrical power to the pumps resulted in a reactor scram approximately 0.35 s after the breakers were opened. Approximately 17-1/2 s after the breakers were opened, the electrical power to the EM pump in the secondary system was cut off, thereby causing the flow to coast down. After the coast-down of the secondary-system flow, both the primary and secondary systems were undergoing natural-circulation flow.

After several minutes of near-equilibrium natural-circulation flow in the two sodium systems, the auxiliary EM pump was turned back on to establish forced flow in the primary system. Data obtained during this portion of the test were used to determine offsets in the flowmeters of the high-pressure plenum (HPP2) and the two low-pressure plenums (LPP1 and LPP2) in the manner discussed in Sec. IV. After about 11 minutes of operation with the auxiliary pump on, the primary-system pumps were turned on to 100% normal full flow. The data obtained during this portion of the test were used to determine flowmeter normalization factors and thermocouple offsets.

IV. INSTRUMENTATION AND DATA OFFSETS

The test data were collected at the rate of two samples per second by the EBR-II data-acquisition system (DAS). Data were obtained from the normal plant process instrumentation in the primary, secondary, and steam systems and from instrumented subassembly XX08. Included in the normal plant process instruments are thermocouples measuring the coolant temperature at the outlet of several subassemblies in the reactor. Figure 2 shows the location of the in-core subassembly outlet thermocouples (SOT's), and Table II notes the type of subassembly beneath each SOT during Test 8A. Also shown in Table II are the calculated powers[12] and calculated flow rates for each of these subassemblies at the steady-state condition of 21.8 MWt of total reactor power and 40.0% reactor flow. Instrumented subassembly XX08 is included in Table II, because coolant outlet thermocouples are part of its instrumentation package. The recorded flow rate for XX08 is the measured value.

The coolant temperatures in the reactor outlet plenum were measured by the "upper-plenum instrument probe." This probe is above the blanket sub-

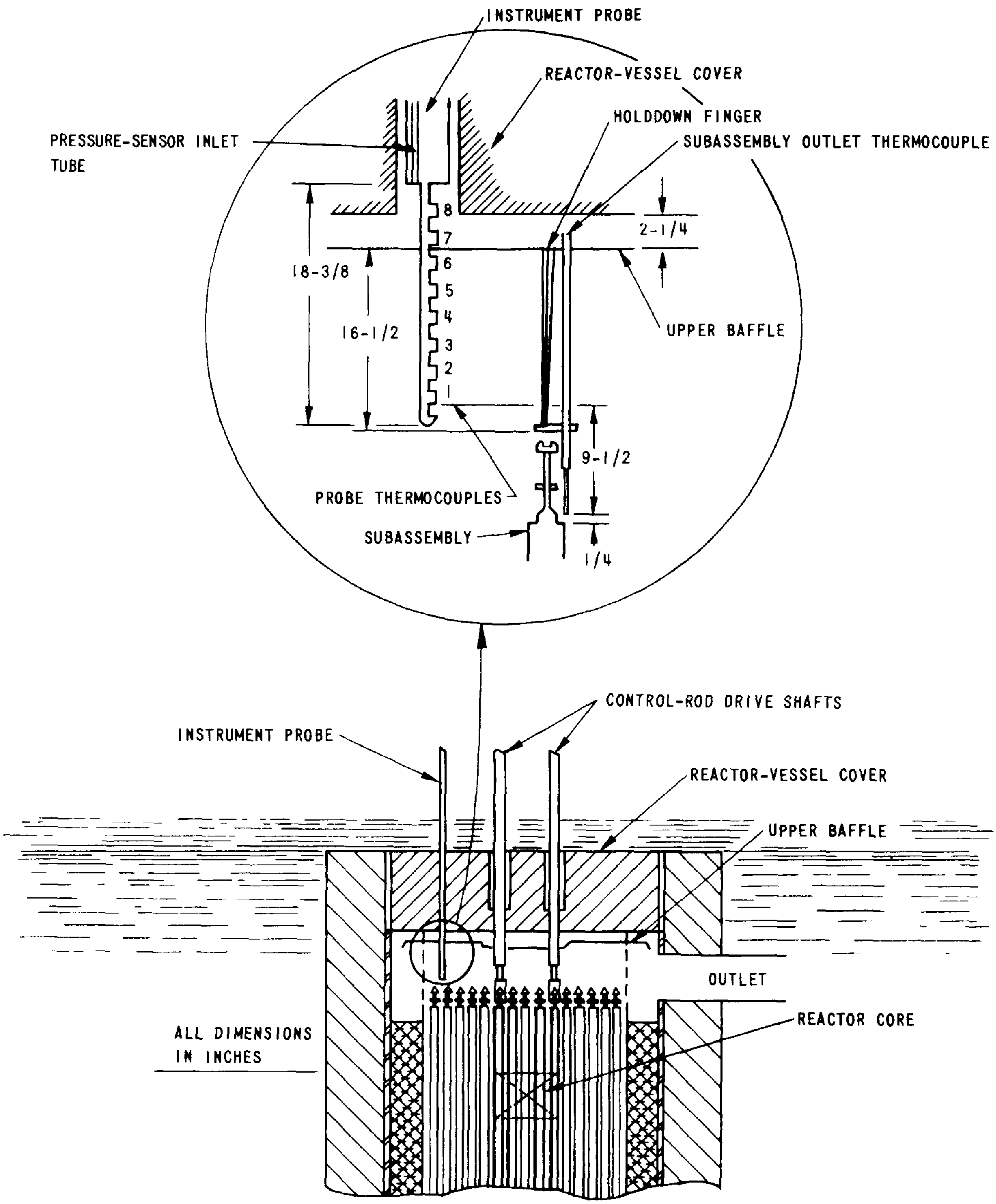


Fig. 2. Location of Subassembly Outlet Thermocouples and Orientation of Upper-plenum Instrument Probe in EBR-II. Conversion factor: 1 in. = 25.4 mm.

assembly in the 14D6 grid position and has thermocouples at eight different axial positions in the outlet plenum. The probe from which Test 8A data were obtained is essentially the same as that shown in Fig. 2.

TABLE II. Locations and In-core Parameters of Subassemblies with SOT's during Test 8A

Location	Subassembly	Power, kWt	Flow, gpm[a]
1A1	X270A (driver experiment)	246.9	51.34
2A1	Driver	279.7	50.21
2B1	X262D (structural experiment)	6.0	4.84
2C1	Driver	263.9	50.21
2E1	Driver	283.5	50.21
2F1	X101M (structural experiment)	6.7	4.84
3B1	X227A (37-pin oxide/bypass flow experiment)	125.0	19.79
3C1	Driver	278.4	43.27
3F1	X333 (19-pin oxide experiment)	92.0	8.63
4B1	Driver	266.0	33.31
4C3	Driver	262.9	33.31
4E1	Driver	264.9	33.31
4F1	Driver	269.2	33.31
5A4	Driver	260.1	28.79
5C2	X318 (19-pin carbide/bypass flow experiment)	165.1	26.74
6C4	Driver	235.1	23.41
7A3	Driver	196.6	23.57
7D4	Driver	194.4	23.57
5D3	XX08	146.2	16.52

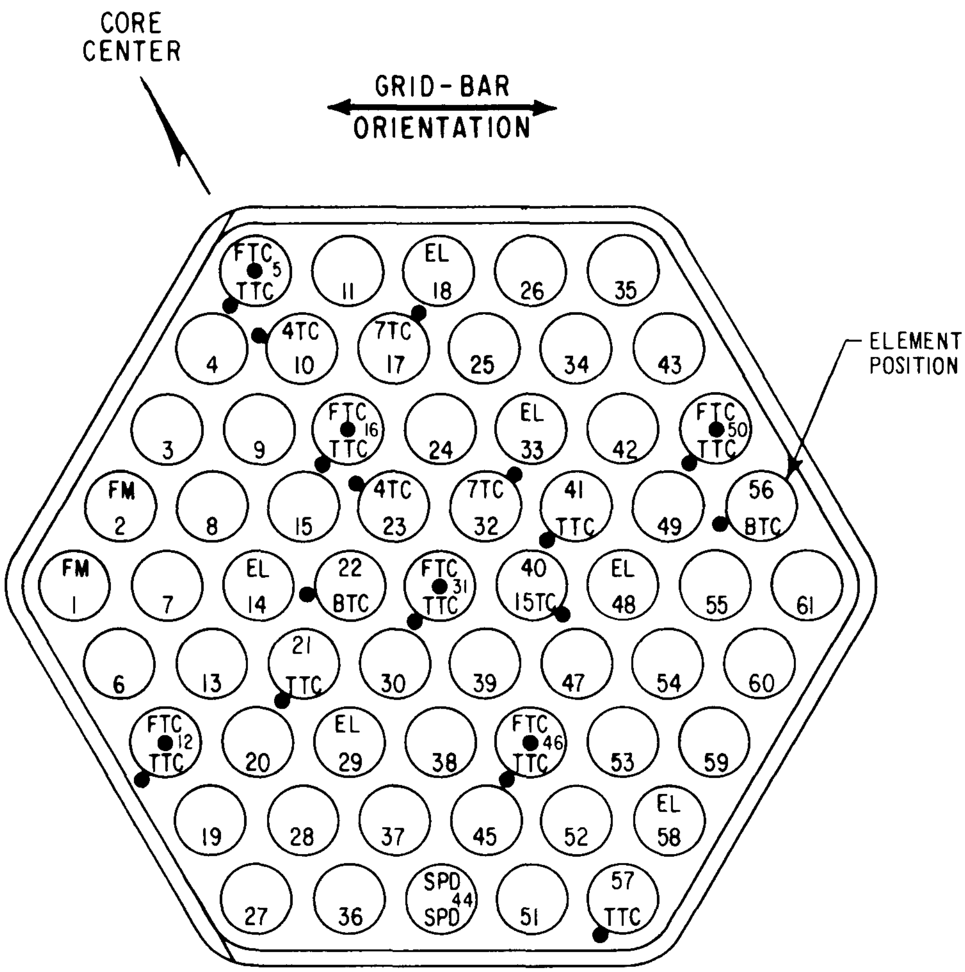
[a]Conversion factor: 1 gpm = $6.31 \times 10^{-5}\ m^3/s$.

The bulk of the in-core test data was obtained from instrumentation in instrumented subassembly XX08. This experiment is a uranium-metal-fueled subassembly equipped with two permanent-magnet flowmeters (providing three flow readings) at the core and 24 thermocouples at different radial and axial locations in the subassembly. Figure 3 shows the pattern of the XX08 instrumentation. Not shown in Fig. 3 are two thermocouples (OTC's) that measure the mixed mean outlet coolant temperature from XX08. Reference 1 provides a more complete description of XX08.

As was noted previously, the final part of the test consisted of operating the primary pumps at 100% flow. This action served two purposes. First, it provided full-flow readings for all primary-system flowmeters, which could then be used as normalization factors for subsequent data handling. Second, it provided nearly isothermal conditions so that offsets in the thermocouples in the primary system could be determined.

Several thermocouples measure the local temperature at various locations within the primary tank. In determining offsets we assumed that the average reading of these thermocouples under the nearly isothermal conditions noted above was, in fact, the true temperature of the sodium in the primary tank. For this test the average value of all these thermocouples was 662°F (350°C). All thermocouple readings were then corrected for offset by taking the difference between the isothermal (or average) value and the value actually recorded by the thermocouple. Where appropriate, the small temperature rise due to the low fission-product-decay power was added to the isothermal value before determining the offset.

As in all previous XX08 natural-circulation tests, the signal from the HPP2 flowmeter gave indications of negative (i.e., reverse) flow during various portions of the test. Because flow reversal in the high-pressure plenum was contrary to expected behavior and, more importantly, was totally inconsistent with other experimental data on flow and temperature, it was concluded that an offset existed in this flowmeter signal. Large differences between the measured flow rates for LPP1 and LPP2 were also observed in this test. The two flow paths from the pumps to the low-pressure plenum were designed identically, and previous experience has shown the two measured flow rates to be nearly equal. Because of the large differences observed in this test, we concluded that these signals should also be corrected by an offset factor.



	LEGEND	REQUIRED
FM	FLOWMETER LEAD	2
SPD	SELF-POWERED DETECTOR	2
BTC	CORE BOTTOM COOLANT TC	2
4TC	COOLANT TC 0 137m ABOVE CORE BOTTOM	2
7TC	COOLANT TC 0 240m ABOVE CORE BOTTOM	2
TTC	COOLANT TC TOP OF CORE	9
FTC	FUEL CENTERLINE TC	6
15TC	COOLANT TC 0 514m ABOVE CORE BOTTOM	1
EL	EXTENDED-LENGTH (0 660m) MK II ELEMENTS	6

NOTES a) DOTS REPRESENT LATERAL POSITION OF TC JUNCTIONS IRRESPECTIVE OF AXIAL LOCATION

b) TWO OUTLET-COOLANT TC's (NOT SHOWN) EXIST ABOVE THE FUEL ELEMENTS

c) NUMBERS INDICATE ELEMENT POSITION

Fig. 3. Location of Instrumentation Sensors in XX08

To quantify the offsets in these signals, a technique similar to that discussed in Refs. 2-6 was used. The basic premise of this technique is that at the flow rate supplied by the auxiliary pump, the percentage of full flow measured by the HPP2 flowmeter and by each of the two low-pressure-plenum flowmeters should be equal to that measured by the XX08 flowmeters. For the HPP2 flowmeter, determining the offset in this manner is believed to be quite accurate, because the thermal and hydraulic characteristics of XX08 are similar to those of the average subassembly receiving coolant from the high-pressure plenum. Some analytical predictions indicate, however, that because of the slightly greater power-to-flow ratio (and resultant buoyant driving force) in XX08 as compared to the average subassembly, the XX08 flow should be a higher percentage of the full-flow value. This difference, however, is relatively slight, and no experimental data have verified it. Therefore, we concluded that we would get much greater accuracy by offsetting the signal of the HPP2 flowmeter rather than leaving it incorrected.

Under fission-product-decay-heat conditions, a reflector or blanket subassembly will retain a greater fraction of its steady-state power than a fueled subassembly. Therefore, when forced flow is provided by the auxiliary pump, the temperature rises in these subassemblies are a larger fraction of the full-power temperature rises than the temperature rises in a fueled subassembly. These larger temperature increases produce buoyant forces that are more comparable to the forced-flow driving forces than those developed in fueled subassemblies. Thus the net flow (forced plus convective) in blanket and reflector subassemblies will be a greater percentage of the full operational value than the net flow in fueled subassemblies.

As noted earlier, in determining the offsets in the low-pressure-plenum flowmeters, the signals were equated to the flow measured by XX08. It is likely, therefore, that the low-pressure-plenum flows reported in the appendix are slightly low, especially at the auxiliary-pump flow level or lower. However, we believe that these flows are much closer than the uncorrected values to those actually realized during the test, and therefore decided to use the corrective means discussed above.

In terms of an equation, the flowmeter offsets were determined by solving the following equality:

$$100 \times \frac{\text{(flow signal with auxiliary pump on) + offset}}{\text{(flow signal at full flow) + offset}} = \begin{array}{l}\text{Percent of XX08 flow}\\ \text{with auxiliary pump on.}\end{array}$$

The offsets for the HPP2, LPP1, and LPP2 flowmeters determined from the above relationship were 0.268, 4.516, and -1.385%, respectively. These values were used in preparing the figures presented in the appendix.

Table III lists the correction factors for instruments located in the Primary system. The corrected data take the form of

$$\text{Corrected value} = (\text{DAS signal} + A)/B,$$

where A is the offset and B is a normalization factor. A value of B not equal to 1.0 is used to express the data in terms of percent of the full-flow value.

The "Neutron Power (Log Range B)" signal (pp. A32 and A33 of the appendix) was normalized to yield the correct percent power during the initial steady-state portion of the test. Values of A = 0.0 and B = 0.753 were used for this purpose.

The DAS data obtained for the secondary-sodium temperature at the inlet to the IHX was inexplicably high. An offset of -25.9°F (-14.4°C) was used to make the DAS values equal to those indicated by the instruments in the reactor control room. All other data for the secondary and steam systems are presented without offset or normalization factor (i.e., A = 0.0 and B = 1.0).

TABLE III. Correction Factors for Data from XX08 Test 8A

Parameter	Units	Correction Factors A	Correction Factors B
XX08 lower flowmeter	%	0.0	0.4128
XX08 upper flowmeter--signal 1	%	0.0	0.3070
XX08 upper flowmeter--signal 2	%	0.0	0.3059
XX08 FTC-5	°F	1.3	1.0
XX08 FTC-12	°F	0.9	1.0
XX08 FTC-16	°F	1.2	1.0
XX08 FTC-31	°F	0.5	1.0
XX08 FTC-46	°F	0.8	1.0
XX08 FTC-50	°F	0.8	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	Correction Factors B
XX08 BTC-56	°F	0.8	1.0
XX08 4TC-10	°F	1.4	1.0
XX08 4TC-23	°F	3.0	1.0
XX08 7TC-17	°F	2.6	1.0
XX08 7TC-32	°F	1.9	1.0
XX08 15TC-40	°F	1.2	1.0
XX08 TTC-5	°F	2.7	1.0
XX08 TTC-12	°F	1.8	1.0
XX08 TTC-16	°F	1.5	1.0
XX08 TTC-21	°F	2.0	1.0
XX08 TTC-31	°F	1.6	1.0
XX08 TTC-41	°F	2.1	1.0
XX08 TTC-46	°F	1.5	1.0
XX08 TTC-50	°F	1.4	1.0
XX08 TTC-57	°F	1.9	1.0
XX08 OTC-1	°F	2.0	1.0
XX08 OTC-2	°F	1.6	1.0
Primary-pump-1 speed	rpm	0.0	1.0
Primary-pump-2 speed	rpm	0.0	1.0
High-pressure-plenum-2 flow	%	0.268	0.9852
Low-pressure-plenum-1 flow	%	4.516	1.0380
Low-pressure-plenum-2 flow	%	-1.384	1.0099
Total primary flow (541E)	%	0.0	0.9780
Bulk-sodium temp (501 X)	°F	-2.1	1.0
Bulk-sodium temp (501 AA)	°F	1.5	1.0
Bulk-sodium temp (501 V)	°F	-1.6	1.0
Bulk-sodium temp (501 W)	°F	-0.2	1.0
Bulk-sodium temp (501 T)	°F	0.6	1.0
Bulk-sodium temp (501 D)	°F	1.3	1.0
Bulk-sodium temp (501 E)	°F	5.7	1.0
Bulk-sodium temp (501 Q)	°F	5.0	1.0
Bulk-sodium temp (501 F)	°F	7.8	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	Correction Factors B
Bulk-sodium temp (530	°F	10.1	1.0
Primary-pump inlet temp	°F	2.3	1.0
Primary-pump-1 outlet temp (540 C)	°F	-5.5	1.0
Primary-pump-1 outlet temp (540 D)	°F	-6.0	1.0
Primary-pump-2 outlet temp (540 A)	°F	-4.6	1.0
Primary-pump-2 outlet temp (540 E)	°F	-4.0	1.0
Primary-pump-2 outlet temp (540 F)	°F	-3.4	1.0
Low-pressure-plenum sodium temp (540 AR)	°F	-0.6	1.0
Low-pressure-plenum sodium temp (540 AS)	°F	1.4	1.0
Low-pressure-plenum sodium temp (540 AV)	°F	1.8	1.0
High-pressure-plenum sodium temp (540 AT)	°F	0.0	1.0
Subassembly outlet temp, position 1A1	°F	1.8	1.0
Subassembly outlet temp, position 2A1	°F	5.7	1.0
Subassembly outlet temp, position 2B1	°F	2.9	1.0
Subassembly outlet temp, position 2C1	°F	-0.5	1.0
Subassembly outlet temp, position 2E1	°F	2.0	1.0
Subassembly outlet temp, position 2F1	°F	5.1	1.0
Subassembly outlet temp, position 3B1	°F	3.1	1.0
Subassembly outlet temp, position 3C1	°F	-5.4	1.0
Subassembly outlet temp, position 3F1	°F	-0.3	1.0
Subassembly outlet temp, position 4B1	°F	2.3	1.0
Subassembly outlet temp, position 4C3	°F	2.7	1.0
Subassembly outlet temp, position 4E1	°F	-0.1	1.0
Subassembly outlet temp, position 4F1	°F	1.3	1.0
Subassembly outlet temp, position 5A4	°F	0.9	1.0
Subassembly outlet temp, position 5C2	°F	0.1	1.0
Subassembly outlet temp, position 6C4	°F	-0.9	1.0
Subassembly outlet temp, position 7D4	°F	2.7	1.0
Subassembly outlet temp, position 9E4	°F	2.2	1.0
Subassembly outlet temp, position 12E6	°F	-1.0	1.0
Subassembly outlet temp, position 16E9	°F	-0.2	1.0
Upper-plenum-probe temp TC1	°F	1.7	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	B
Upper-plenum-probe temp TC2	°F	3.4	1.0
Upper-plenum-probe temp TC3	°F	1.2	1.0
Upper-plenum-probe temp TC4	°F	1.7	1.0
Upper-plenum-probe temp TC5	°F	1.9	1.0
Upper-plenum-probe temp TC6	°F	2.1	1.0
Upper-plenum-probe temp TC7	°F	2.0	1.0
Upper-plenum-probe temp TC8	°F	1.3	1.0
Upper-plenum-probe pressure 1	psi	0.0	1.0
Upper-plenum-probe pressure 2	psi	0.0	1.0
Reactor outlet temp (1534 CF)	°F	4.7	1.0
Reactor outlet temp (506 X)	°F	2.3	1.0
IHX primary-inlet temp (507 BK)	°F	1.1	1.0
IHX primary-inlet temp (507 BQ)	°F	-6.1	1.0
IHX primary-outlet temp (540 AB)	°F	-1.0	1.0
IHX primary-outlet temp (540 AC)	°F	-1.0	1.0
IHX primary-outlet temp (540 AD)	°F	-1.0	1.0
IHX primary-outlet temp (540 AE)	°F	-0.9	1.0
IHX primary-outlet temp (540 AM)	°F	-1.3	1.0
IHX primary-outlet temp (540 AN)	°F	0.3	1.0
IHX primary-outlet temp (540 AP)	°F	-0.8	1.0
IHX primary-outlet temp (540 AQ)	°F	-1.0	1.0
IHX top orifice plate (507 CP)	°F	1.8	1.0
IHX bottom orifice plate (507 CC)	°F	1.8	1.0
IHX bottom orifice plate (507 BX)	°F	1.3	1.0
IHX bottom orifice plate (507 EF)	°F	0.8	1.0
IHX bottom orifice plate (507 EG)	°F	1.8	1.0
IHX bottom orifice plate (507 CA)	°F	1.3	1.0
IHX bottom orifice plate (507 CG)	°F	1.6	1.0
IHX secondary-inlet temp	°F	-25.9	1.0

Conversion factors: °C = (°F - 32)/1.8; 1 psi = 6.89 kPa.

V. TEST DATA

The data from XX08 Test 8A are presented in graphical form in the appendix. For each plot, time = 0 represents the time at which the primary pumps started to coast down. For the primary-system data, the time period shown covers the interval from just before the auxiliary pump was turned off until the primary system was in an equilibrium natural-circulation state. The time intervals for the secondary- and steam-system data extend beyond that shown for the primary-system data so that any effects having longer time delays may be observed. Some primary-system data are shown twice, with the second plot, which has an expanded time scale, covering only the flow-coastdown interval. In this way, the coastdown characteristics can be observed in finer detail.

Included in the appendix are plots showing the average values of several combinations of parameters. In each case the heading on the plot states which instruments have been averaged. The experimental data presented in this document will be compared with the analytical results in a subsequent report. However, some basic observations can be made from the data.

The curves for pump-speed rundown are shown on pp. A40-A41. Two features are apparent from these curves. First, as has been noted earlier, the rundown times (i.e., the time required for the pump speed to decrease to zero) are significantly shorter for this test than has been previously experienced in the XX08 natural-circulation-test program. For example, the rundown time for pump No. 1 was about 21-1/2 s in Test 8A compared to 35 s in Test 8. For pump No. 2, the corresponding times were approximately 25 and 42 s. The effect of this shorter rundown time is a higher peak temperature during natural circulation than would have been reached if the original mode of pump trip had been used. The magnitude of the temperature increase will be determined when this test is analyzed with the applicable models.

The basic phenomena observed in Test 8A are characteristic of those seen in other natural-circulation tests. For example, the transition from forced to natural-circulation cooling, as indicated by each flowmeter, was again very smooth. The large inter- and intrasubassembly coolant-temperature gradients existing under normal power operating conditions were again observed to dramatically reduce. This feature, which has been experienced in all natural-circulation tests in EBR-II, is discussed in detail in Ref. 13.

Tests in the XX08 natural-circulation program that have been initiated from substantial levels of fission power and flow have provided data that support the thesis presented in Ref. 13. These data, which are reported in Refs. 8, 9, and 11 and in this report, further substantiate the importance of inter- and intrasubassembly heat transfer in reducing local temperature gradients under natural-circulation conditions in an LMFBR. Data such as these can be used to reduce calculated local-hot-spot factors used in the safety analyses of loss-of-forced-flow transients. Any such reductions in these hot-channel factors could result in more efficient and economical design and operation of future LMFBR's while still maintaining a reasonable margin of safety.

Table IV summarizes the effects of the delay time between the trips of the primary- and secondary-system pumps. In this table, some of the significant parameters for the last three XX08 natural-convection tests are noted. The initial conditions for each test were very similar. The most significant difference in these tests is the time lapse between the primary- and secondary-pump trips, although the shorter pump-rundown times in Test 8A also affected the peak transient temperatures.

The importance of the dynamic thermal interactions between the primary and secondary systems is evident from the data in Table IV. This information can be used in the development of analytical models for various LMFBR components (e.g., the IHX) as well as for entire reactor systems.

ACKNOWLEDGMENTS

We are very appreciative of the efforts of those people in the Operations and Analysis Departments of the EBR-II Project who were instrumental in preparing for and conducting XX08 Test 8A. A special note of gratitude goes to William Booty for setting up the special data-acquisition-system program and to the operating crews for the expert and conscientious manner in which the test was conducted.

TABLE IV. Effects of Delay Time between Primary- and Secondary-pump Trips

	Test 7C	Test 8	Test 8A
Initial reactor power, %	36.7	37.2	36.3
Initial reactor flow, %	39.0	39.3	40.0
Primary-pump rundown times, s			
Pump 1	35.0	36.0	21.5
Pump 2	42.0	44.0	25.0
Time required for primary flow to reach 10% of full-flow value, s	22.5	23.0	18.0
Time delay between primary- and secondary-pump trips, s	180.0	32.0	17.0
Minimum transient XX08 natural-convection flow rate, %	3.0	2.8	2.4
Maximum transient XX08 temperature at position TTC-31, °F	800.0	807.0	842.0
Time of occurrence of second peak temperature in XX08 after primary-pump trip, s	52.0	57.0	43.0
Minimum transient natural-convection flow rate of secondary sodium, %	1.8	5.0	5.5

Conversion factor: °C = (°F - 32)/1.8.

REFERENCES

1. A. Smaardyk et al., *EBR-II Environmental Instrumented Subassembly XX08: Engineering and Assembly*, ANL-78-9 (May 1978).
2. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 1A*, ANL/EBR-101 (May 1978).
3. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedures EX-140, Section IV, Addenda 1B and 1C*, ANL/EBR-105 (December 1979).
4. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 1D*, ANL/EBR-109 (January 1980).

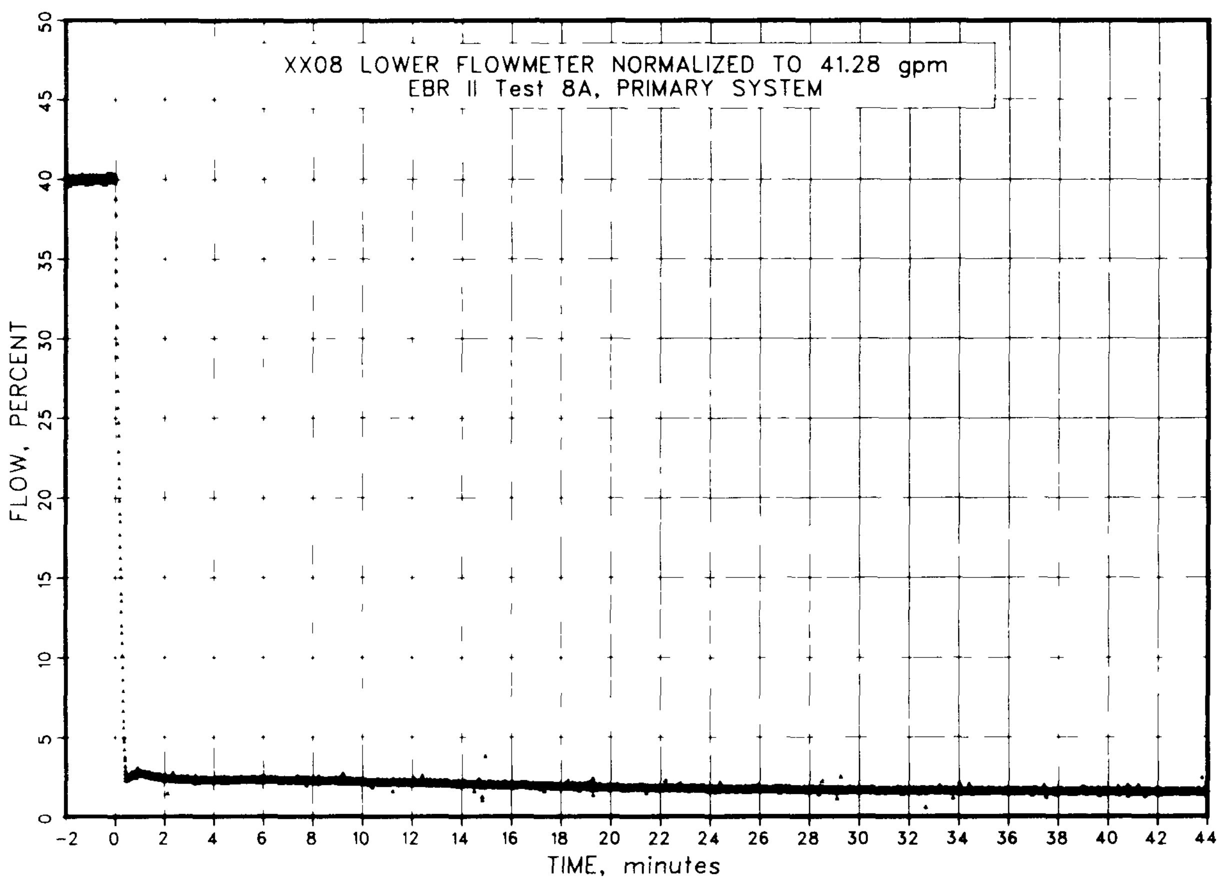
REFERENCES (contd)

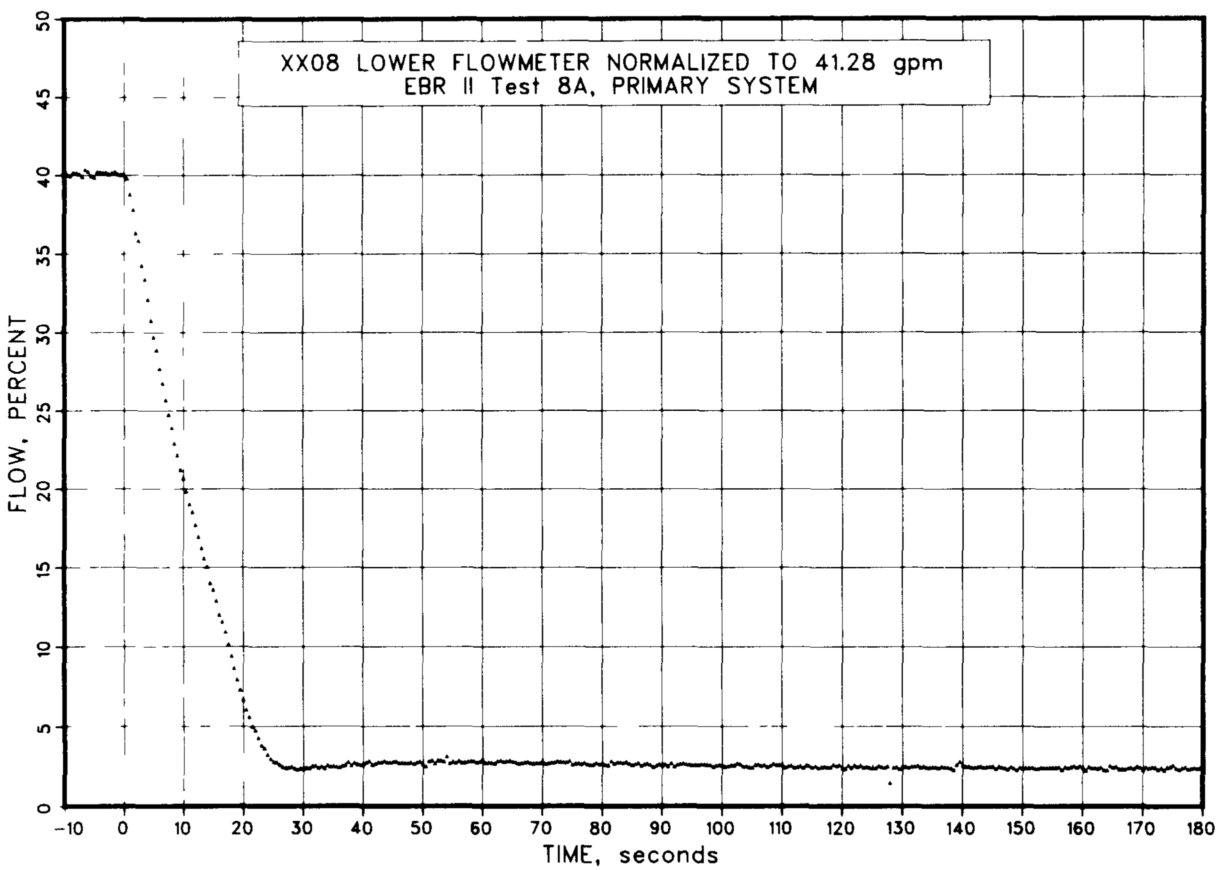
5. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 1E,* ANL/EBR-102 (September 1978).
6. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 10,* ANL/EBR-110 (April 1980).
7. J. L. Gillette et al., *Experimental Study of the Transition from Forced to Natural Circulation in EBR-II at Low Power and Flow,* Paper 79-HT-10, presented at the Joint ASME/AIChE 18th National Heat Transfer Conference, San Diego, CA, August 6-8, 1979.
8. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 7A,* ANL/EBR-104 (April 1979).
9. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 7C,* ANL/EBR-111 (May 1980).
10. R. M. Singer et al., *Studies of Thermal-hydraulic Phenomena in EBR-II,* to be published in Nuclear Engineering and Design.
11. J. L. Gillette et al., *Compilation of Data from EBR-II Natural-circulation-test Procedure EX-140, Section IV, Addendum 8,* ANL/EBR-112 (May 1980).
12. K. E. Phillips, personal communication (May 1979).
13. R. M. Singer and J. L. Gillette, *Measurements of Subassembly and Core Temperature Distributions in an LMFBR,* AIChE Symposium Series *73* (164) pp. 97-104 (1977).

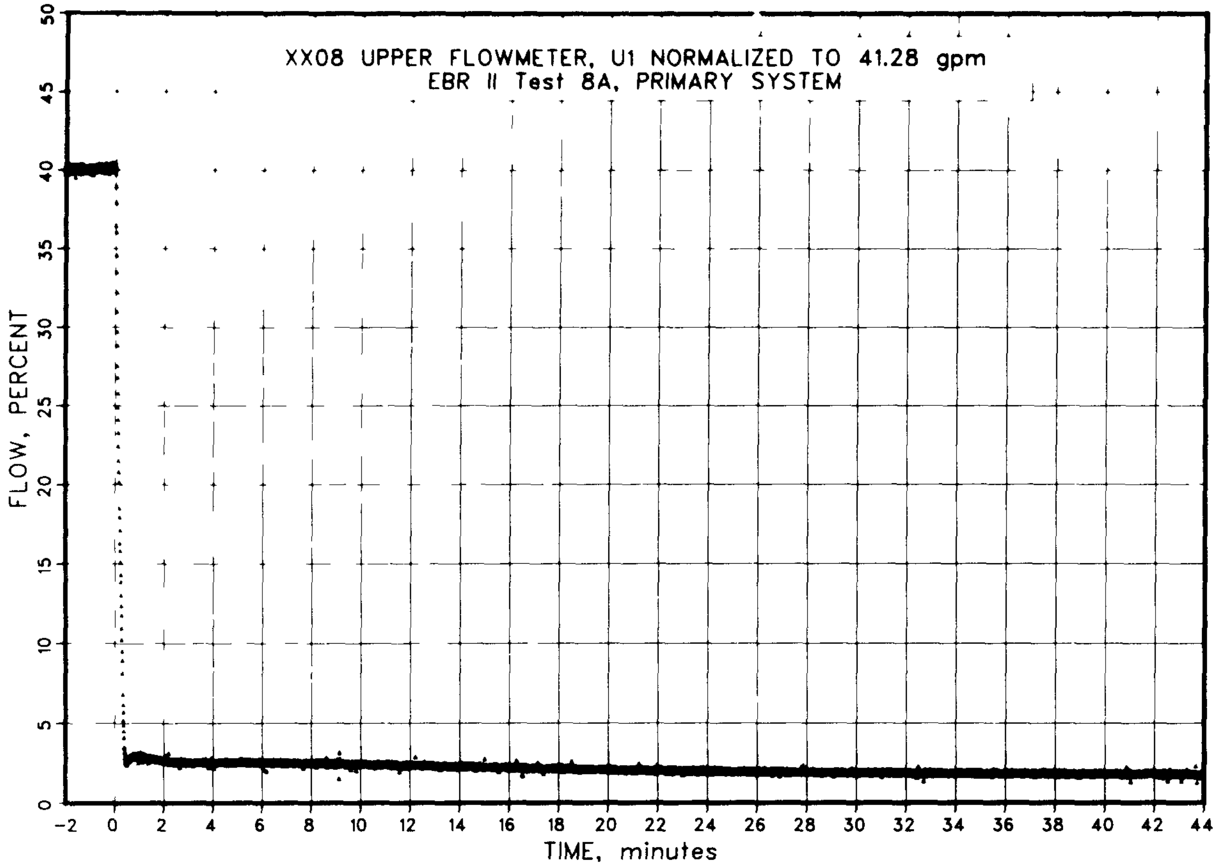
APPENDIX

Plots of Data from Test 8A

The plots of data obtained during XX08 Test 8A are presented in the following order:


XX08 LOWER FLOWMETER NORMALIZED TO 41.28 gpm
EBR II Test 8A, PRIMARY SYSTEM
FLOW, PERCENT
0
5
10
15
20
25
30
35
40
45
50
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


XX08 LOWER FLOWMETER NORMALIZED TO 41.28 gpm
EBR II Test 8A, PRIMARY SYSTEM
FLOW, PERCENT
0
5
10
15
20
25
30
35
40
45
50
TIME, seconds
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


XX08 UPPER FLOWMETER, U1 NORMALIZED TO 41.28 gpm
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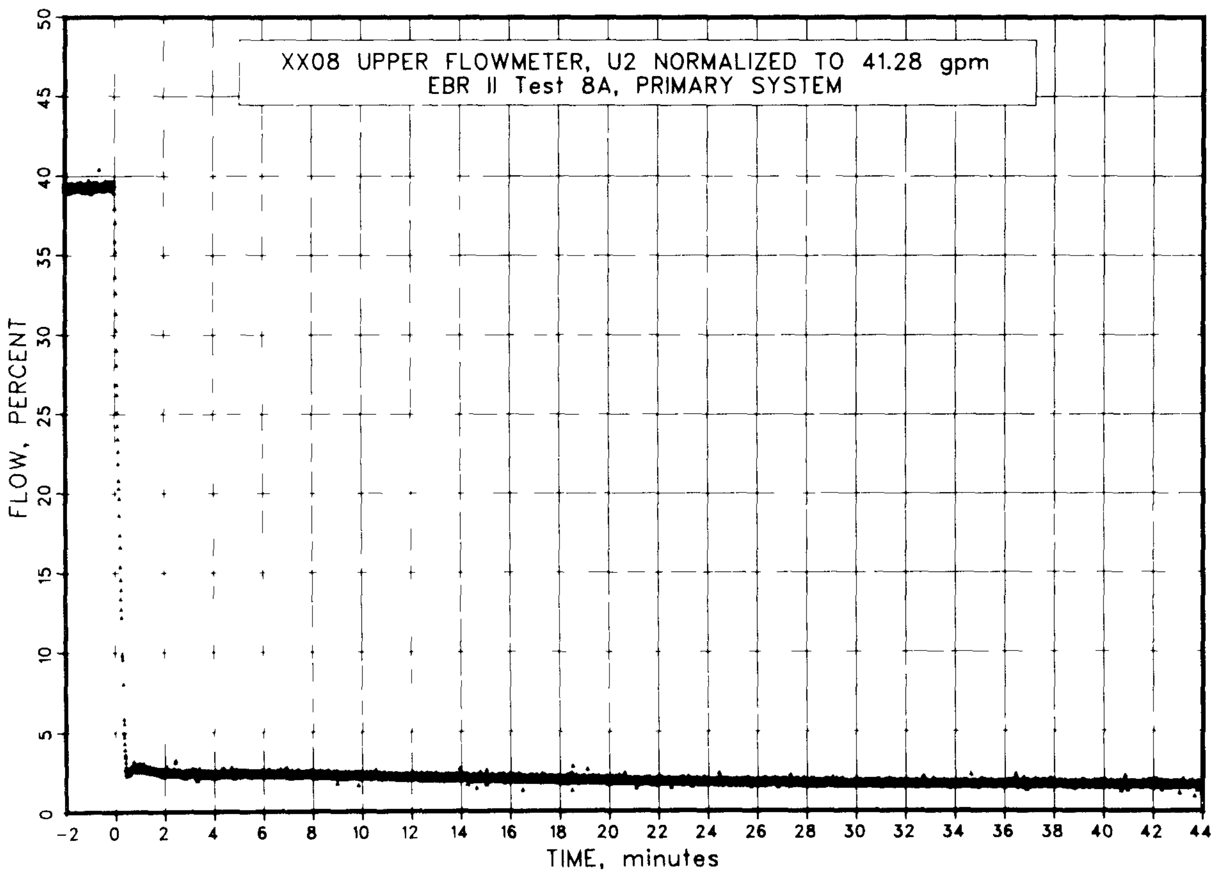
FLOW, PERCENT
TIME, minutes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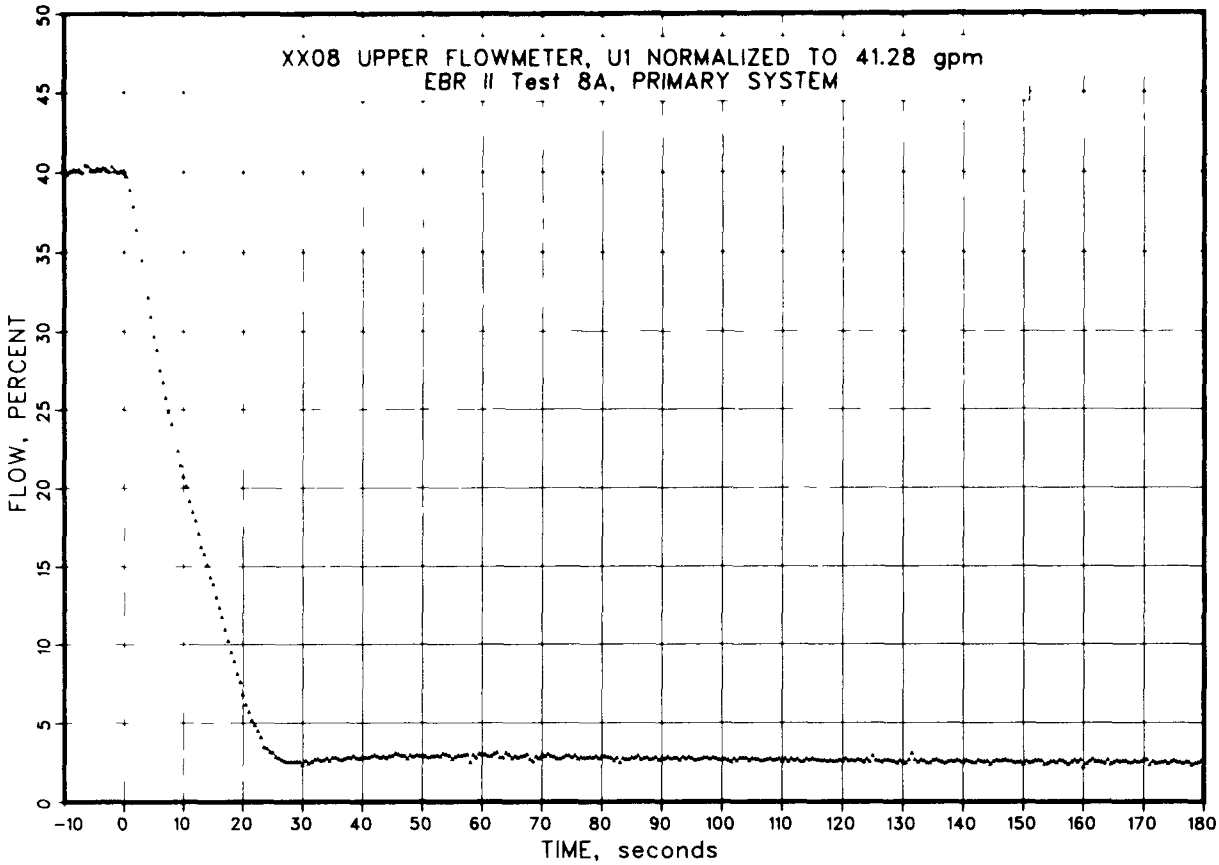
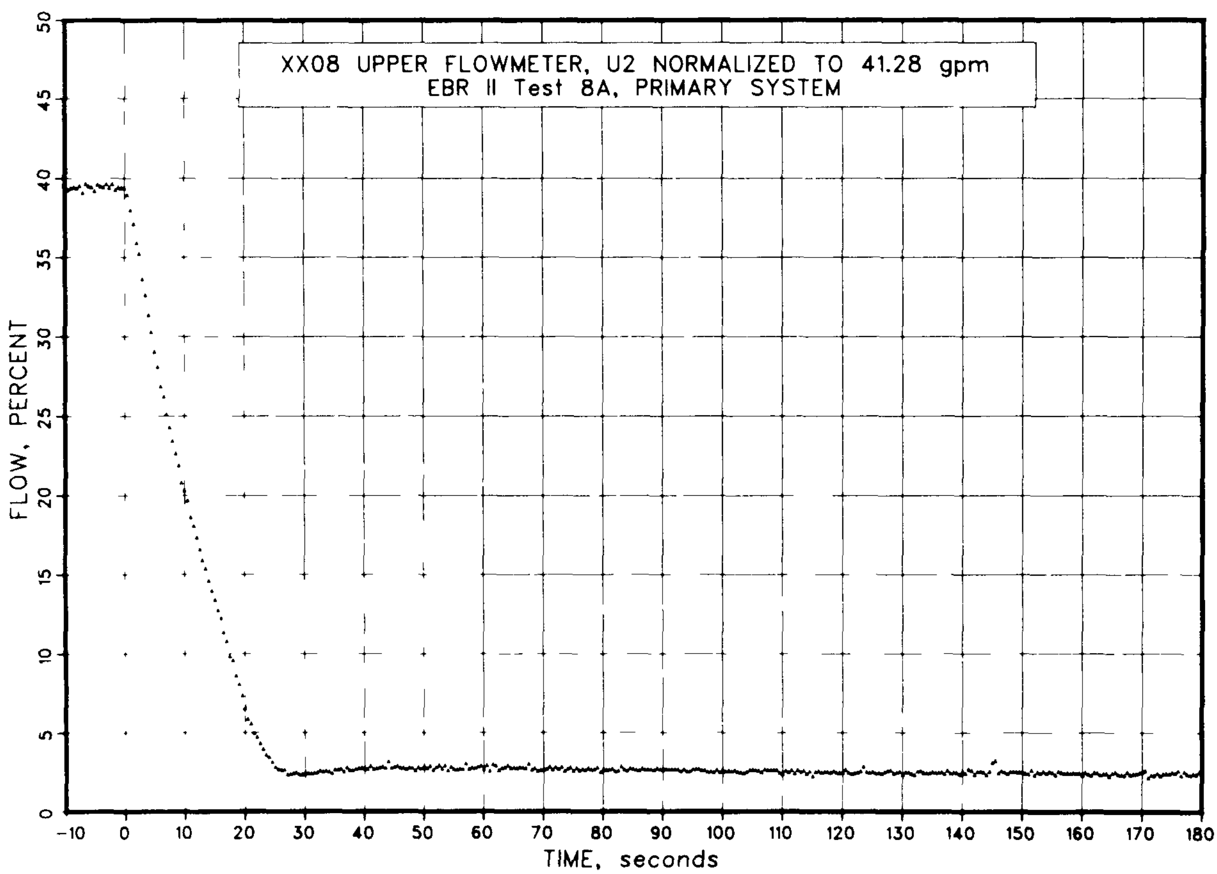
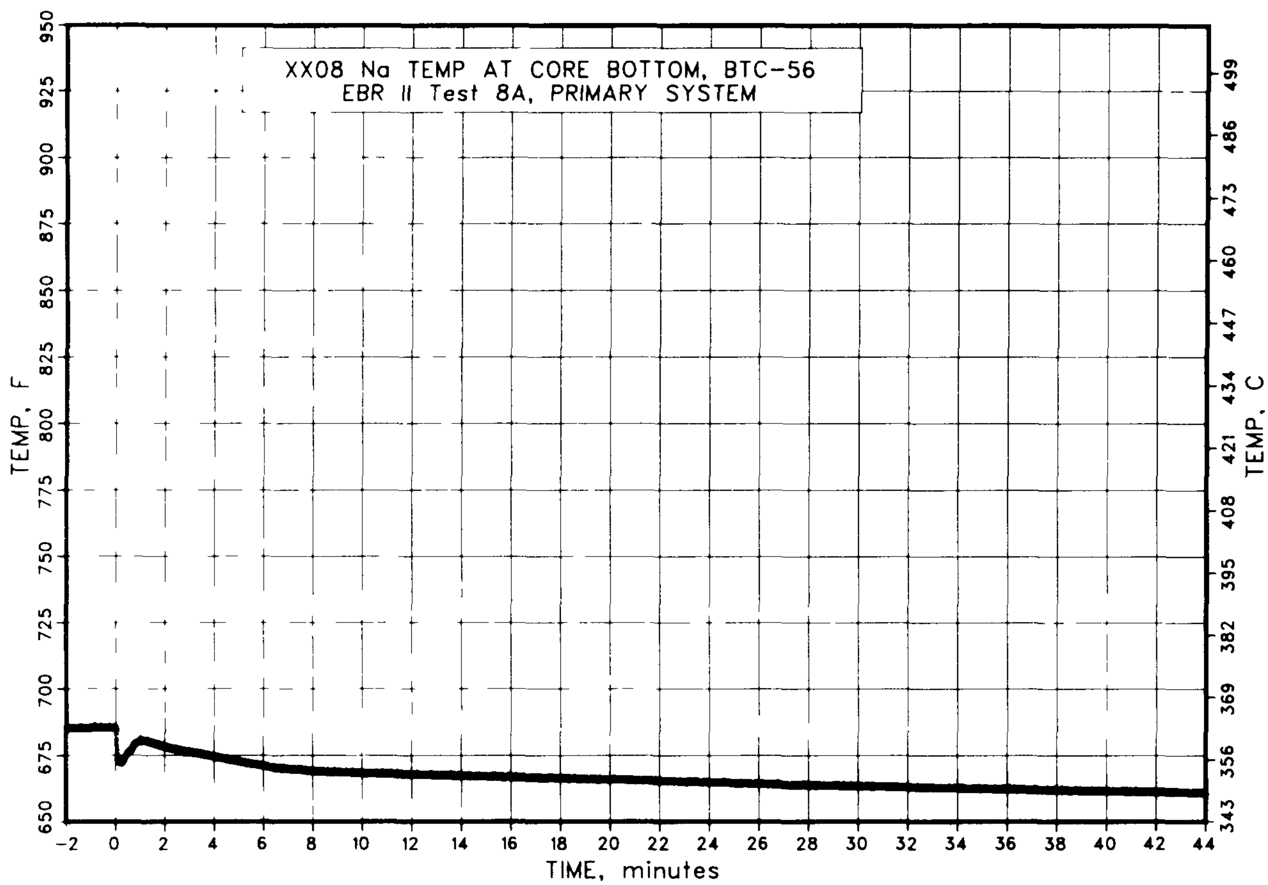
EBR II Test 8A, PRIMARY SYSTEM
FLOW, PERCENT
TIME, minutes


XX08 UPPER FLOWMETER, U1 NORMALIZED TO 41.28 gpm
EBR II Test 8A, PRIMARY SYSTEM
FLOW, PERCENT
TIME, seconds
0
5
10
15
20
25
30
35
40
45
50
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


XX08 UPPER FLOWMETER, U2 NORMALIZED TO 41.28 gpm
EBR II Test 8A, PRIMARY SYSTEM
FLOW, PERCENT
TIME, seconds
0
5
10
15
20
25
30
35
40
45
50
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180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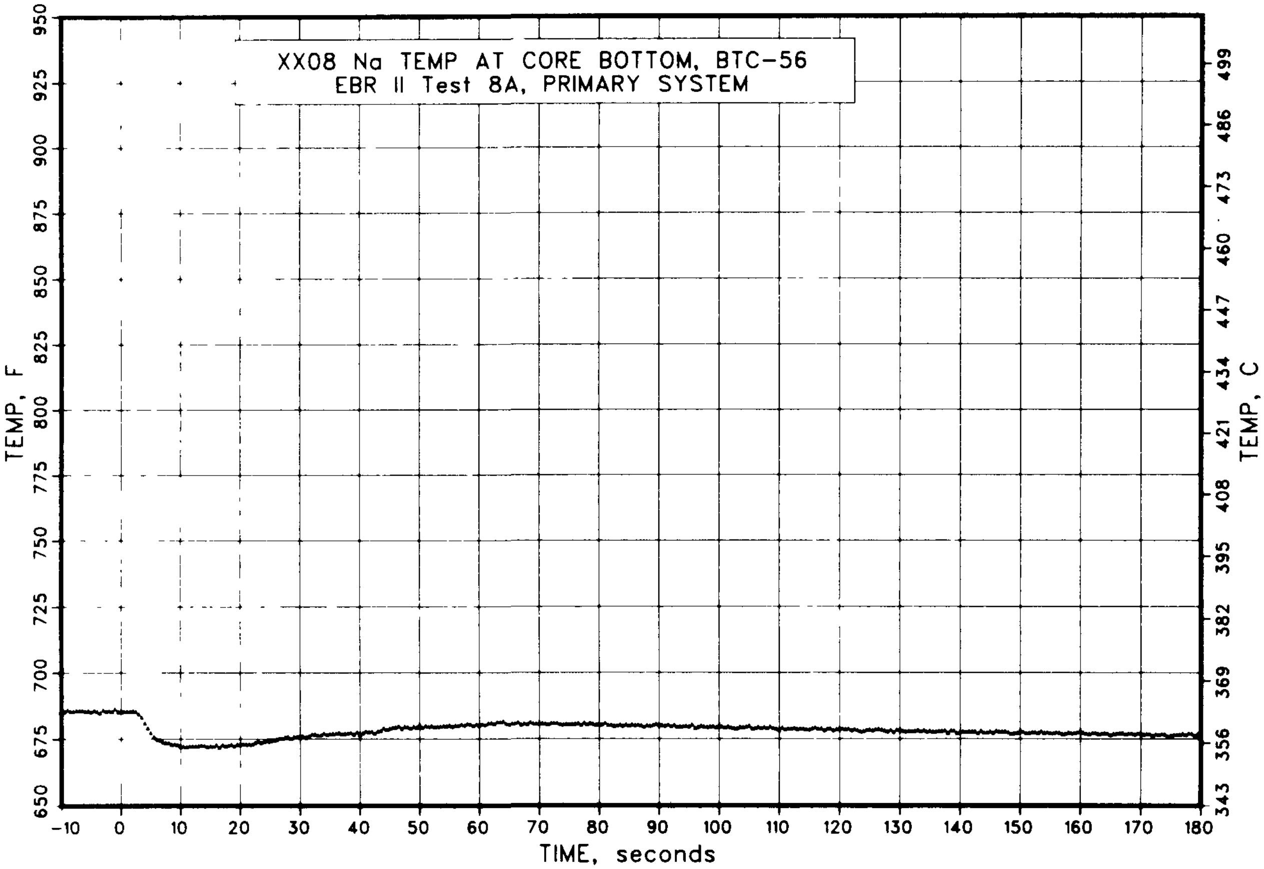
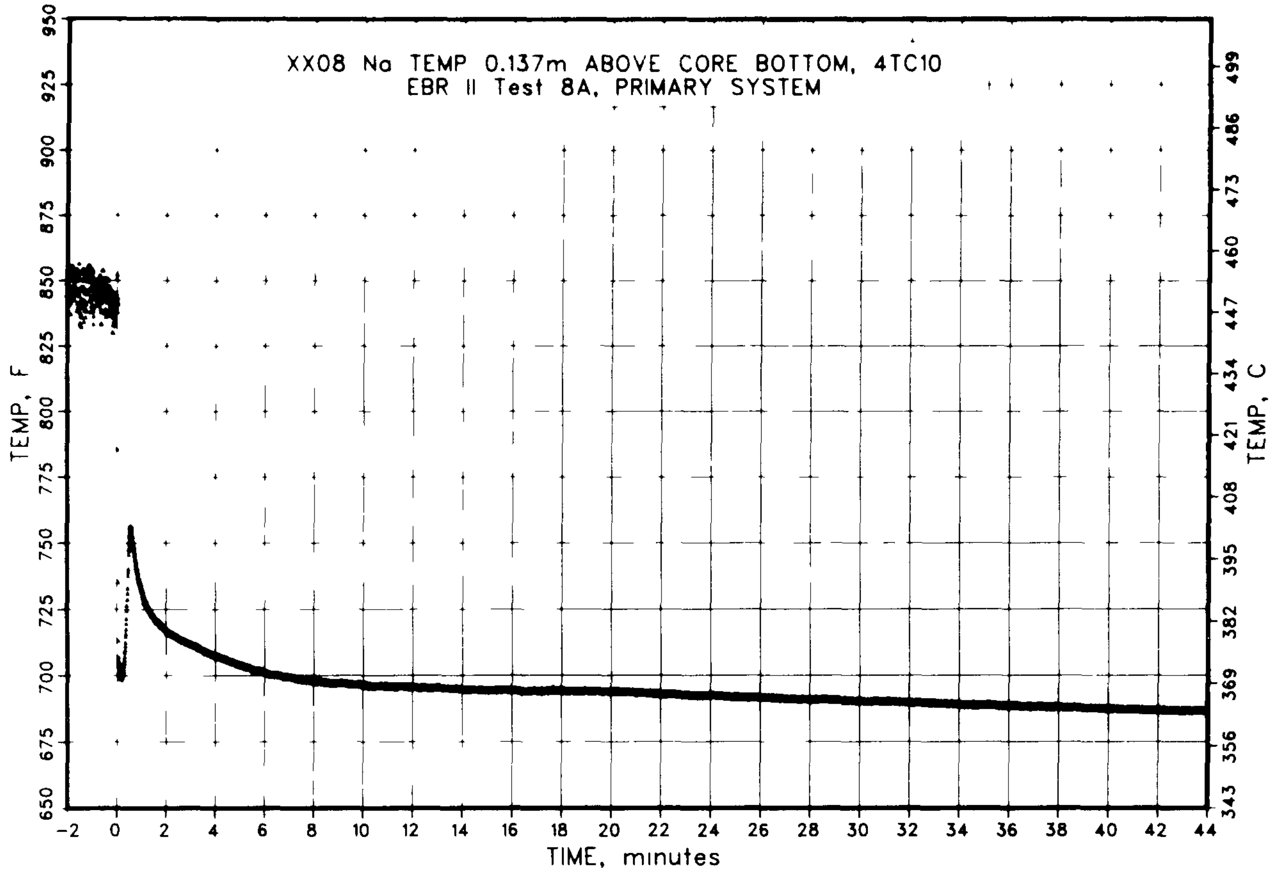
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


XX08 Na TEMP AT CORE BOTTOM, BTC-56
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180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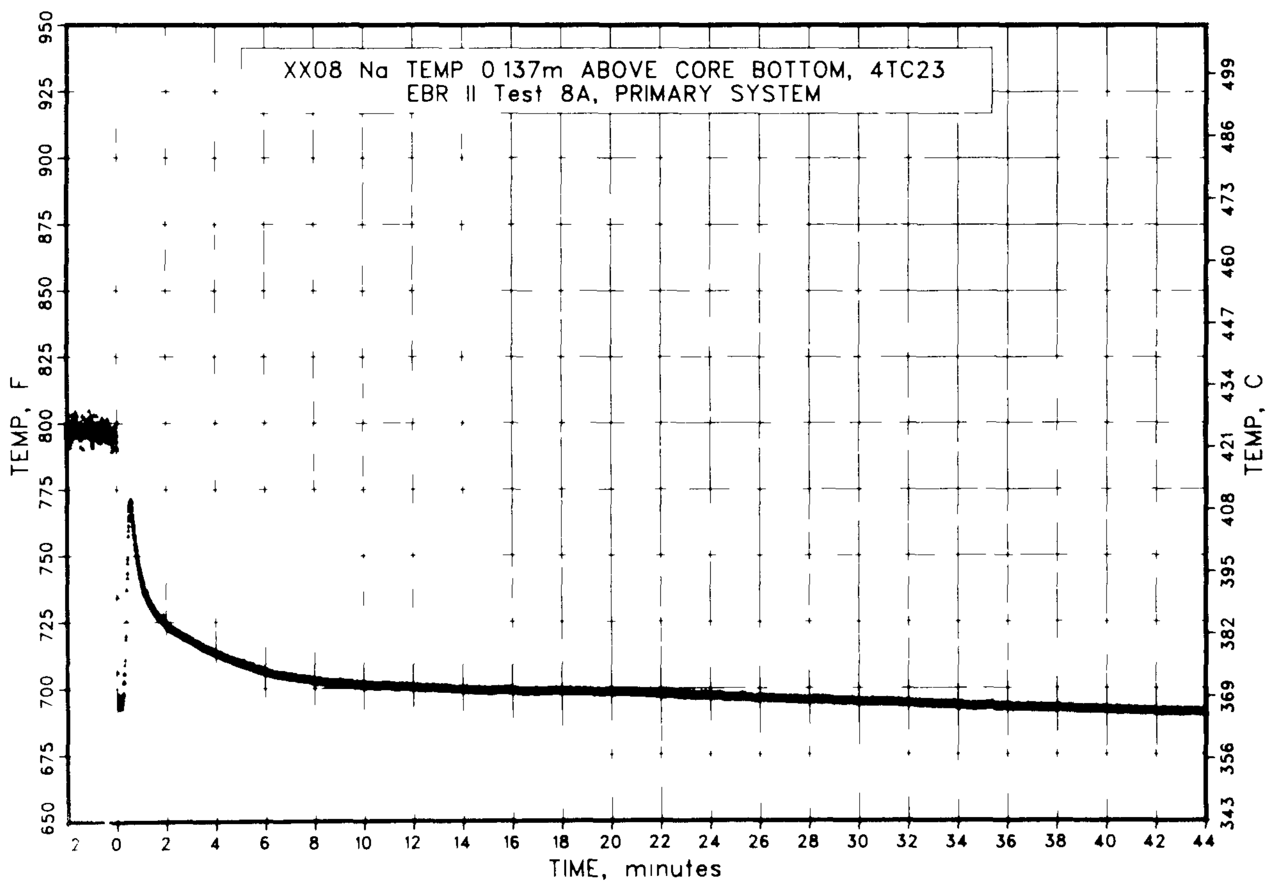
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes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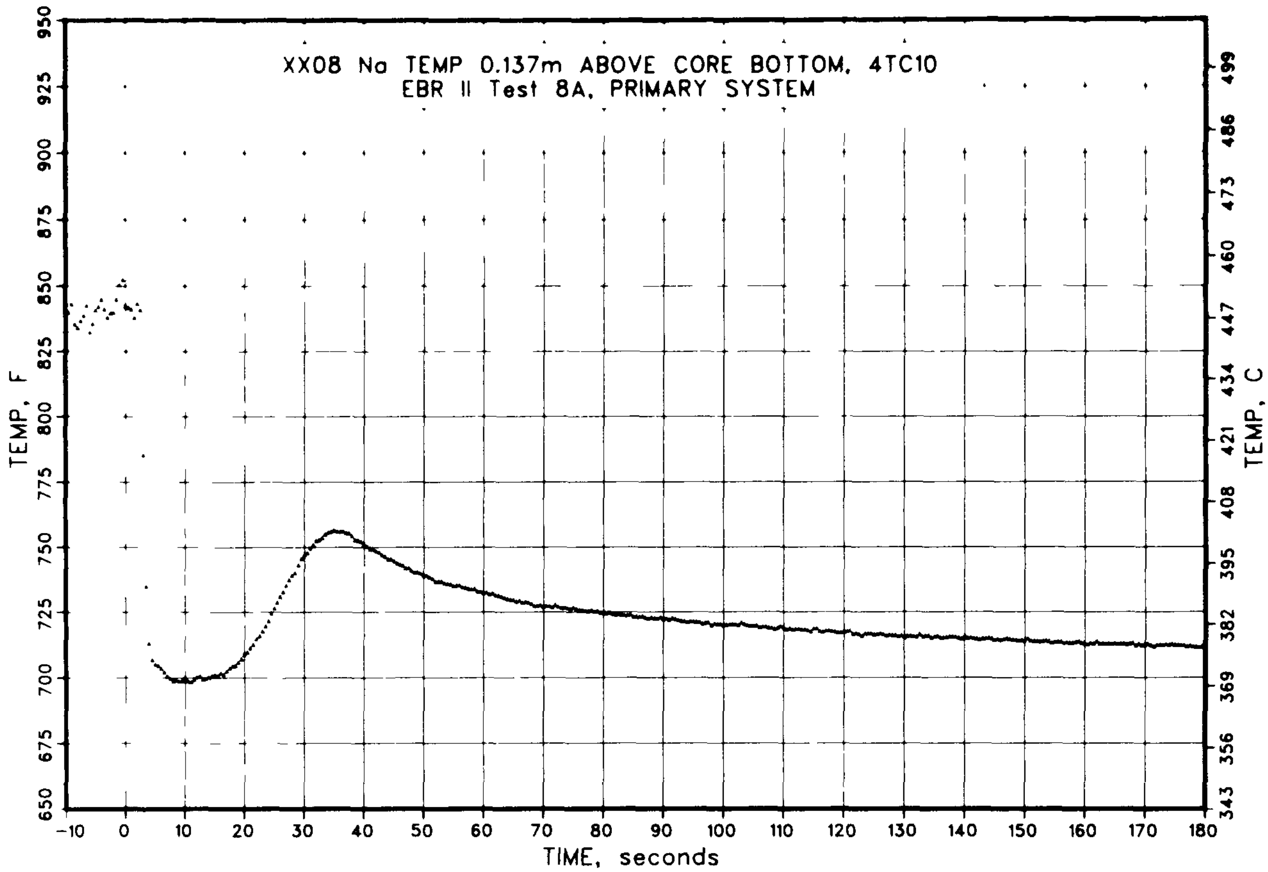
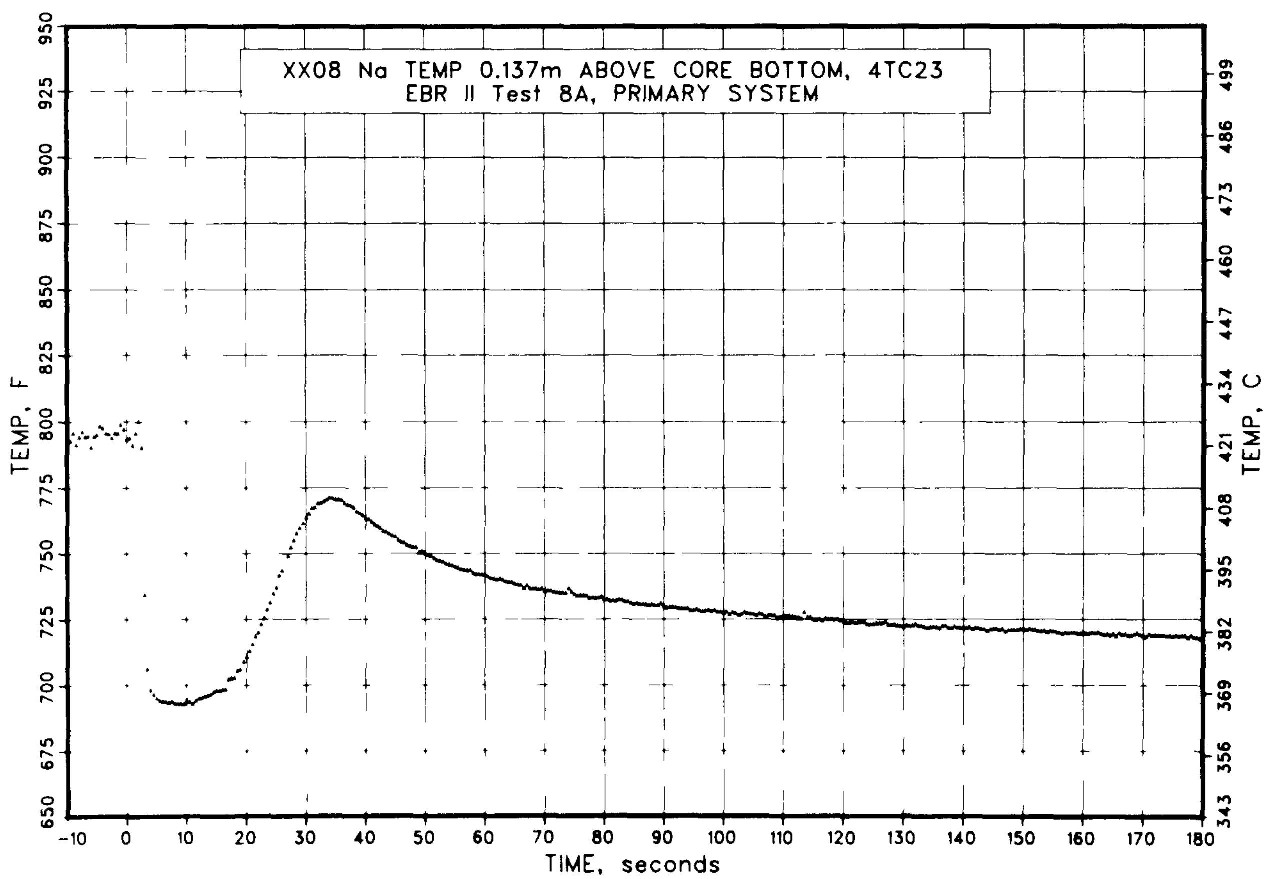
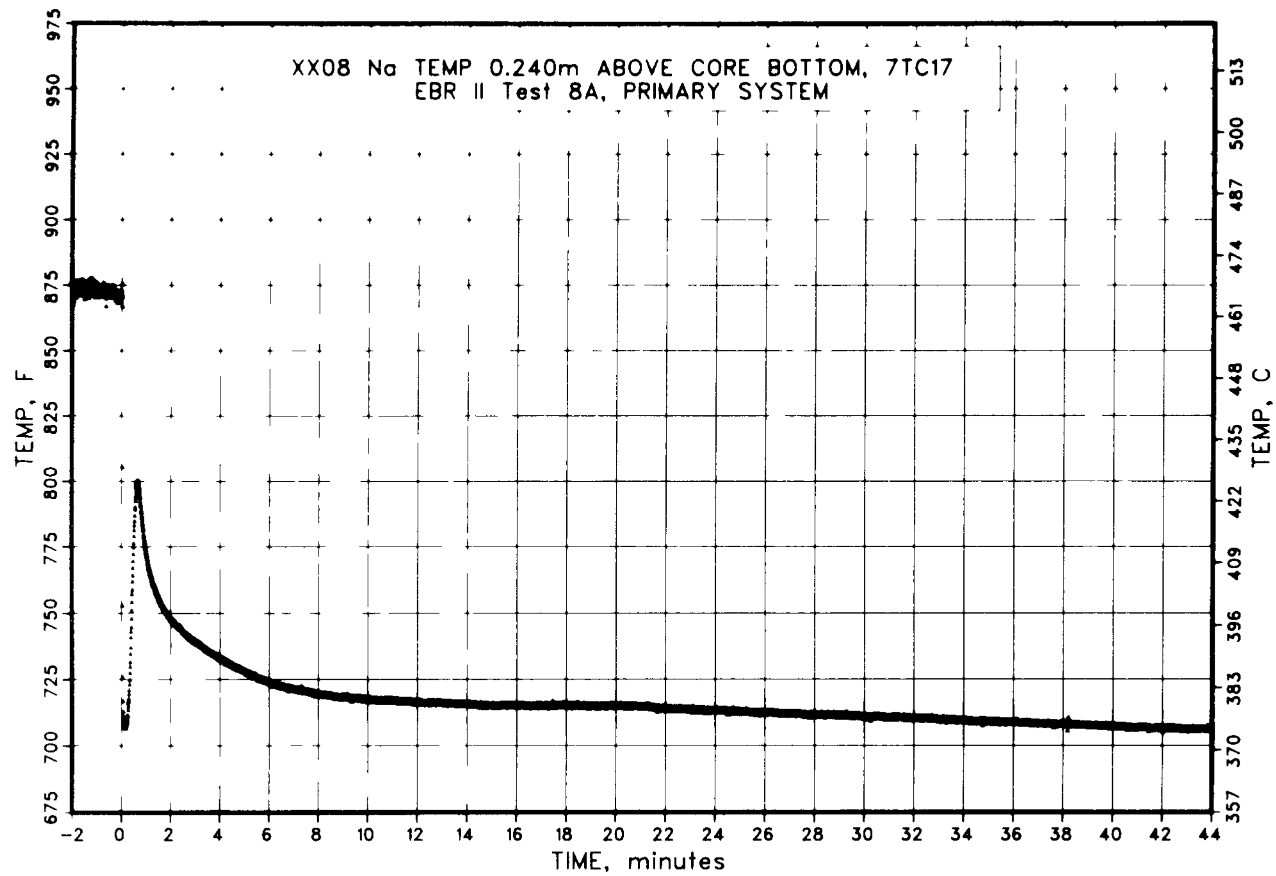
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.137m ABOVE CORE BOTTOM, 4TC10
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


XX08 Na TEMP 0.137m ABOVE CORE BOTTOM, 4TC23
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180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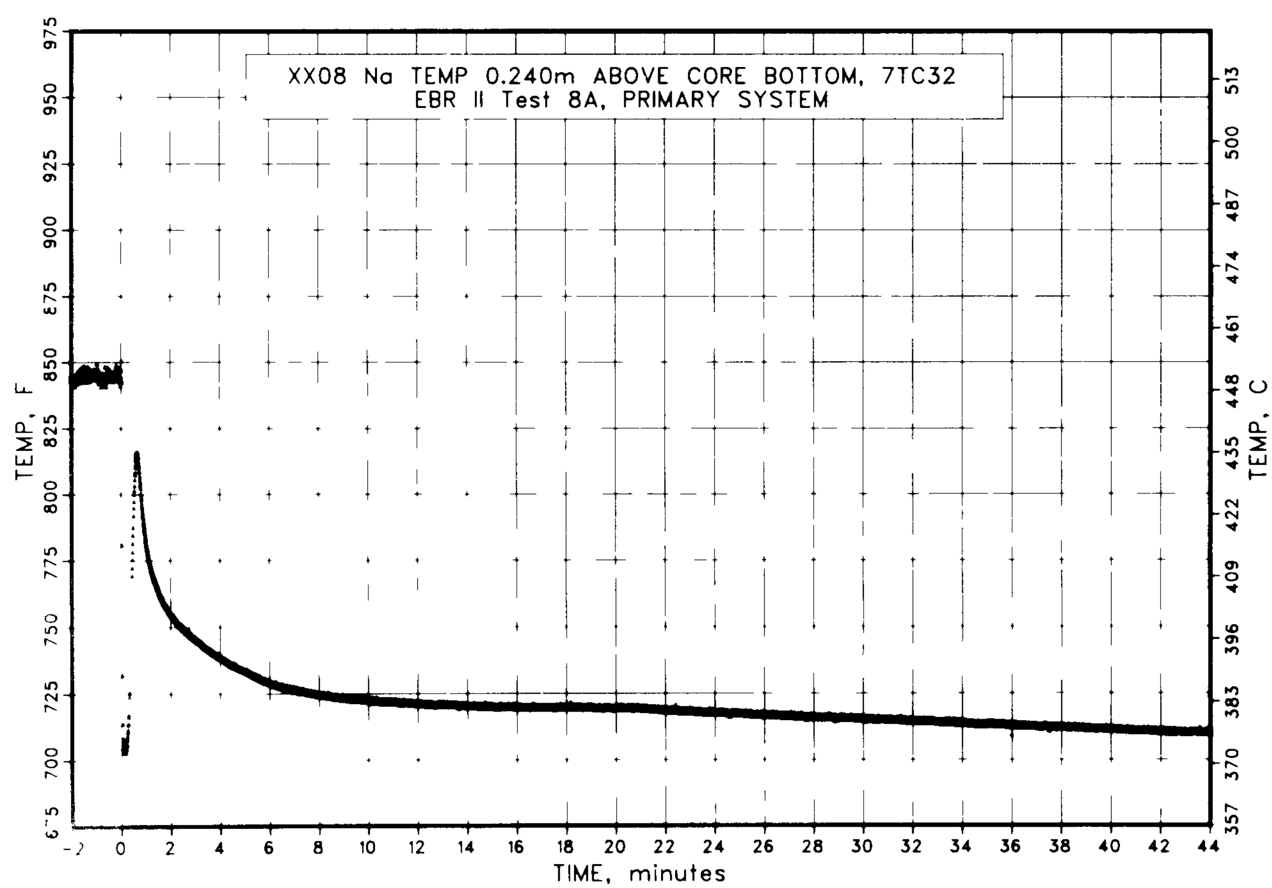
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes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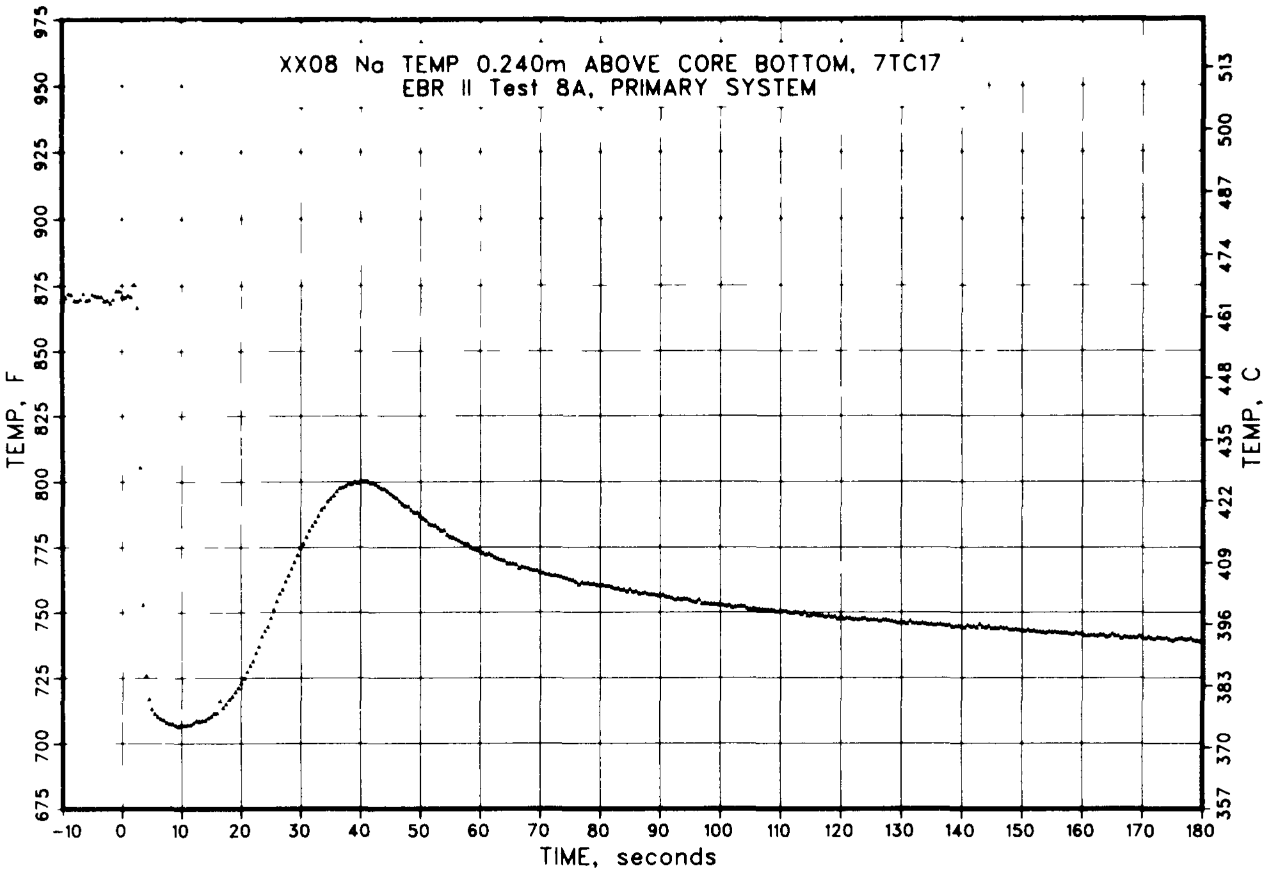
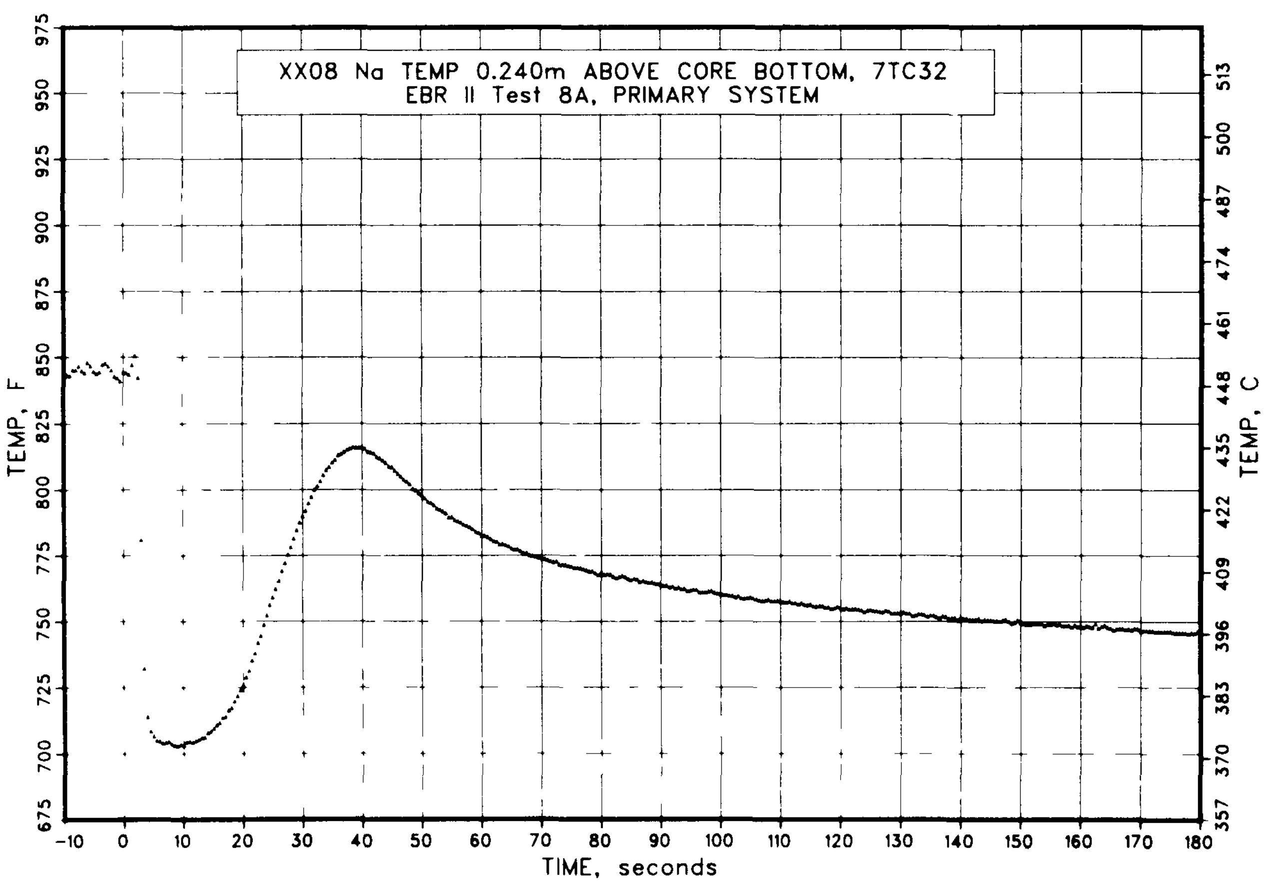
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.240m ABOVE CORE BOTTOM, 7TC17
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180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EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
10
20
30
40
50
60
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100
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130
140
150
160
170
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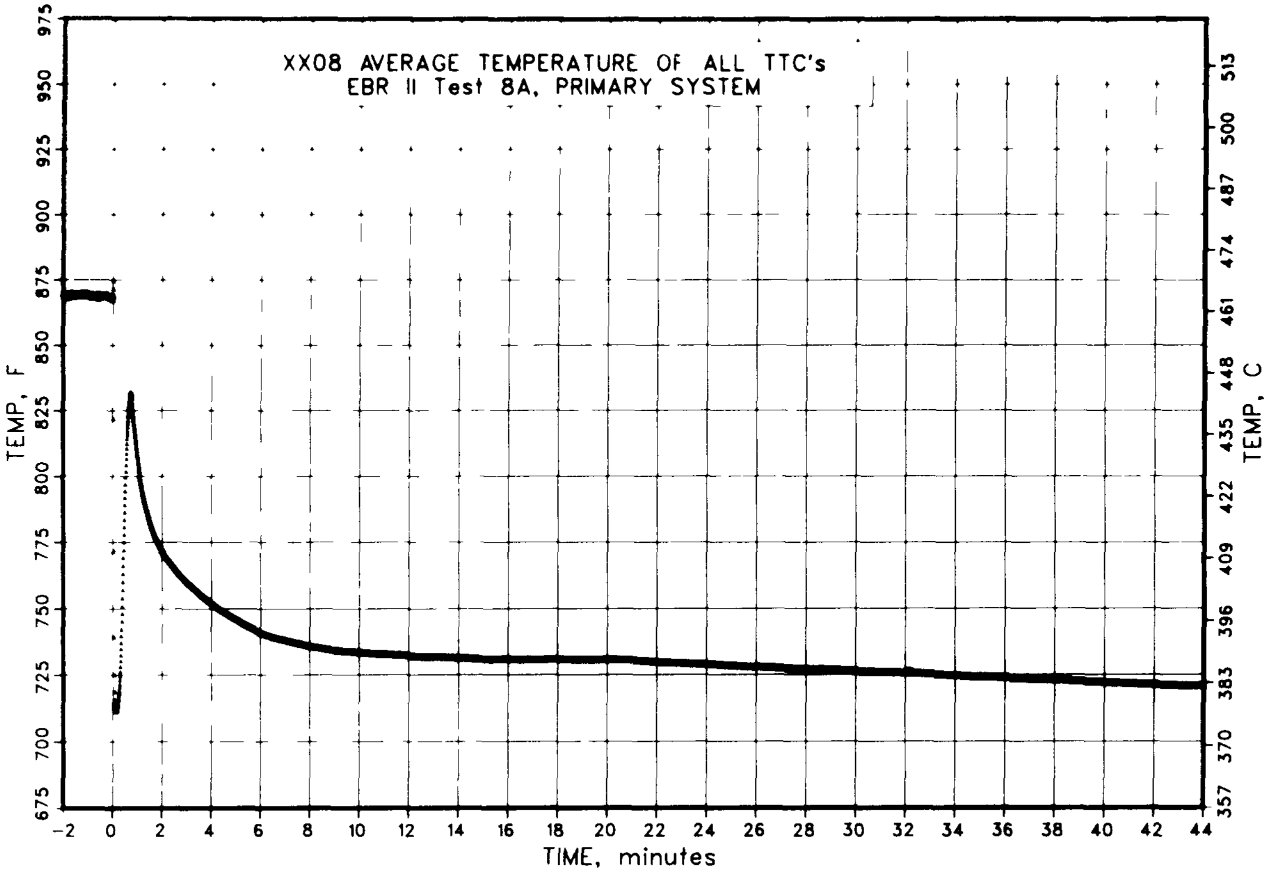
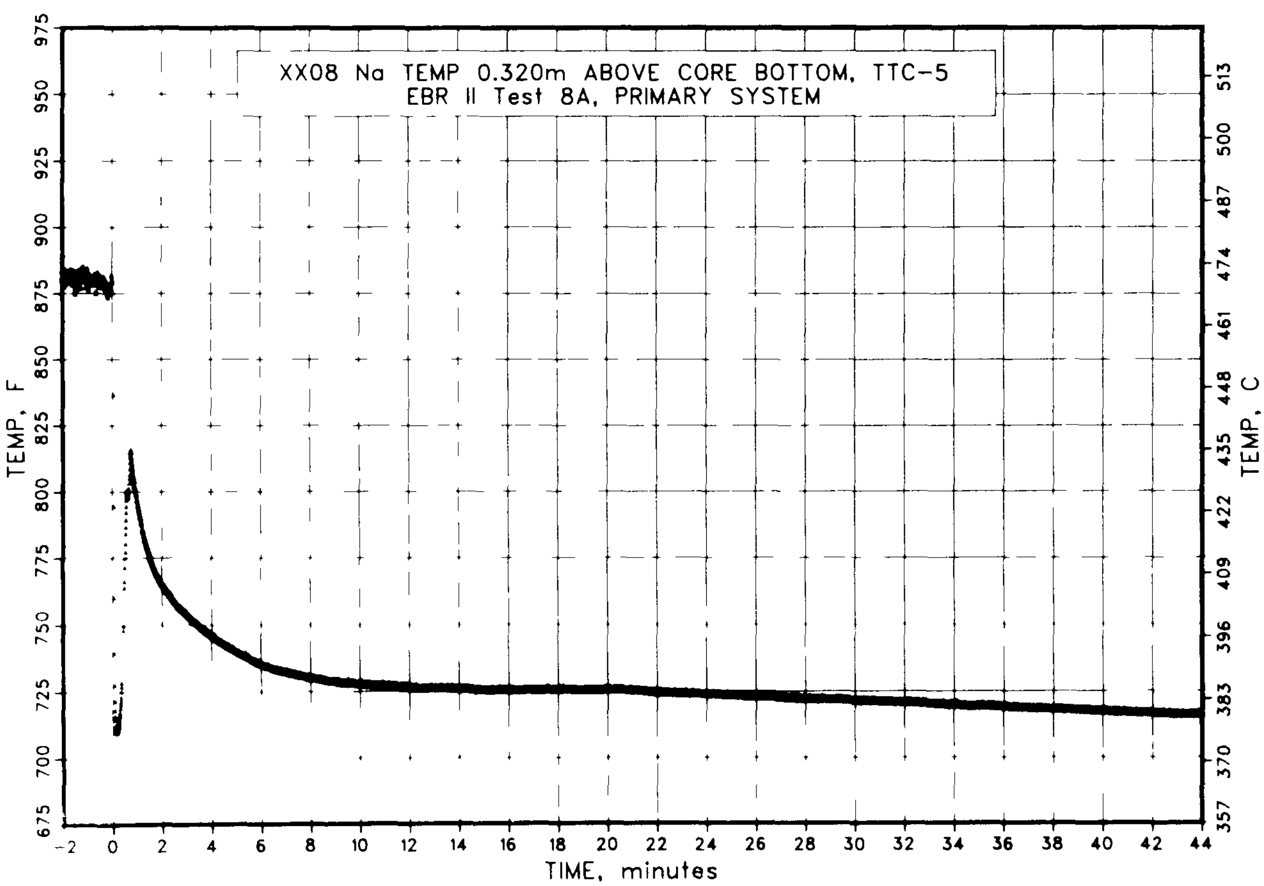

XX08 AVERAGE TEMPERATURE OF ALL TTC's
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
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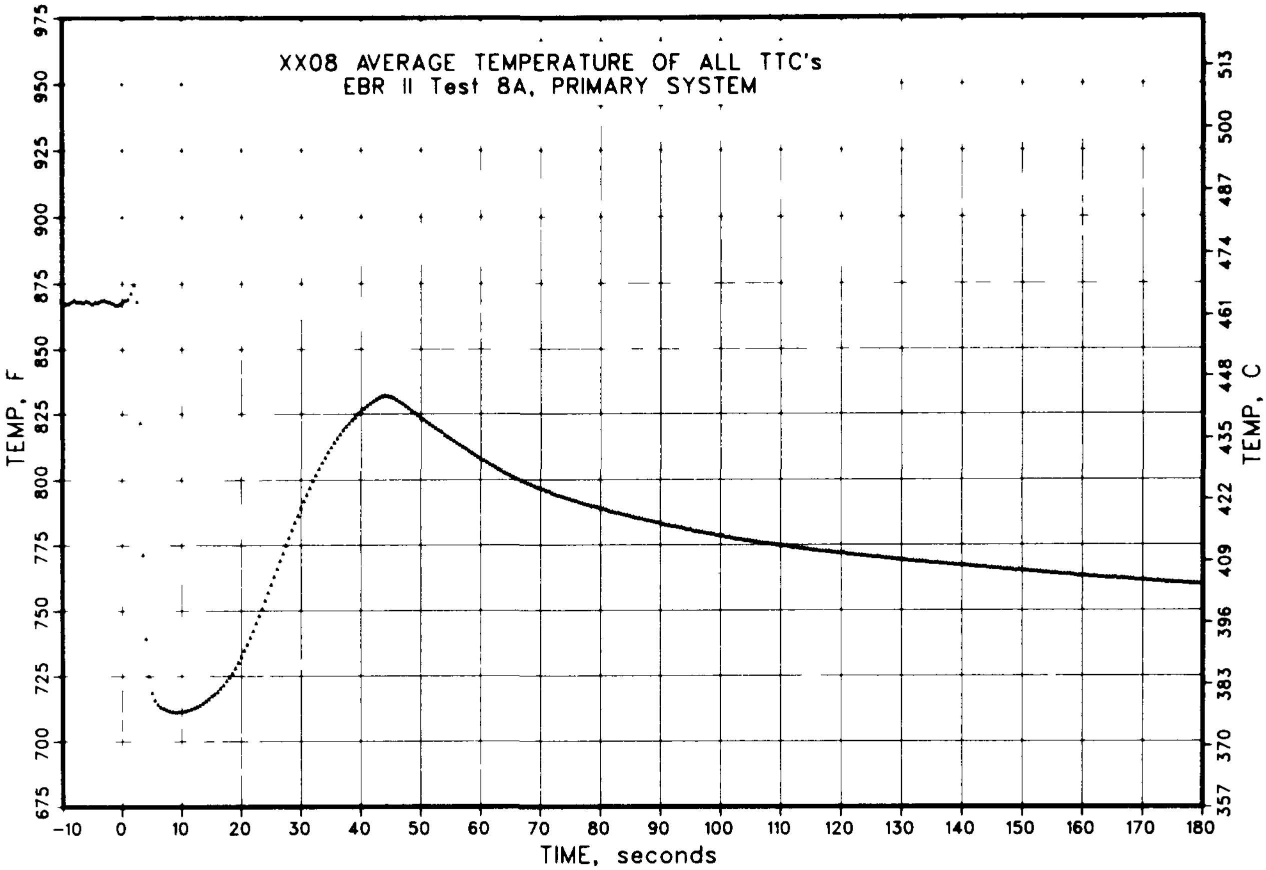
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes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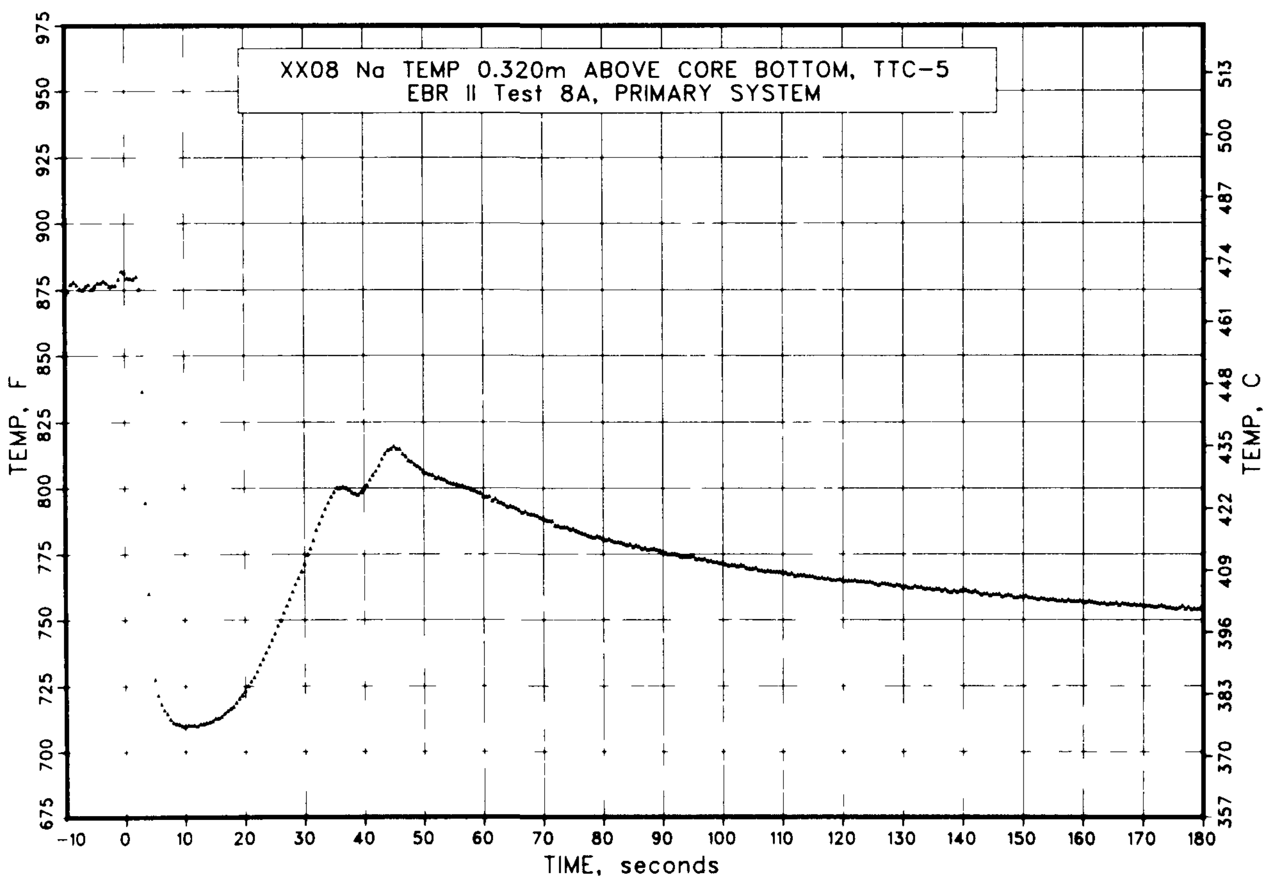
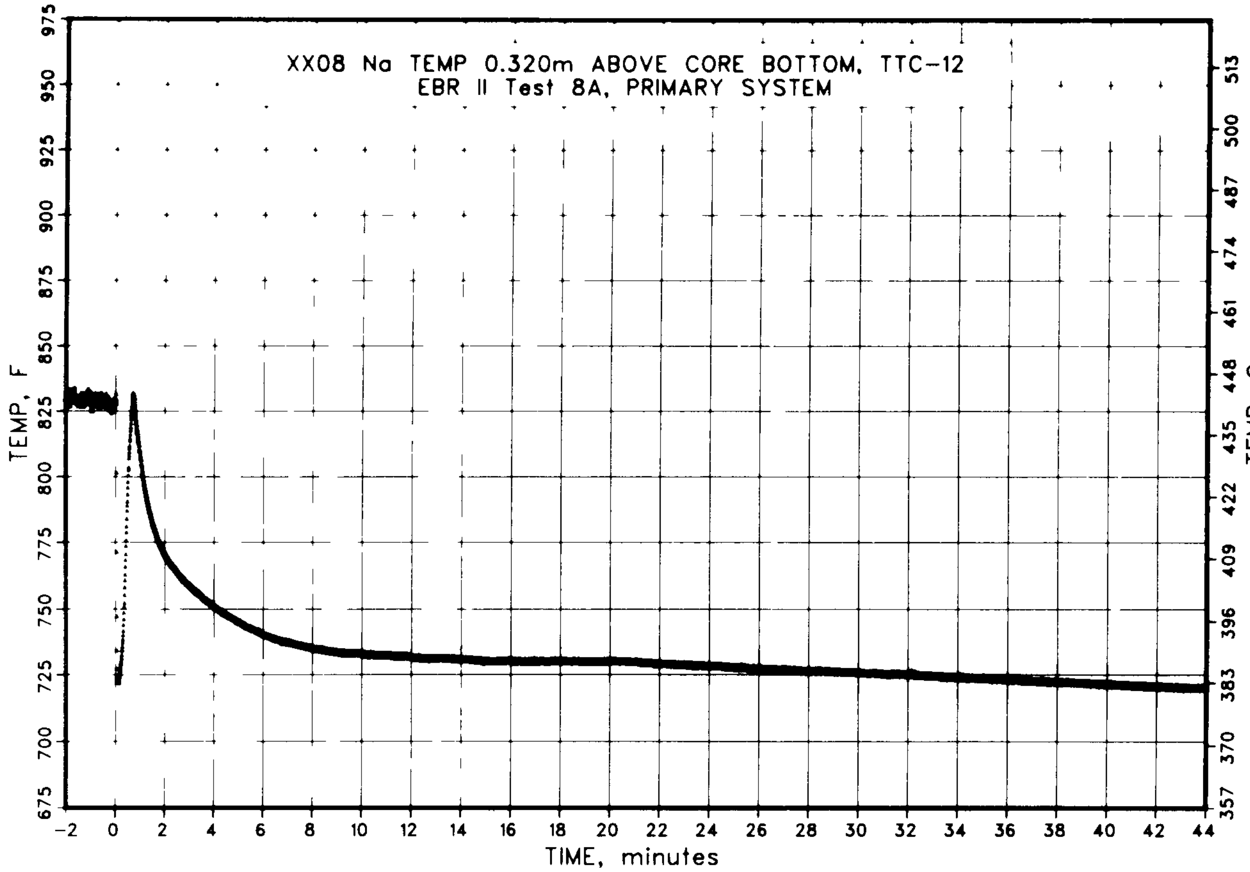
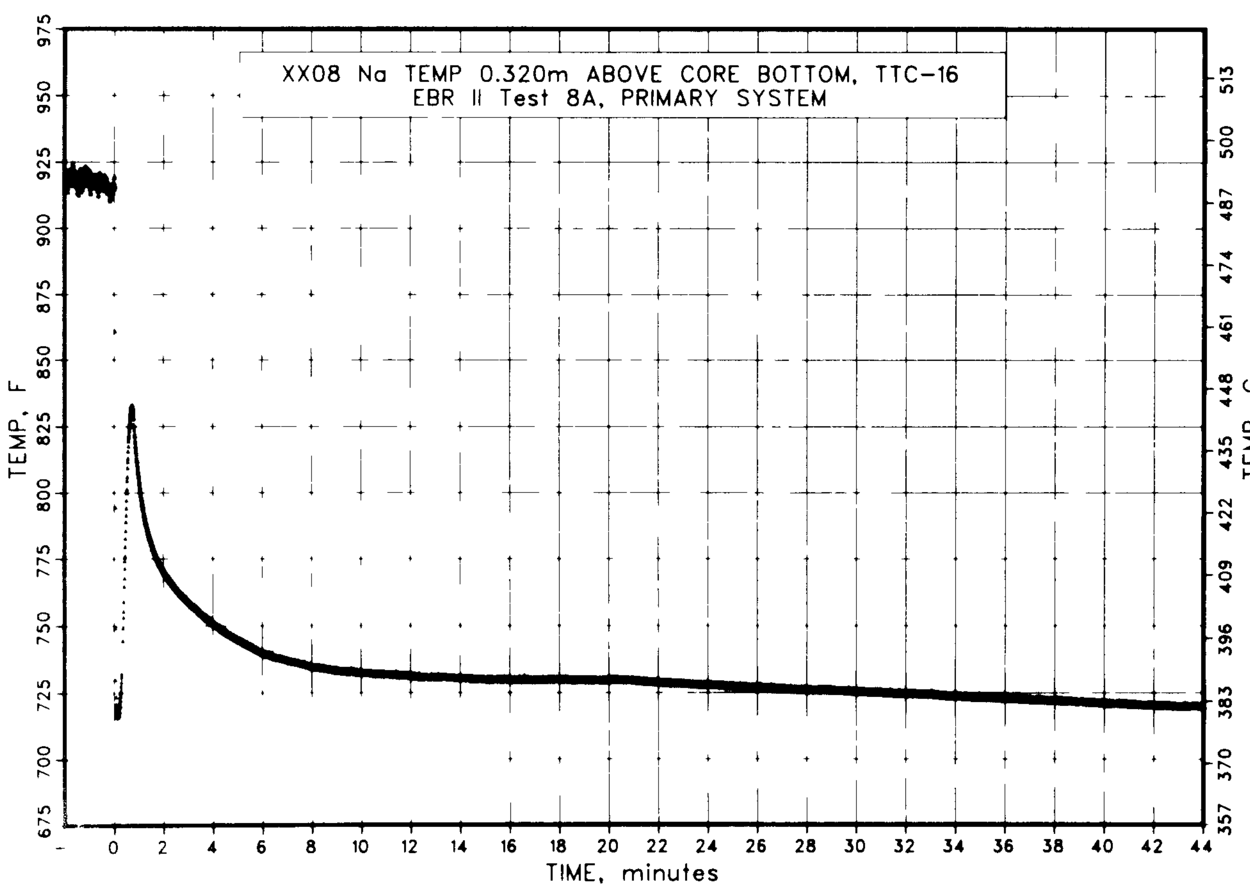
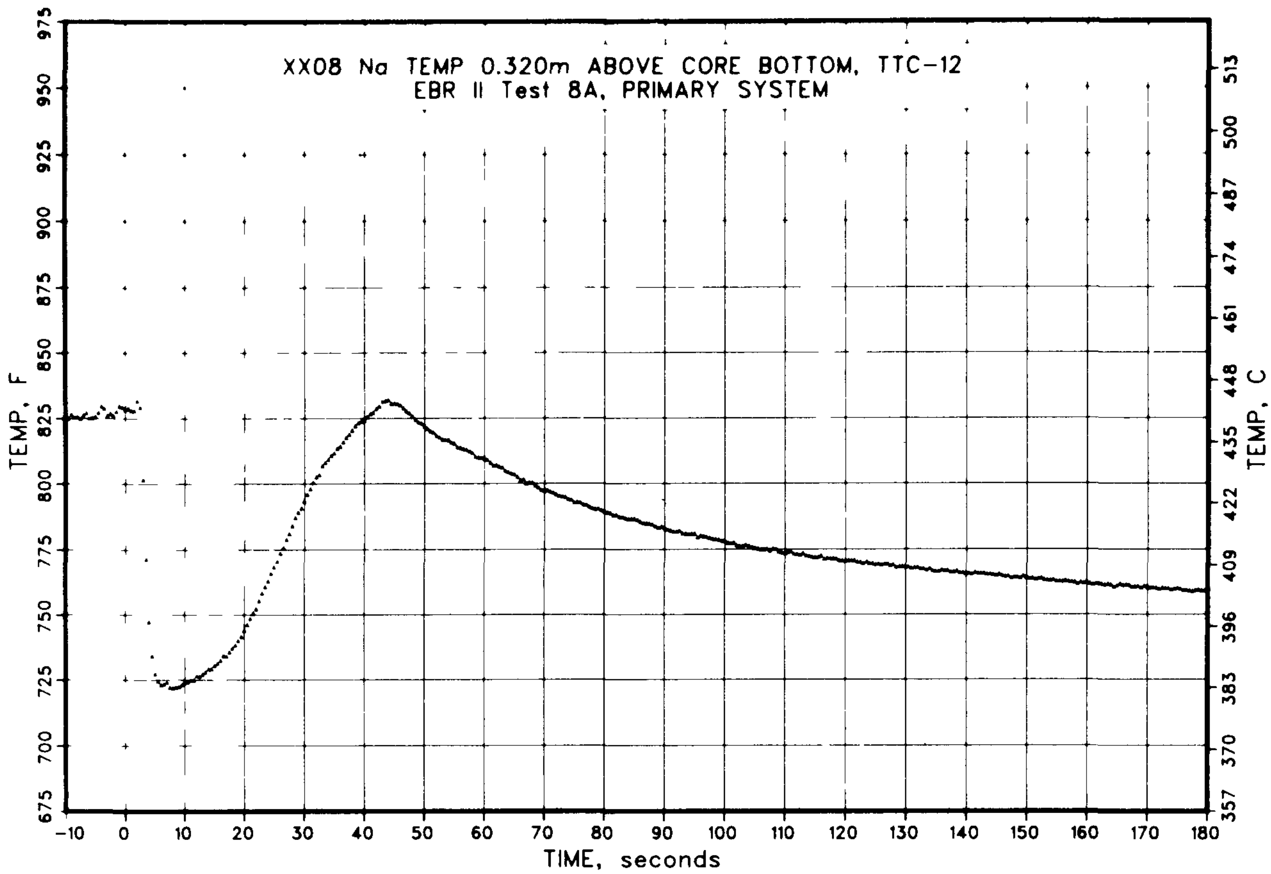
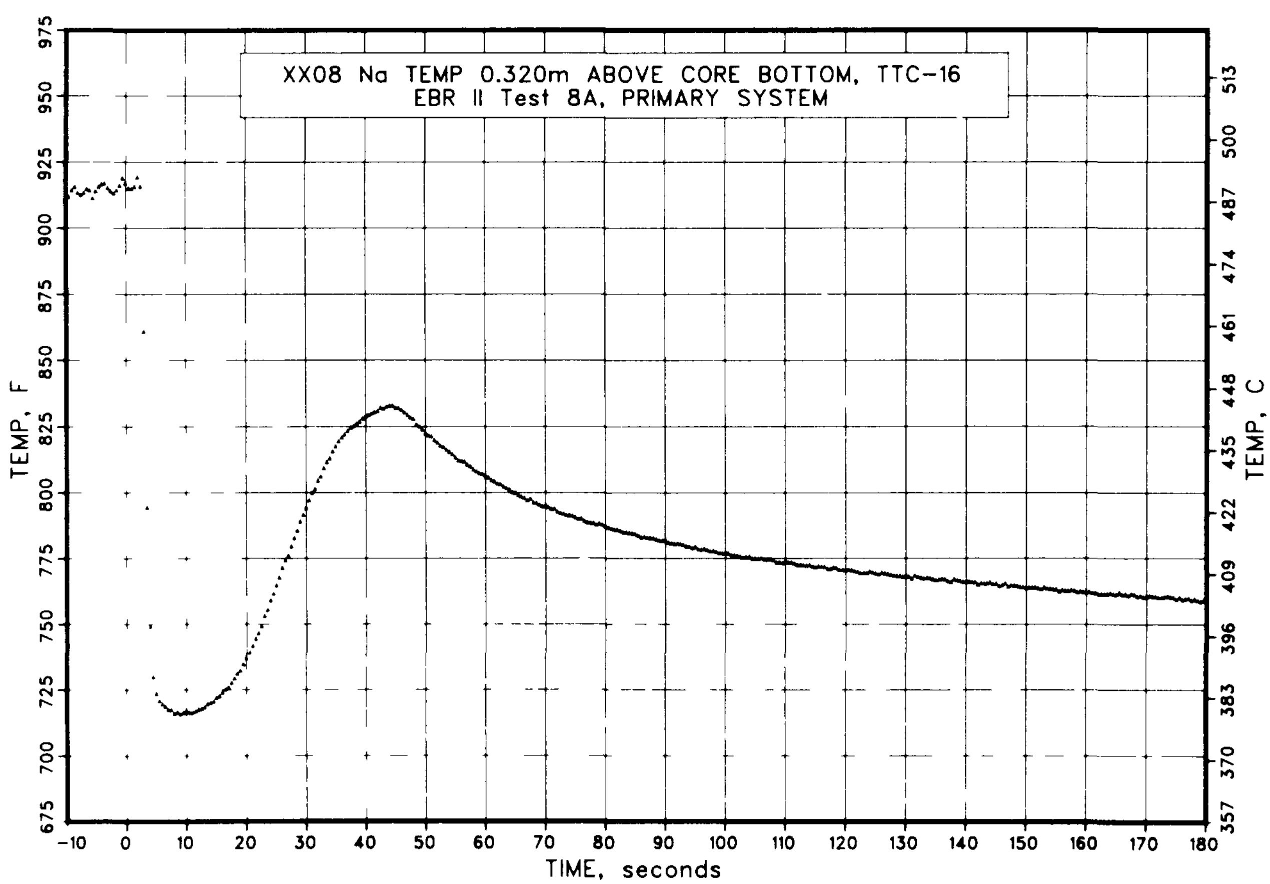
TEMP, F
TEMP, C
TIME, seconds

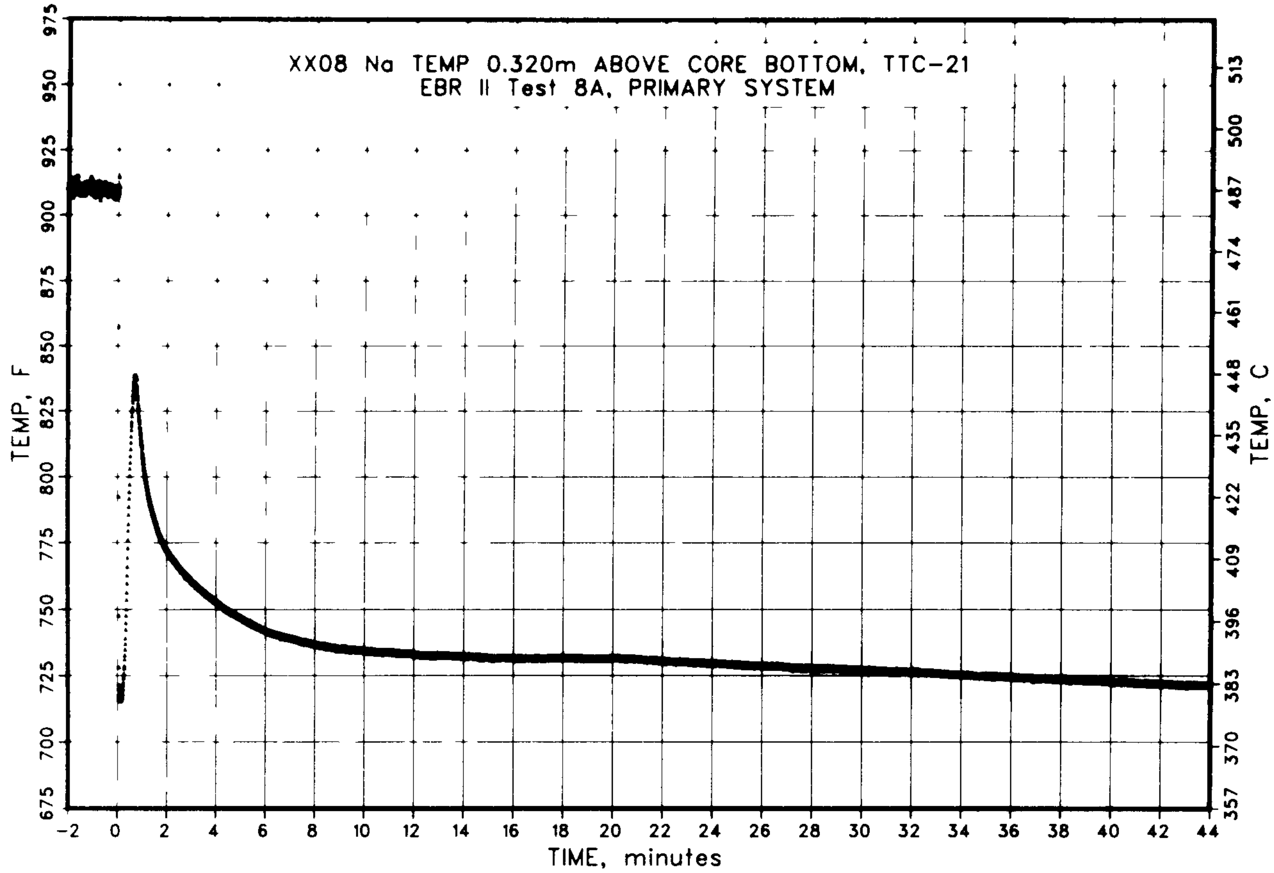

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

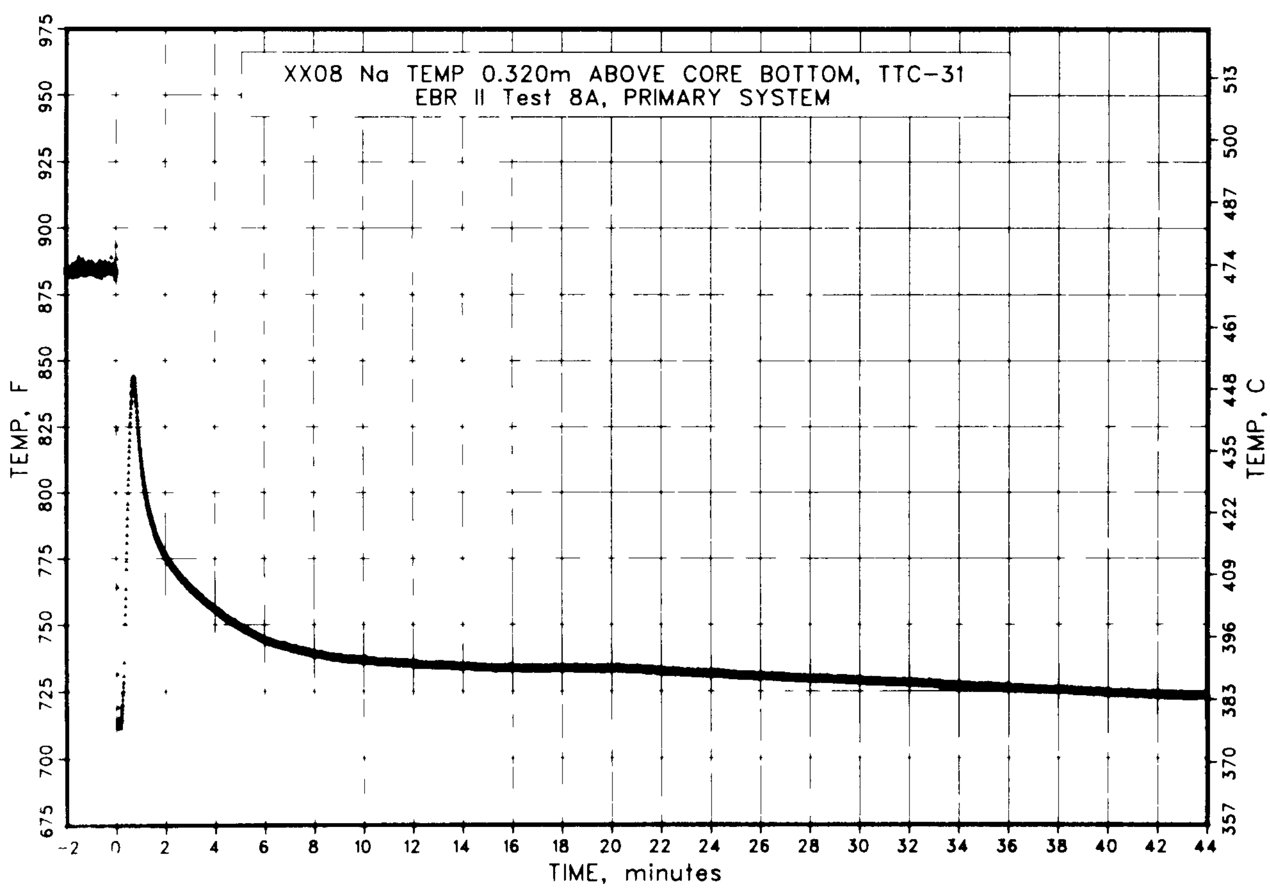

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-12
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

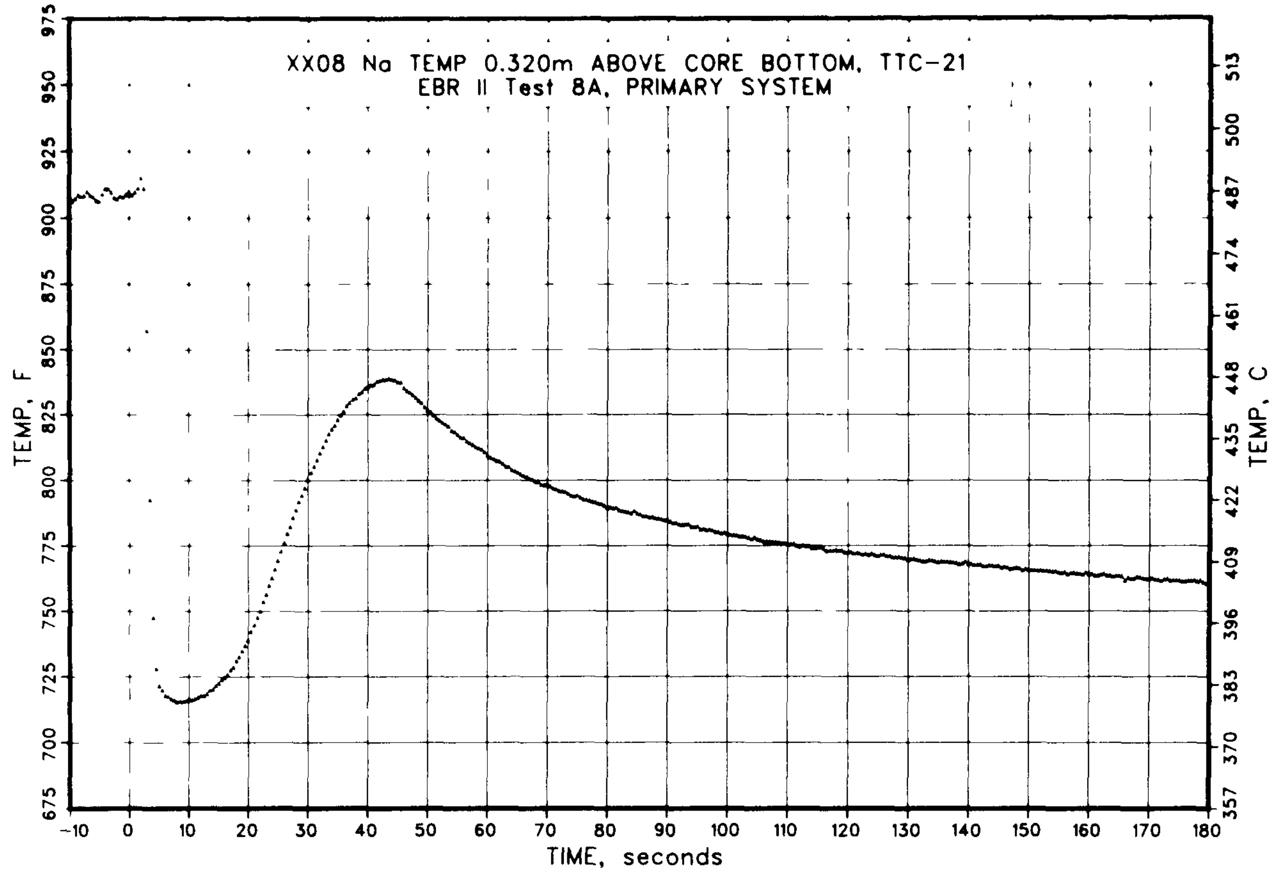

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-16
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

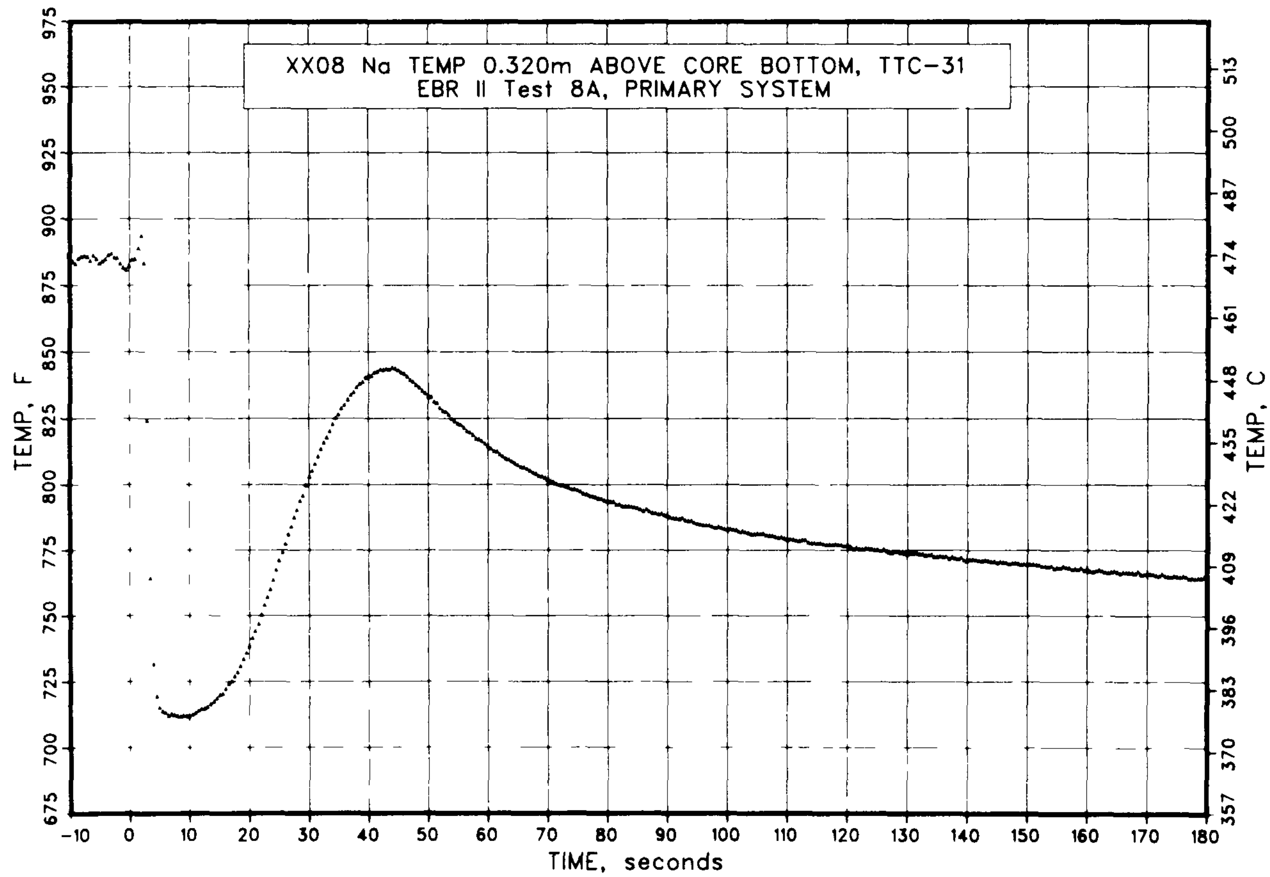

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-12
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-16
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-21
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-31
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-21
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-31
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
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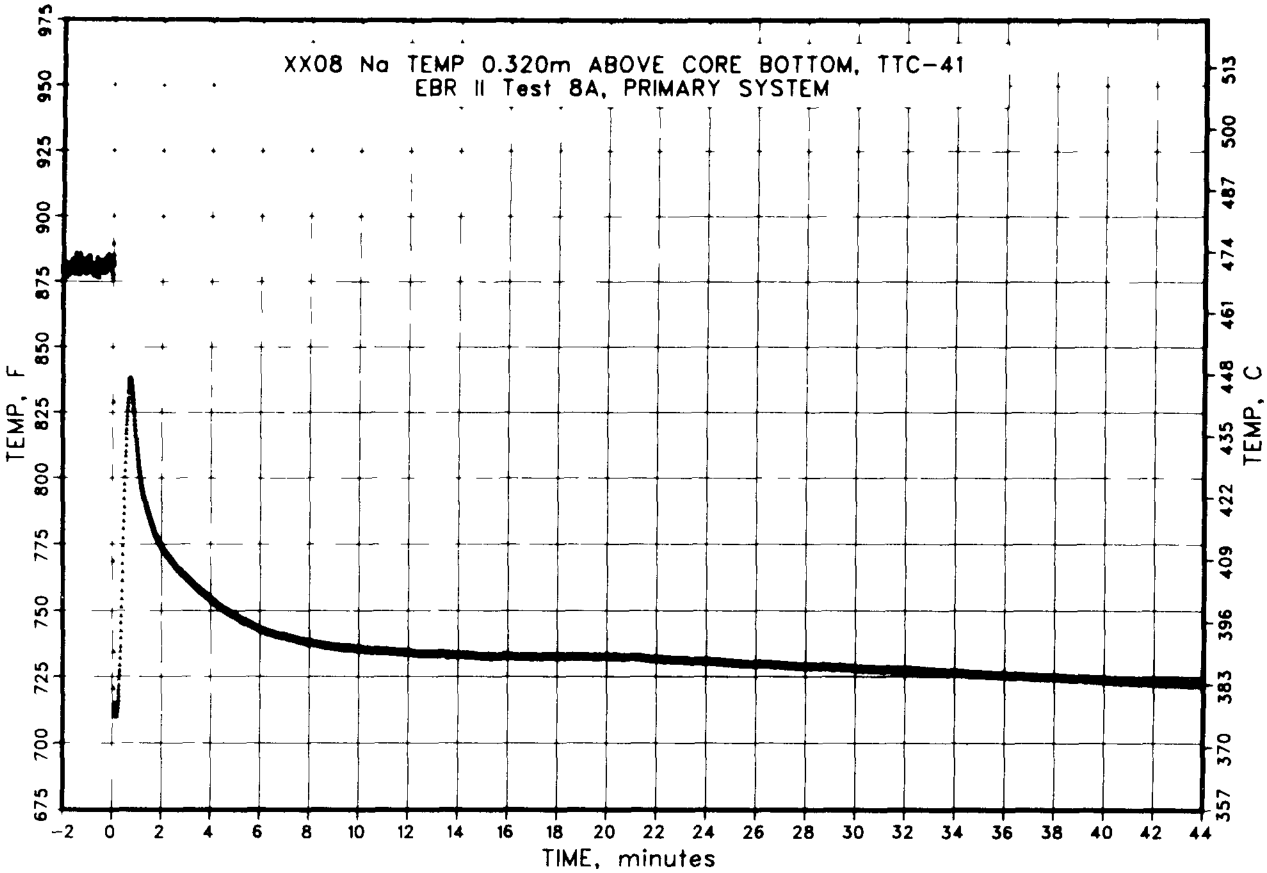
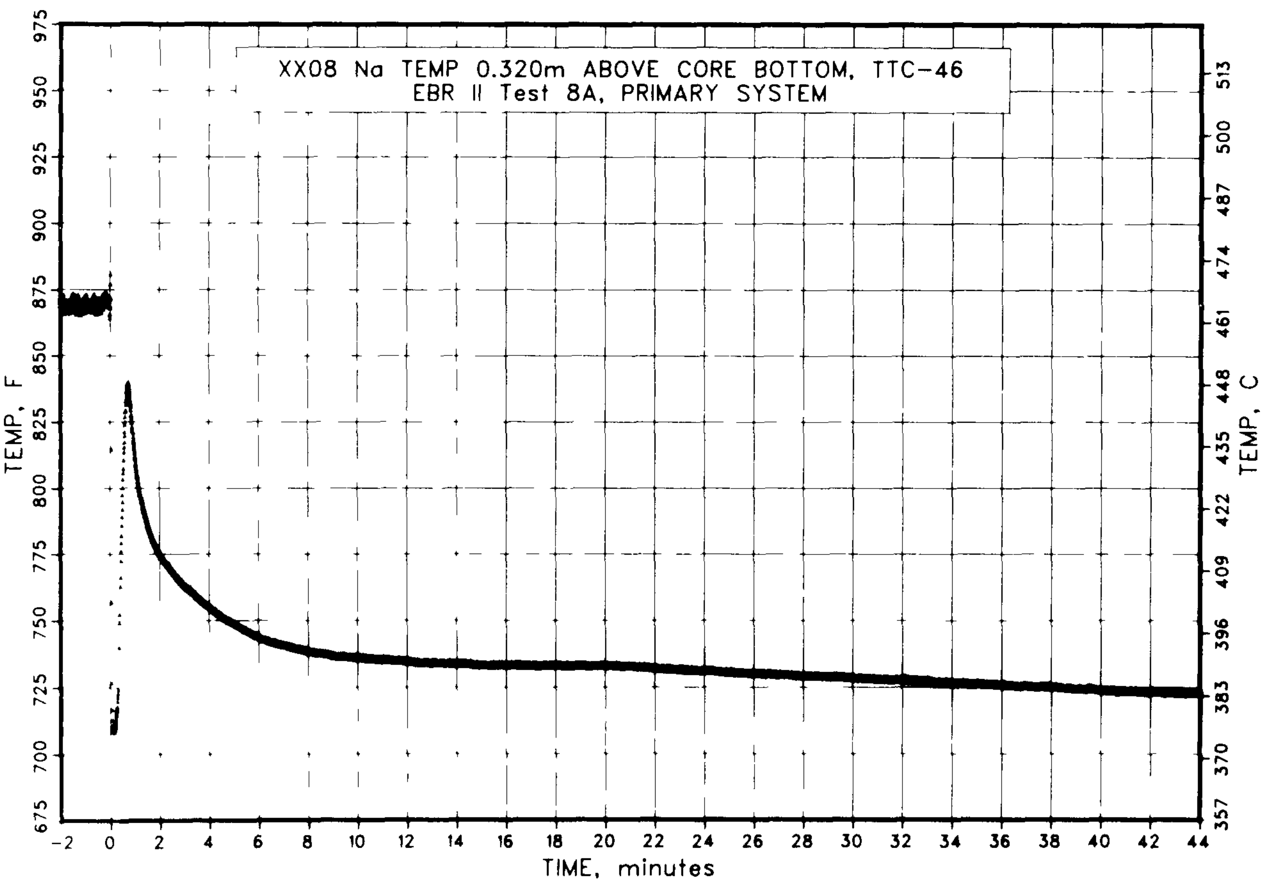
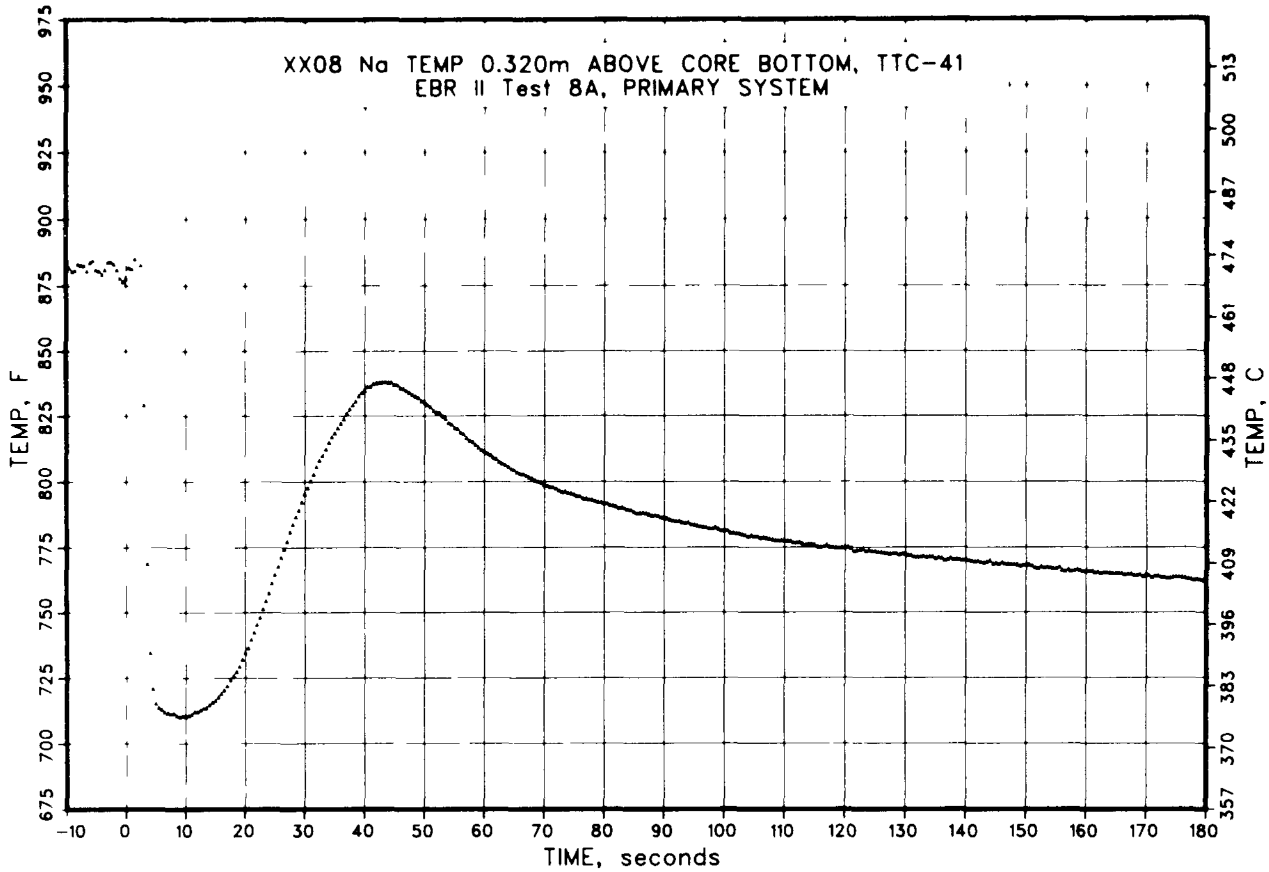

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-41
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-46
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-41
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
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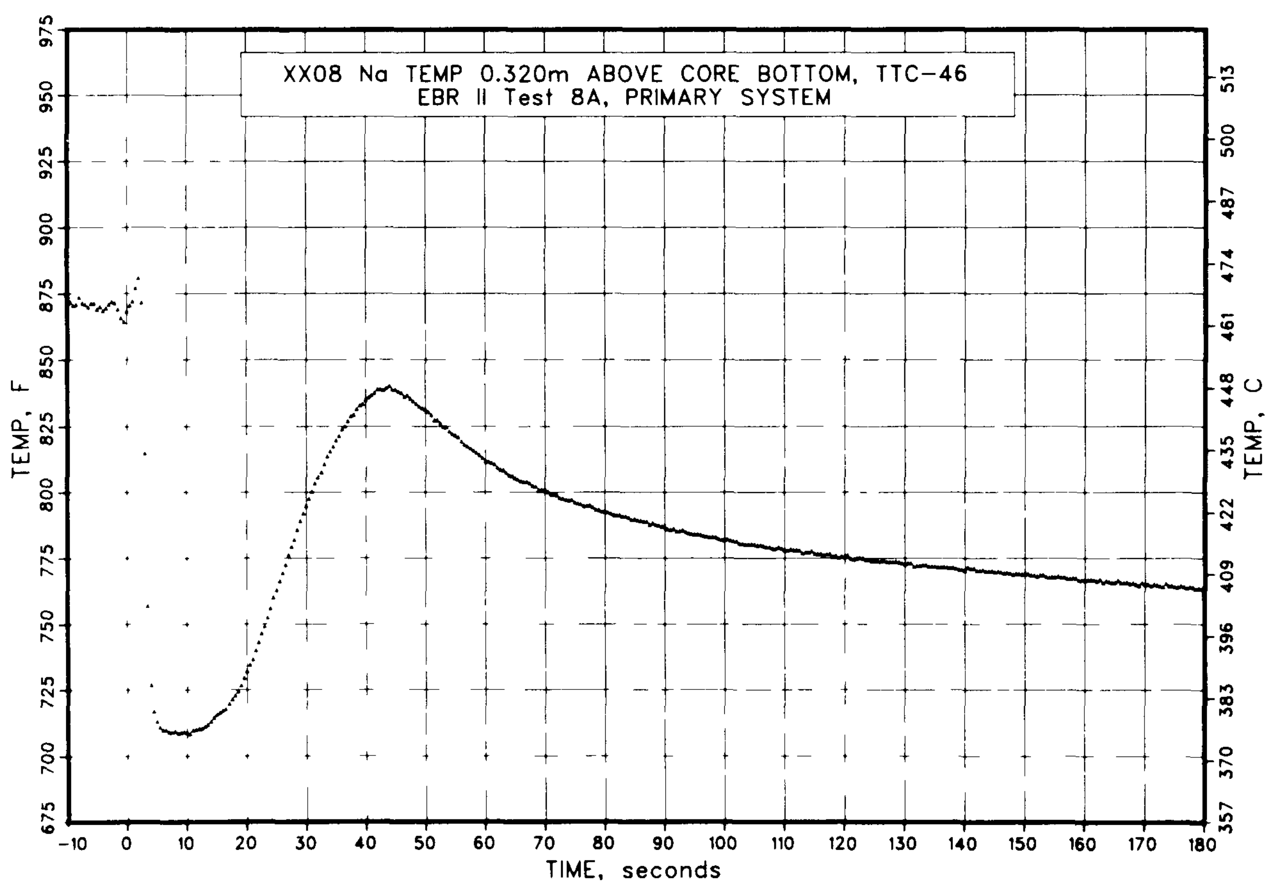
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-46
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
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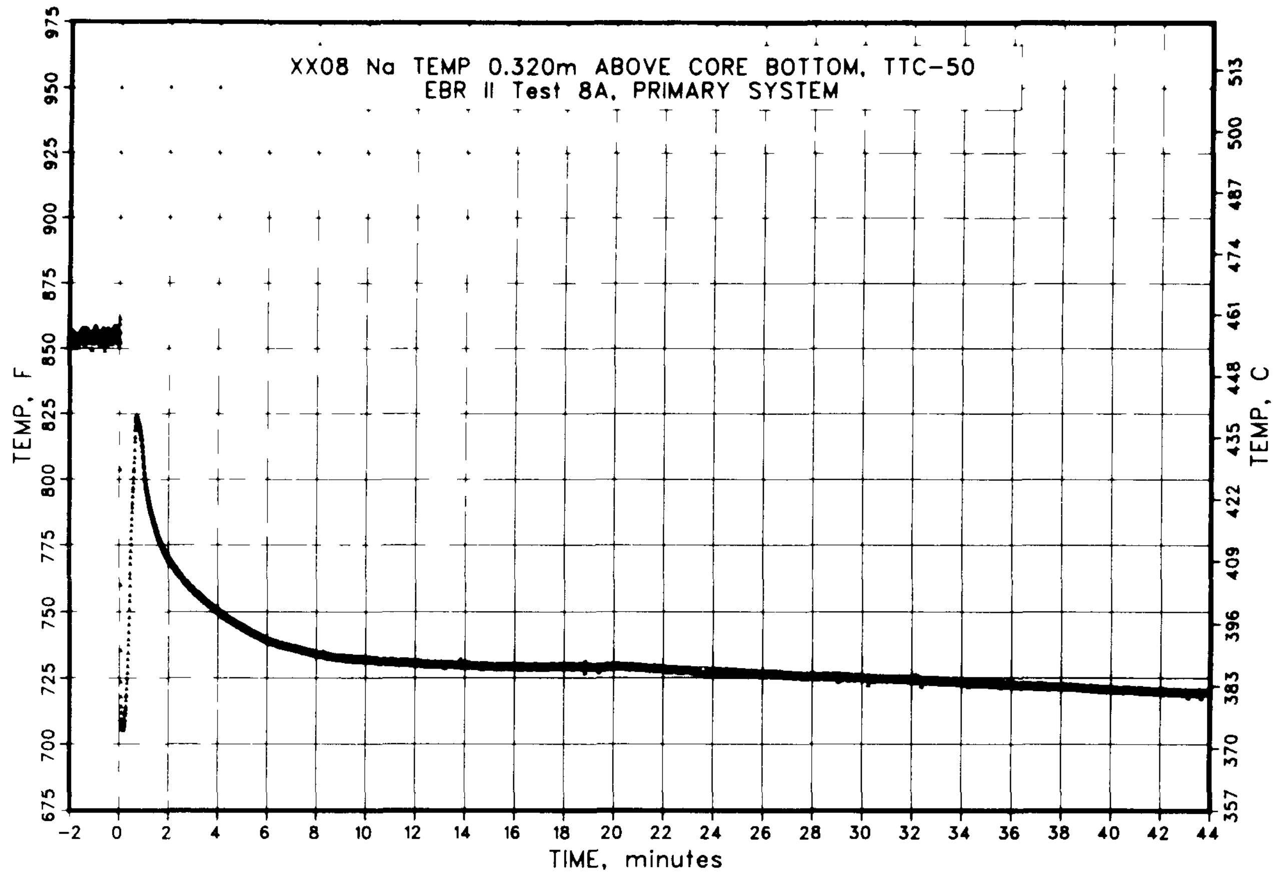
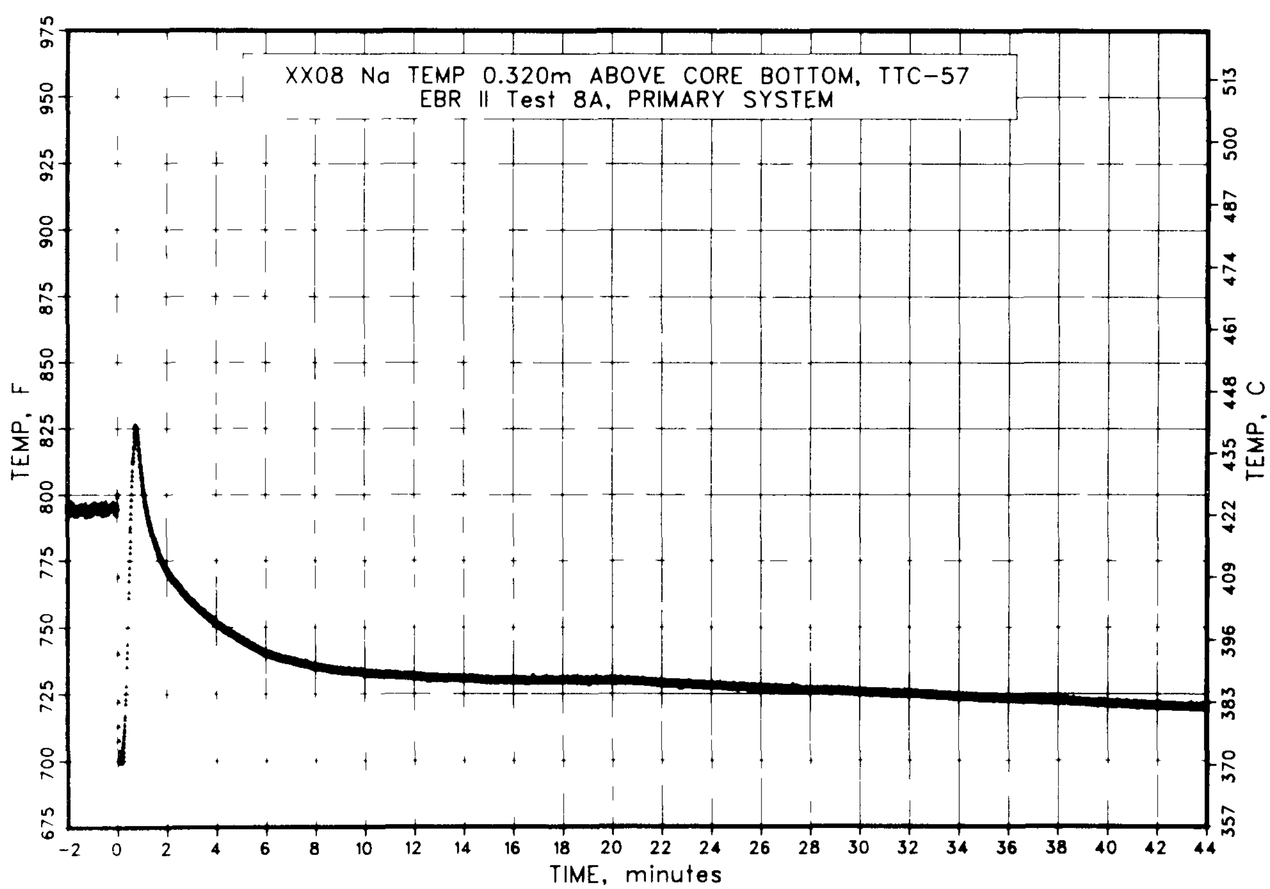
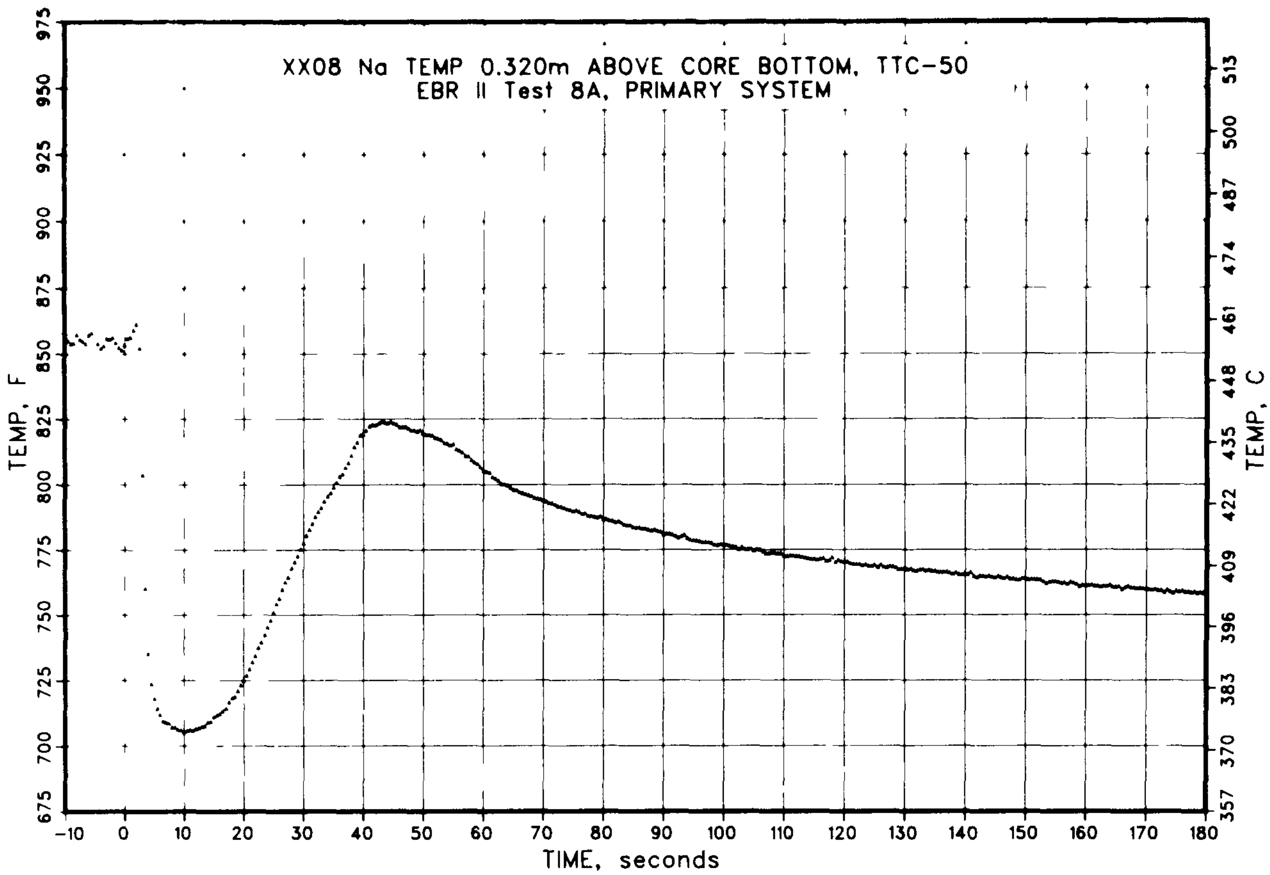
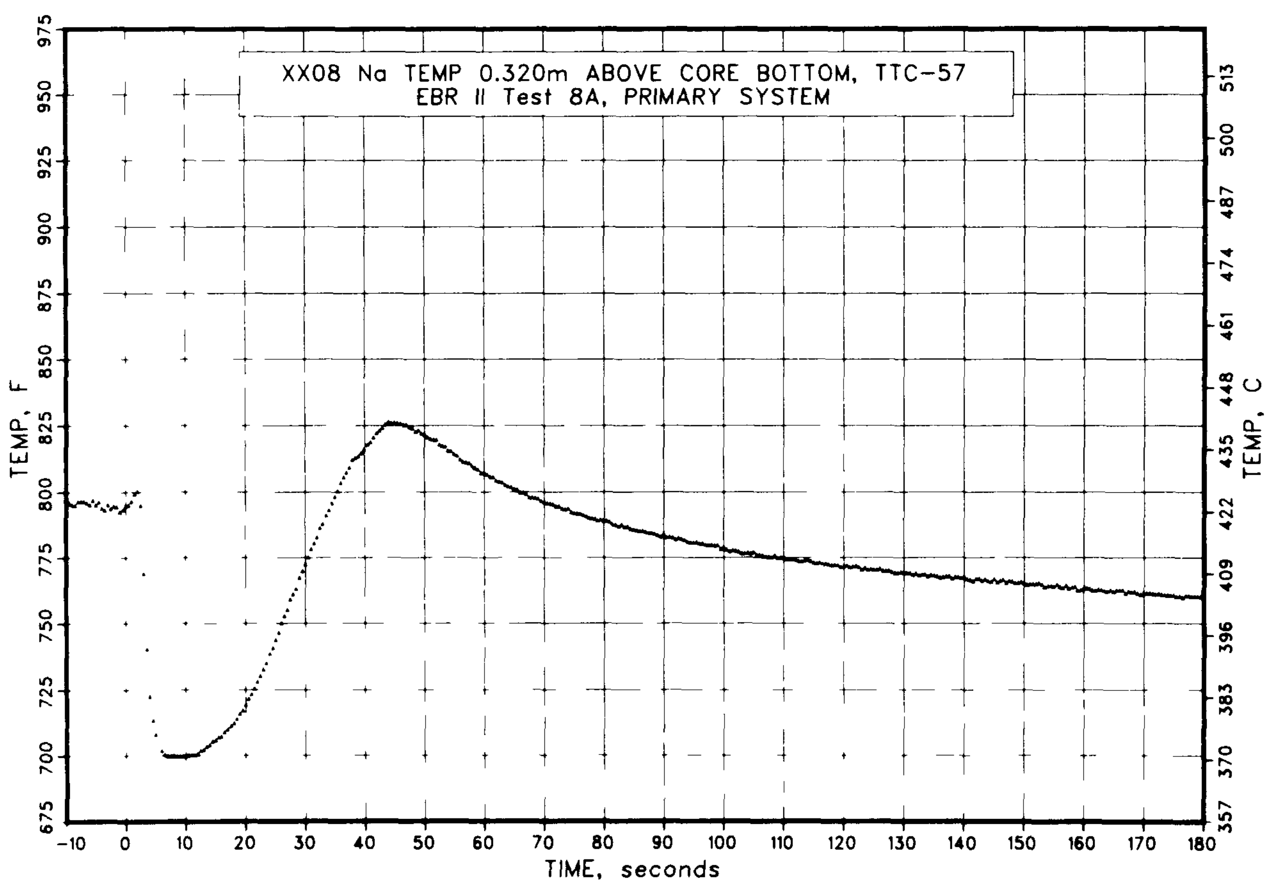
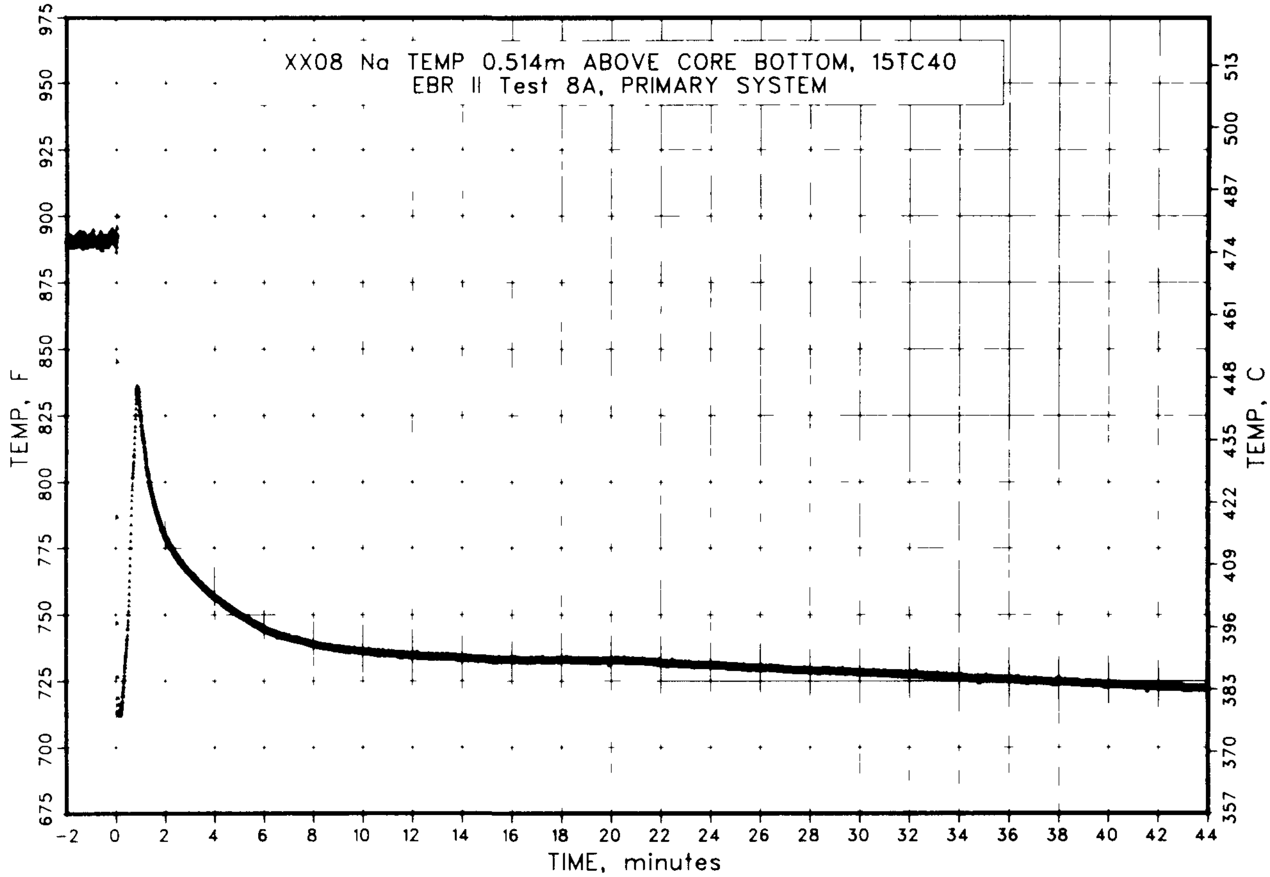
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

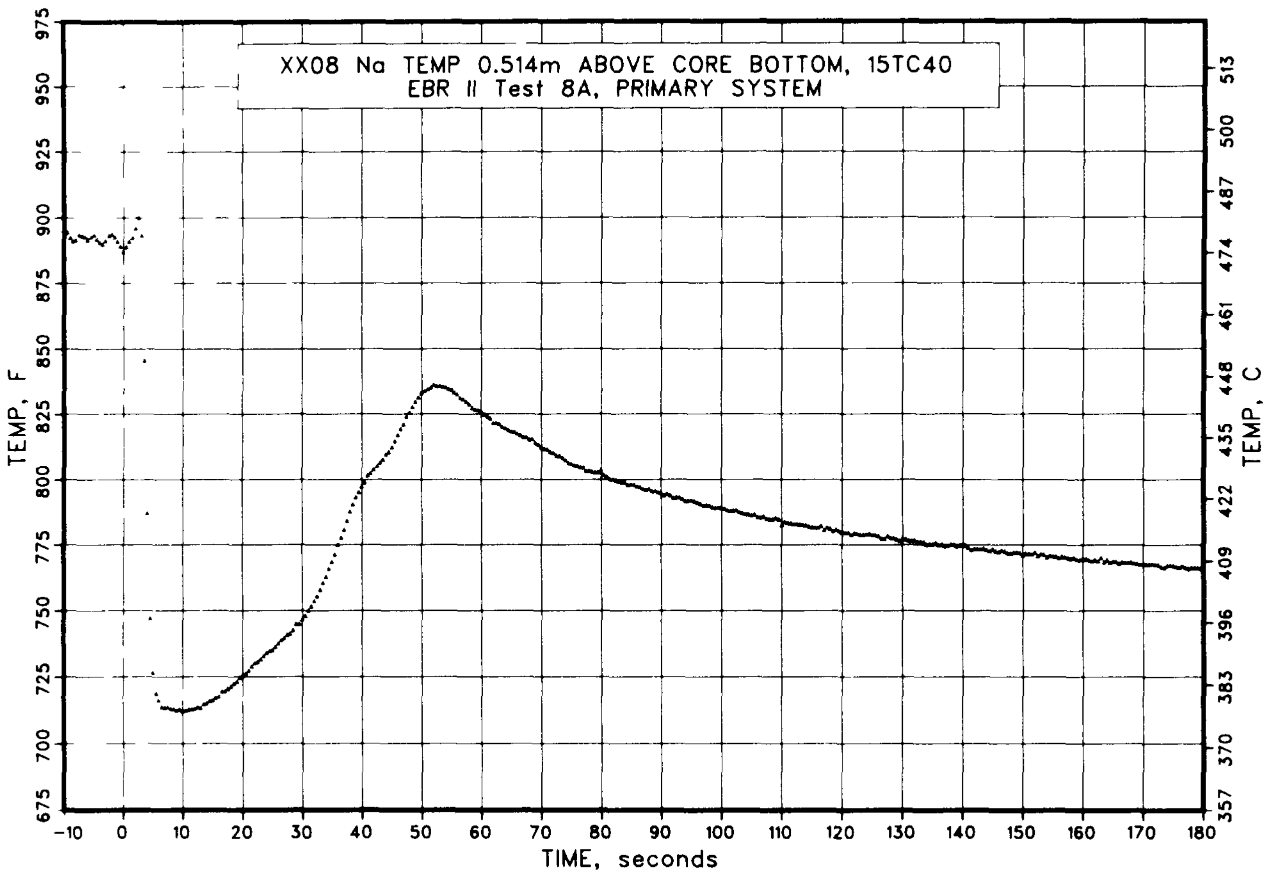

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-50
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-57
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-50
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
675 700 725 750 775 800 825 850 875 900 925 950 975
357 370 383 396 409 422 435 448 461 474 487 500 513
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-57
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
675 700 725 750 775 800 825 850 875 900 925 950 975
357 370 383 396 409 422 435 448 461 474 487 500 513
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


XX08 Na TEMP 0.514m ABOVE CORE BOTTOM, 15TC40
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


XX08 Na TEMP 0.514m ABOVE CORE BOTTOM, 15TC40
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
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950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
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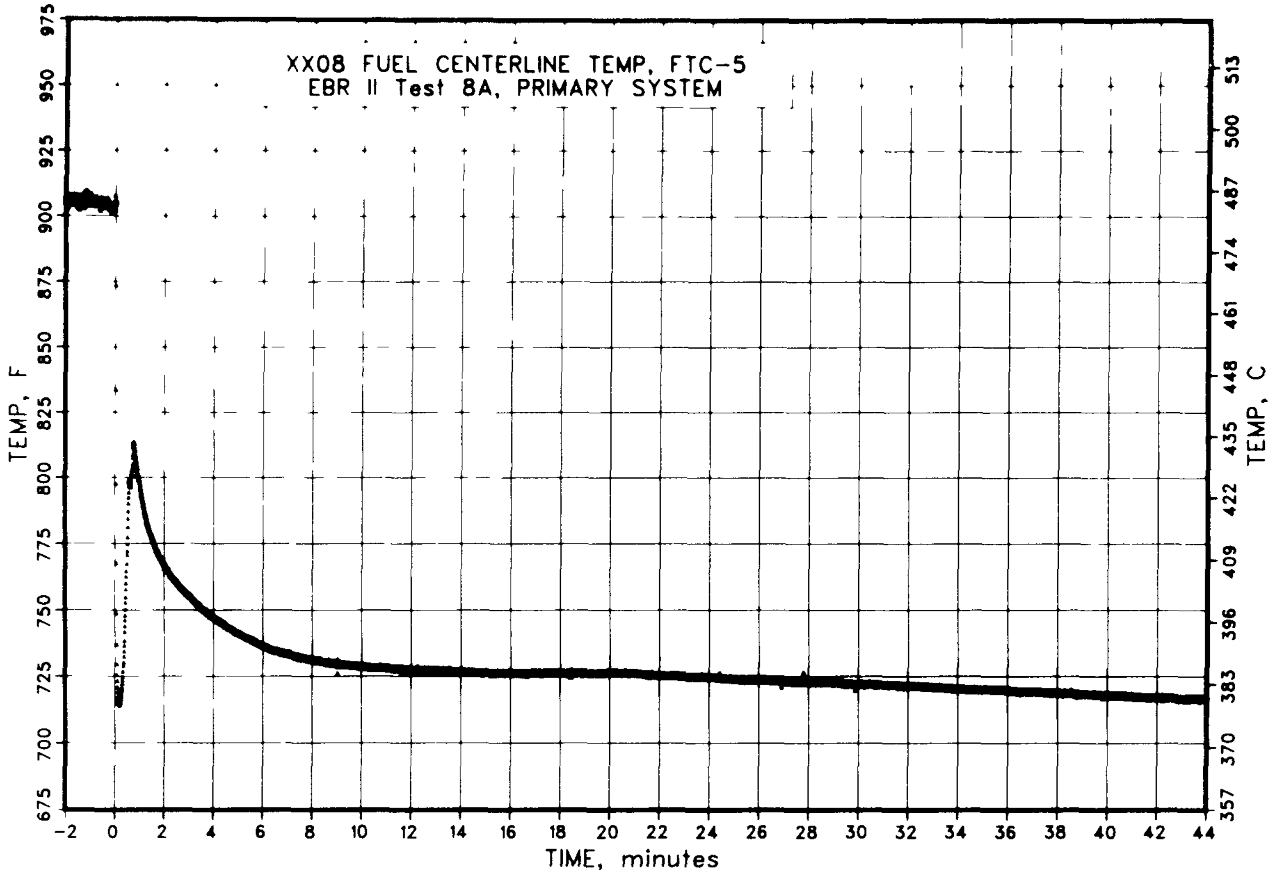
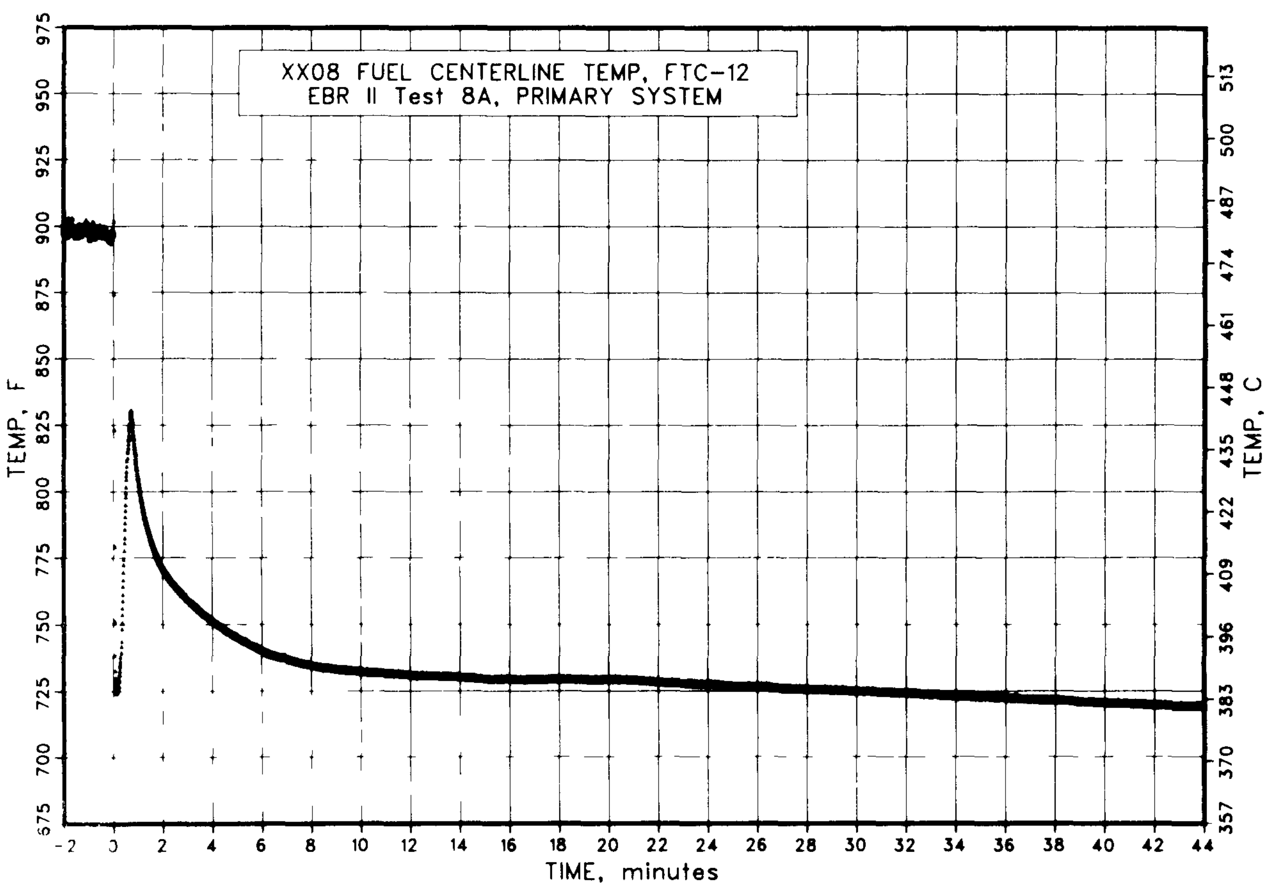
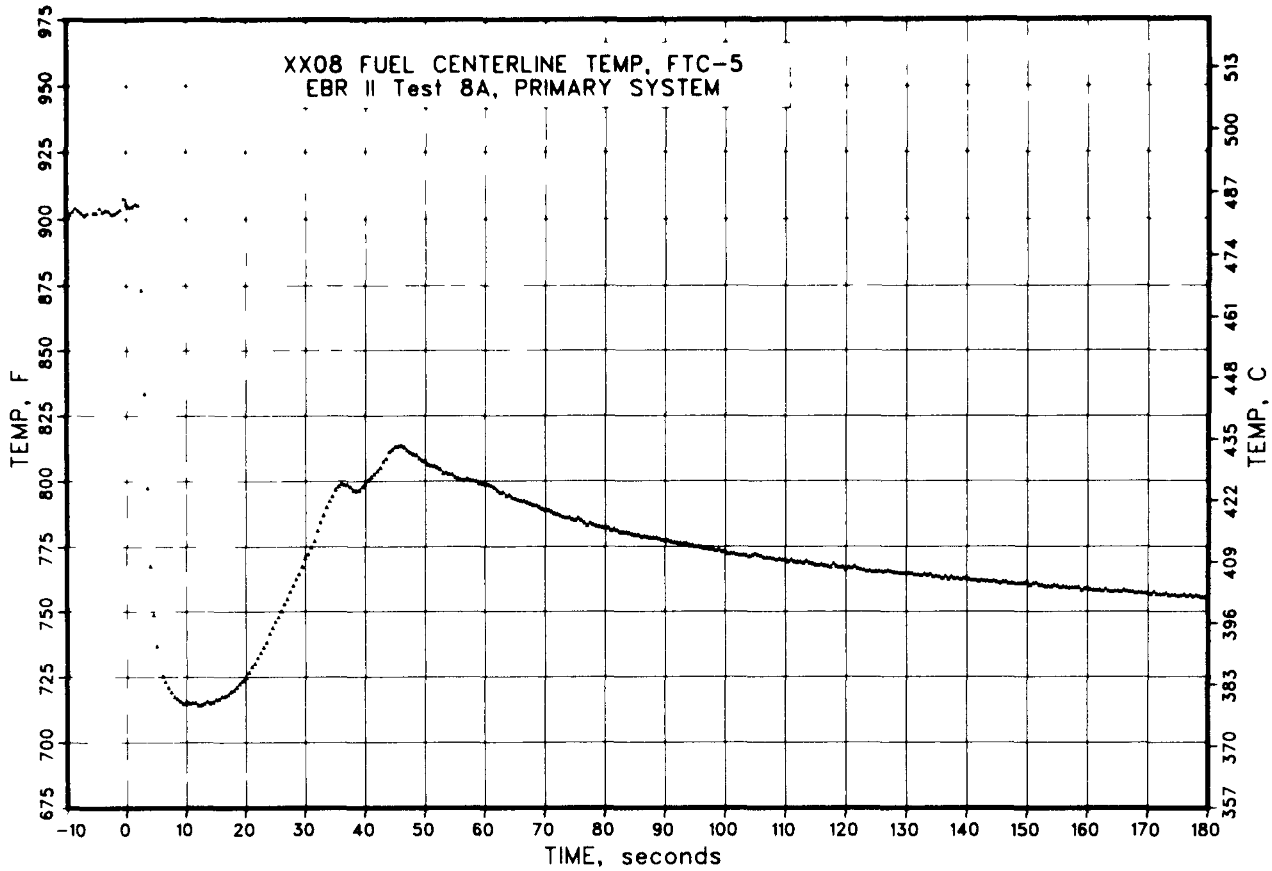
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


XX08 FUEL CENTERLINE TEMP, FTC-5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 FUEL CENTERLINE TEMP, FTC-12
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 FUEL CENTERLINE TEMP, FTC-5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
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30
40
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60
70
80
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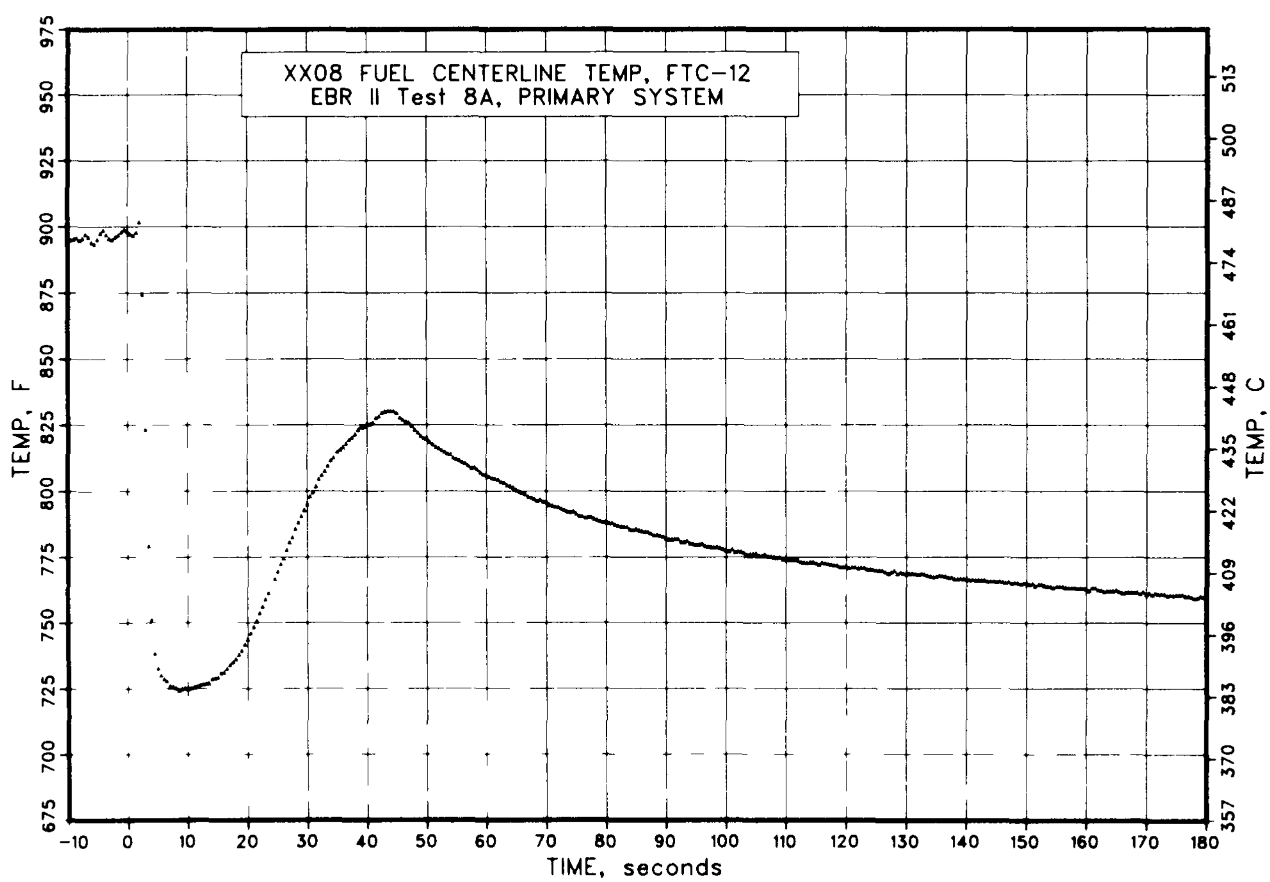
100
110
120
130
140
150
160
170
180


XX08 FUEL CENTERLINE TEMP, FTC-12
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
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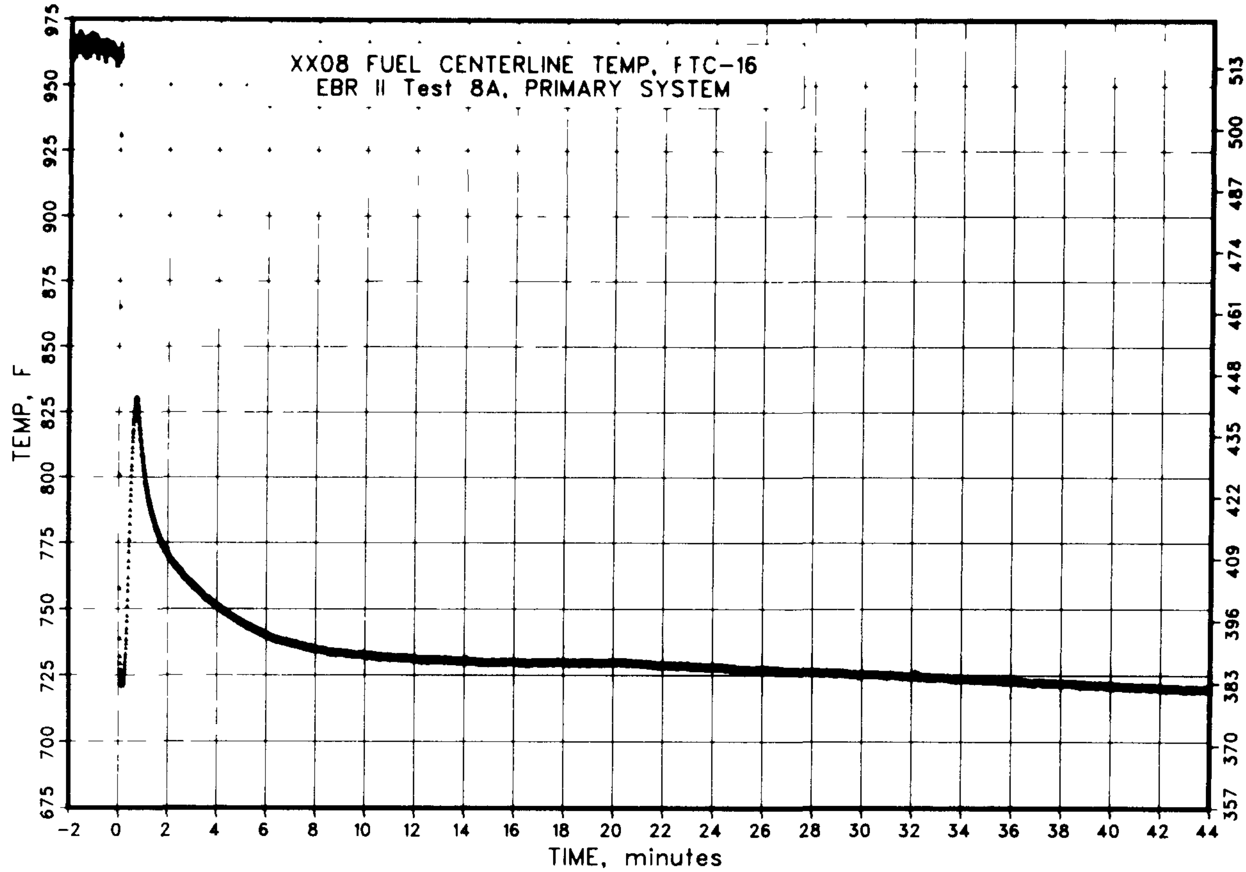
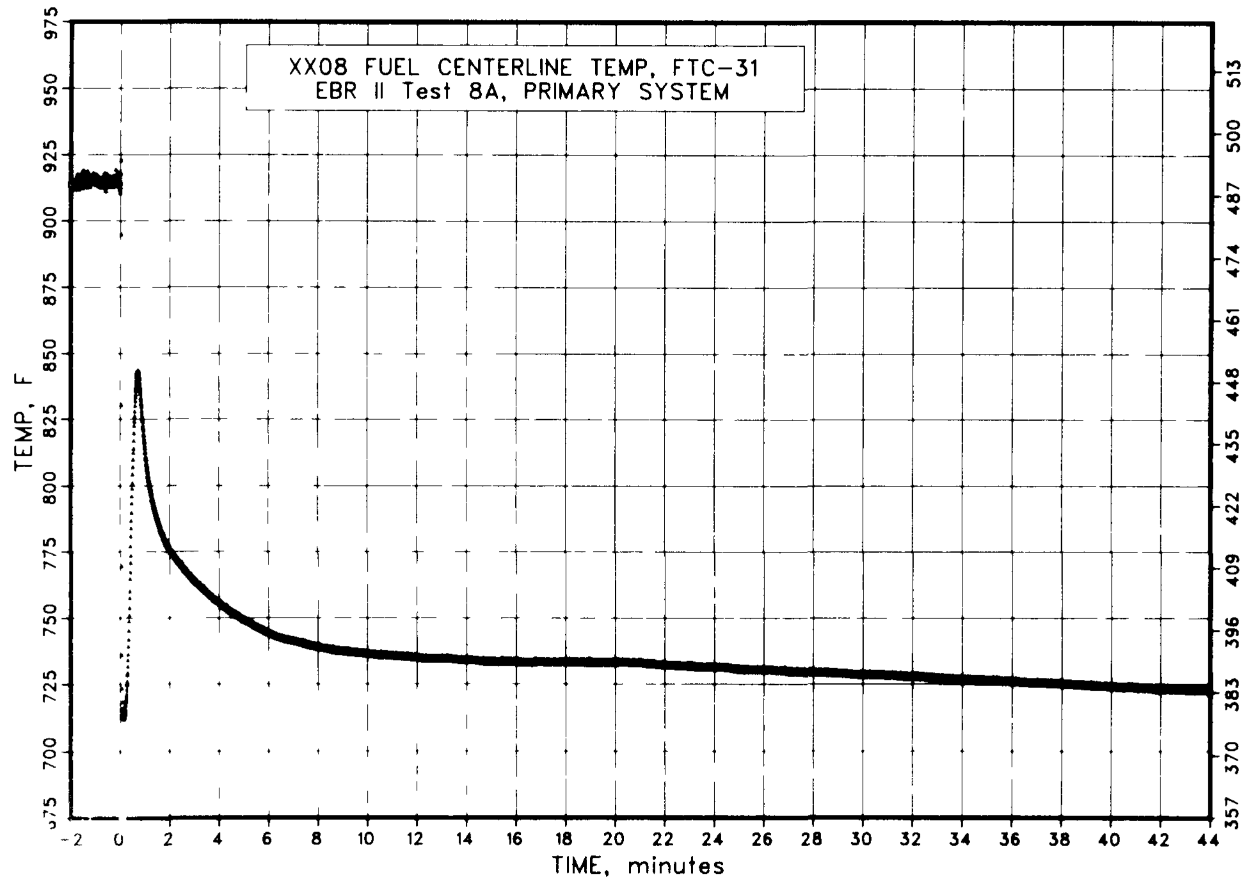
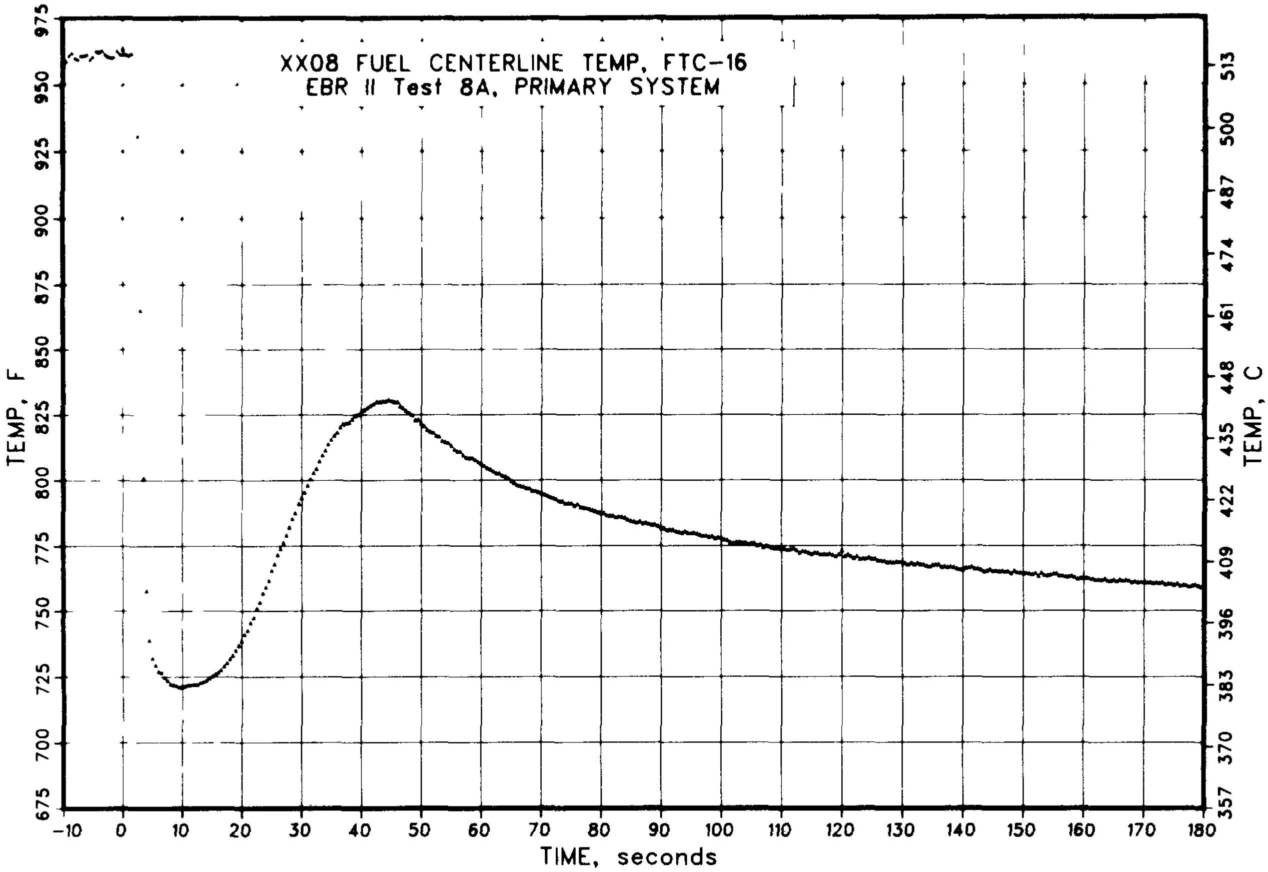
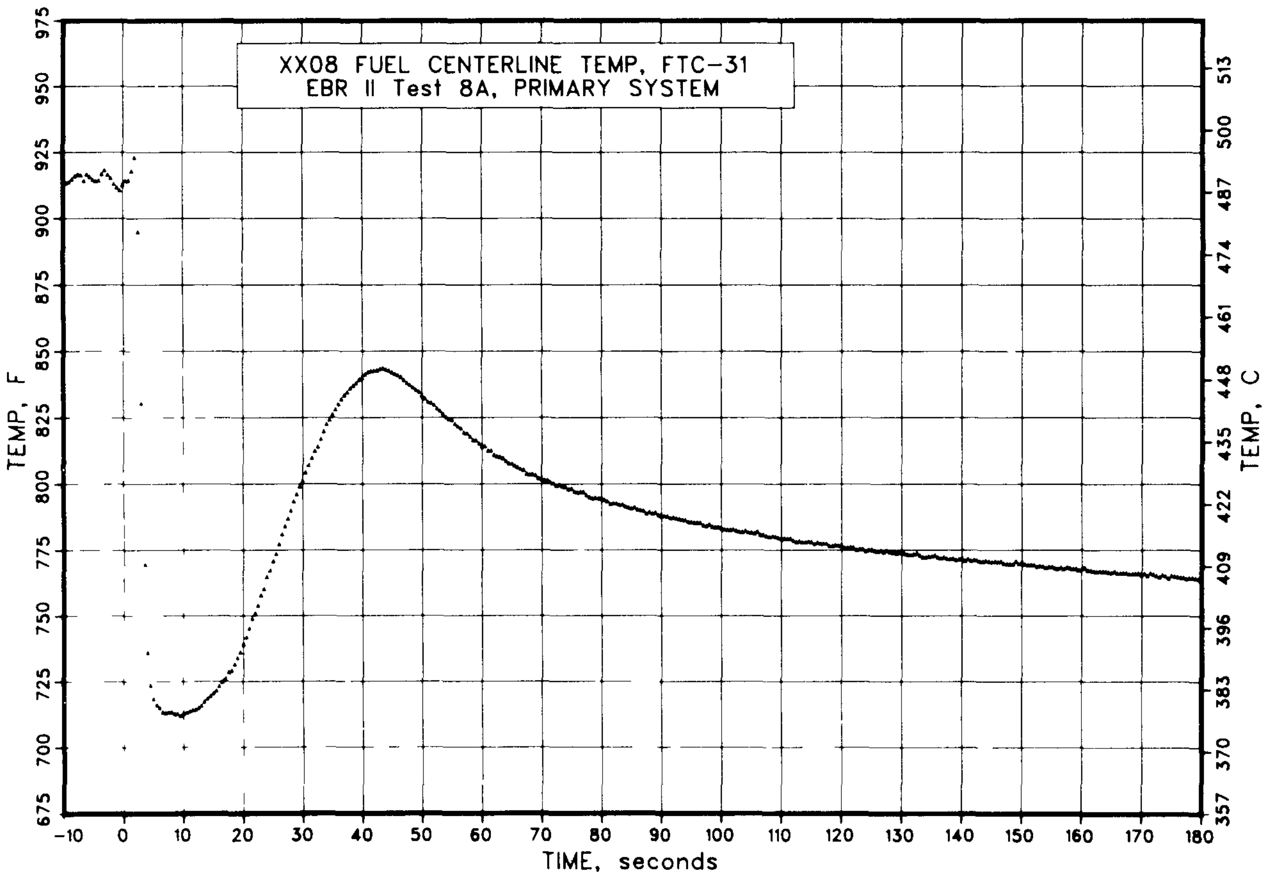
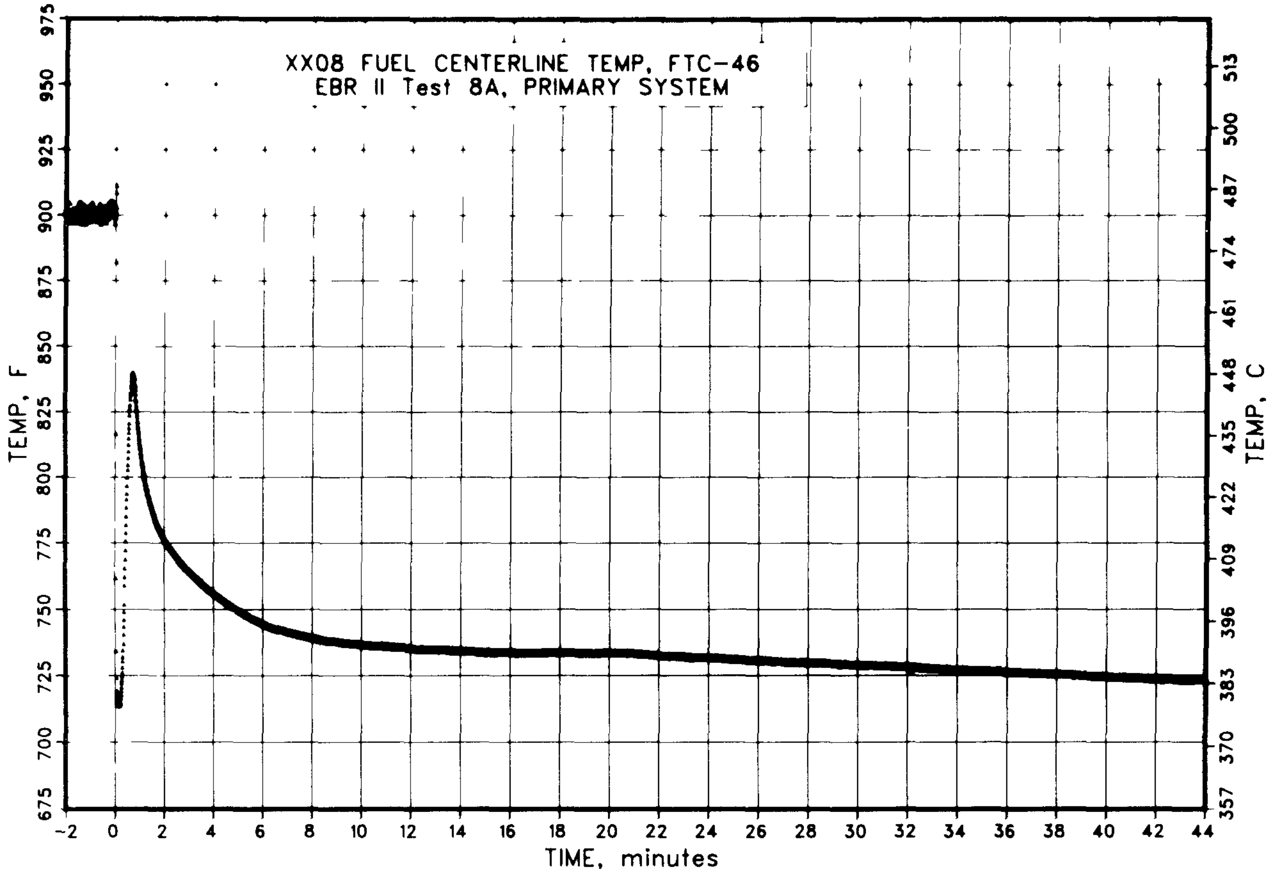
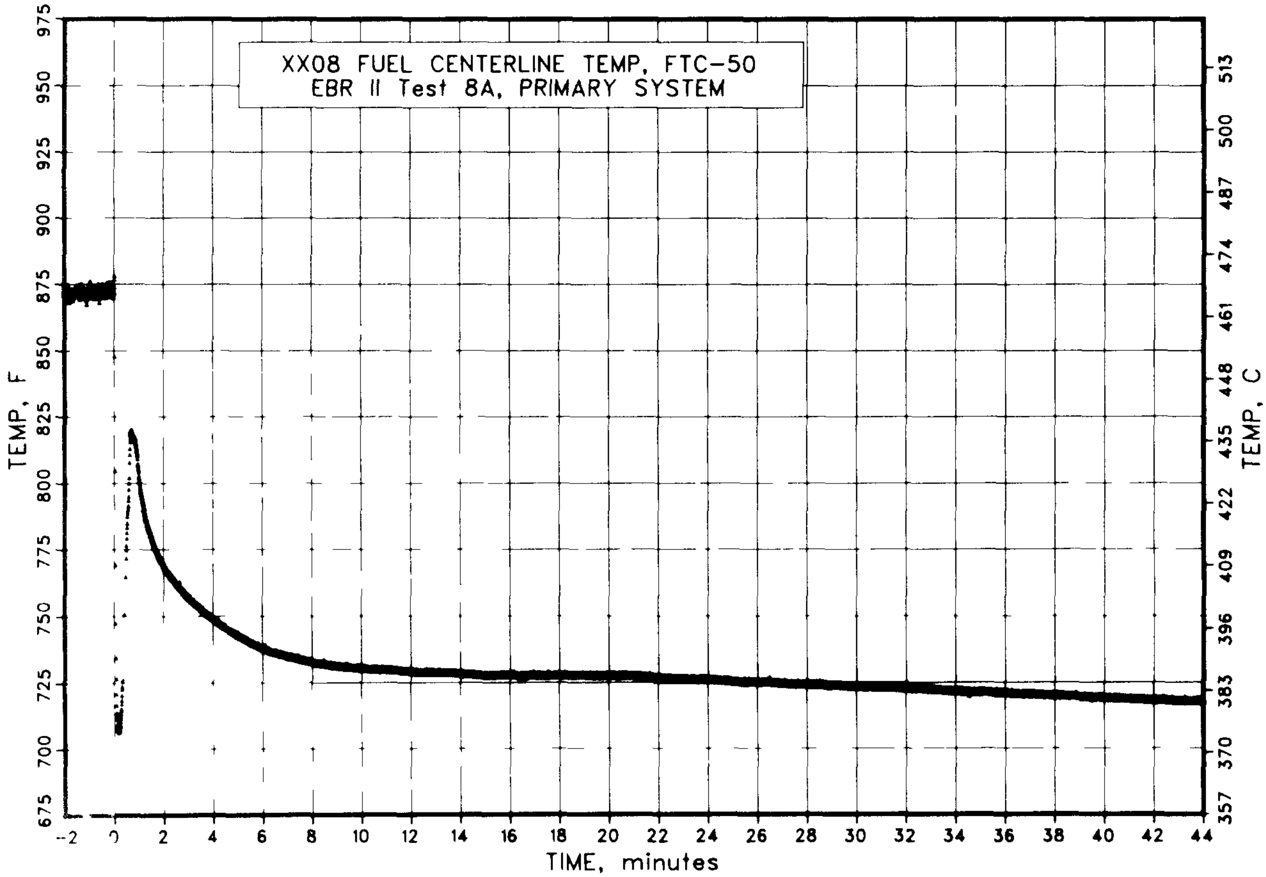

XX08 FUEL CENTERLINE TEMP, FTC-16
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44

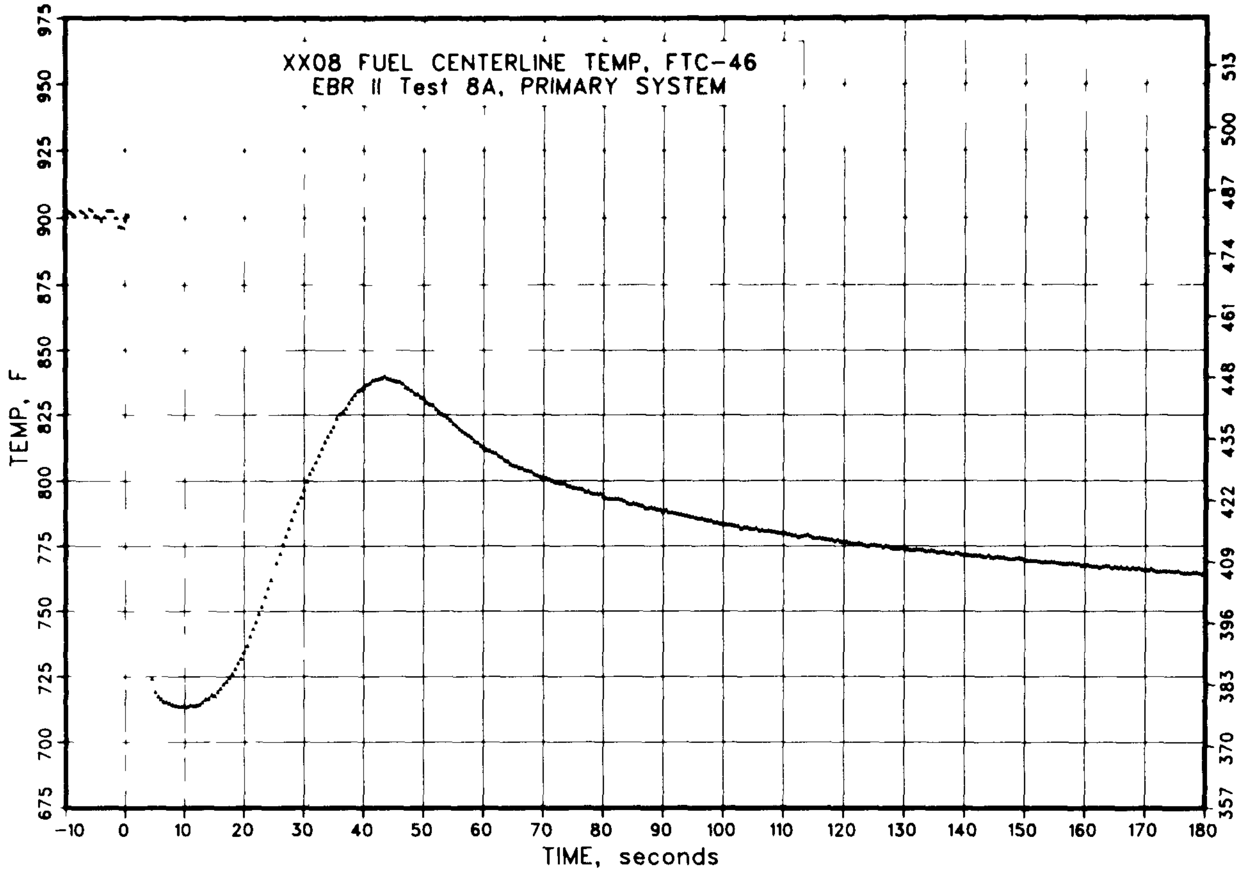

XX08 FUEL CENTERLINE TEMP, FTC-31
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44

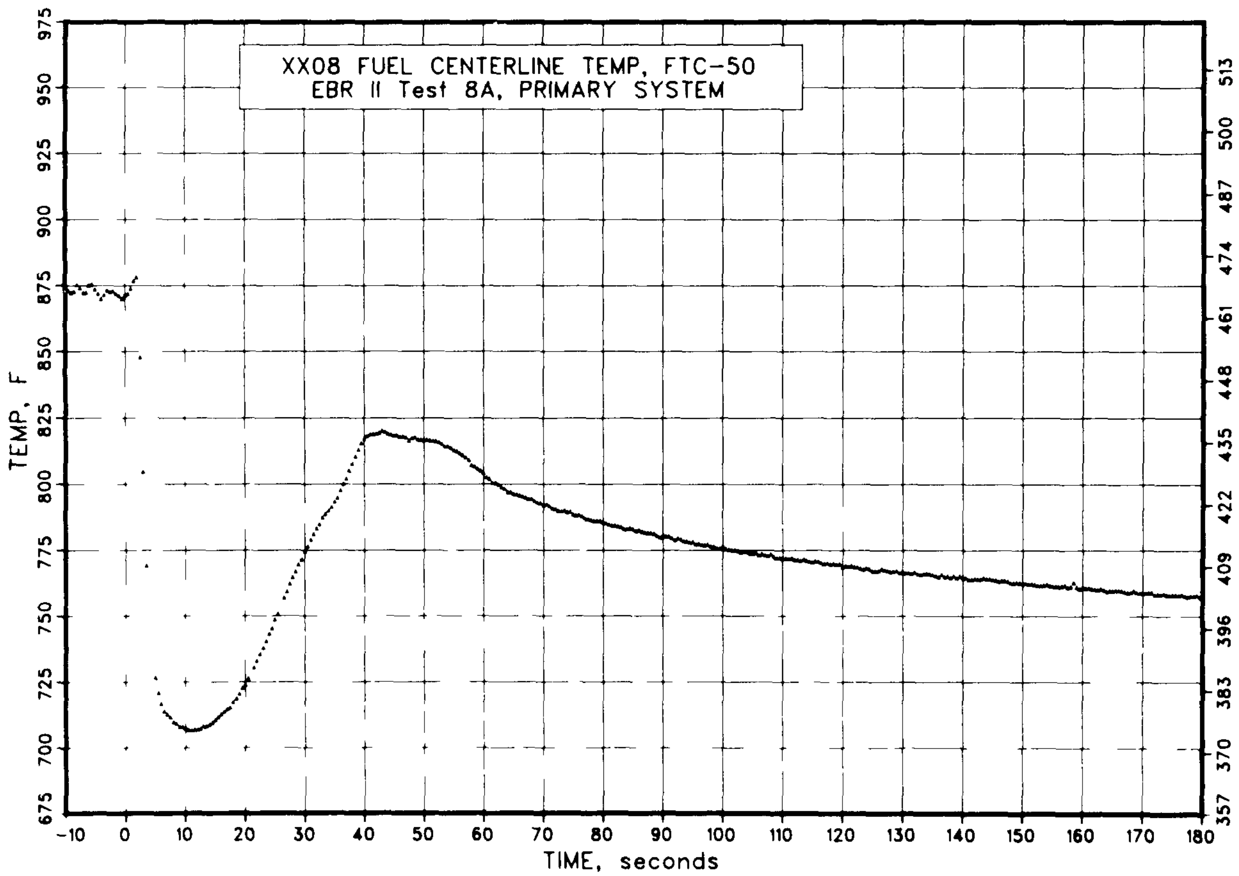

XX08 FUEL CENTERLINE TEMP, FTC-16
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

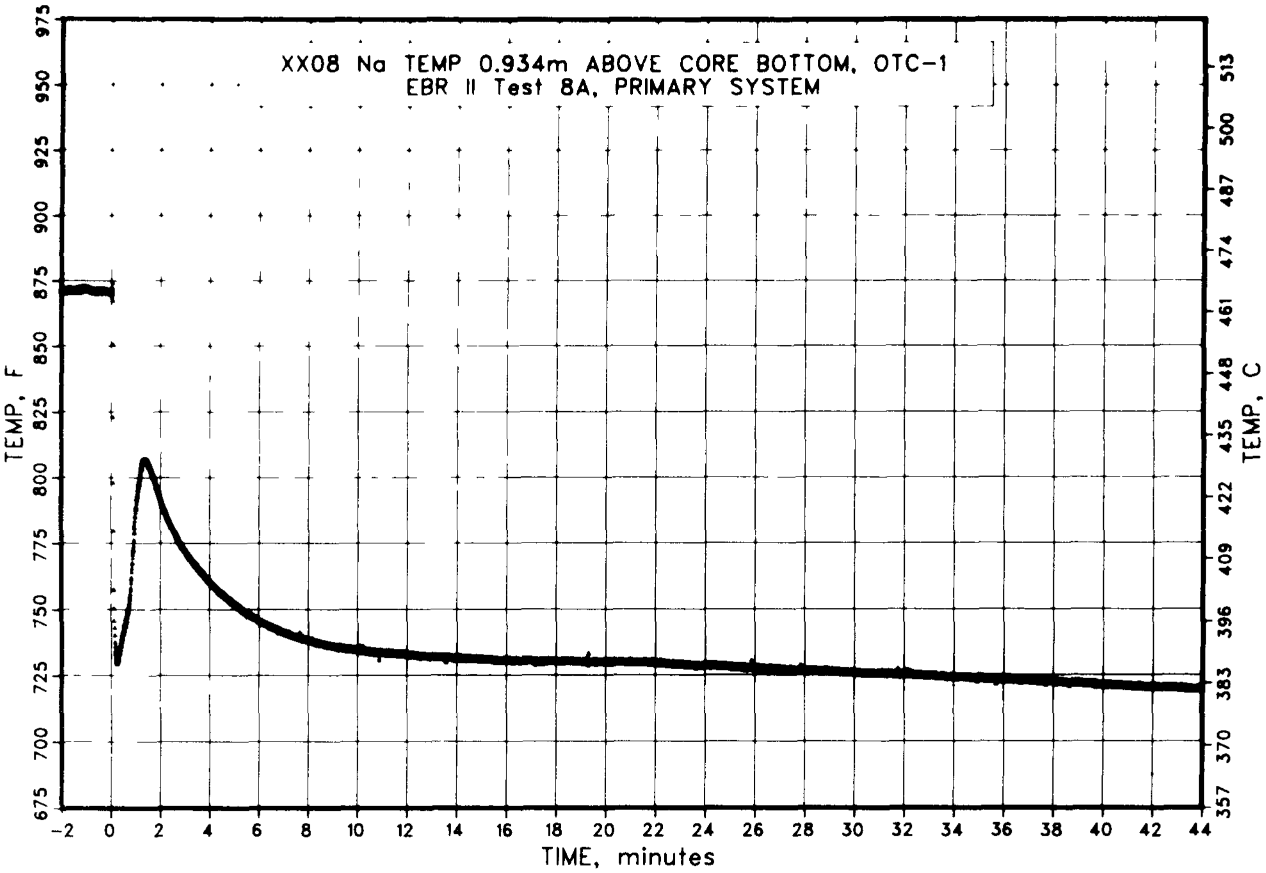

XX08 FUEL CENTERLINE TEMP, FTC-31
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

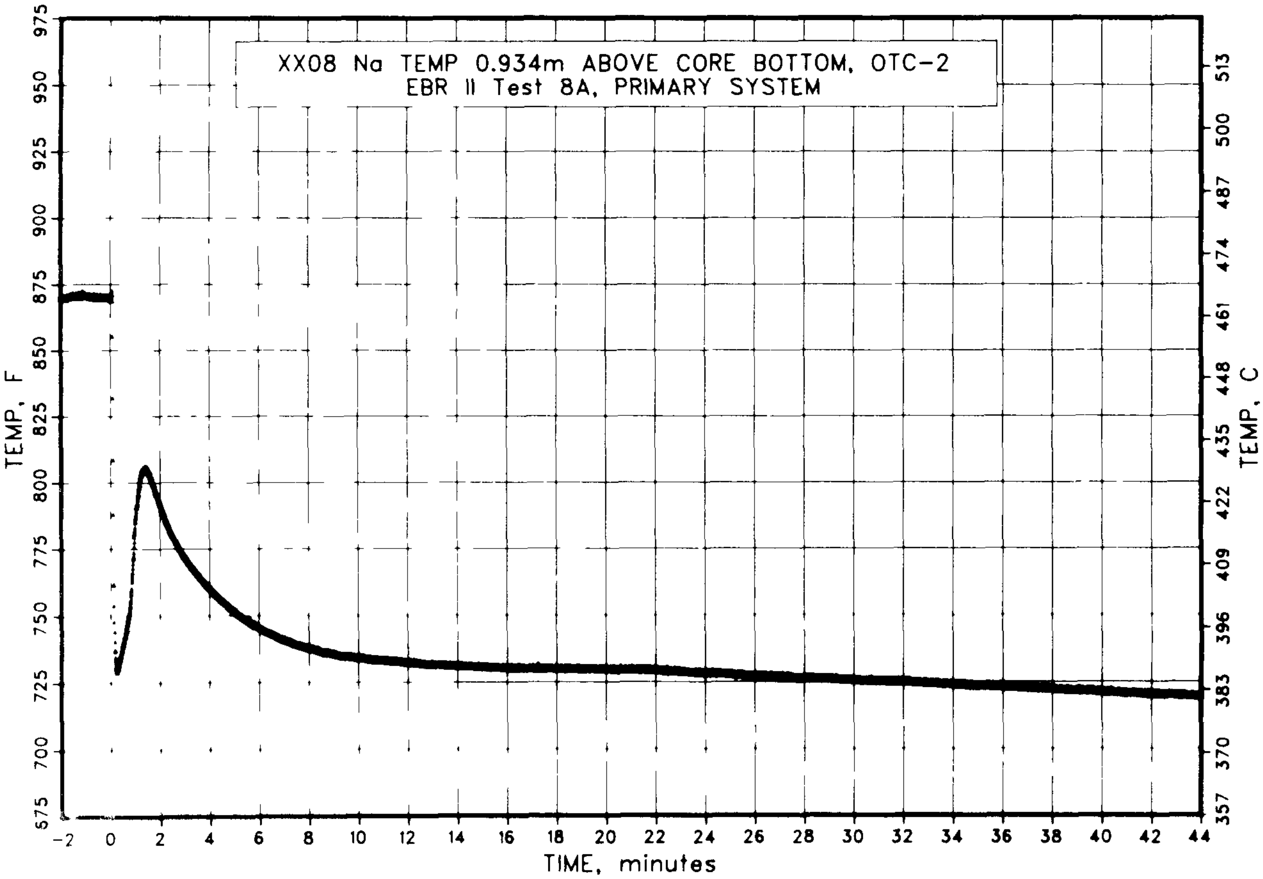

XX08 FUEL CENTERLINE TEMP, FTC-46
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

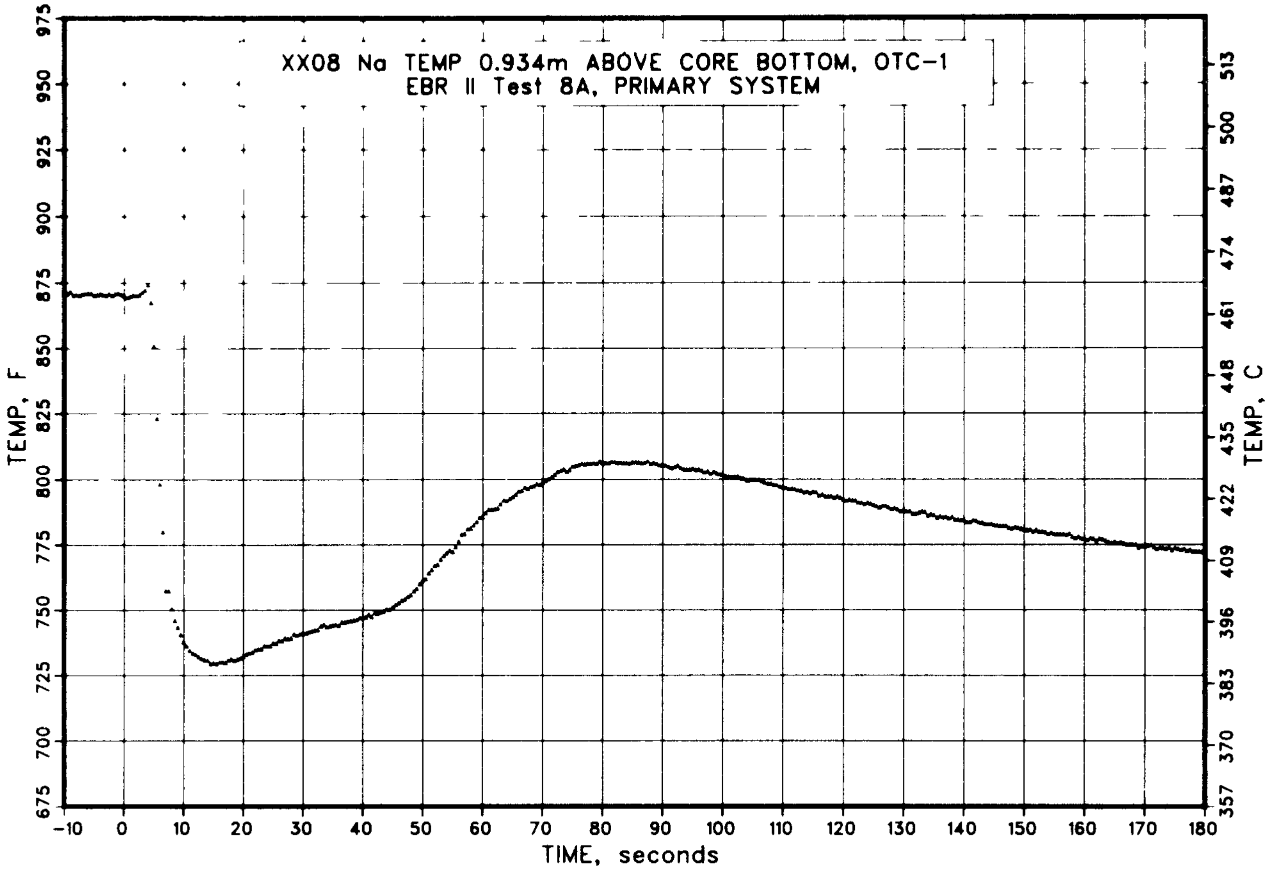

XX08 FUEL CENTERLINE TEMP, FTC-50
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


XX08 FUEL CENTERLINE TEMP, FTC-46
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
TIME, seconds


XX08 FUEL CENTERLINE TEMP, FTC-50
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
TIME, seconds


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-1
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
TIME, minutes
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-2
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
TIME, minutes
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-1
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
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50
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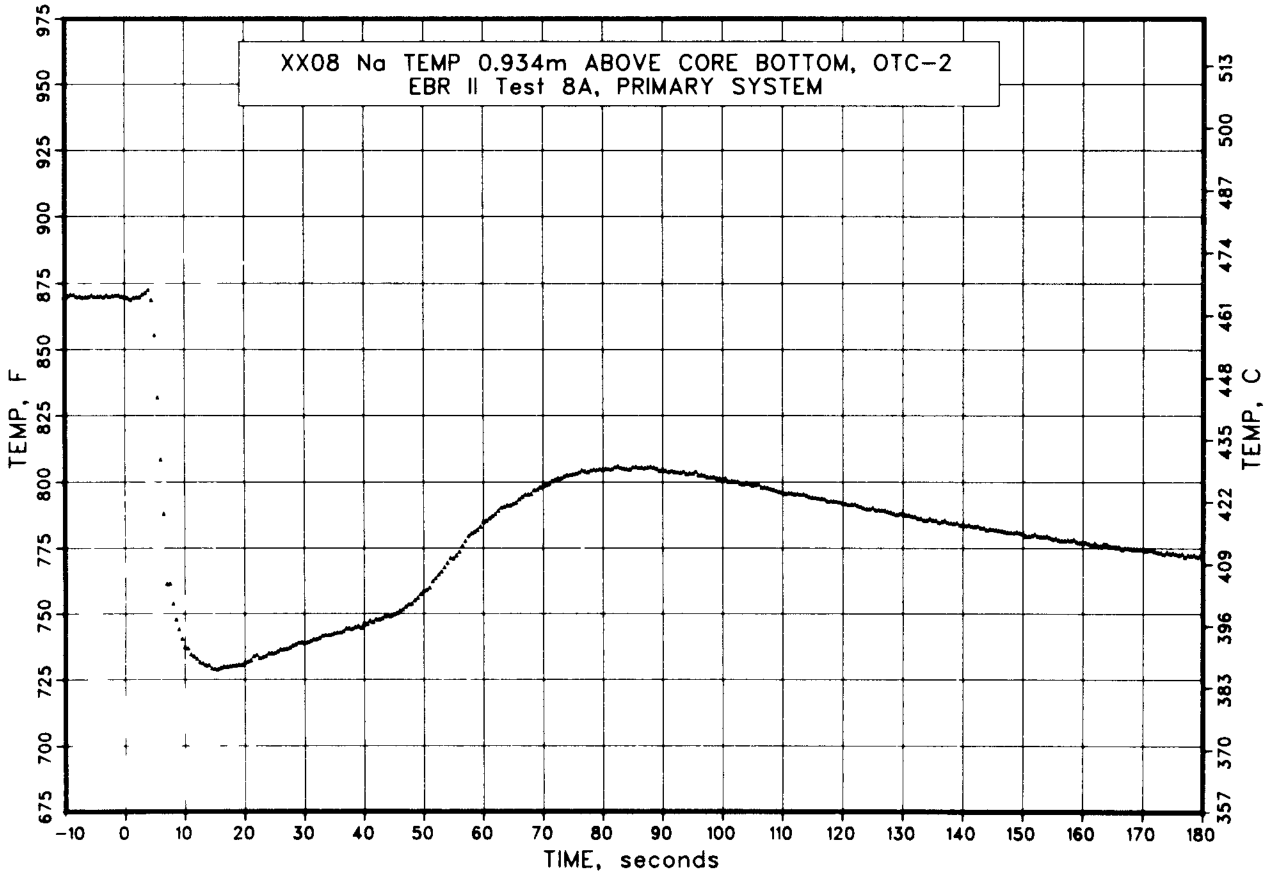
180


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-2
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10
0
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60
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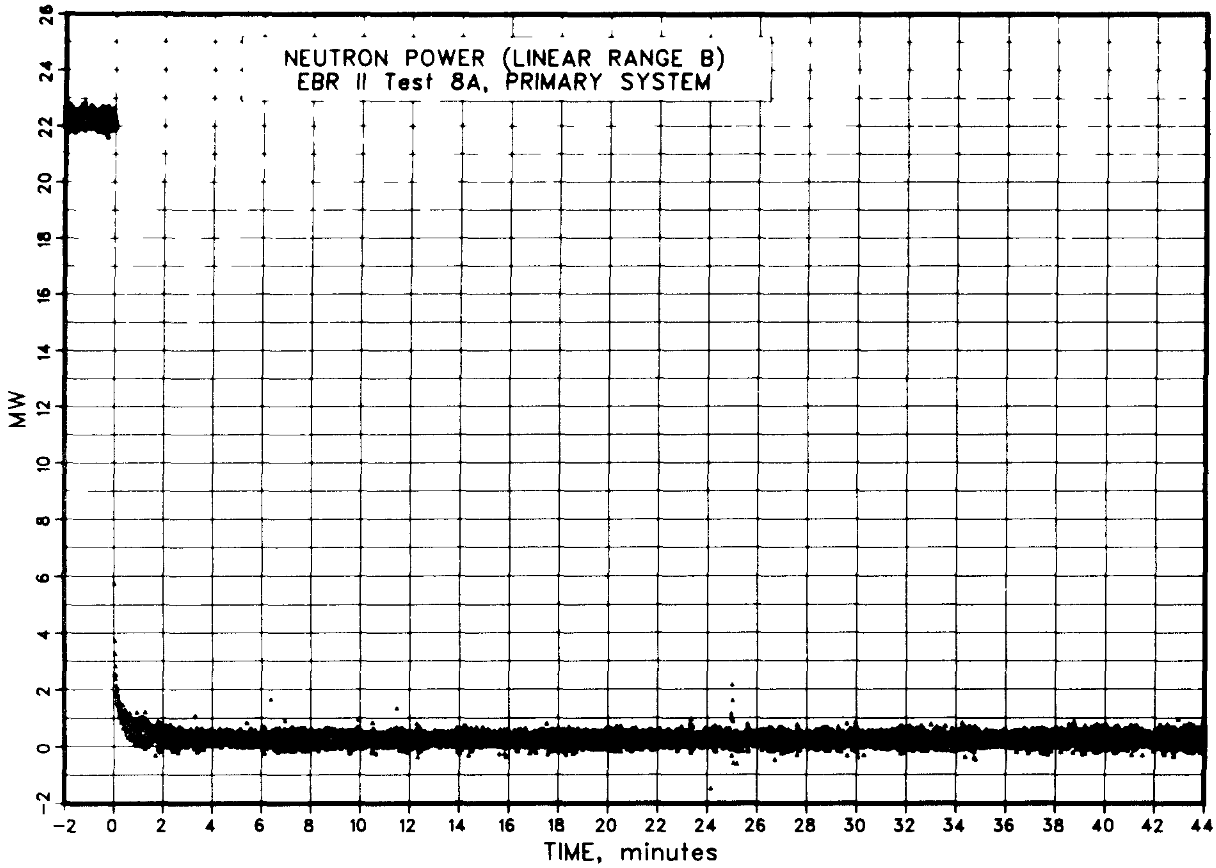
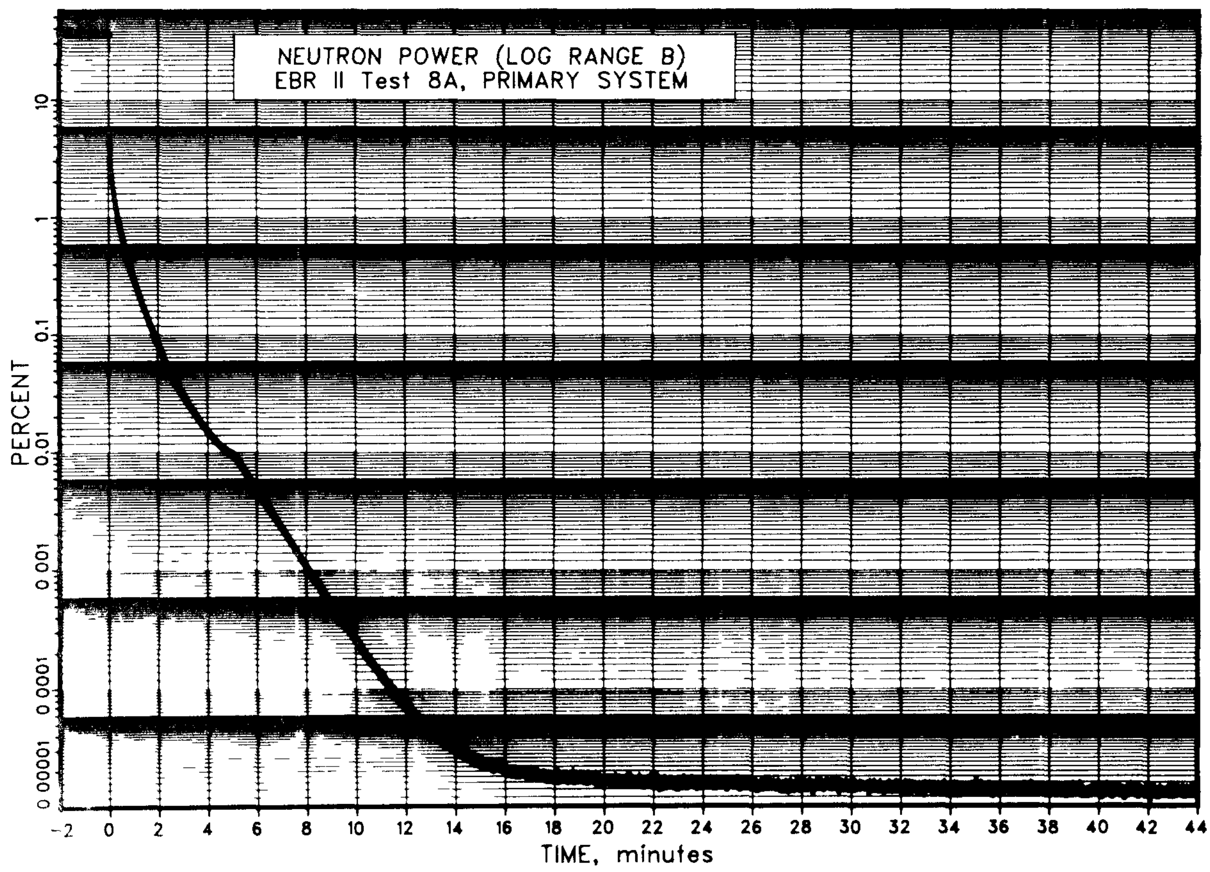
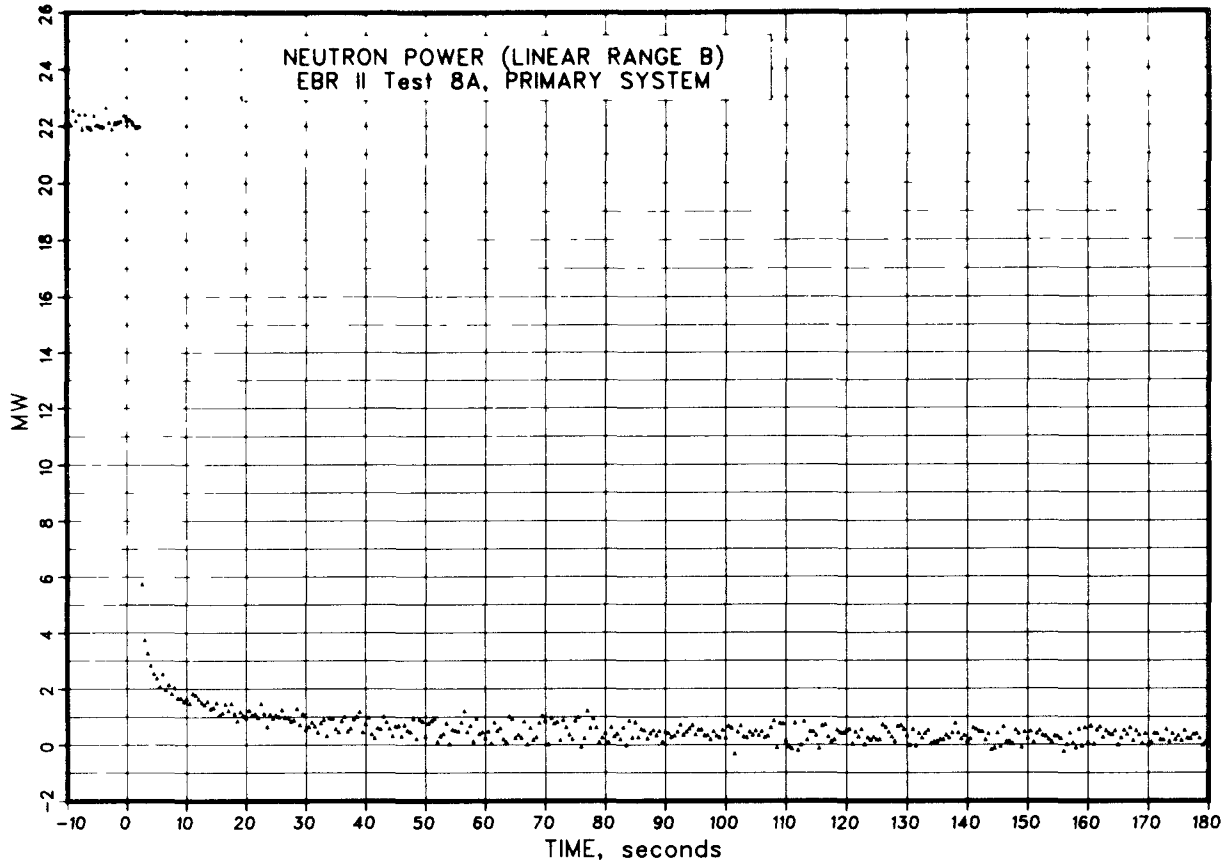
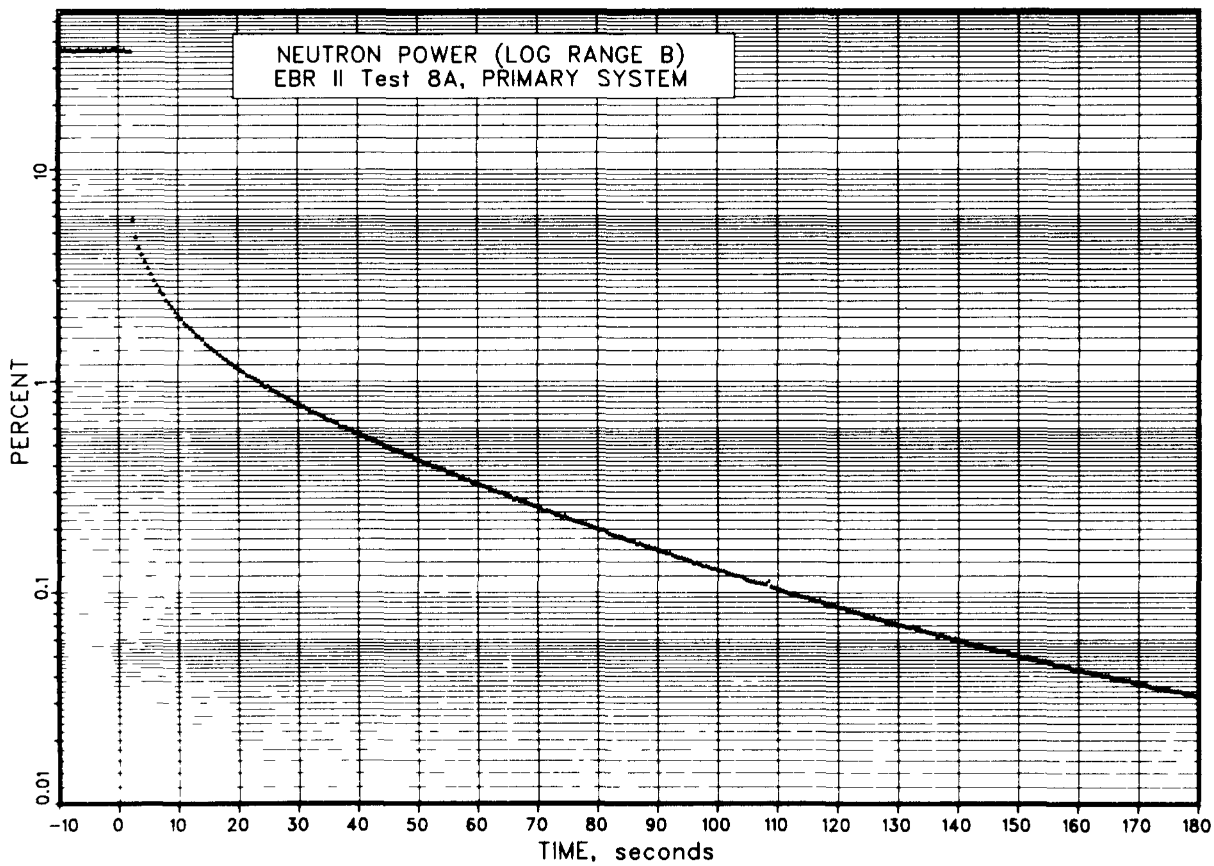
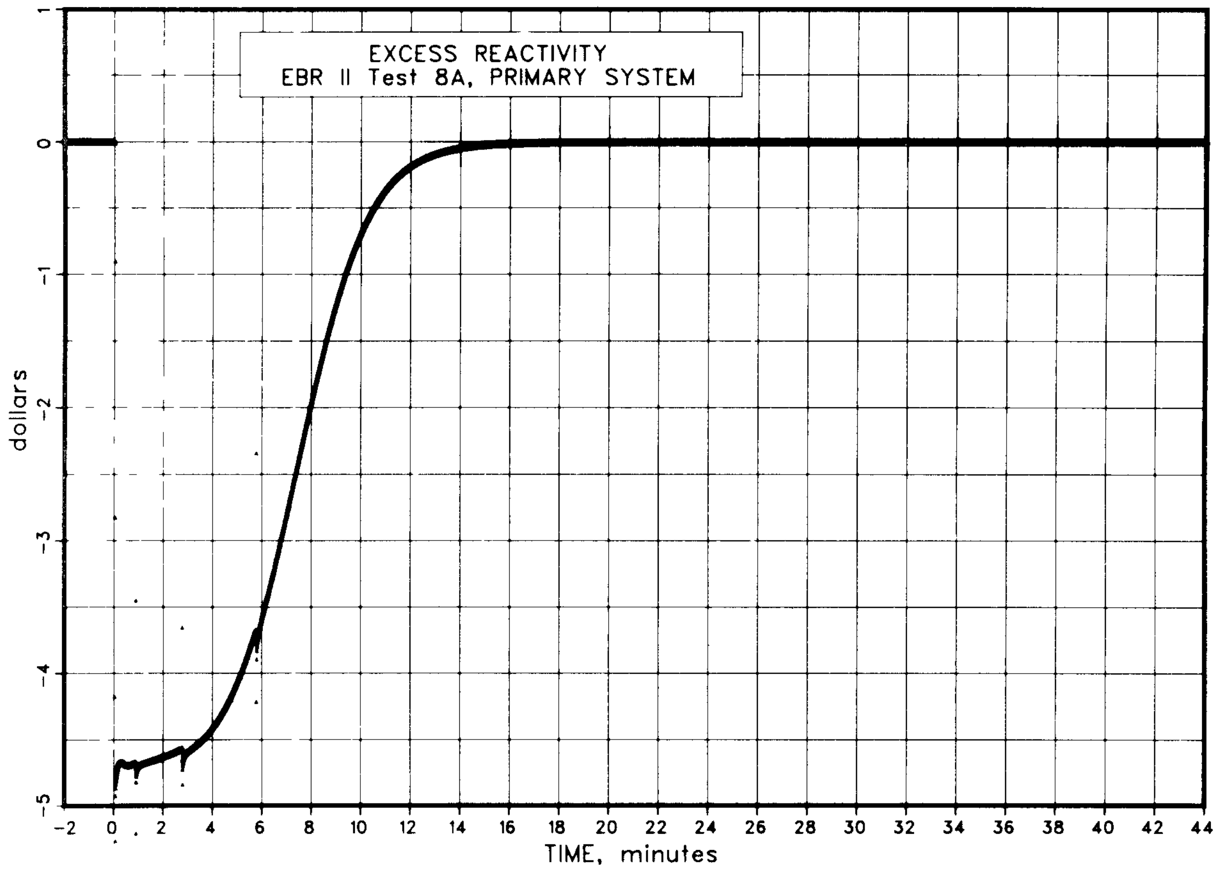
80
90
100
110
120
130
140
150
160
170
180

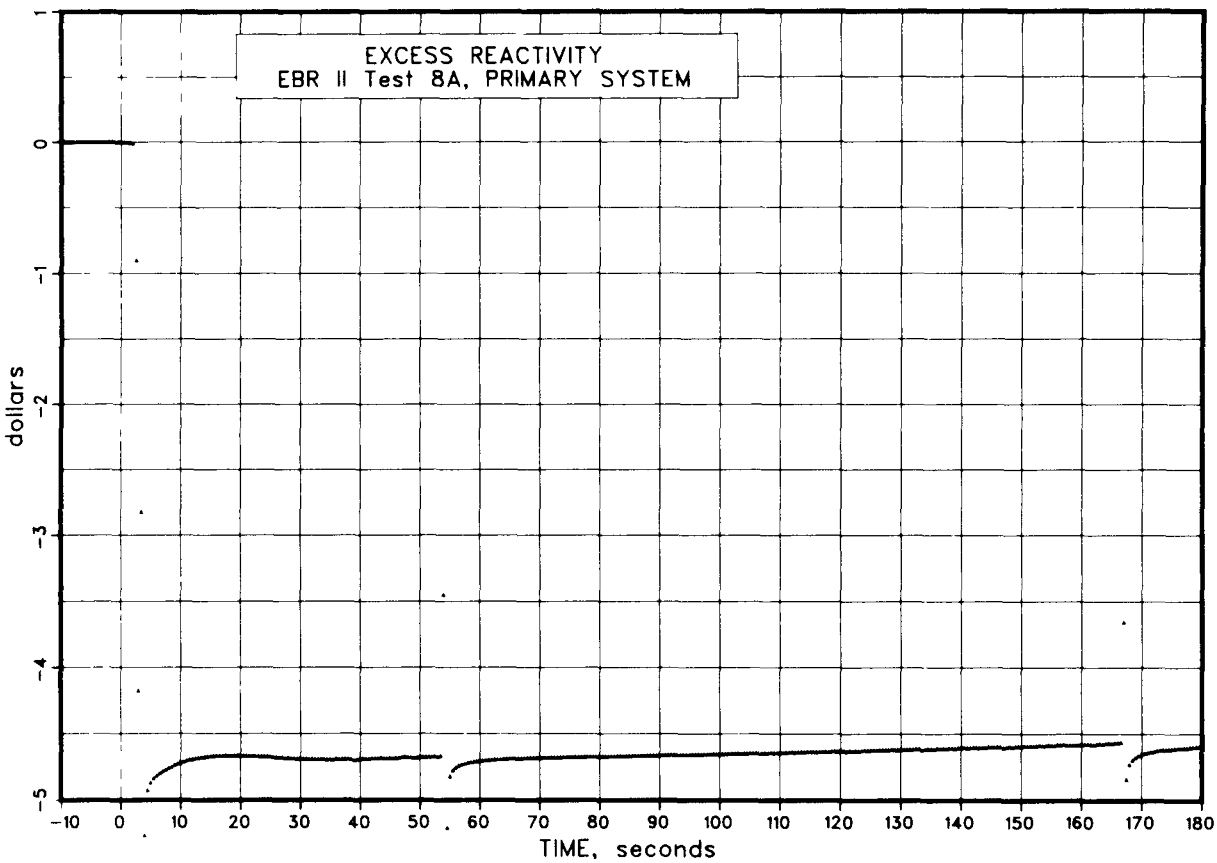

NEUTRON POWER (LINEAR RANGE B)
EBR II Test 8A, PRIMARY SYSTEM
MW
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

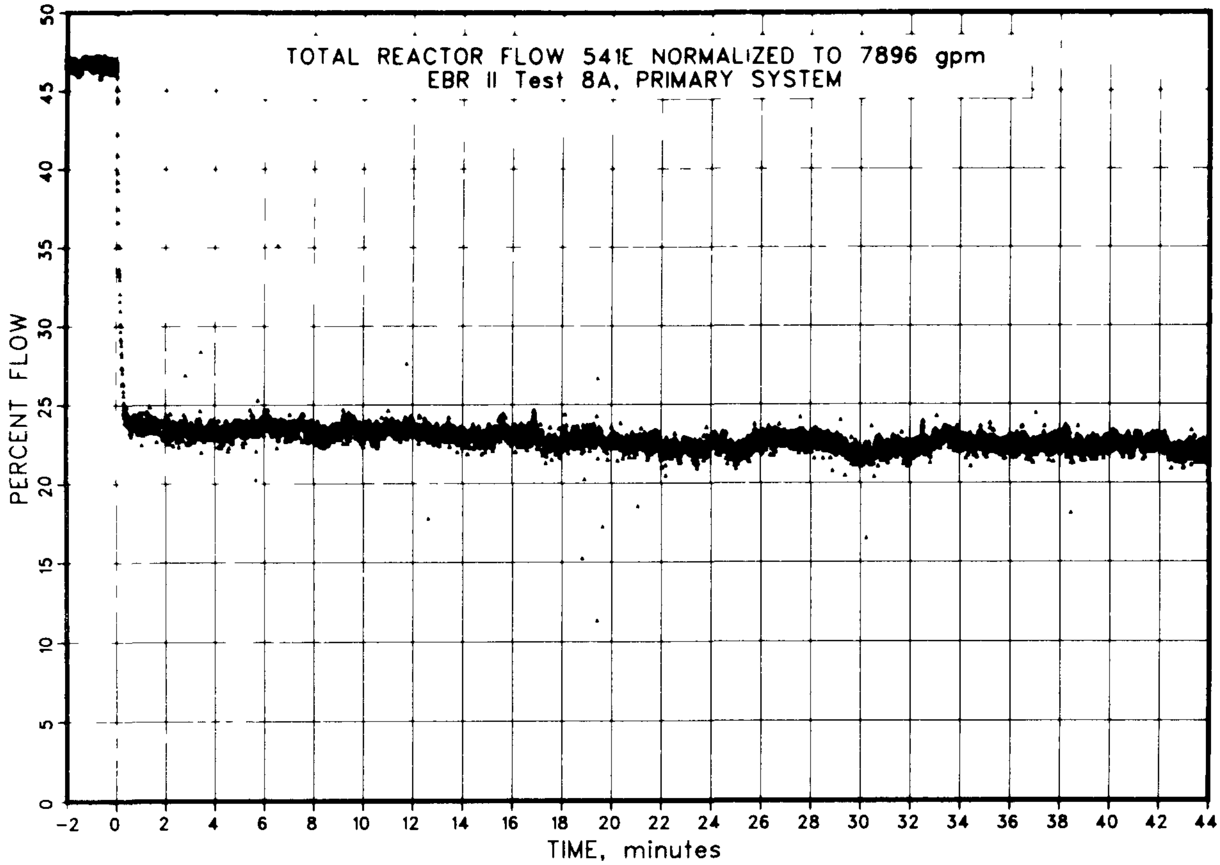

NEUTRON POWER (LOG RANGE B)
EBR II Test 8A, PRIMARY SYSTEM
PERCENT
0.00001 0.0001 0.001 0.01 0.1 1 10
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

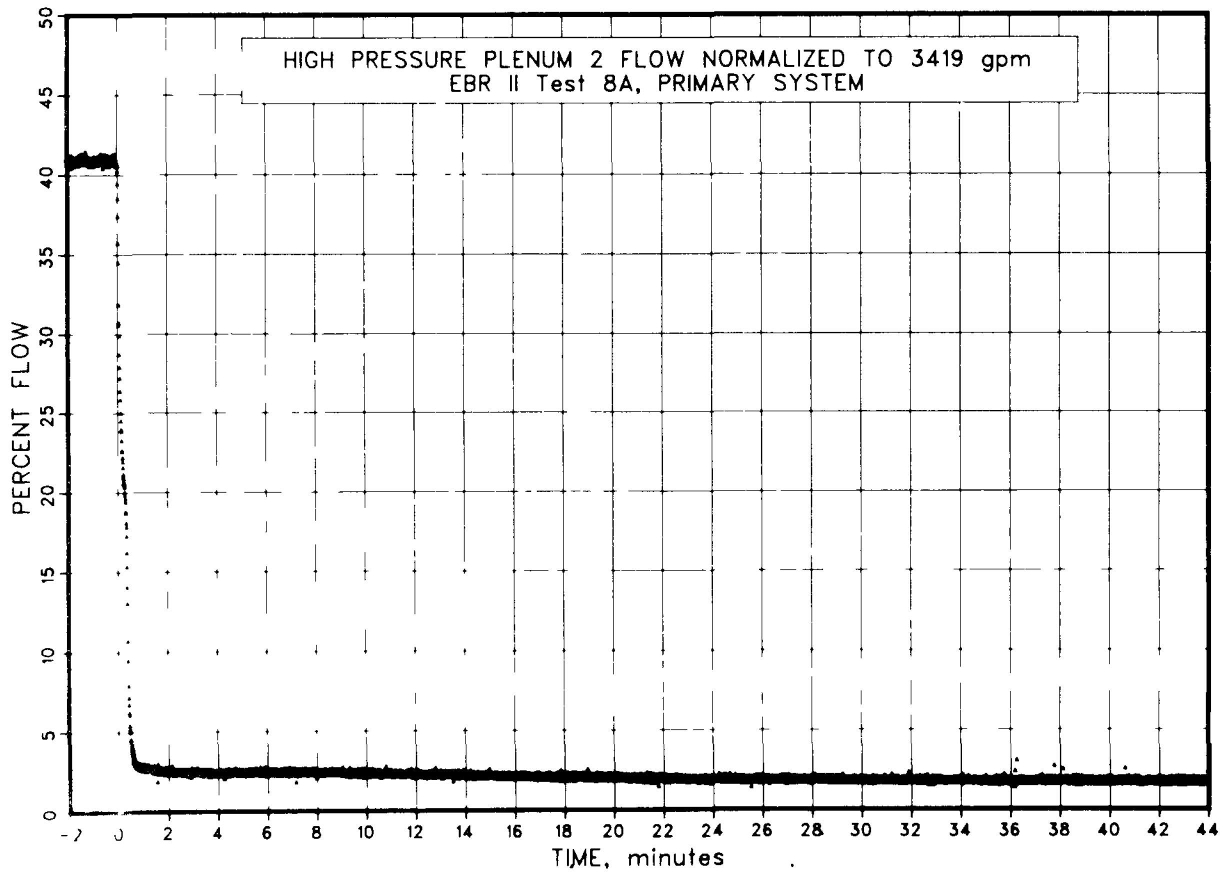

NEUTRON POWER (LINEAR RANGE B)
EBR II Test 8A, PRIMARY SYSTEM
MW
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

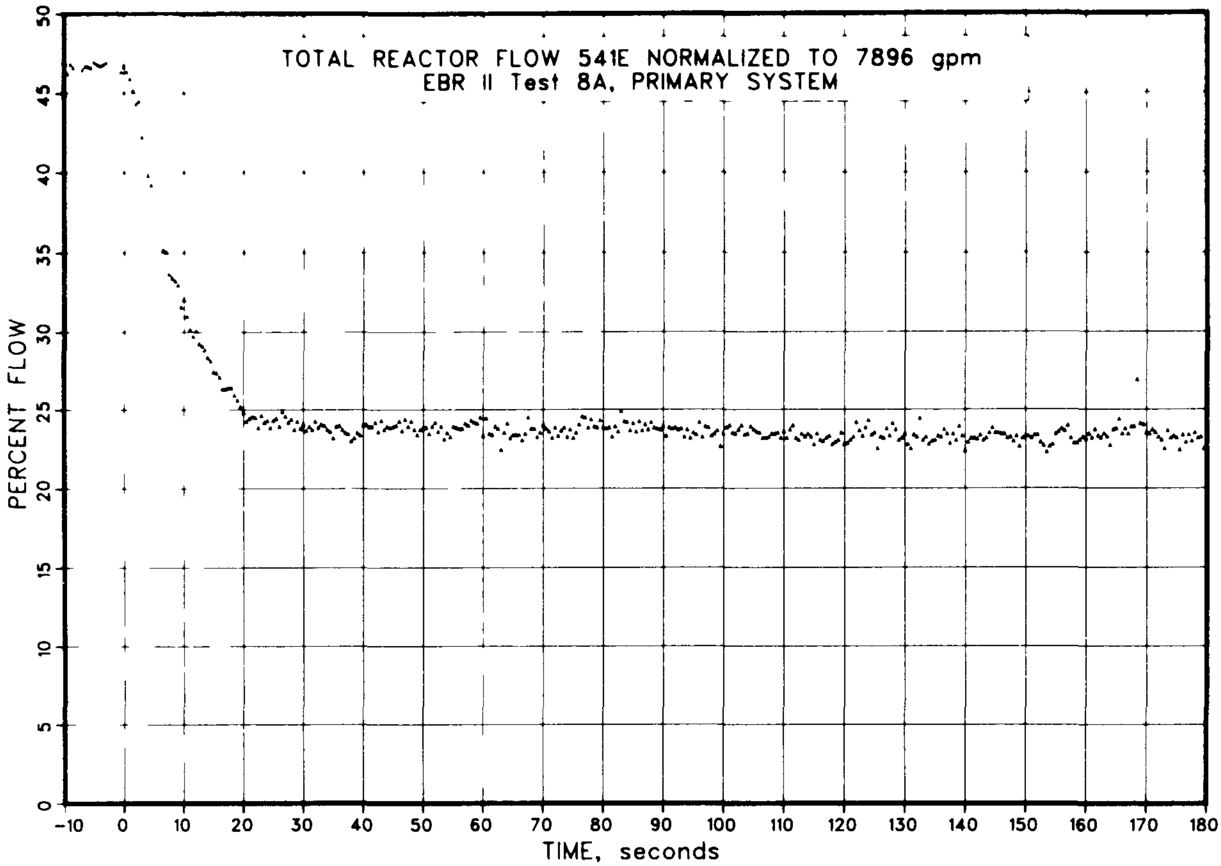

NEUTRON POWER (LOG RANGE B)
EBR II Test 8A, PRIMARY SYSTEM
PERCENT
0.01
0.1
1
10
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


EXCESS REACTIVITY
EBR II Test 8A, PRIMARY SYSTEM
dollars
1
0
-1
-2
-3
-4
-5
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


EXCESS REACTIVITY
EBR II Test 8A, PRIMARY SYSTEM
dollars
1
0
-1
-2
-3
-4
-5
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


TOTAL REACTOR FLOW 541E NORMALIZED TO 7896 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes


HIGH PRESSURE PLENUM 2 FLOW NORMALIZED TO 3419 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes


TOTAL REACTOR FLOW 541E NORMALIZED TO 7896 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
0
5
10
15
20
25
30
35
40
45
50
-10
0
10
20
30
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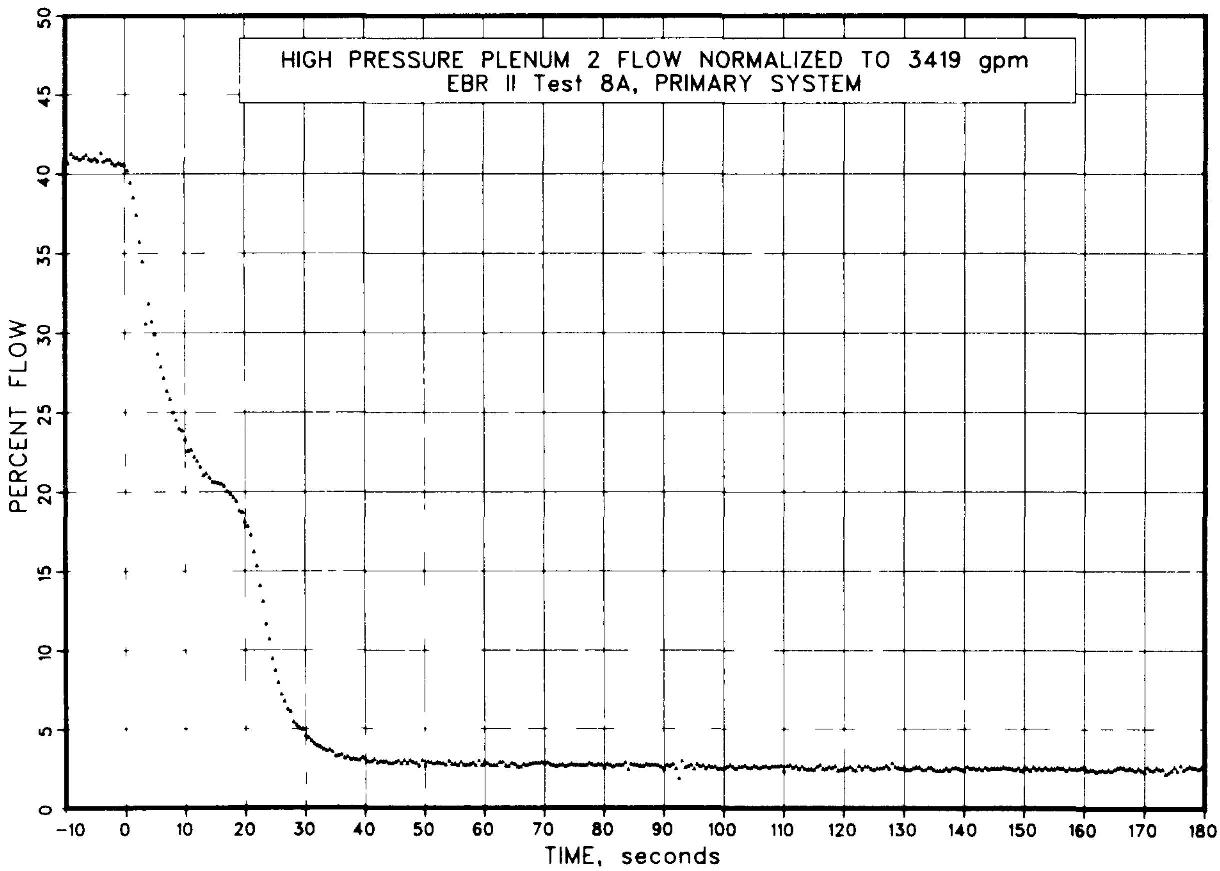
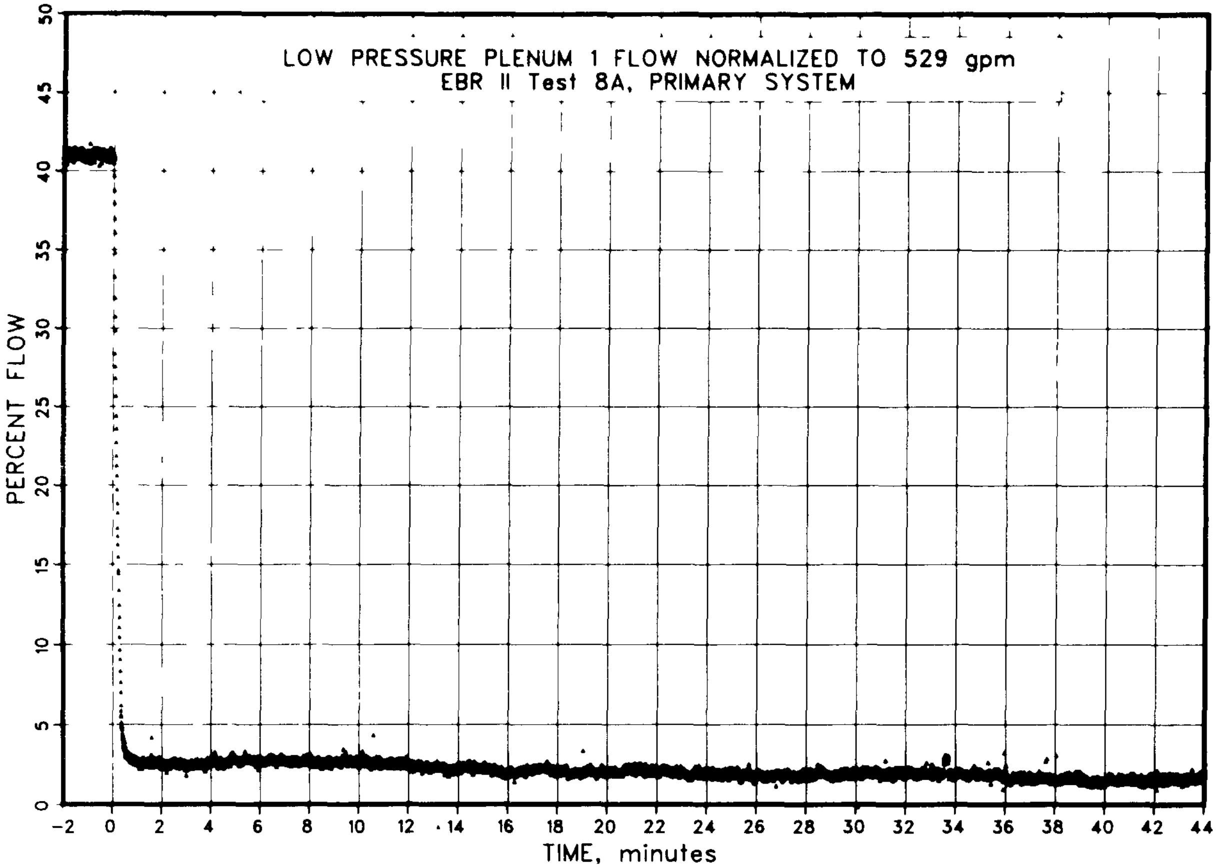
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


HIGH PRESSURE PLENUM 2 FLOW NORMALIZED TO 3419 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
0
5
10
15
20
25
30
35
40
45
50
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


LOW PRESSURE PLENUM 1 FLOW NORMALIZED TO 529 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
0
5
10
15
20
25
30
35
40
45
50
TIME, minutes
-2
0
2
4
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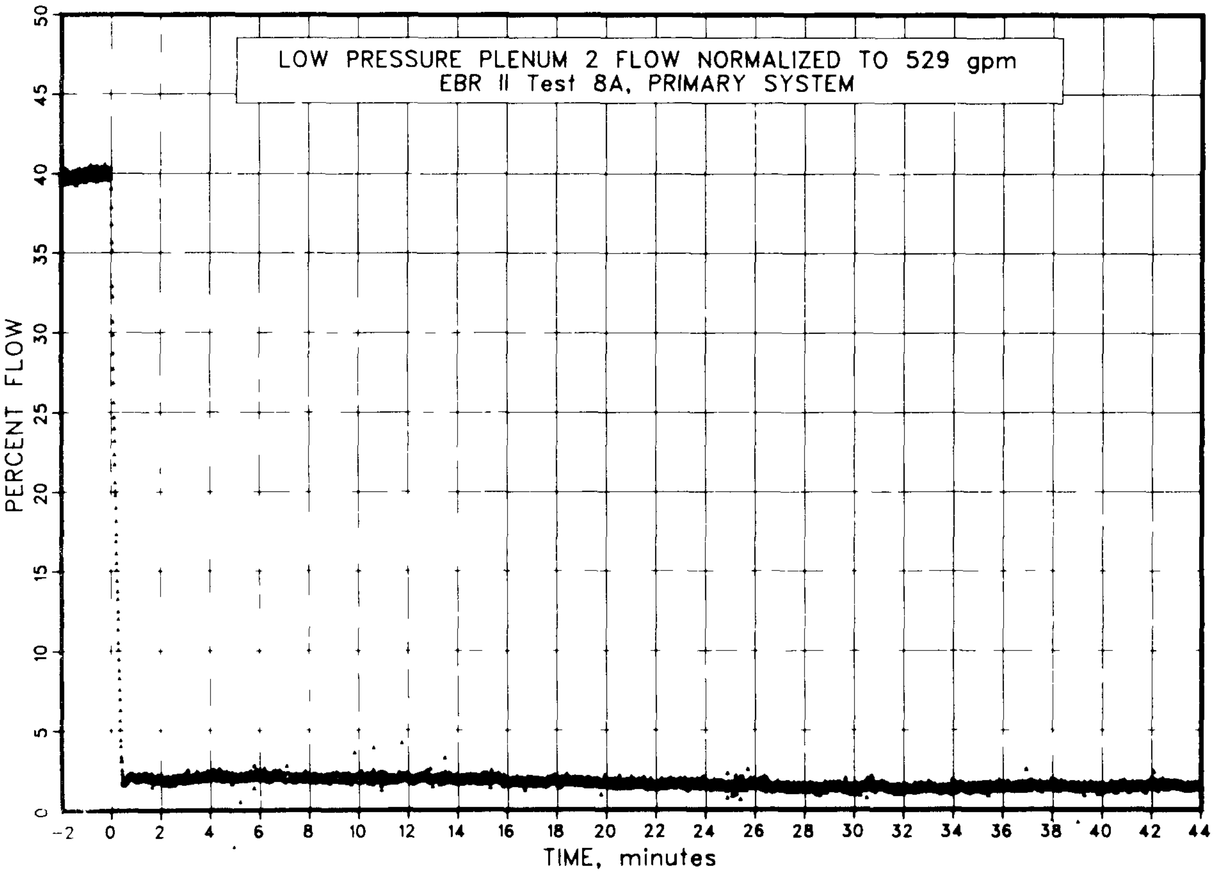
36
38
40
42
44


LOW PRESSURE PLENUM 2 FLOW NORMALIZED TO 529 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
0
5
10
15
20
25
30
35
40
45
50
TIME, minutes
-2
0
2
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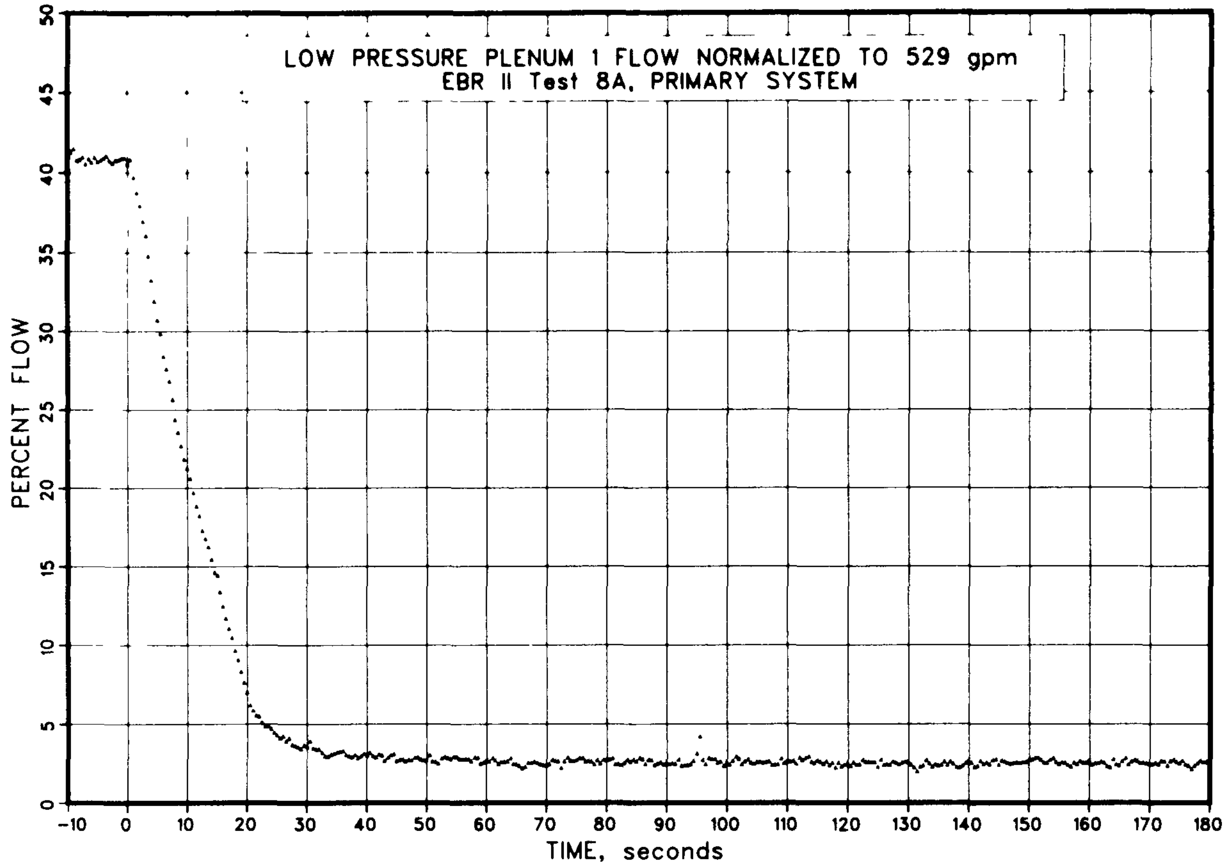
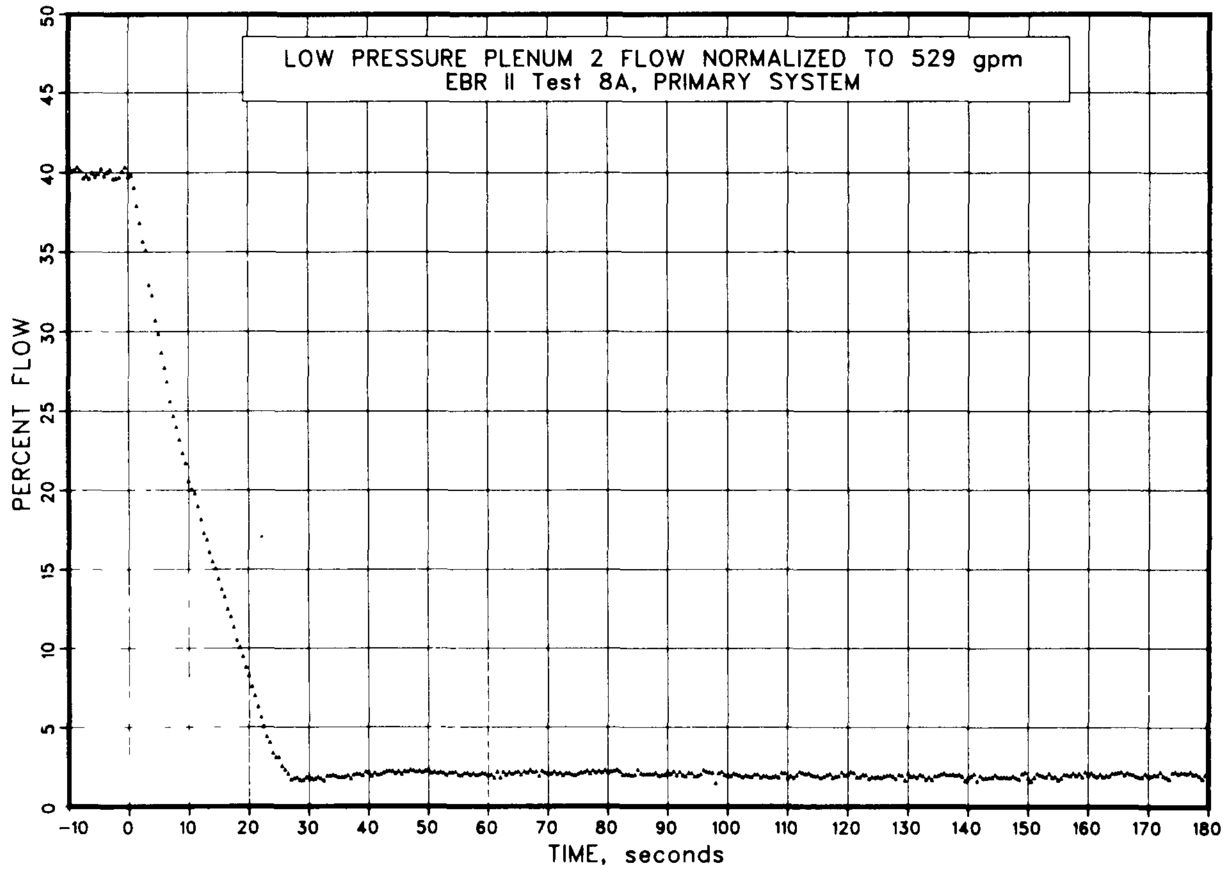
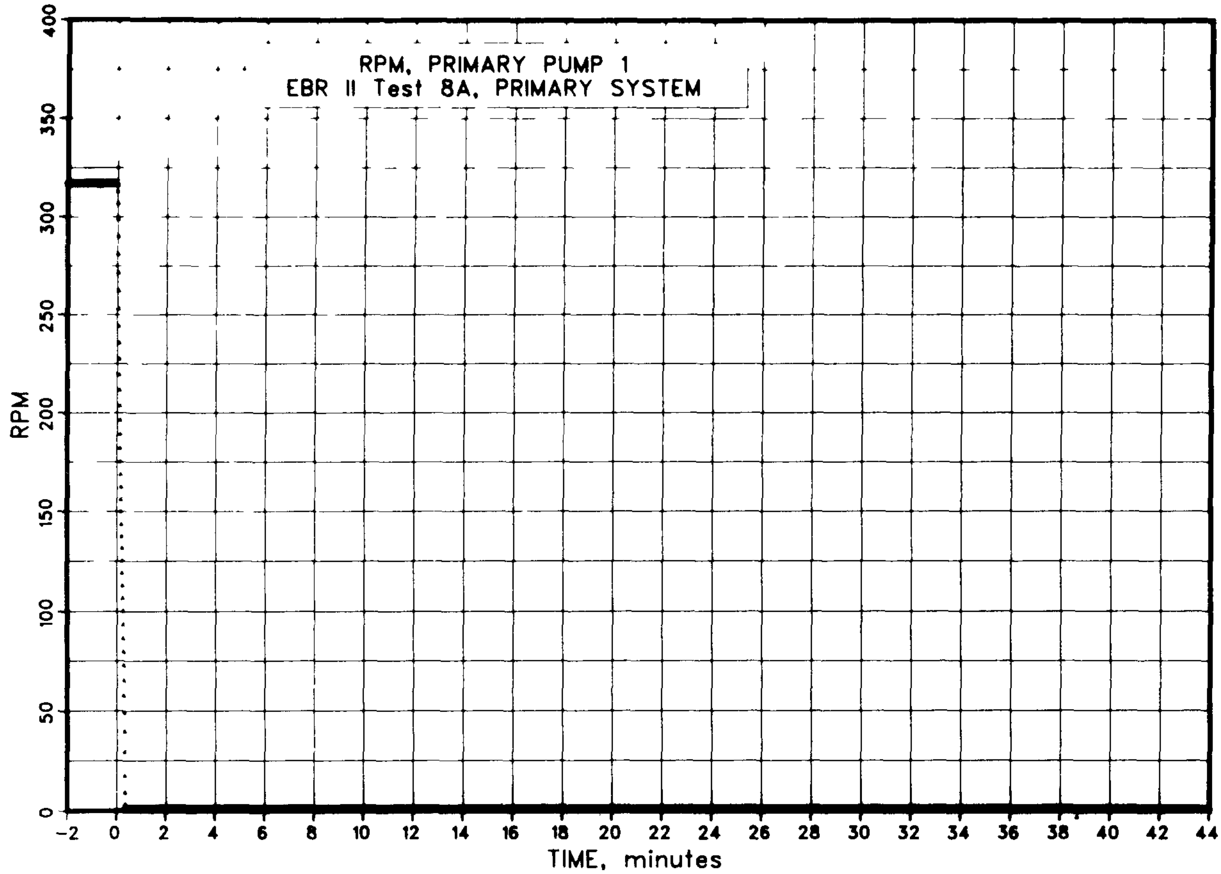
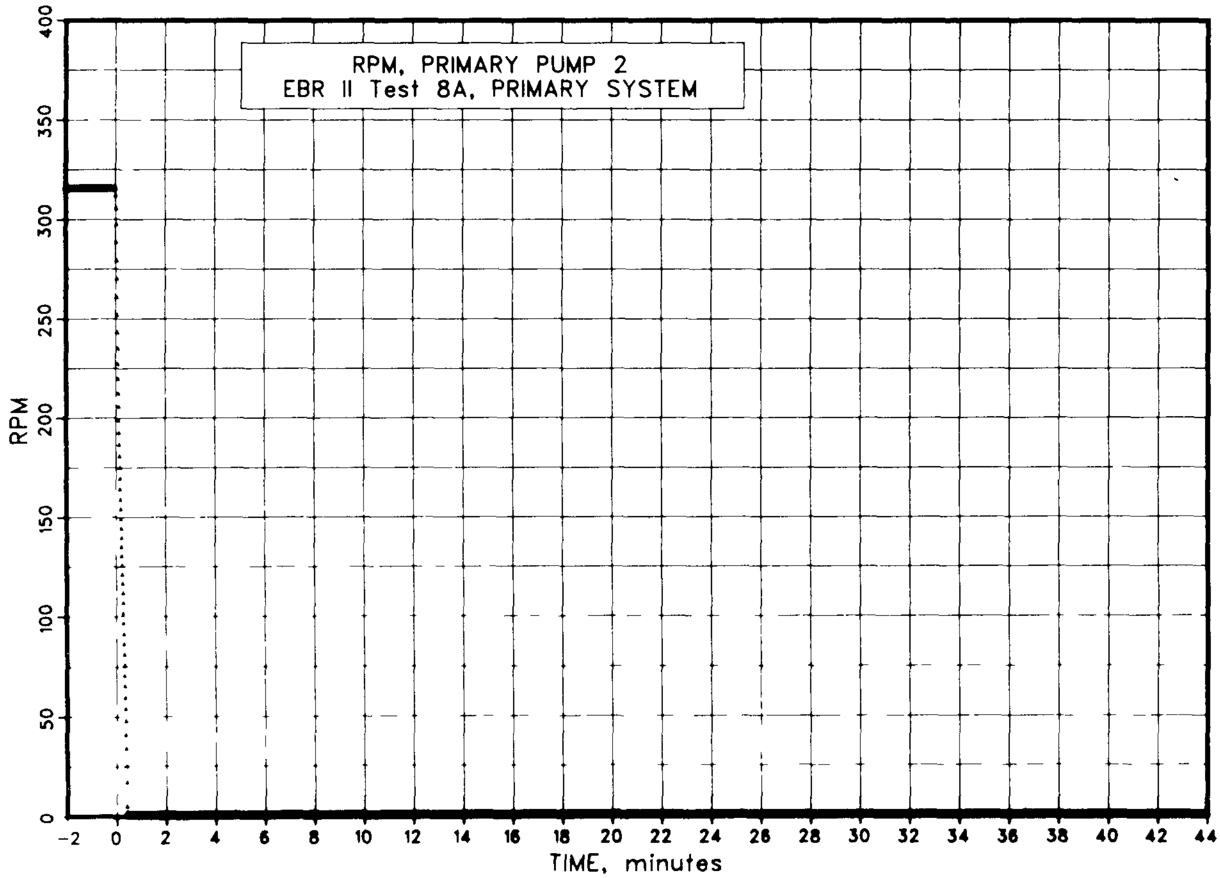
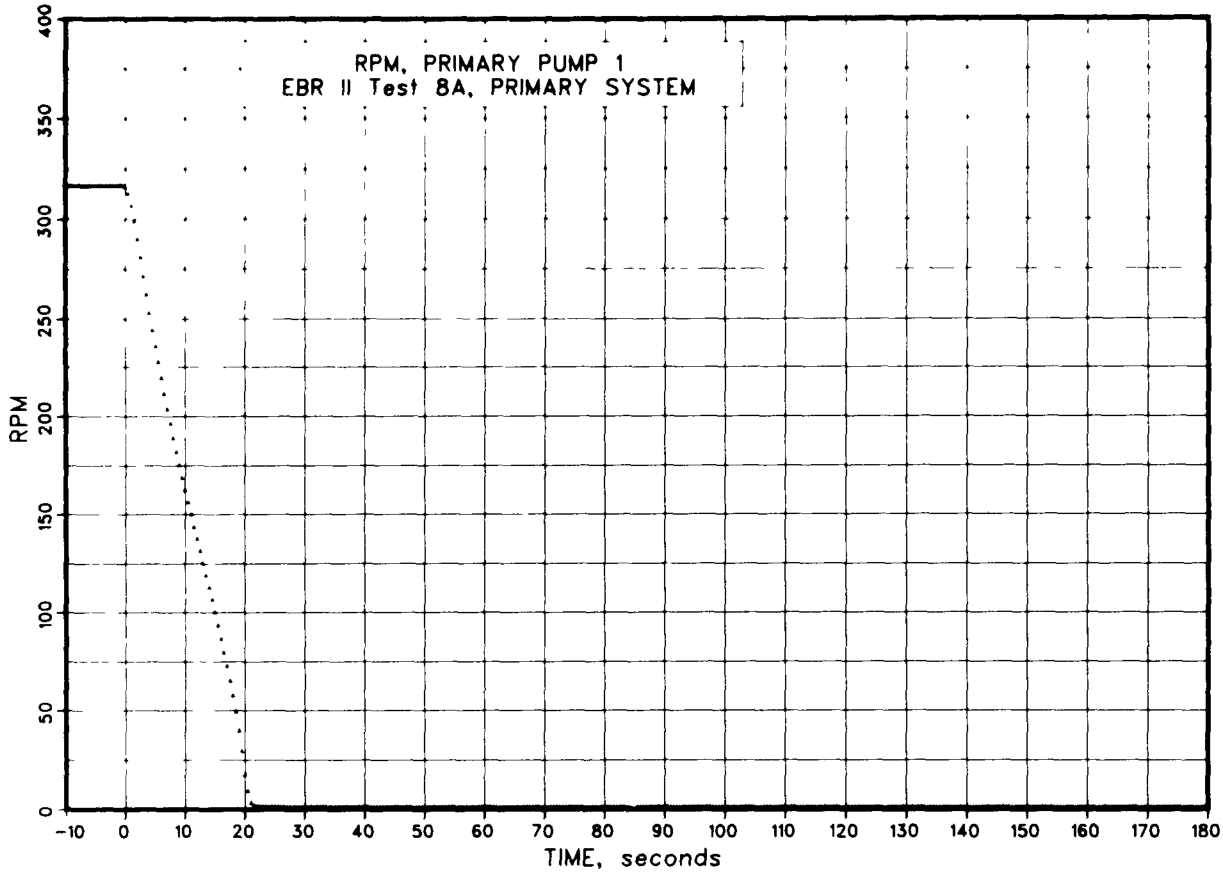
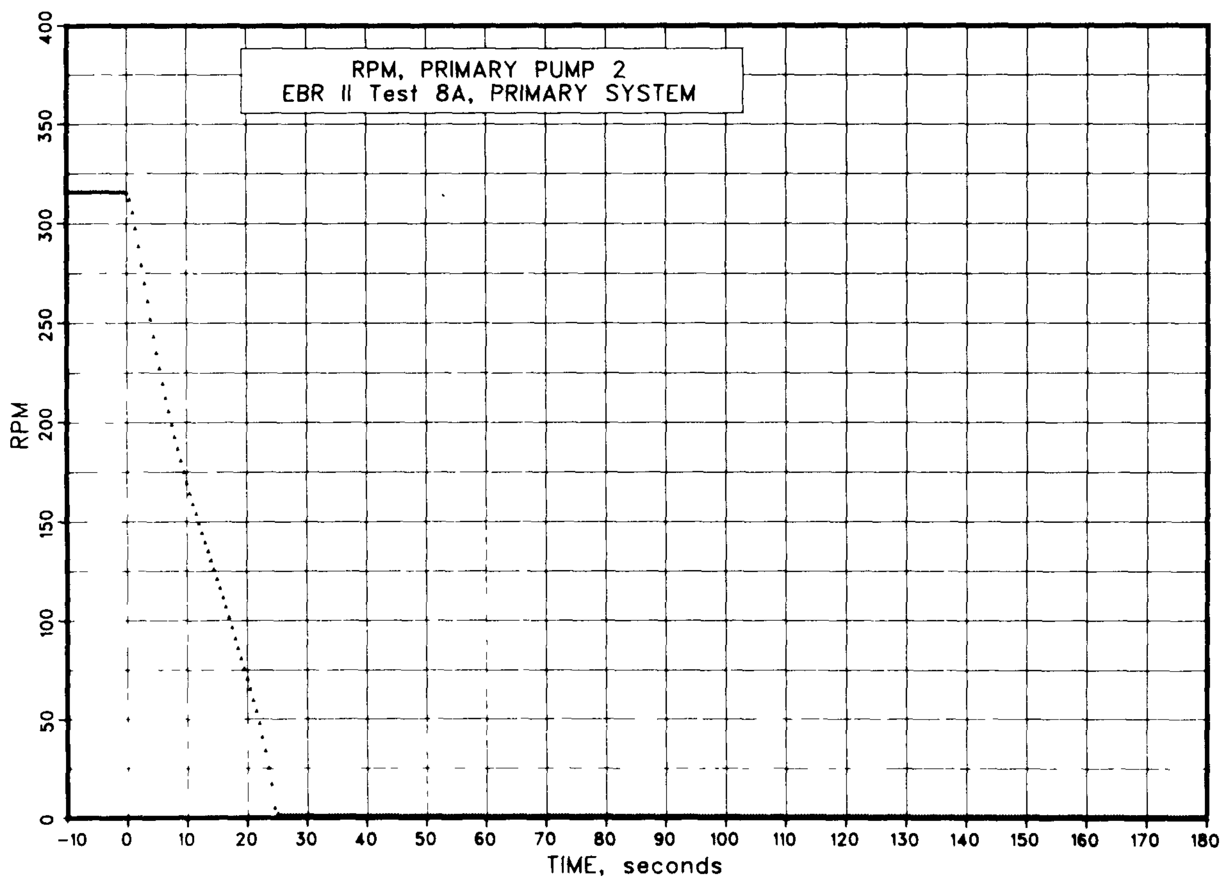

LOW PRESSURE PLENUM 1 FLOW NORMALIZED TO 529 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

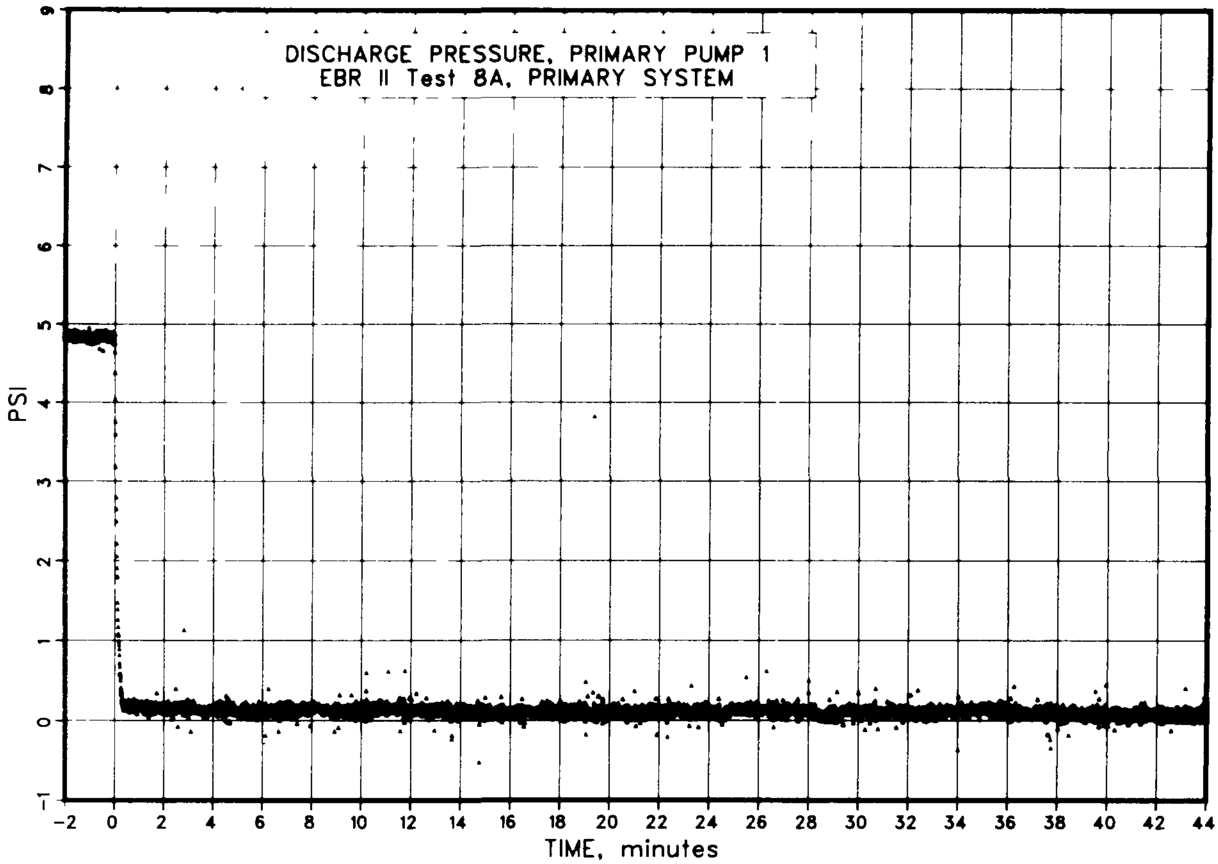

LOW PRESSURE PLENUM 2 FLOW NORMALIZED TO 529 gpm
EBR II Test 8A, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

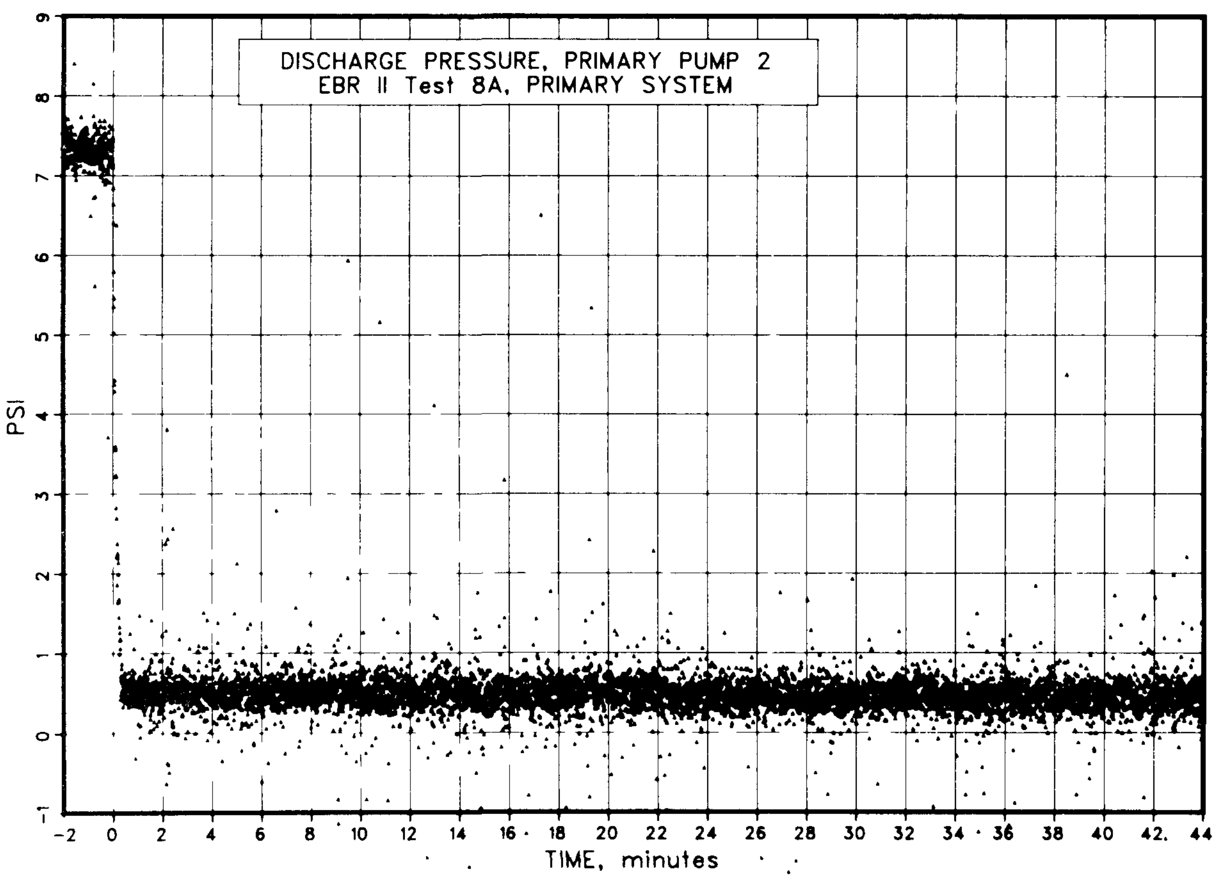

RPM, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
RPM
0
50
100
150
200
250
300
350
400
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

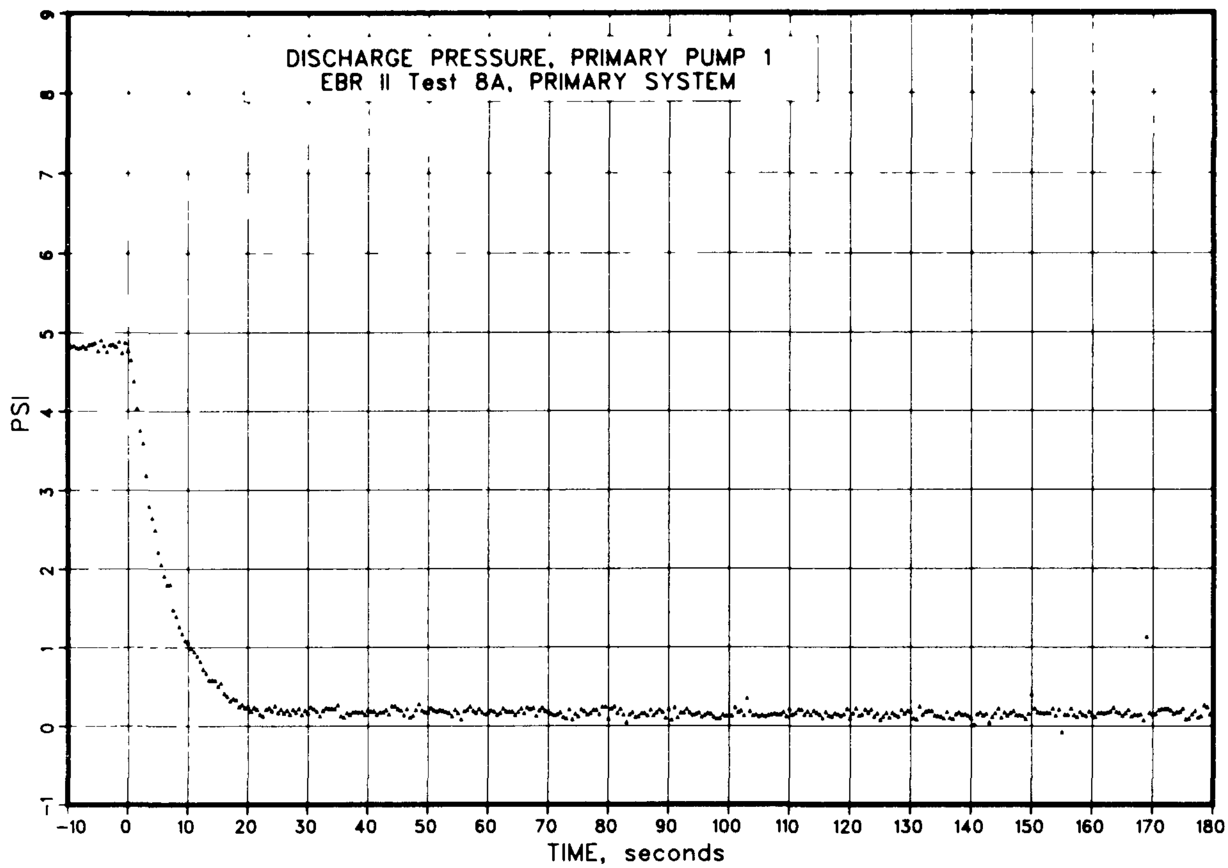

RPM, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
RPM
0
50
100
150
200
250
300
350
400
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

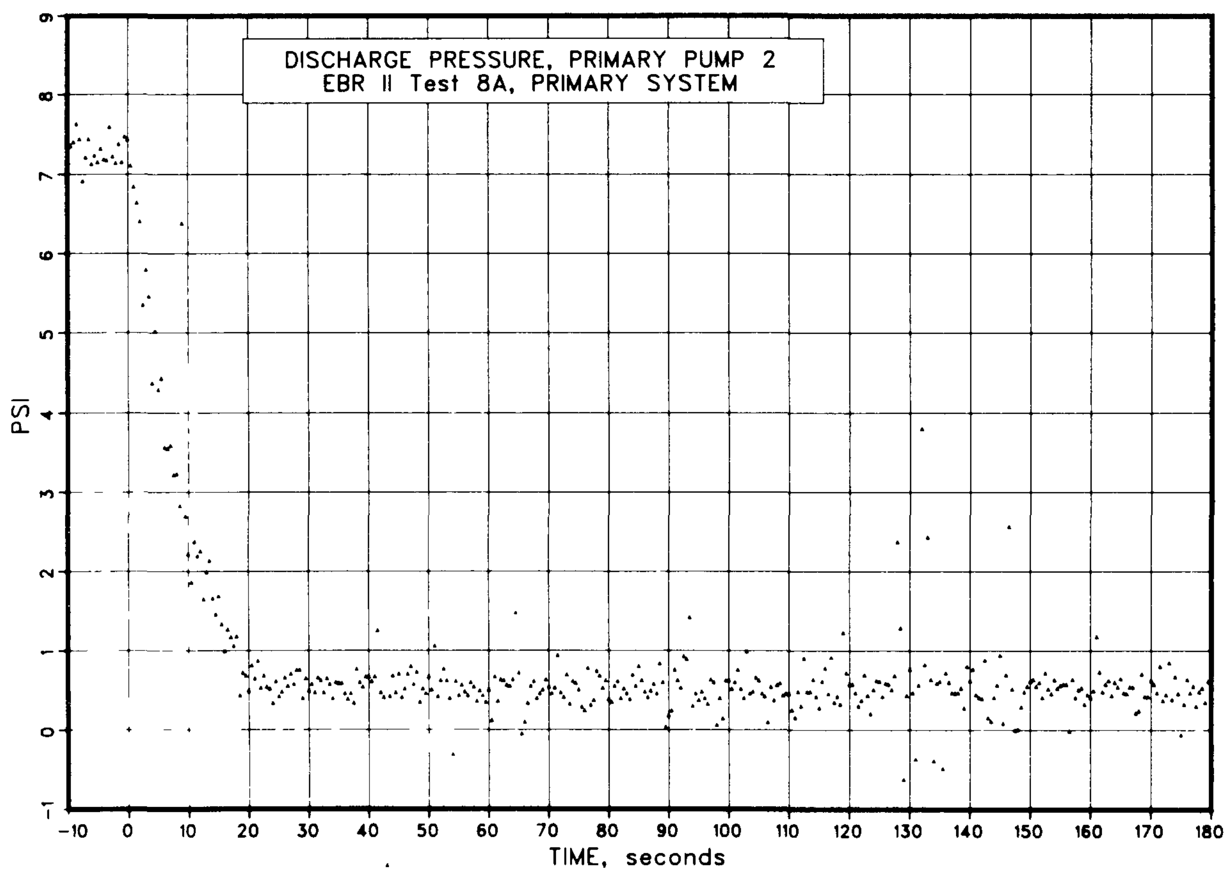

RPM, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
RPM
0
50
100
150
200
250
300
350
400
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

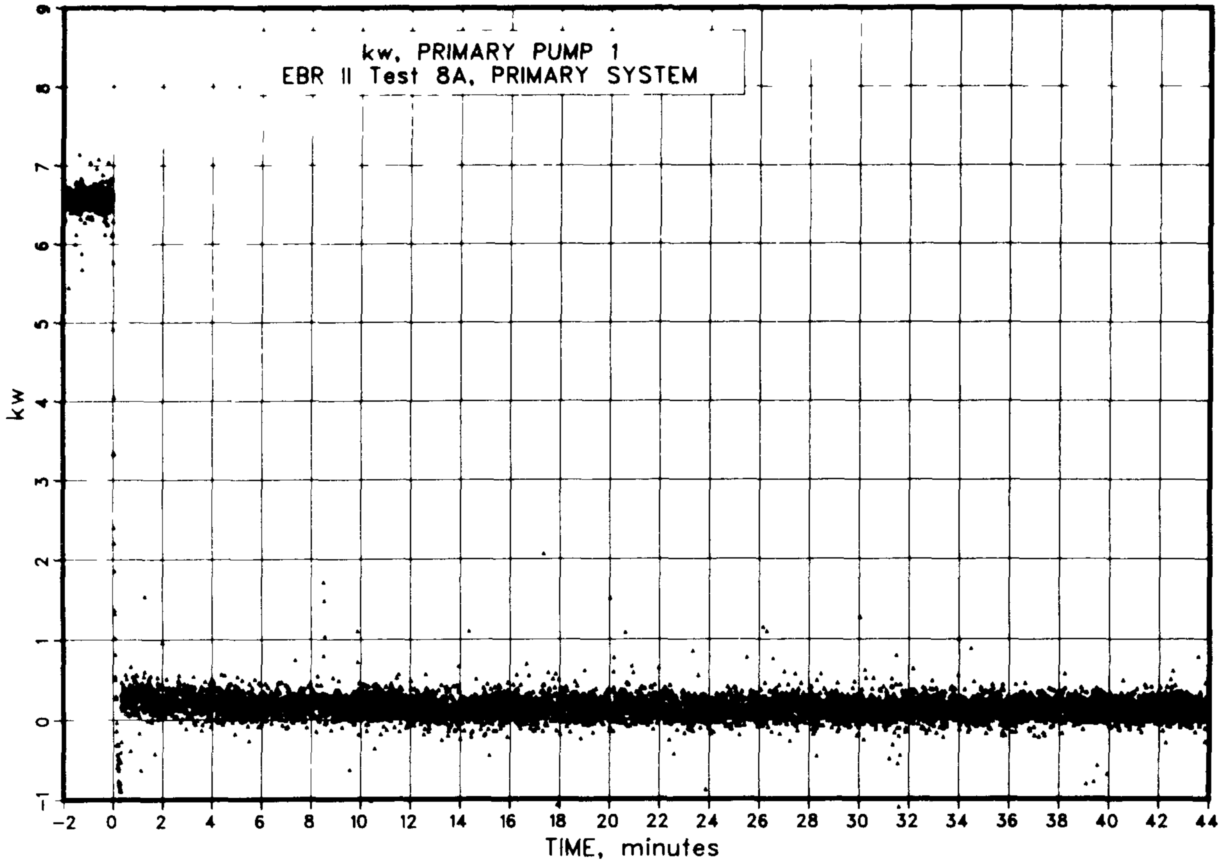

RPM, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
RPM
0
50
100
150
200
250
300
350
400
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

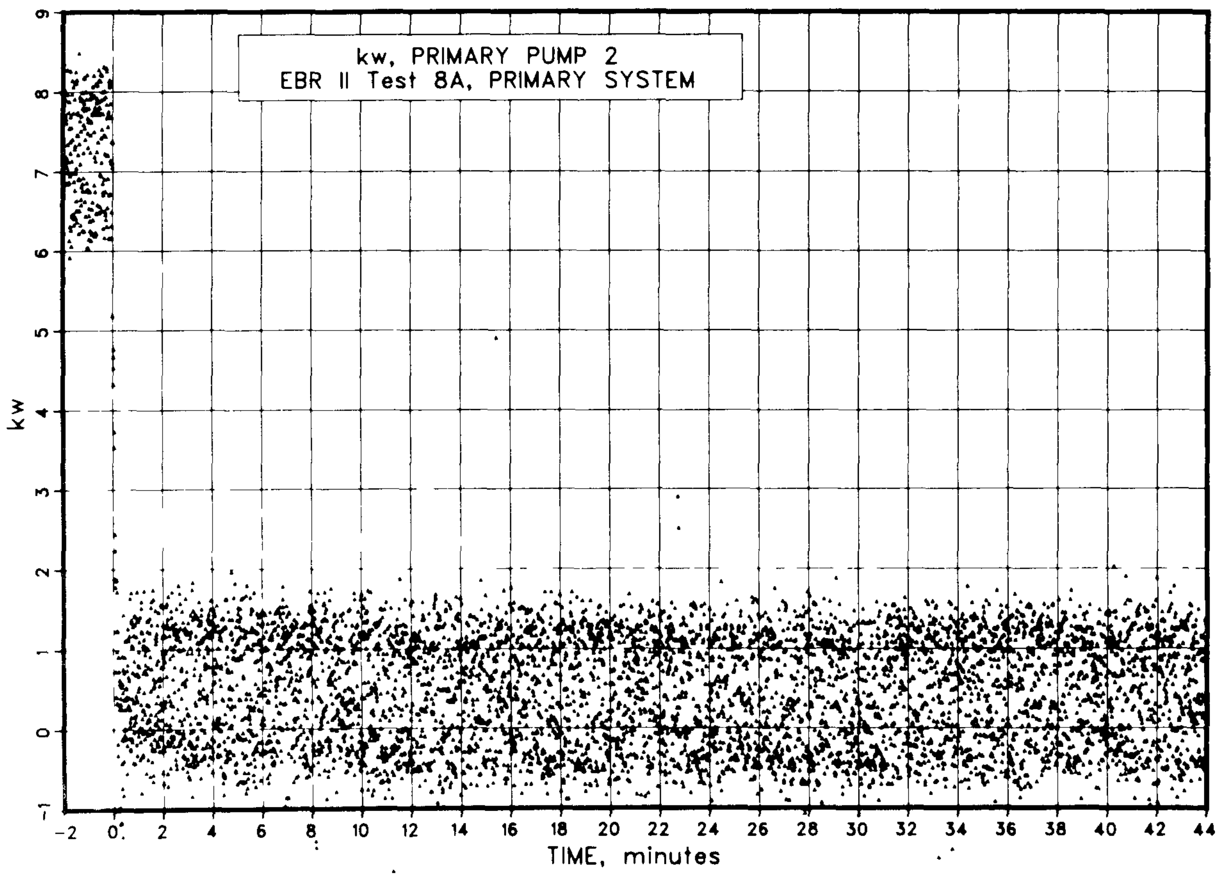

DISCHARGE PRESSURE, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
PSI
TIME, minutes

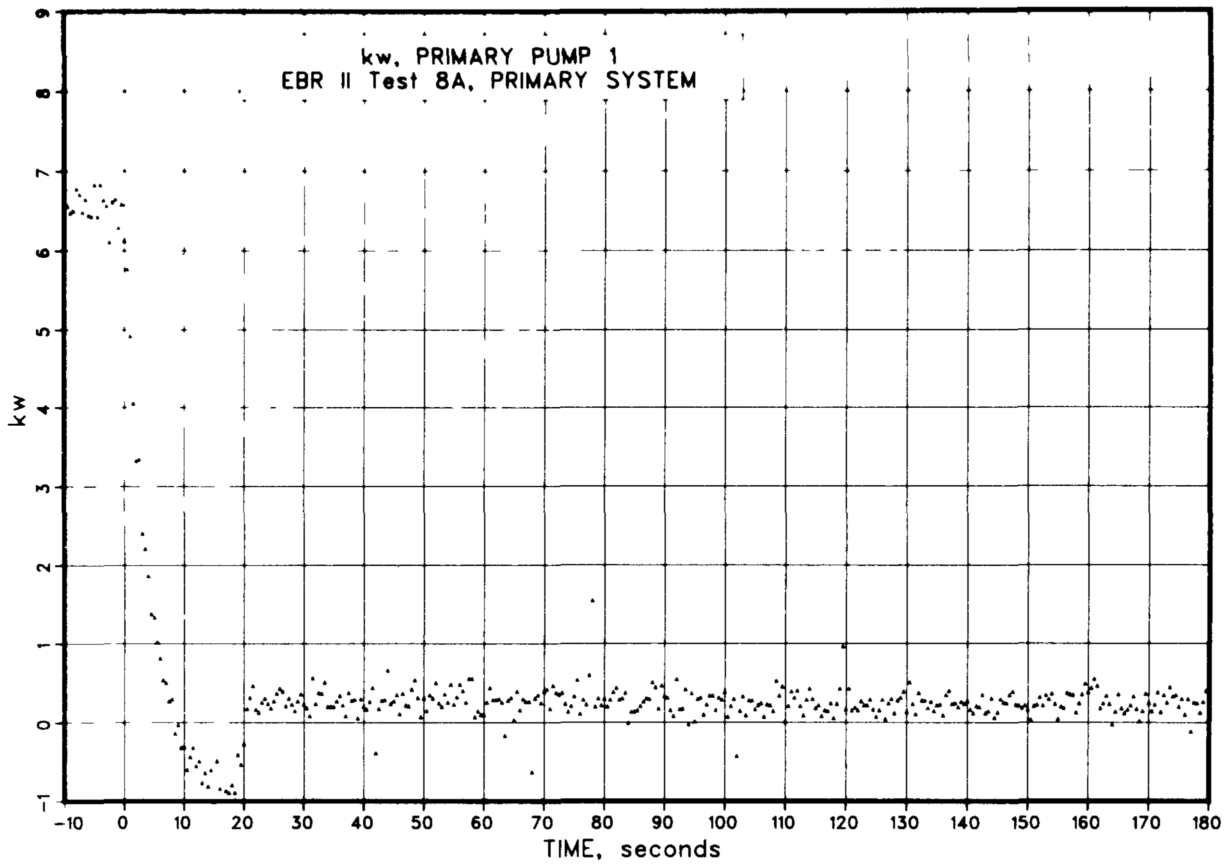

DISCHARGE PRESSURE, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
PSI
TIME, minutes

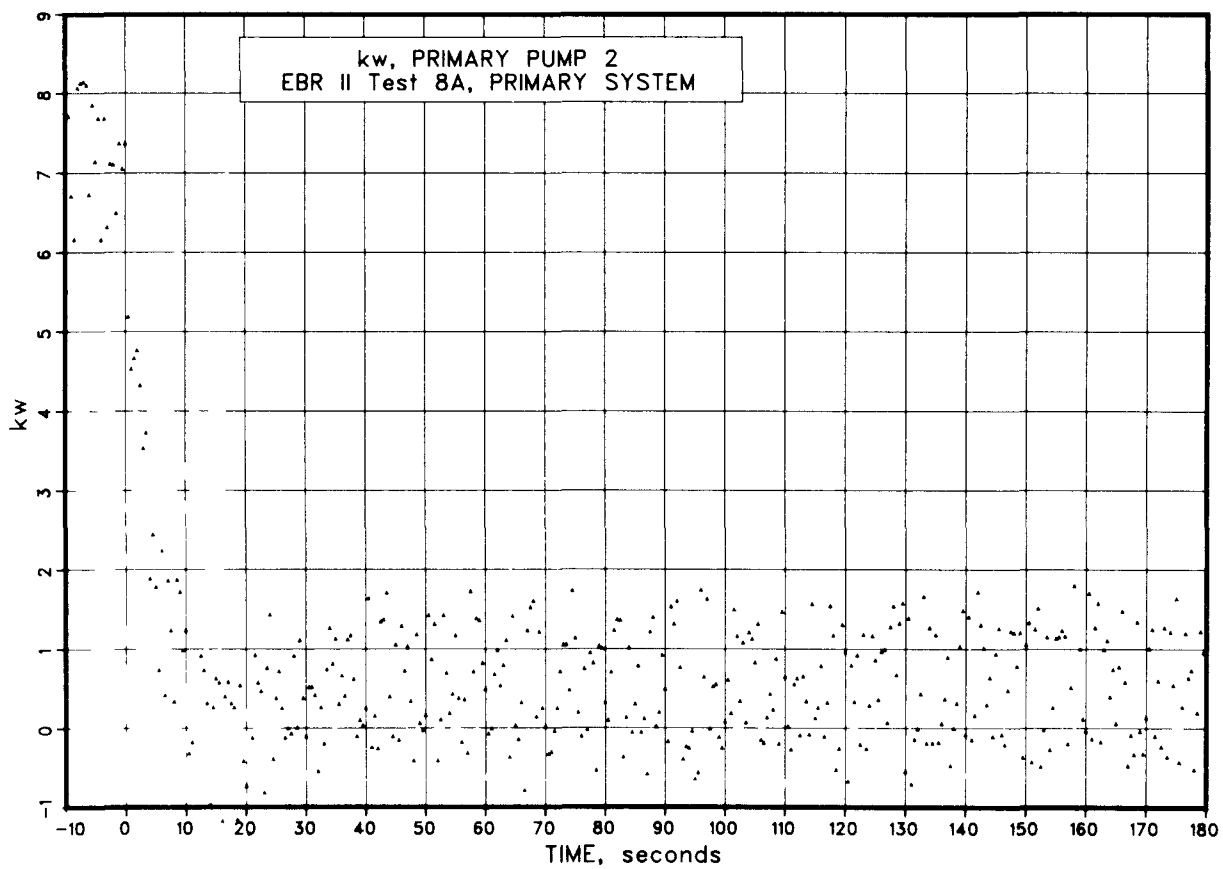

DISCHARGE PRESSURE, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
PSI
TIME, seconds
-1
0
1
2
3
4
5
6
7
8
9
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

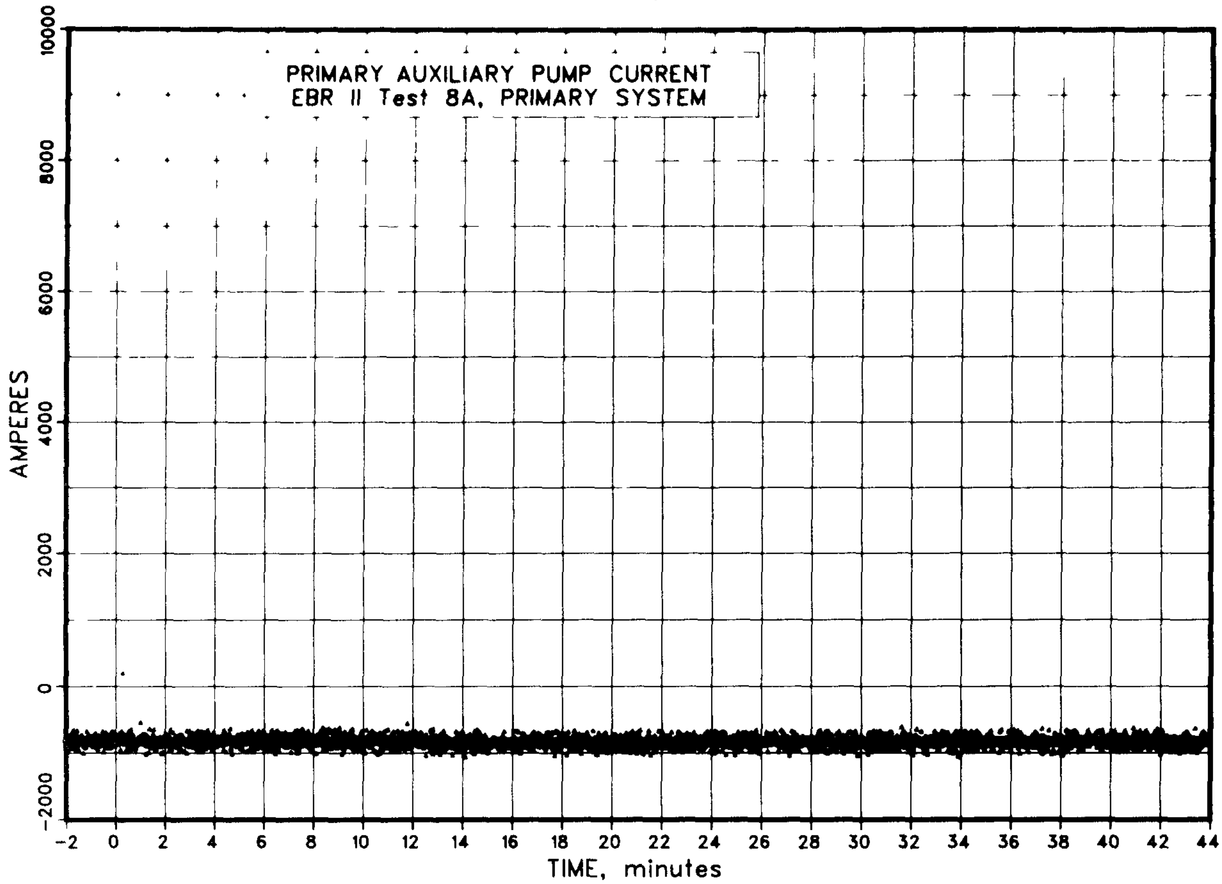

DISCHARGE PRESSURE, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
PSI
TIME, seconds
-1
0
1
2
3
4
5
6
7
8
9
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

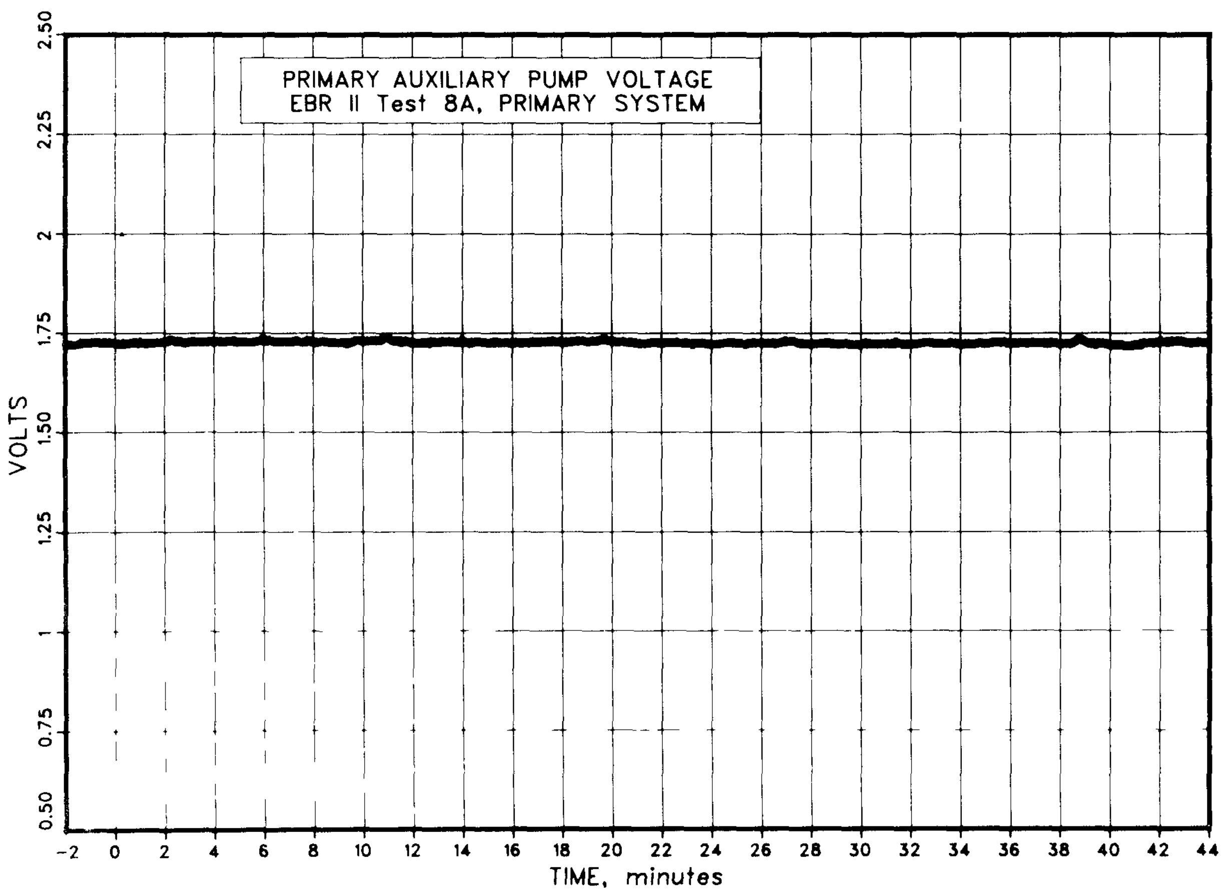

kw, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
kw
TIME, minutes

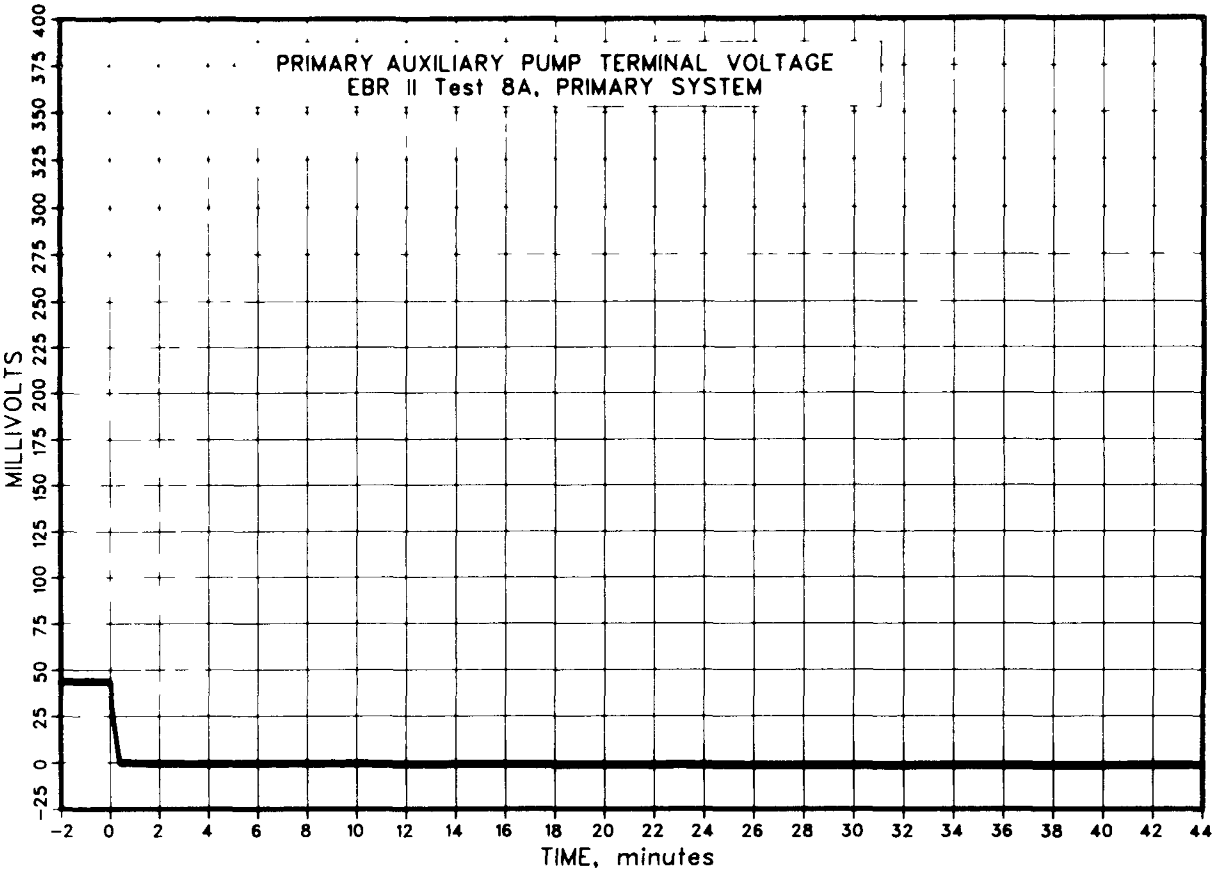

kw, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
kw
TIME, minutes

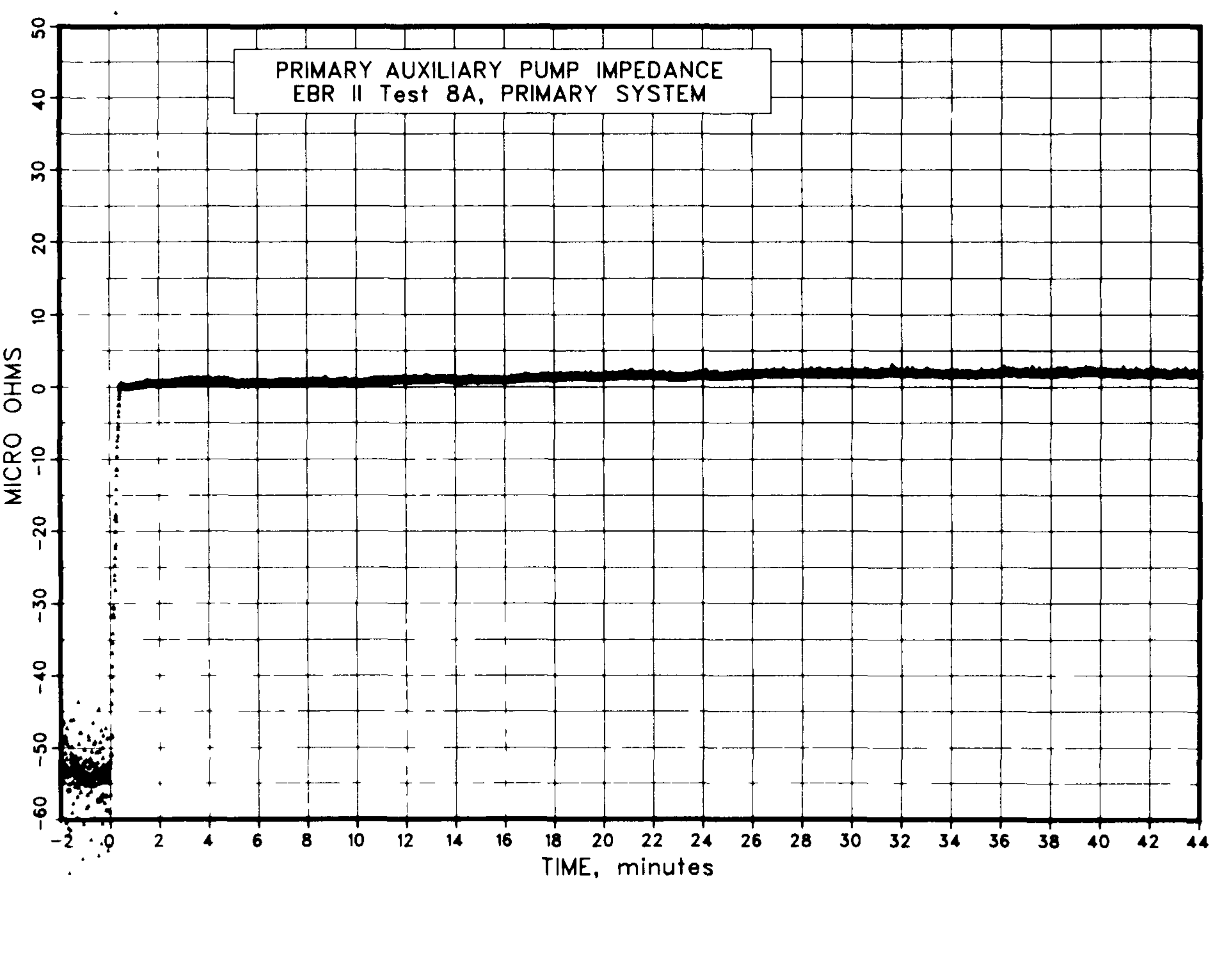

kw, PRIMARY PUMP 1
EBR II Test 8A, PRIMARY SYSTEM
kw
TIME, seconds
-1
0
1
2
3
4
5
6
7
8
9
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

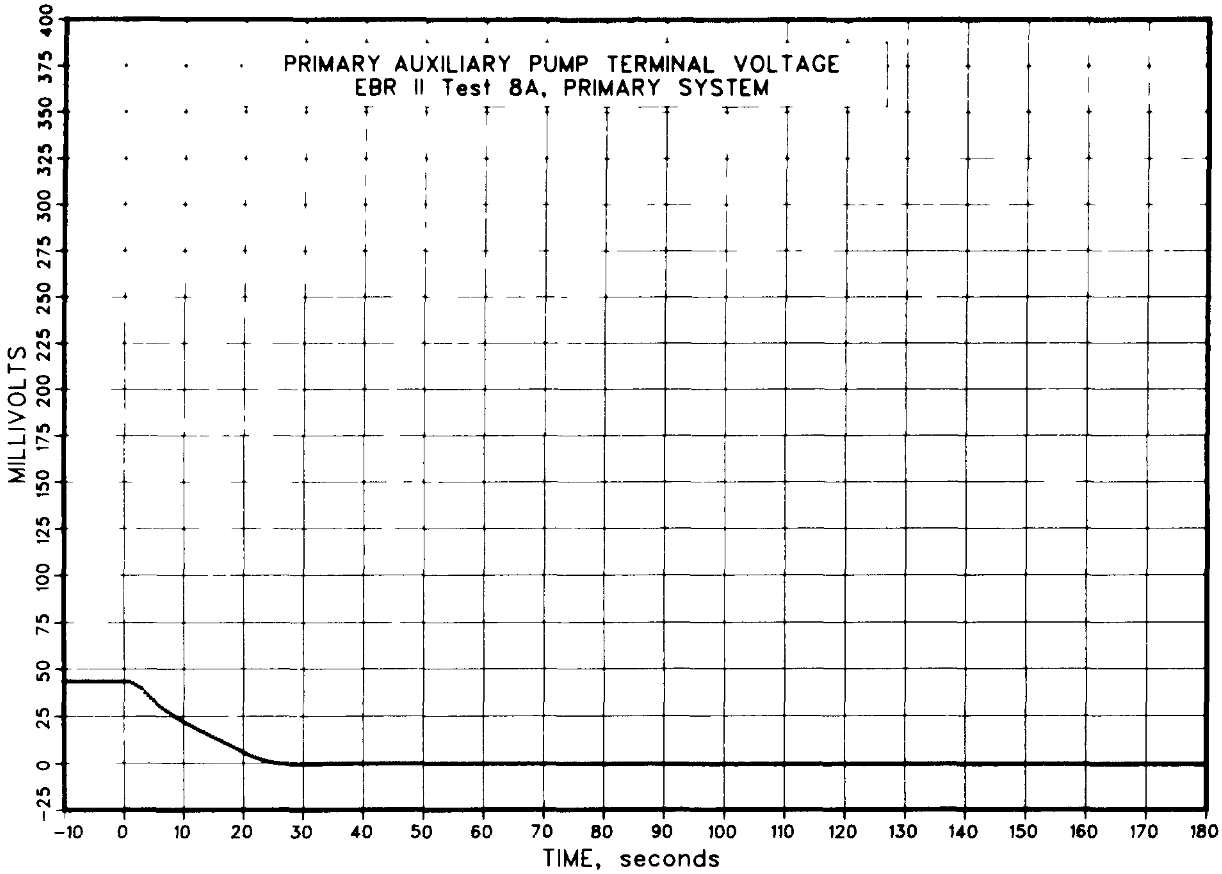

kw, PRIMARY PUMP 2
EBR II Test 8A, PRIMARY SYSTEM
kw
TIME, seconds
-1
0
1
2
3
4
5
6
7
8
9
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

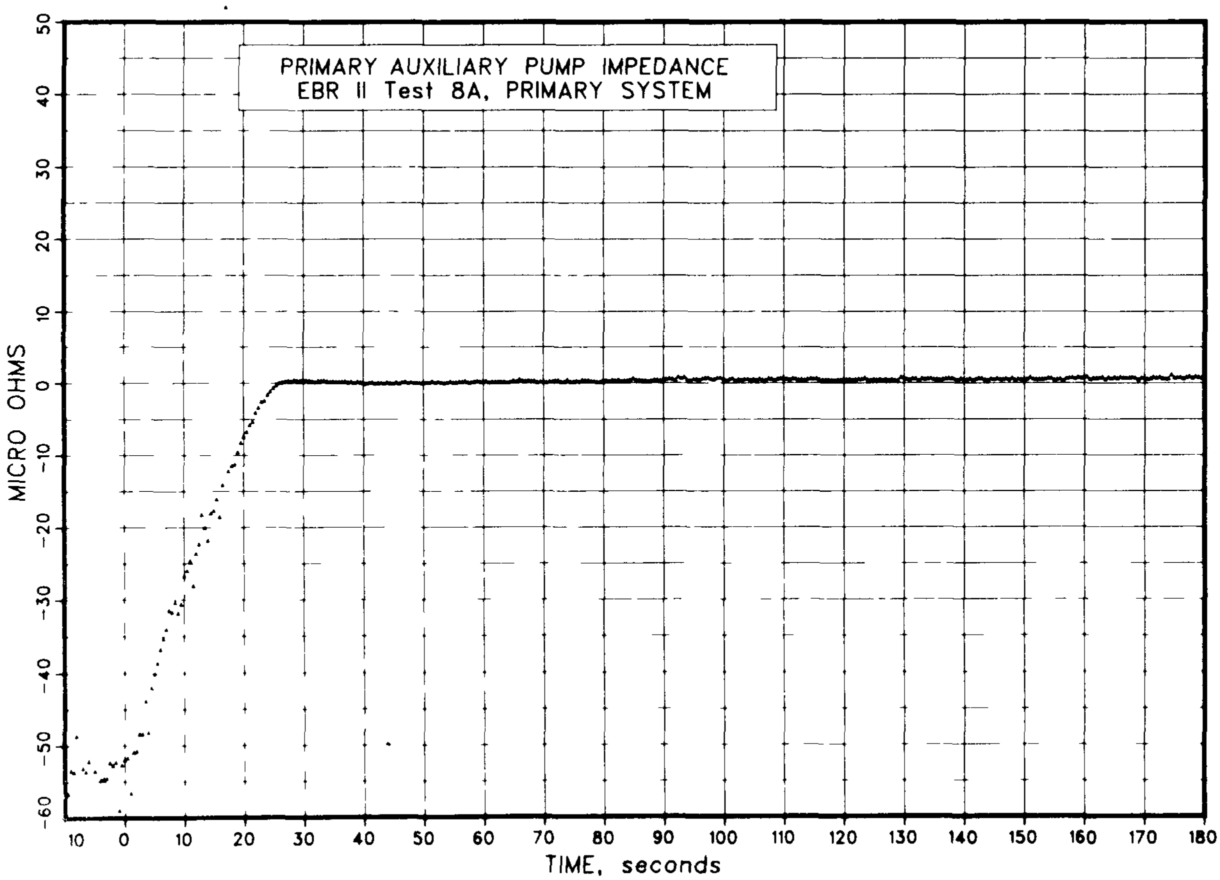

PRIMARY AUXILIARY PUMP CURRENT
EBR II Test 8A, PRIMARY SYSTEM
AMPERES
10000
8000
6000
4000
2000
0
-2000
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


PRIMARY AUXILIARY PUMP VOLTAGE
EBR II Test 8A, PRIMARY SYSTEM
VOLTS
2.50
2.25
2
1.75
1.50
1.25
1
0.75
0.50
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


PRIMARY AUXILIARY PUMP TERMINAL VOLTAGE
EBR II Test 8A, PRIMARY SYSTEM
MILLIVOLTS
TIME, minutes


PRIMARY AUXILIARY PUMP IMPEDANCE
EBR II Test 8A, PRIMARY SYSTEM
MICRO OHMS
TIME, minutes


PRIMARY AUXILIARY PUMP TERMINAL VOLTAGE
EBR II Test 8A, PRIMARY SYSTEM
MILLIVOLTS
-25
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


PRIMARY AUXILIARY PUMP IMPEDANCE
EBR II Test 8A, PRIMARY SYSTEM
MICRO OHMS
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
10
0
10
20
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50
60
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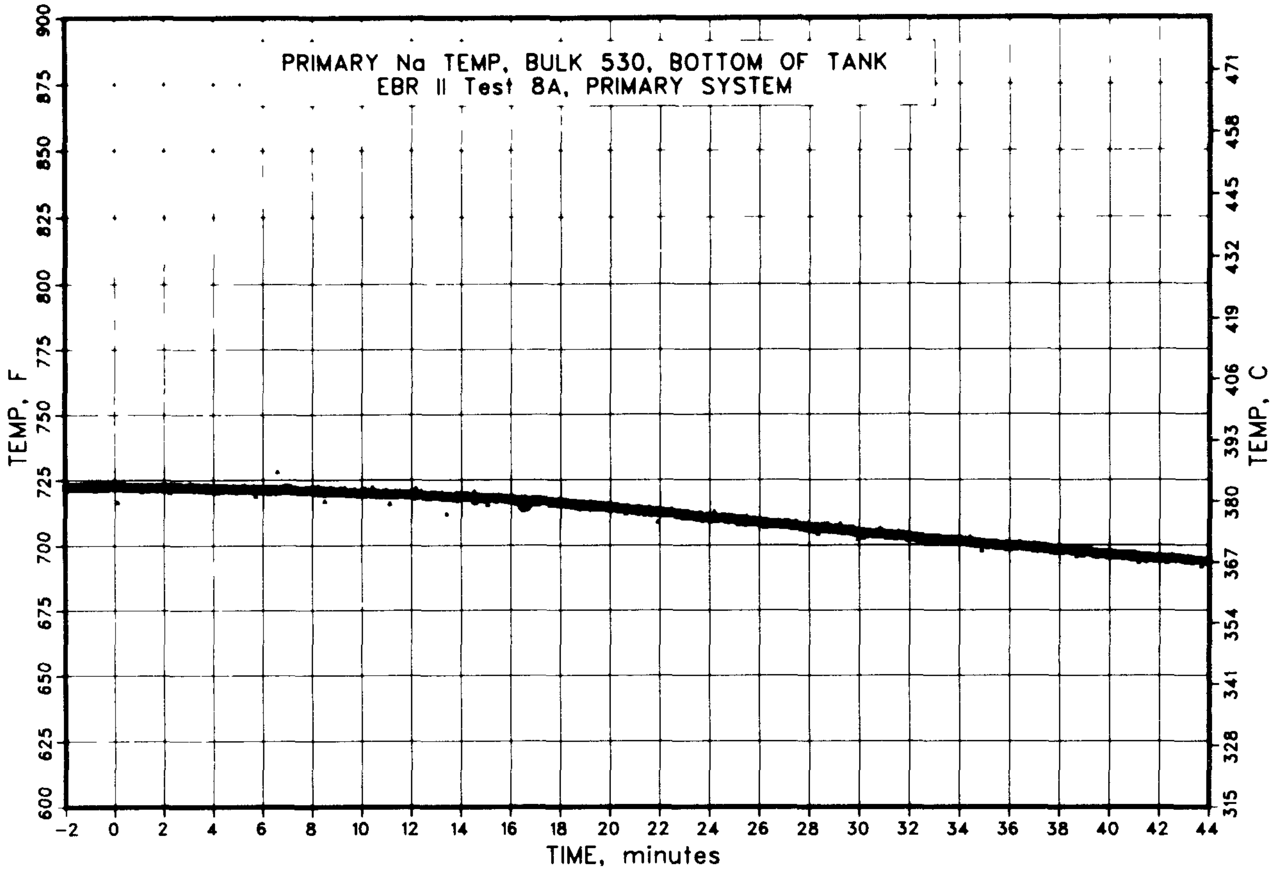
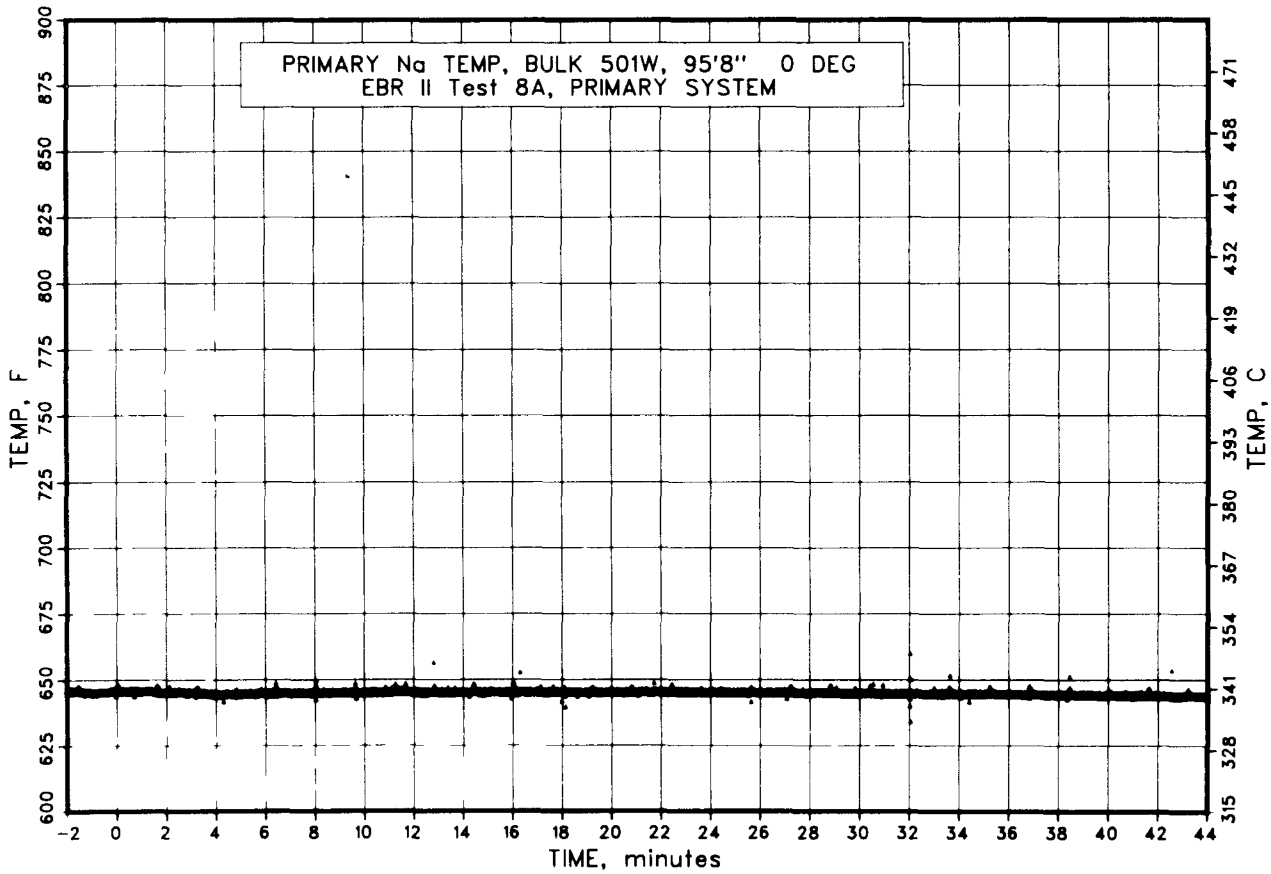
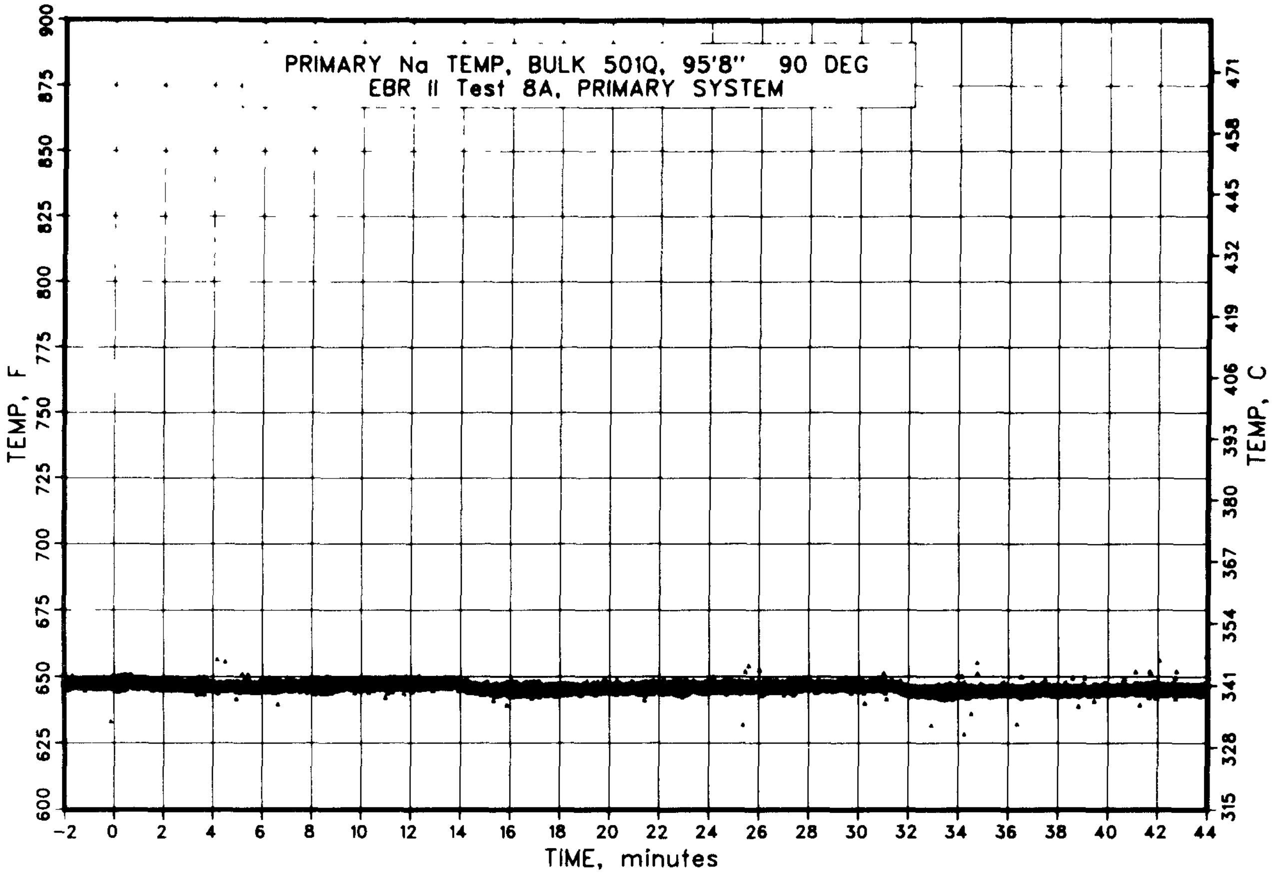
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


PRIMARY Na TEMP, BULK 530, BOTTOM OF TANK
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


PRIMARY Na TEMP, BULK 501W, 95'8" 0 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


PRIMARY Na TEMP, BULK 501Q, 95'8" 90 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
600
625
650
675
700
725
750
775
800
825
850
875
900
315
328
341
354
367
380
393
406
419
432
445
458
471
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
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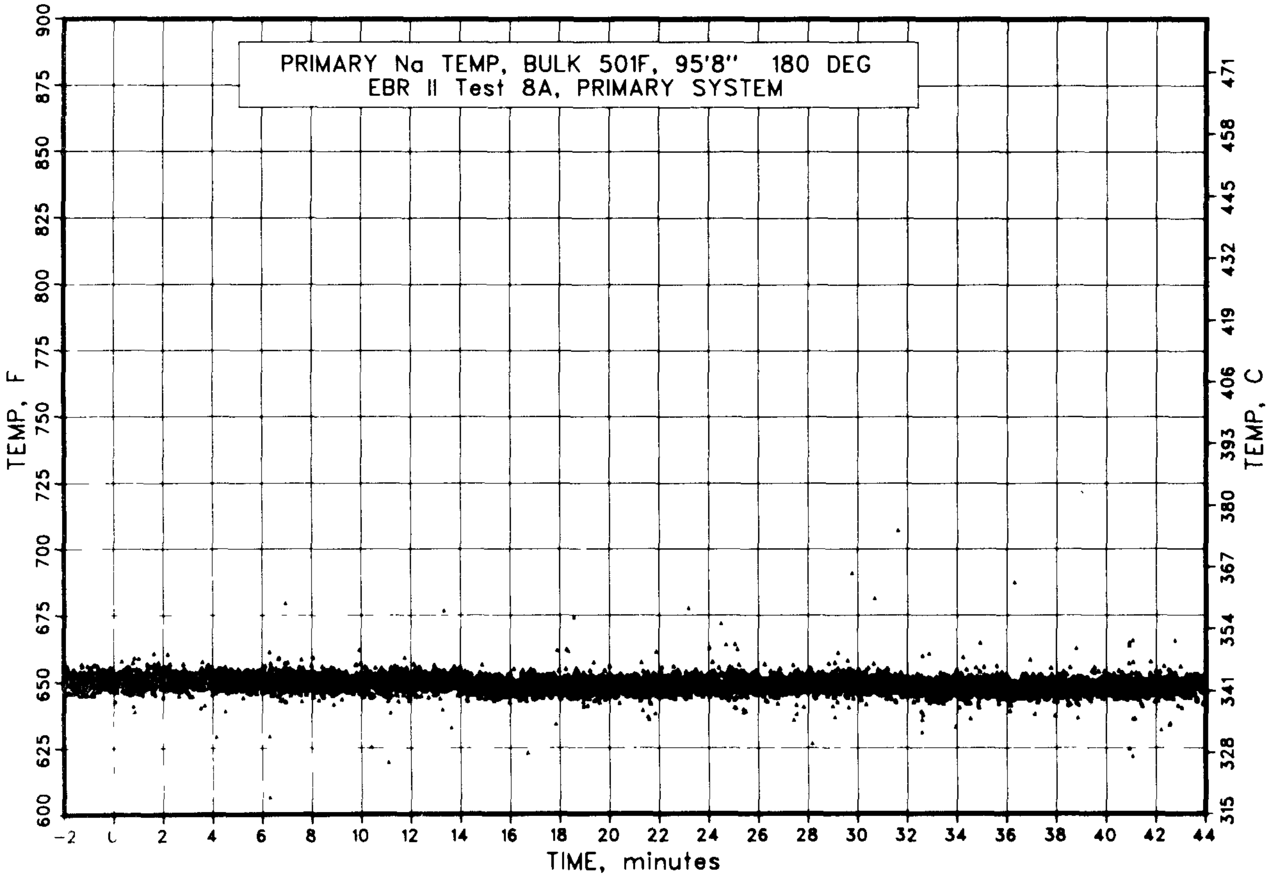
36
38
40
42
44


PRIMARY Na TEMP, BULK 501F, 95'8" 180 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
600
625
650
675
700
725
750
775
800
825
850
875
900
315
328
341
354
367
380
393
406
419
432
445
458
471
-2
2
4
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42
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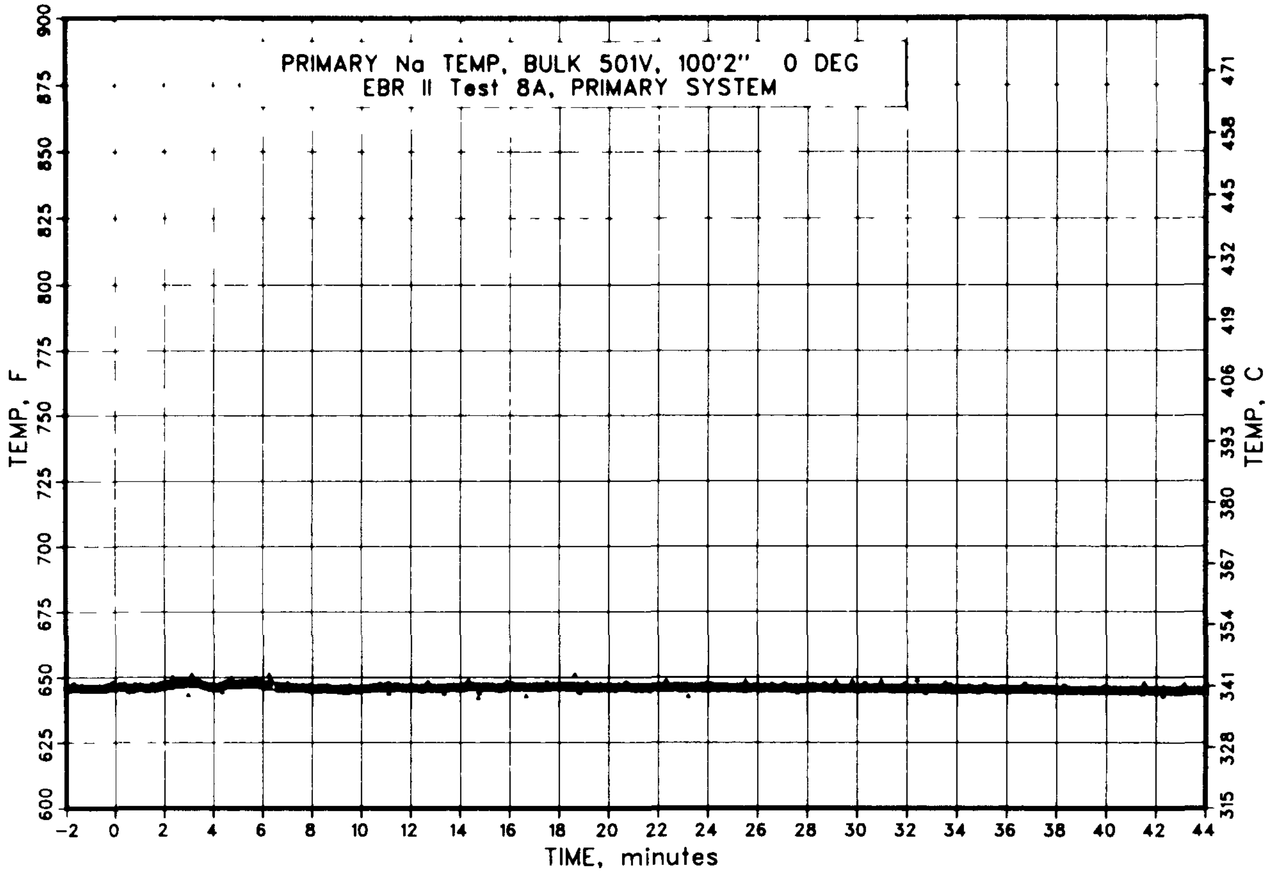
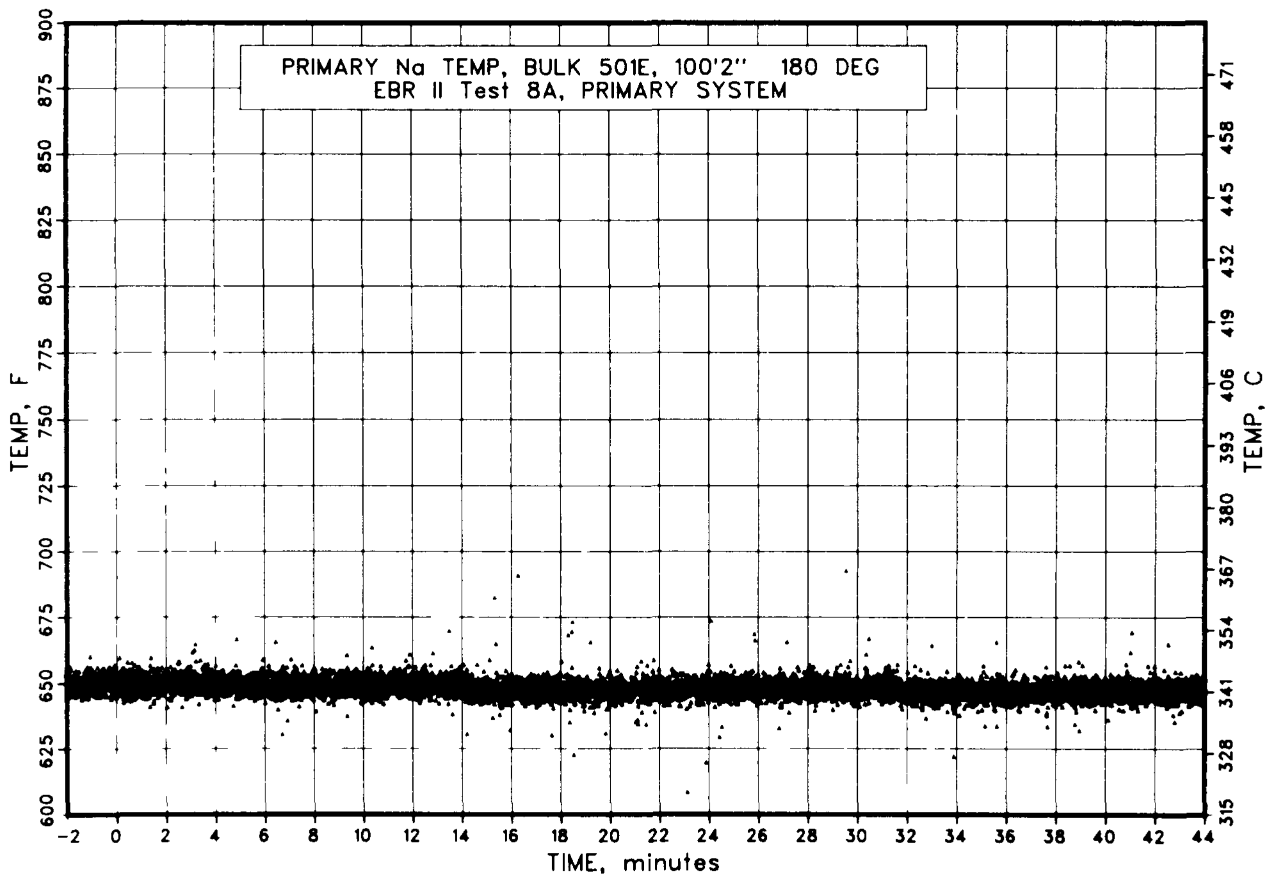
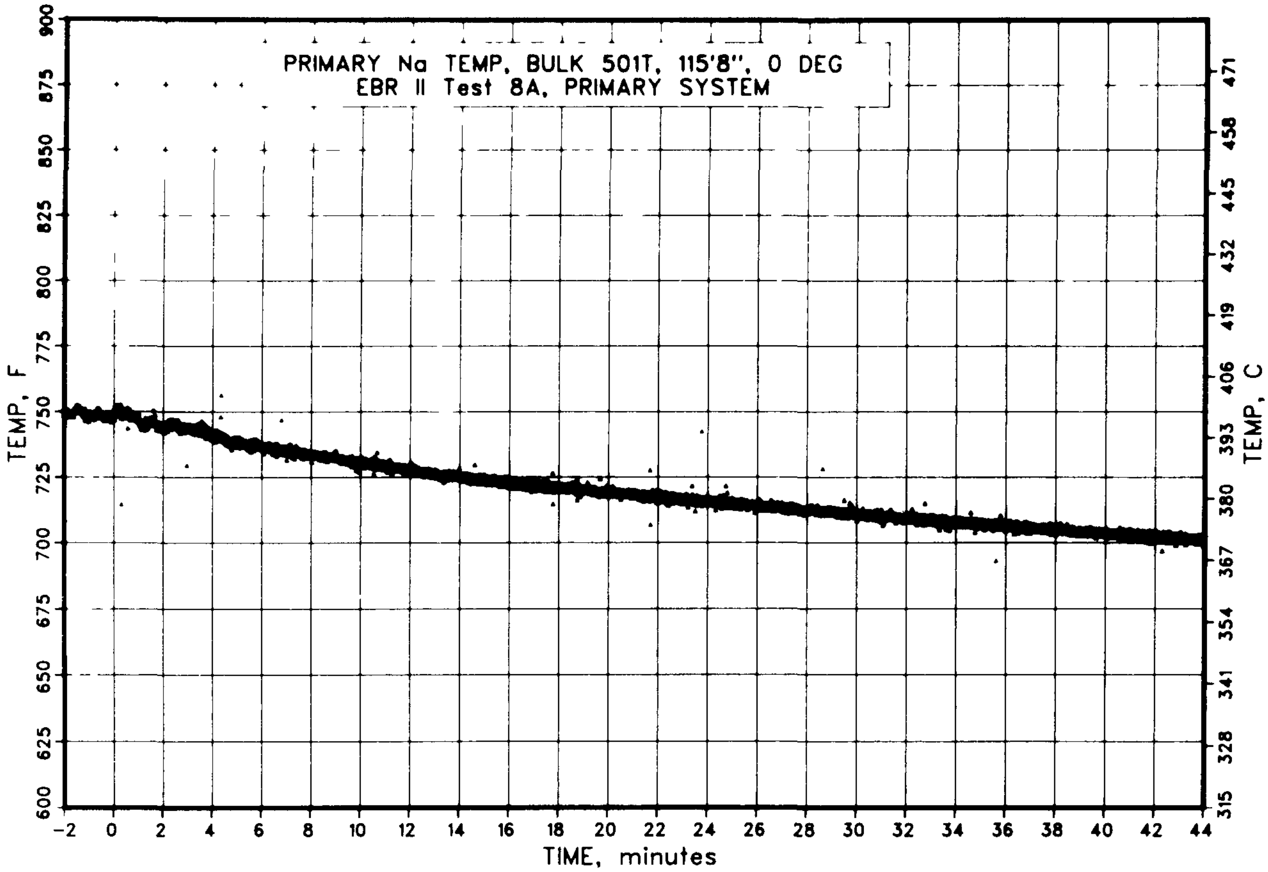
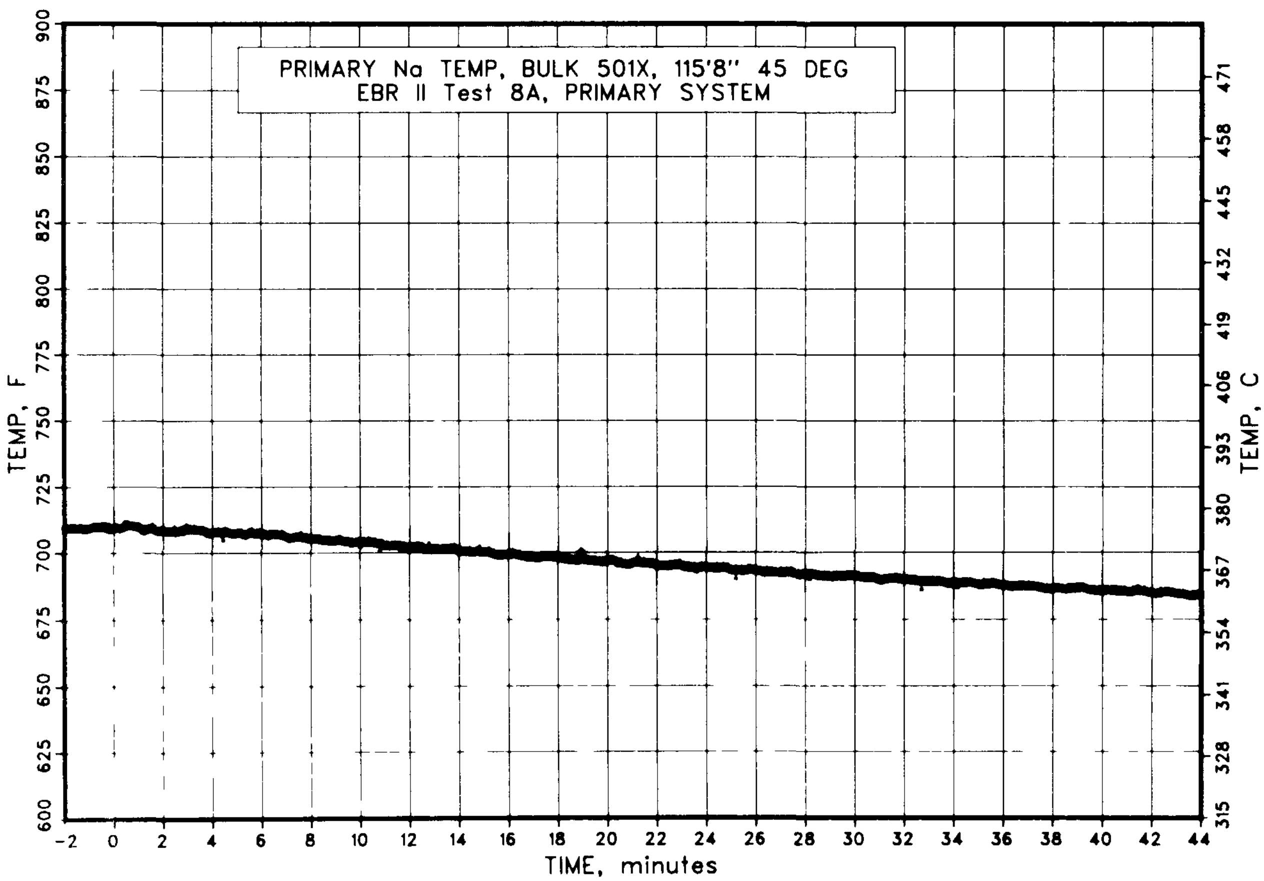


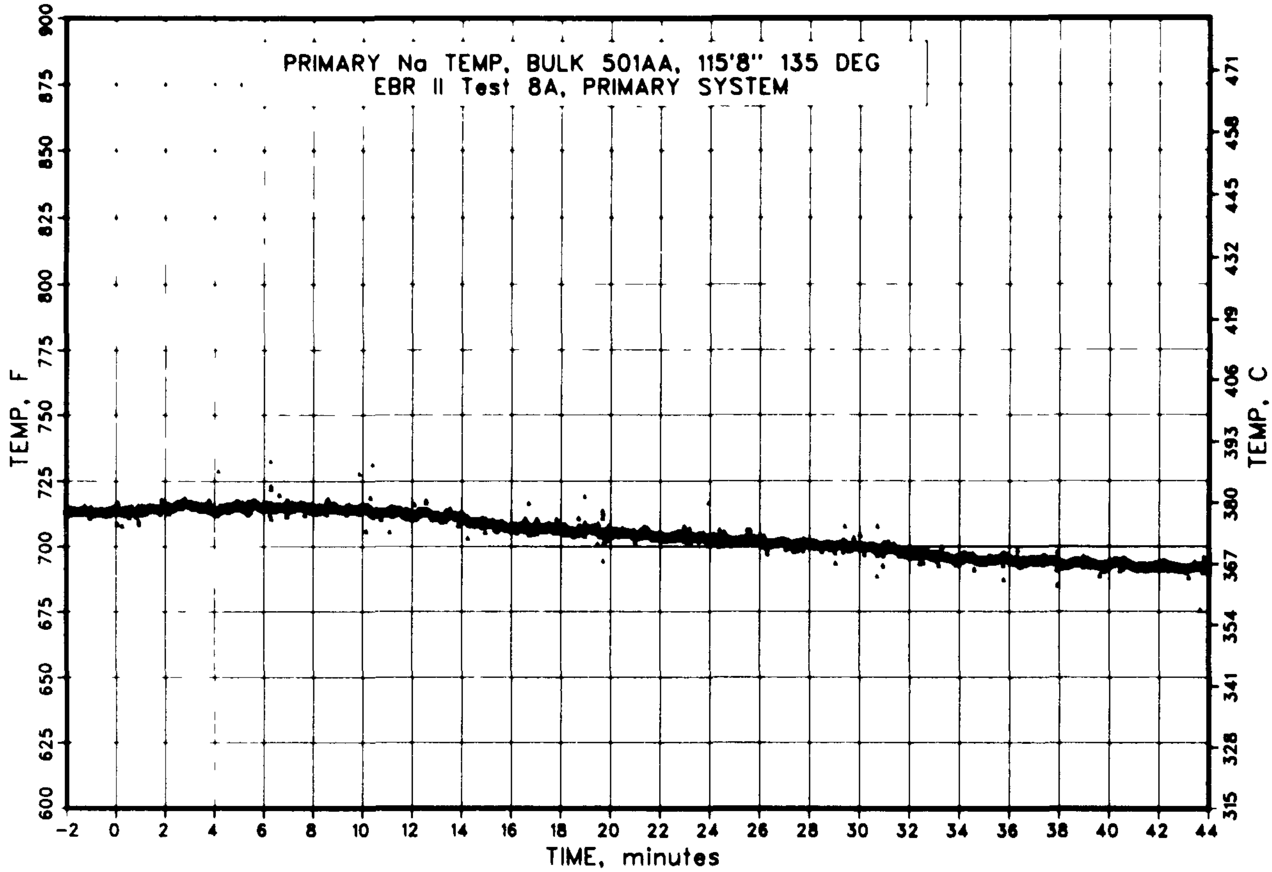
PRIMARY Na TEMP, BULK 501V, 100'2" 0 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

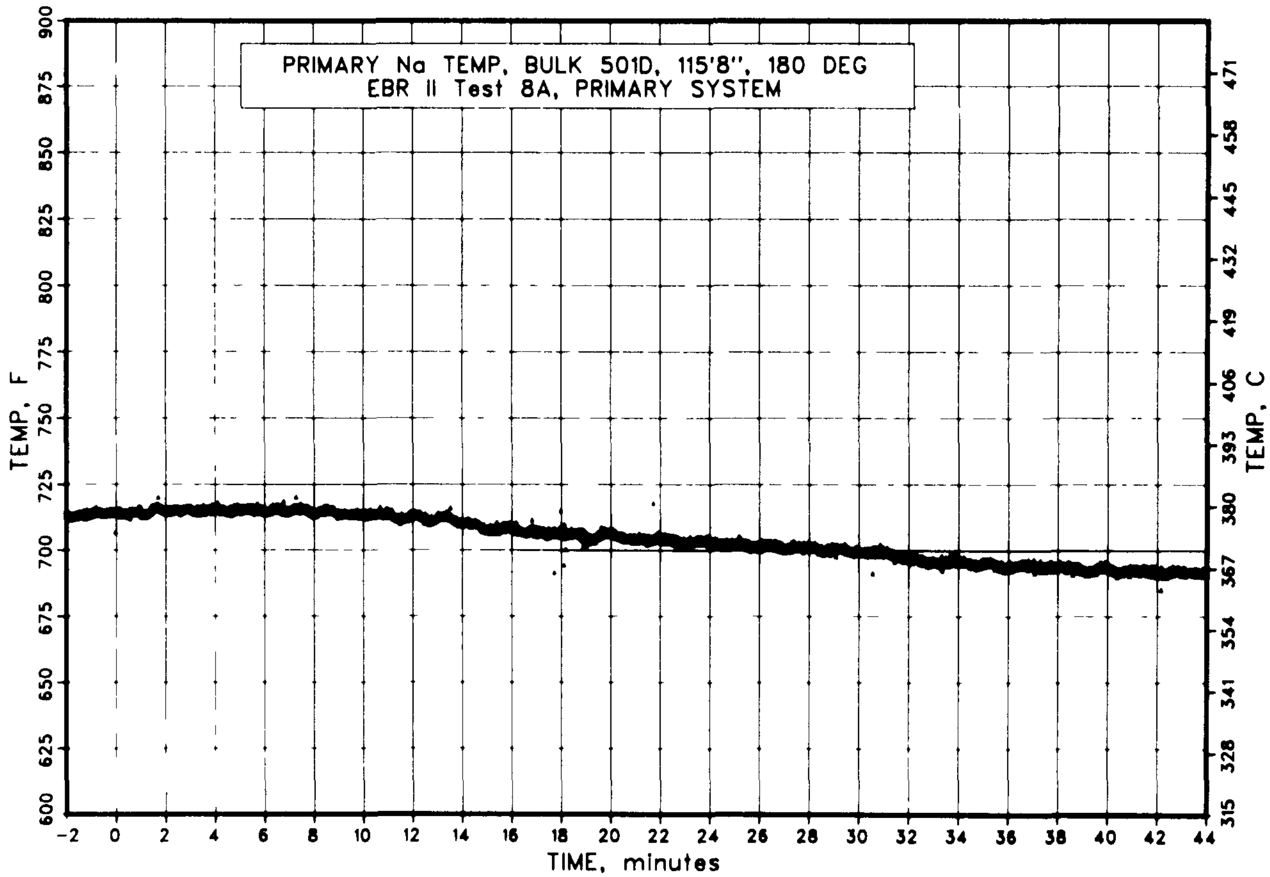


PRIMARY Na TEMP, BULK 501E, 100'2" 180 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, BULK 501T, 115'8", 0 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, BULK 501X, 115'8" 45 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, BULK 501AA, 115'8" 135 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
600
625
650
675
700
725
750
775
800
825
850
875
900
315
328
341
354
367
380
393
406
419
432
445
458
471
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44


PRIMARY Na TEMP, BULK 501D, 115'8", 180 DEG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
600
625
650
675
700
725
750
775
800
825
850
875
900
315
328
341
354
367
380
393
406
419
432
445
458
471
-2
0
2
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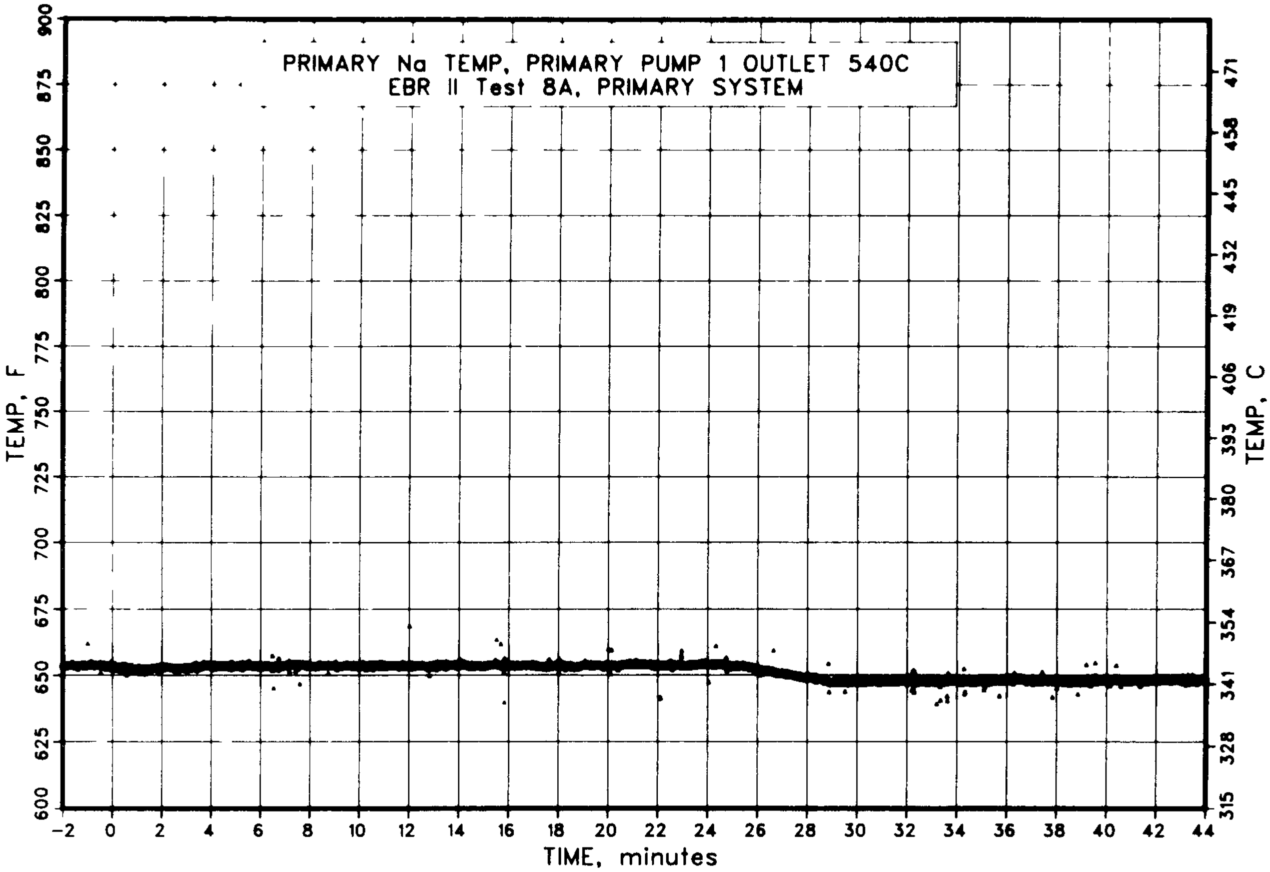
36
38
40
42
44


PRIMARY Na TEMP, PRIMARY PUMP 1 OUTLET 540C
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
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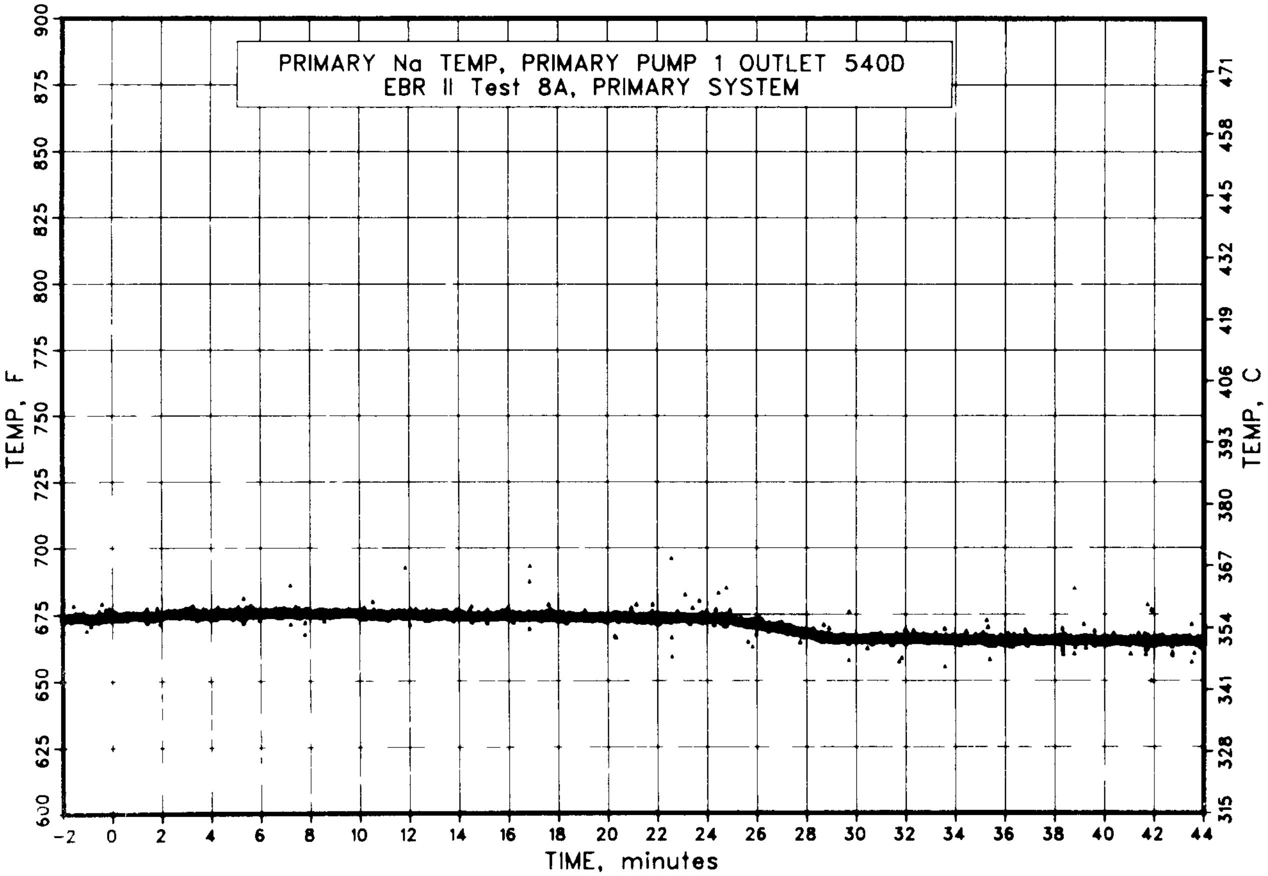
PRIMARY Na TEMP, PRIMARY PUMP 1 OUTLET 540D
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
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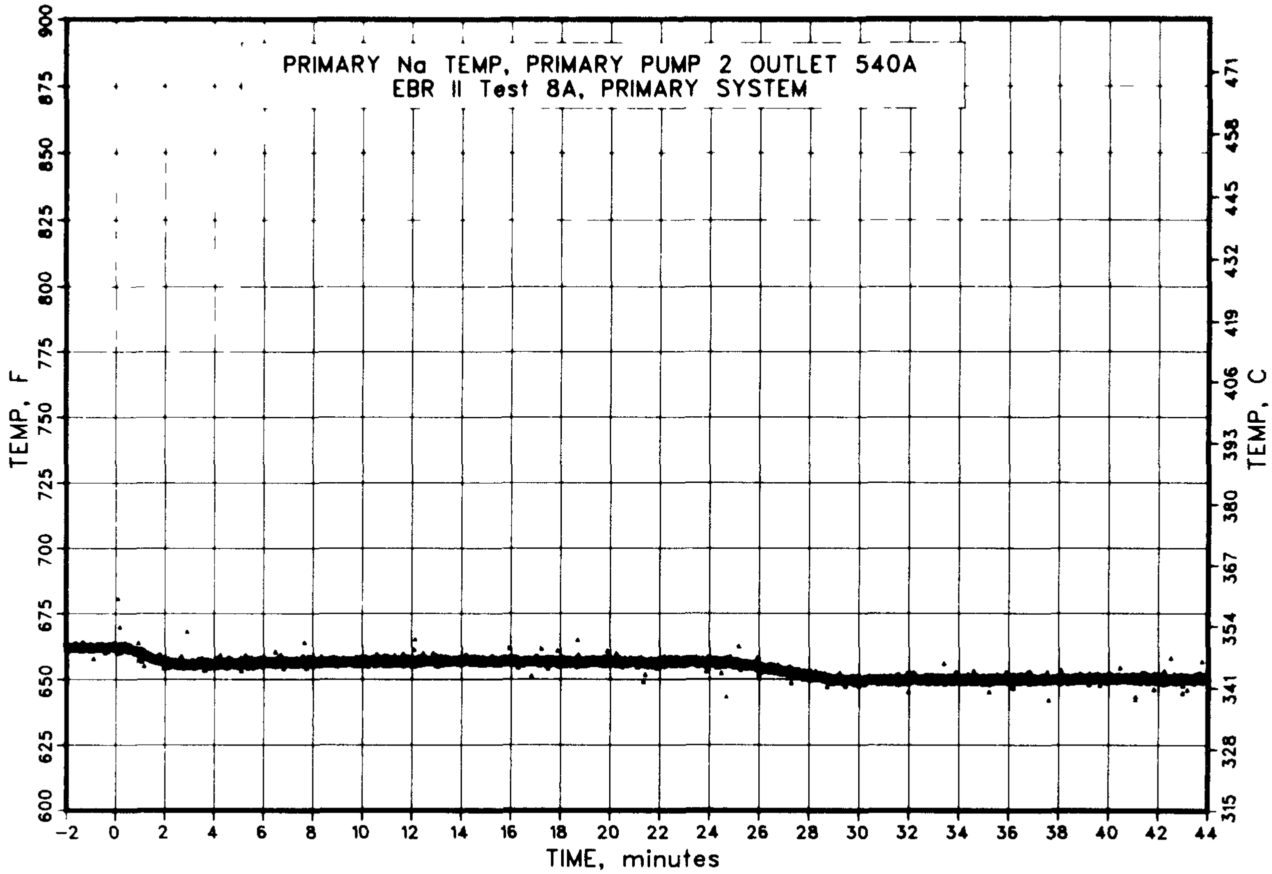
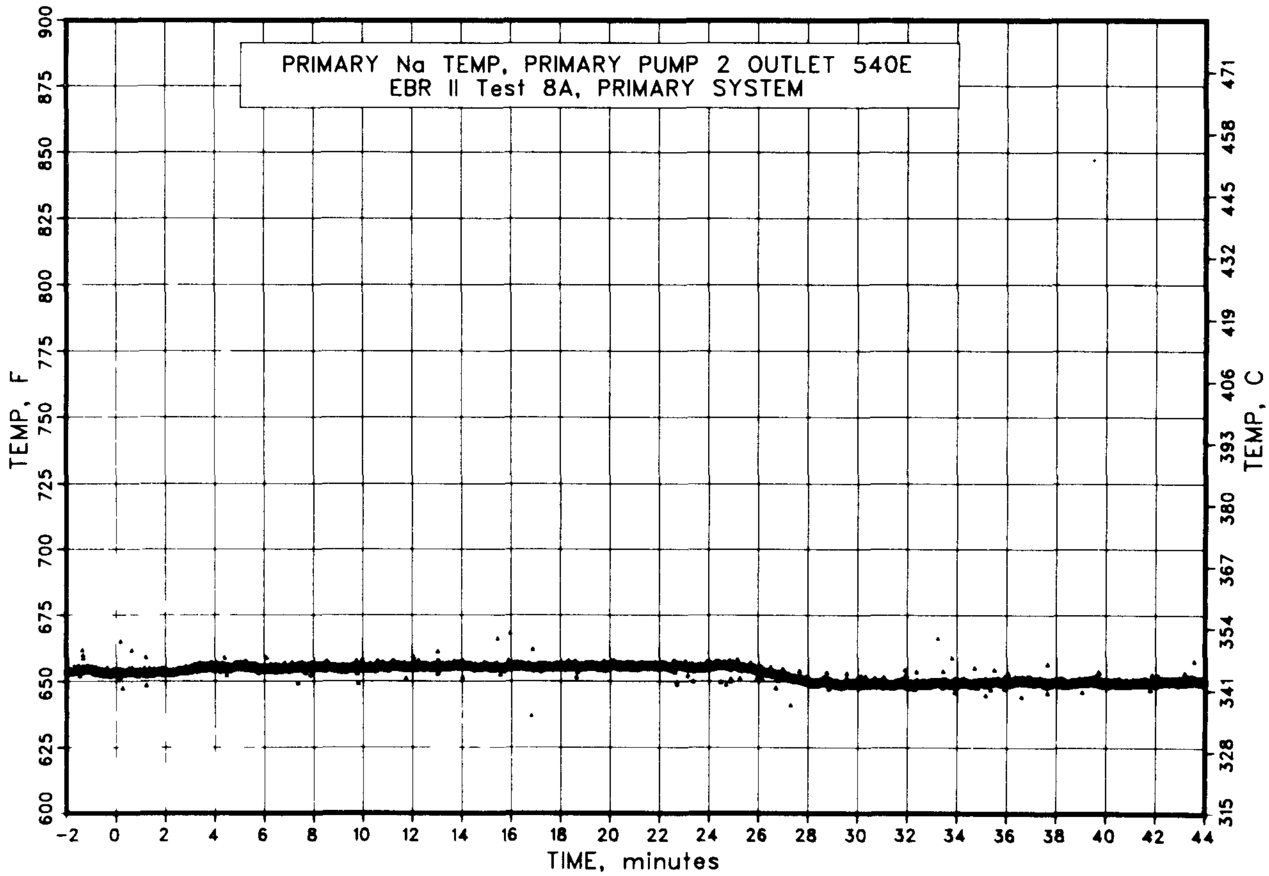
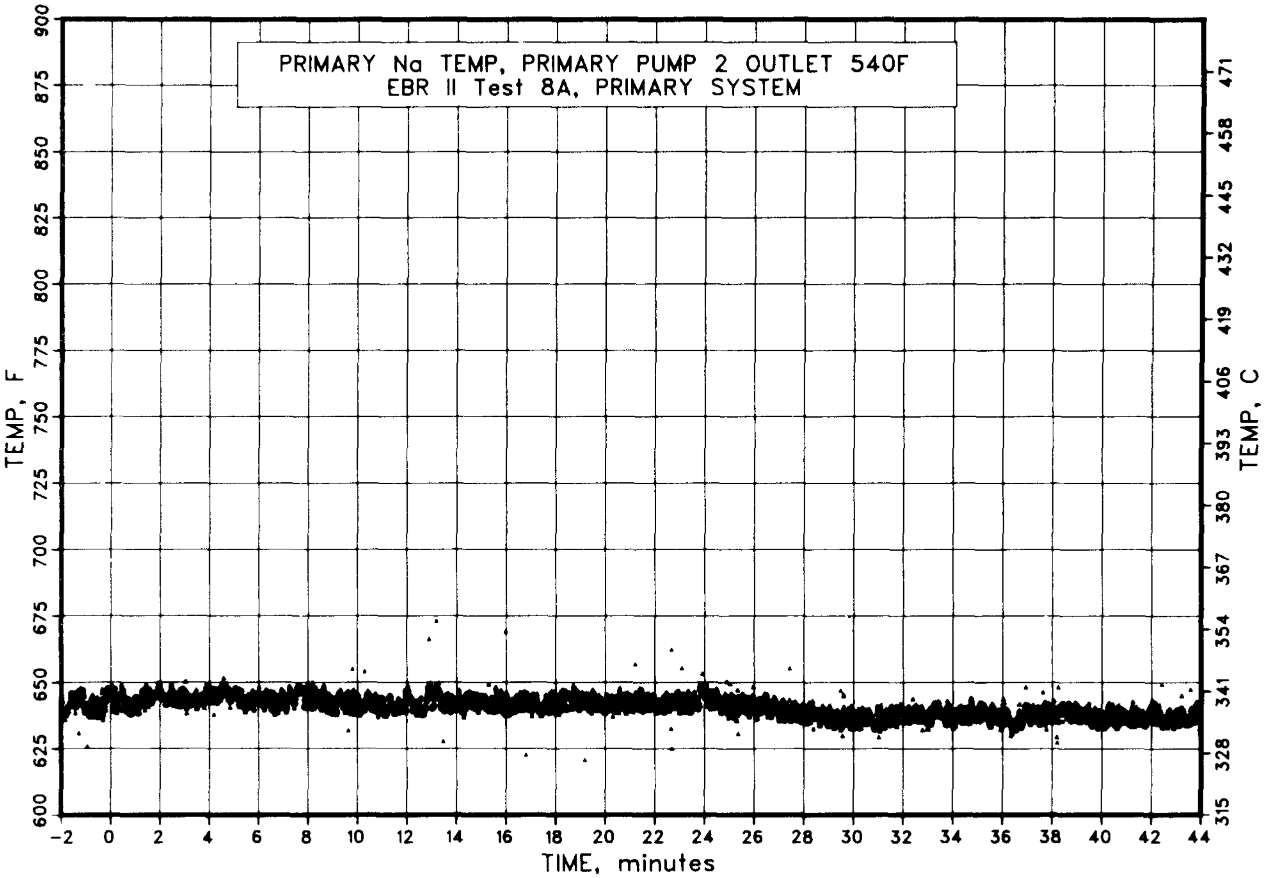

PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540A
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540E
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540F
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
600
625
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800
825
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875
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TEMP, C
315
328
341
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367
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TIME, minutes
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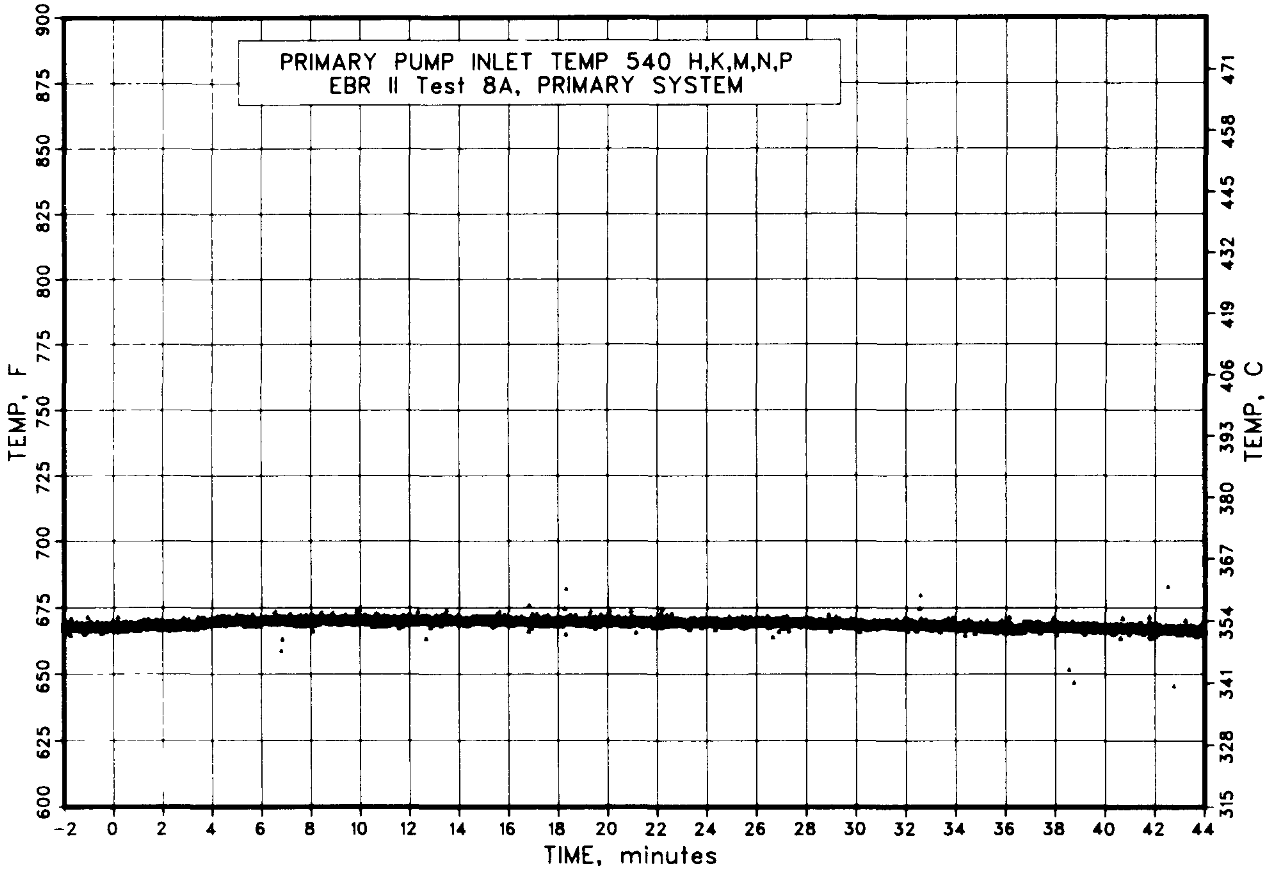
PRIMARY PUMP INLET TEMP 540 H,K,M,N,P
EBR II Test 8A, PRIMARY SYSTEM
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850
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750
725
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600
TEMP, C
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315
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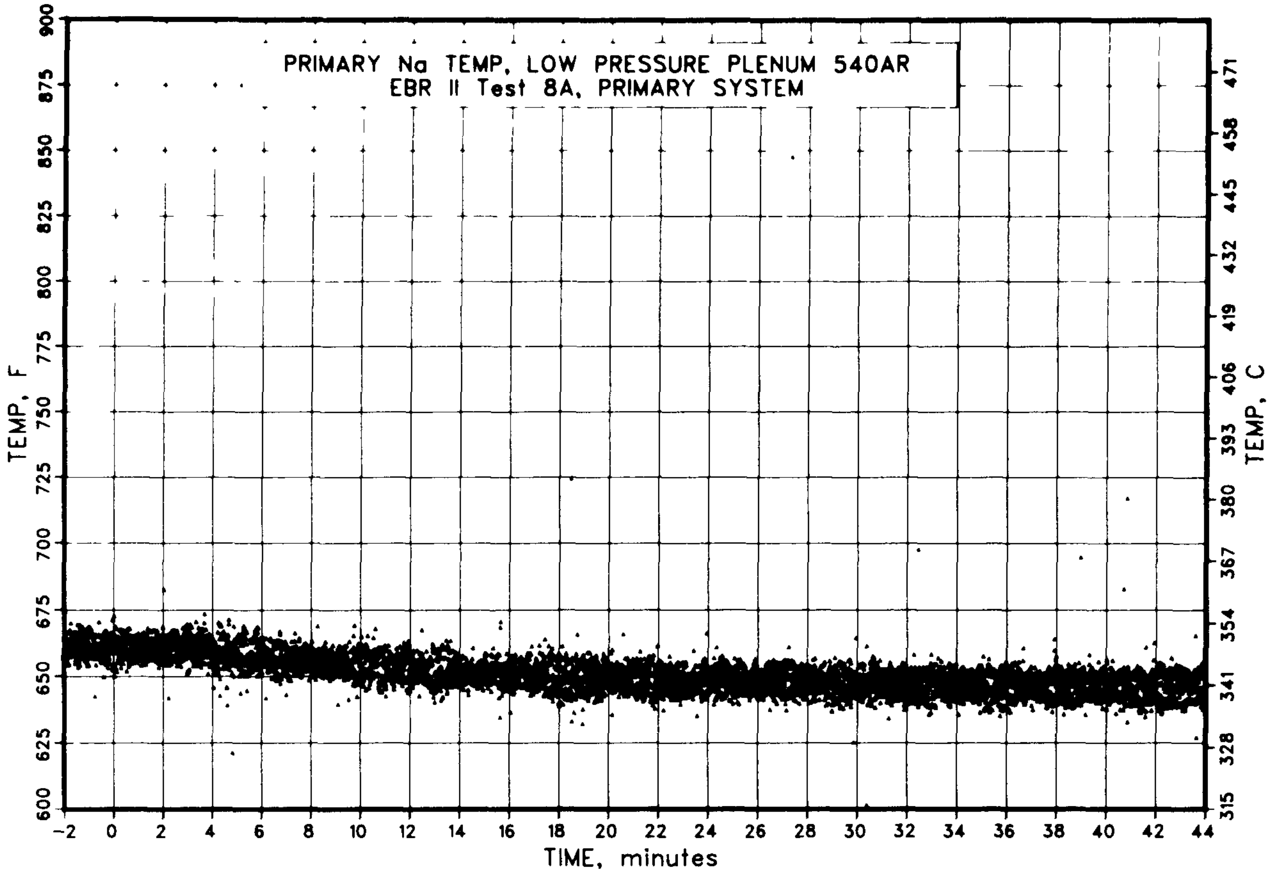
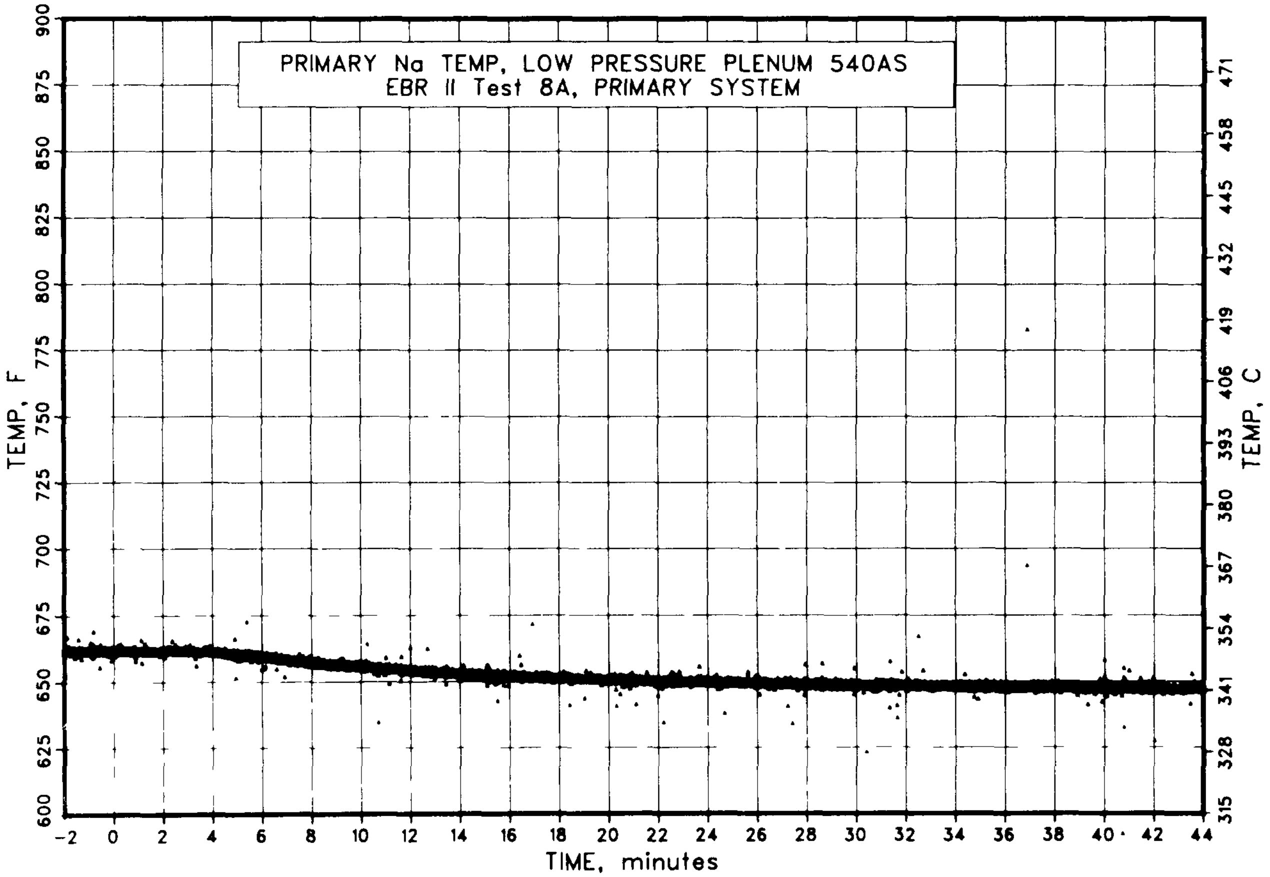
TIME, minutes


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AR
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AS
EBR II Test 8A, PRIMARY SYSTEM
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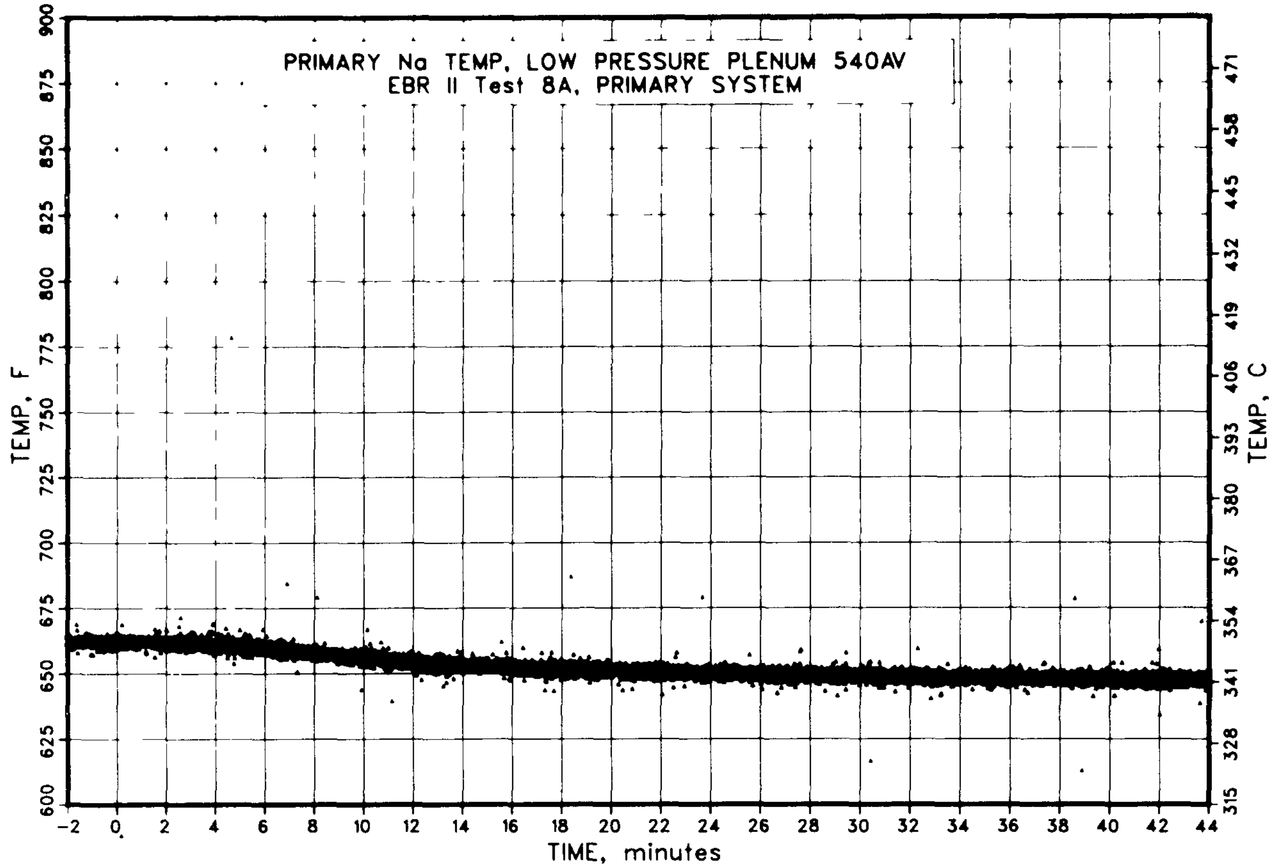
TEMP, C
TIME, minutes


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AV
EBR II Test 8A, PRIMARY SYSTEM
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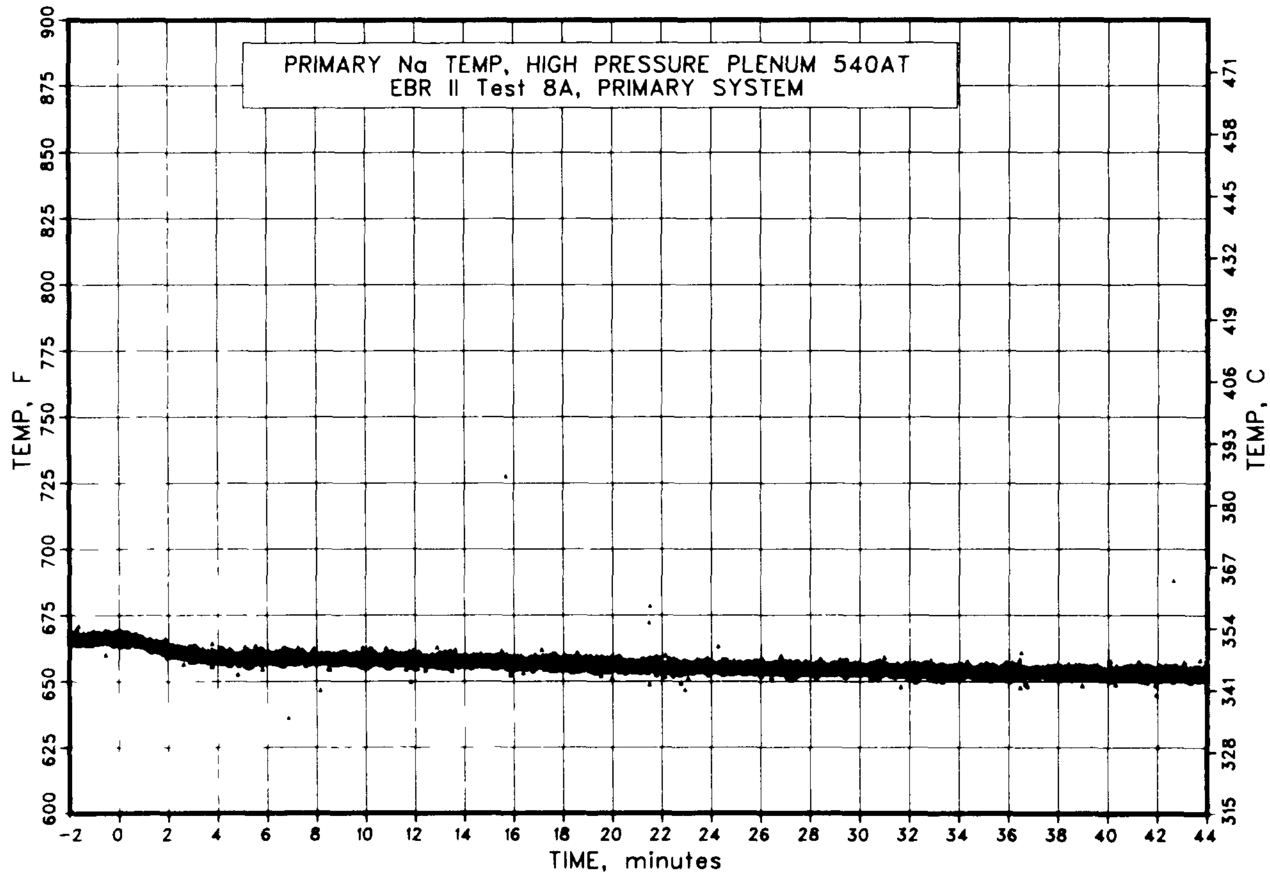
PRIMARY Na TEMP, HIGH PRESSURE PLENUM 540AT
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
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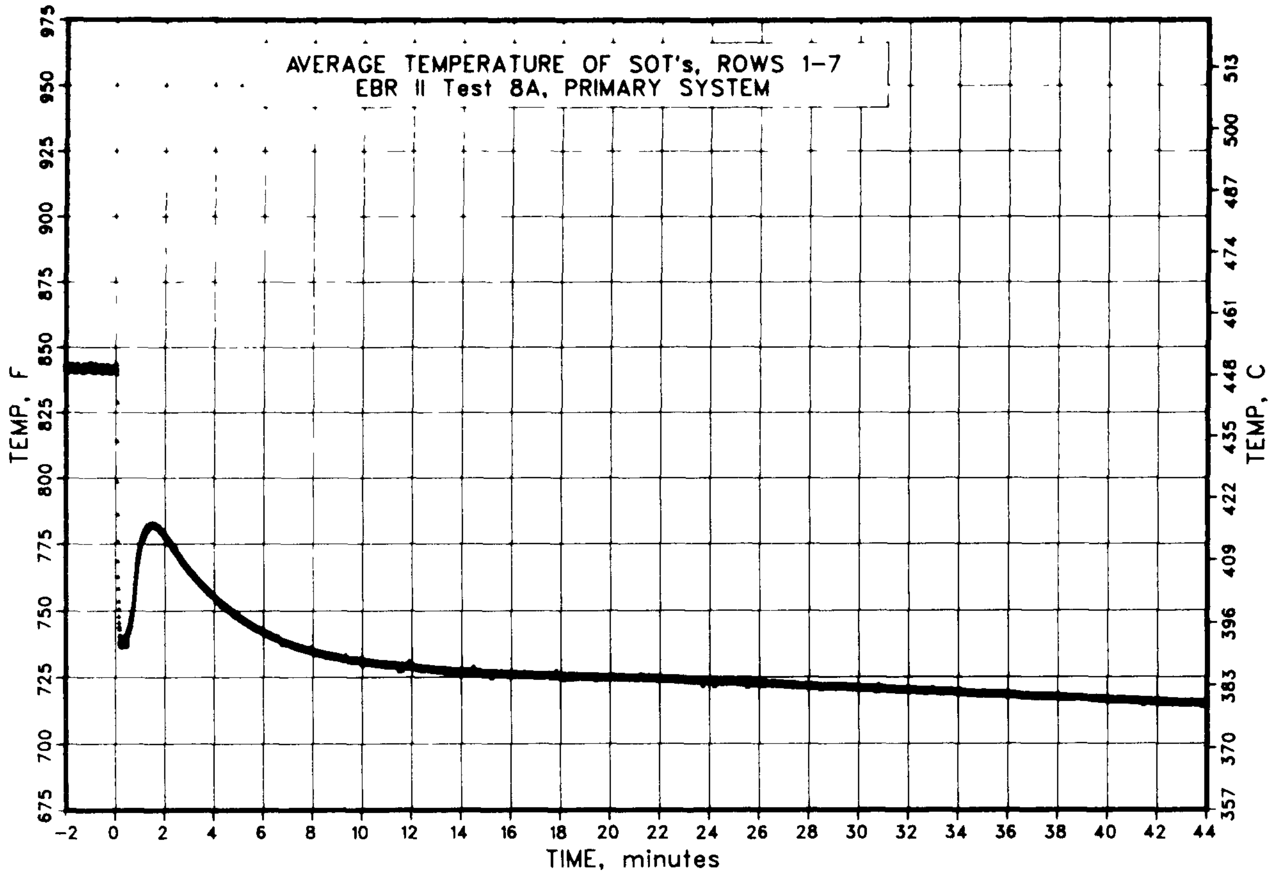
AVERAGE TEMPERATURE OF SOT's, ROWS 1-7
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
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875
850
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775
750
725
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TEMP, C
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TIME, minutes
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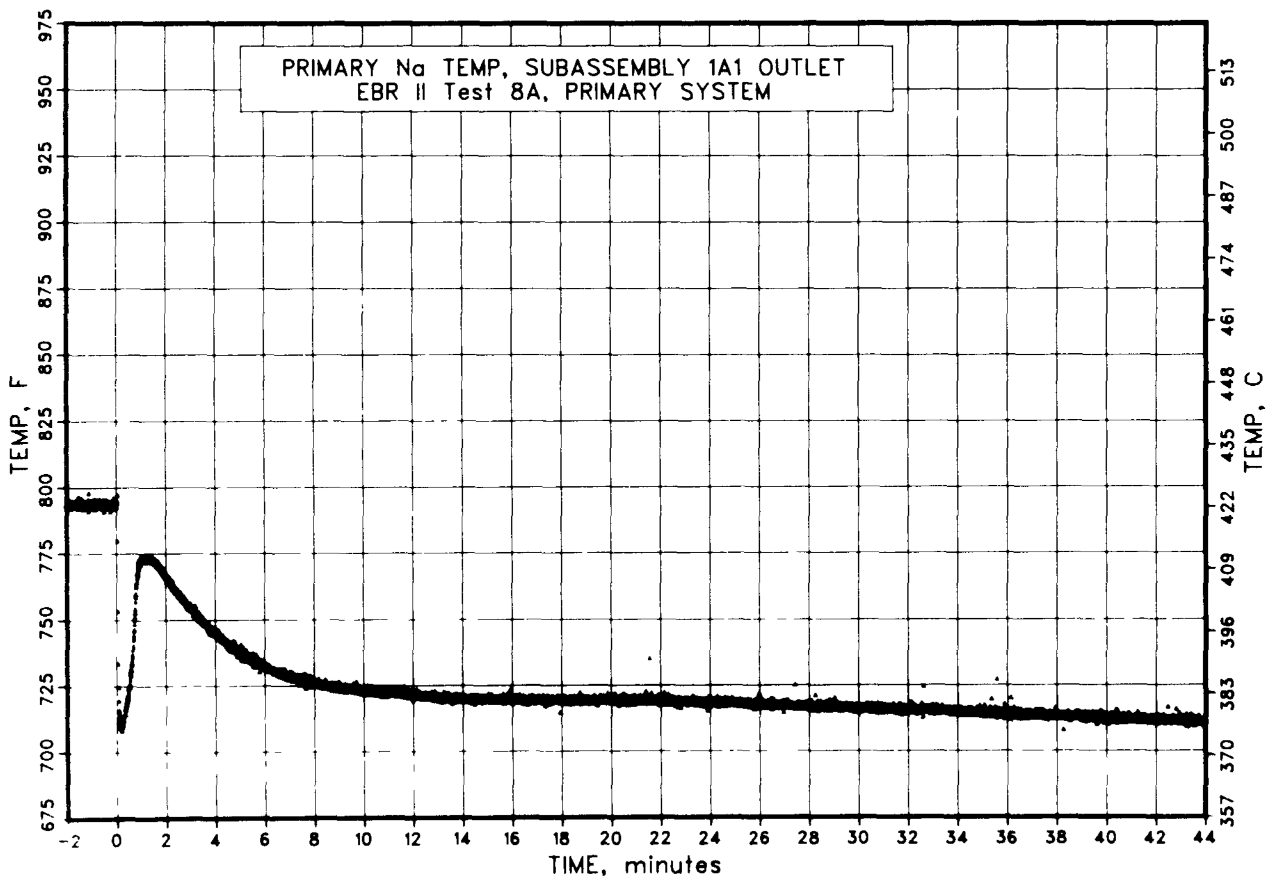
PRIMARY Na TEMP, SUBASSEMBLY 1A1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
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TIME, minutes
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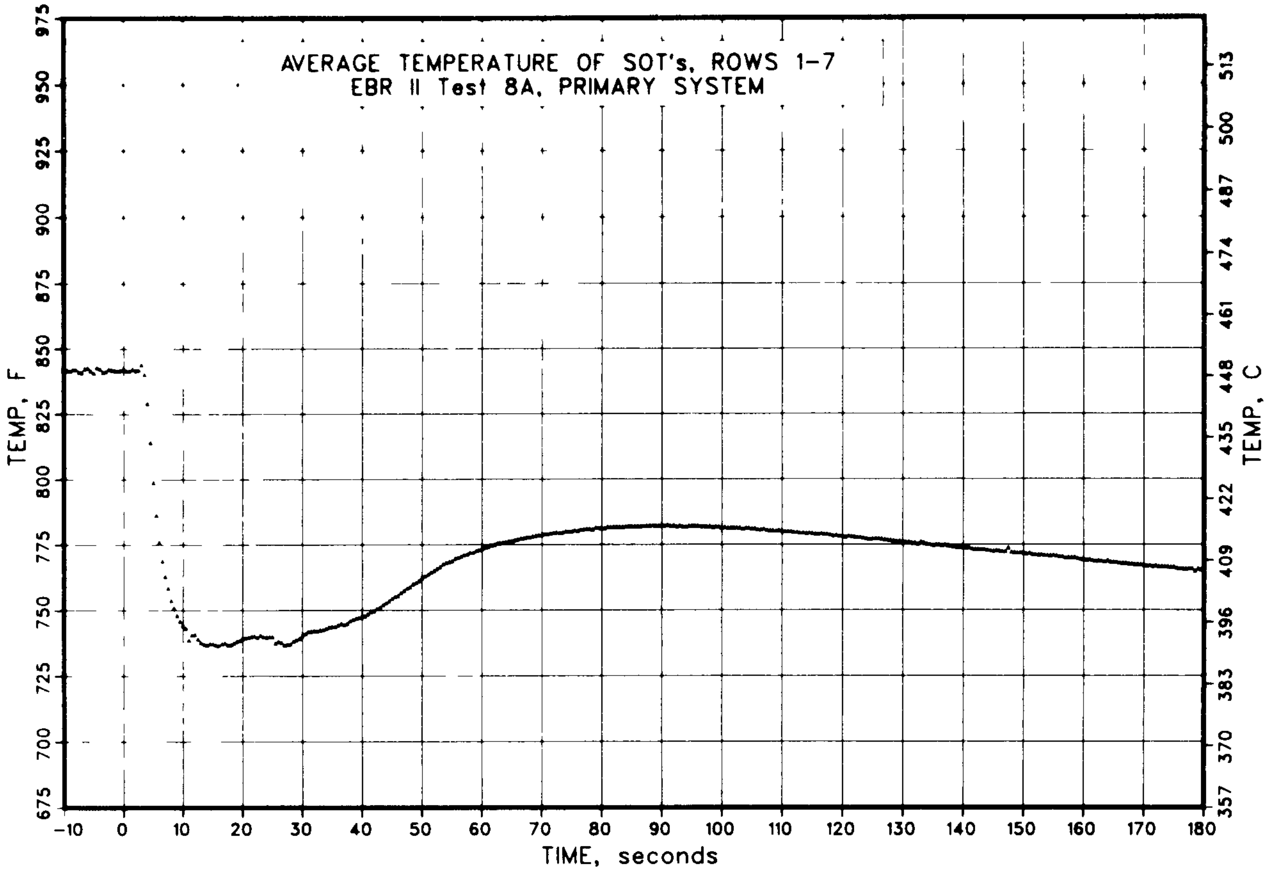
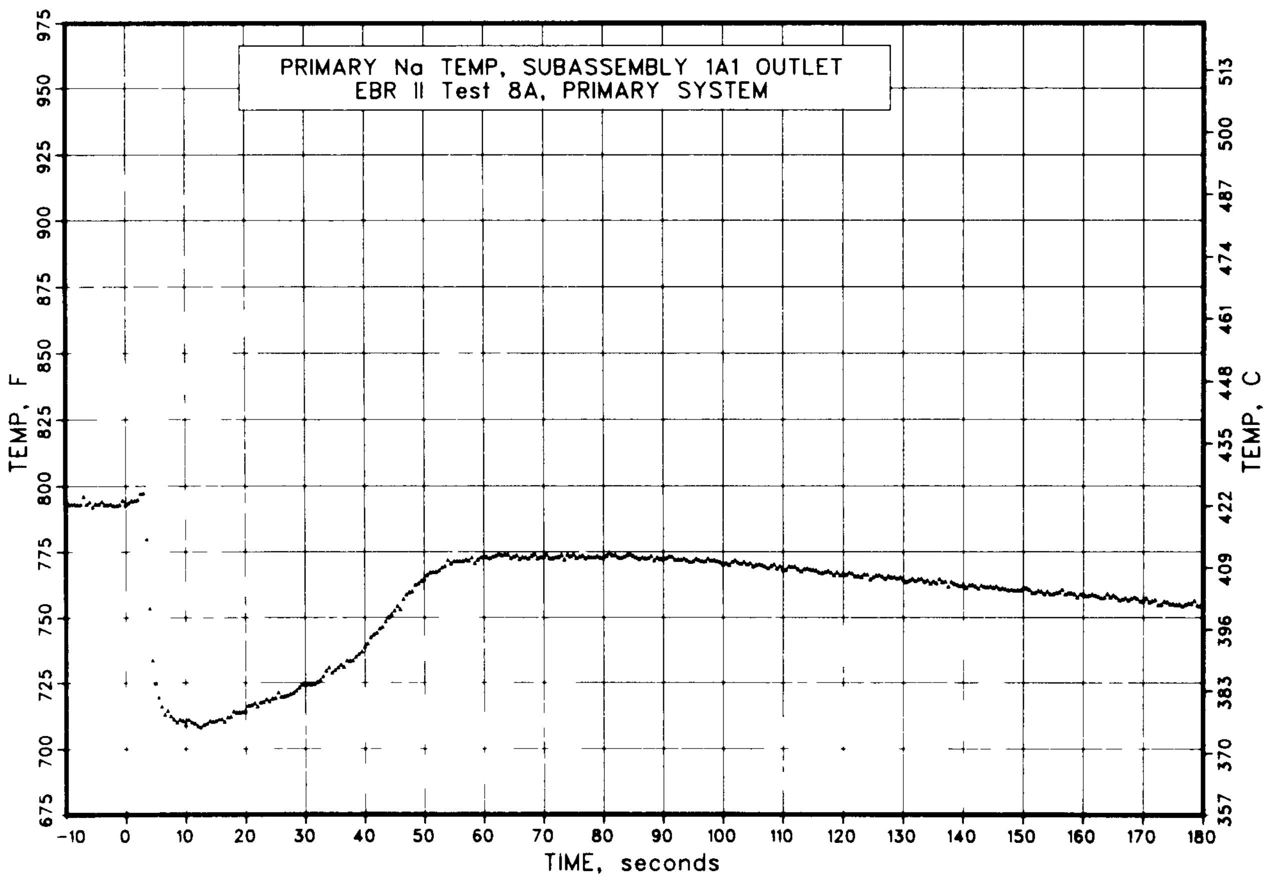
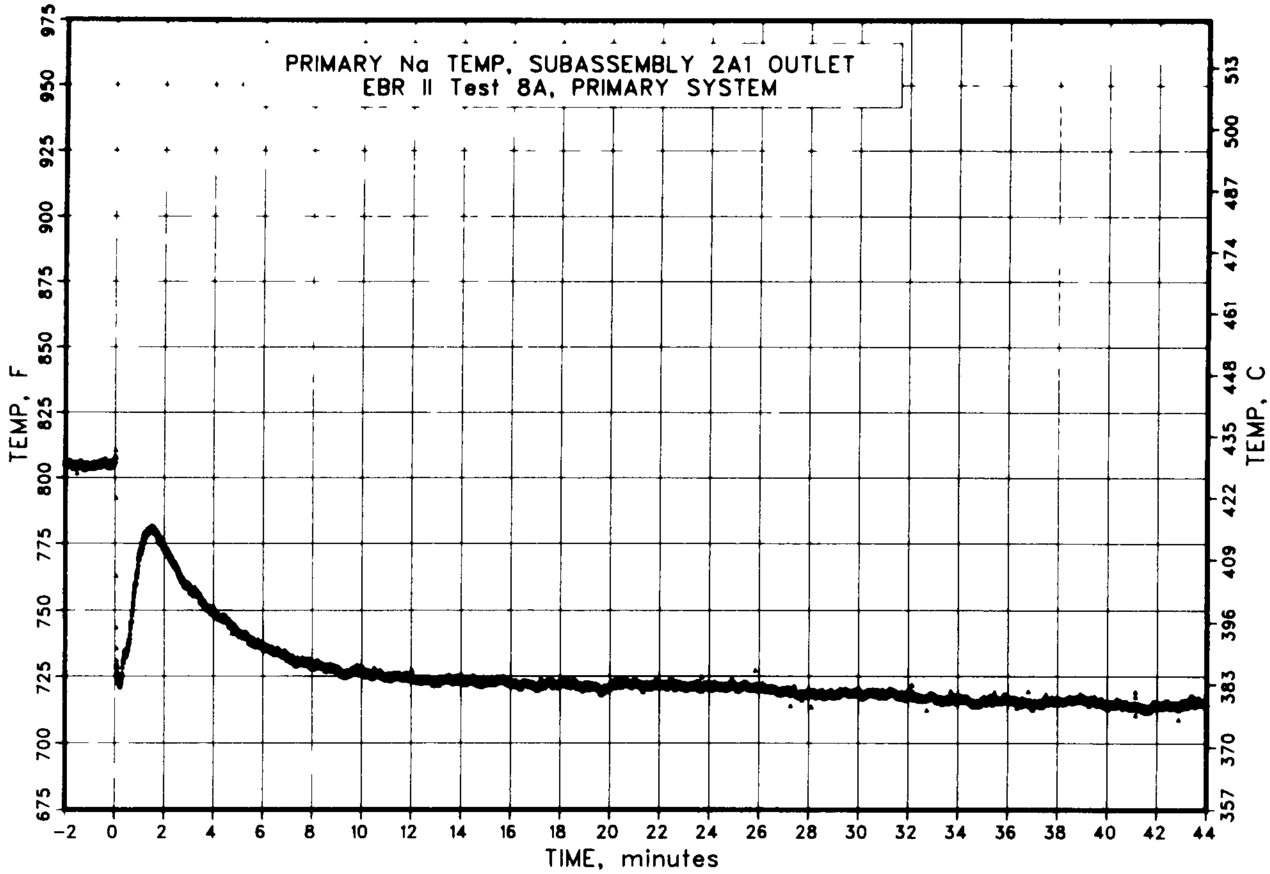
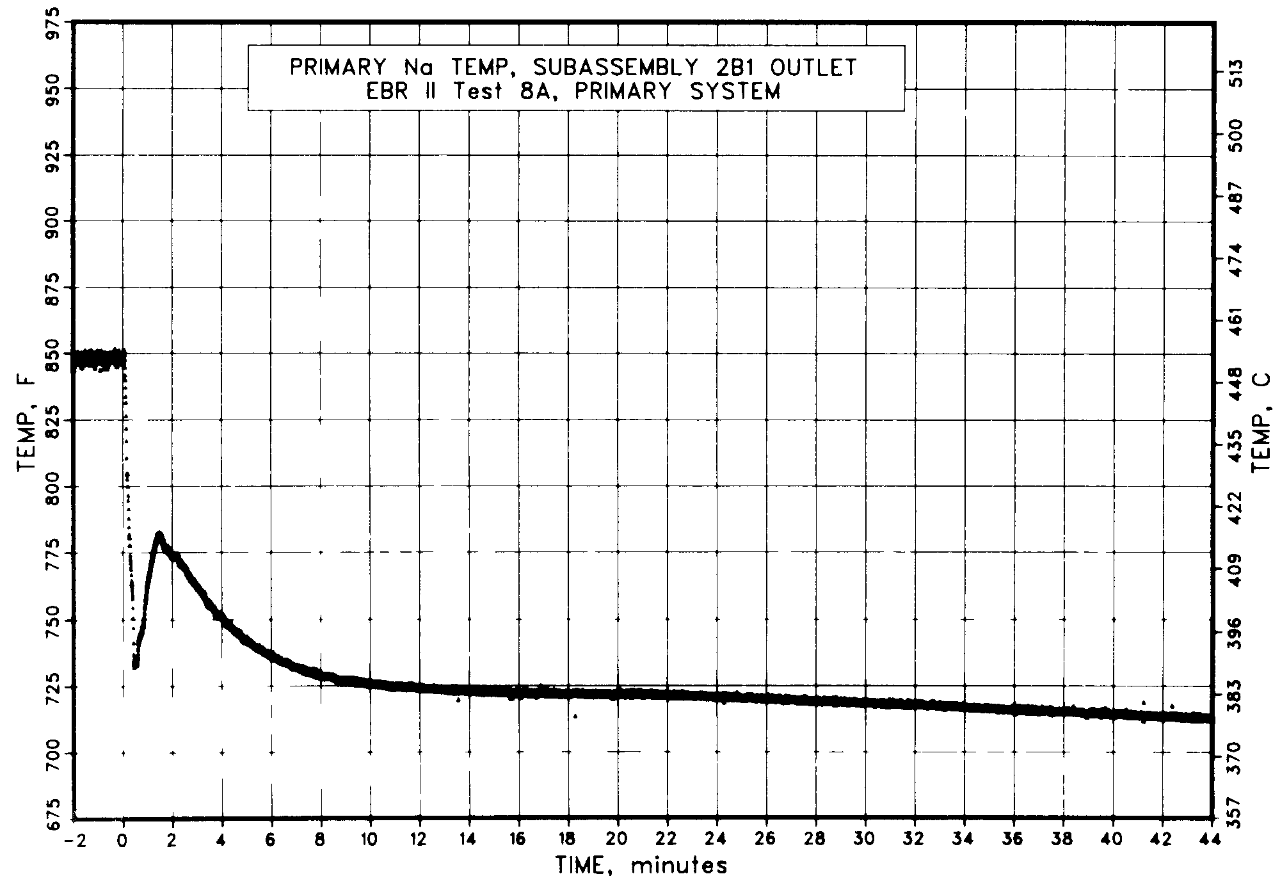

AVERAGE TEMPERATURE OF SOT's, ROWS 1-7
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 1A1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 2A1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 2B1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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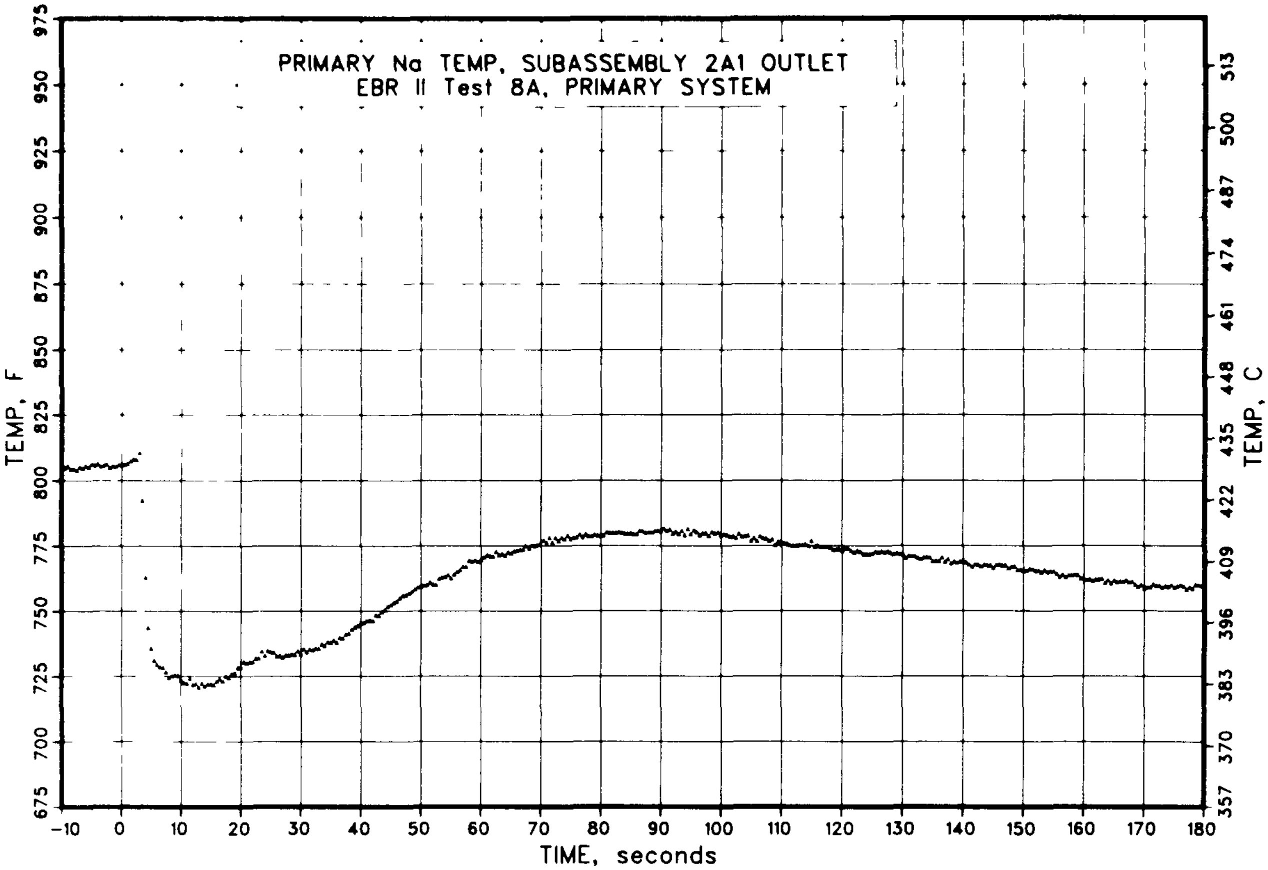
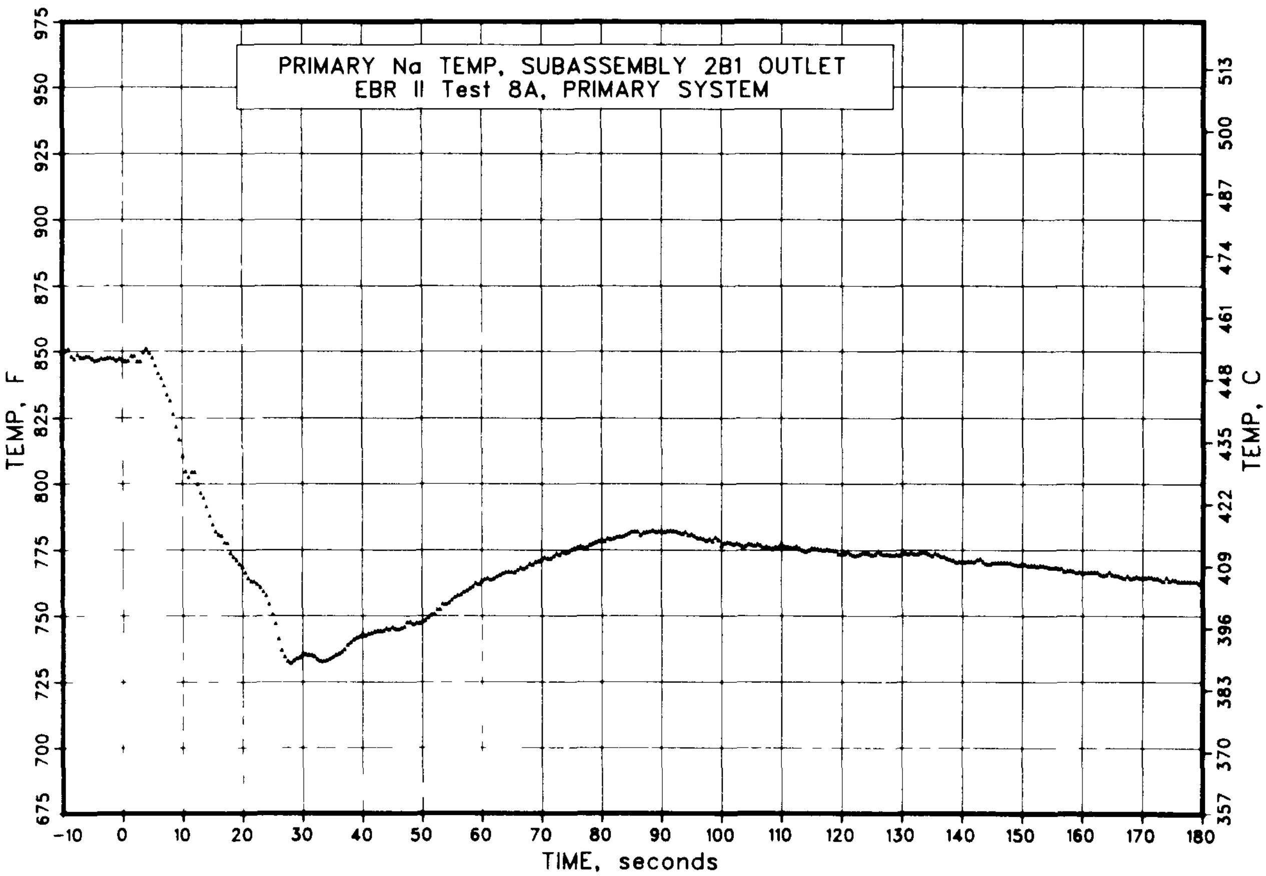
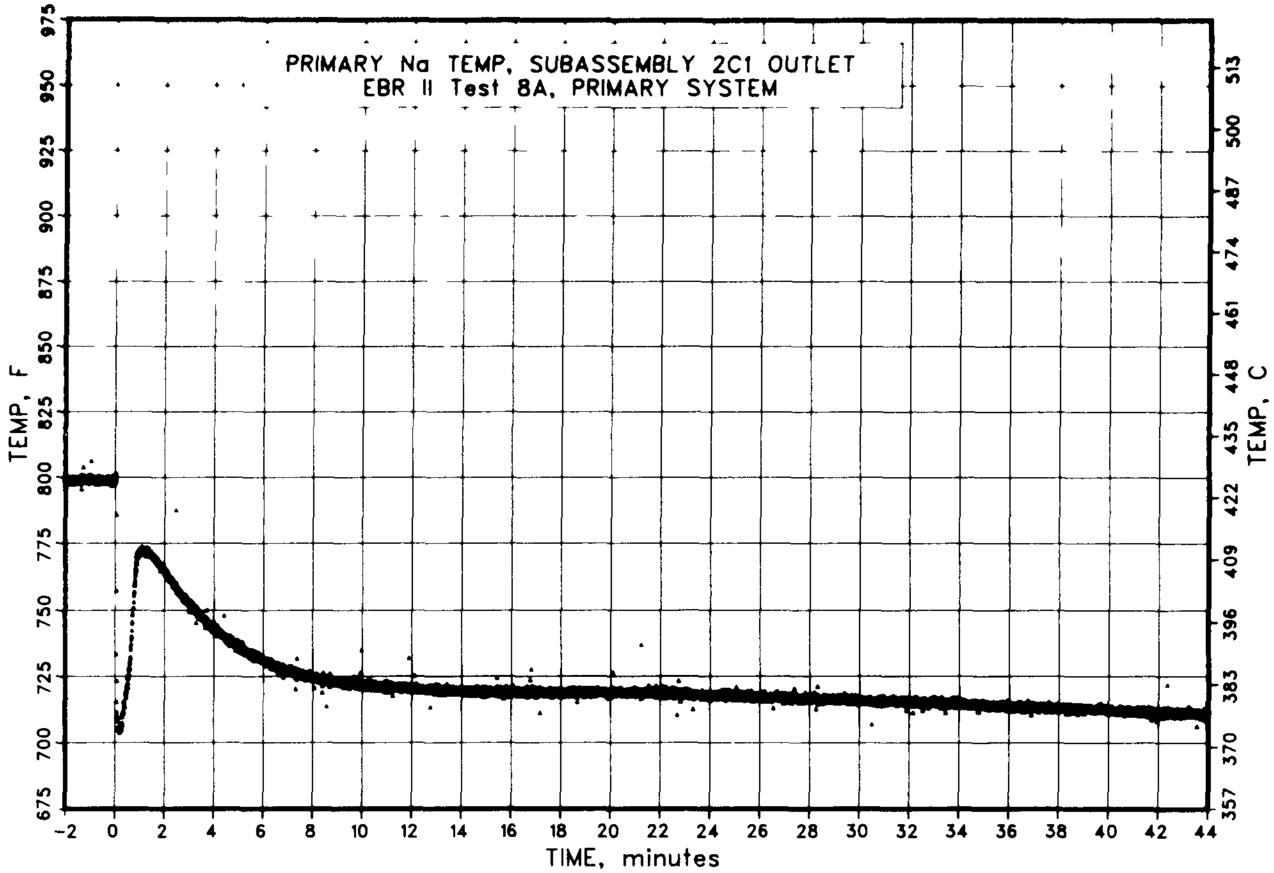
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 2A1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 2B1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 2C1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
TIME, minutes
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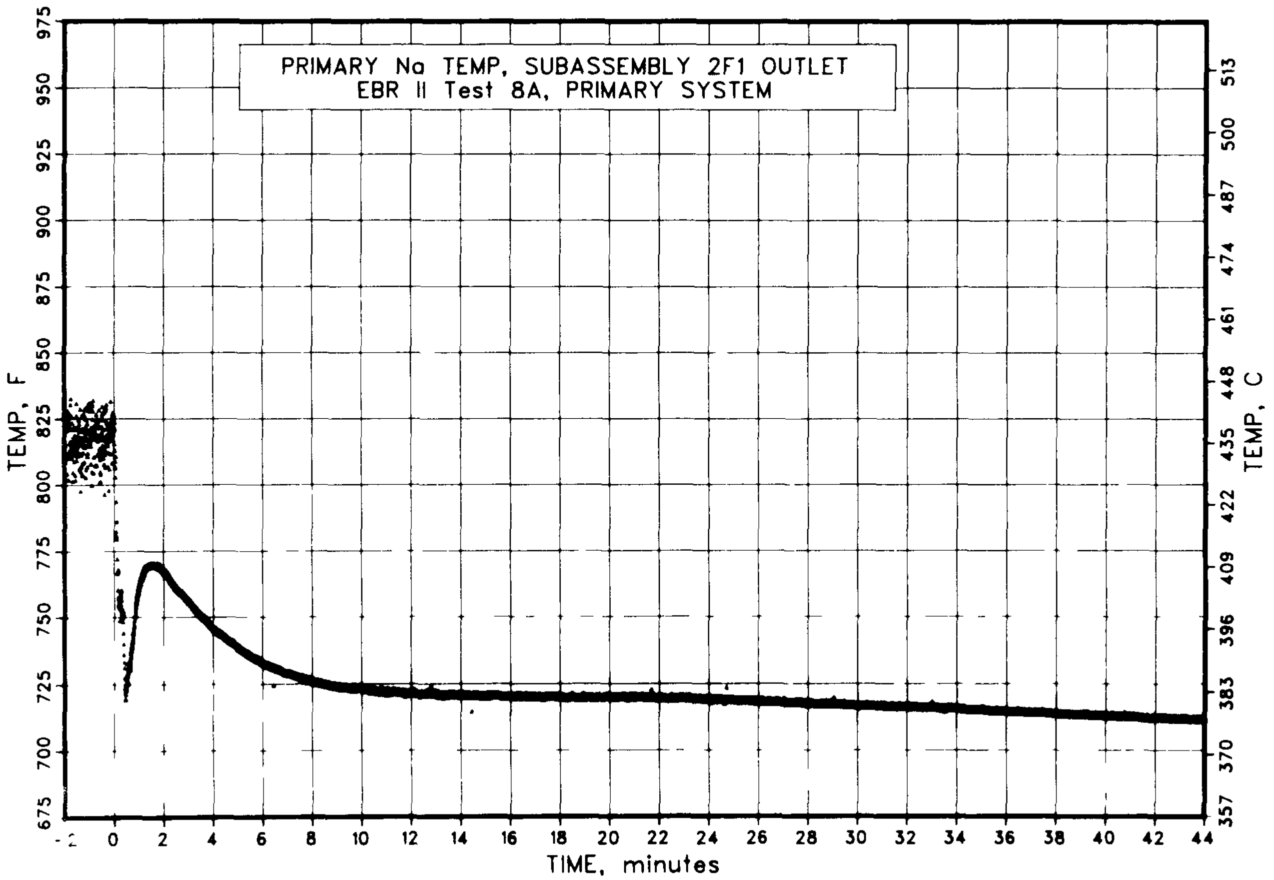
PRIMARY Na TEMP, SUBASSEMBLY 2F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TIME, minutes
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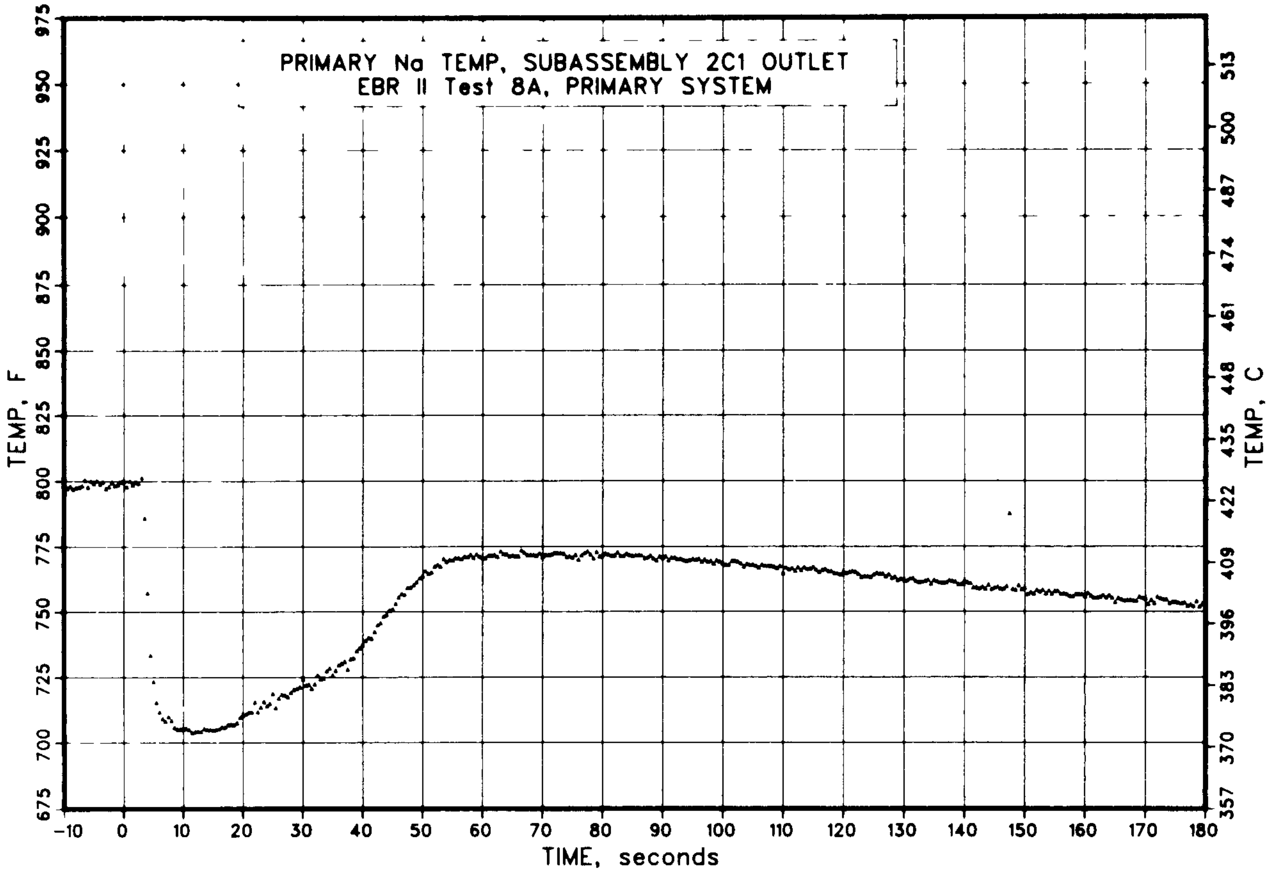
PRIMARY Na TEMP, SUBASSEMBLY 2C1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
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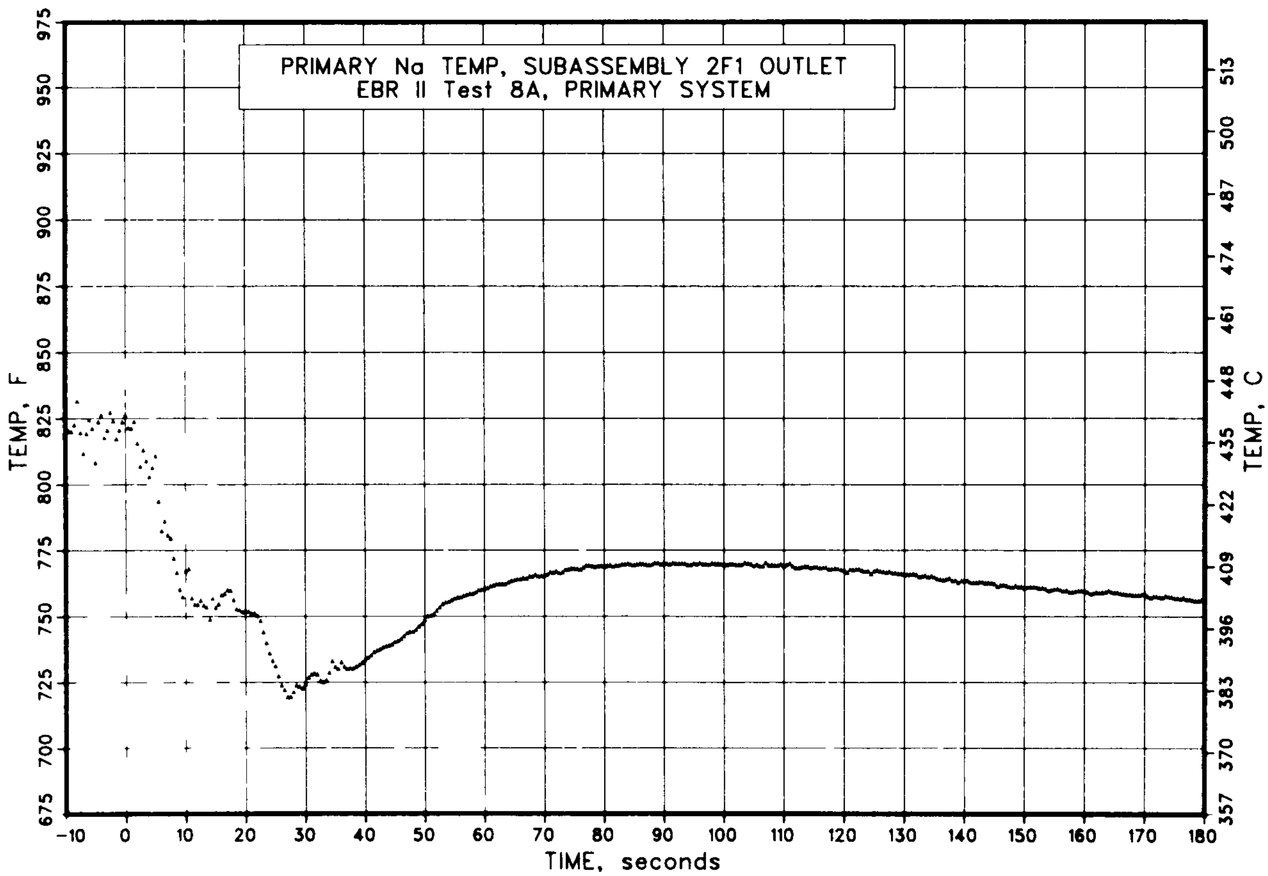
PRIMARY Na TEMP, SUBASSEMBLY 2F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
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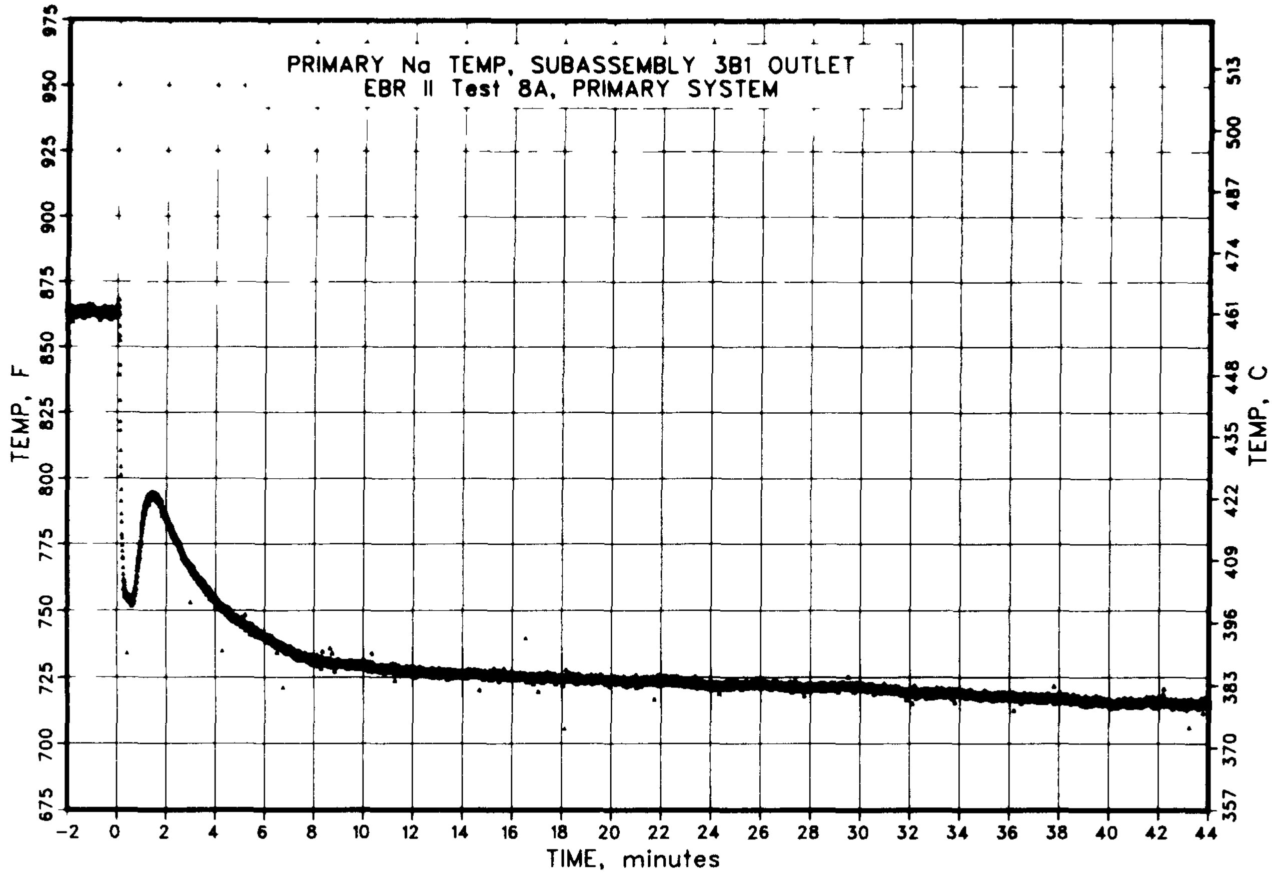
PRIMARY Na TEMP, SUBASSEMBLY 3B1 OUTLET
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TIME, minutes
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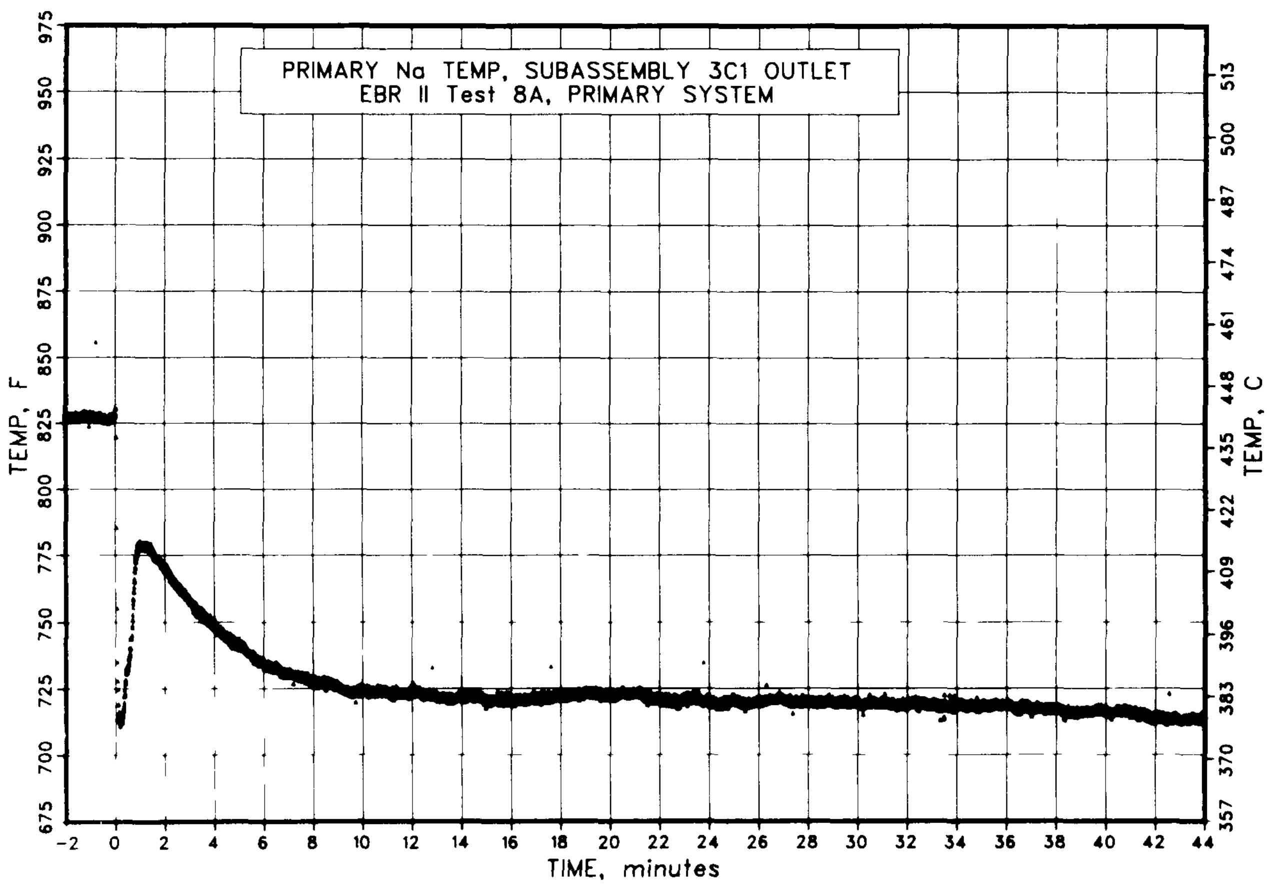
PRIMARY Na TEMP, SUBASSEMBLY 3C1 OUTLET
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TEMP, C
TIME, minutes
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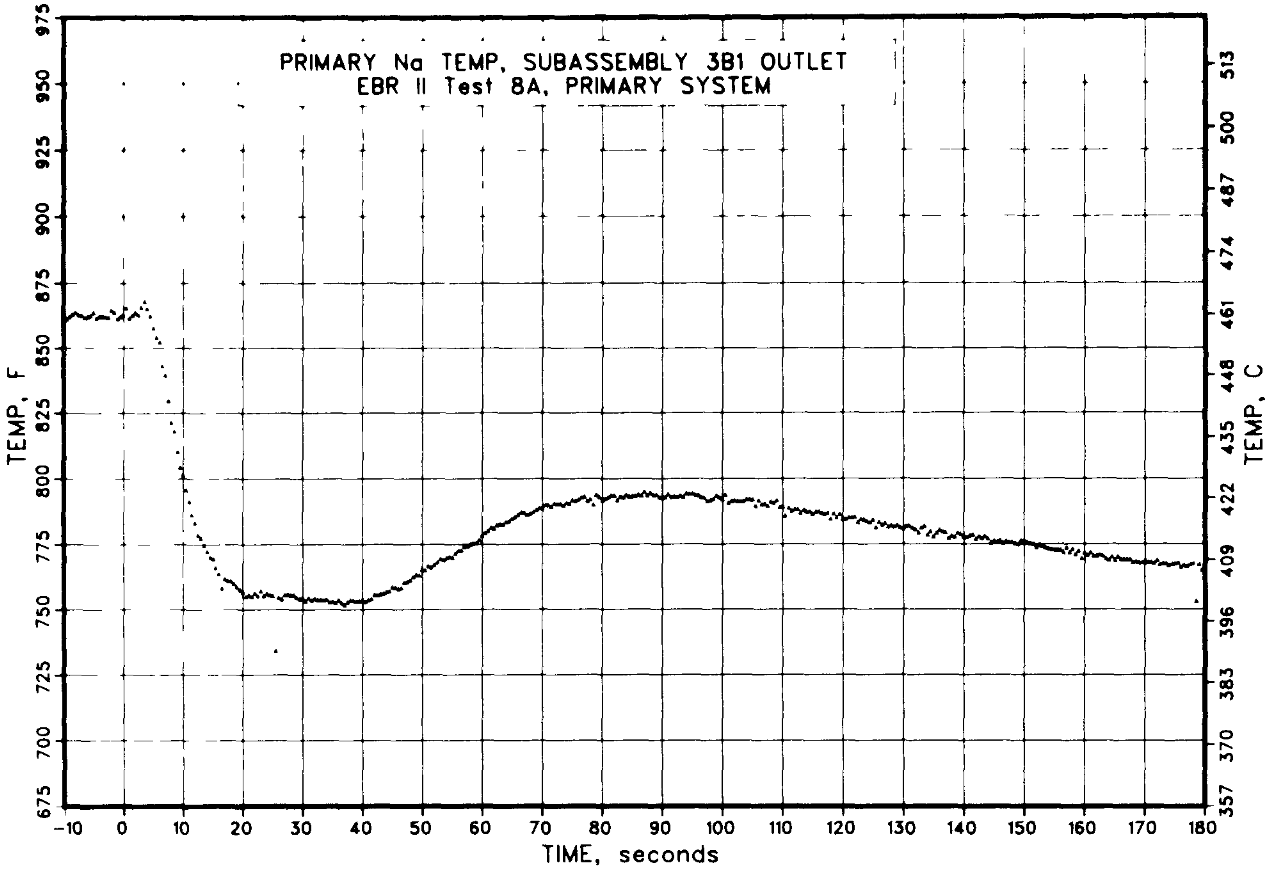
PRIMARY Na TEMP, SUBASSEMBLY 3B1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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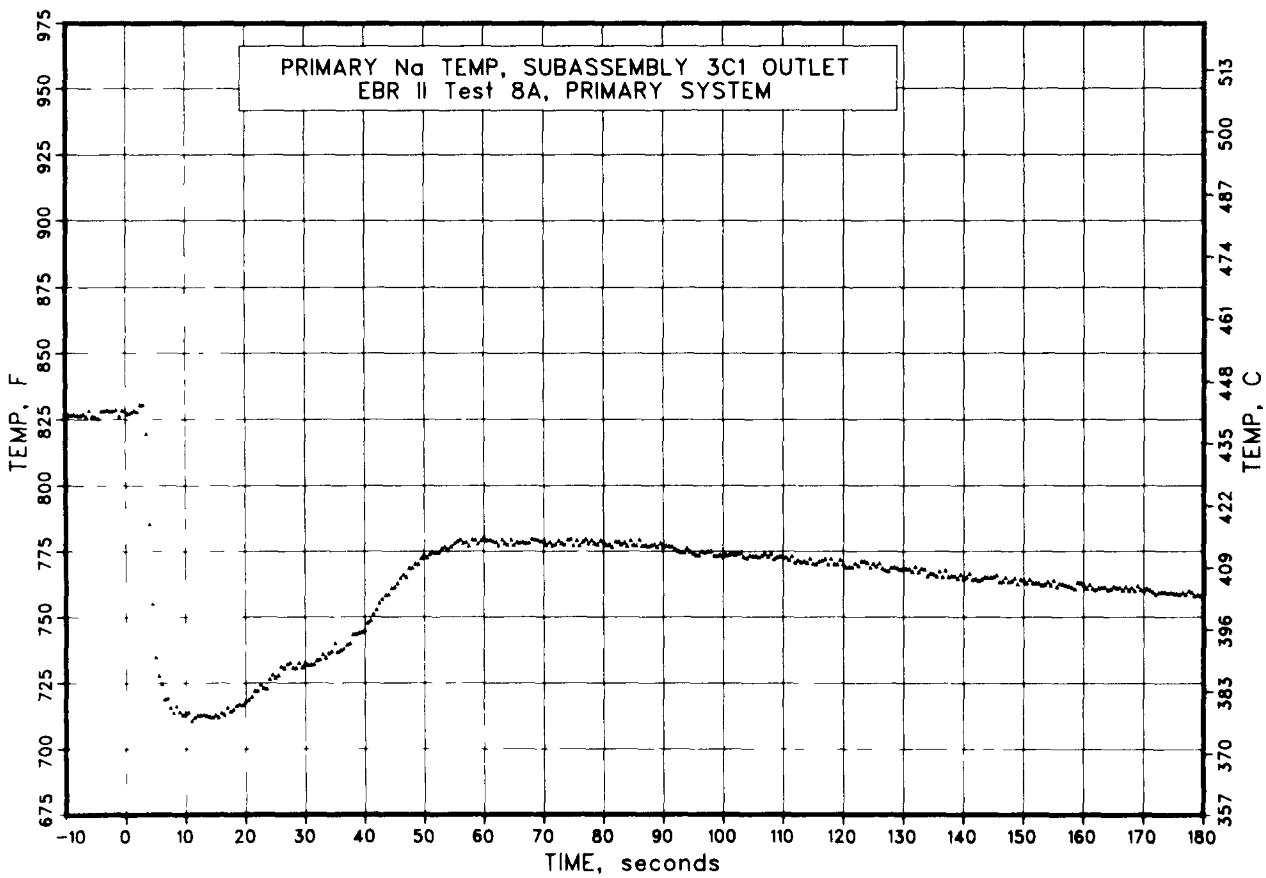
PRIMARY Na TEMP, SUBASSEMBLY 3C1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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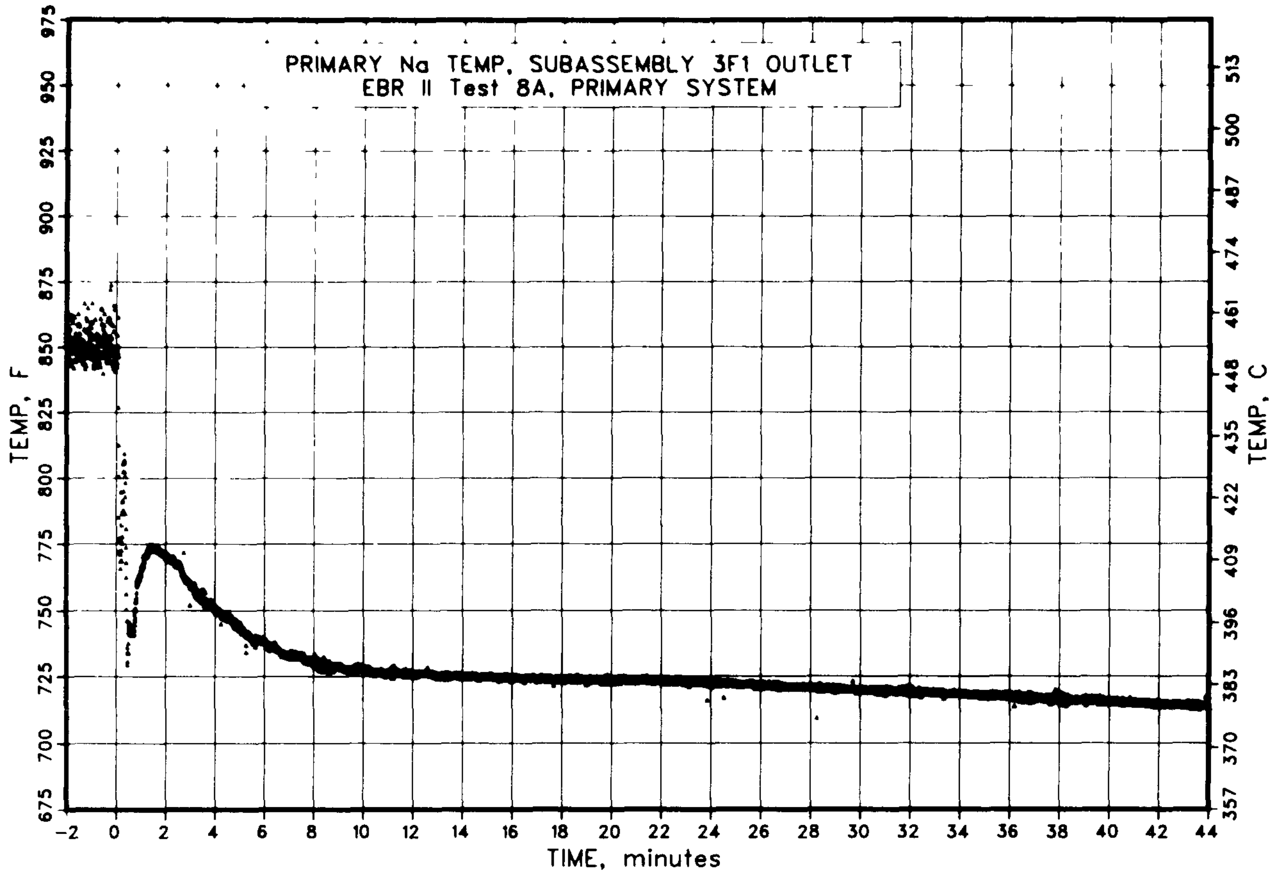
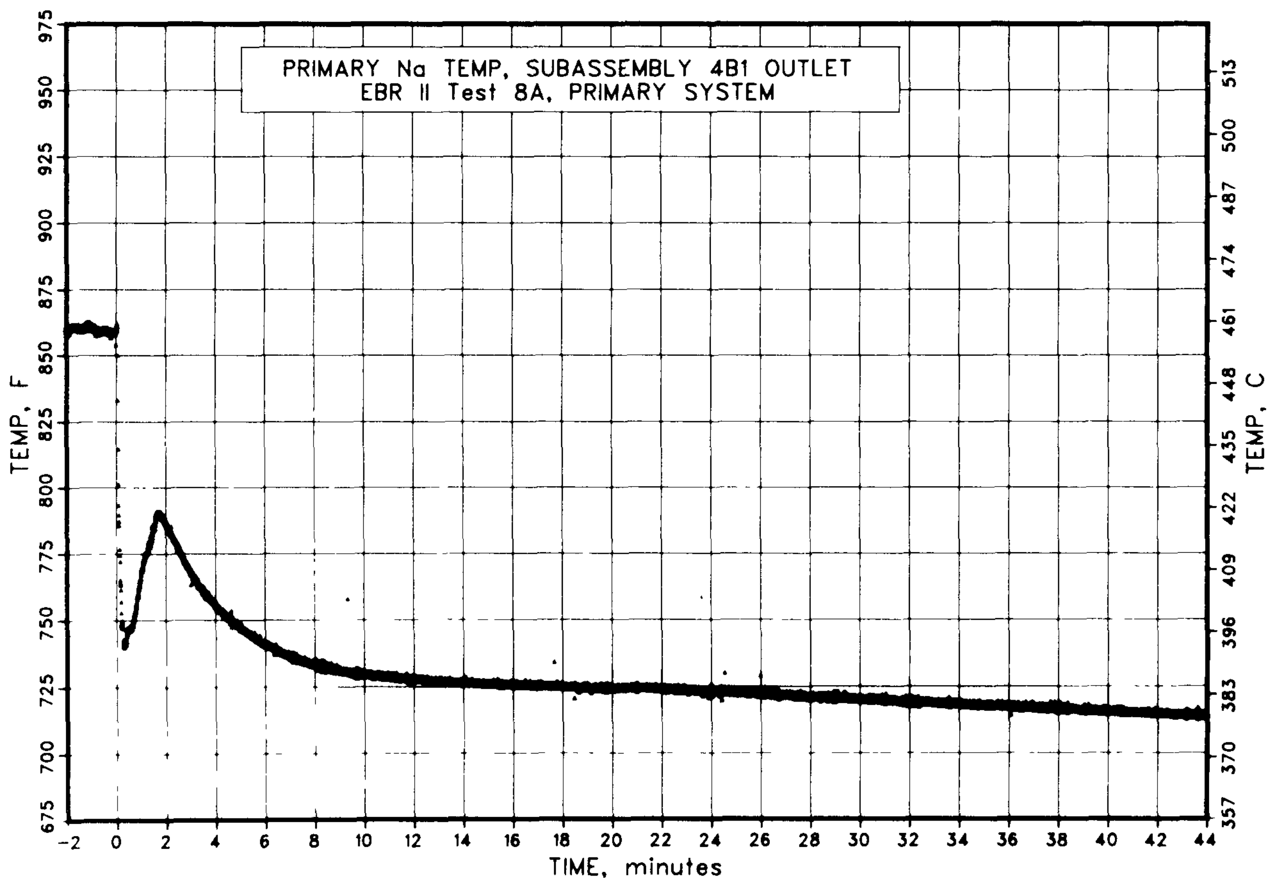
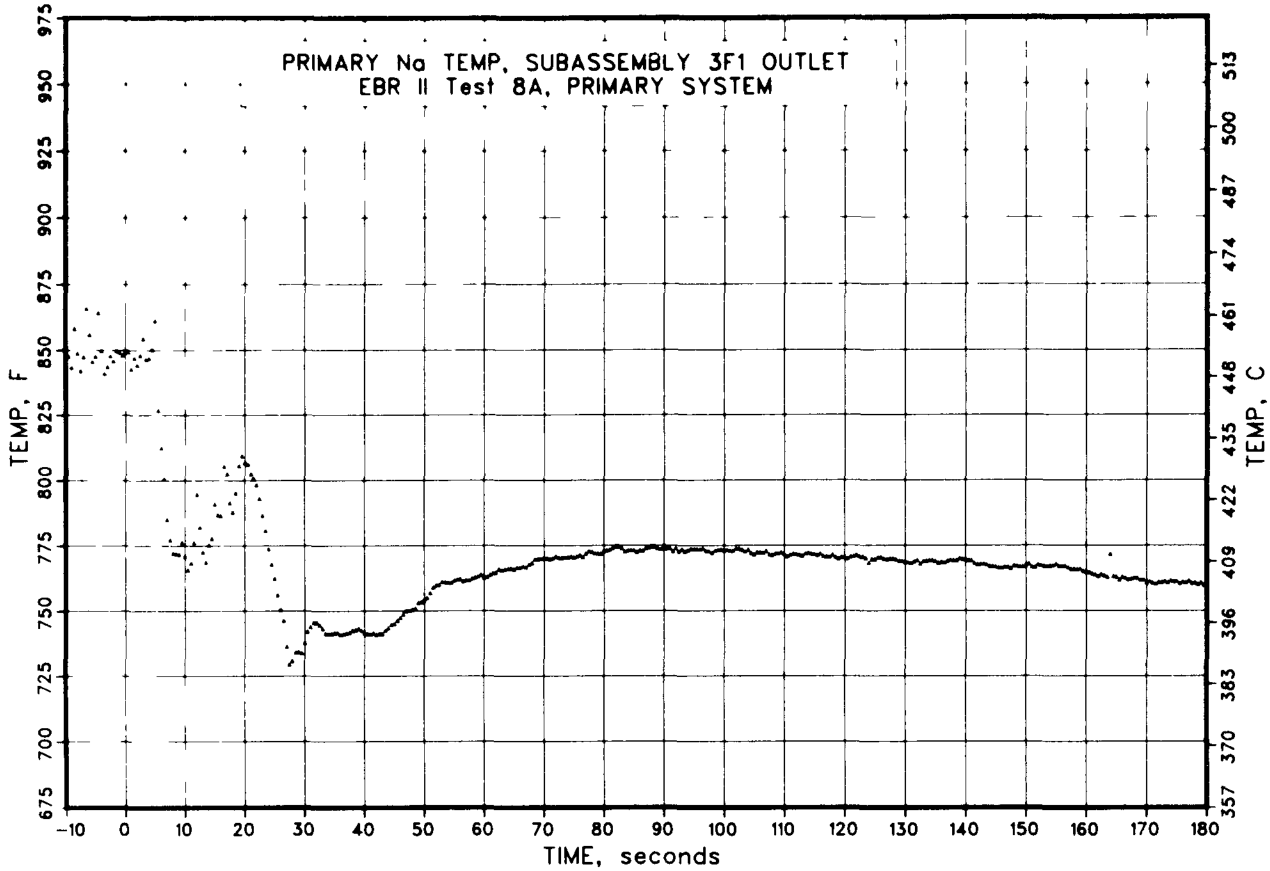

PRIMARY Na TEMP, SUBASSEMBLY 3F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 4B1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 3F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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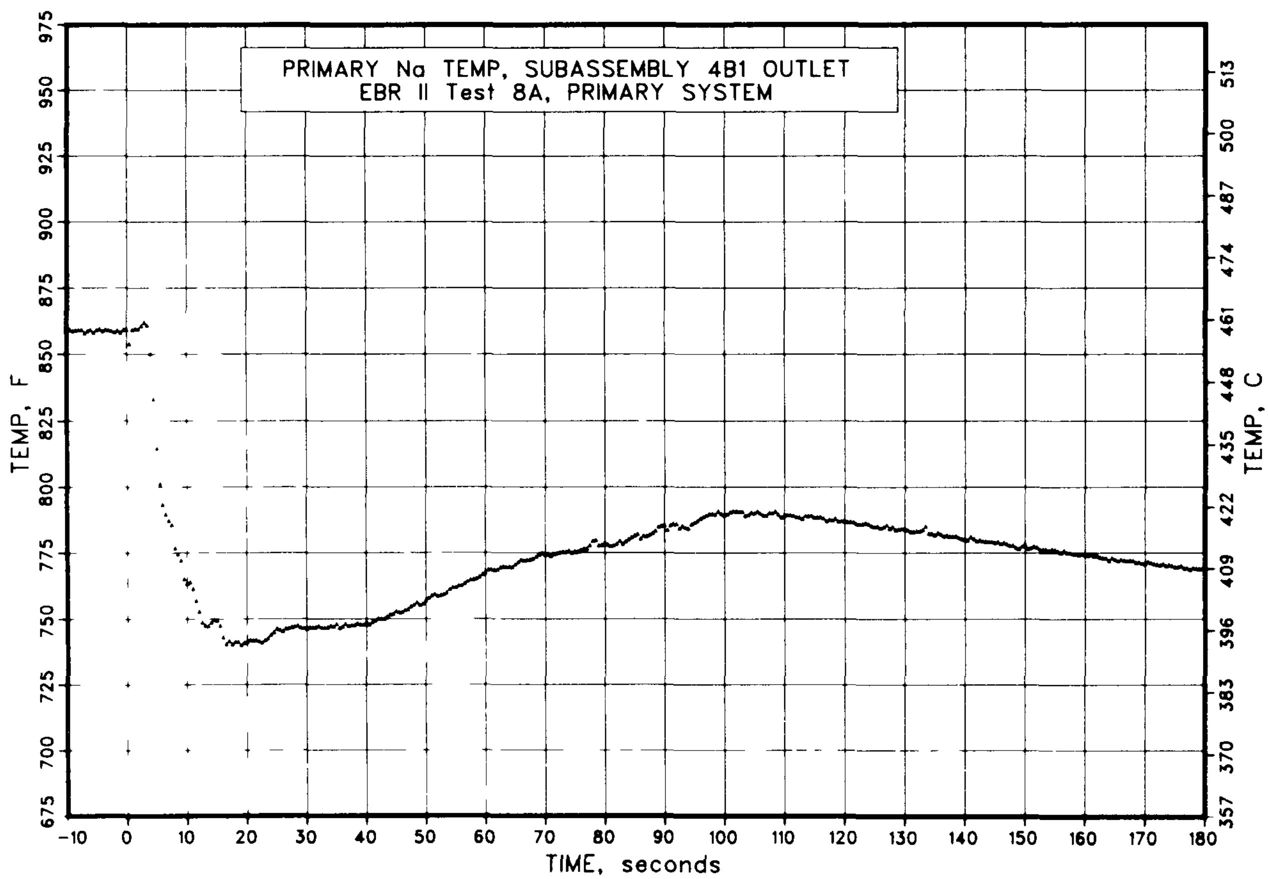
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 4B1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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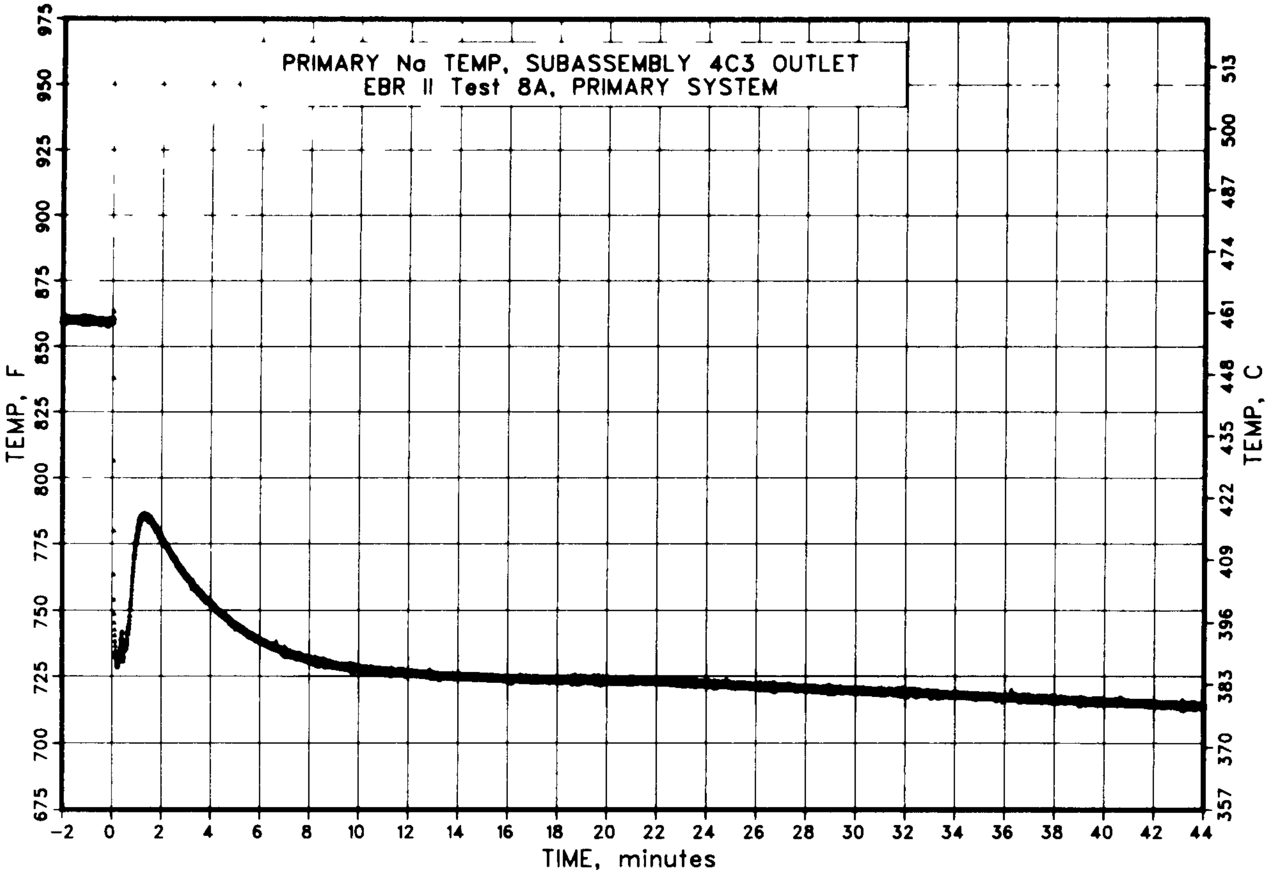
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 4C3 OUTLET
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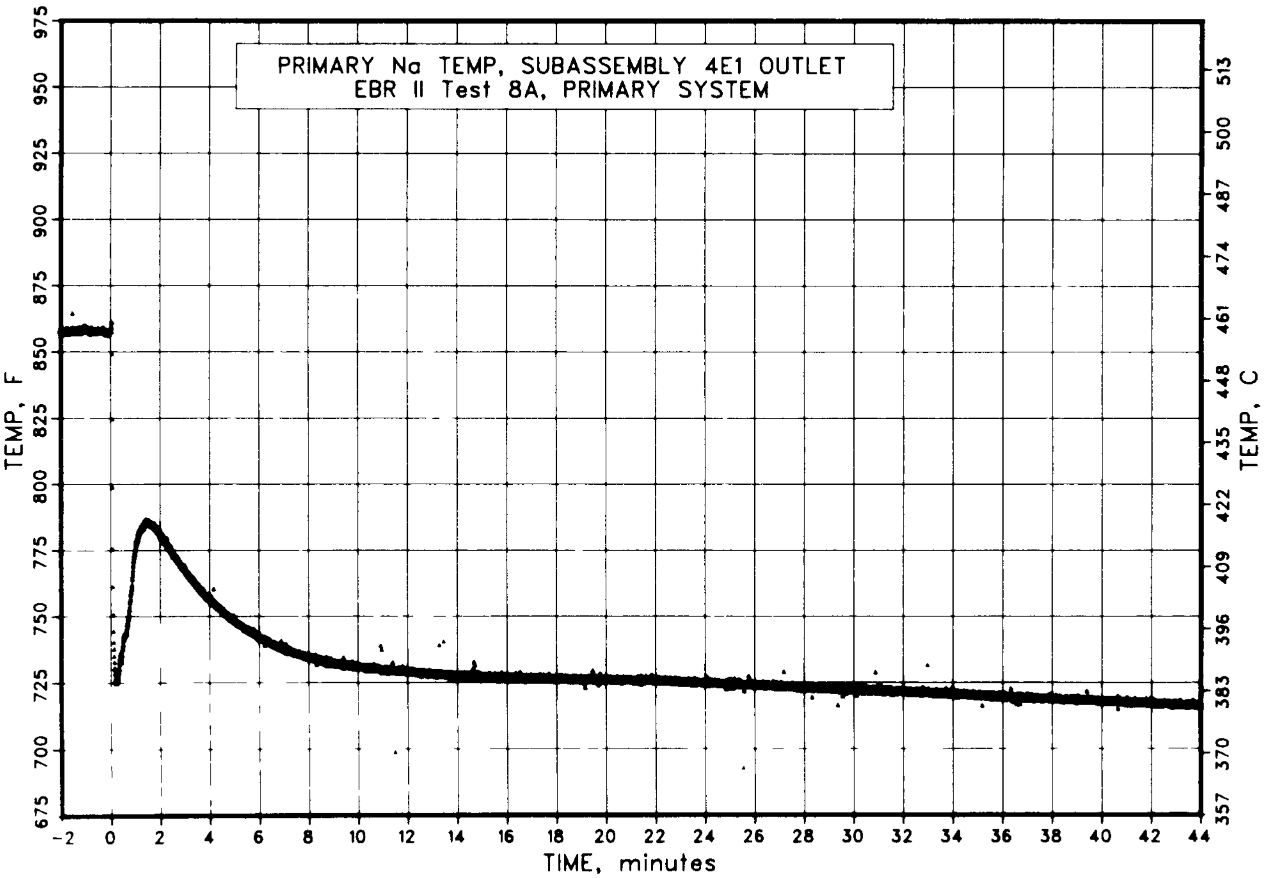
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 4E1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
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TEMP, C
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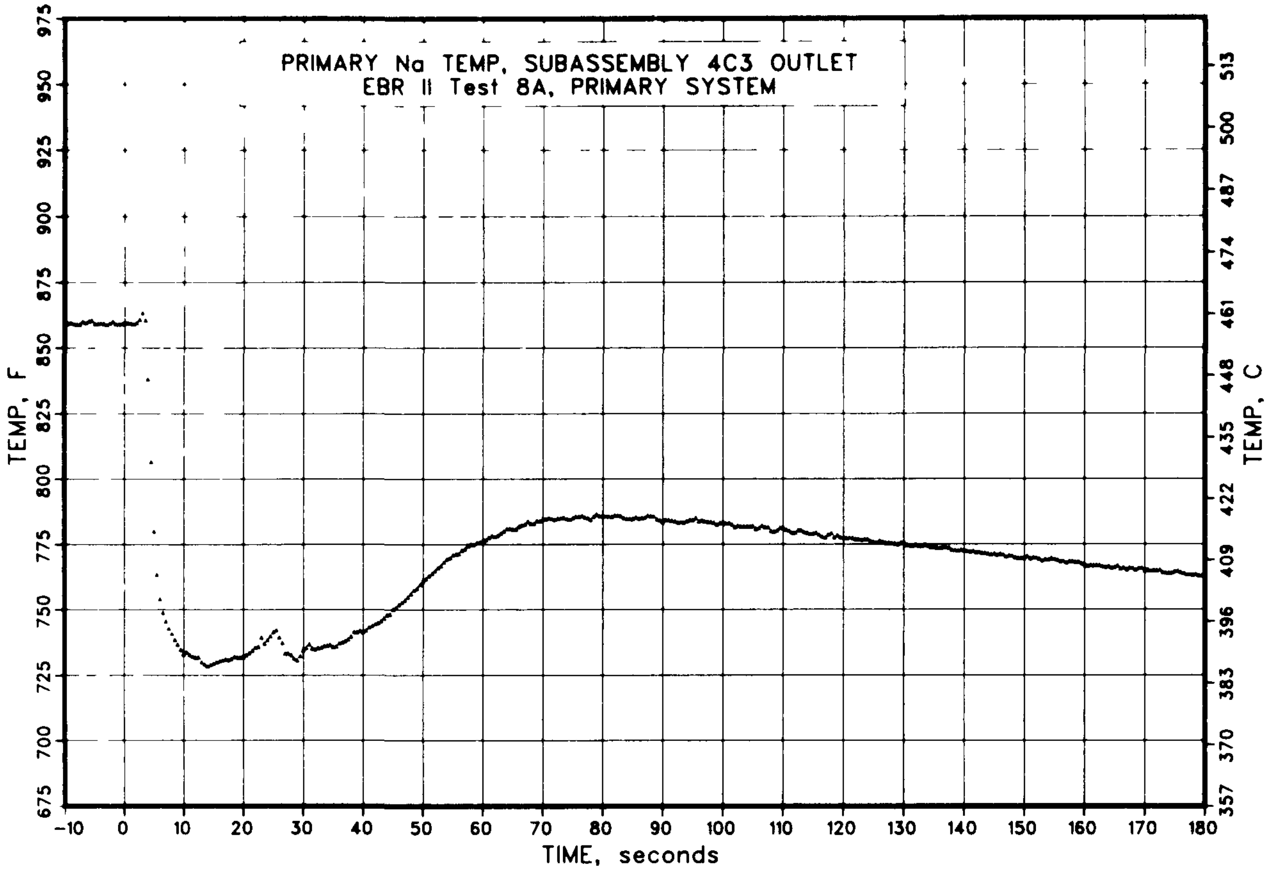
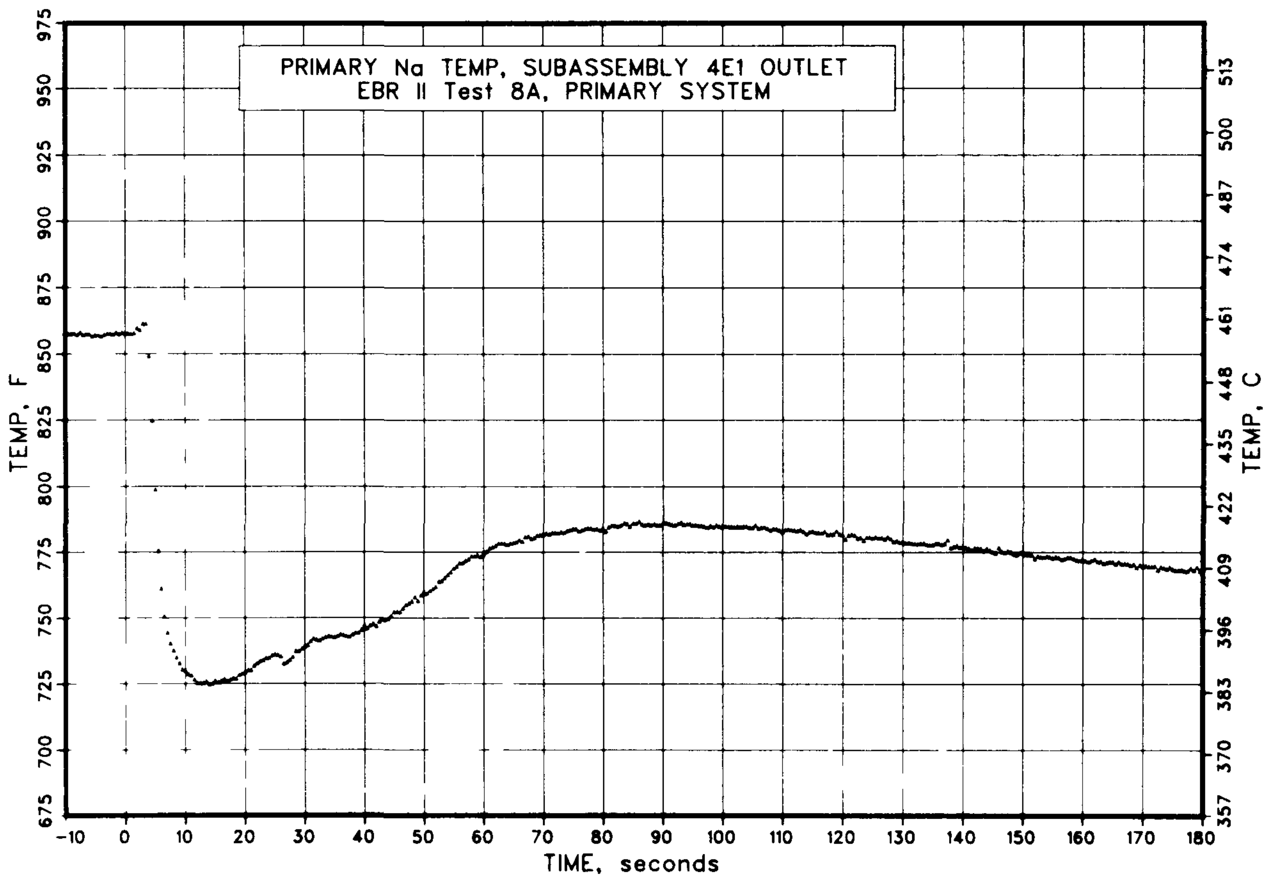
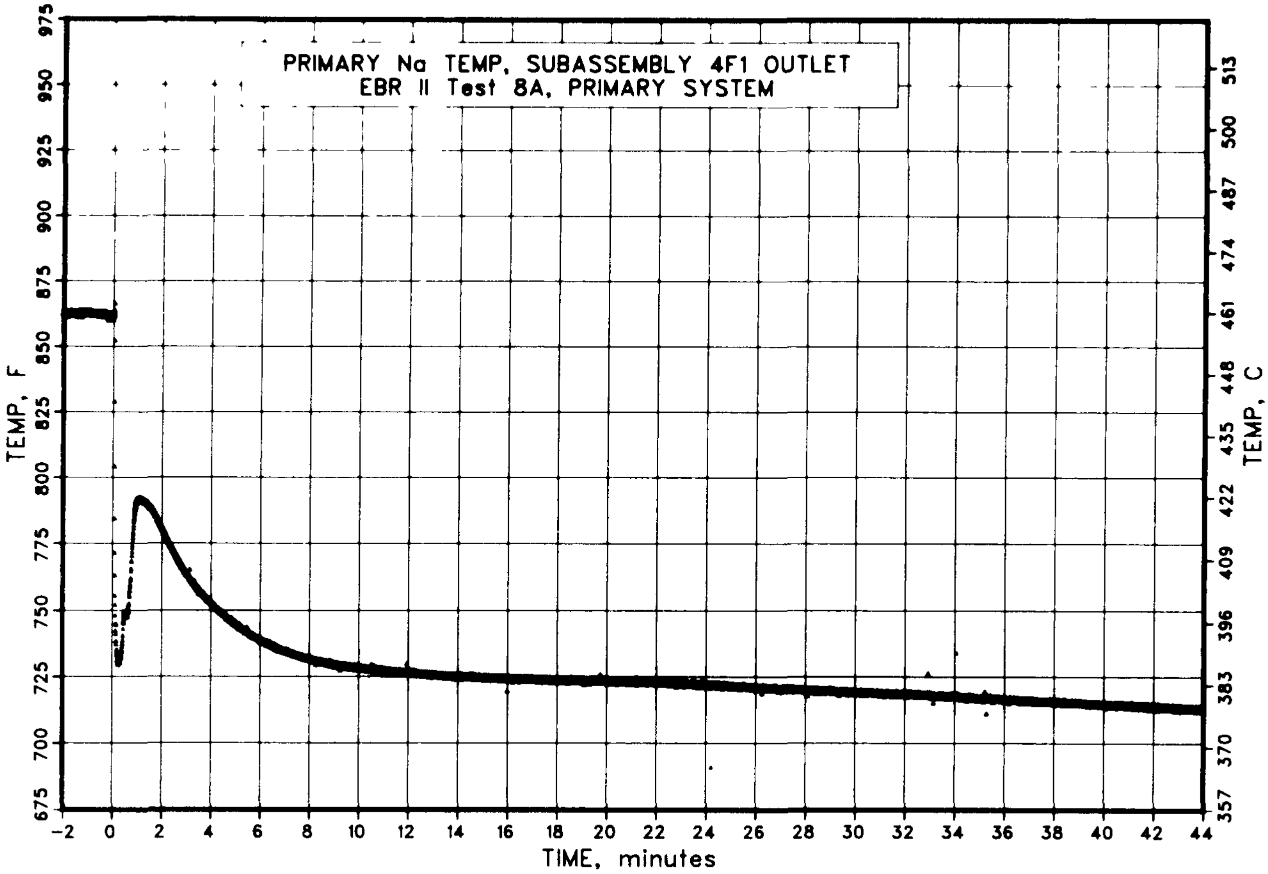
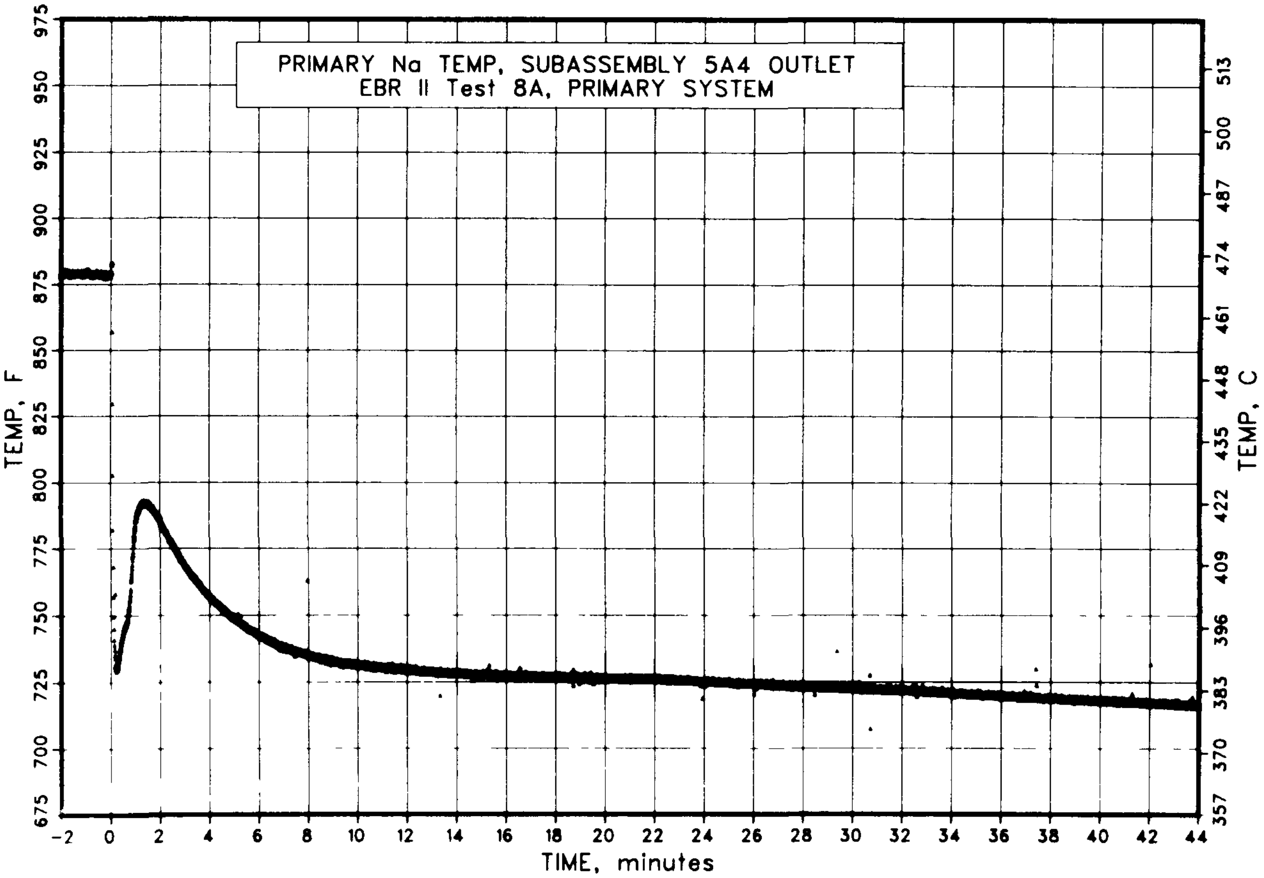
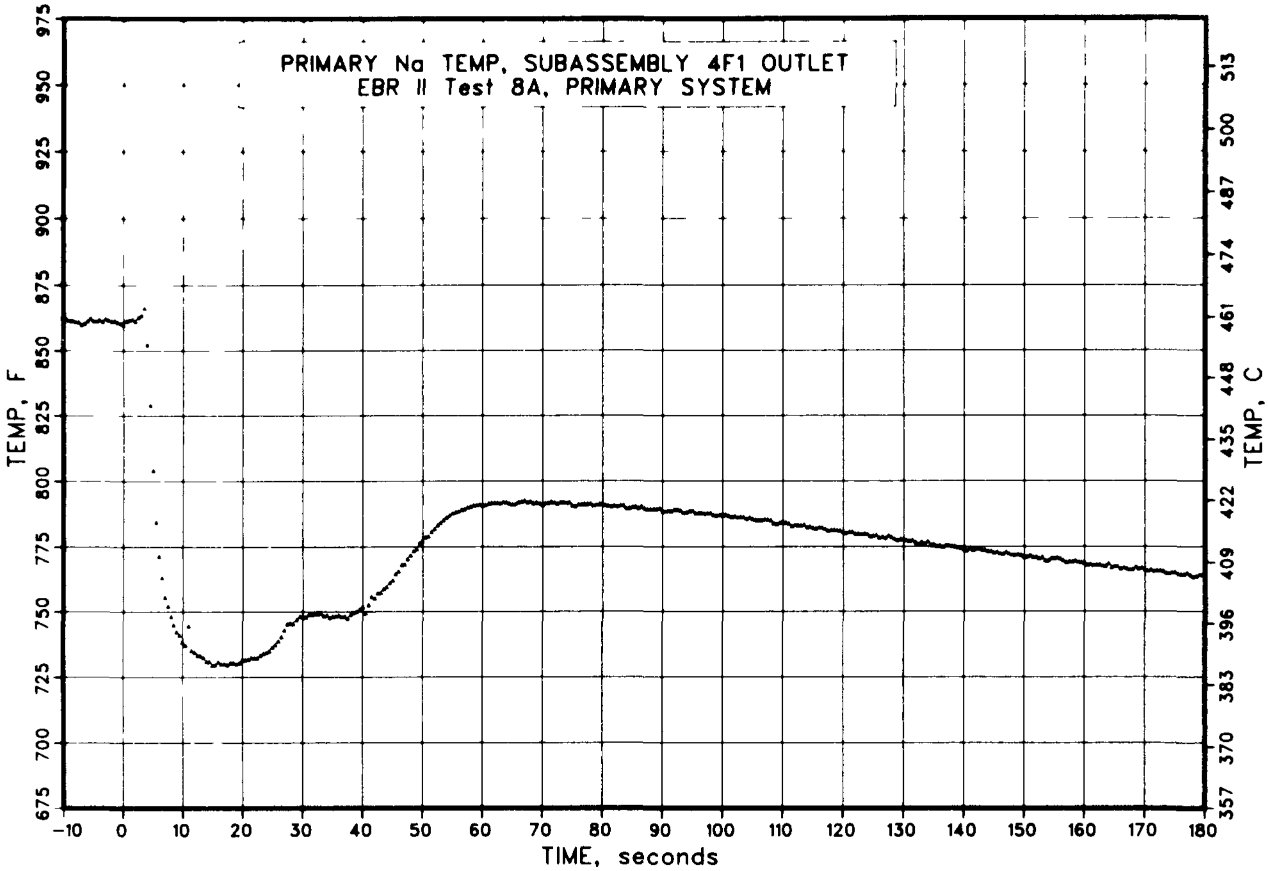
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

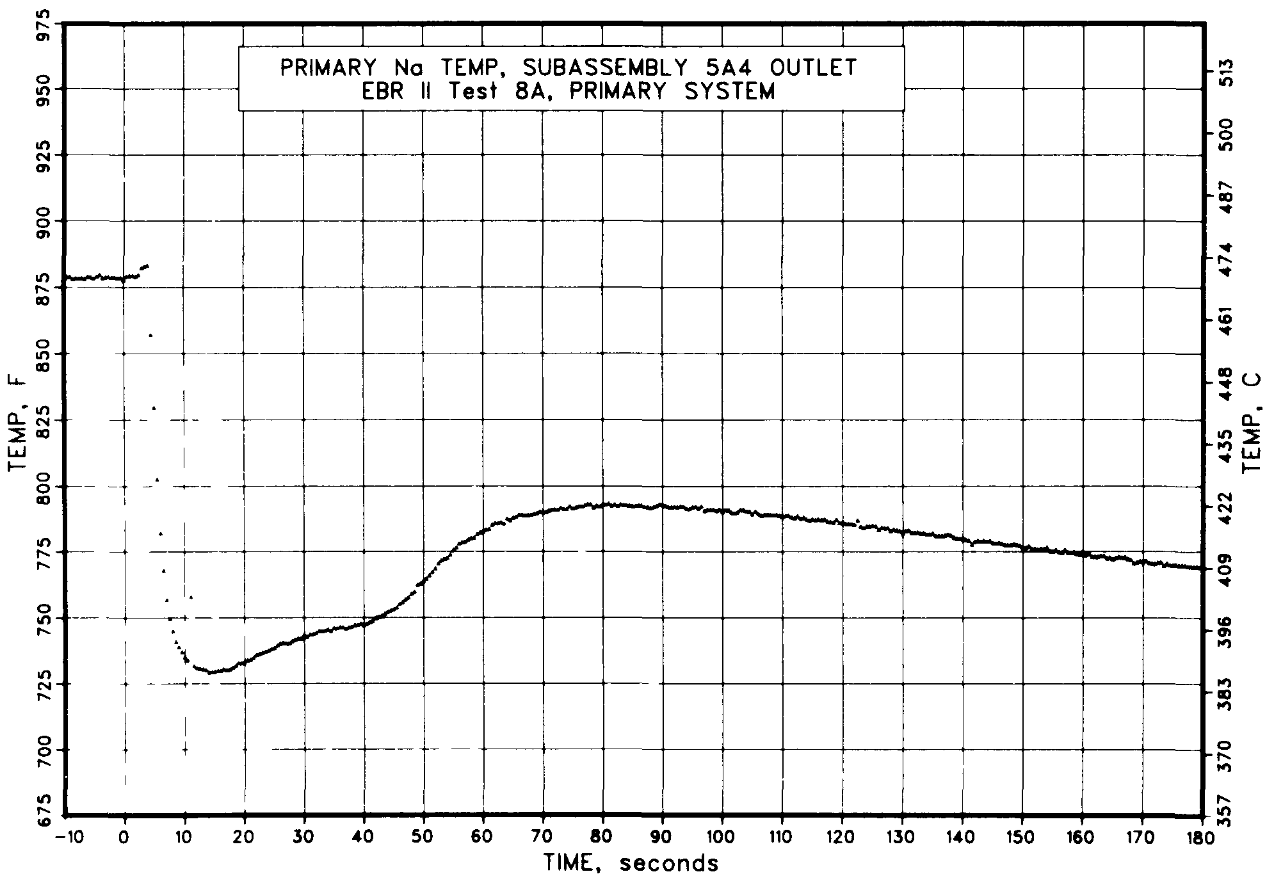

PRIMARY Na TEMP, SUBASSEMBLY 4C3 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

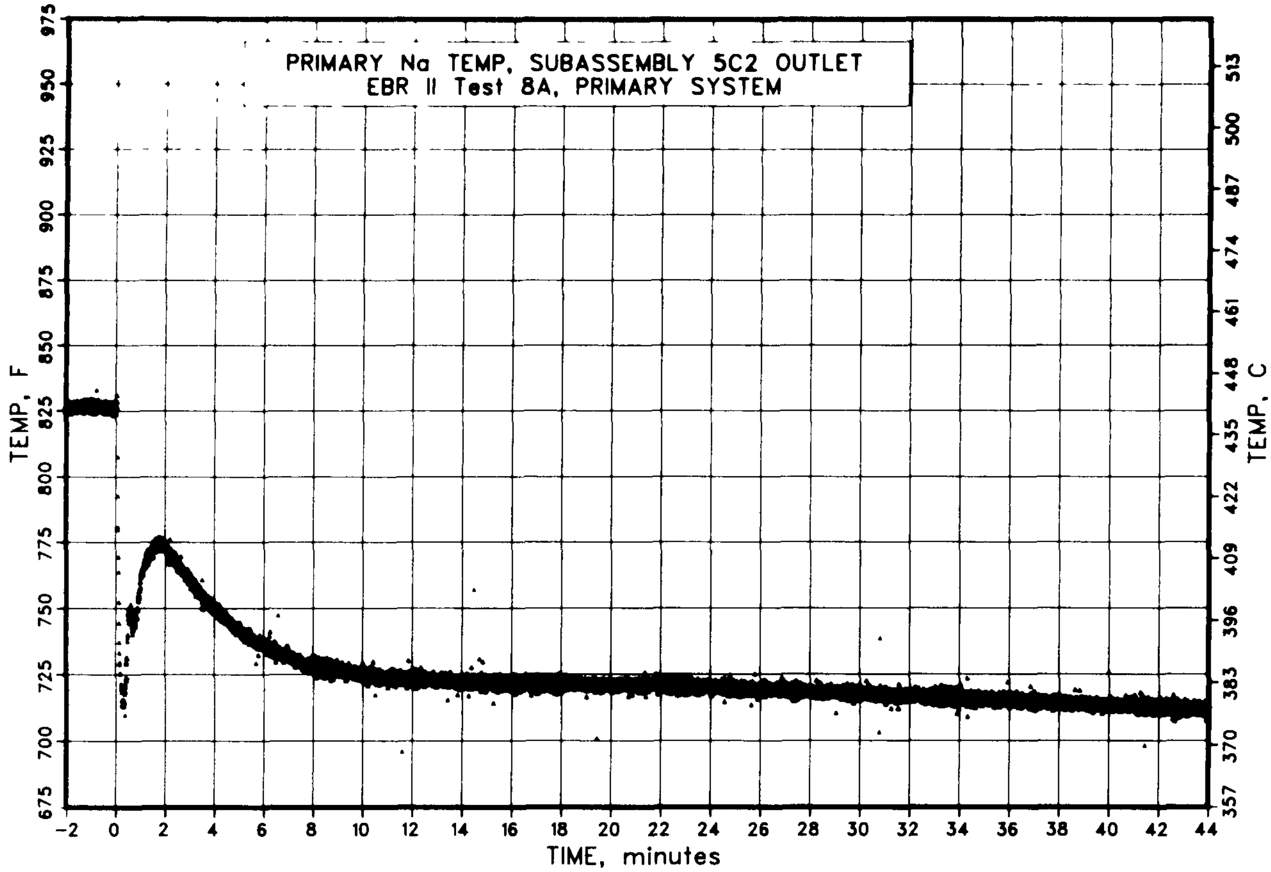

PRIMARY Na TEMP, SUBASSEMBLY 4E1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

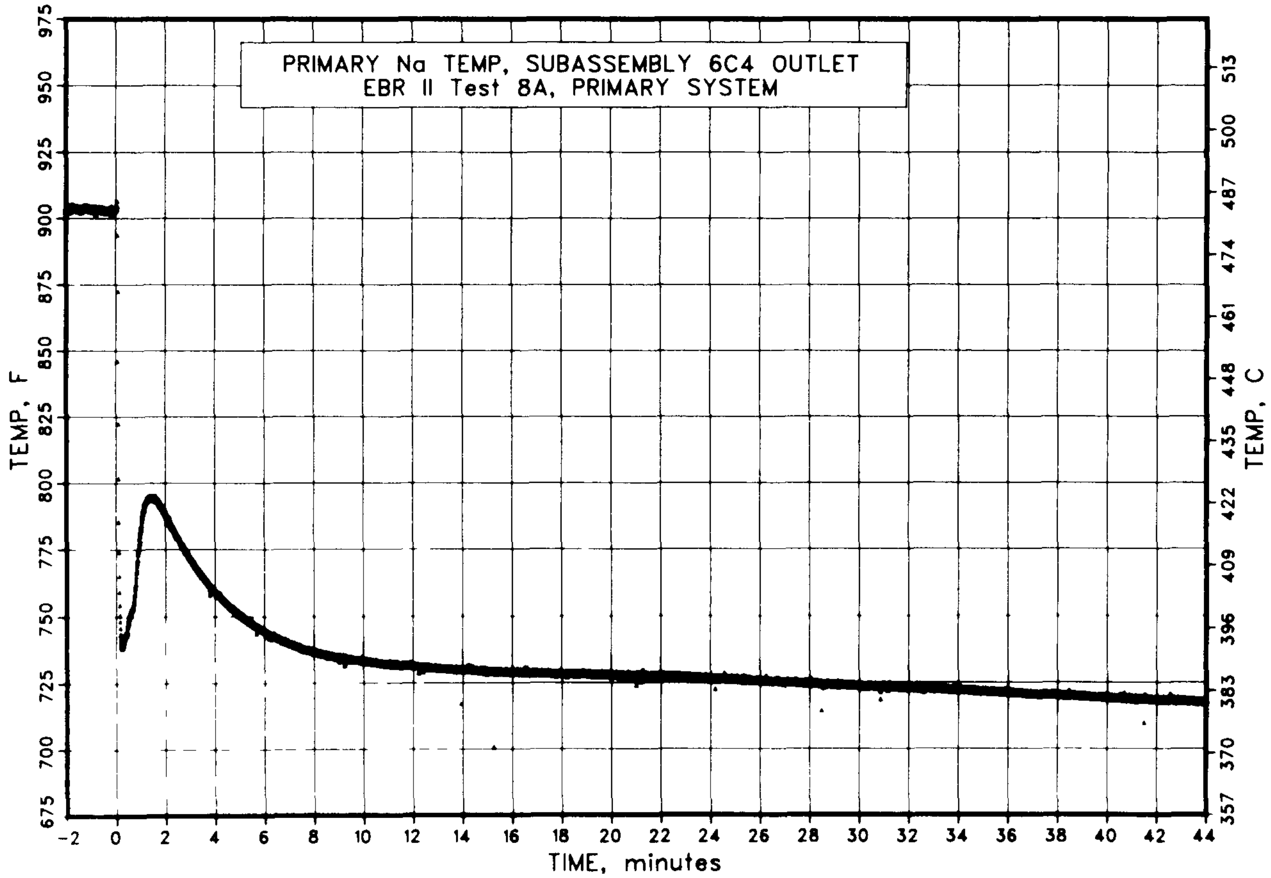

PRIMARY Na TEMP, SUBASSEMBLY 4F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

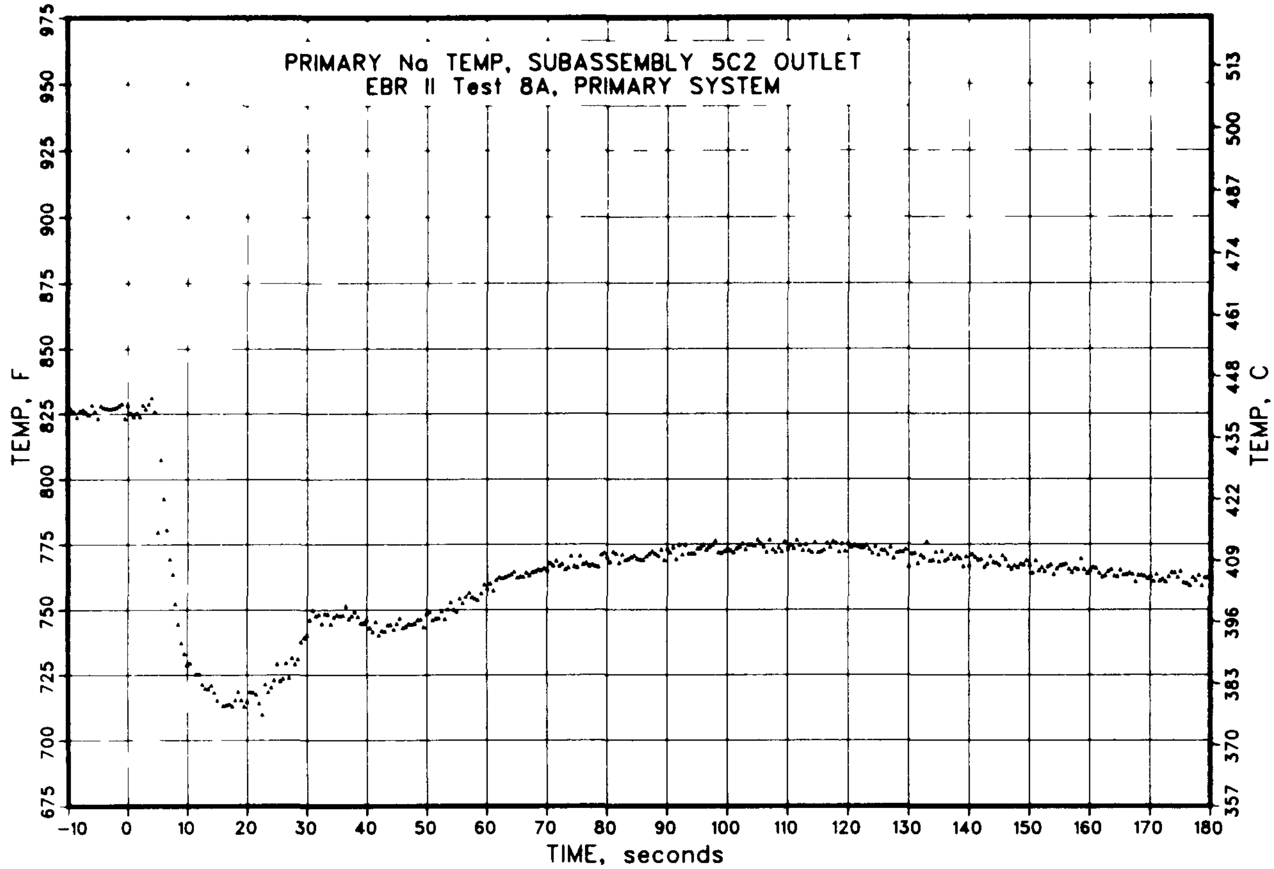

PRIMARY Na TEMP, SUBASSEMBLY 5A4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

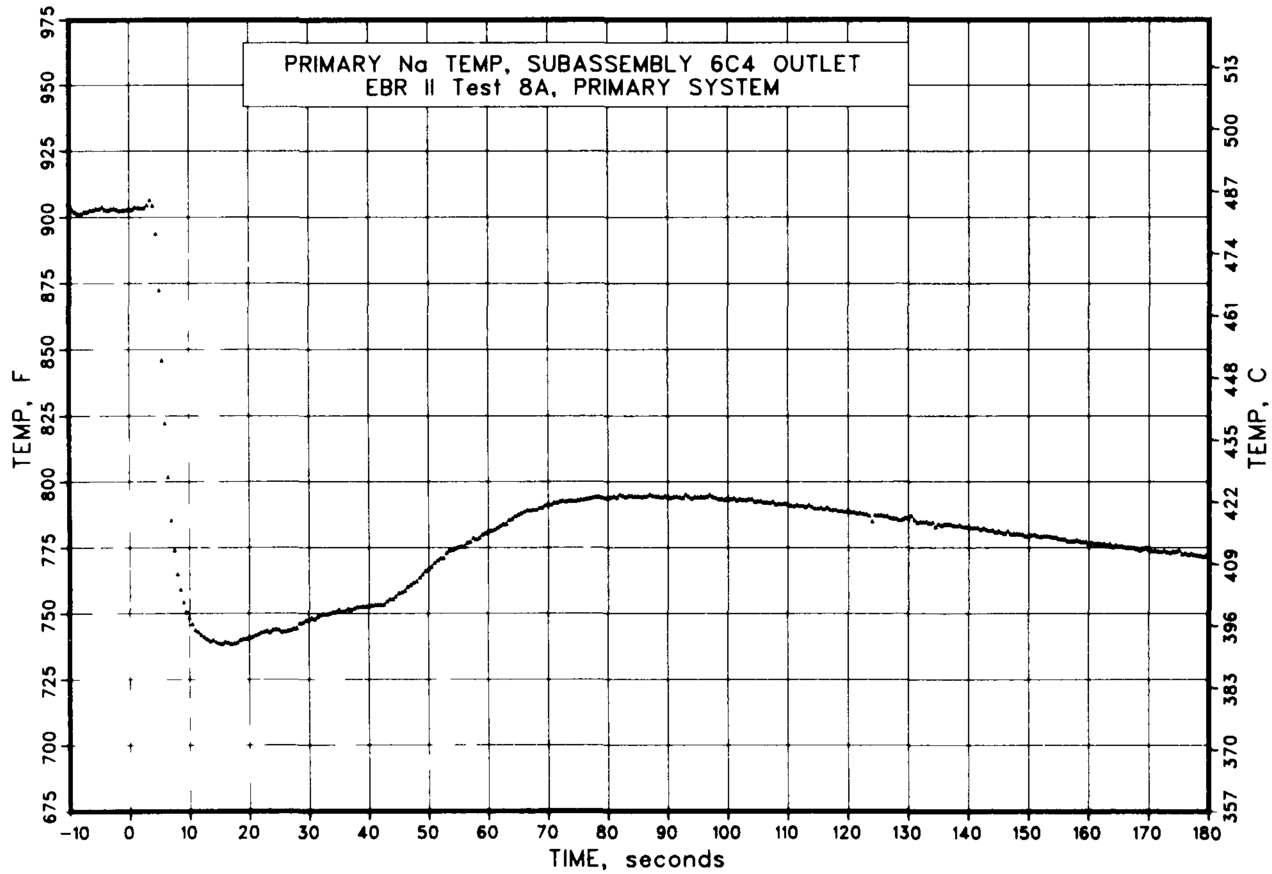

PRIMARY Na TEMP, SUBASSEMBLY 4F1 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 5A4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 5C2 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 6C4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 5C2 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


PRIMARY Na TEMP, SUBASSEMBLY 6C4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
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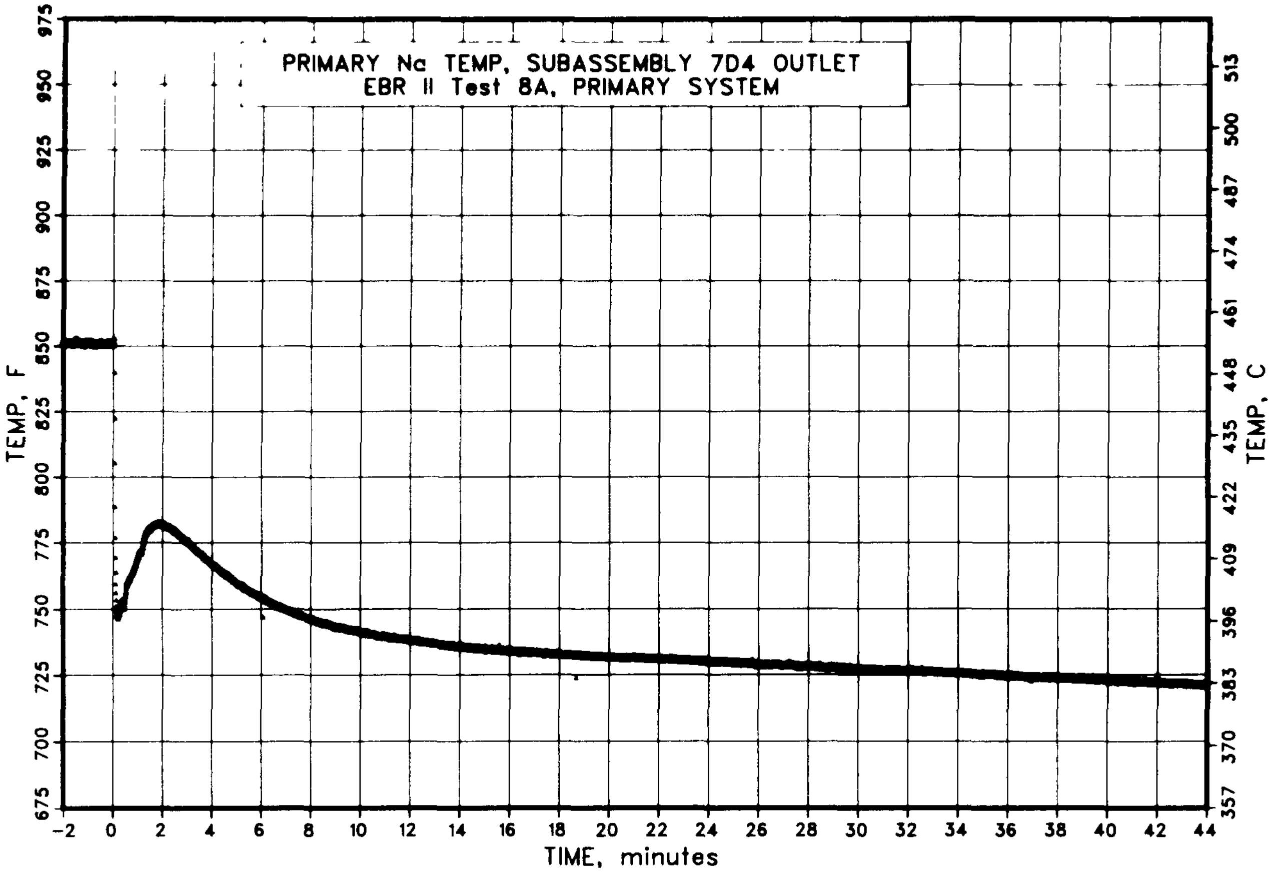
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


PRIMARY Na TEMP, SUBASSEMBLY 7D4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
675
700
725
750
775
800
825
850
875
900
925
950
975
357
370
383
396
409
422
435
448
461
474
487
500
513
-2
0
2
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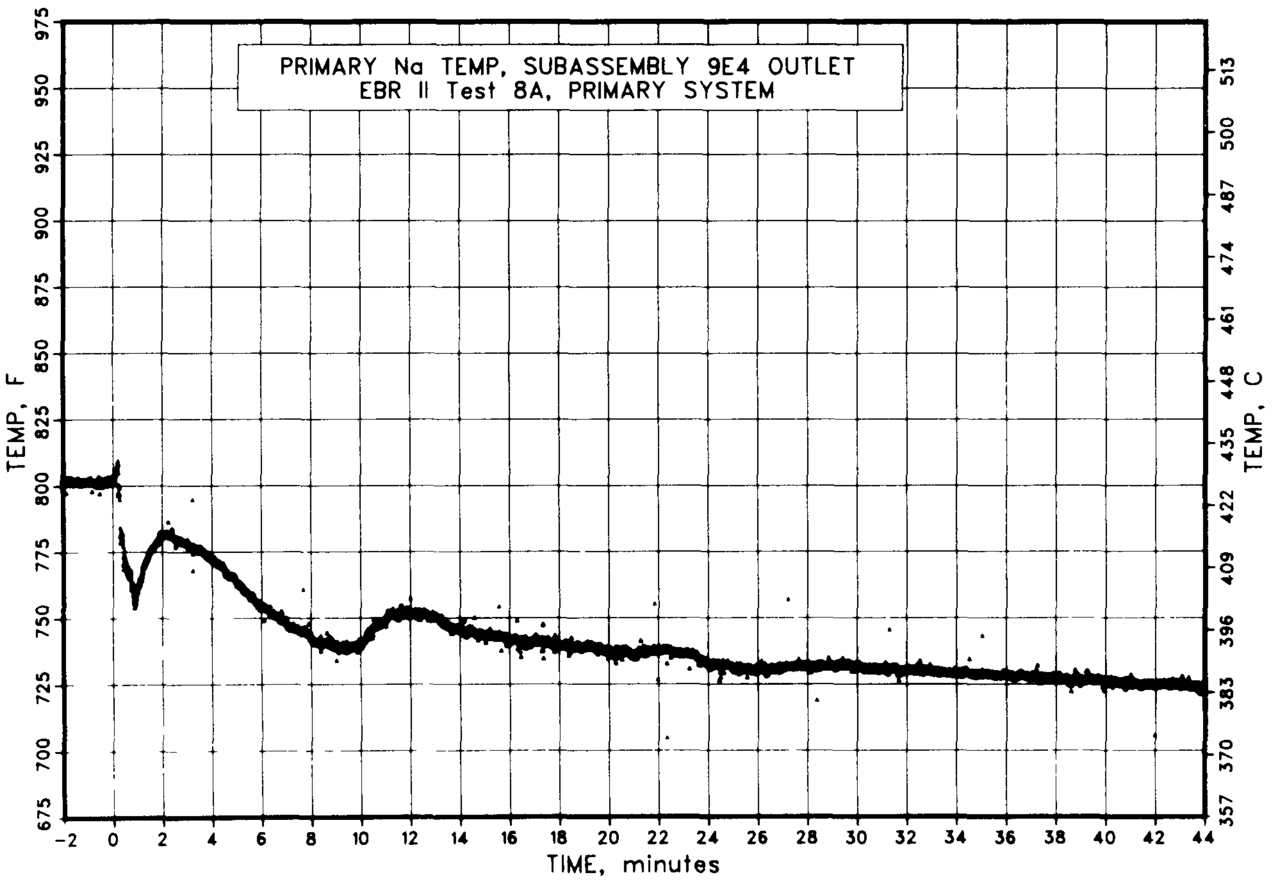
PRIMARY Na TEMP, SUBASSEMBLY 9E4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
675
700
725
750
775
800
825
850
875
900
925
950
975
357
370
383
396
409
422
435
448
461
474
487
500
513
-2
0
2
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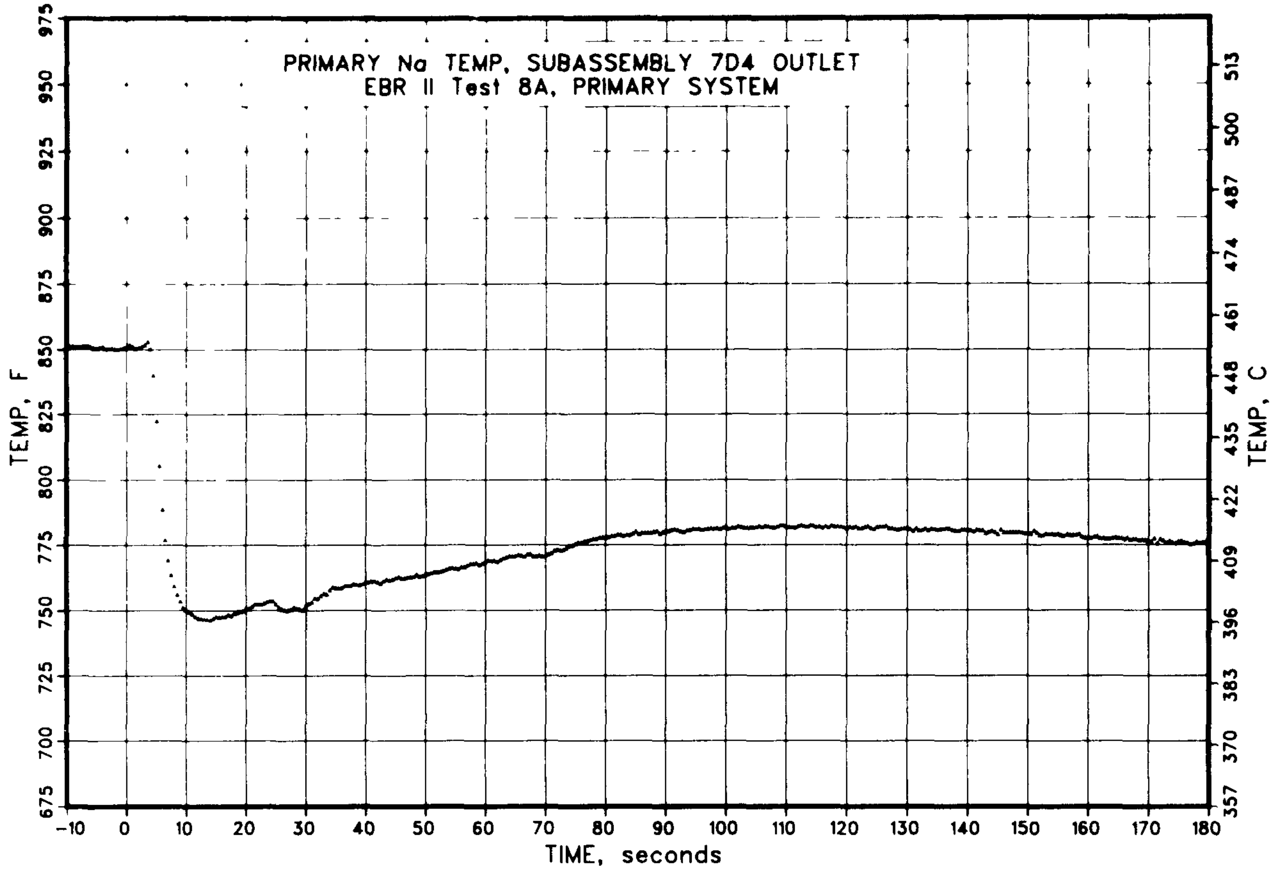

PRIMARY Na TEMP, SUBASSEMBLY 7D4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
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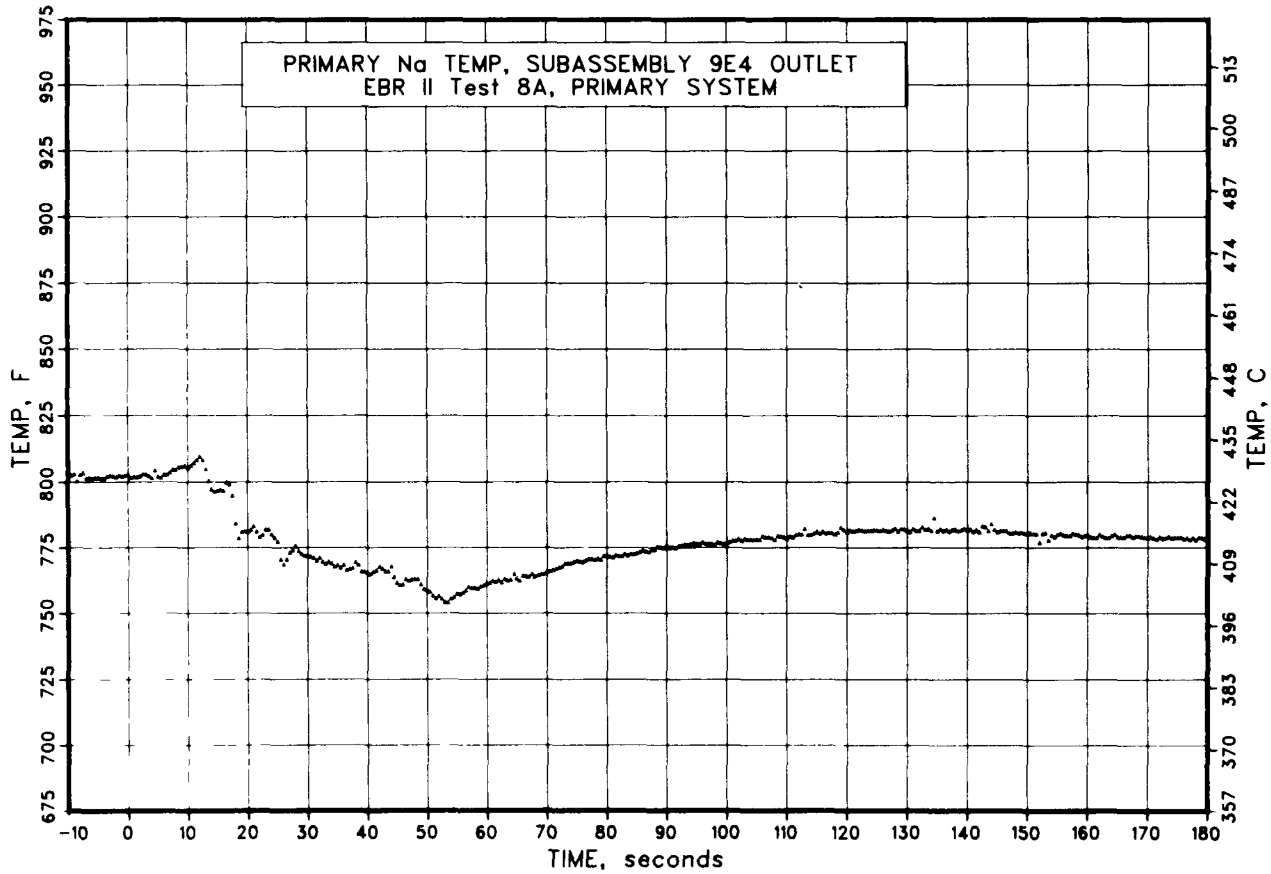
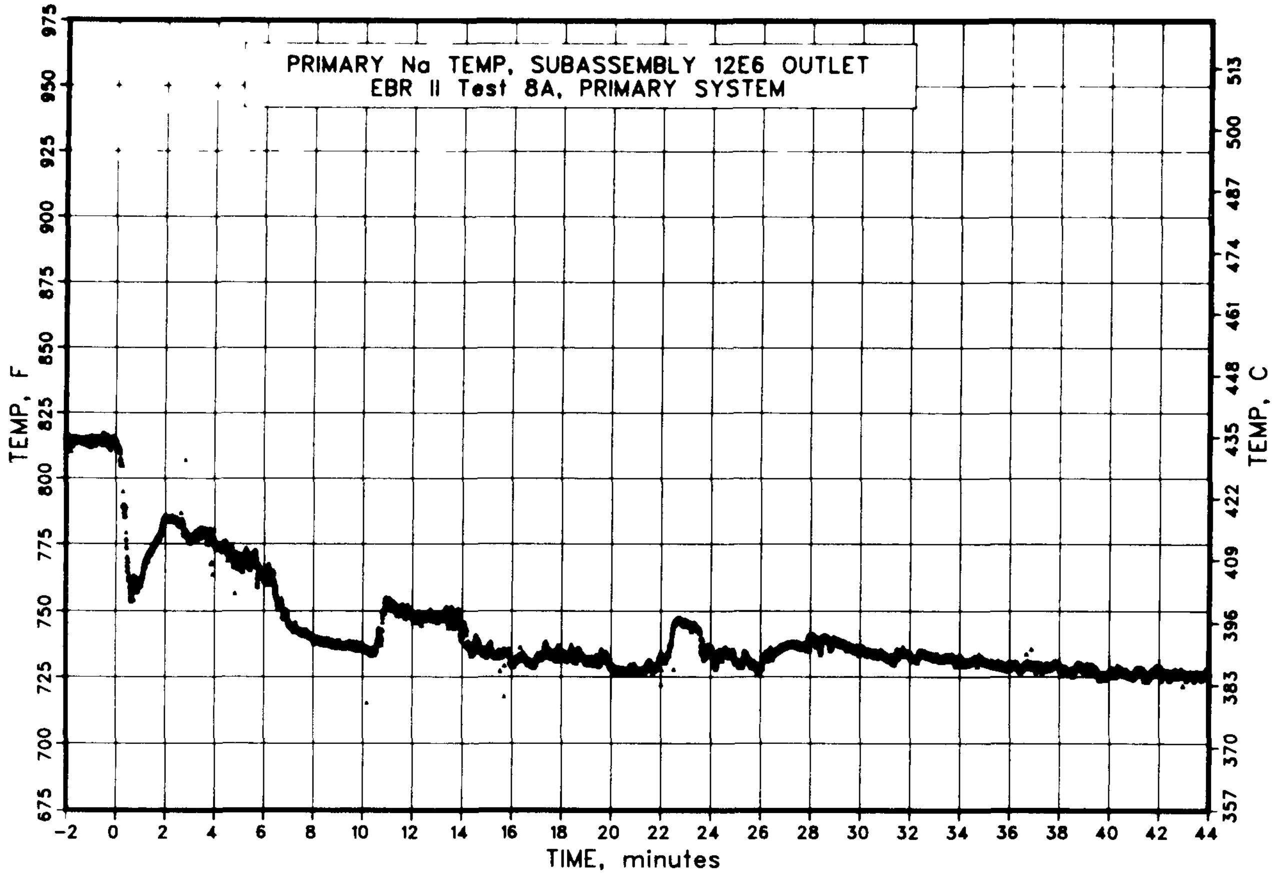
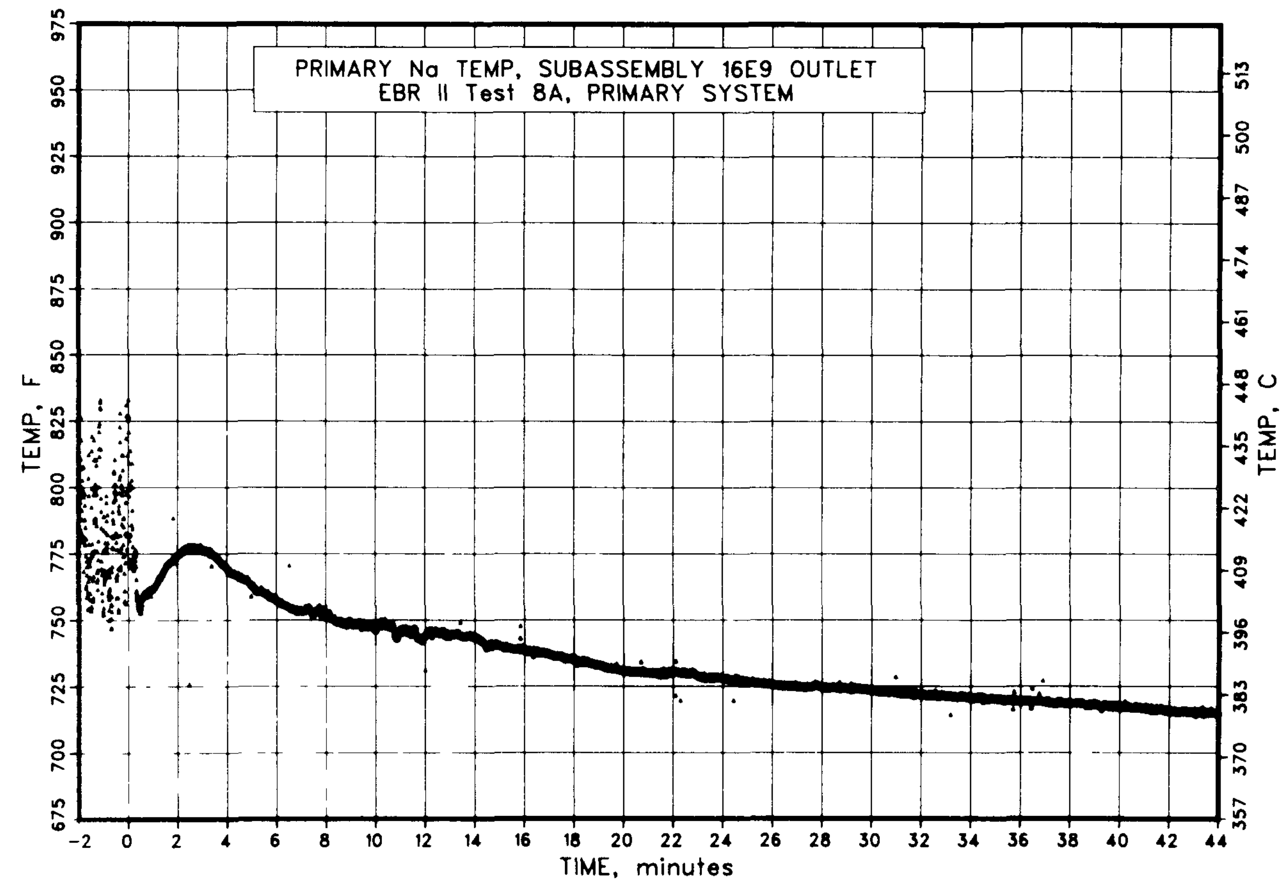
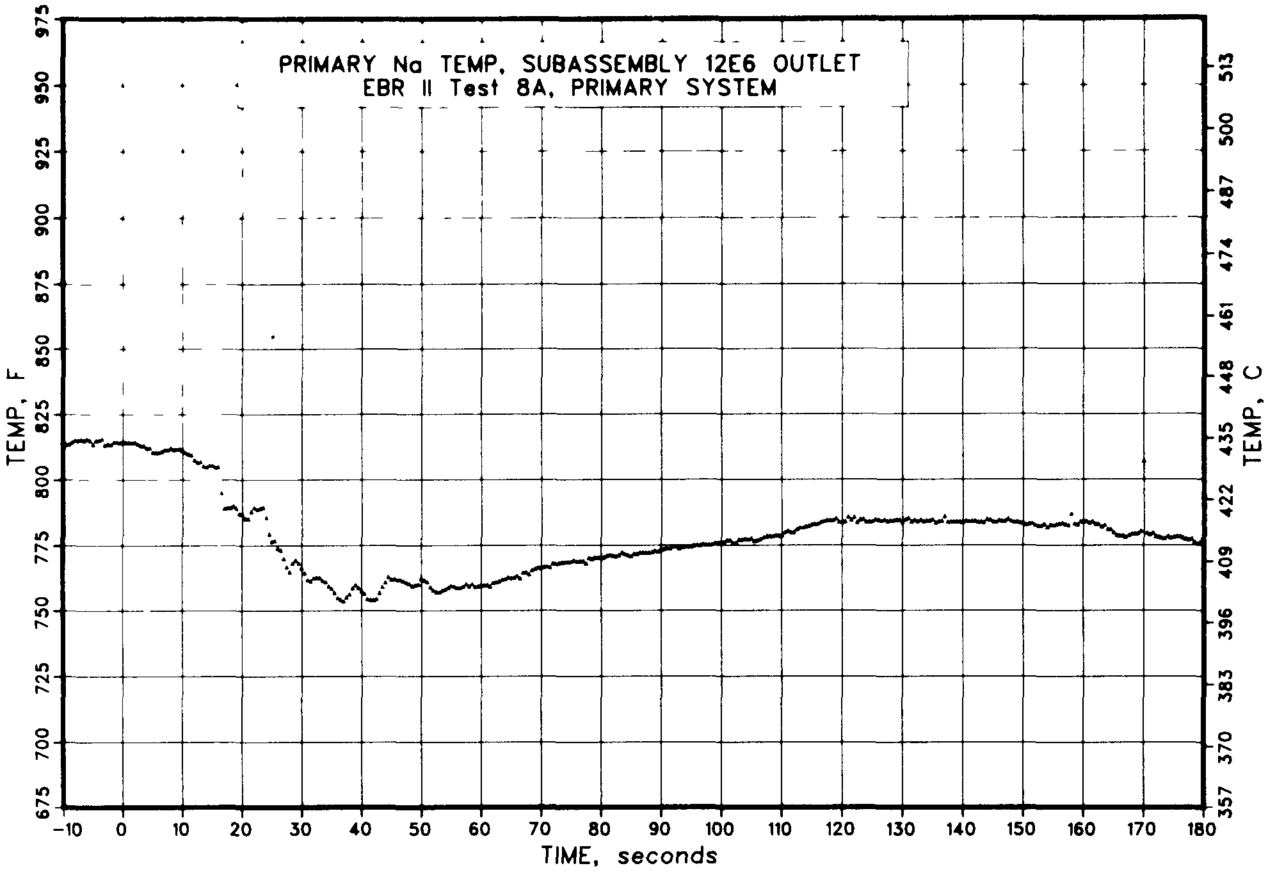
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
TIME, seconds

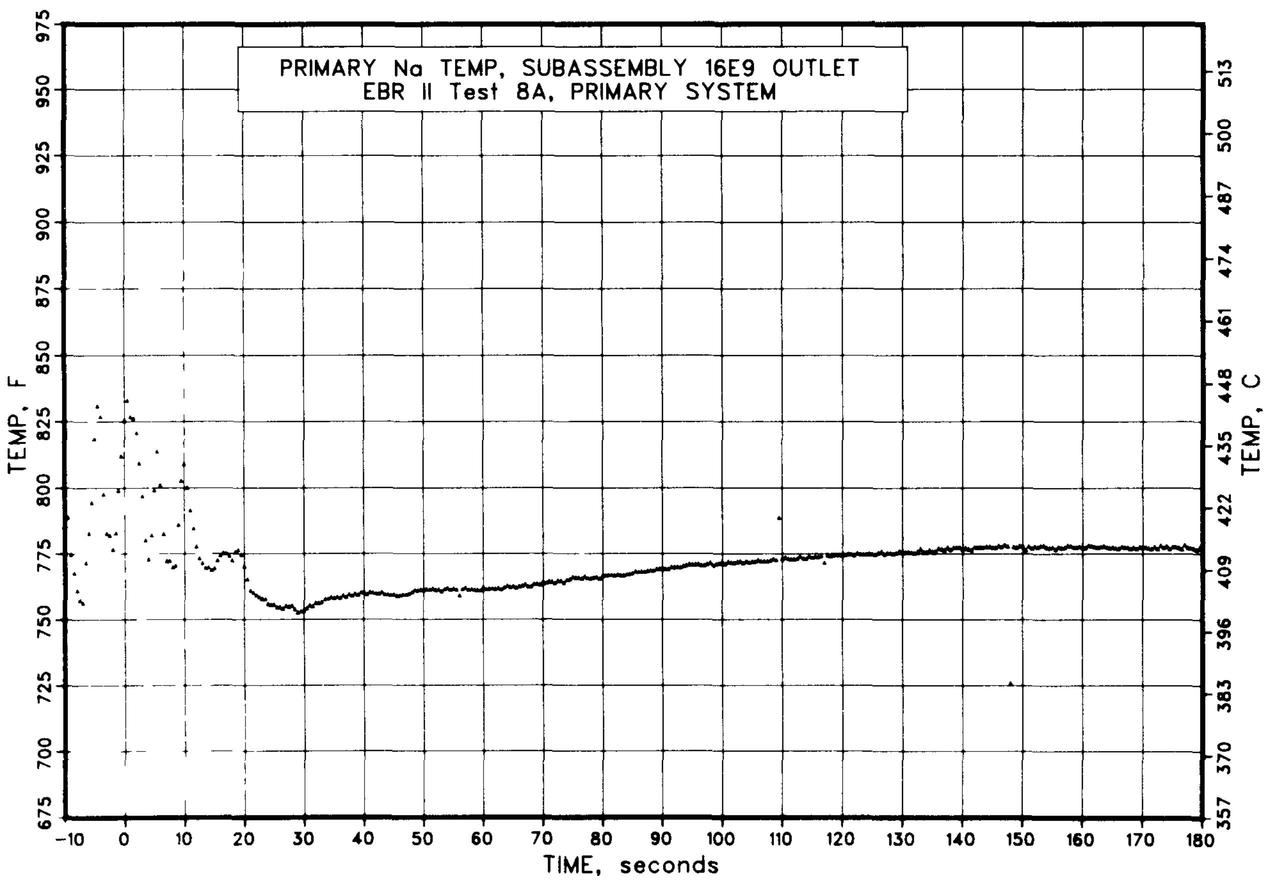


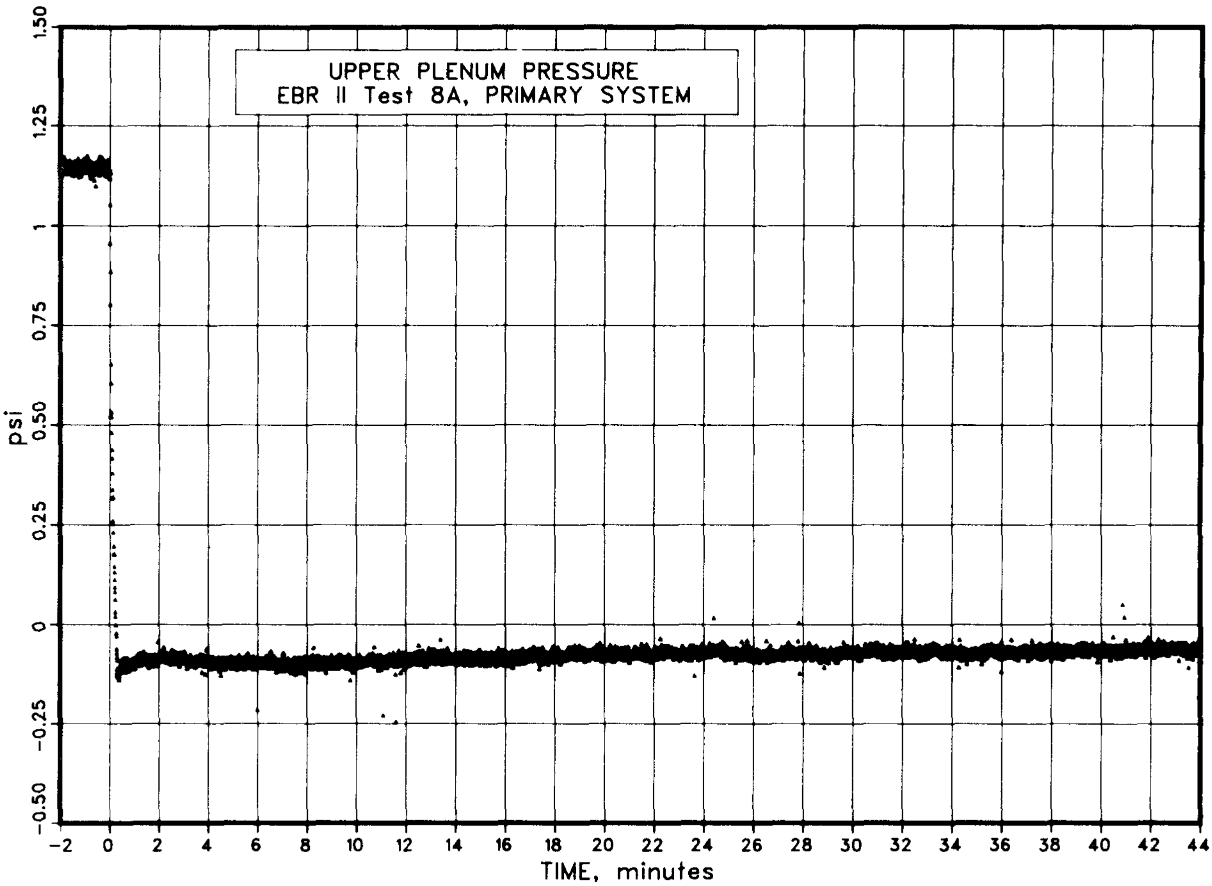
PRIMARY Na TEMP, SUBASSEMBLY 9E4 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
TIME, seconds

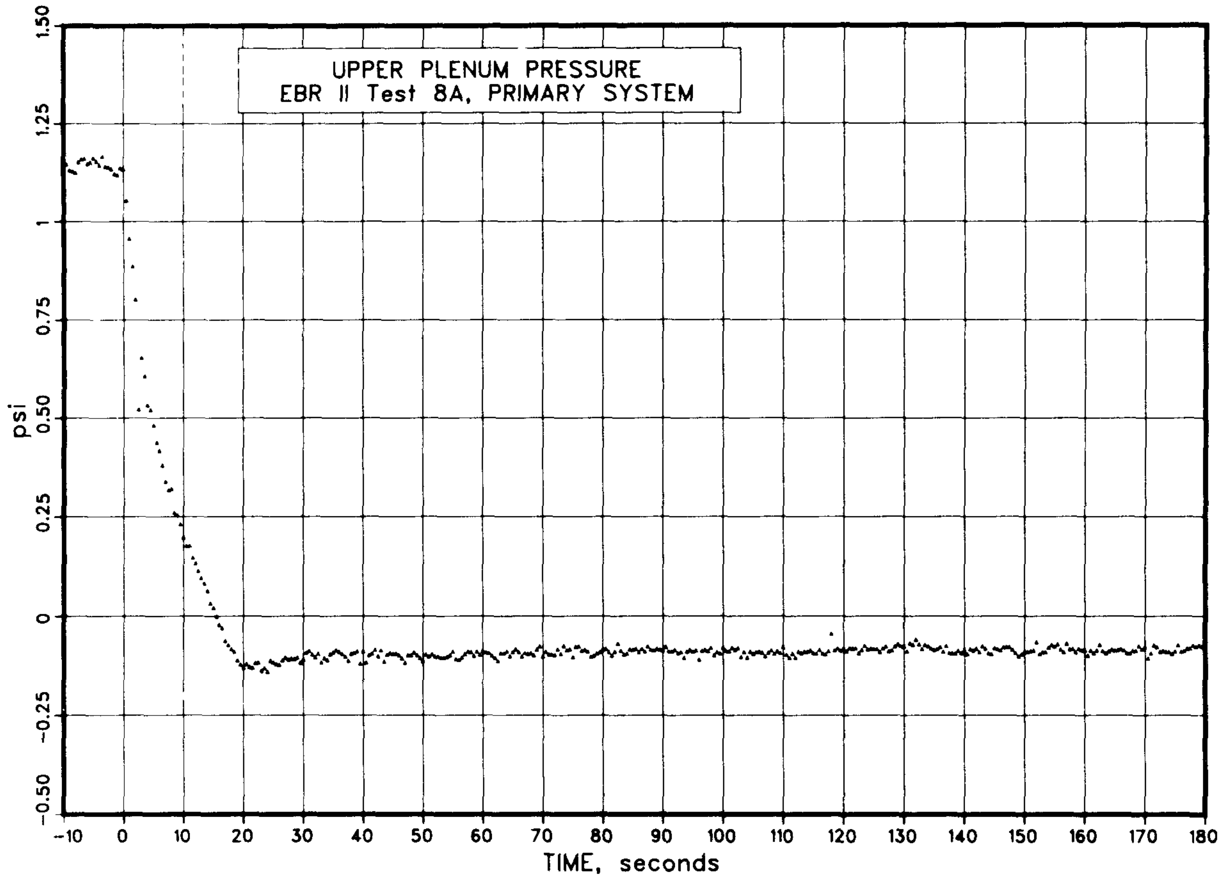

PRIMARY Na TEMP, SUBASSEMBLY 12E6 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

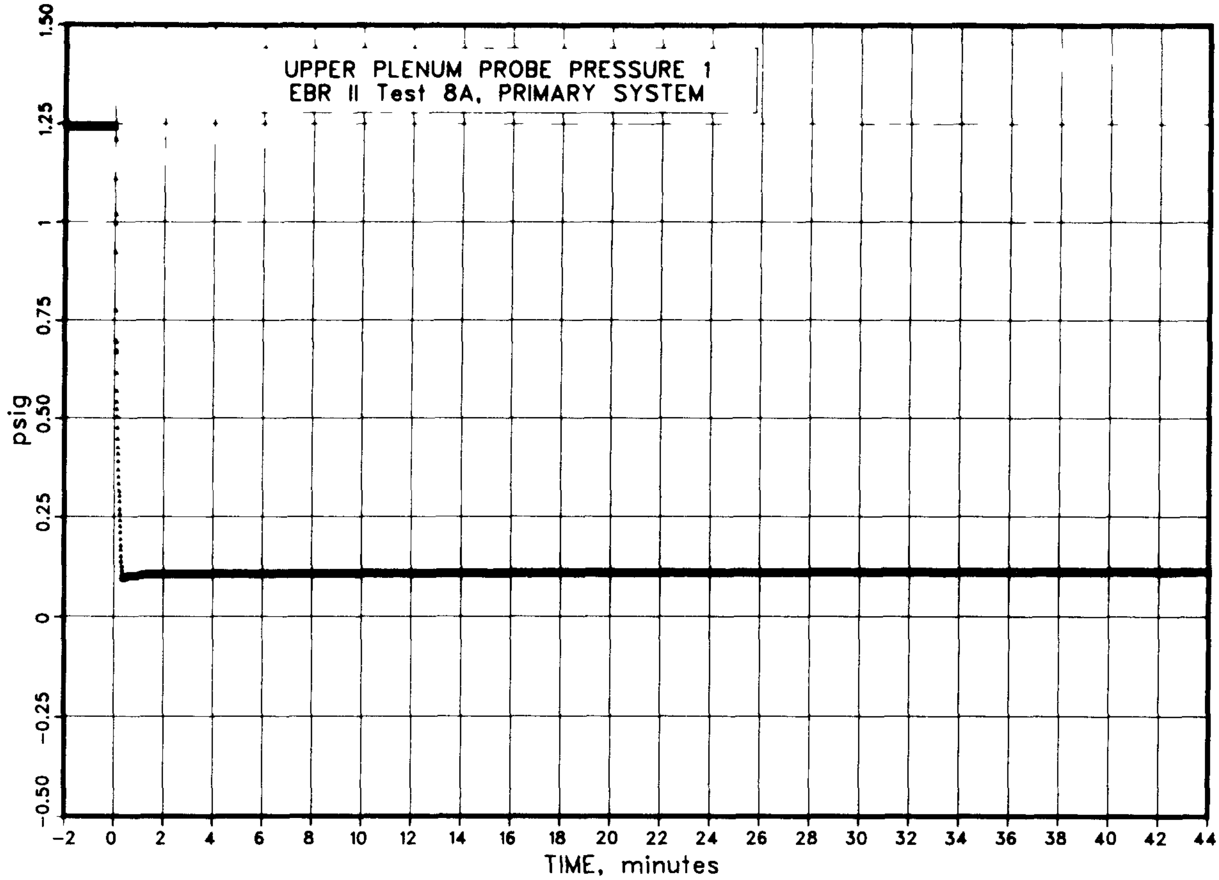

PRIMARY Na TEMP, SUBASSEMBLY 16E9 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

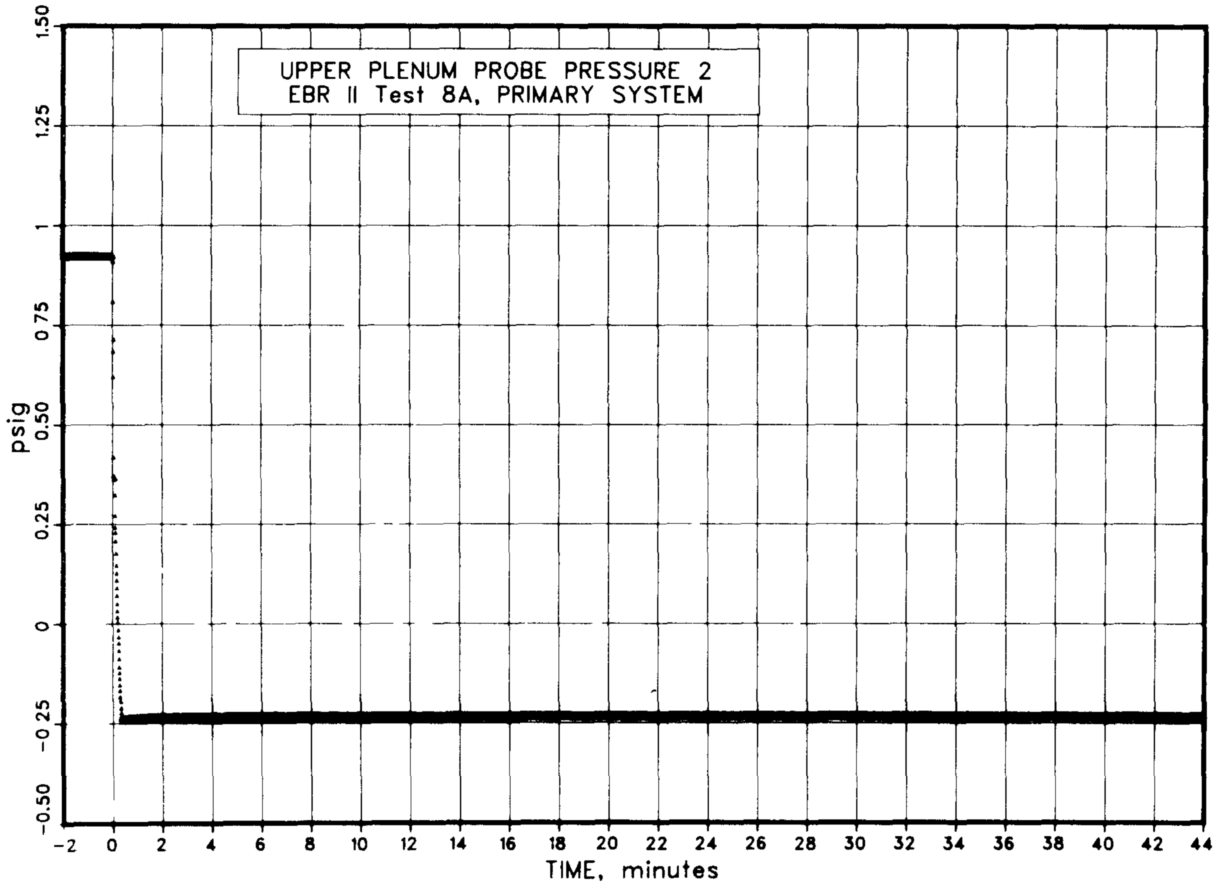

PRIMARY Na TEMP, SUBASSEMBLY 12E6 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

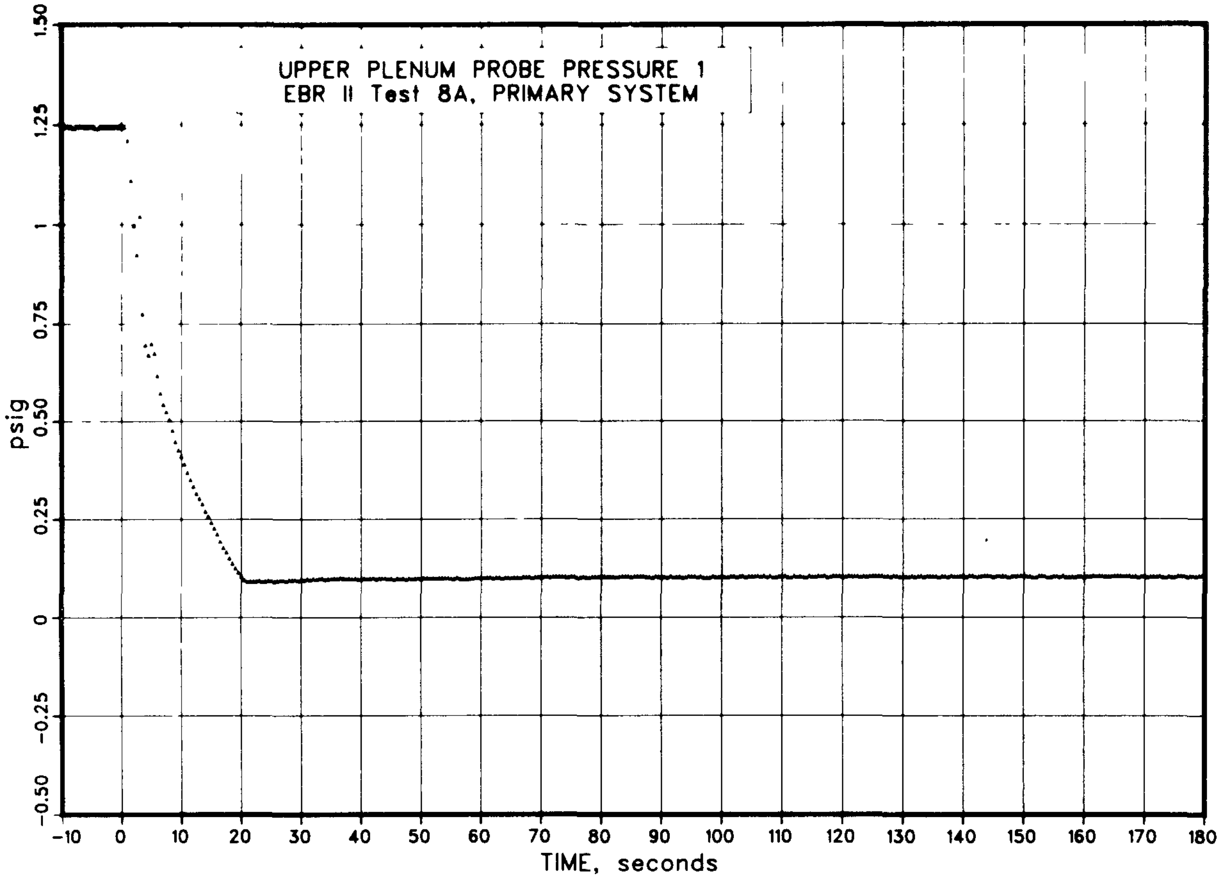

PRIMARY Na TEMP, SUBASSEMBLY 16E9 OUTLET
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

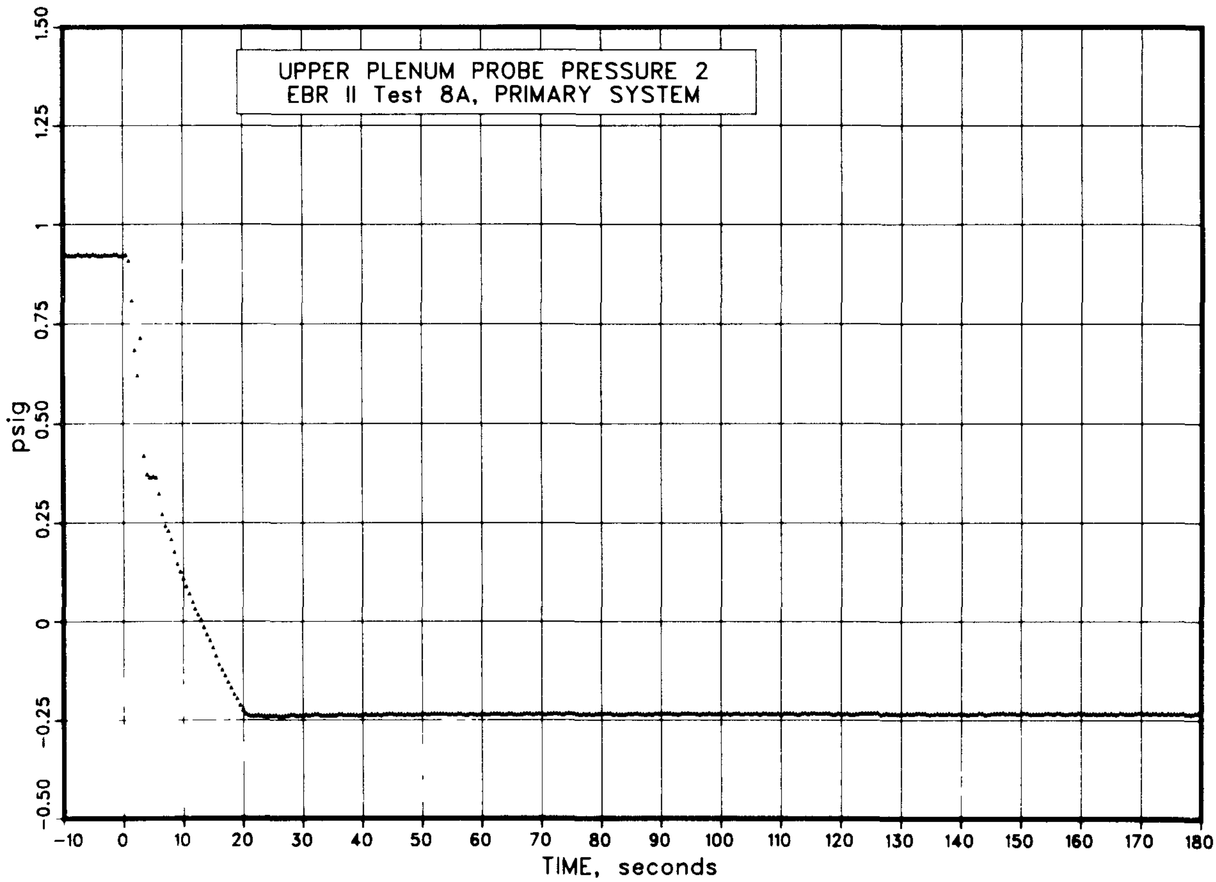

UPPER PLENUM PRESSURE
EBR II Test 8A, PRIMARY SYSTEM
psi
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

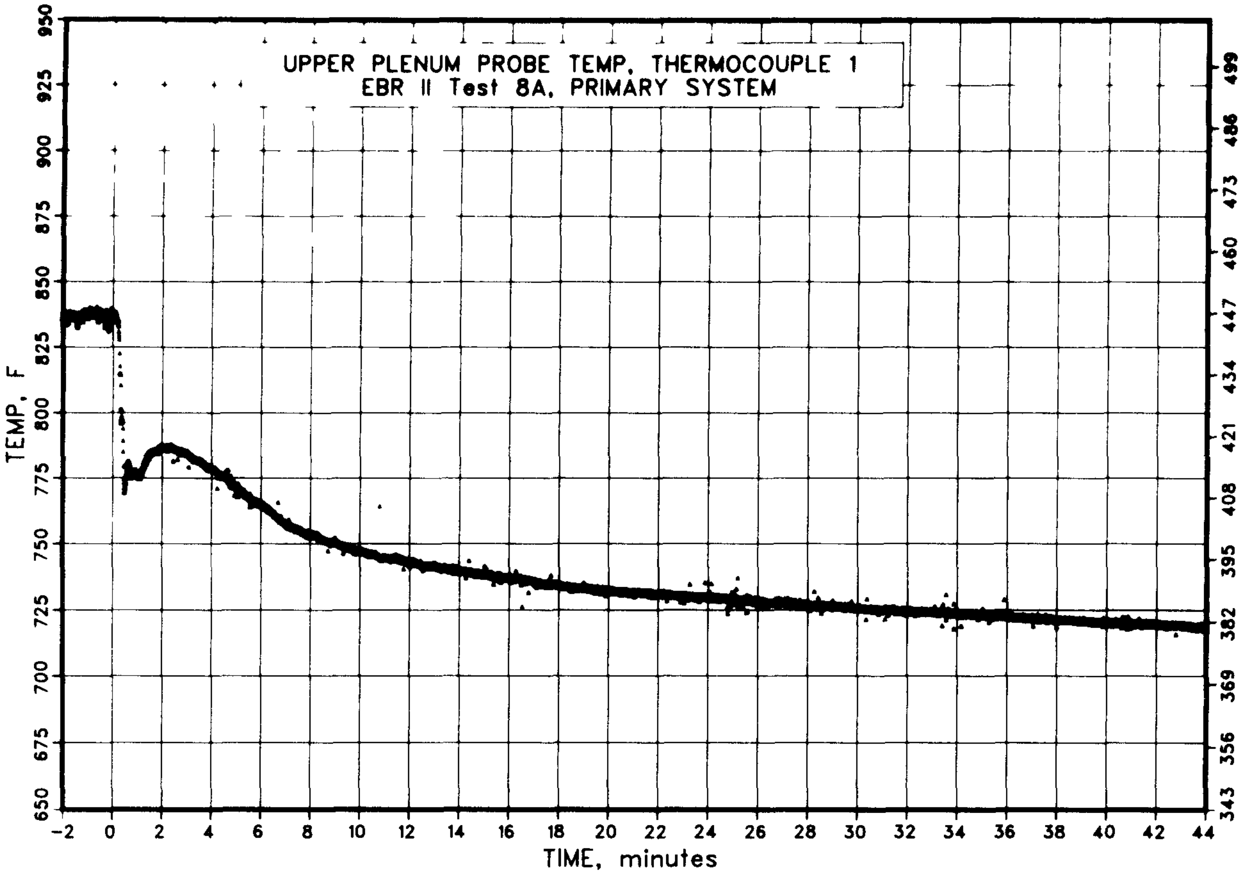

UPPER PLENUM PRESSURE
EBR II Test 8A, PRIMARY SYSTEM
psi
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


UPPER PLENUM PROBE PRESSURE 1
EBR II Test 8A, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


UPPER PLENUM PROBE PRESSURE 2
EBR II Test 8A, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


UPPER PLENUM PROBE PRESSURE 1
EBR II Test 8A, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
−0.25
−0.50
−10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


UPPER PLENUM PROBE PRESSURE 2
EBR II Test 8A, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
−0.25
−0.50
−10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 1
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-2
0
2
4
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24
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30
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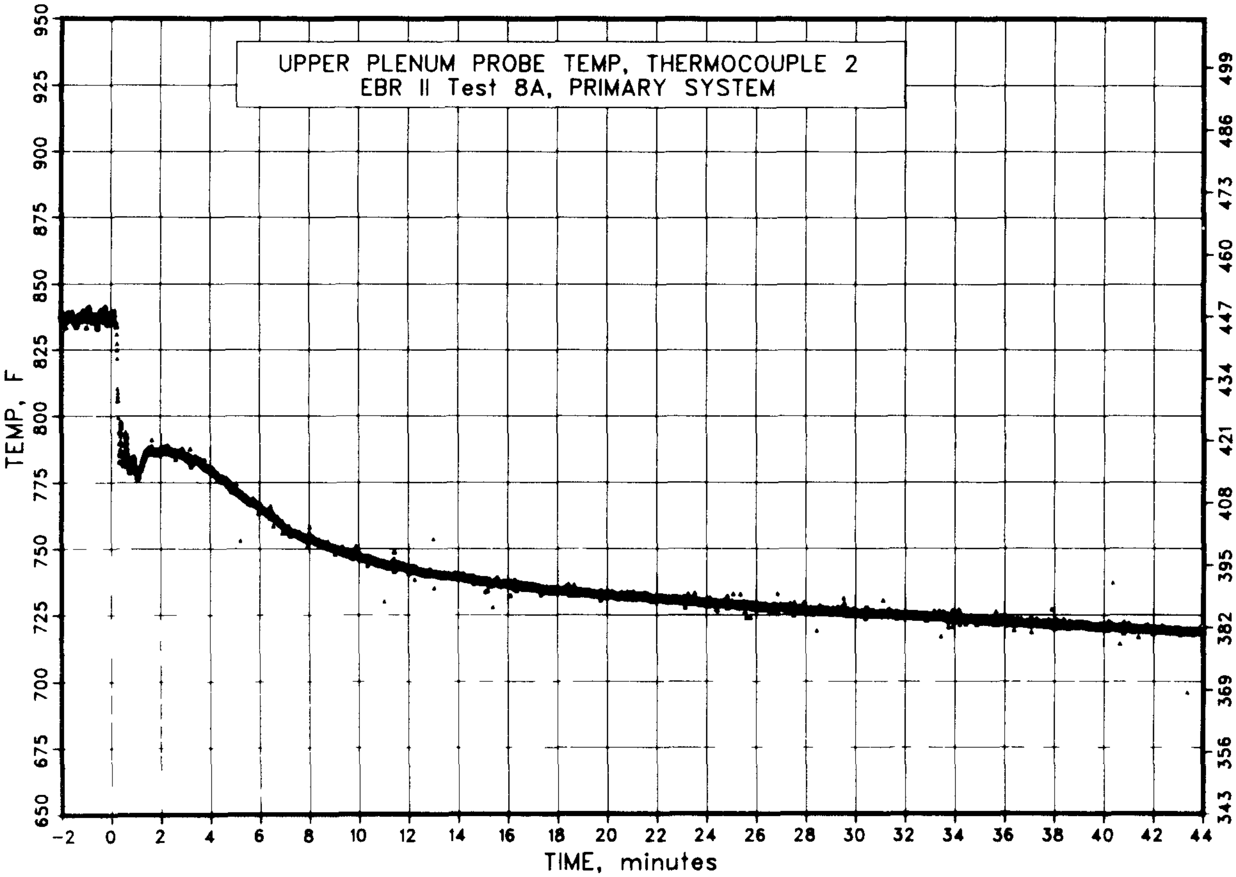
42
44


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 2
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-2
0
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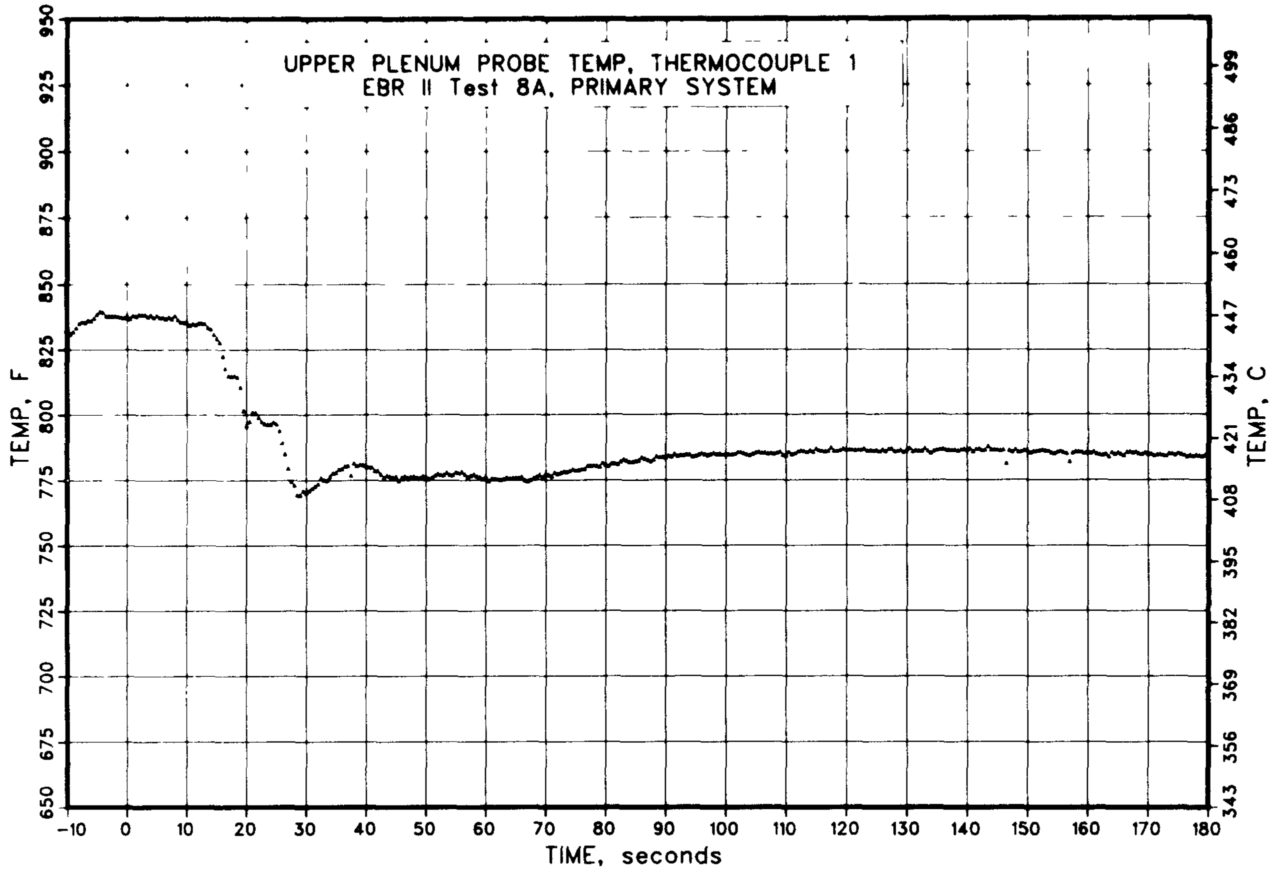
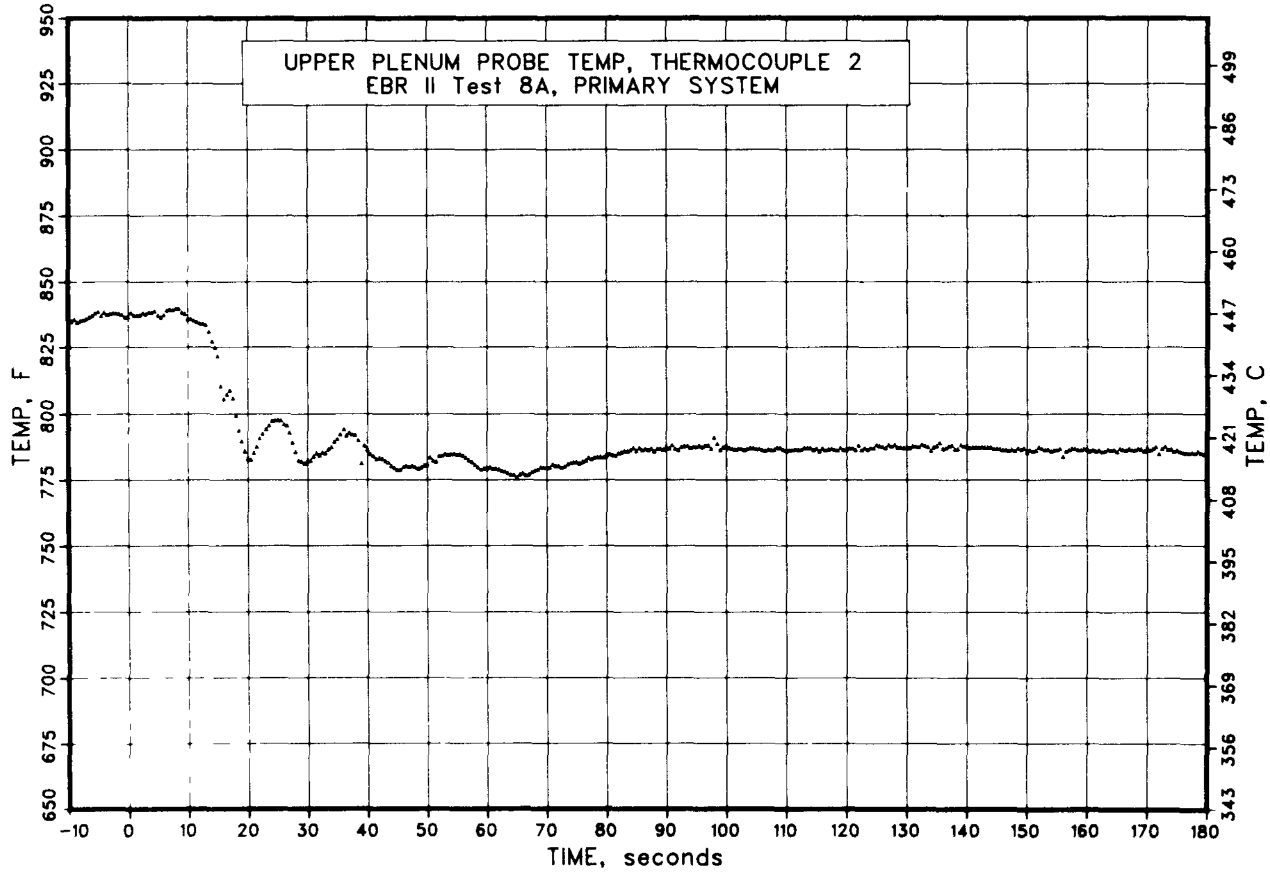
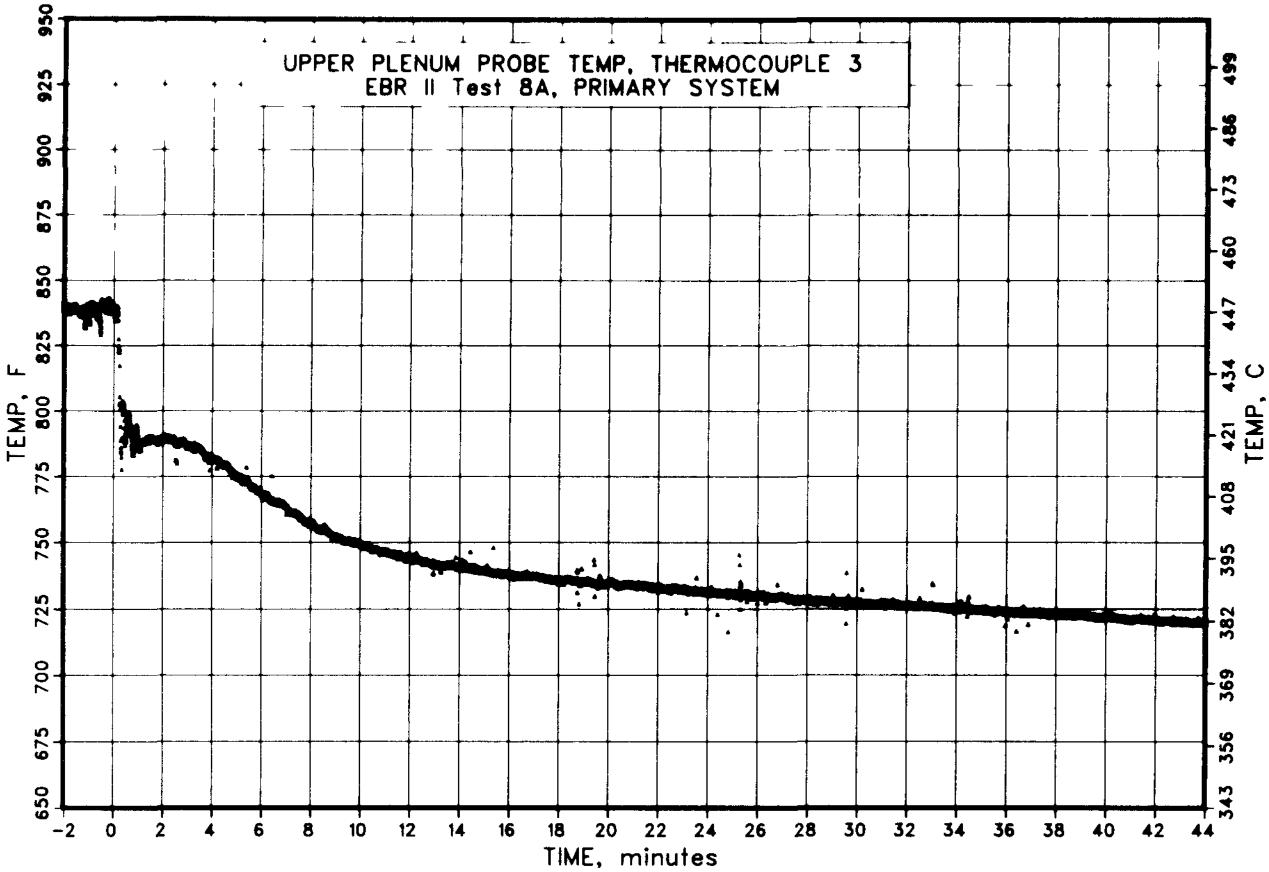
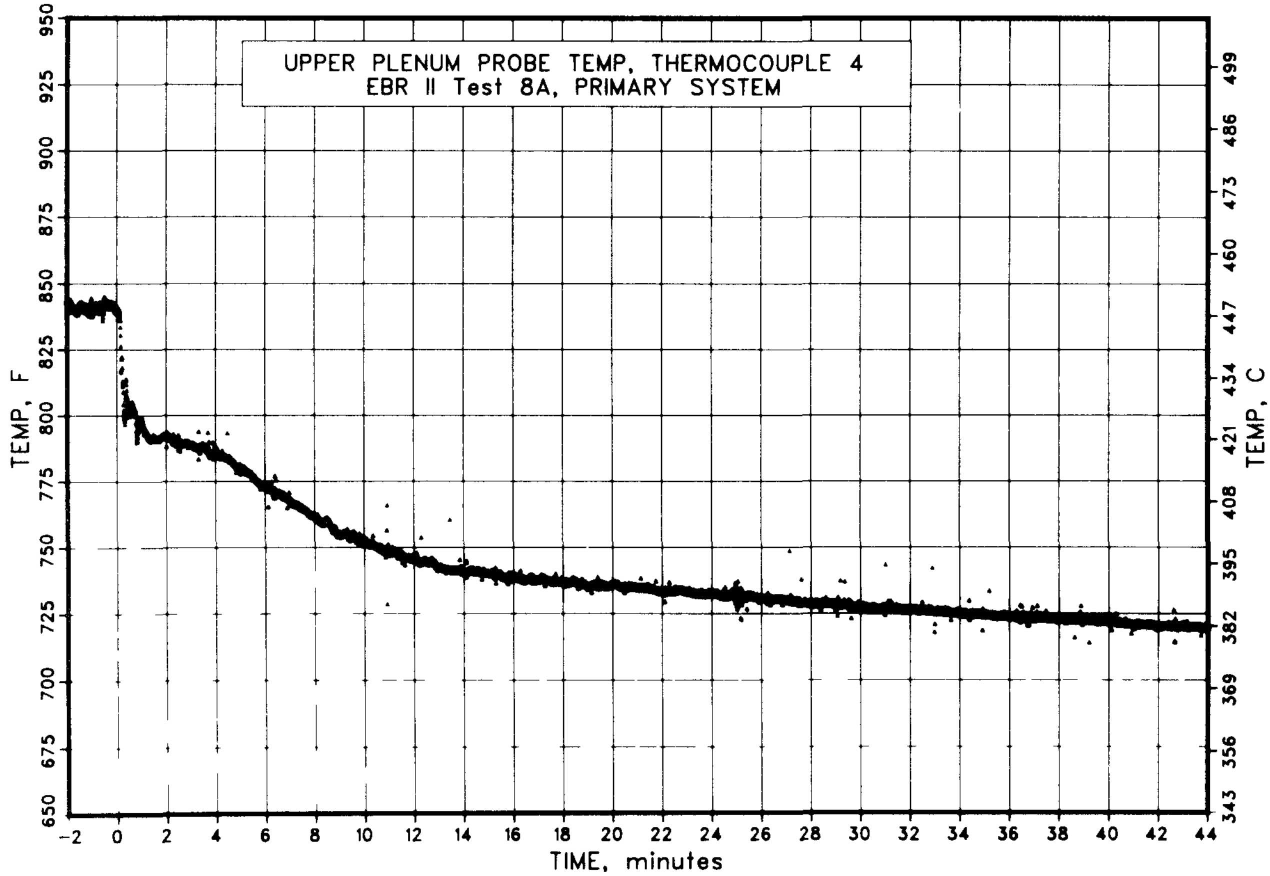
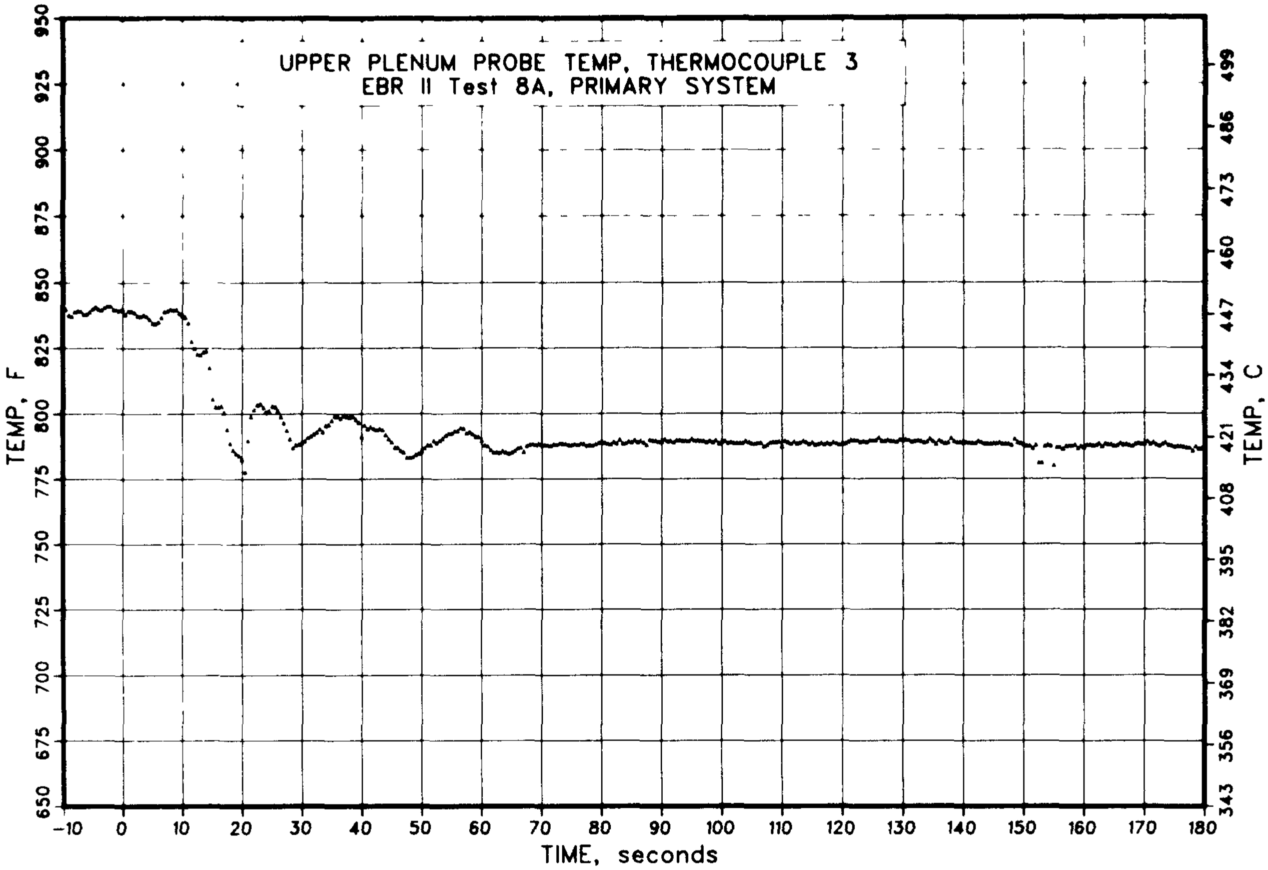

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 1
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 2
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 3
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 4
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes



UPPER PLENUM PROBE TEMP, THERMOCOUPLE 3
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
TIME, seconds
-10
0
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20
30
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60
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110
120
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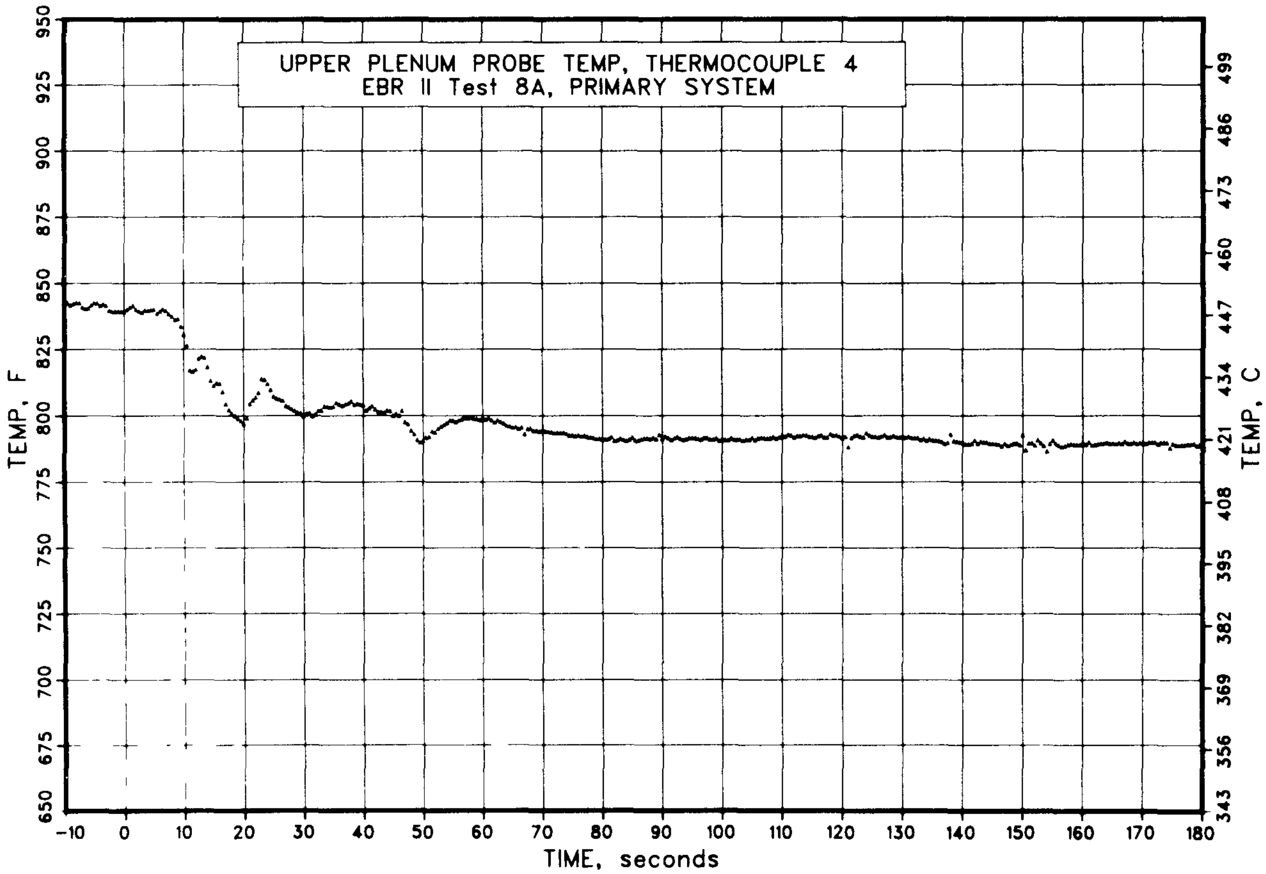
170
180



UPPER PLENUM PROBE TEMP, THERMOCOUPLE 4
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
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775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
TIME, seconds
-10
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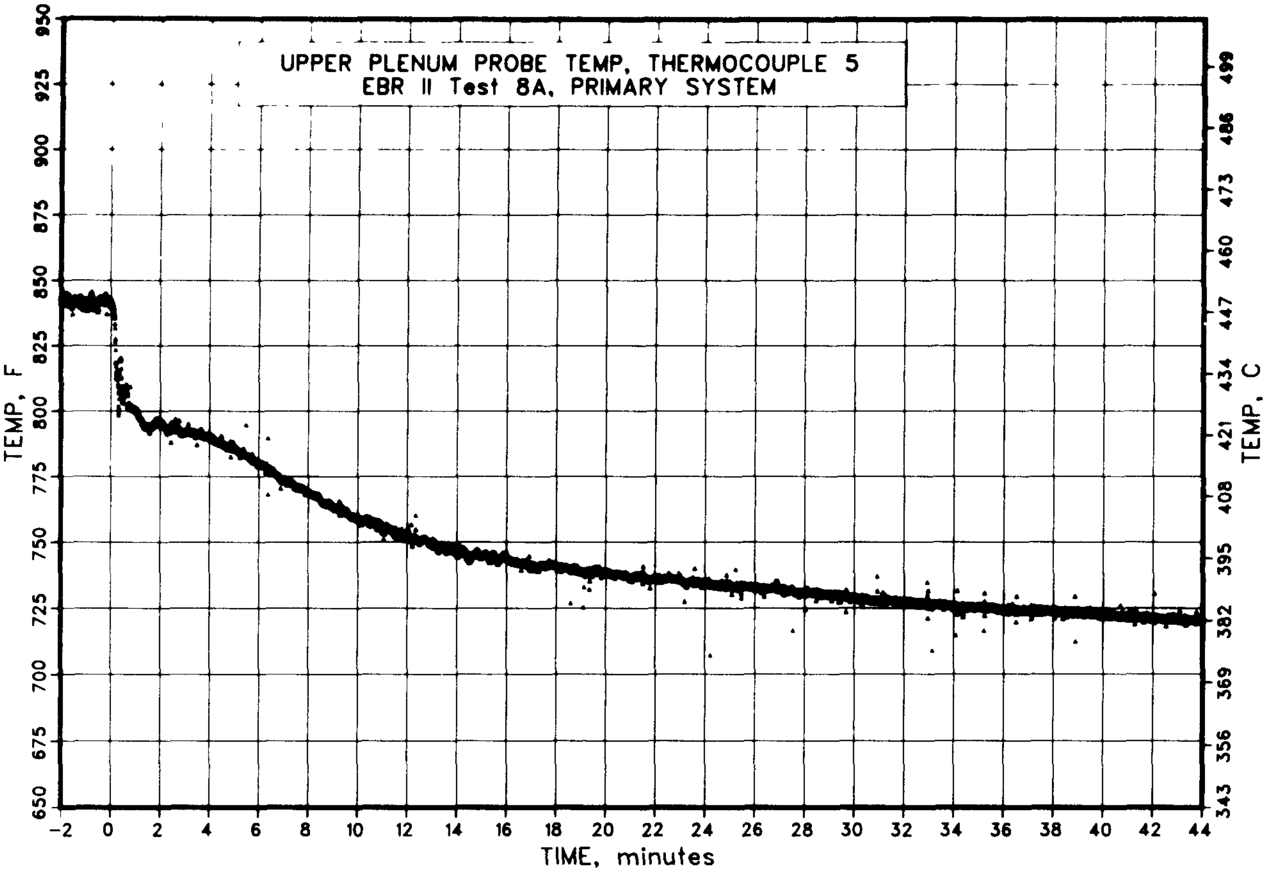
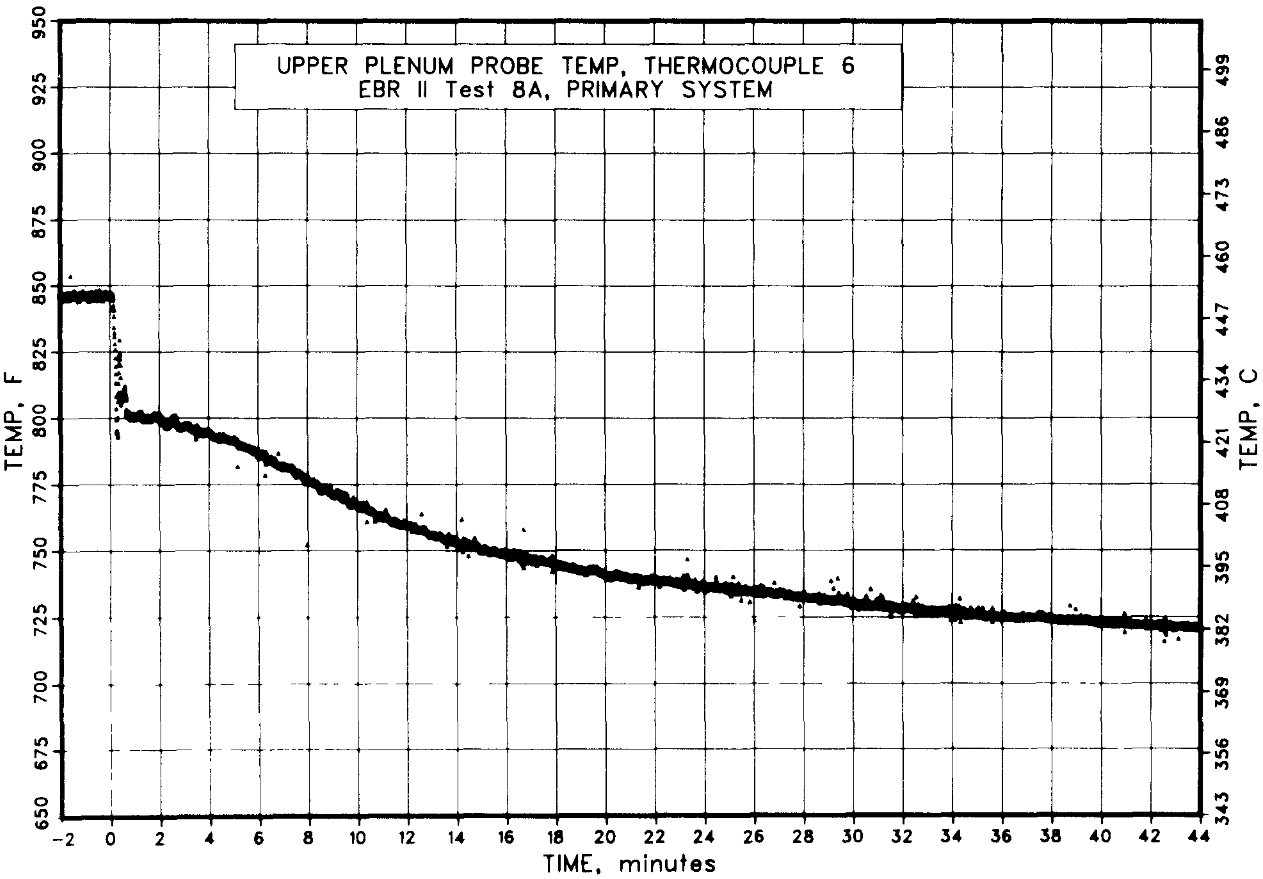
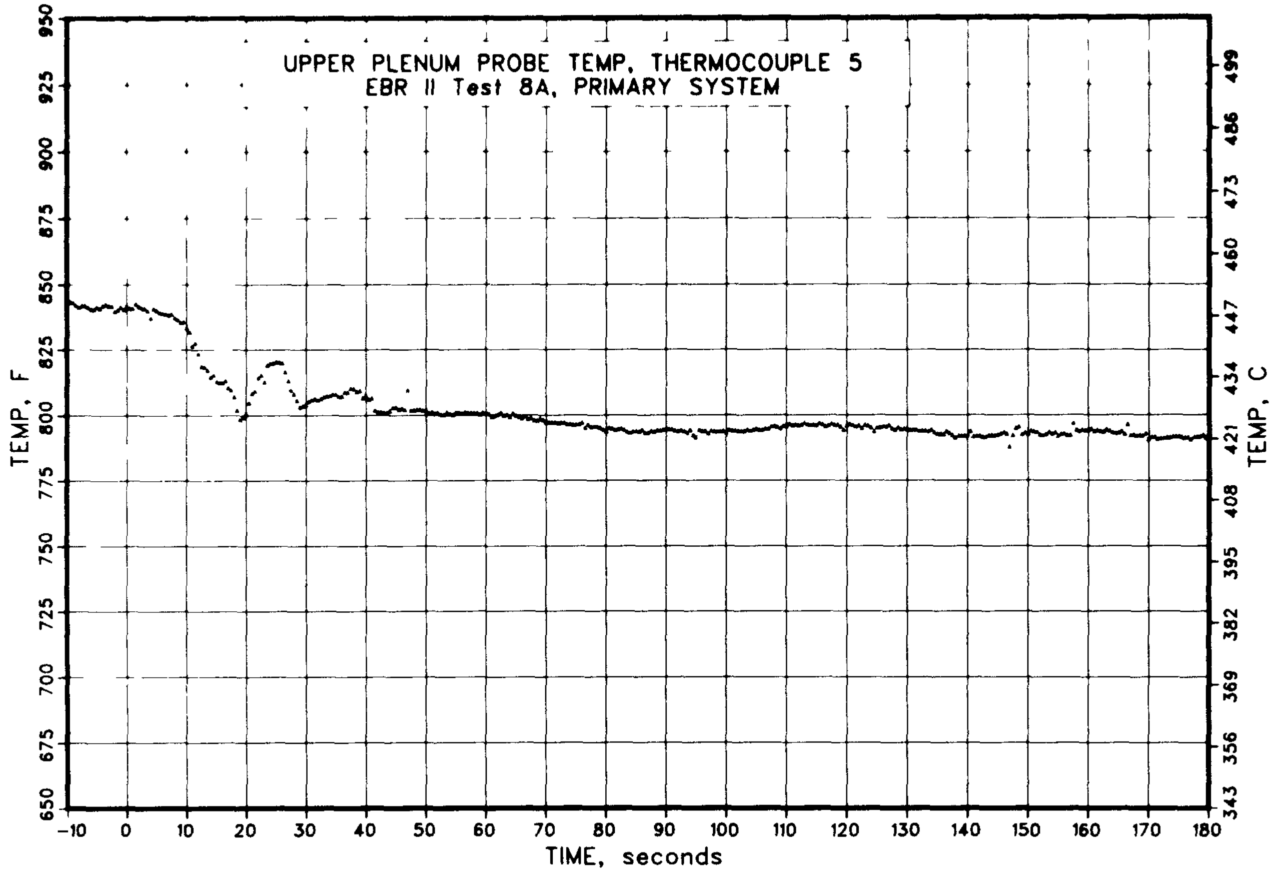

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 6
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 5
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
650
675
700
725
750
775
800
825
850
875
900
925
950
TEMP, C
343
356
369
382
395
408
421
434
447
460
473
486
499
TIME, seconds
-10
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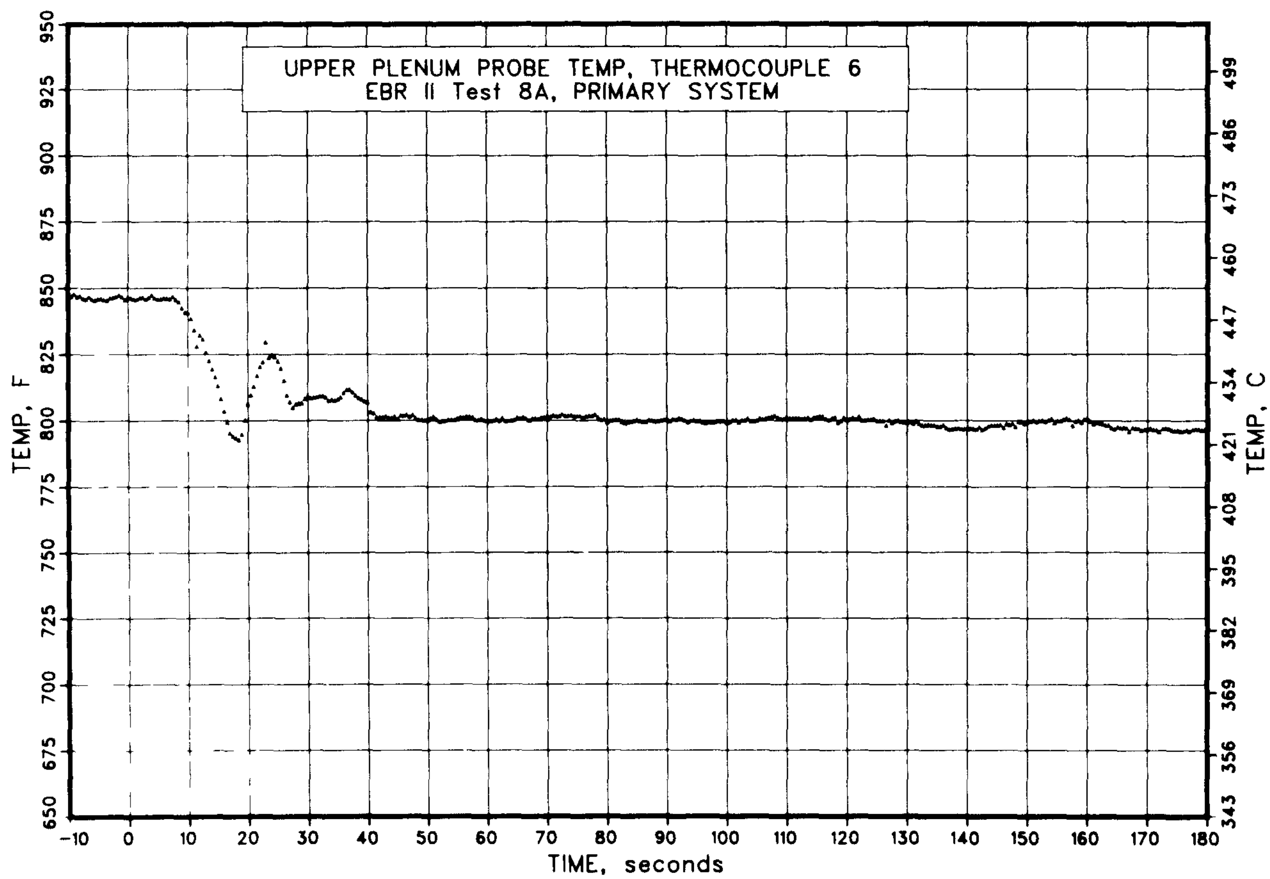
170
180


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 6
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
650
675
700
725
750
775
800
825
850
875
900
925
950
TEMP, C
343
356
369
382
395
408
421
434
447
460
473
486
499
TIME, seconds
-10
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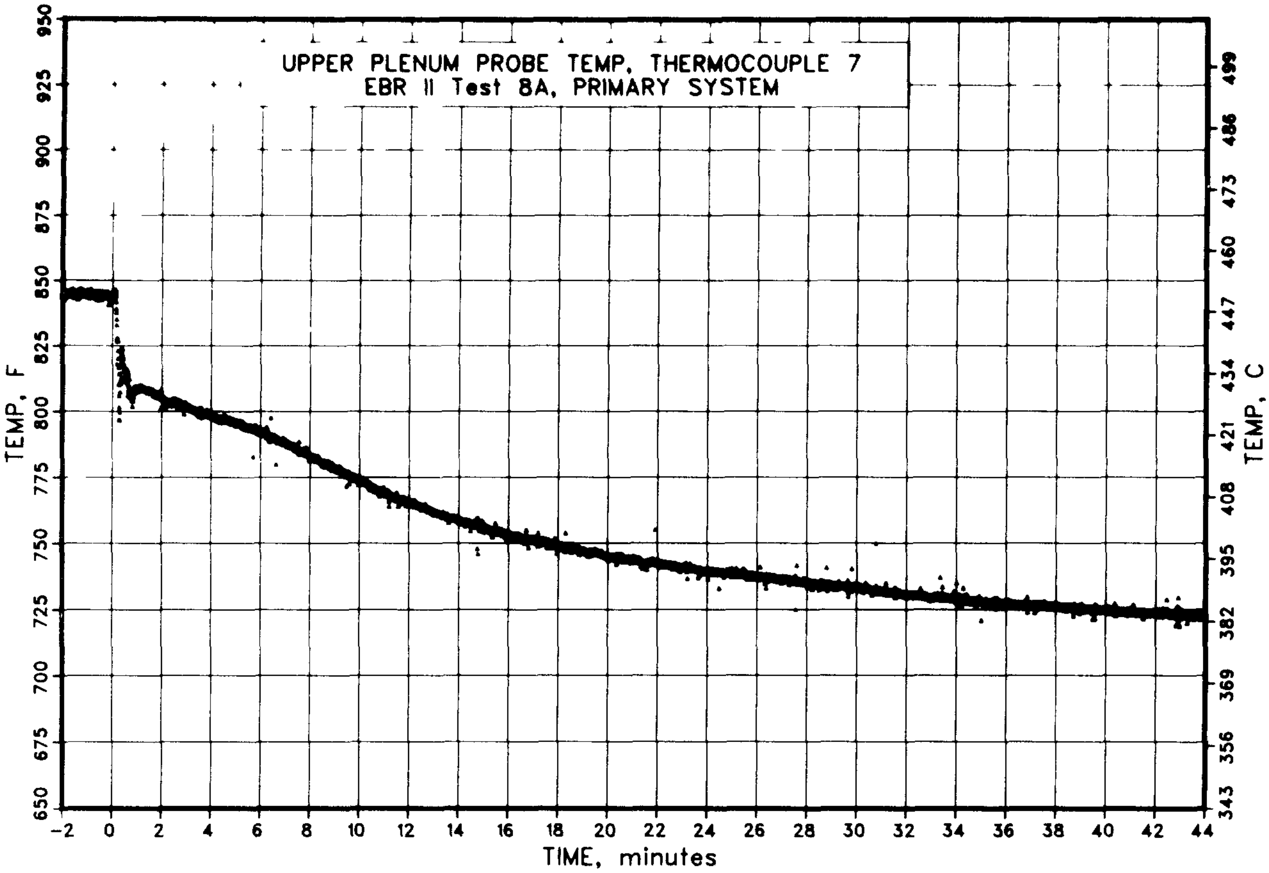
UPPER PLENUM PROBE TEMP, THERMOCOUPLE 7
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
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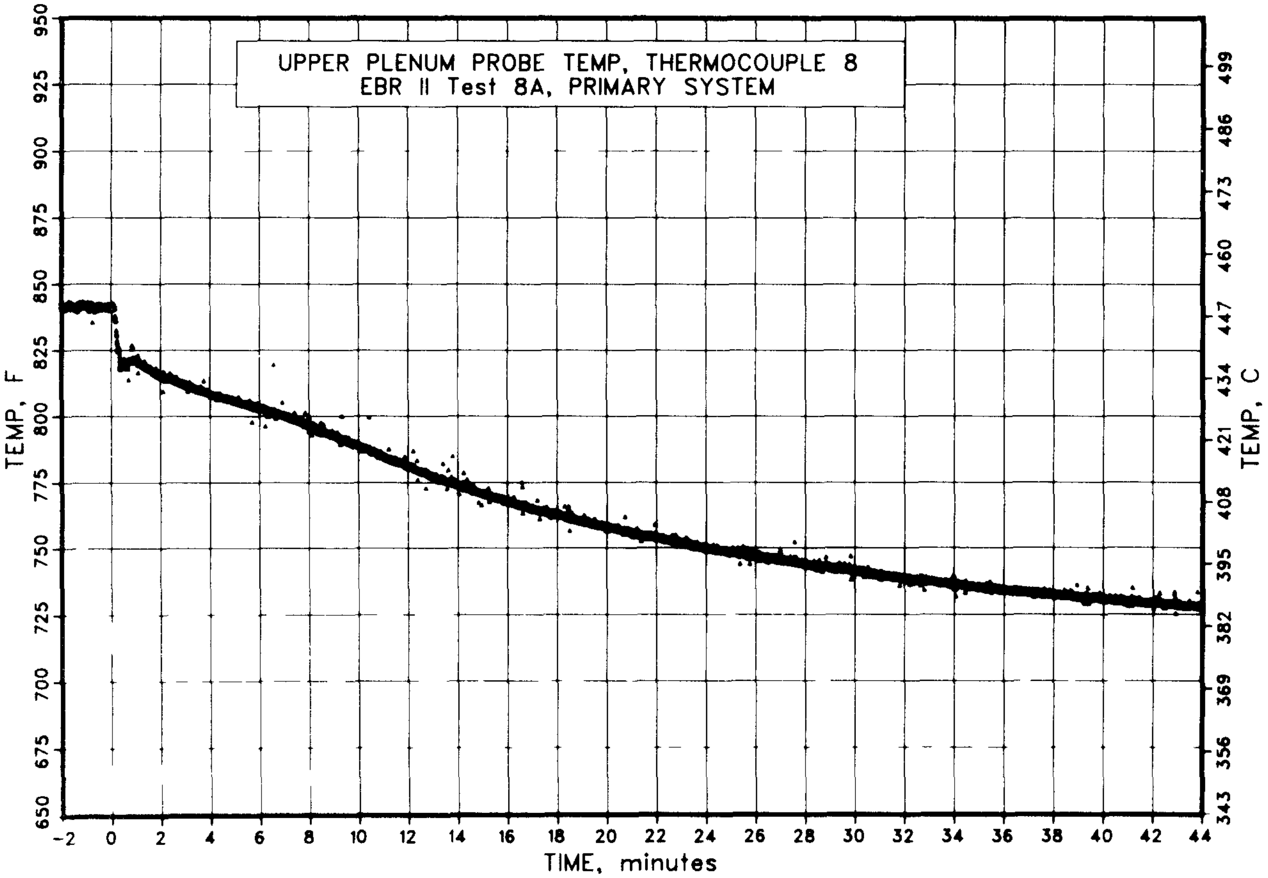
421
408
395
382
369
356
343
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 8
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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925
900
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850
825
800
775
750
725
700
675
650
499
486
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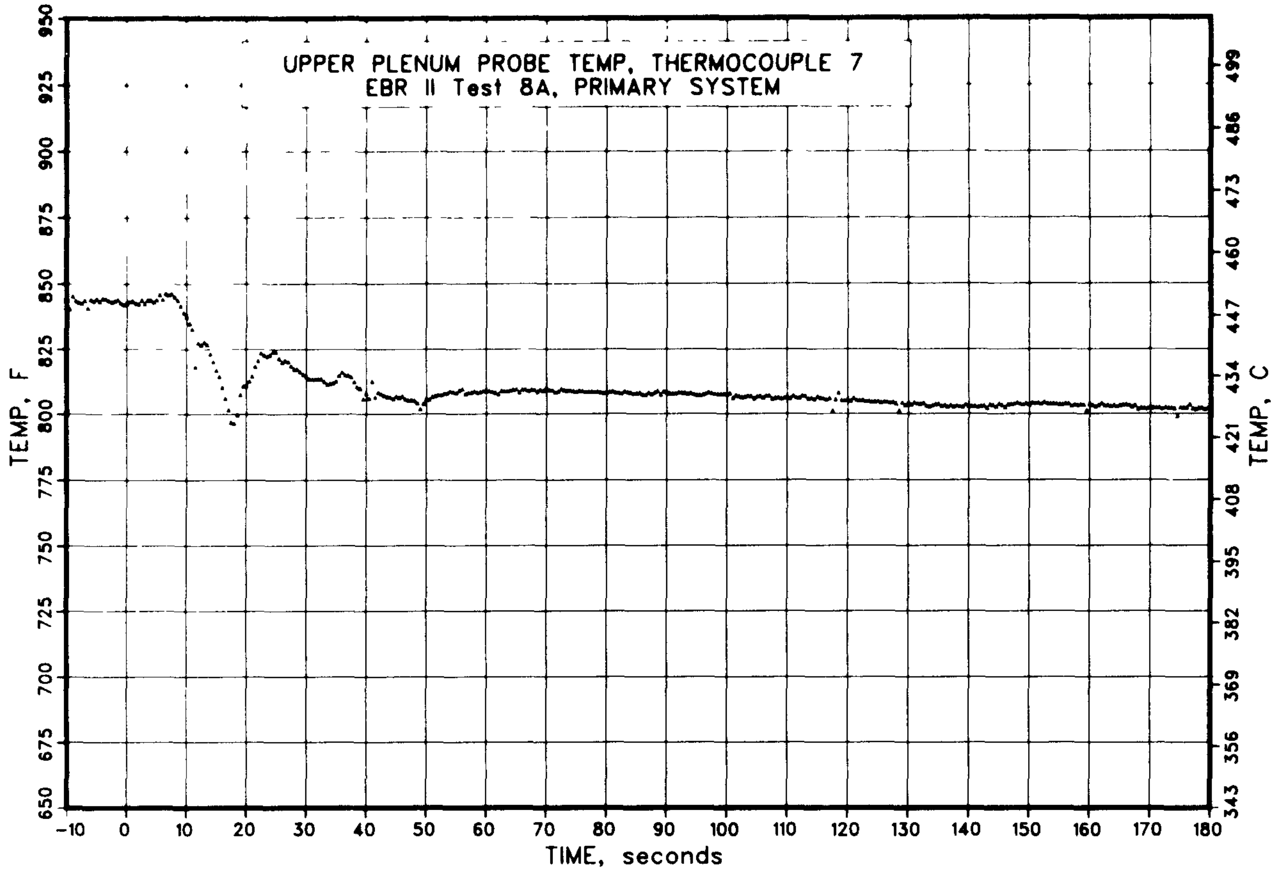
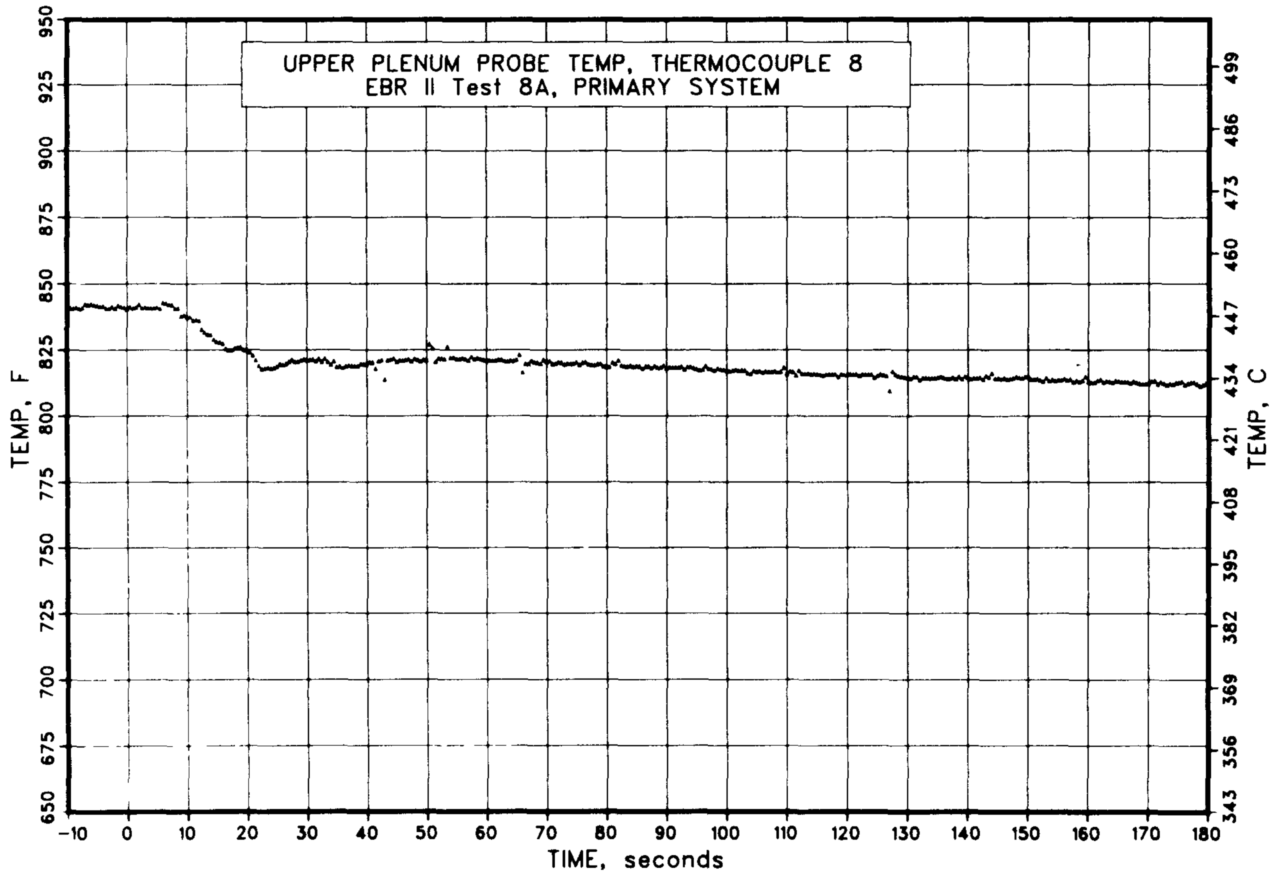
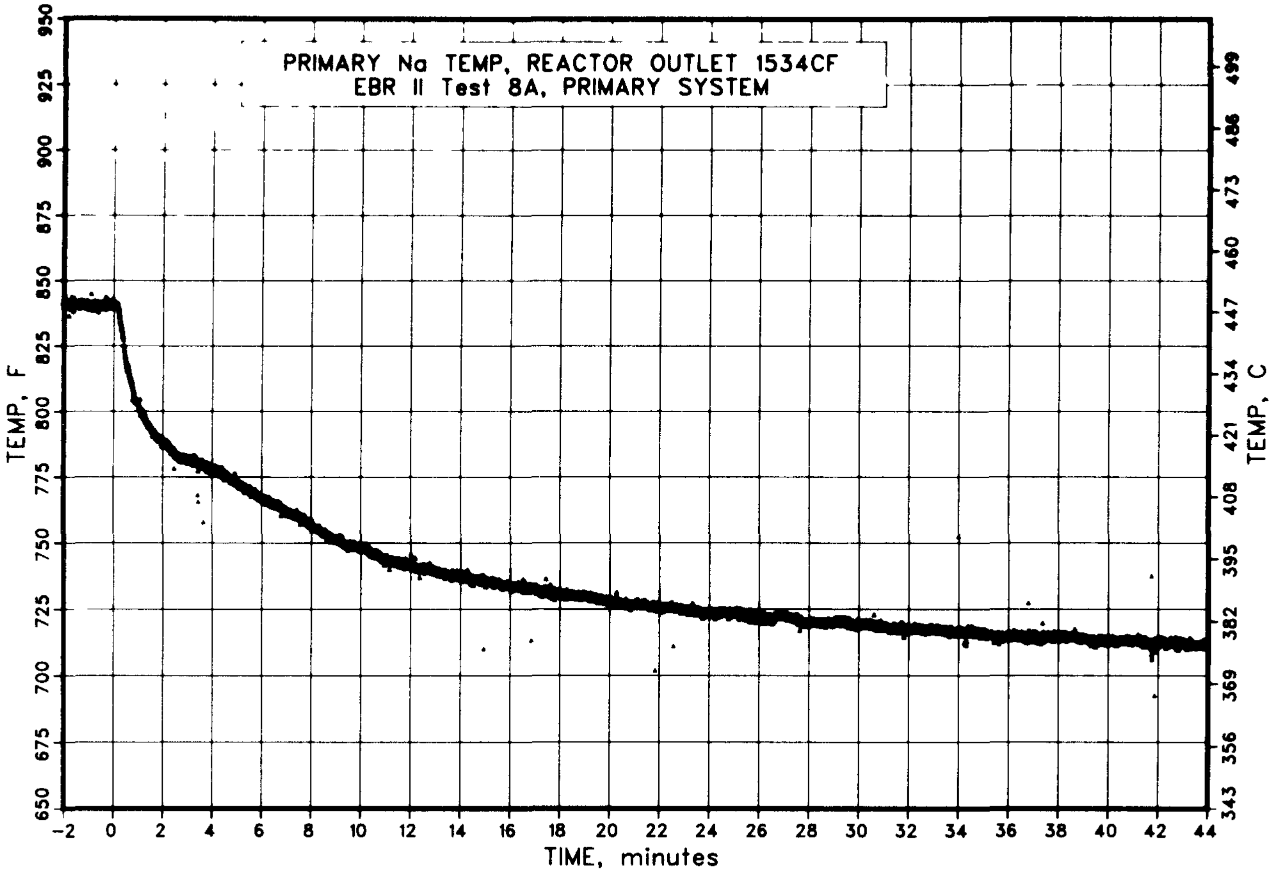

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 7
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 8
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, REACTOR OUTLET 1534CF
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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675
700
725
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775
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825
850
875
900
925
950
343
356
369
382
395
408
421
434
447
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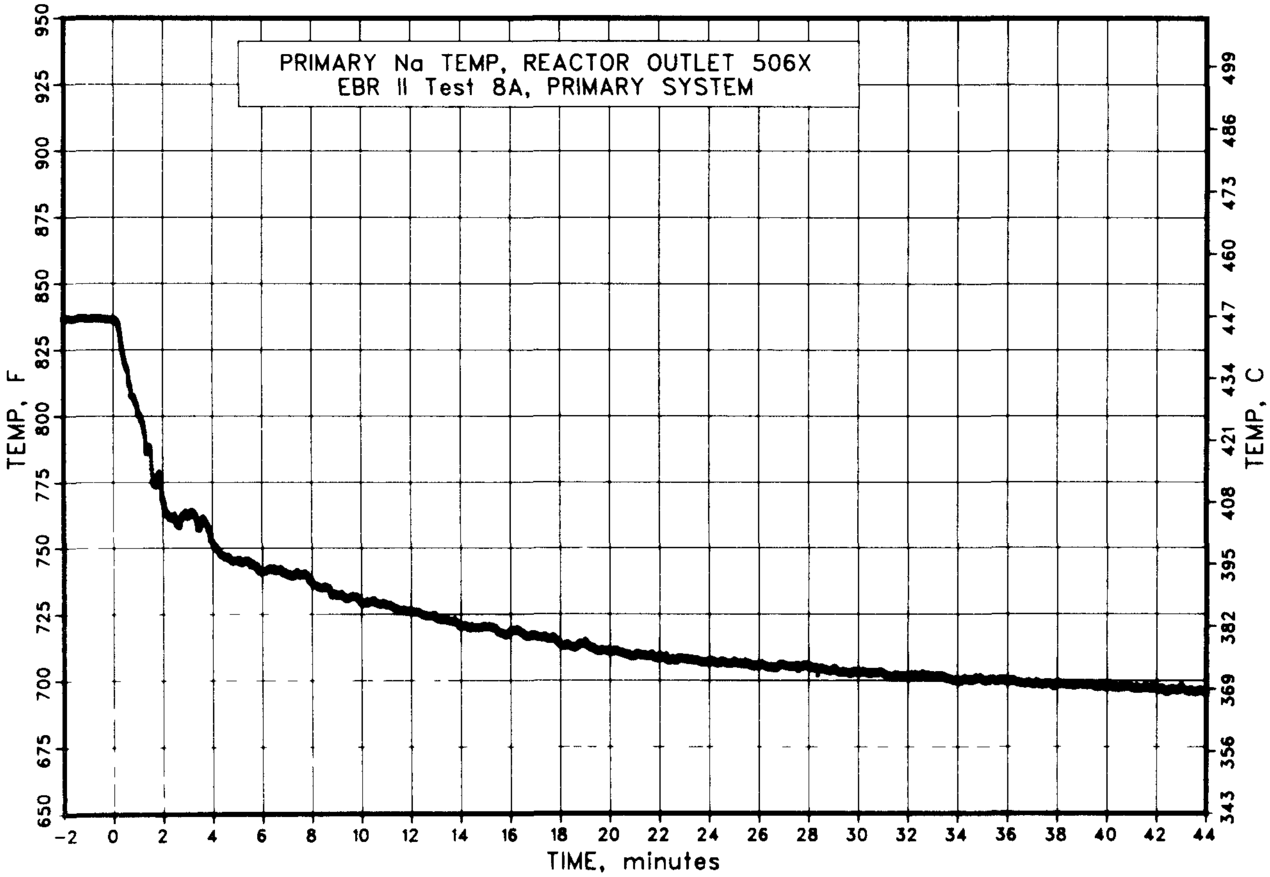
PRIMARY Na TEMP, REACTOR OUTLET 506X
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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700
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775
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825
850
875
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925
950
343
356
369
382
395
408
421
434
447
460
473
486
499
-2
0
2
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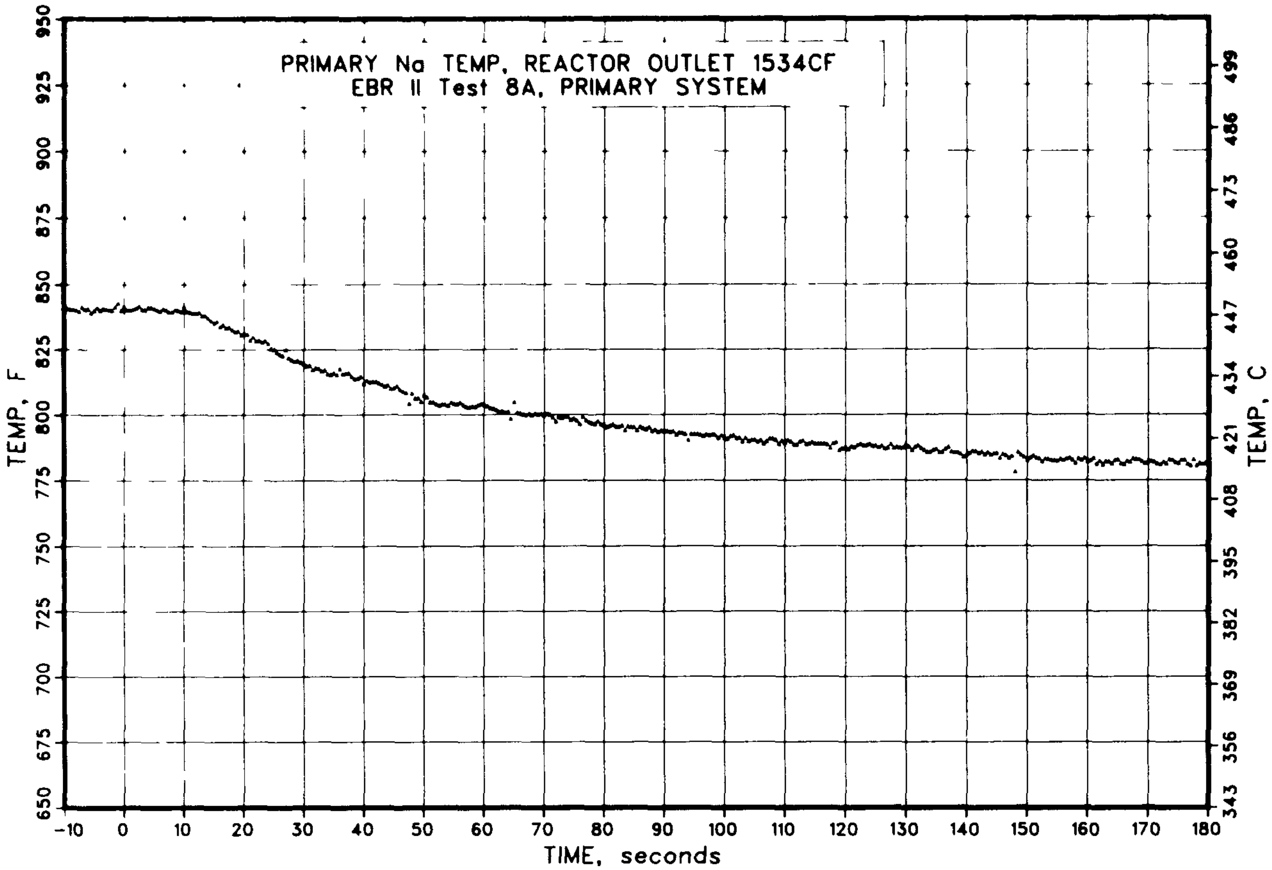
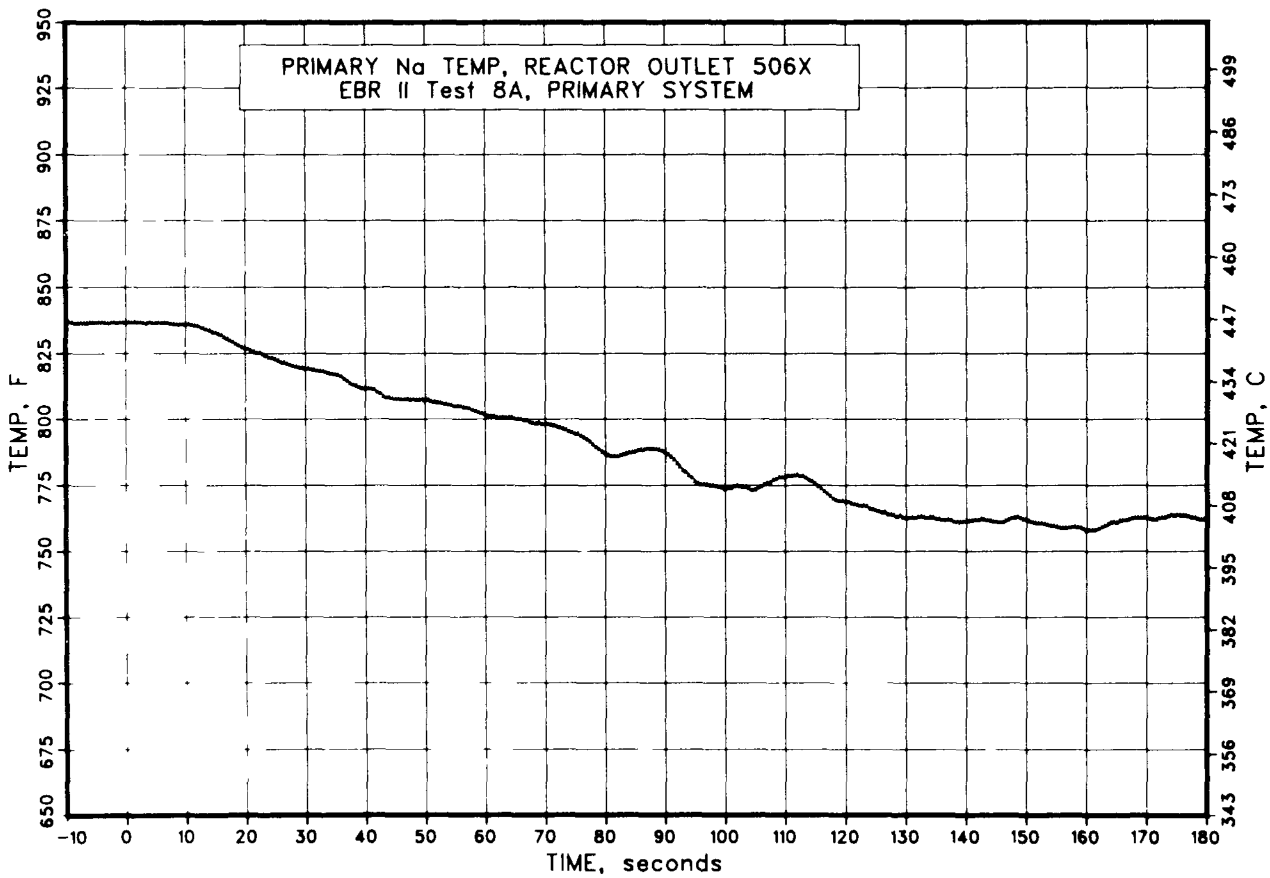
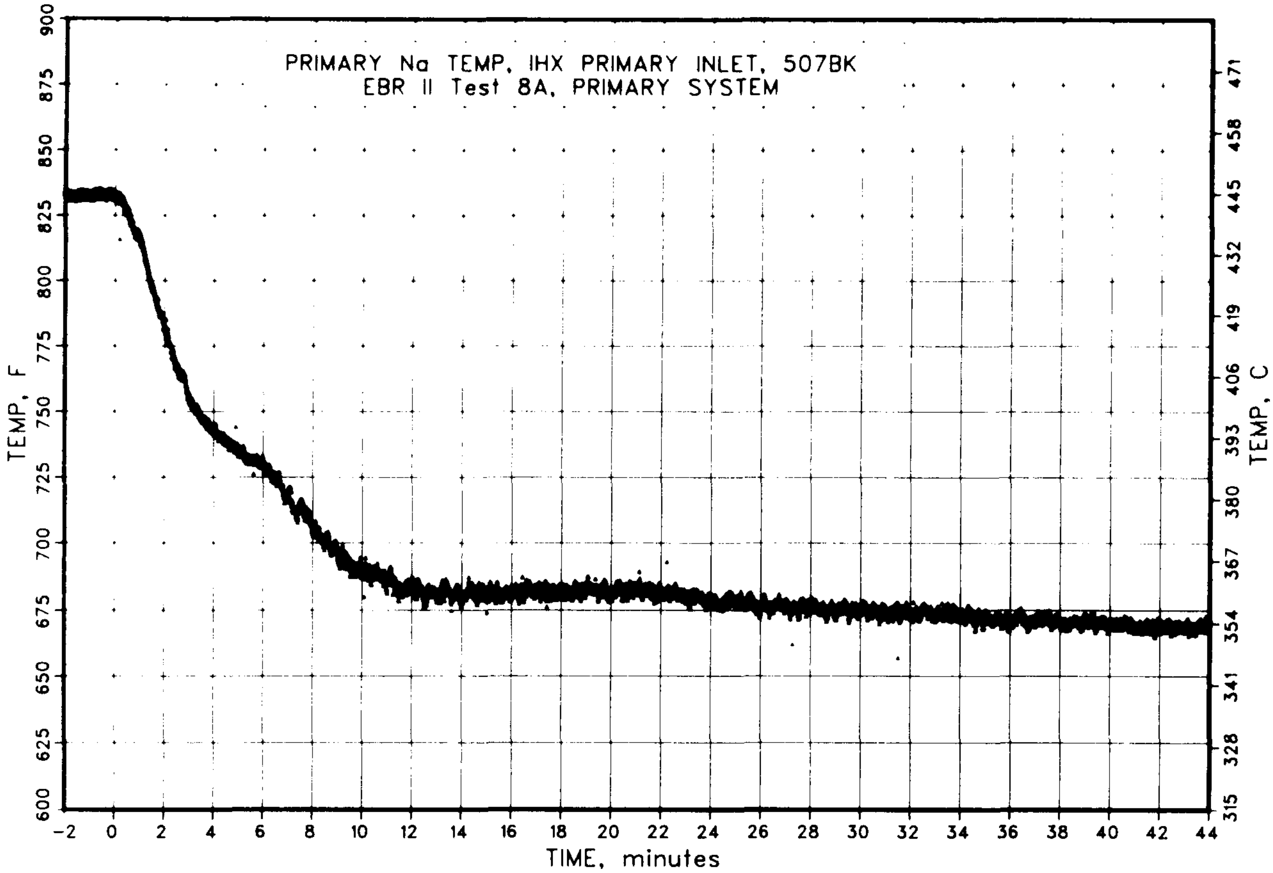
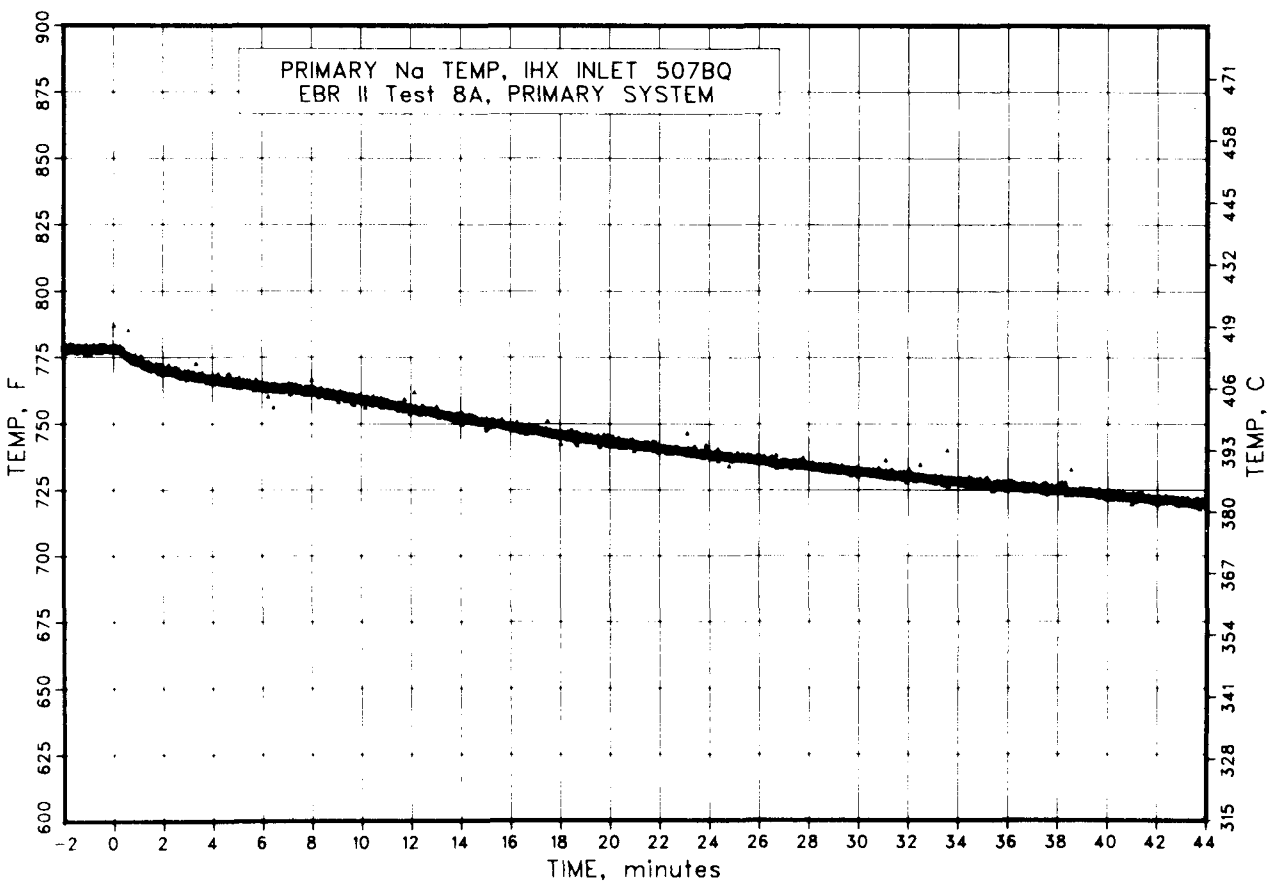
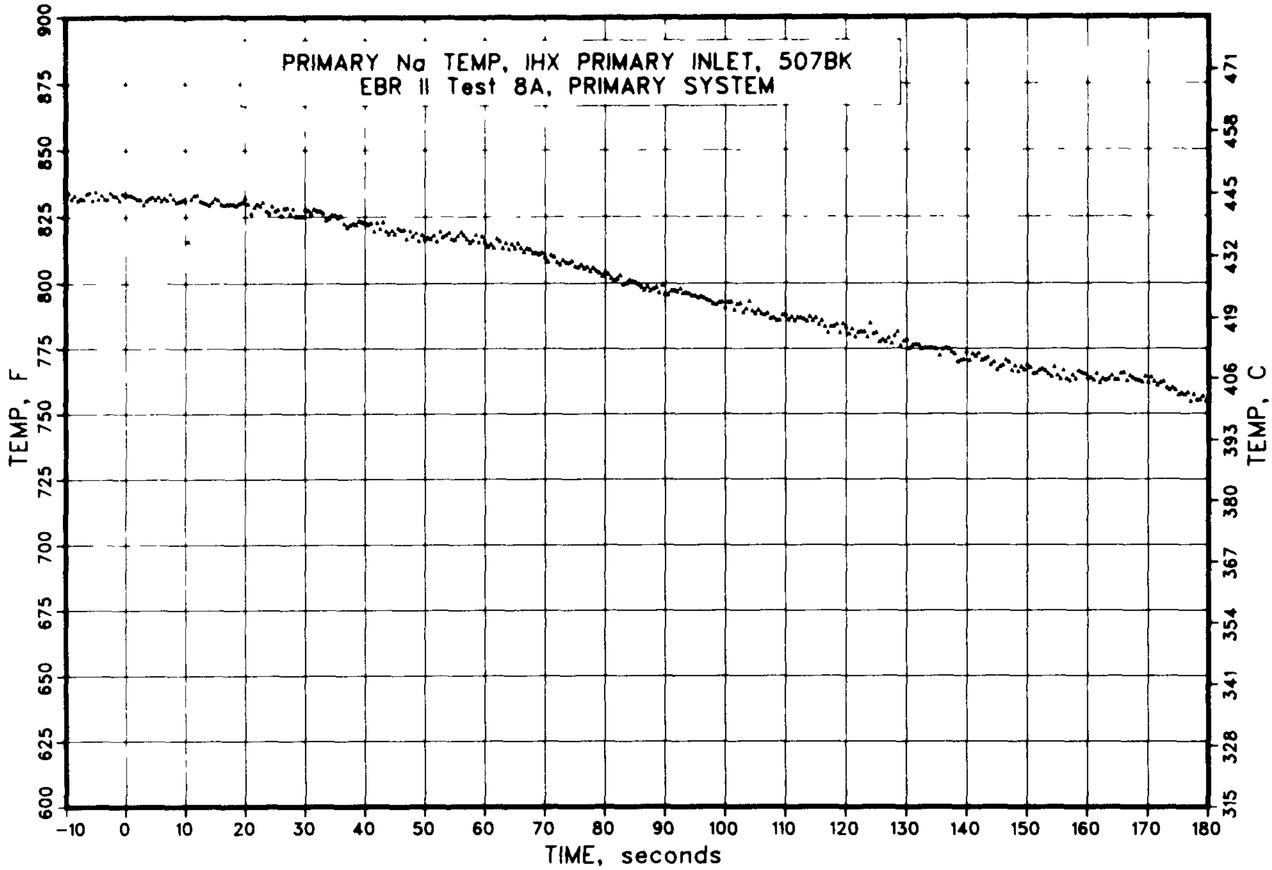
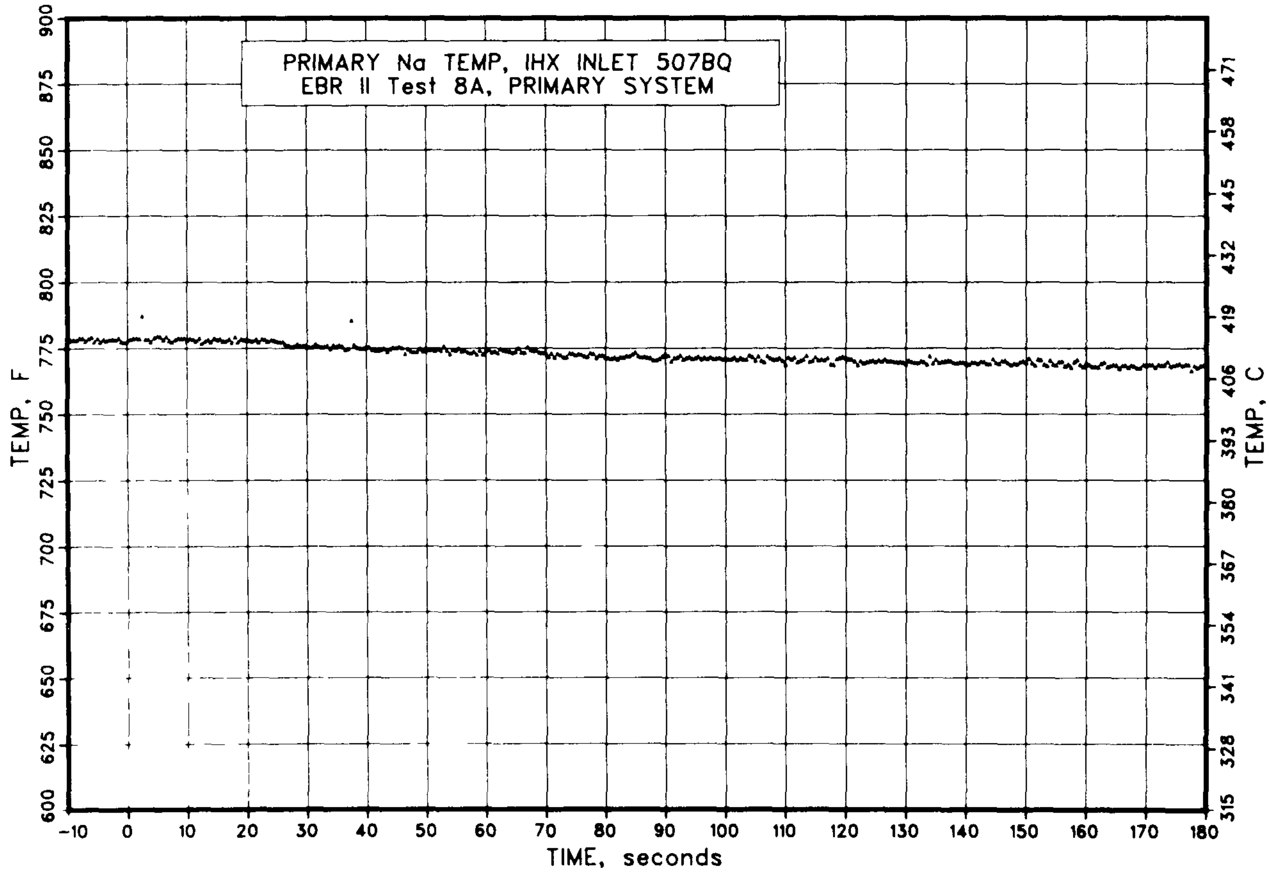

PRIMARY Na TEMP, REACTOR OUTLET 1534CF
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

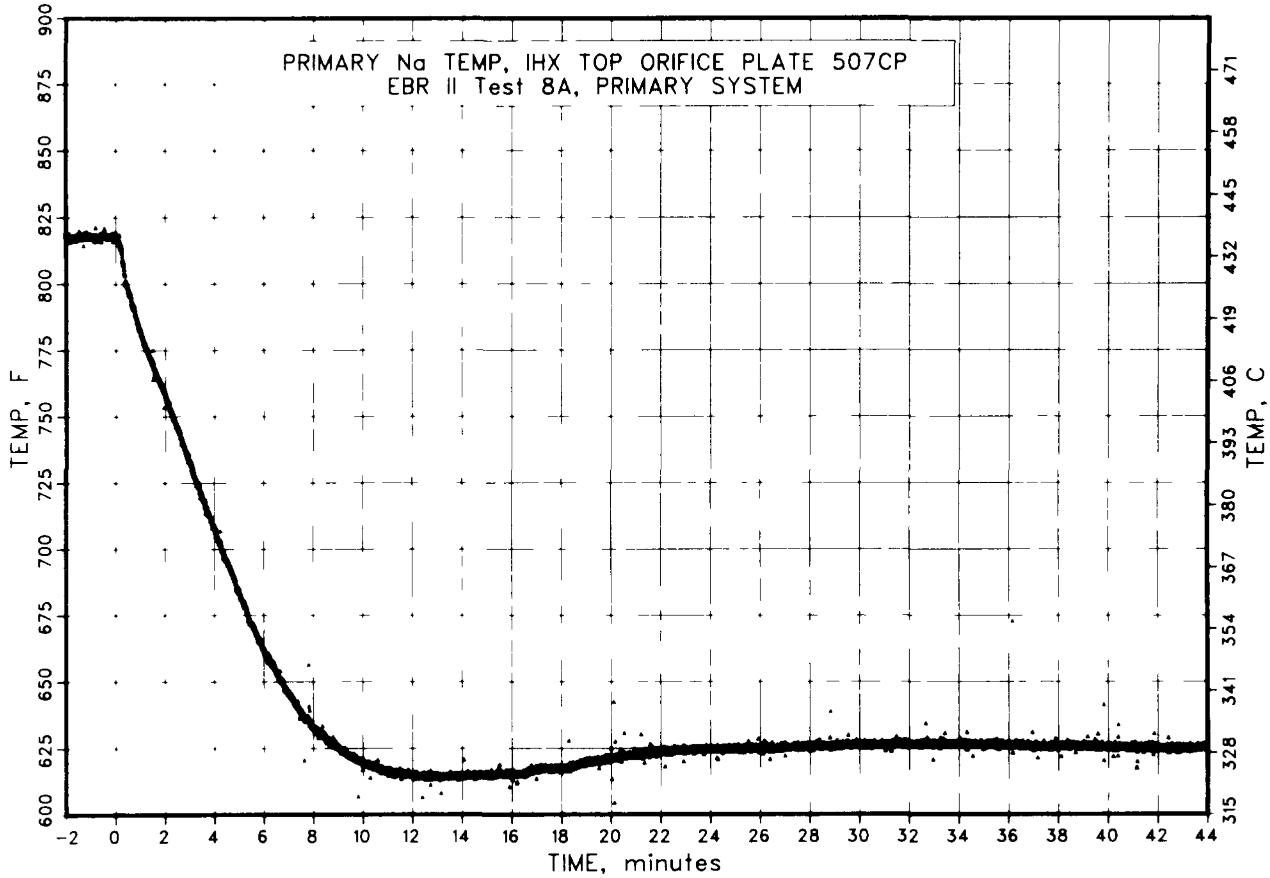

PRIMARY Na TEMP, REACTOR OUTLET 506X
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


PRIMARY Na TEMP, IHX PRIMARY INLET, 507BK
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX INLET 507BQ
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX PRIMARY INLET, 507BK
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
TIME, seconds
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


PRIMARY Na TEMP, IHX INLET 507BQ
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
TIME, seconds
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180


PRIMARY Na TEMP, IHX TOP ORIFICE PLATE 507CP
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
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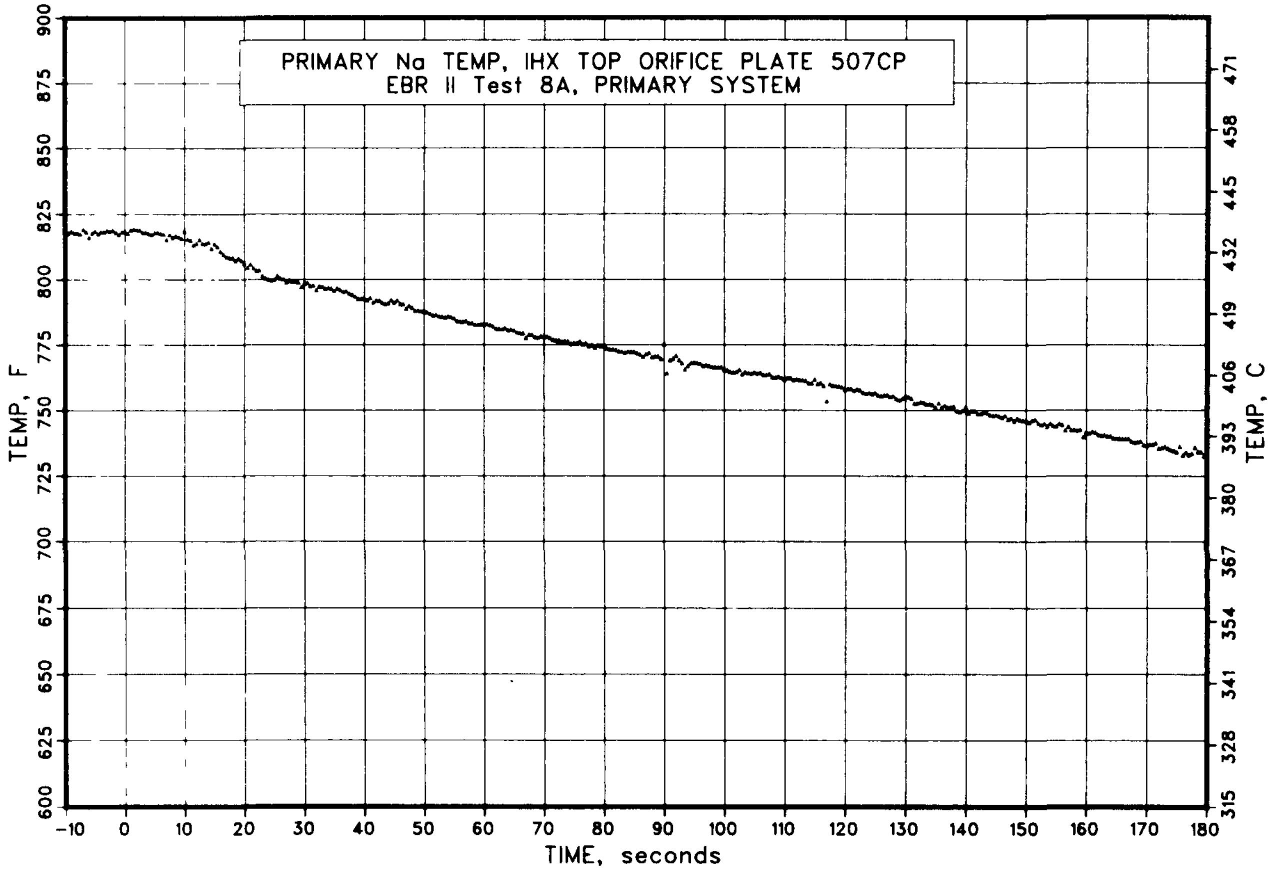
36
38
40
42
44


PRIMARY Na TEMP, IHX TOP ORIFICE PLATE 507CP
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-10
0
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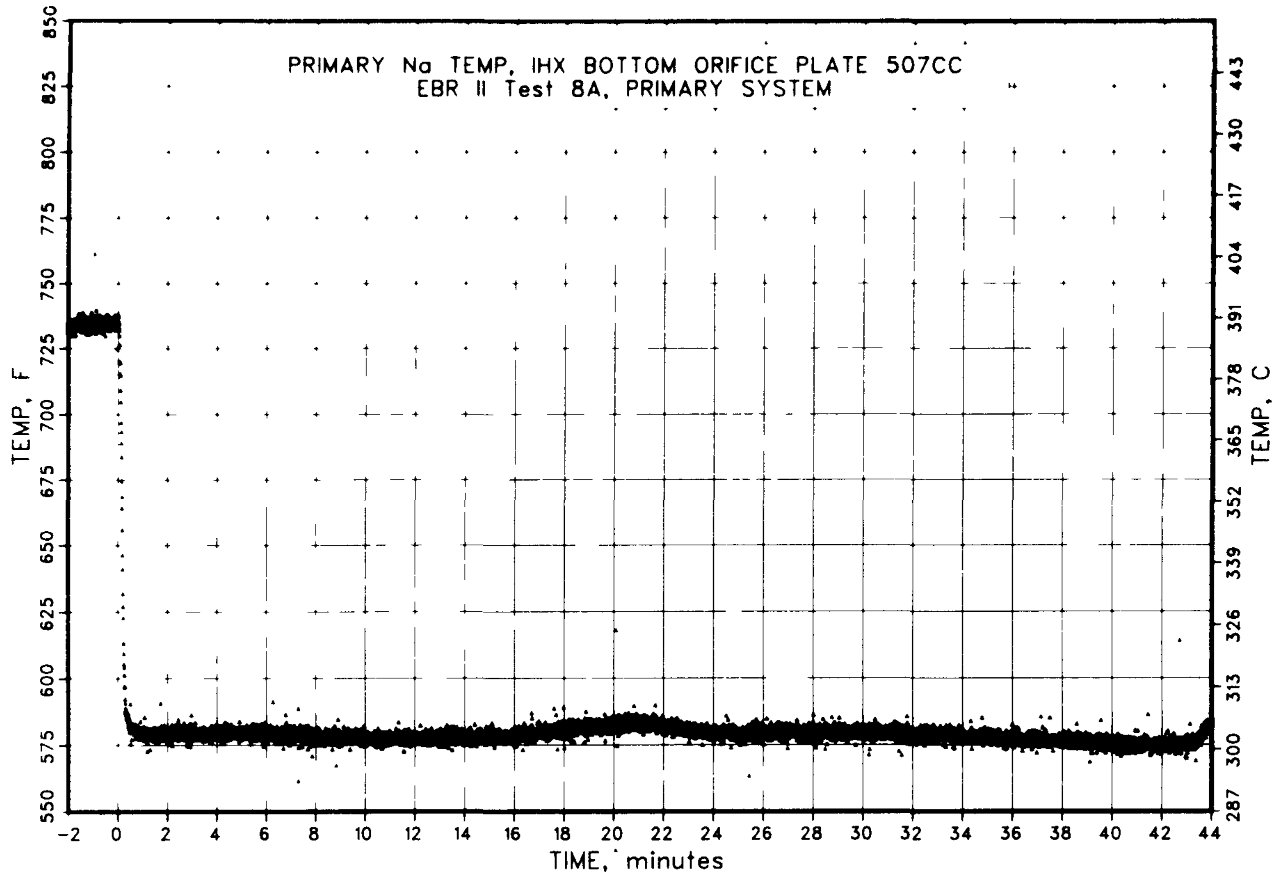
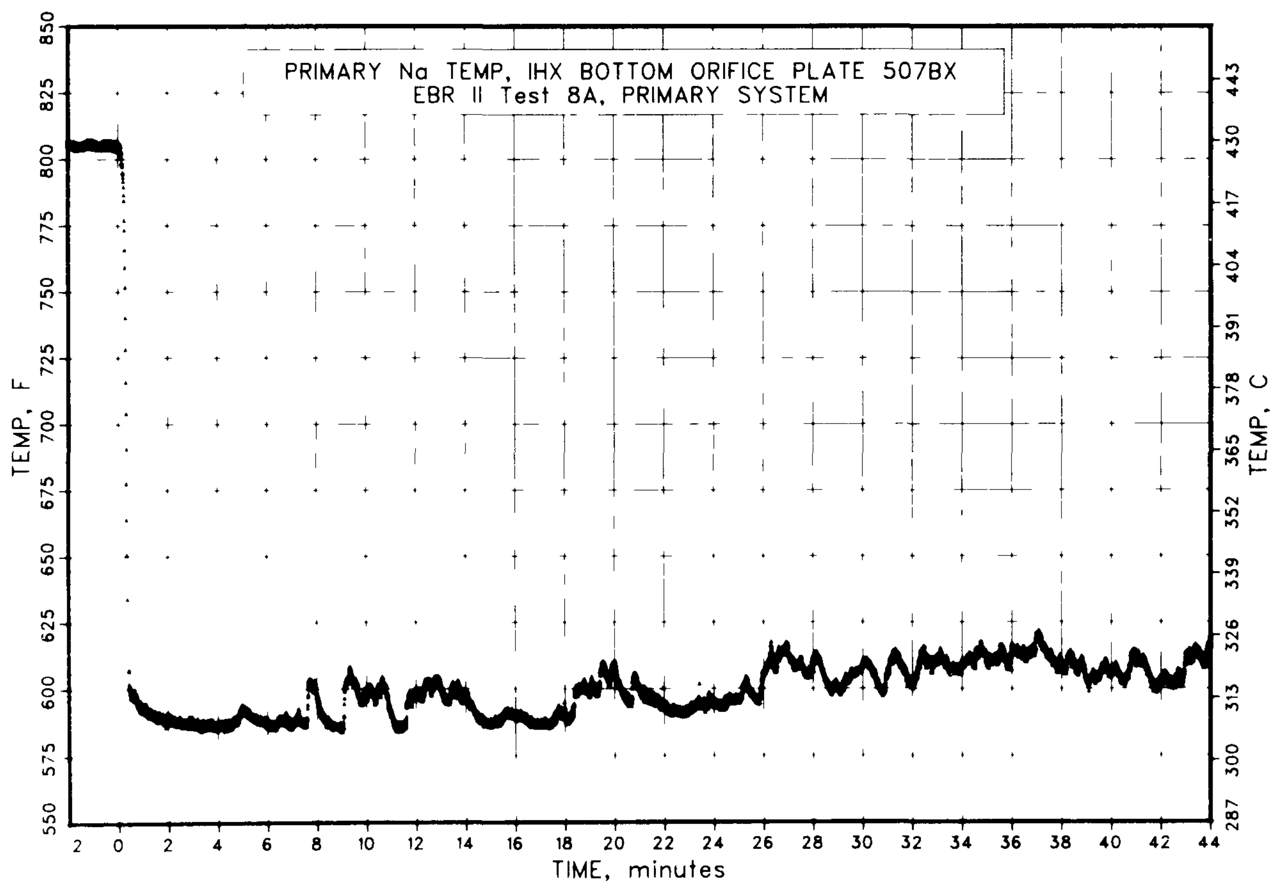
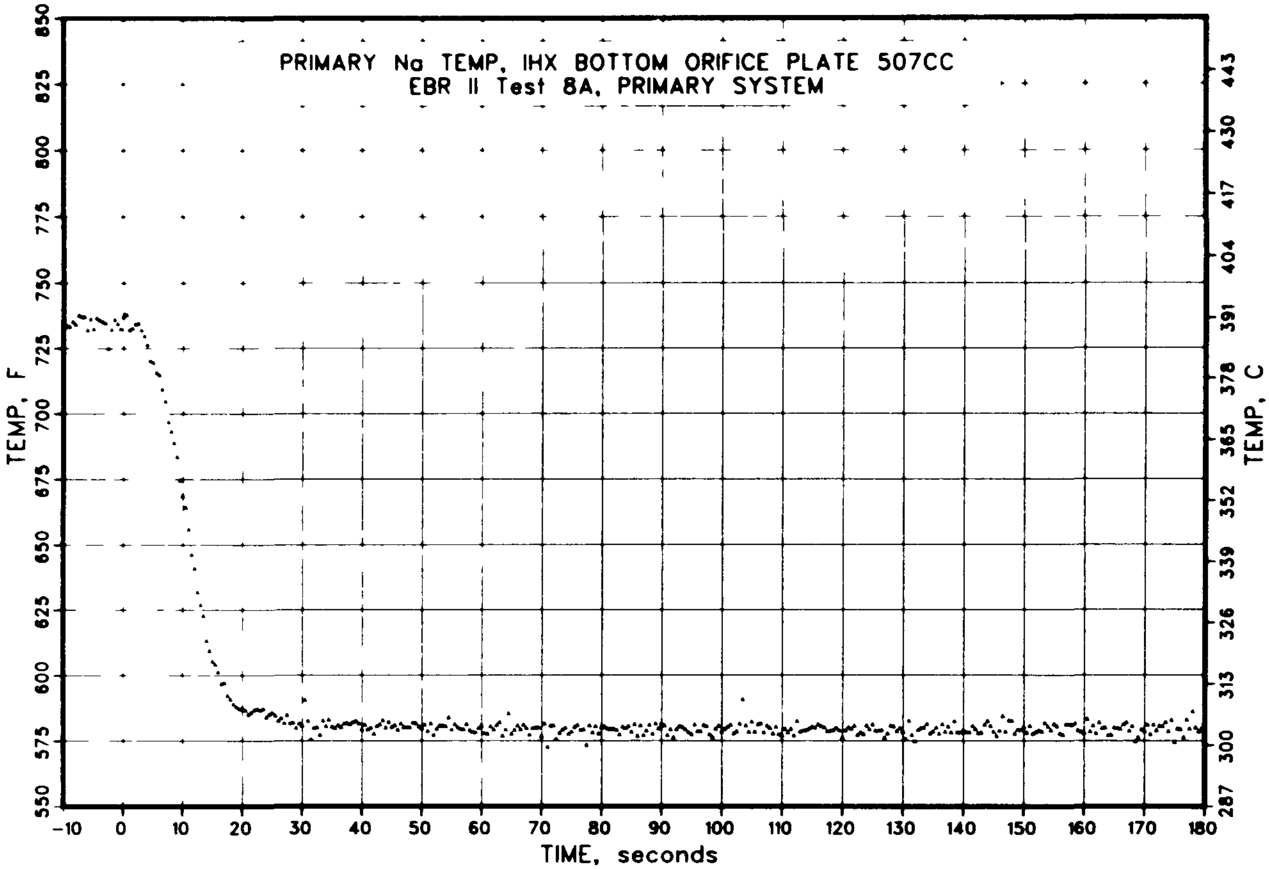
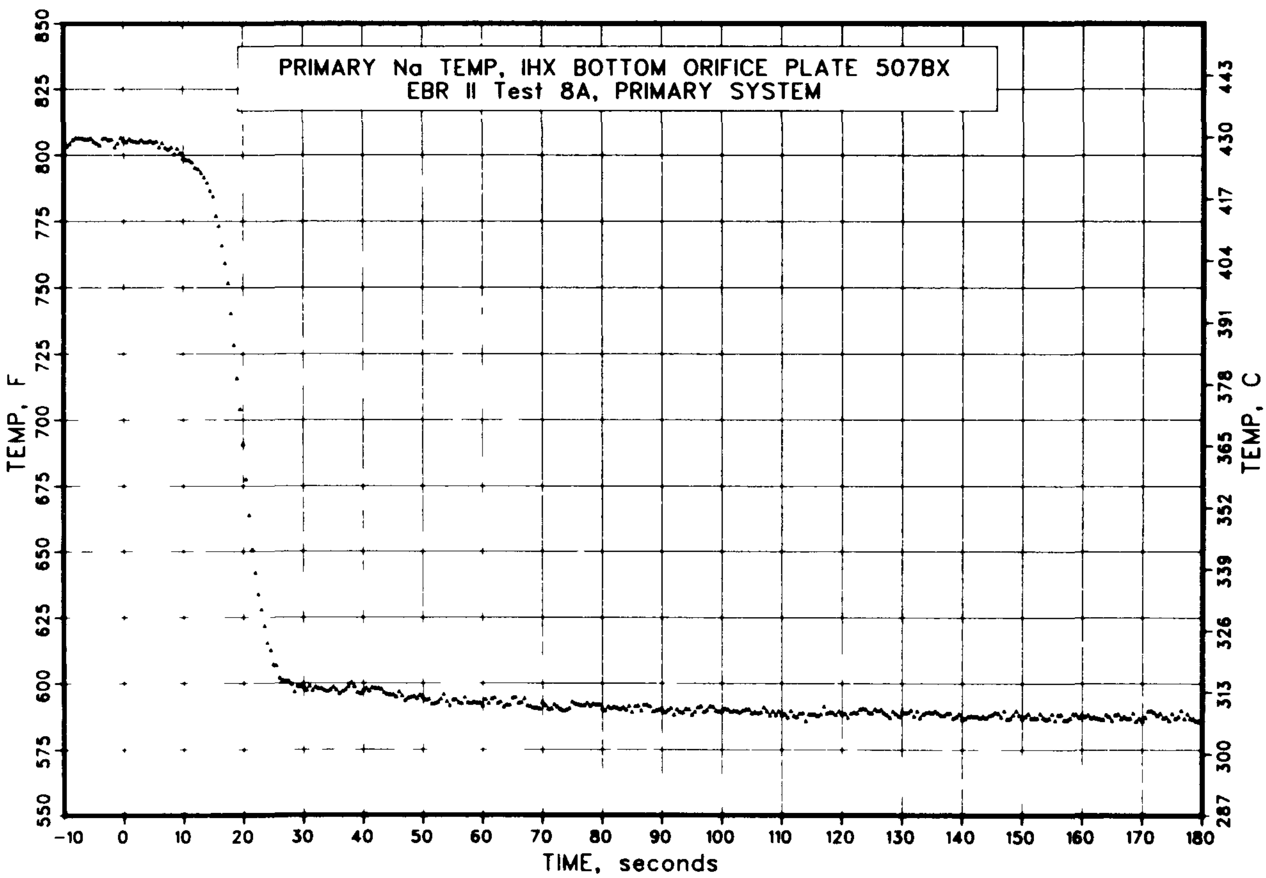
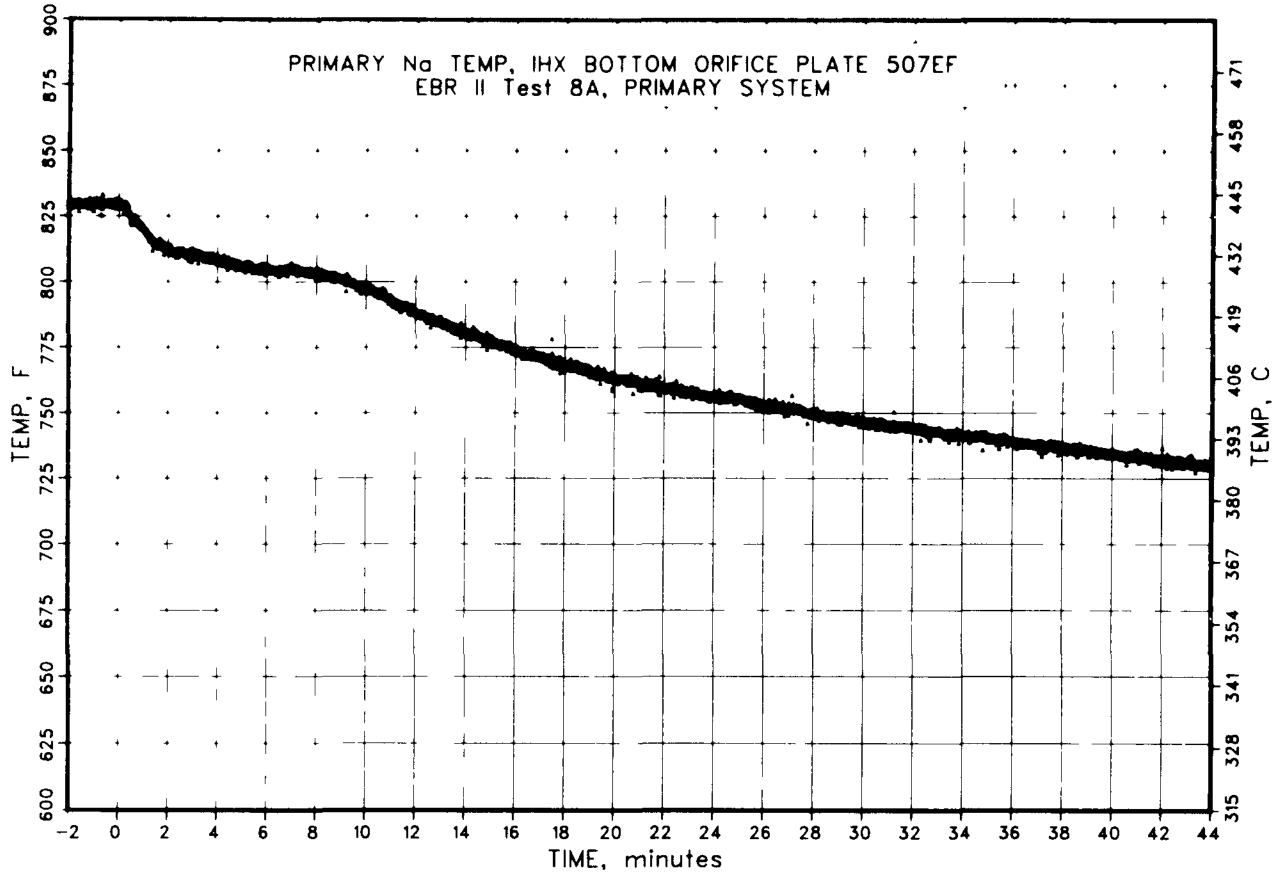
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CC
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507BX
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CC
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507BX
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EF
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
600
625
650
675
700
725
750
775
800
825
850
875
900
315
328
341
354
367
380
393
406
419
432
445
458
471
-2
0
2
4
6
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14
16
18
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30
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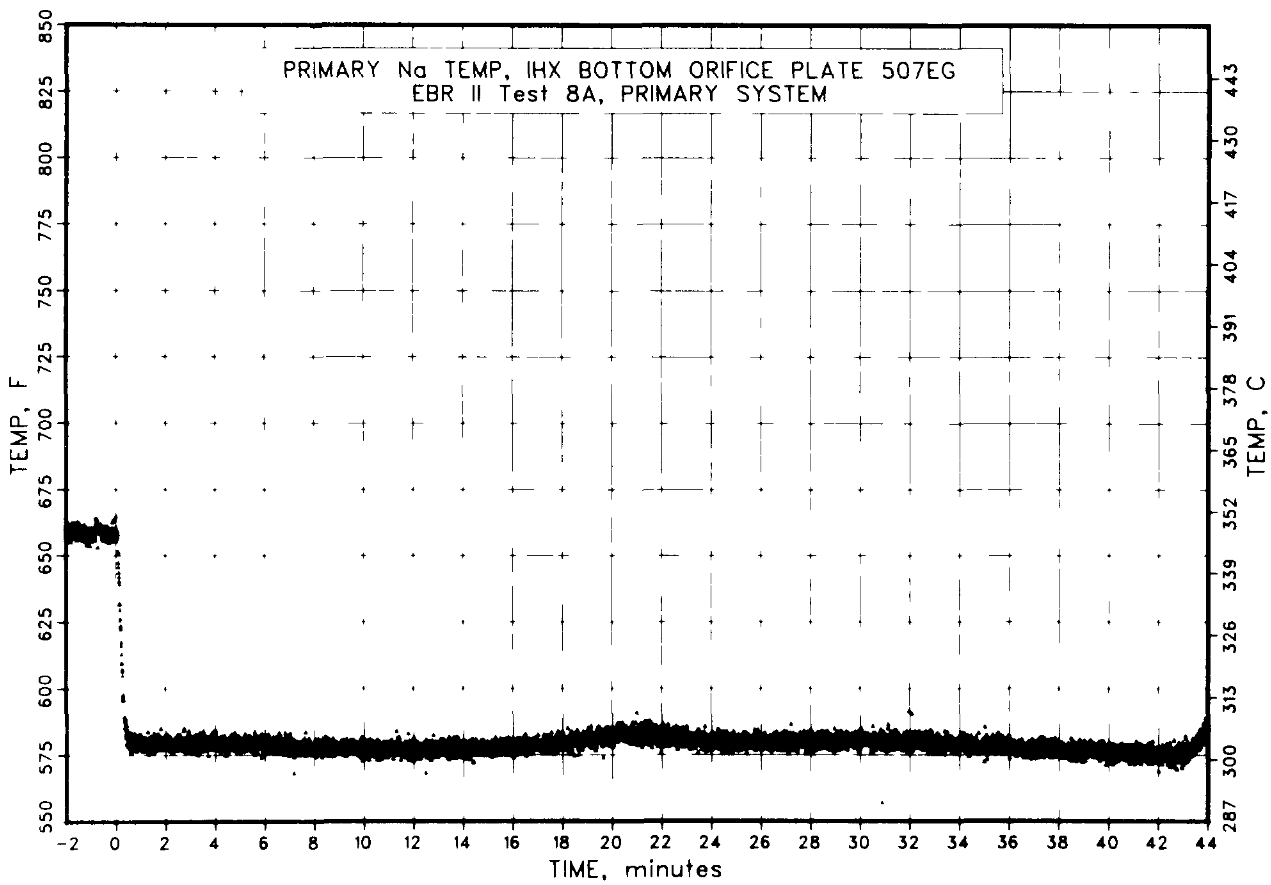
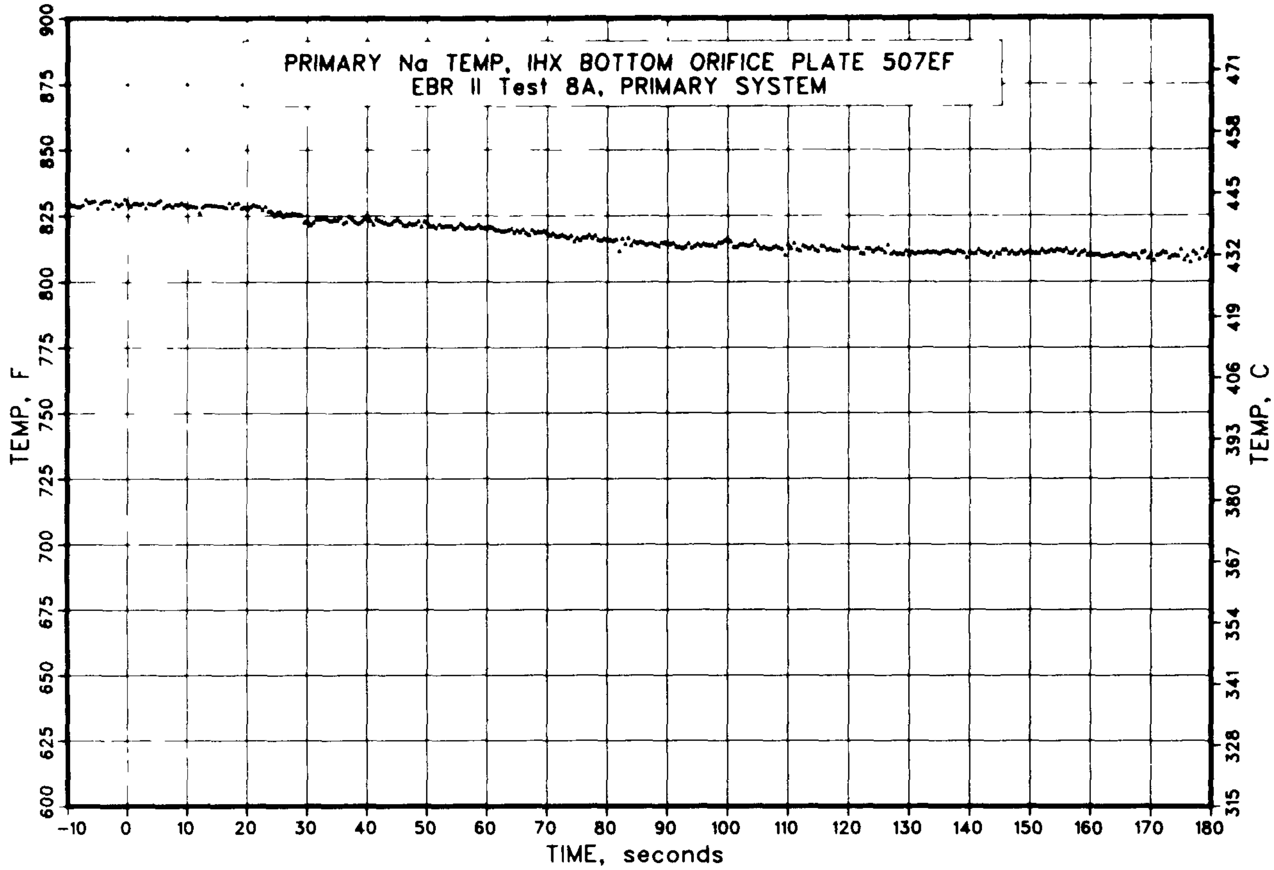
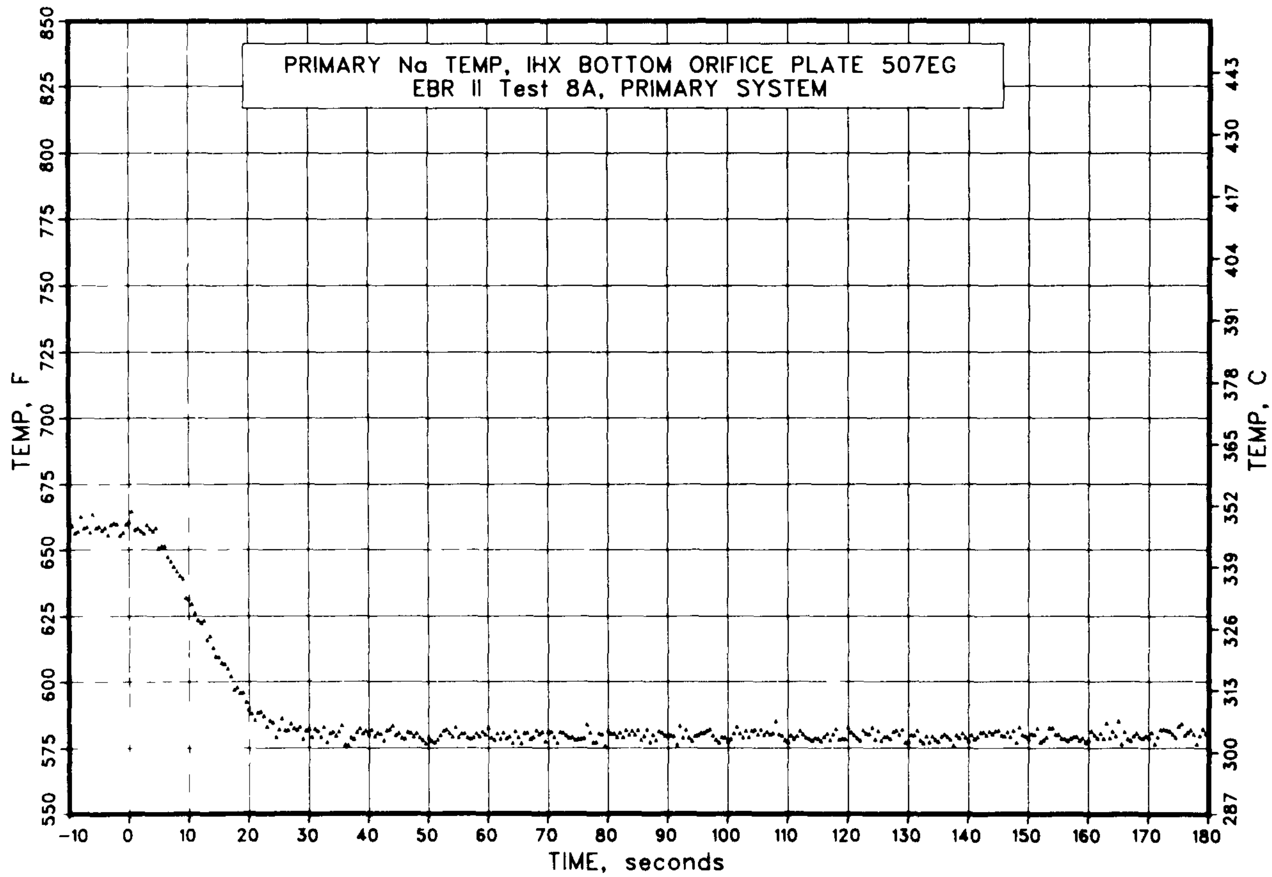
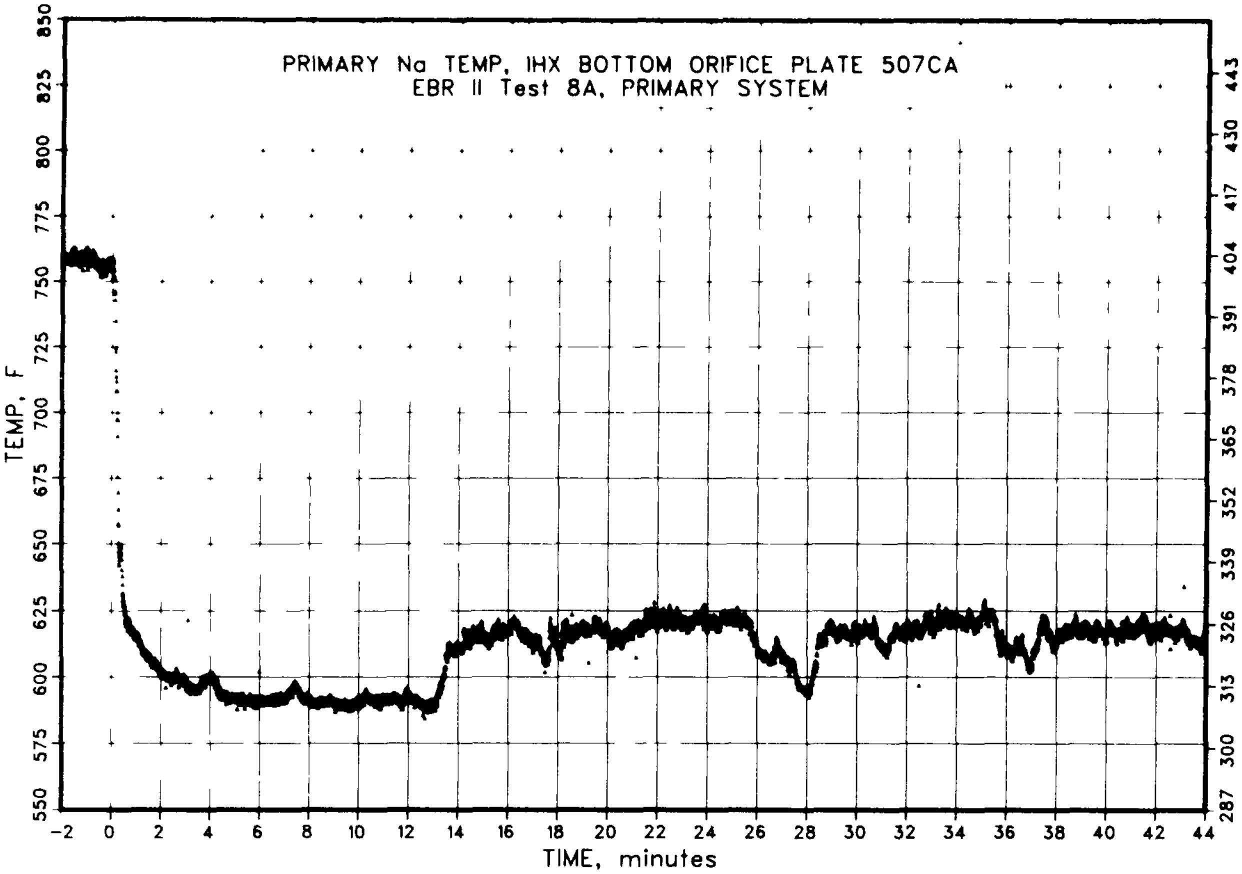
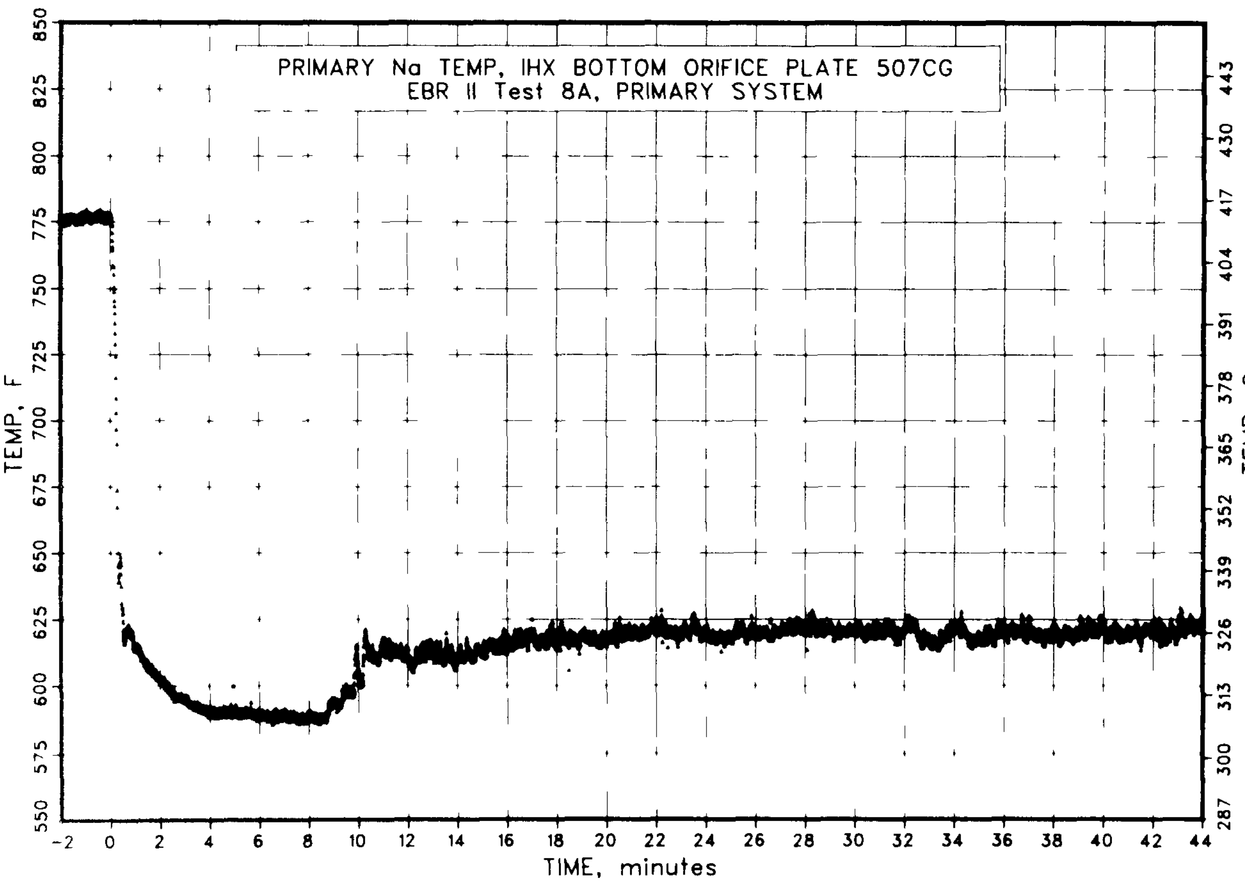
42
44

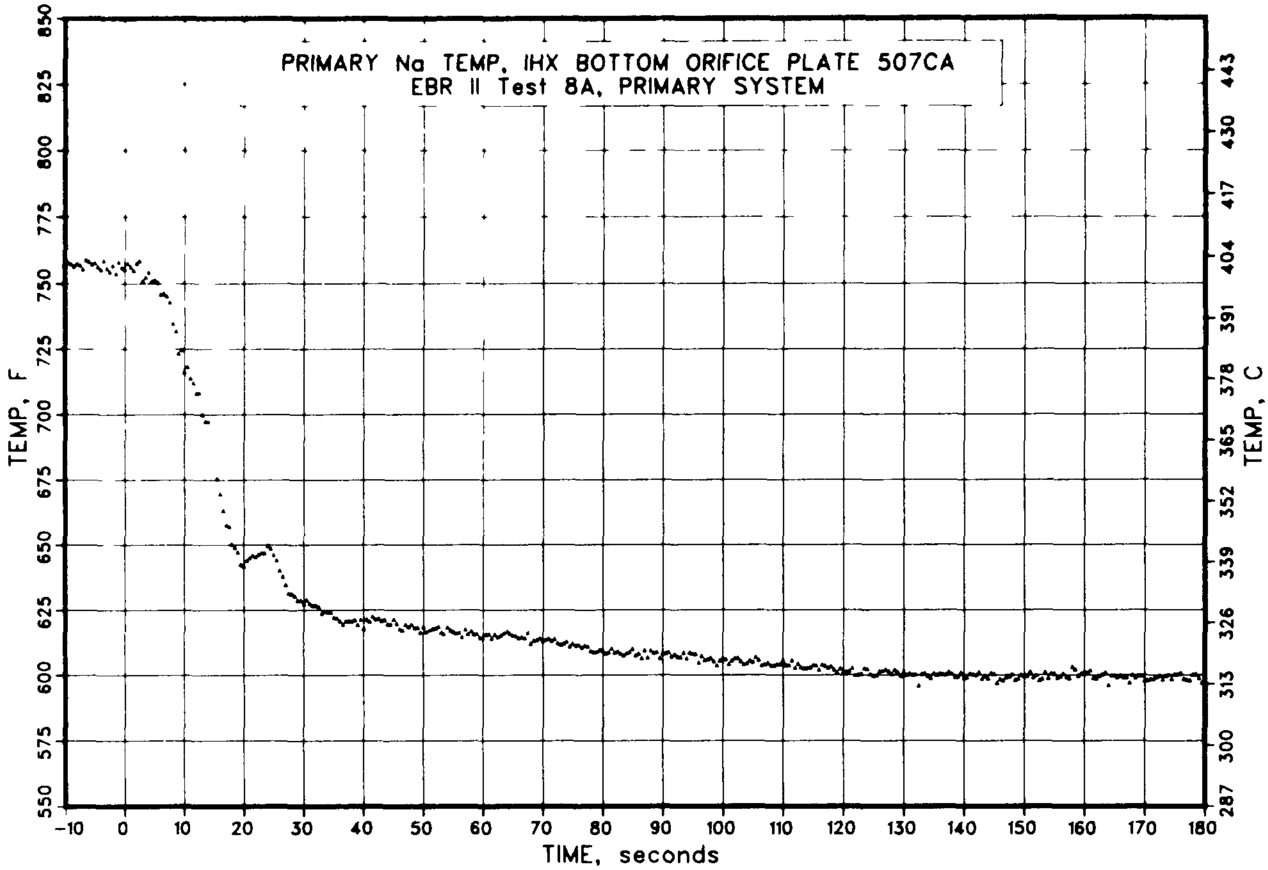

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
550
575
600
625
650
675
700
725
750
775
800
825
850
287
300
313
326
339
352
365
378
391
404
417
430
443
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EF
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CA
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CA
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-10
0
10
20
30
40
50
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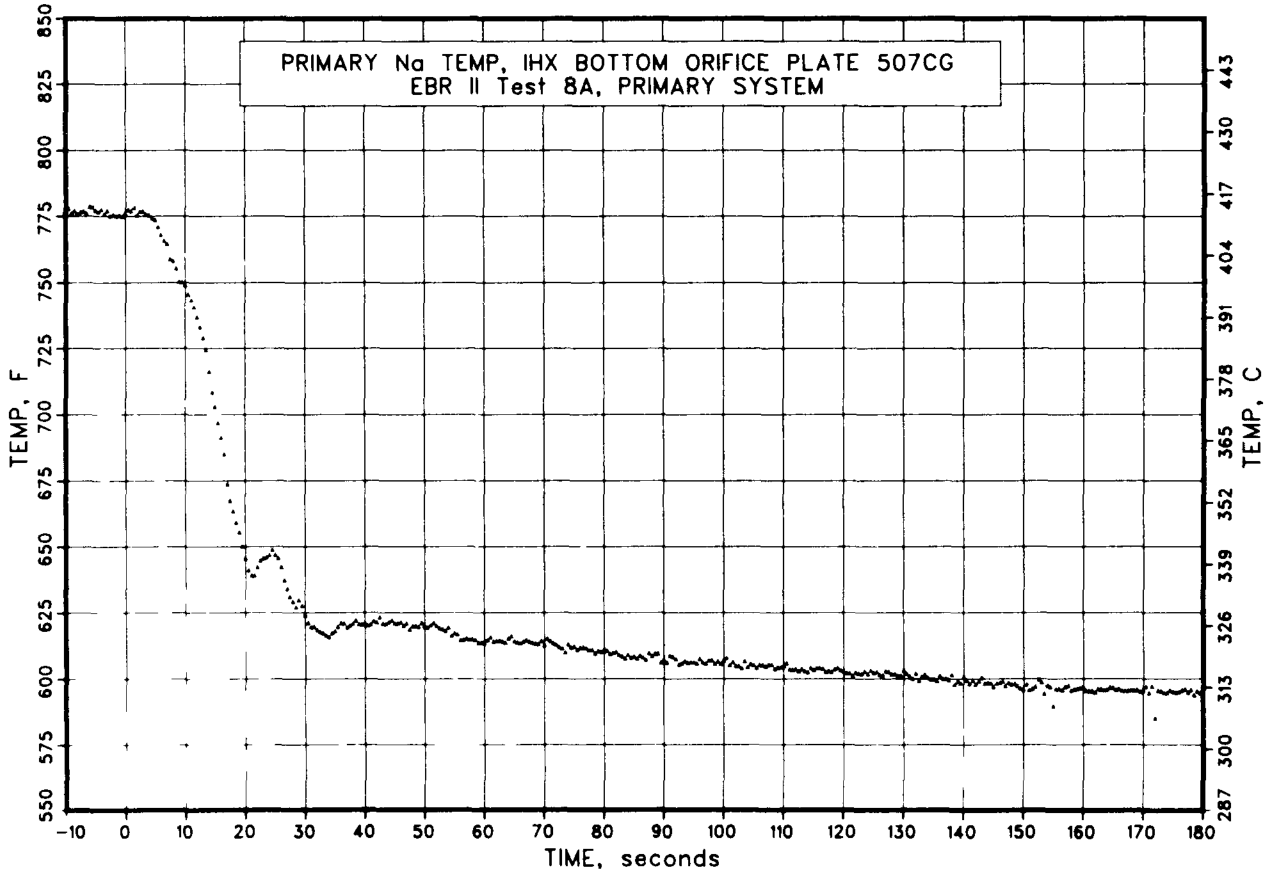
70
80
90
100
110
120
130
140
150
160
170
180


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CG
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-10
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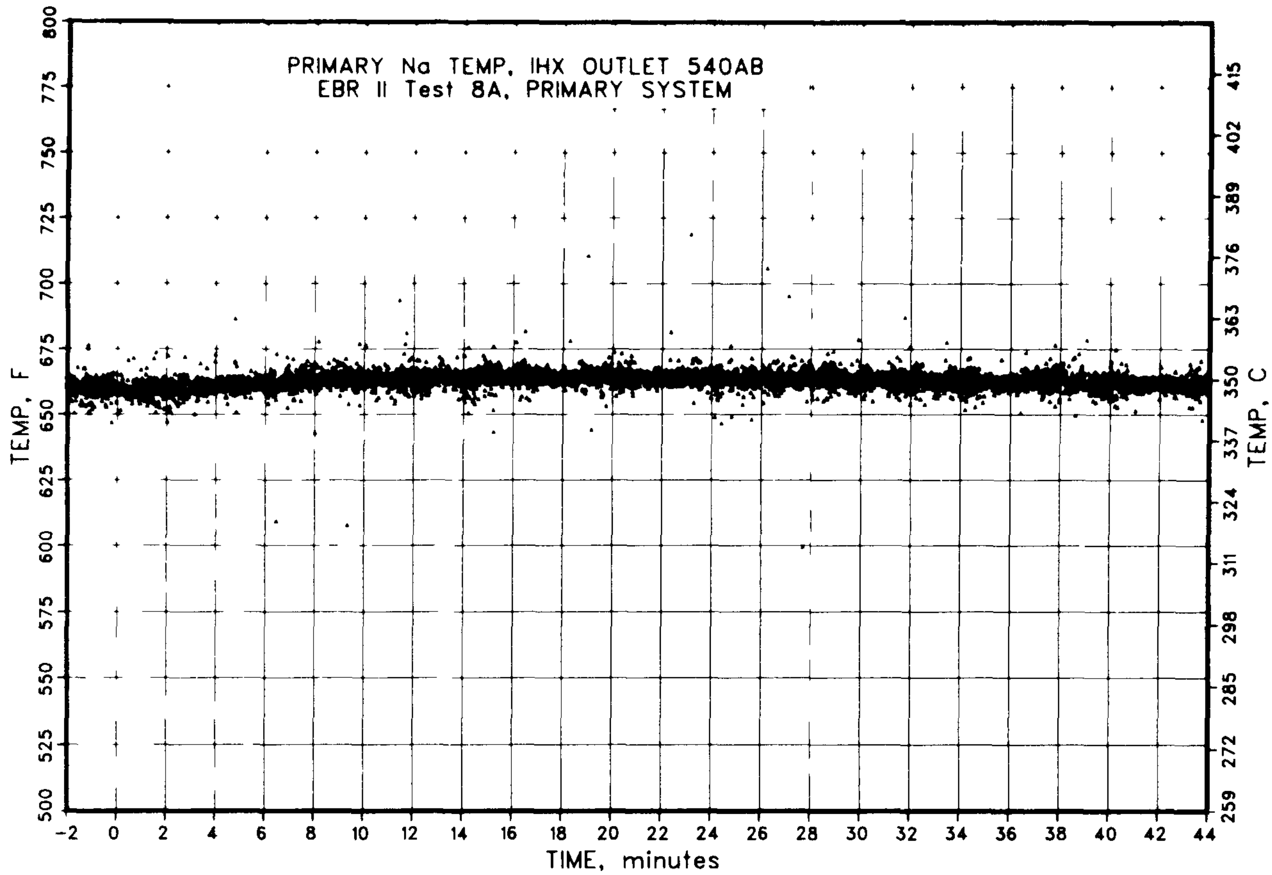
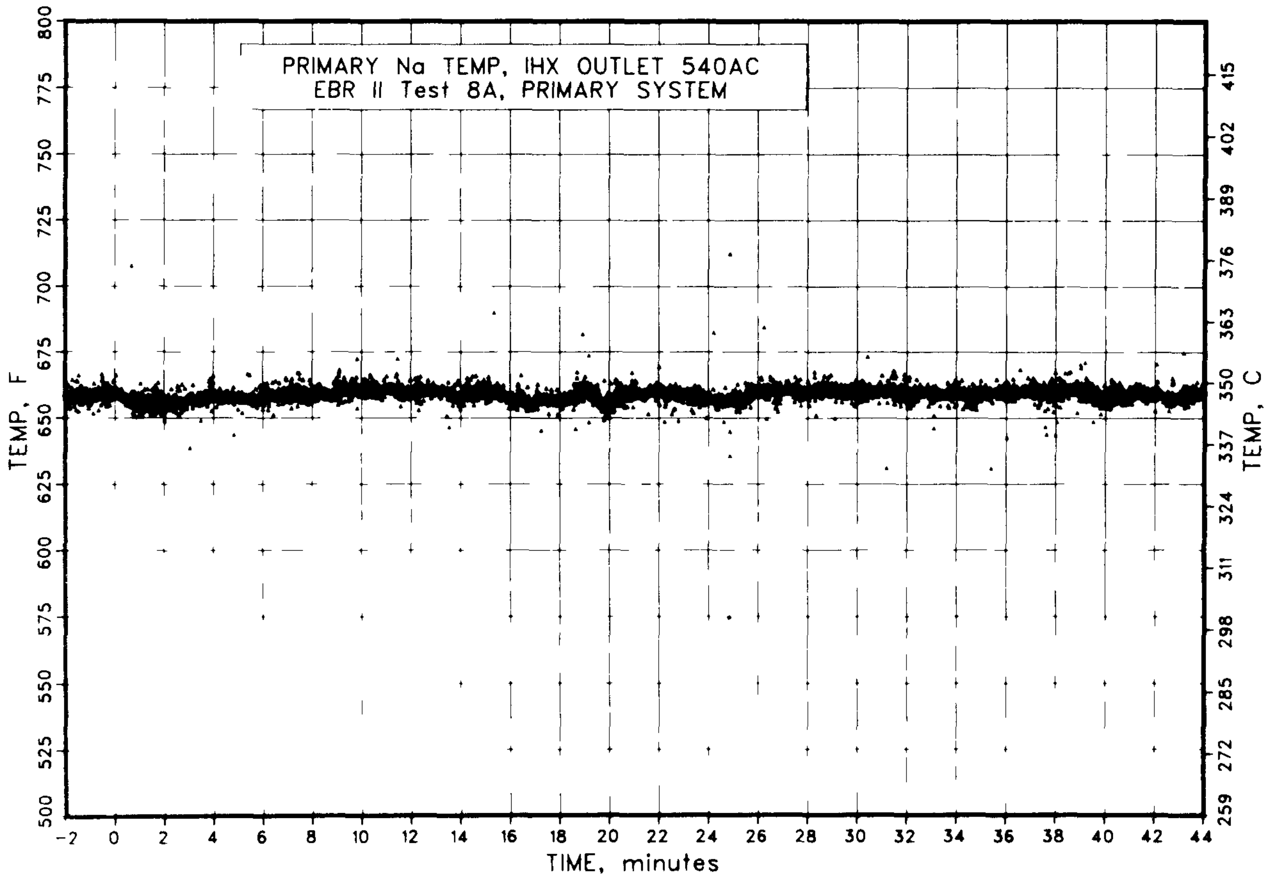
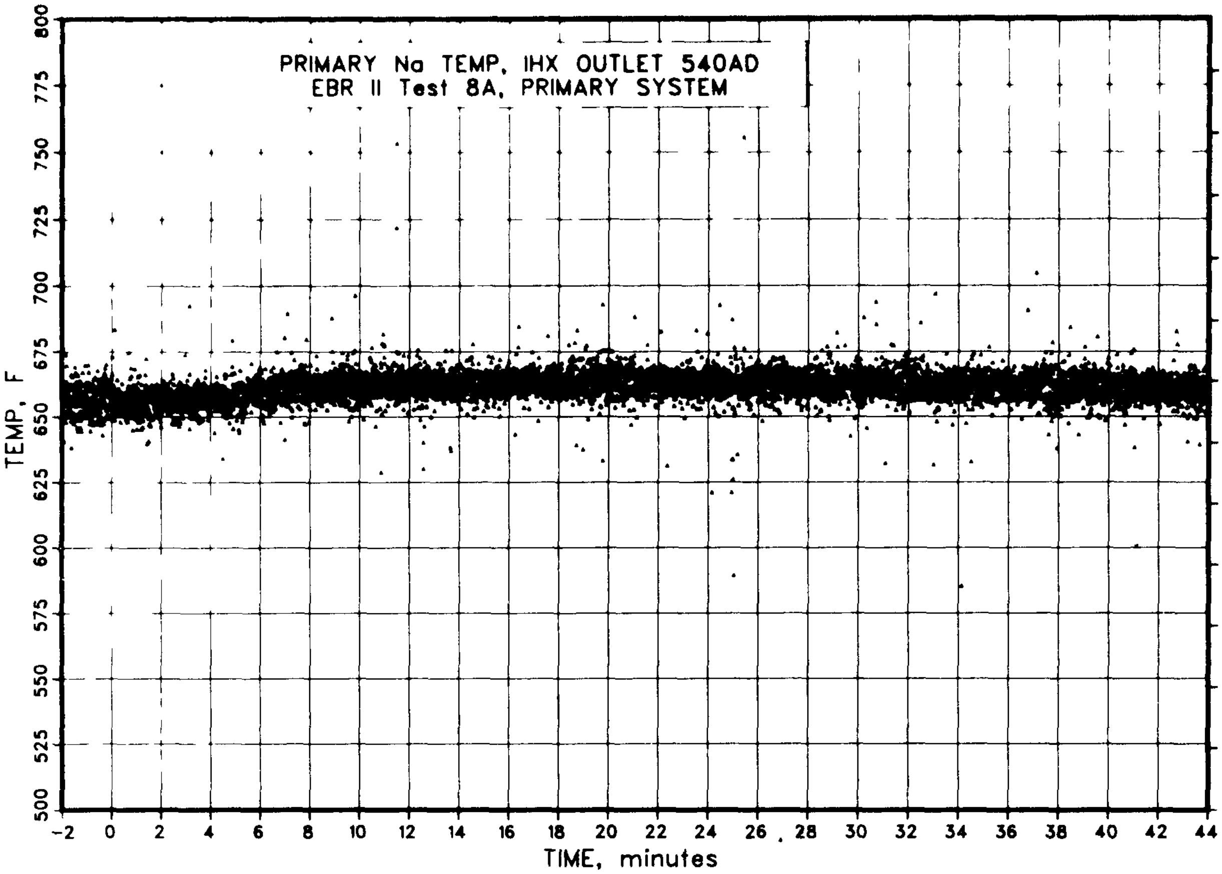
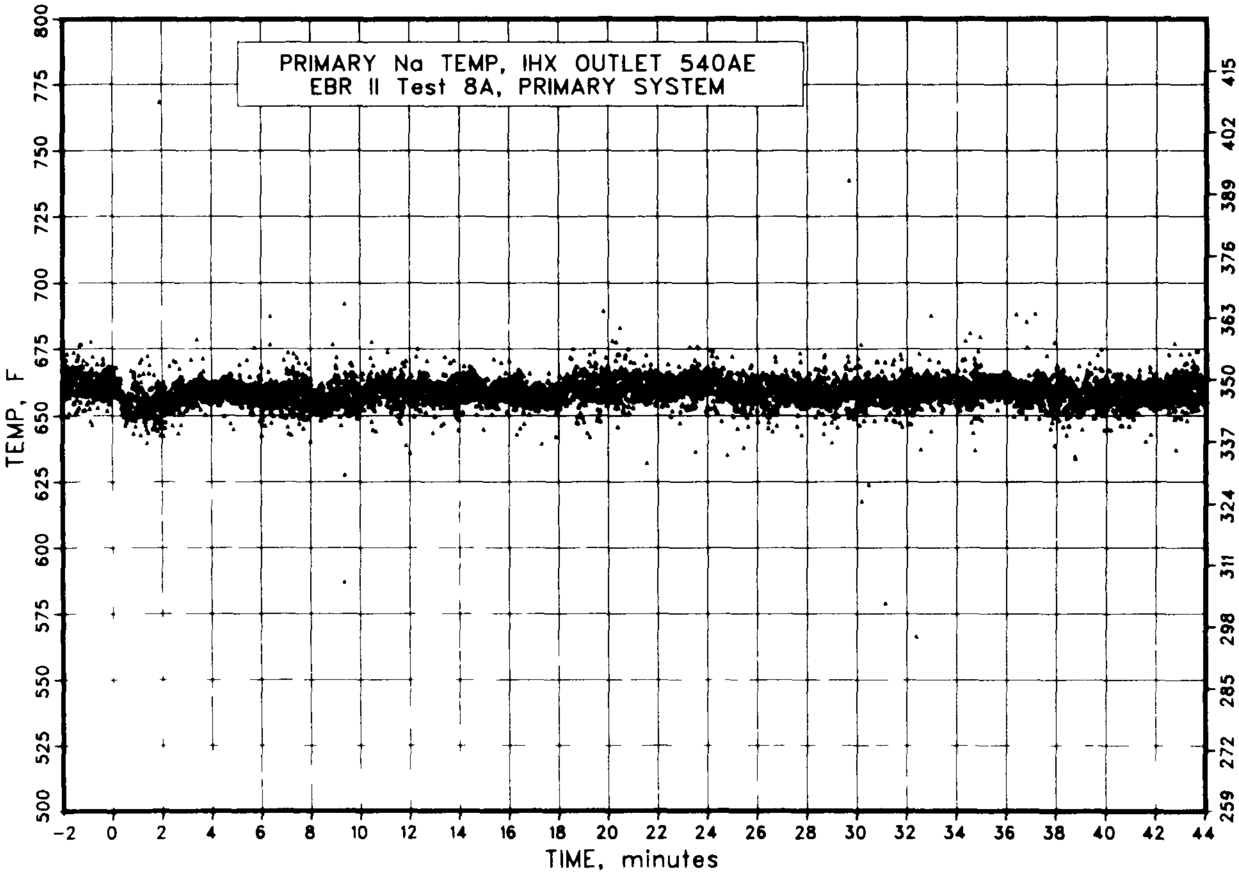
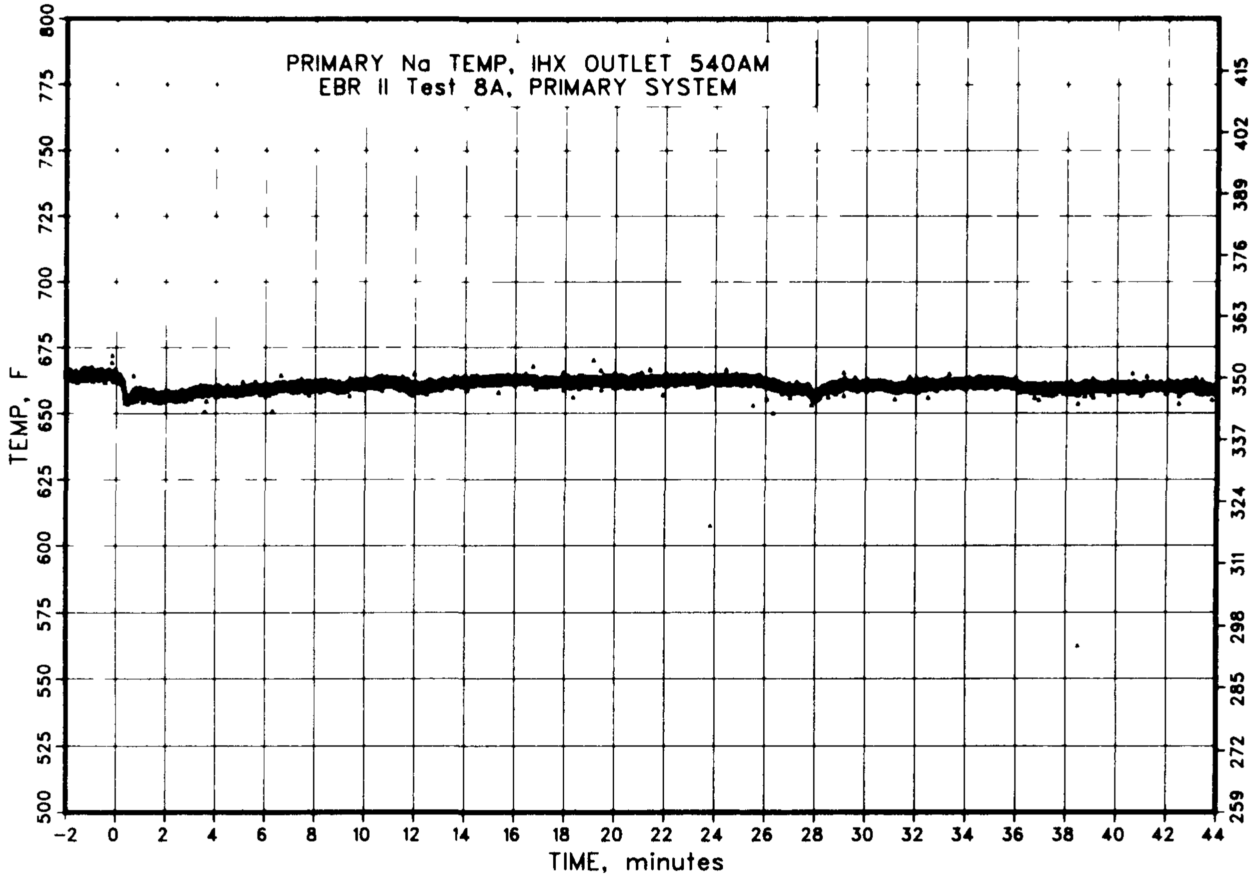
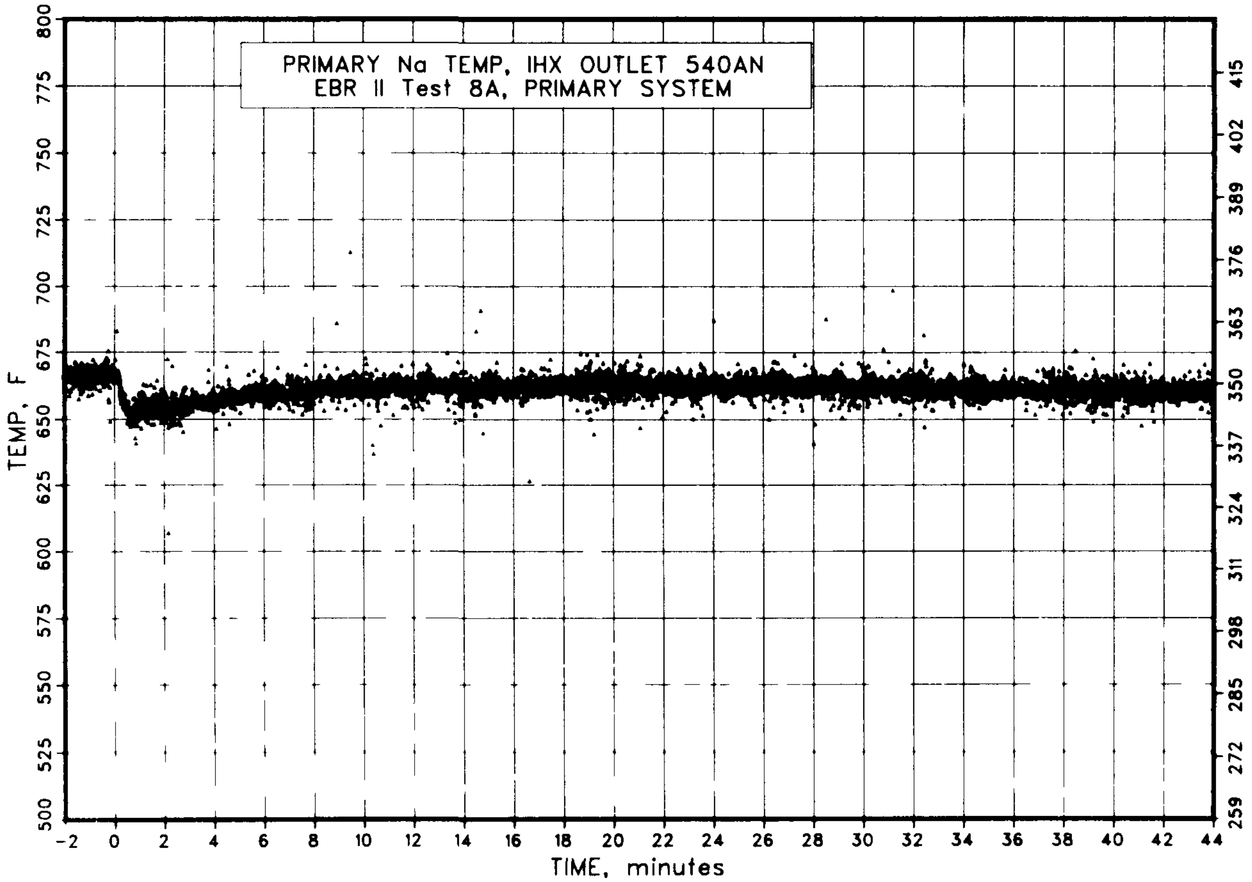

PRIMARY Na TEMP, IHX OUTLET 540AB
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

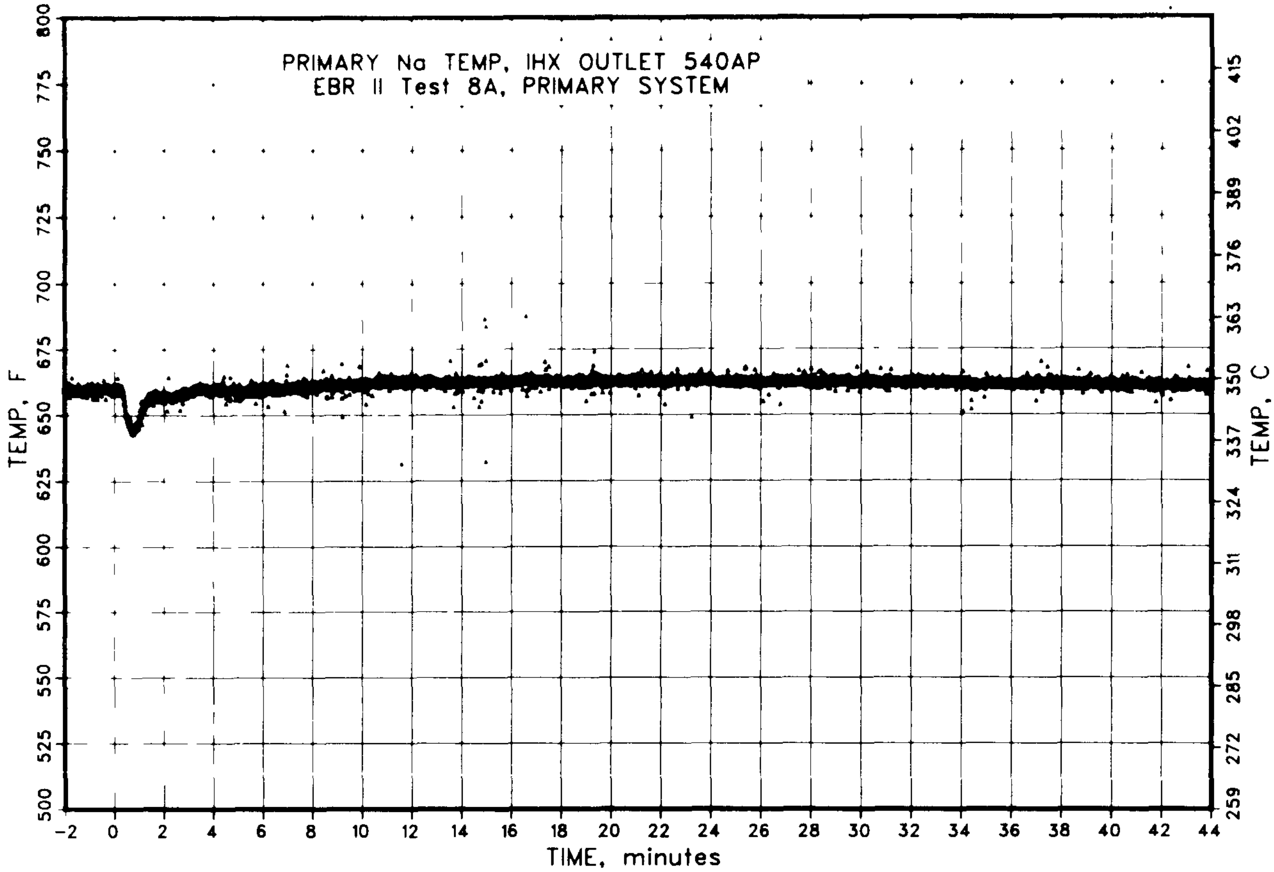

PRIMARY Na TEMP, IHX OUTLET 540AC
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

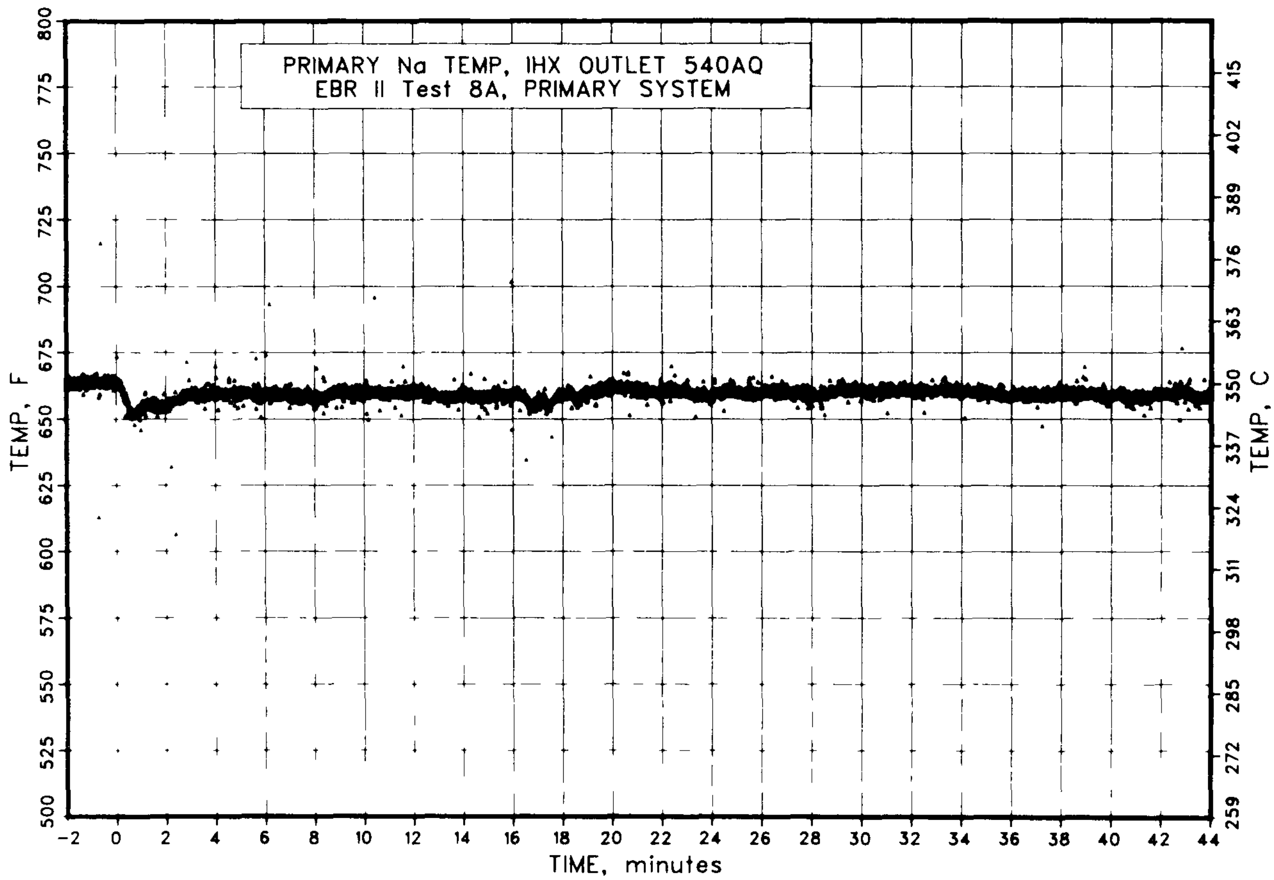

PRIMARY Na TEMP, IHX OUTLET 540AD
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

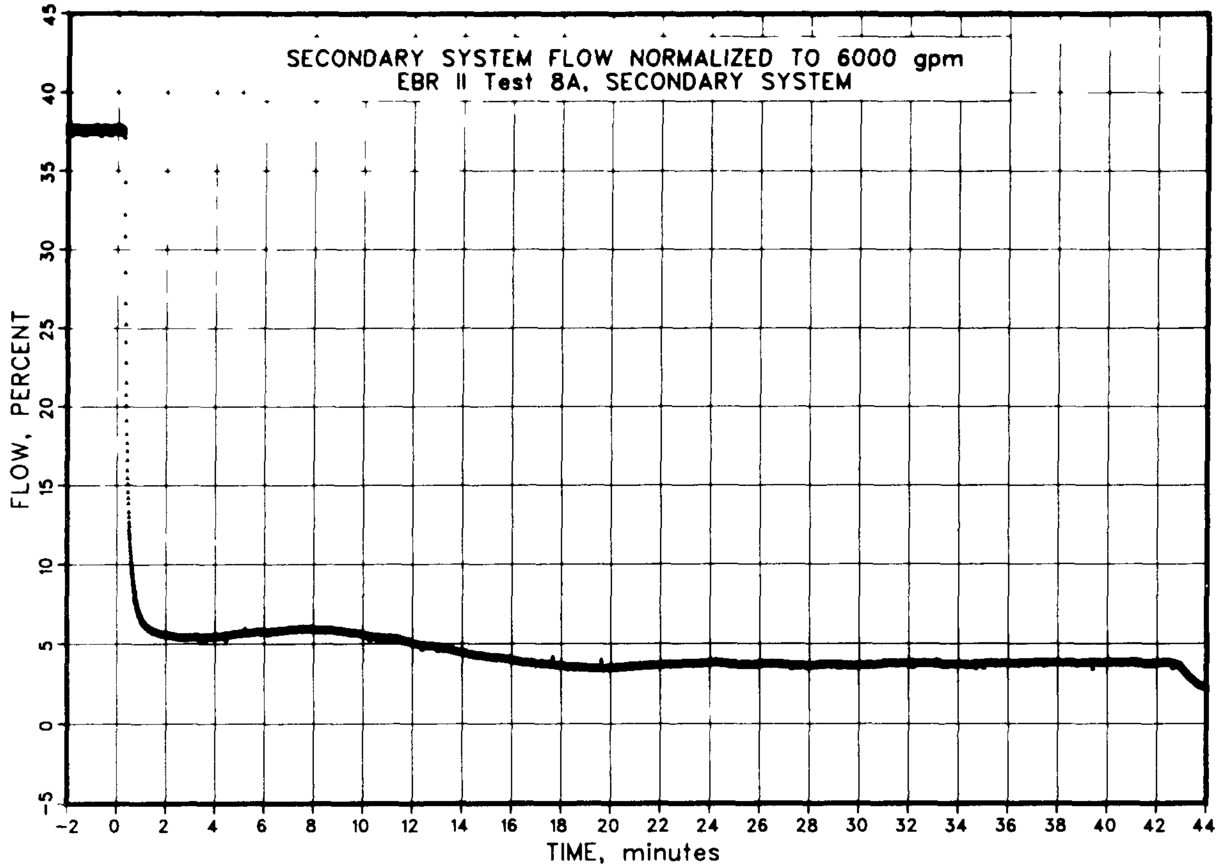

PRIMARY Na TEMP, IHX OUTLET 540AE
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

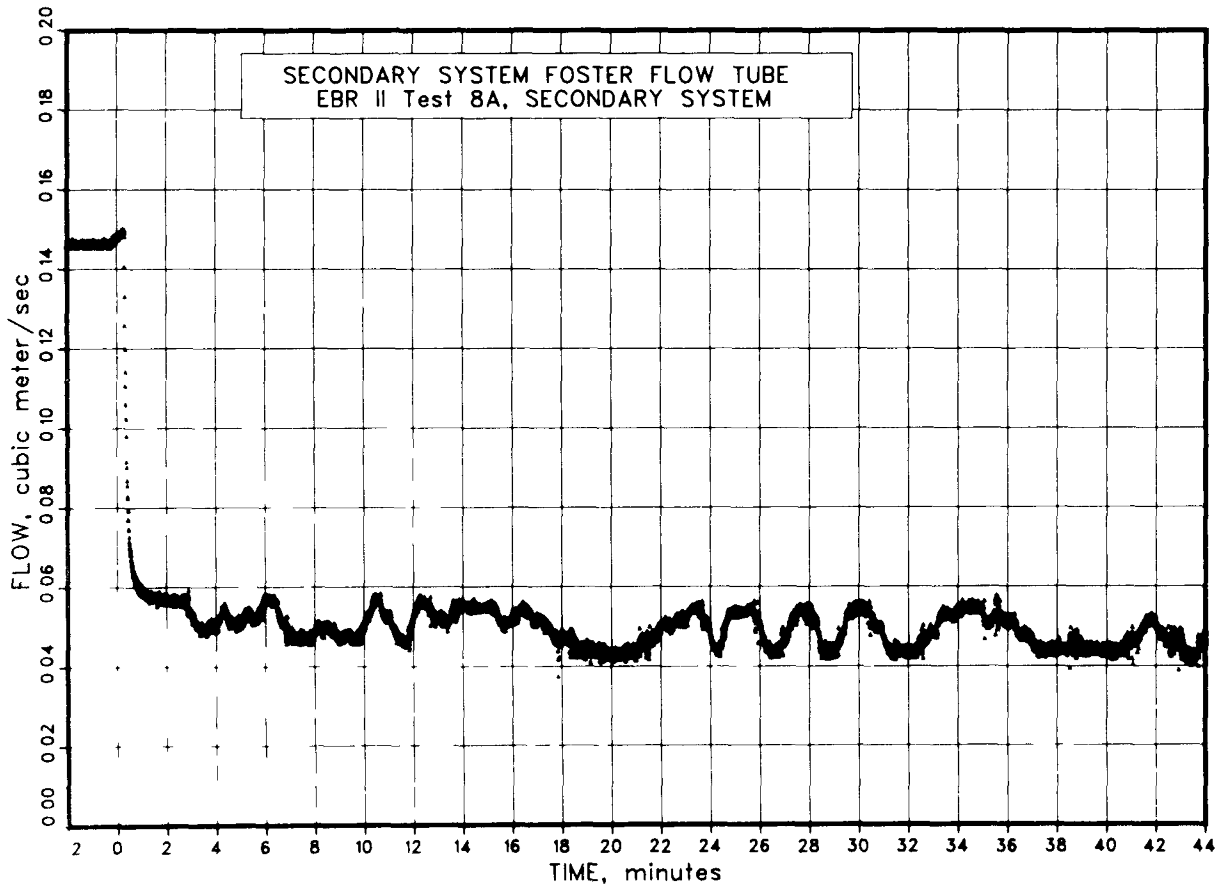

PRIMARY Na TEMP, IHX OUTLET 540AM
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

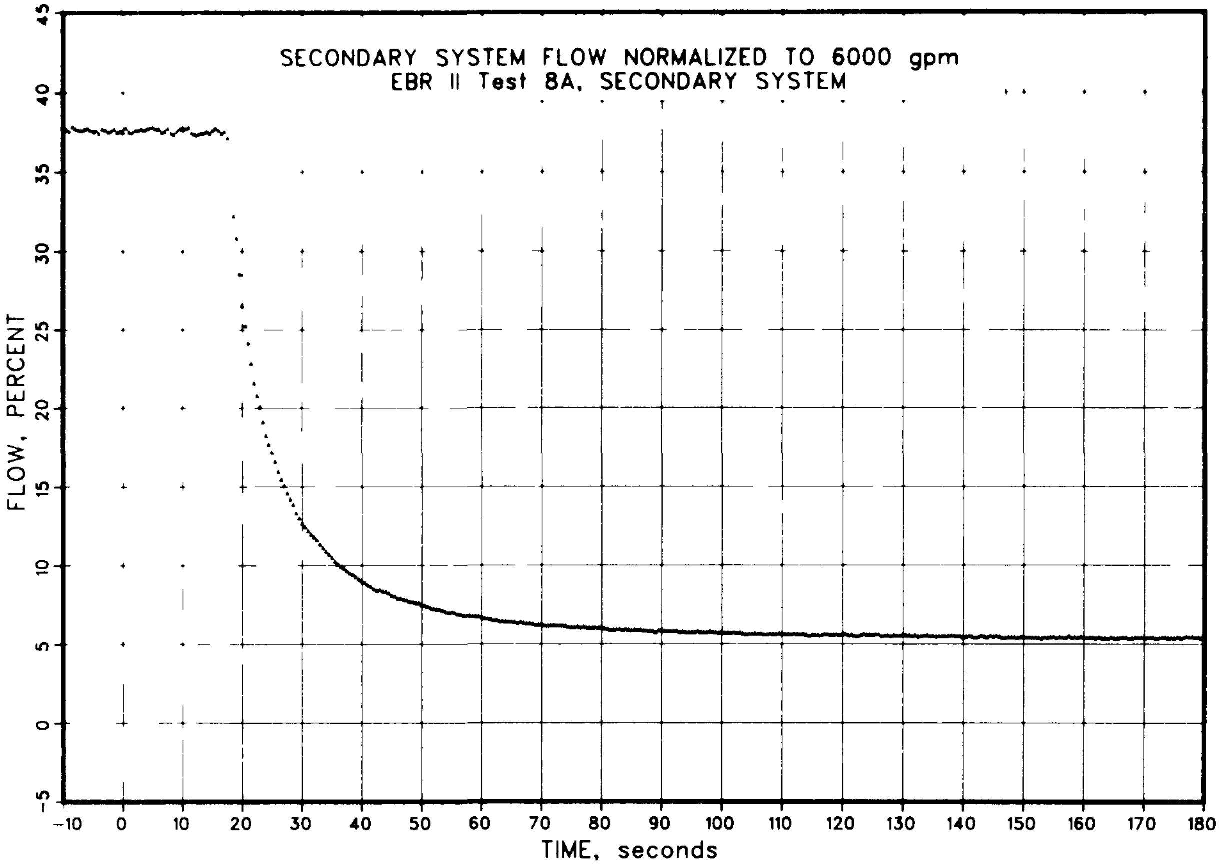

PRIMARY Na TEMP, IHX OUTLET 540AN
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX OUTLET 540AP
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
500
525
550
575
600
625
650
675
700
725
750
775
800
TEMP, C
259
272
285
298
311
324
337
350
363
376
389
402
415
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

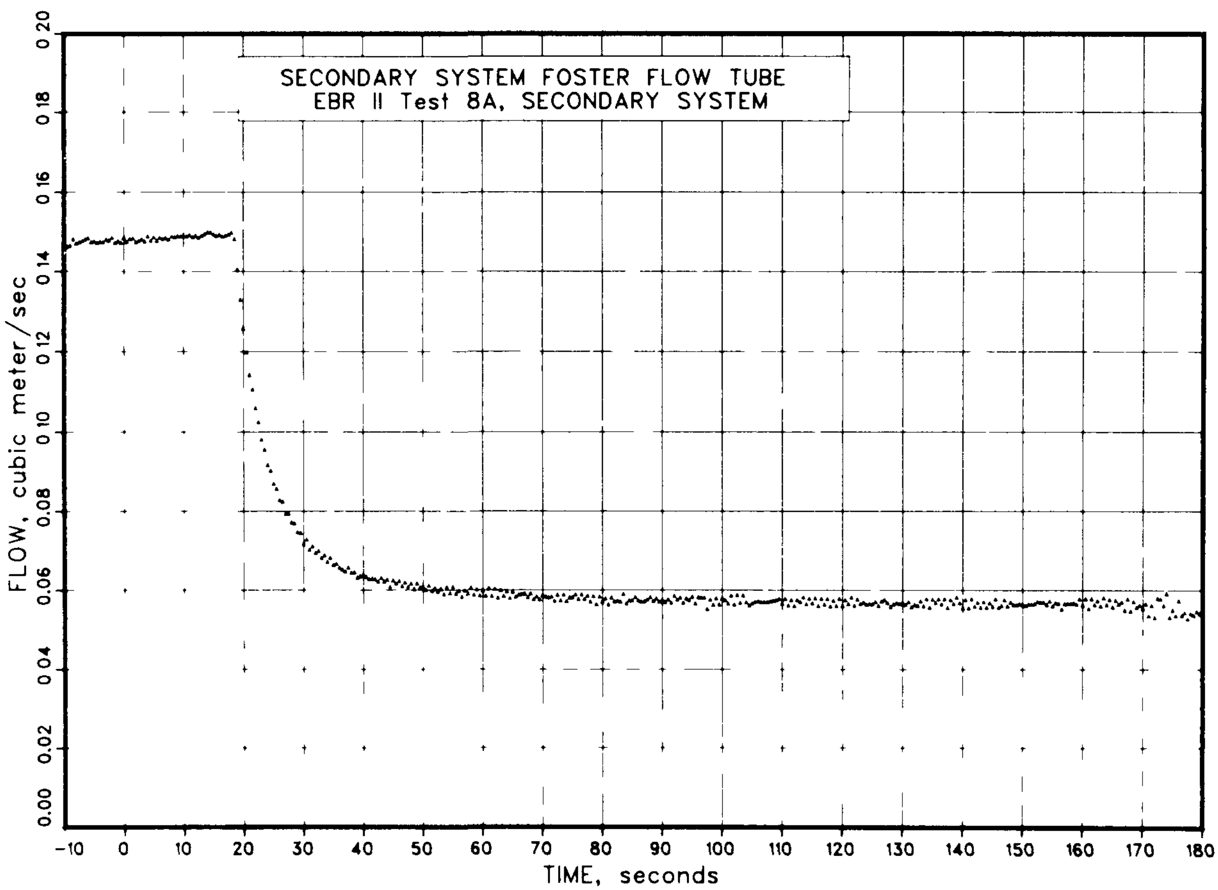

PRIMARY Na TEMP, IHX OUTLET 540AQ
EBR II Test 8A, PRIMARY SYSTEM
TEMP, F
500
525
550
575
600
625
650
675
700
725
750
775
800
TEMP, C
259
272
285
298
311
324
337
350
363
376
389
402
415
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


SECONDARY SYSTEM FLOW NORMALIZED TO 6000 gpm
EBR II Test 8A, SECONDARY SYSTEM
FLOW, PERCENT
TIME, minutes

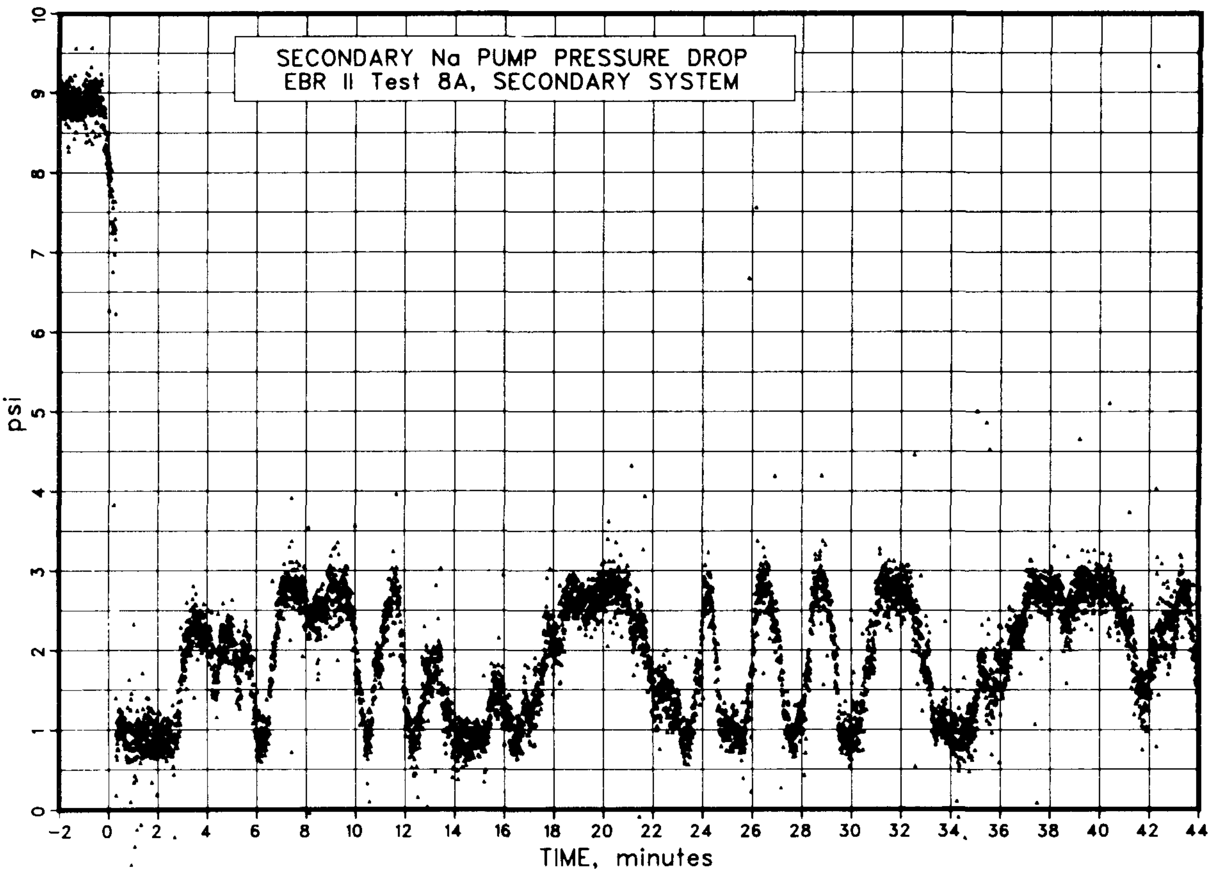

SECONDARY SYSTEM FOSTER FLOW TUBE
EBR II Test 8A, SECONDARY SYSTEM
FLOW, cubic meter/sec
TIME, minutes

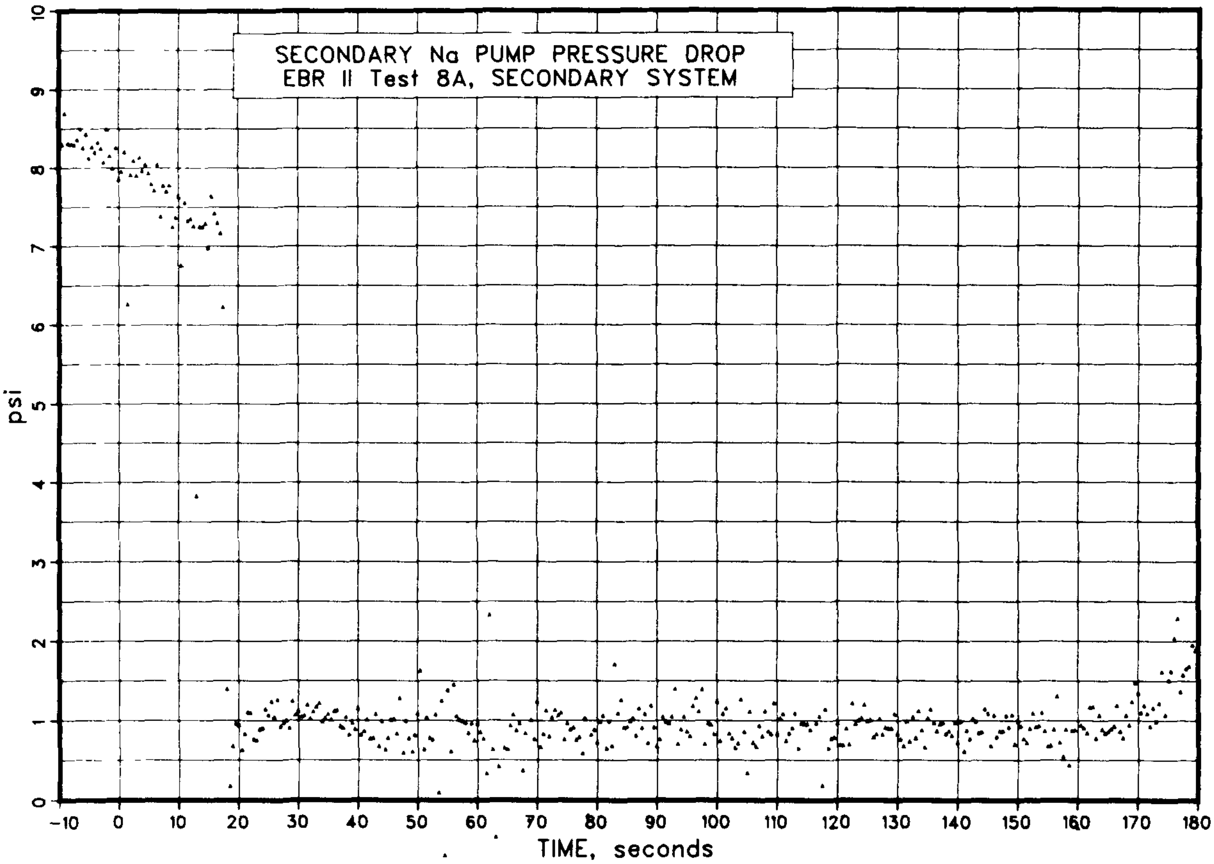


SECONDARY SYSTEM FLOW NORMALIZED TO 6000 gpm
EBR II Test 8A, SECONDARY SYSTEM
FLOW, PERCENT
-5
0
5
10
15
20
25
30
35
40
45
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

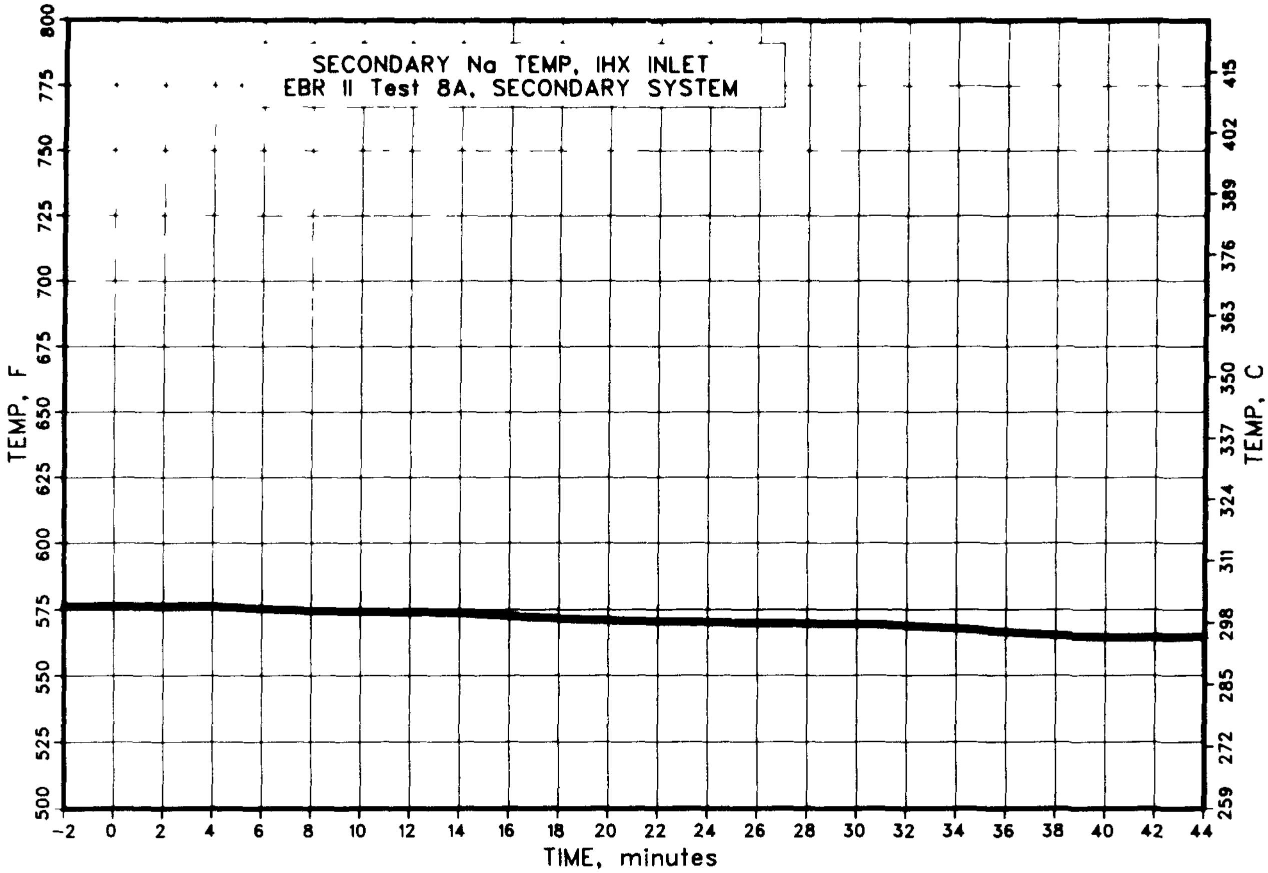


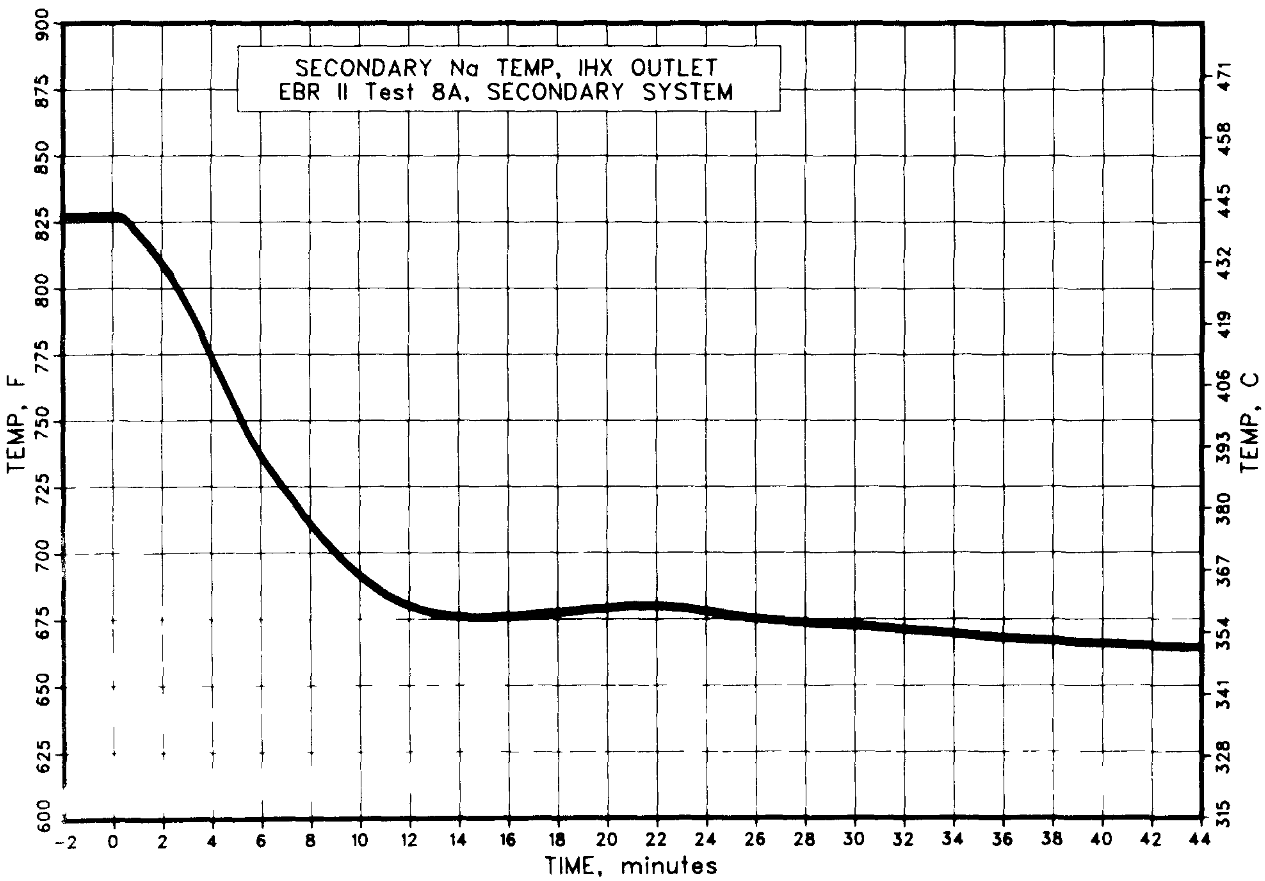
SECONDARY SYSTEM FOSTER FLOW TUBE
EBR II Test 8A, SECONDARY SYSTEM
FLOW, cubic meter/sec
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
TIME, seconds

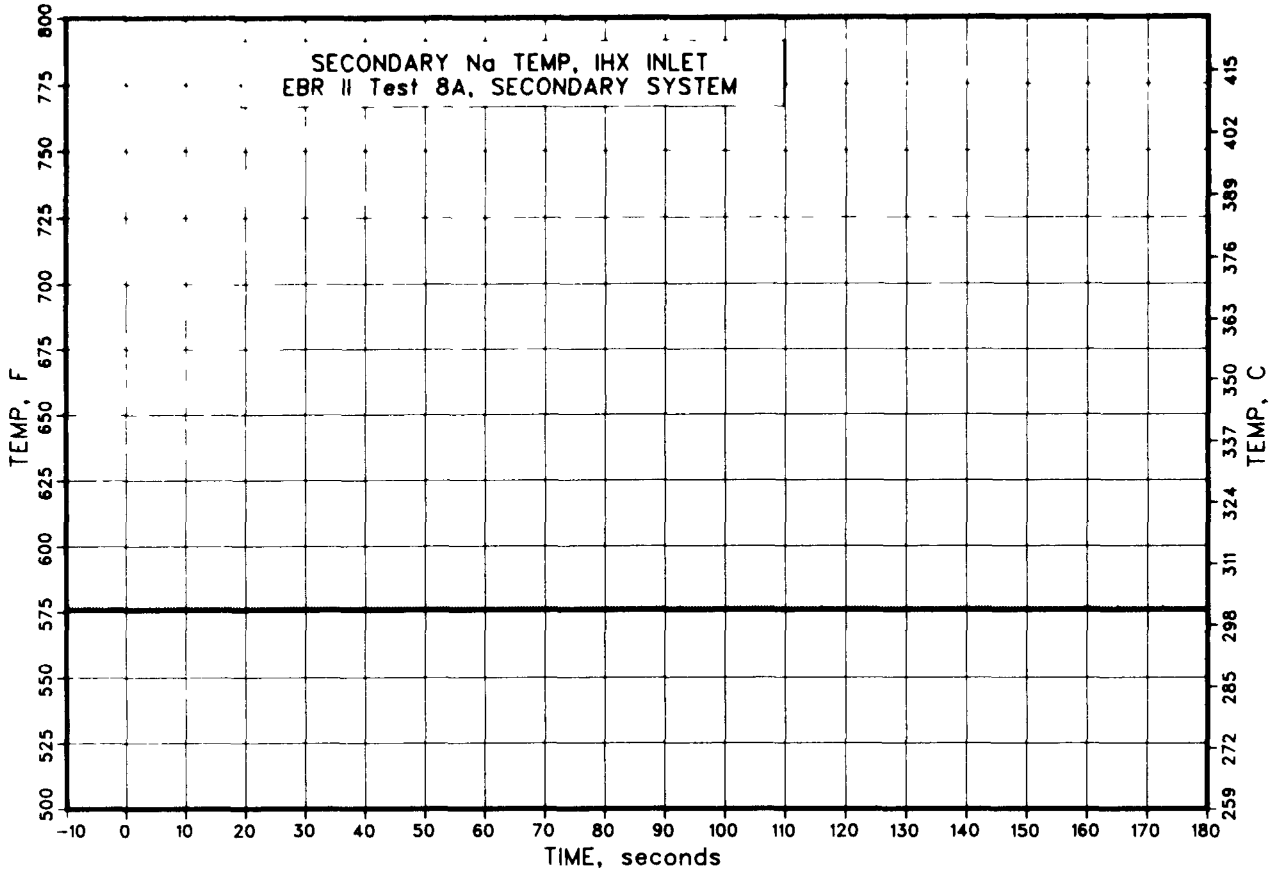

SECONDARY Na PUMP PRESSURE DROP
EBR II Test 8A, SECONDARY SYSTEM
psi
0
1
2
3
4
5
6
7
8
9
10
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes



SECONDARY Na PUMP PRESSURE DROP
EBR II Test 8A, SECONDARY SYSTEM
psi
0
1
2
3
4
5
6
7
8
9
10
TIME, seconds
−10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180


SECONDARY Na TEMP, IHX INLET
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


SECONDARY Na TEMP, IHX OUTLET
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


SECONDARY Na TEMP, IHX INLET
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-10
0
10
20
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40
50
60
70
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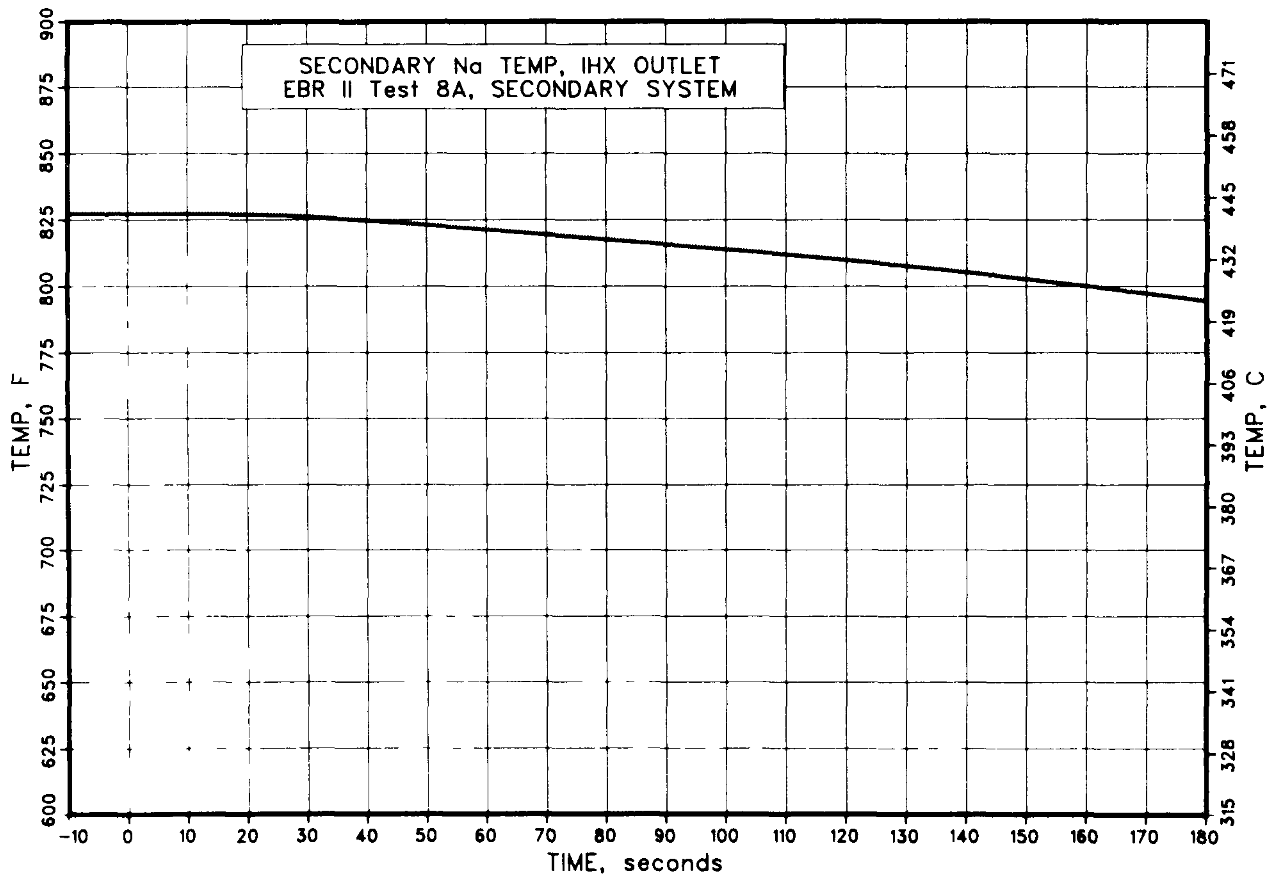
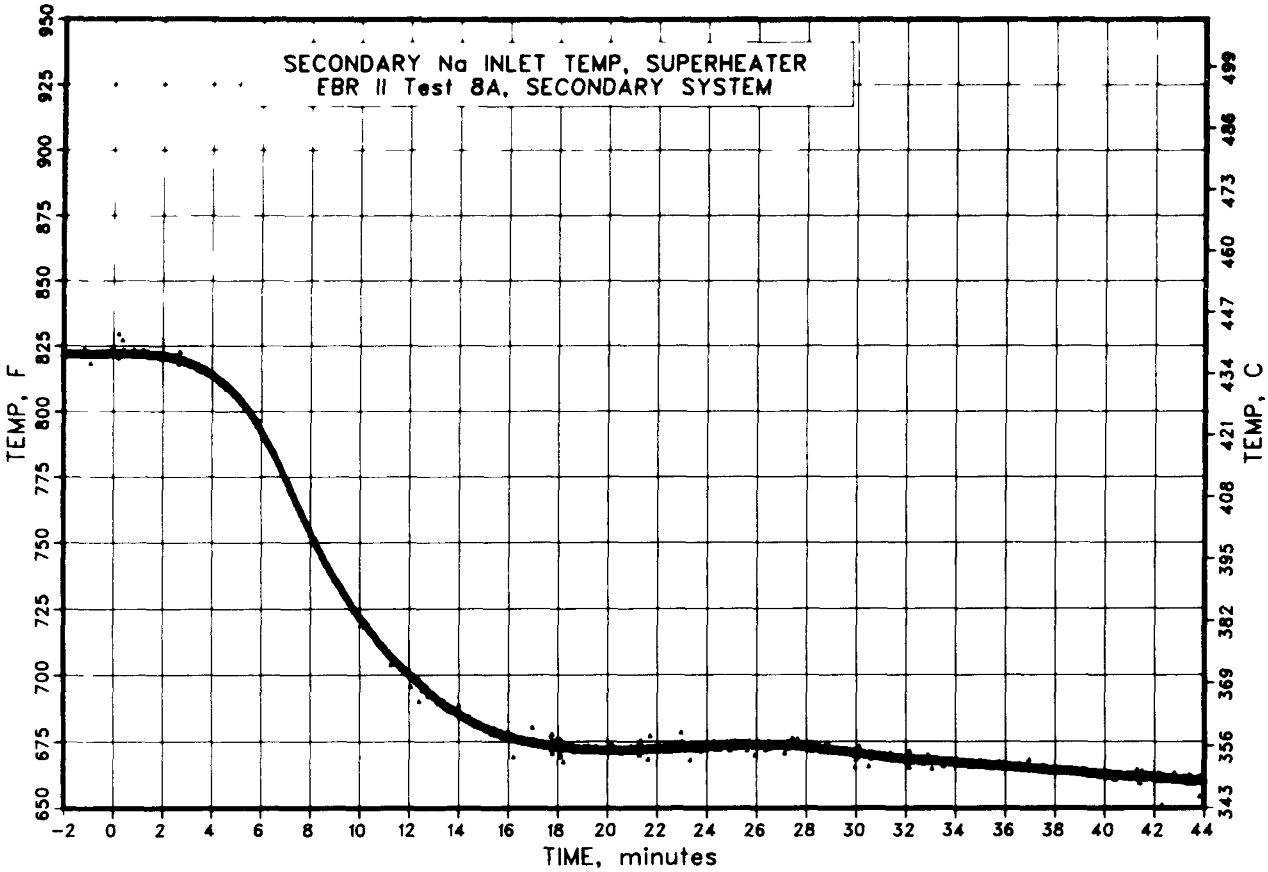
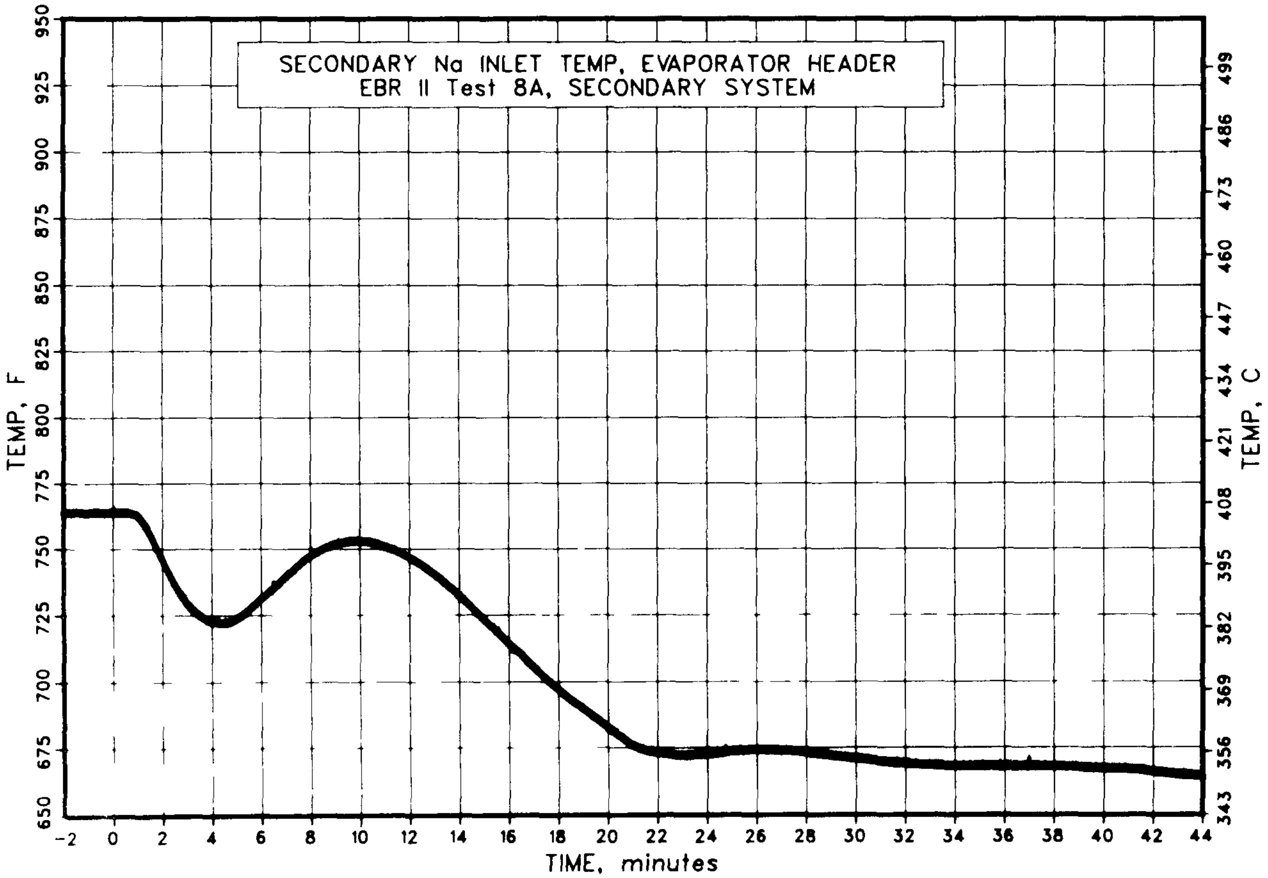
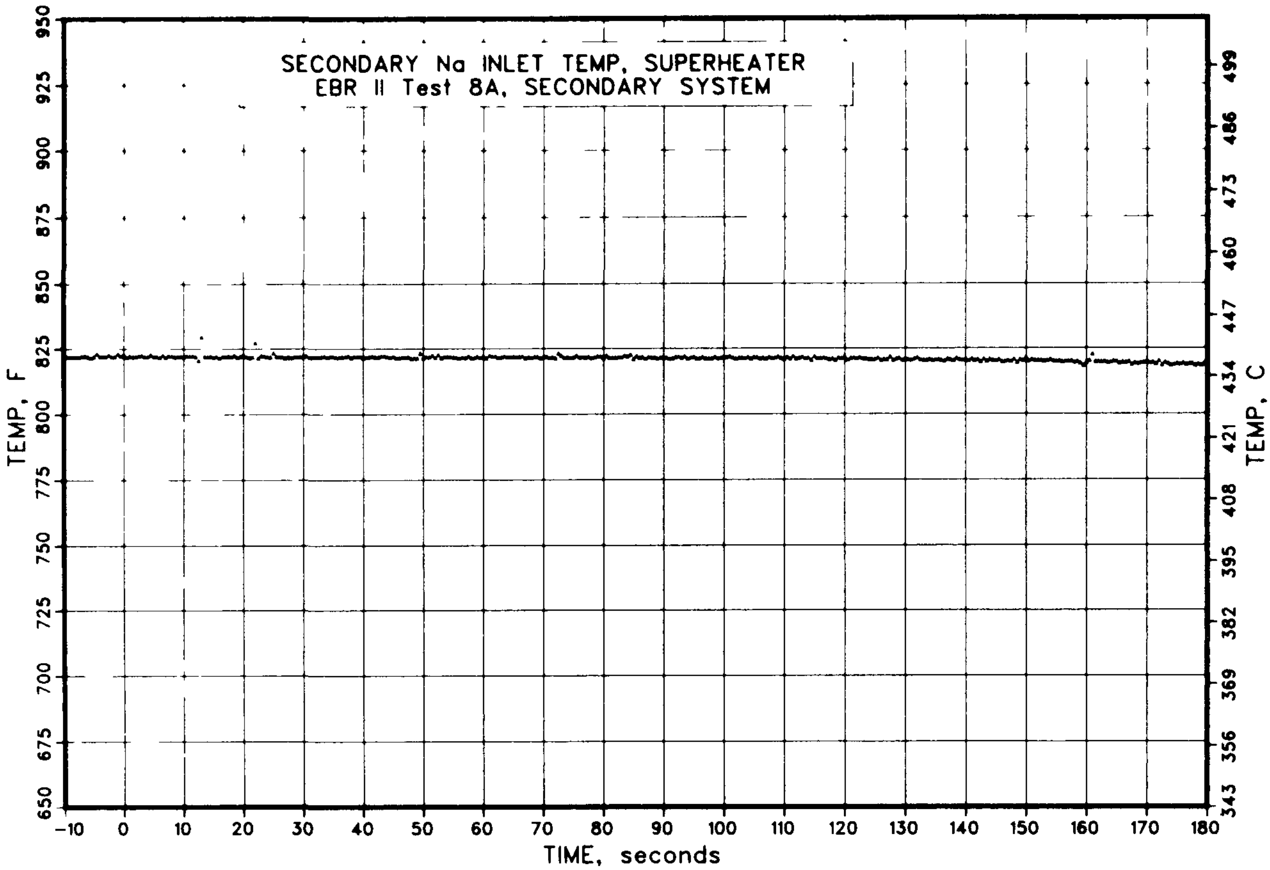
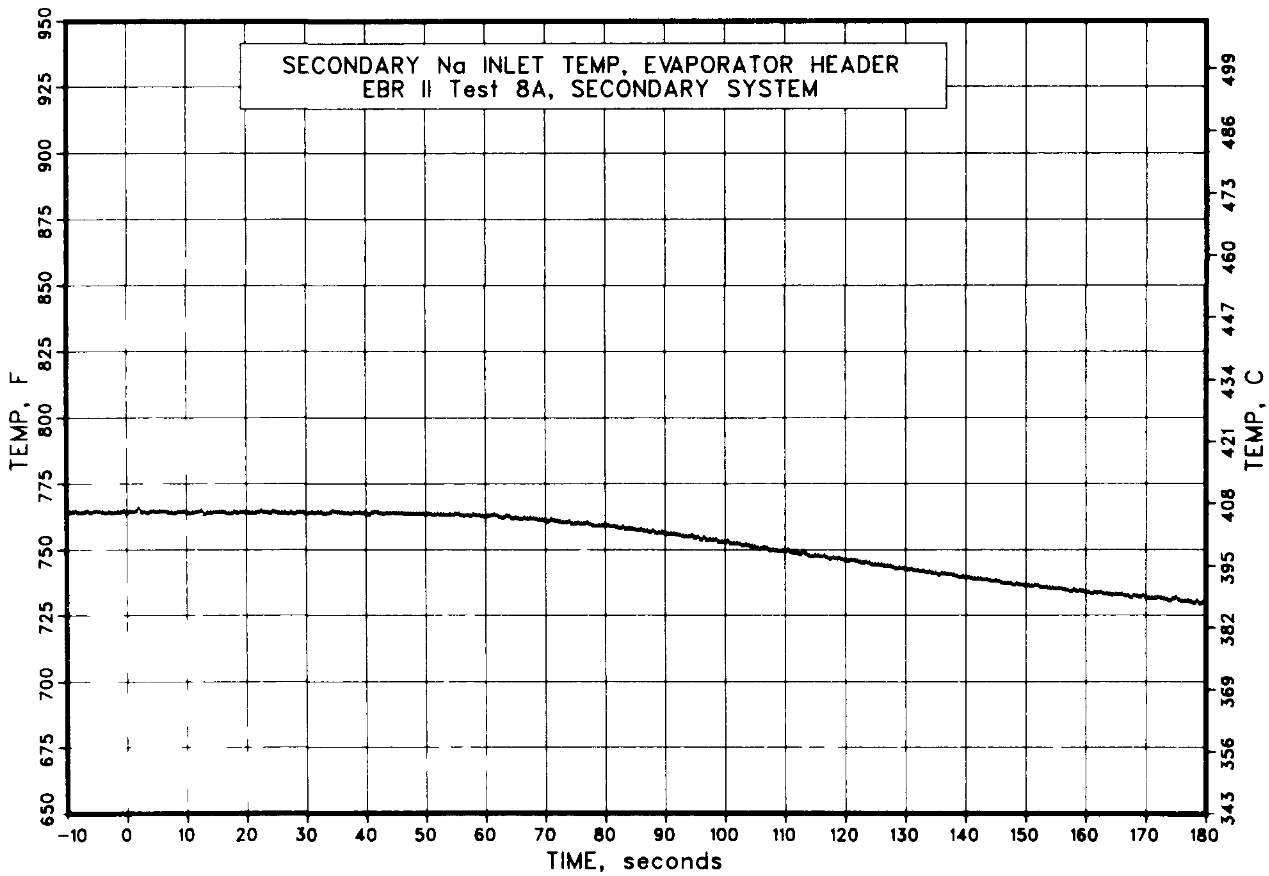
90
100
110
120
130
140
150
160
170
180

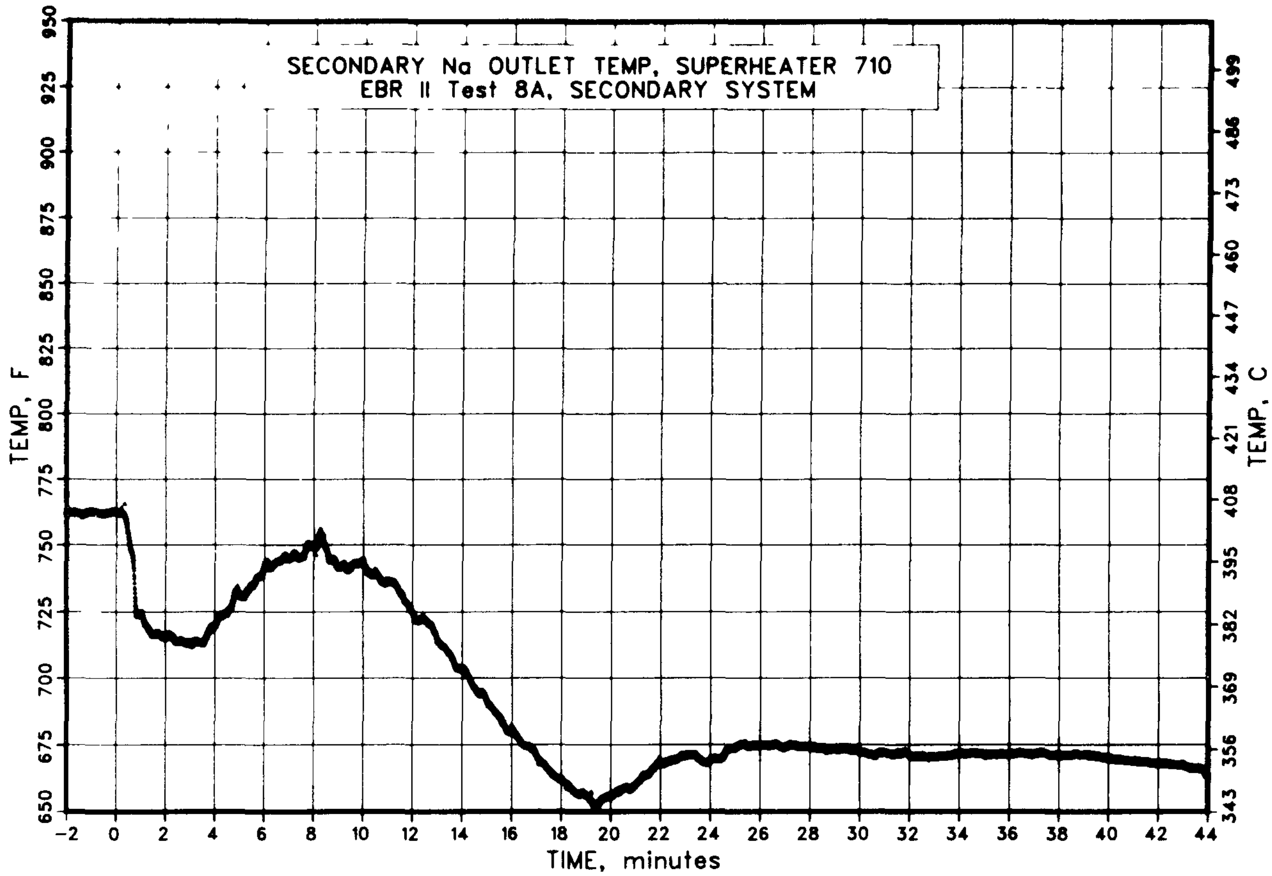

SECONDARY Na TEMP, IHX OUTLET
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

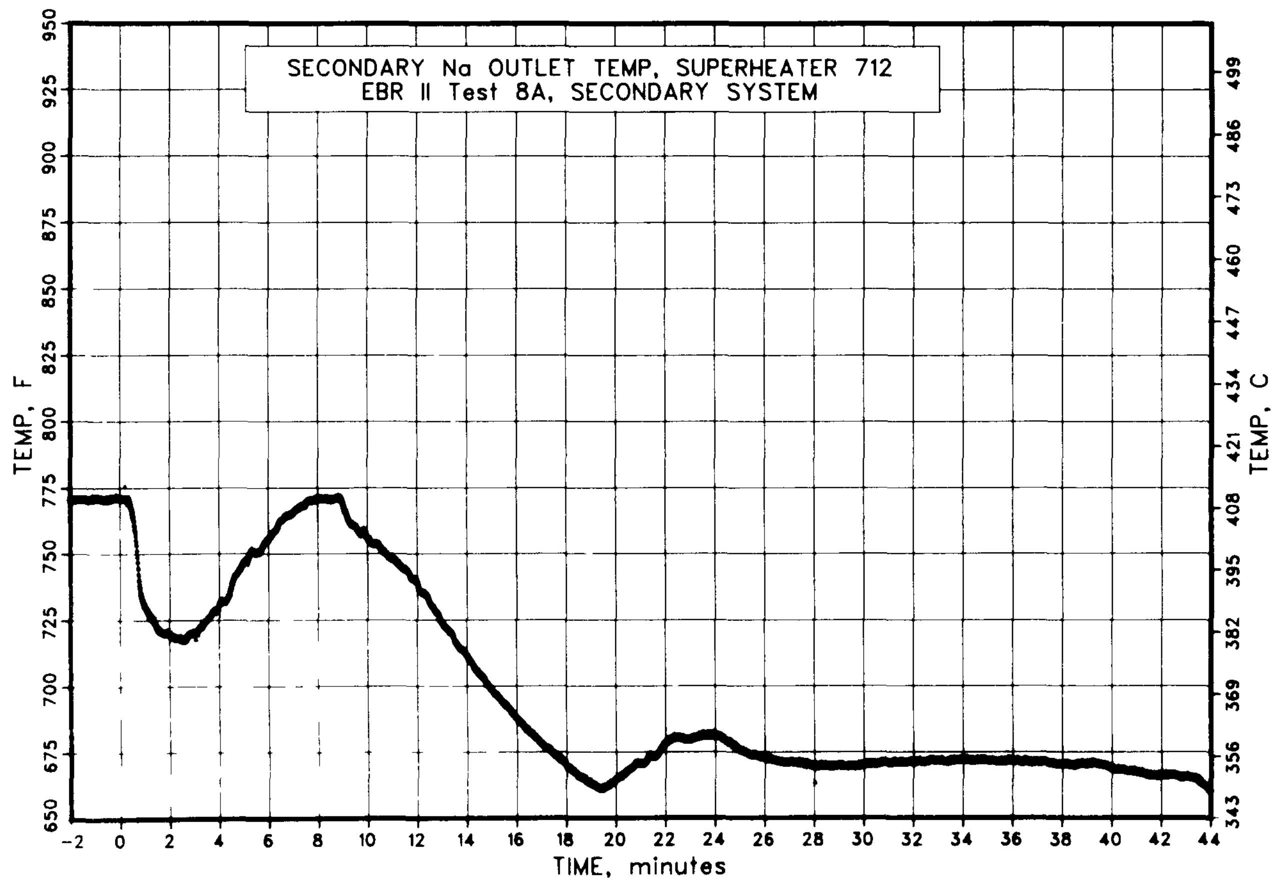

SECONDARY Na INLET TEMP, SUPERHEATER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

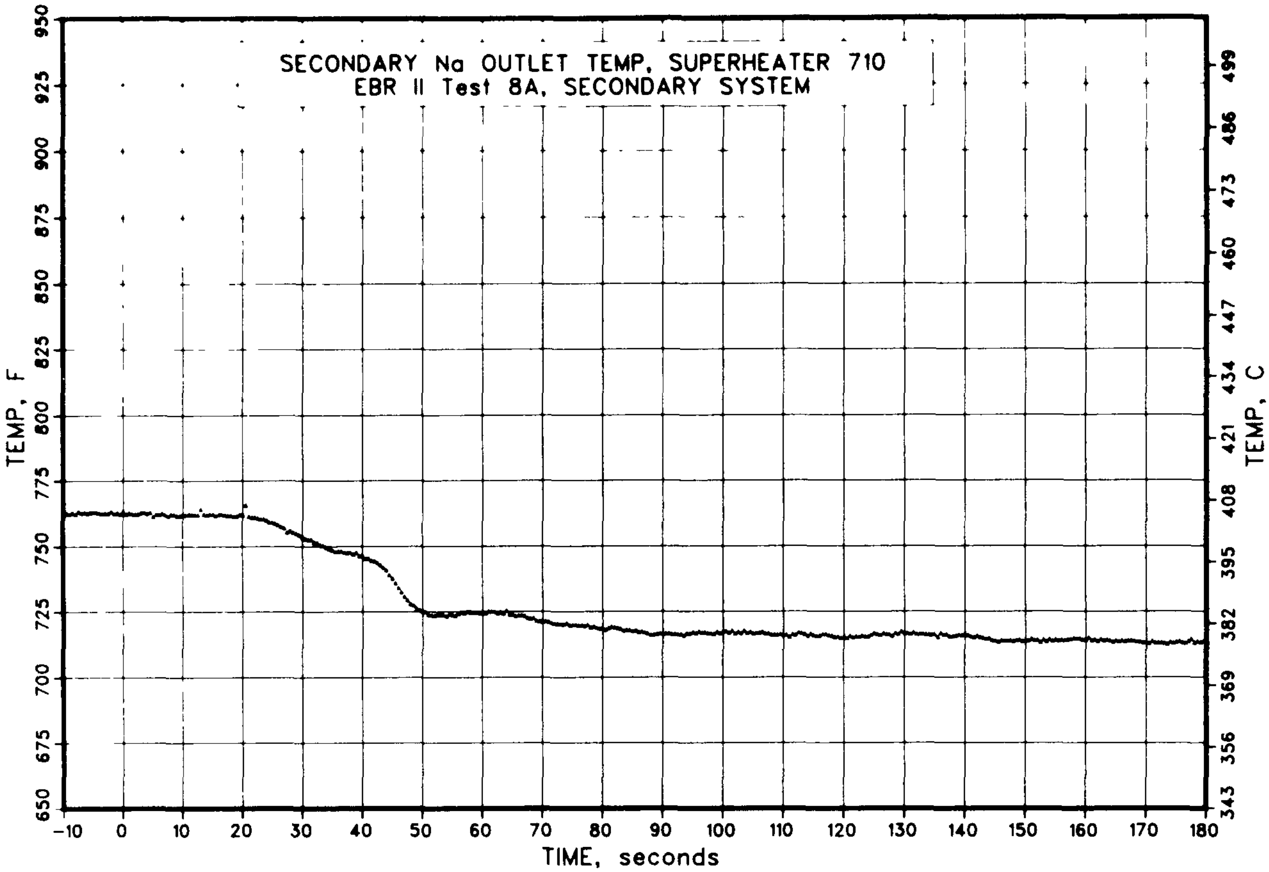

SECONDARY Na INLET TEMP, EVAPORATOR HEADER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

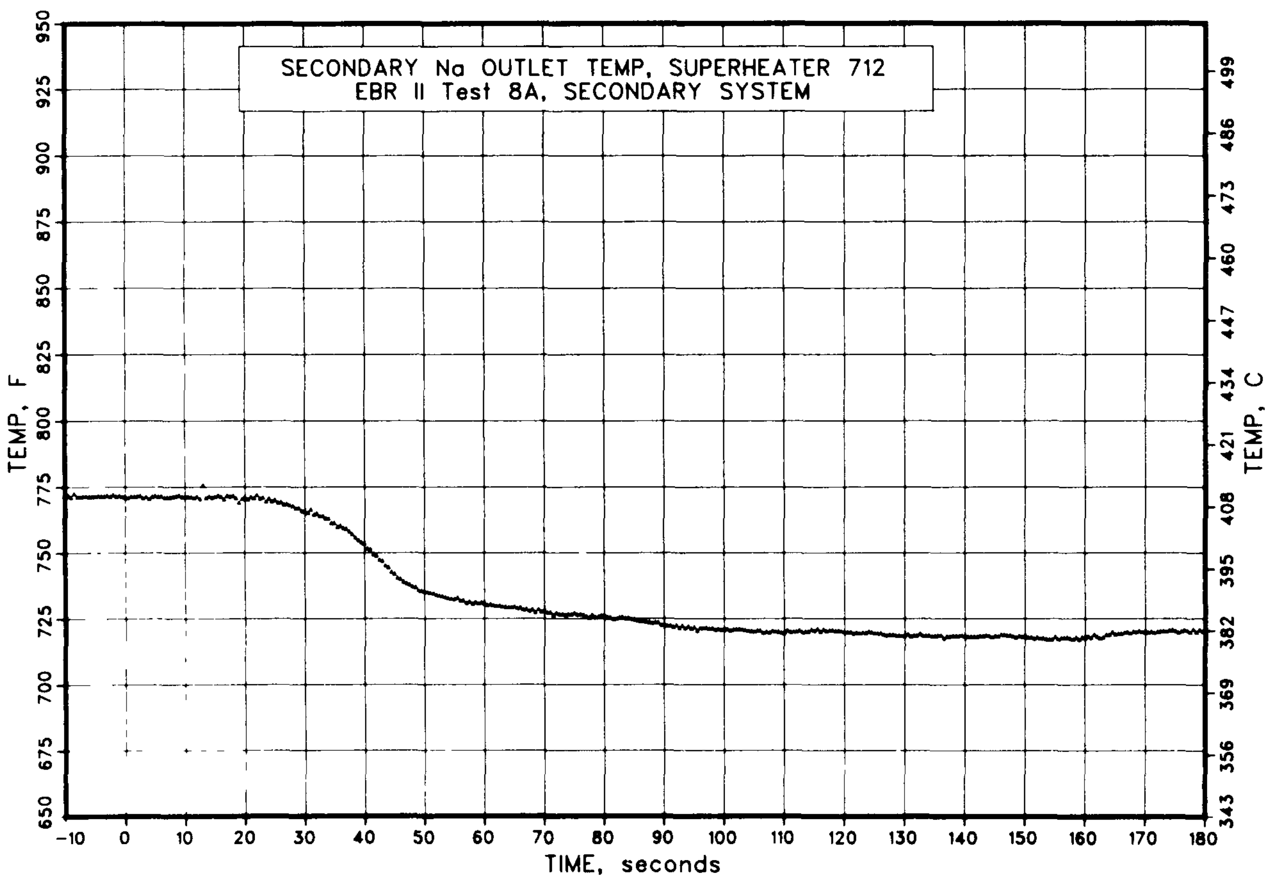

SECONDARY Na INLET TEMP, SUPERHEATER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

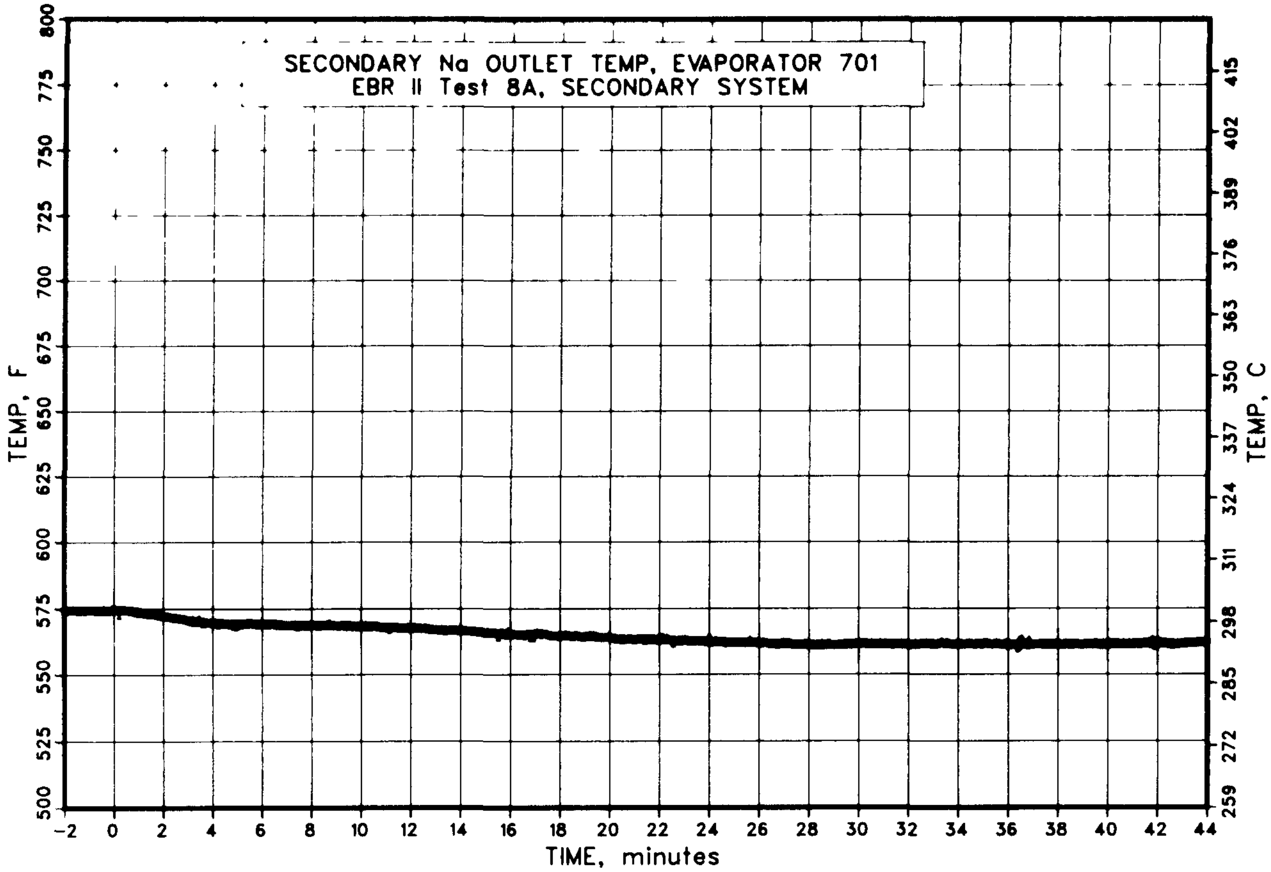

SECONDARY Na INLET TEMP, EVAPORATOR HEADER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

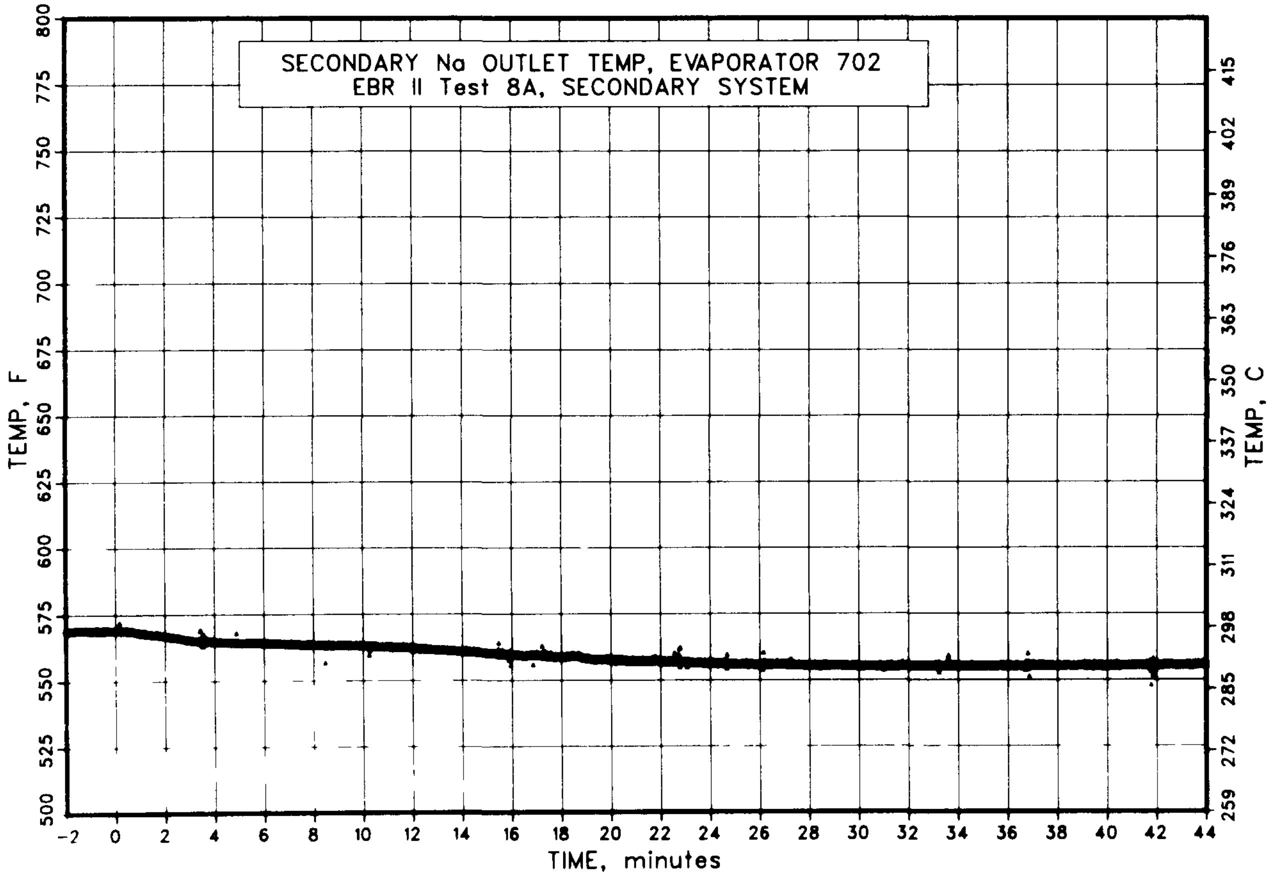

SECONDARY Na OUTLET TEMP, SUPERHEATER 710
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

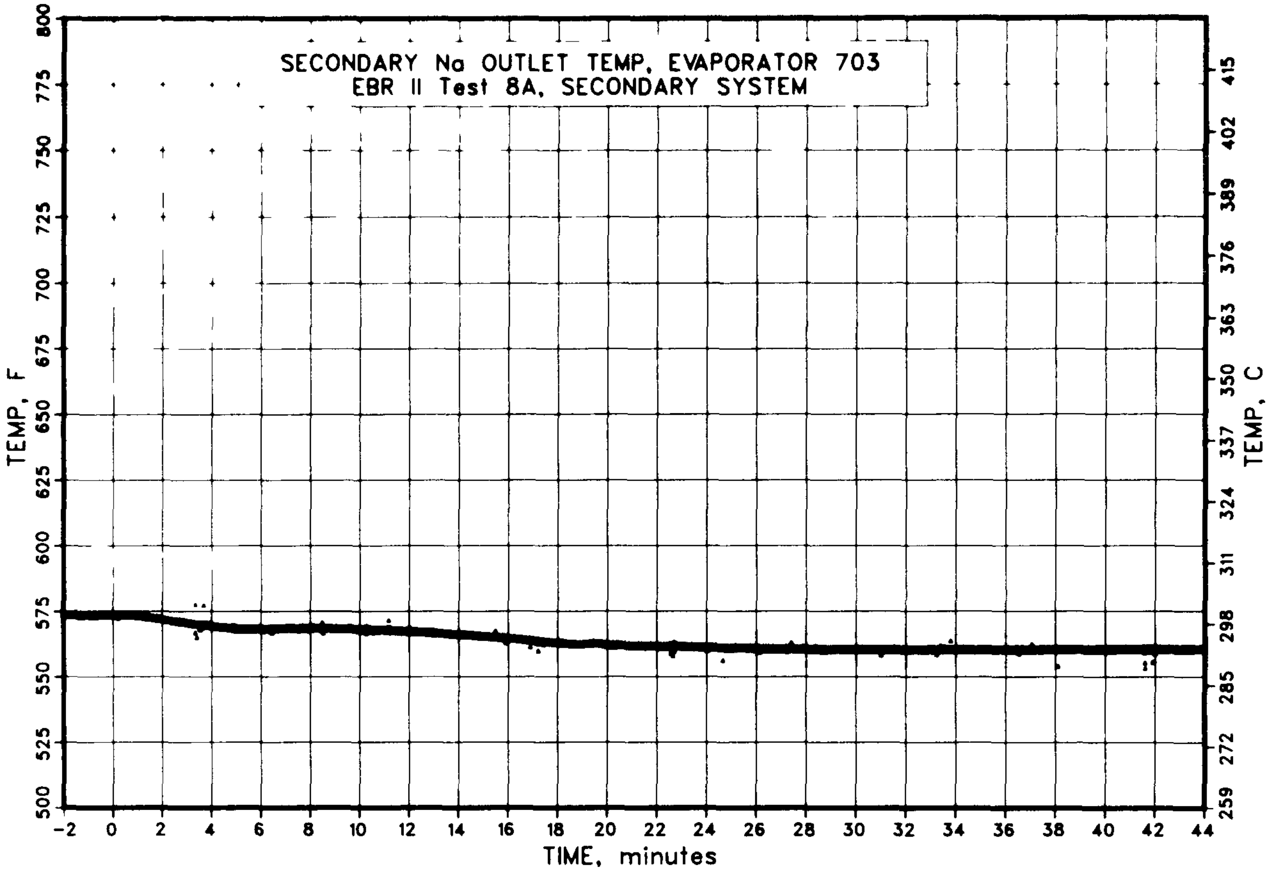

SECONDARY Na OUTLET TEMP, SUPERHEATER 712
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

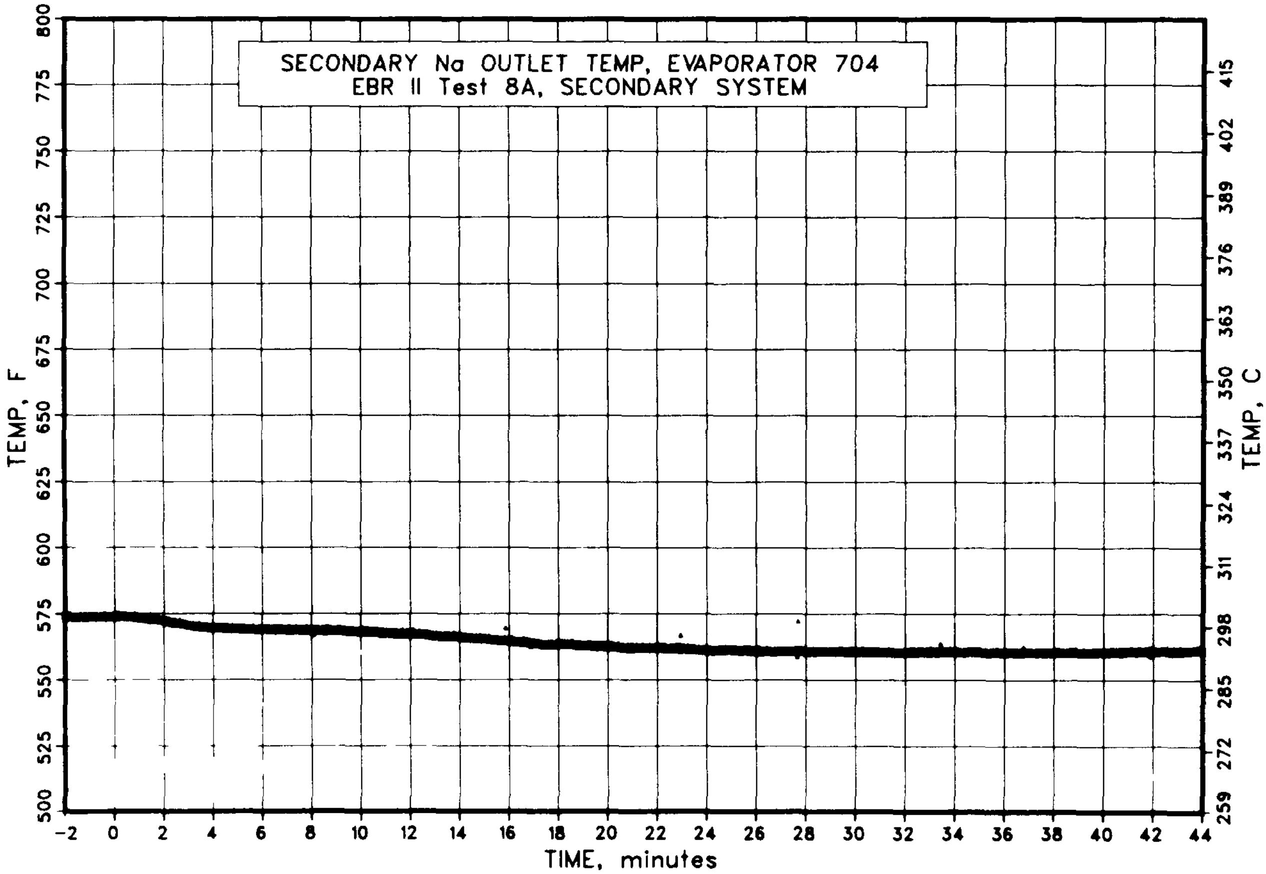

SECONDARY Na OUTLET TEMP, SUPERHEATER 710
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

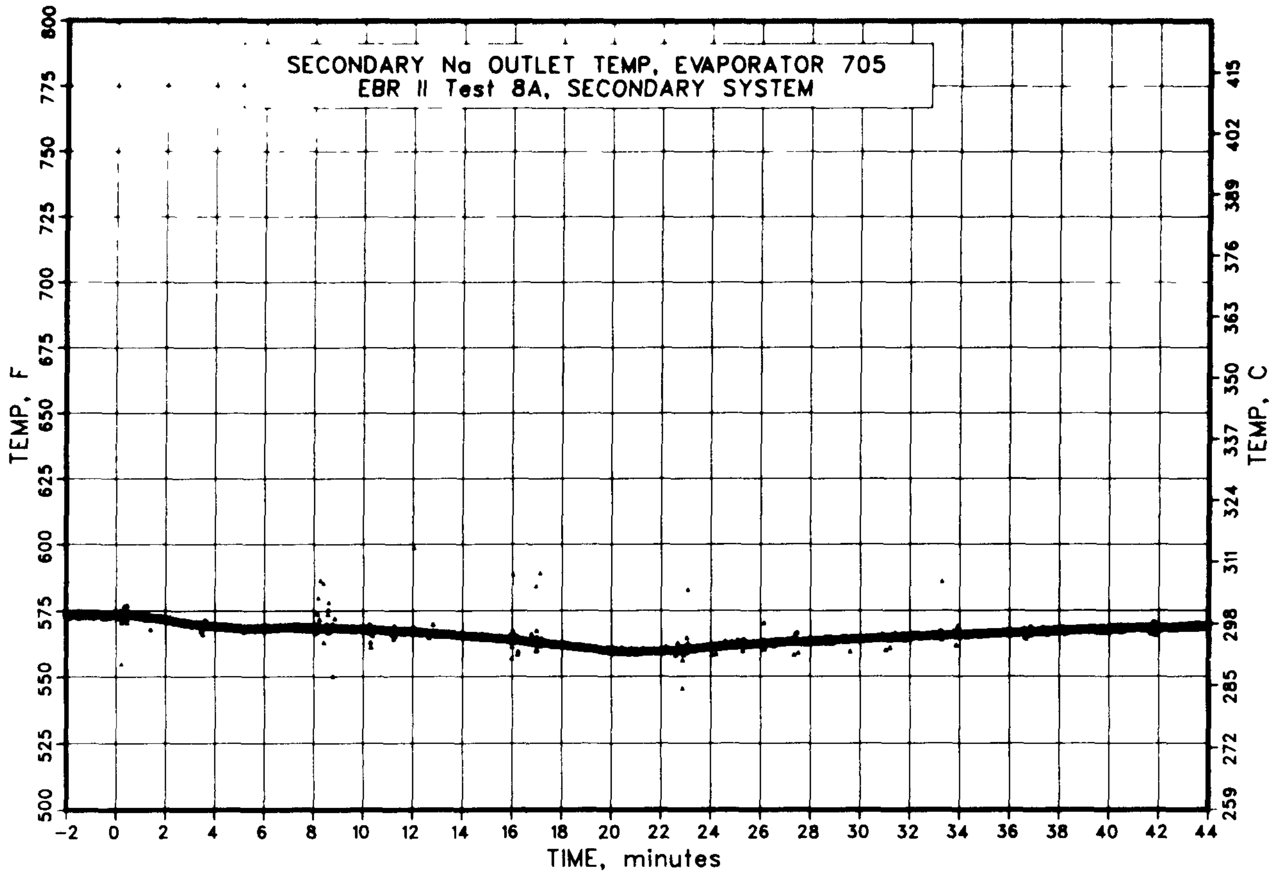

SECONDARY Na OUTLET TEMP, SUPERHEATER 712
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

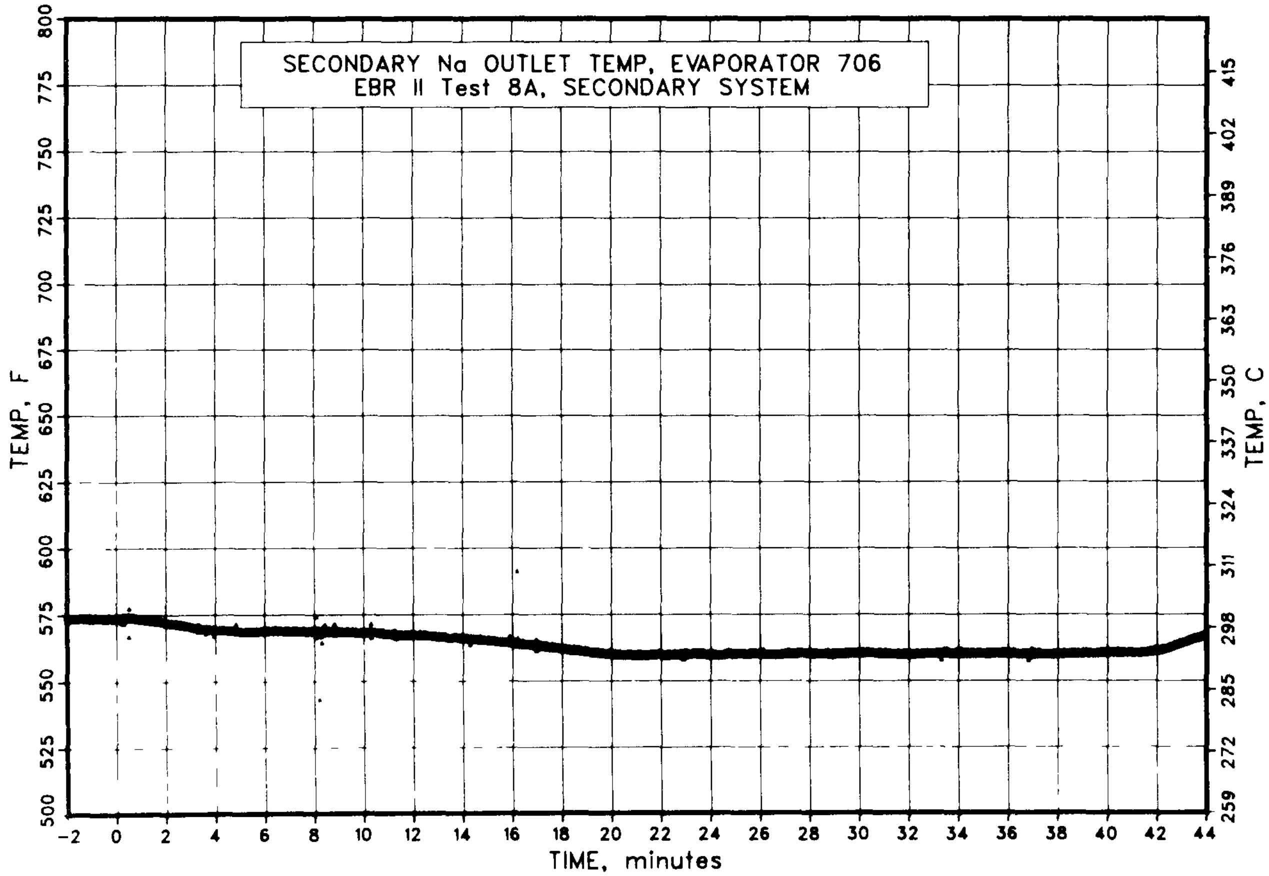

SECONDARY Na OUTLET TEMP, EVAPORATOR 701
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

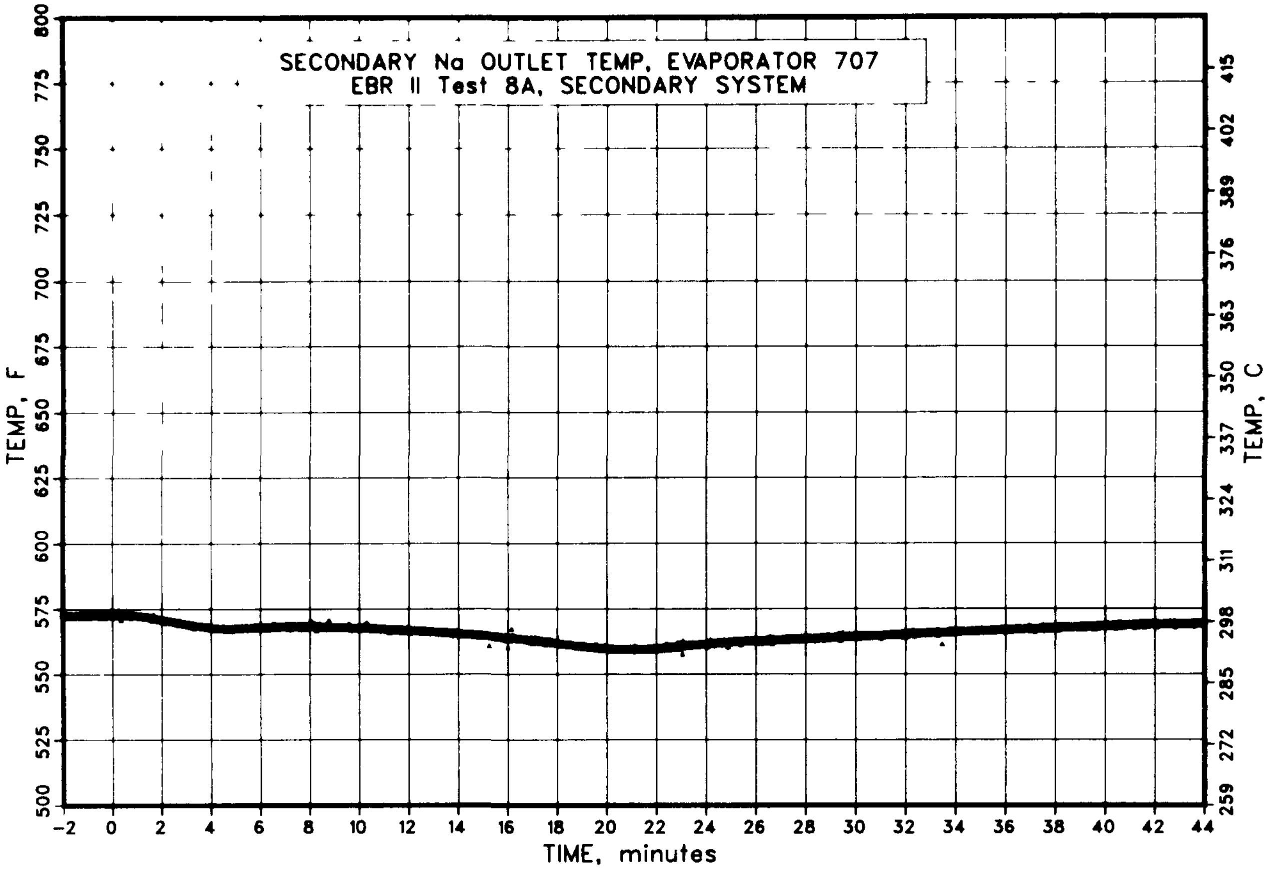

SECONDARY Na OUTLET TEMP, EVAPORATOR 702
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

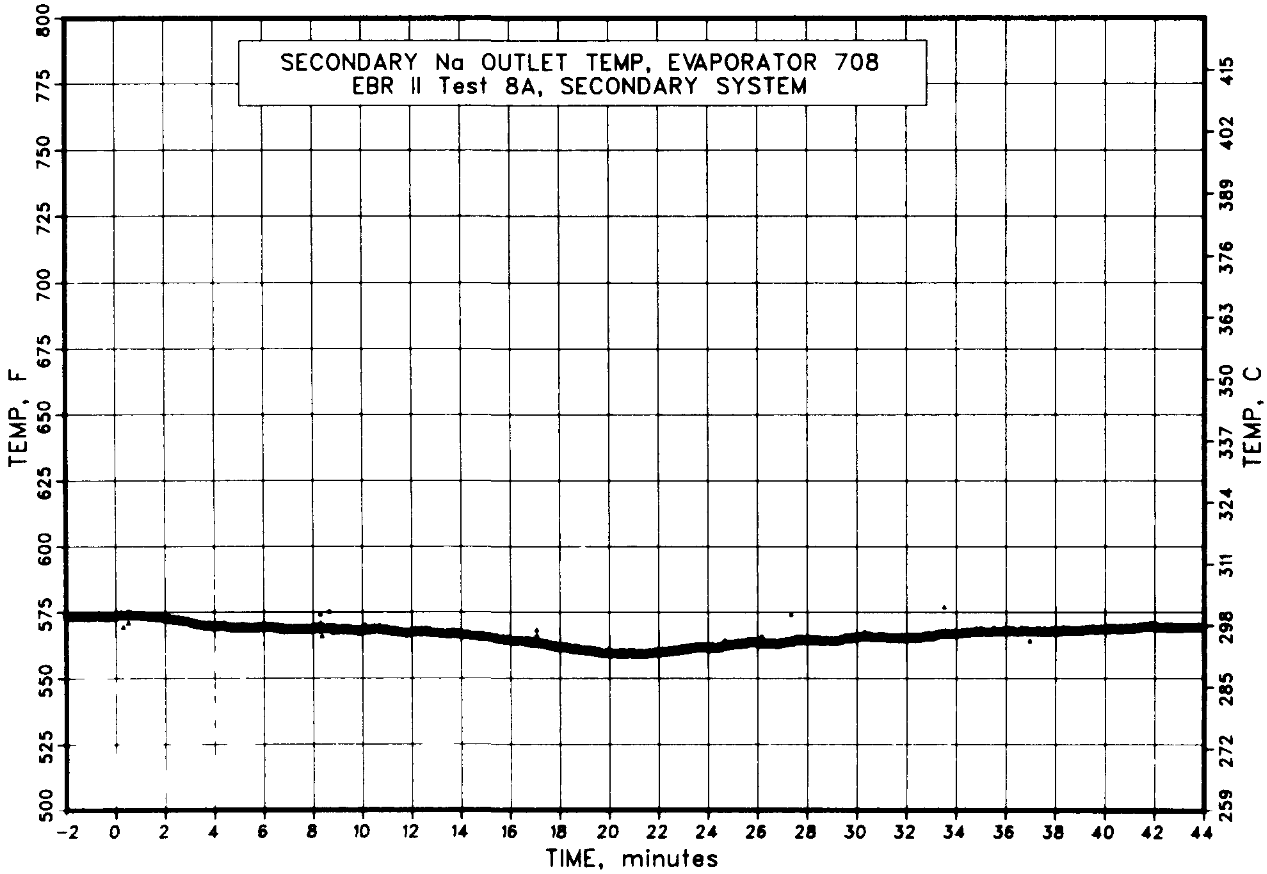

SECONDARY Na OUTLET TEMP, EVAPORATOR 703
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

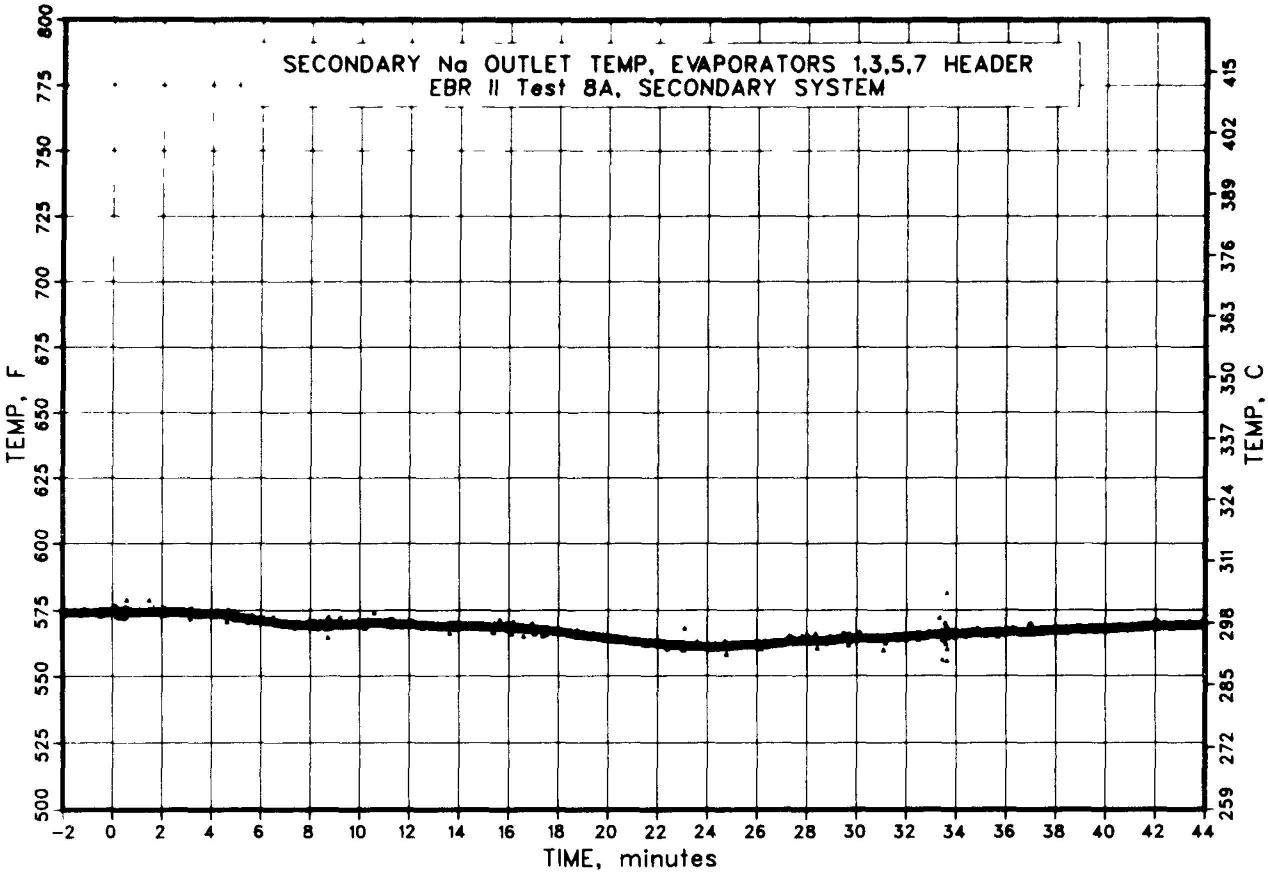

SECONDARY Na OUTLET TEMP, EVAPORATOR 704
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

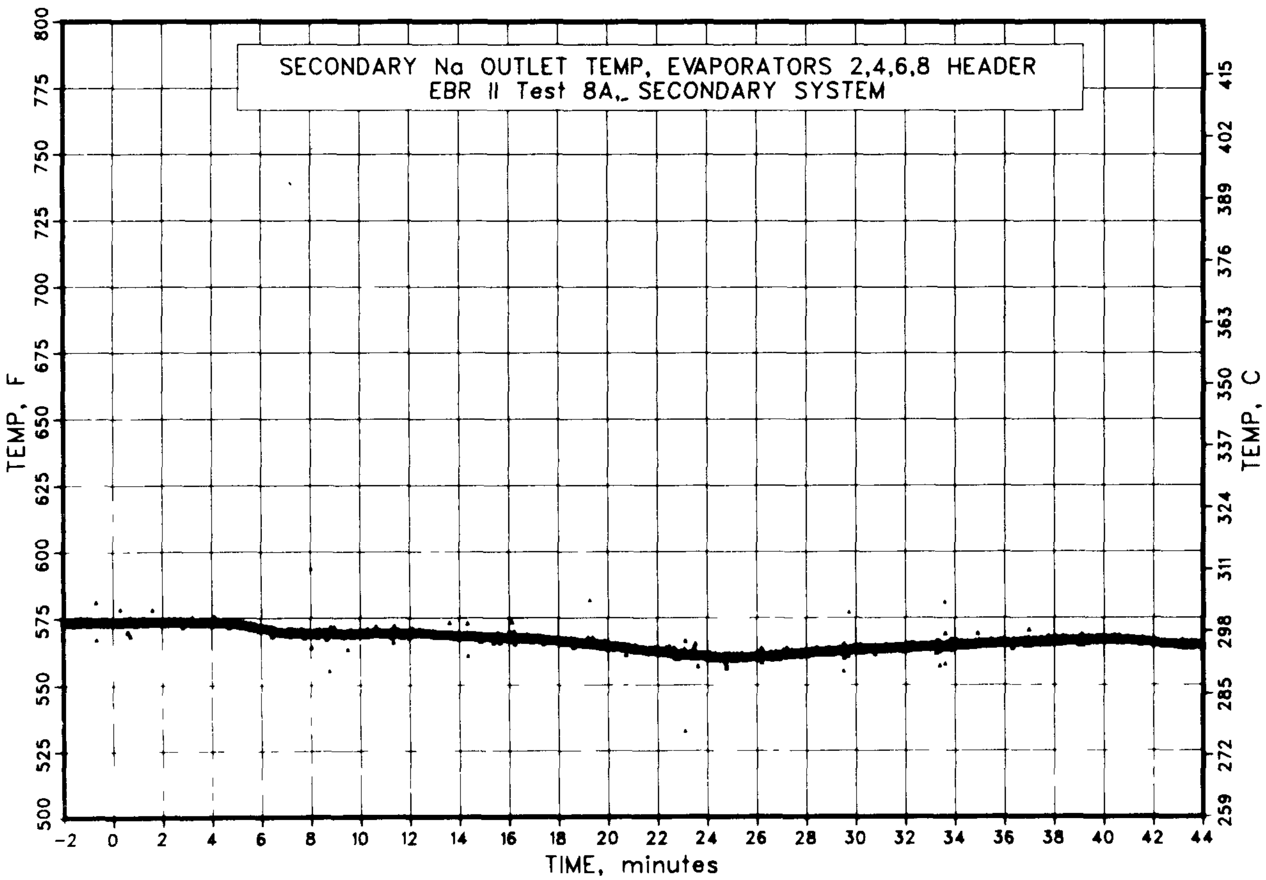

SECONDARY Na OUTLET TEMP, EVAPORATOR 705
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

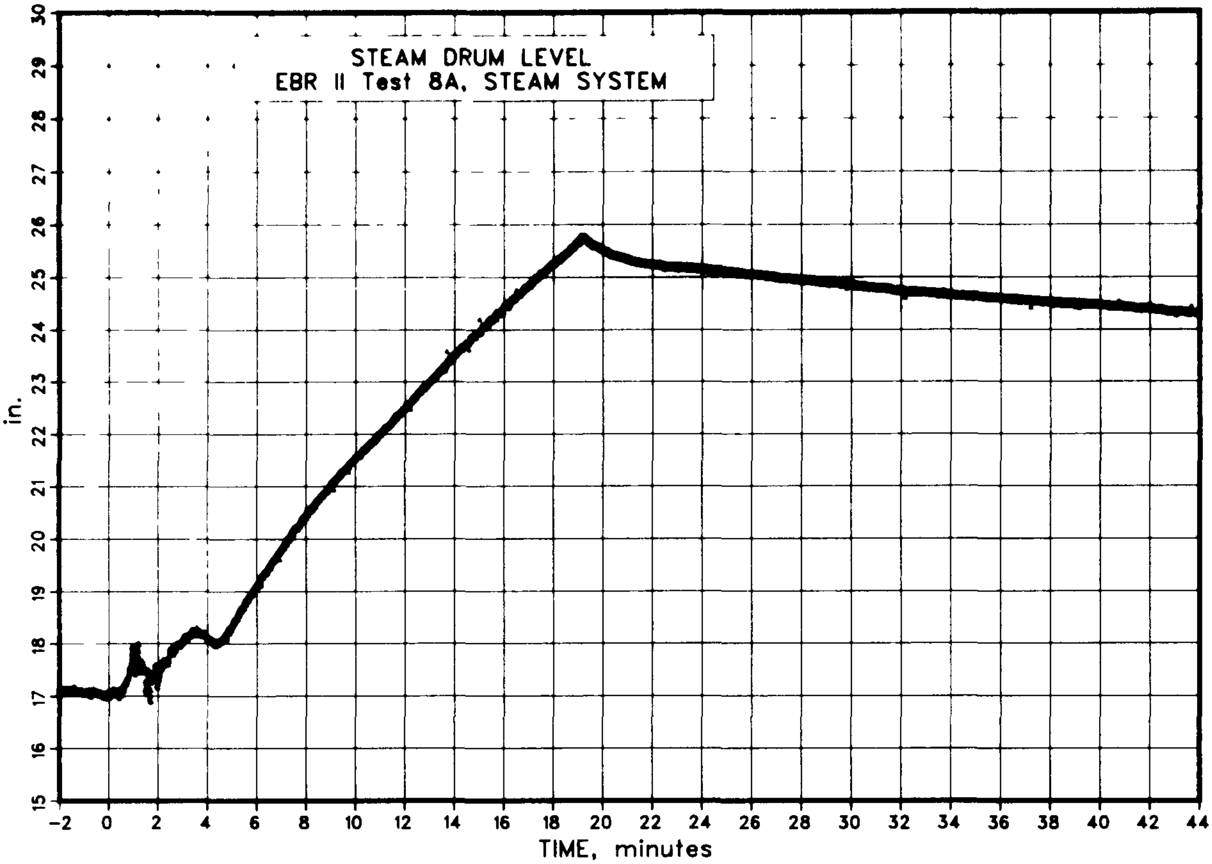

SECONDARY Na OUTLET TEMP, EVAPORATOR 706
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

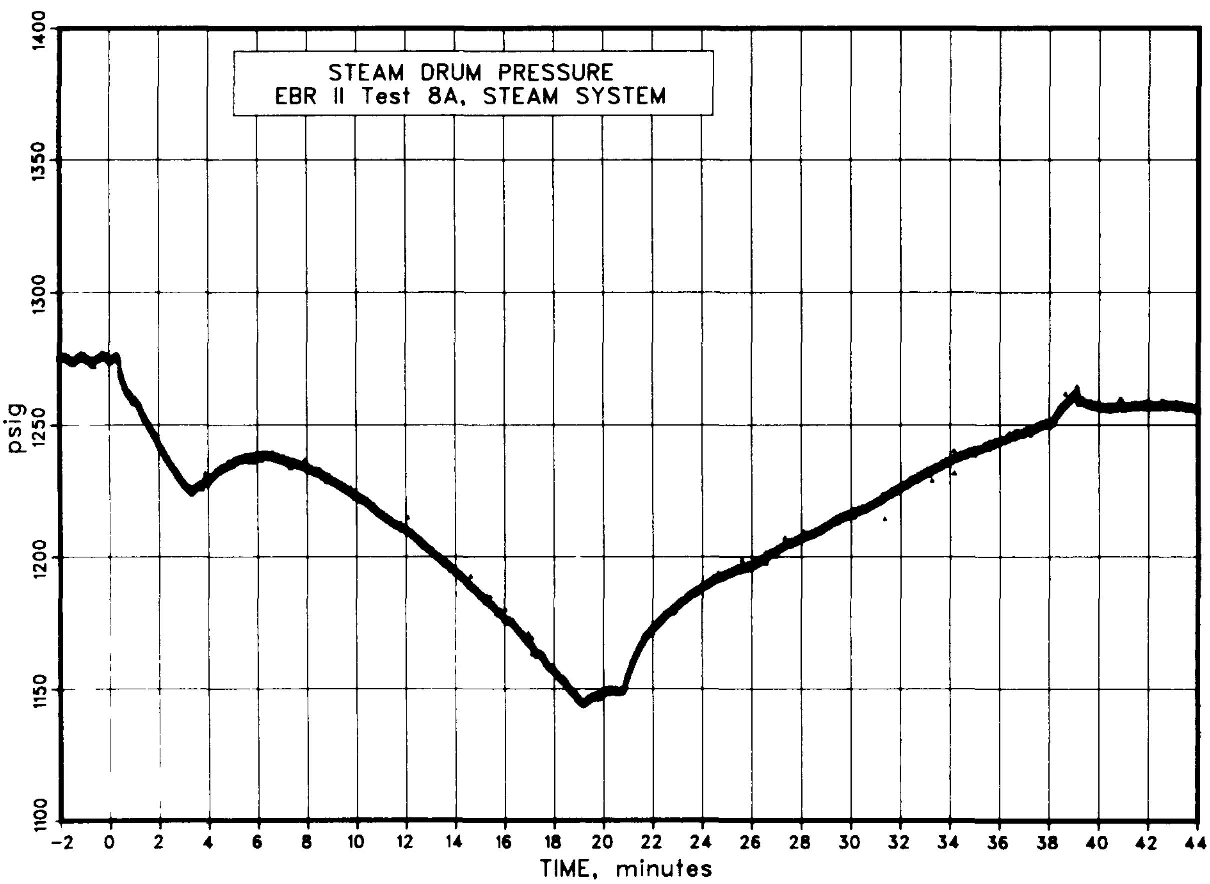

SECONDARY Na OUTLET TEMP, EVAPORATOR 707
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
800 775 750 725 700 675 650 625 600 575 550 525 500
TEMP, C
415 402 389 376 363 350 337 324 311 298 285 272 259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

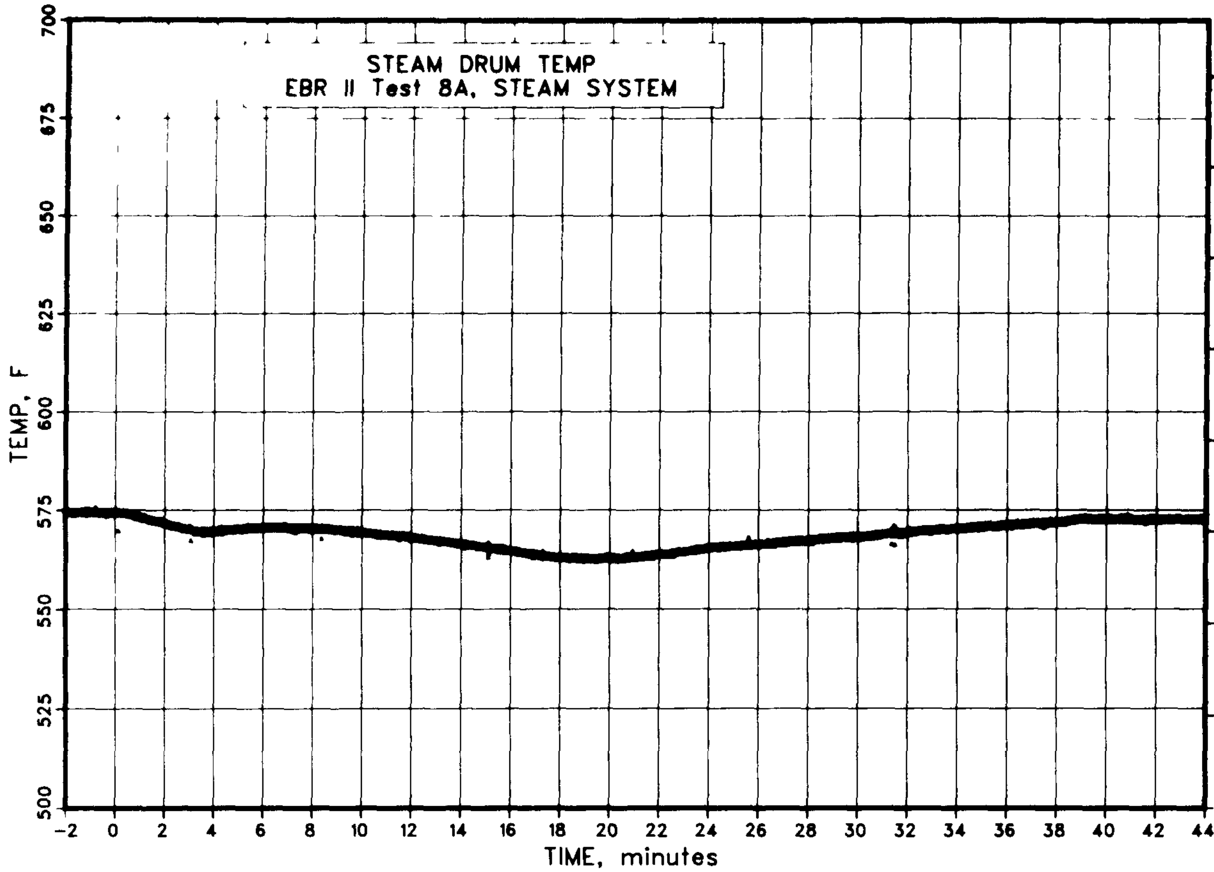

SECONDARY Na OUTLET TEMP, EVAPORATOR 708
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
800 775 750 725 700 675 650 625 600 575 550 525 500
TEMP, C
415 402 389 376 363 350 337 324 311 298 285 272 259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

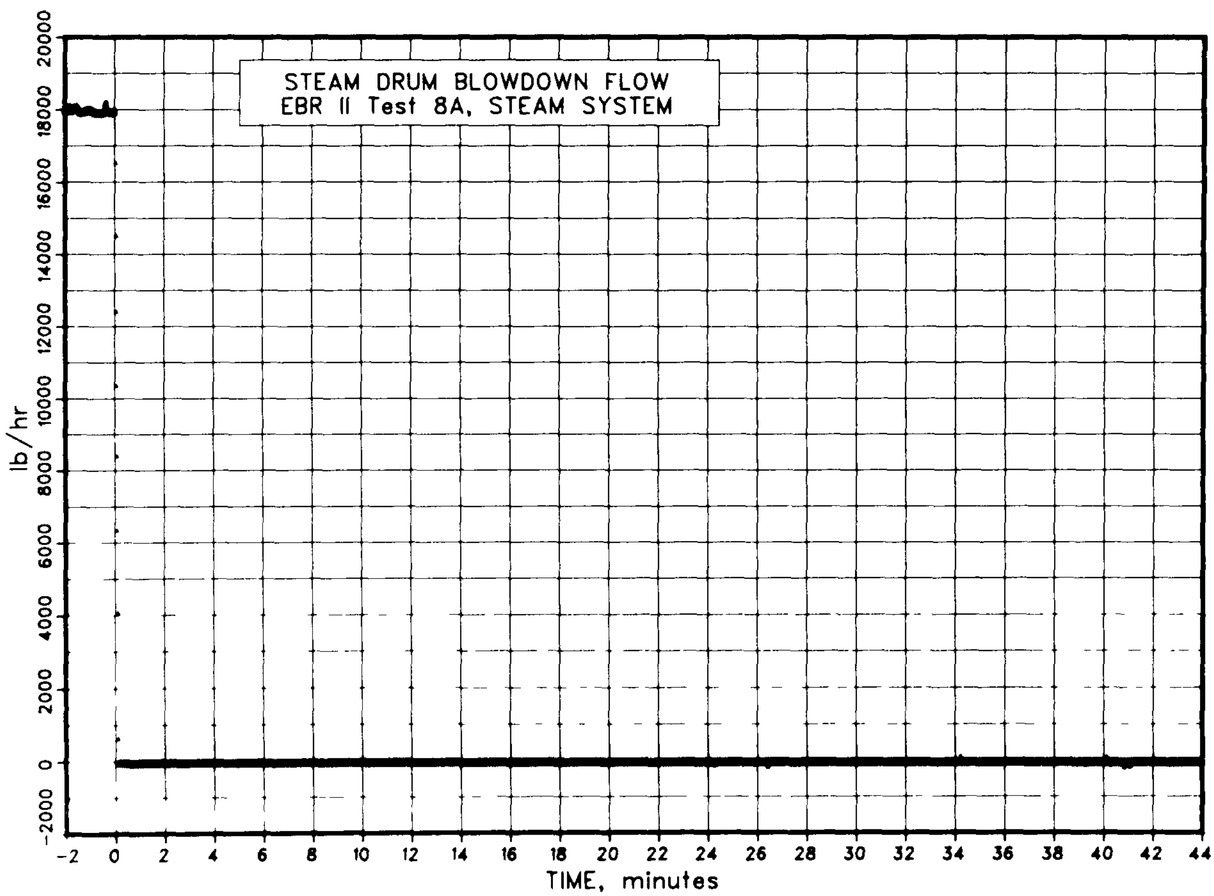

SECONDARY Na OUTLET TEMP, EVAPORATORS 1,3,5,7 HEADER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

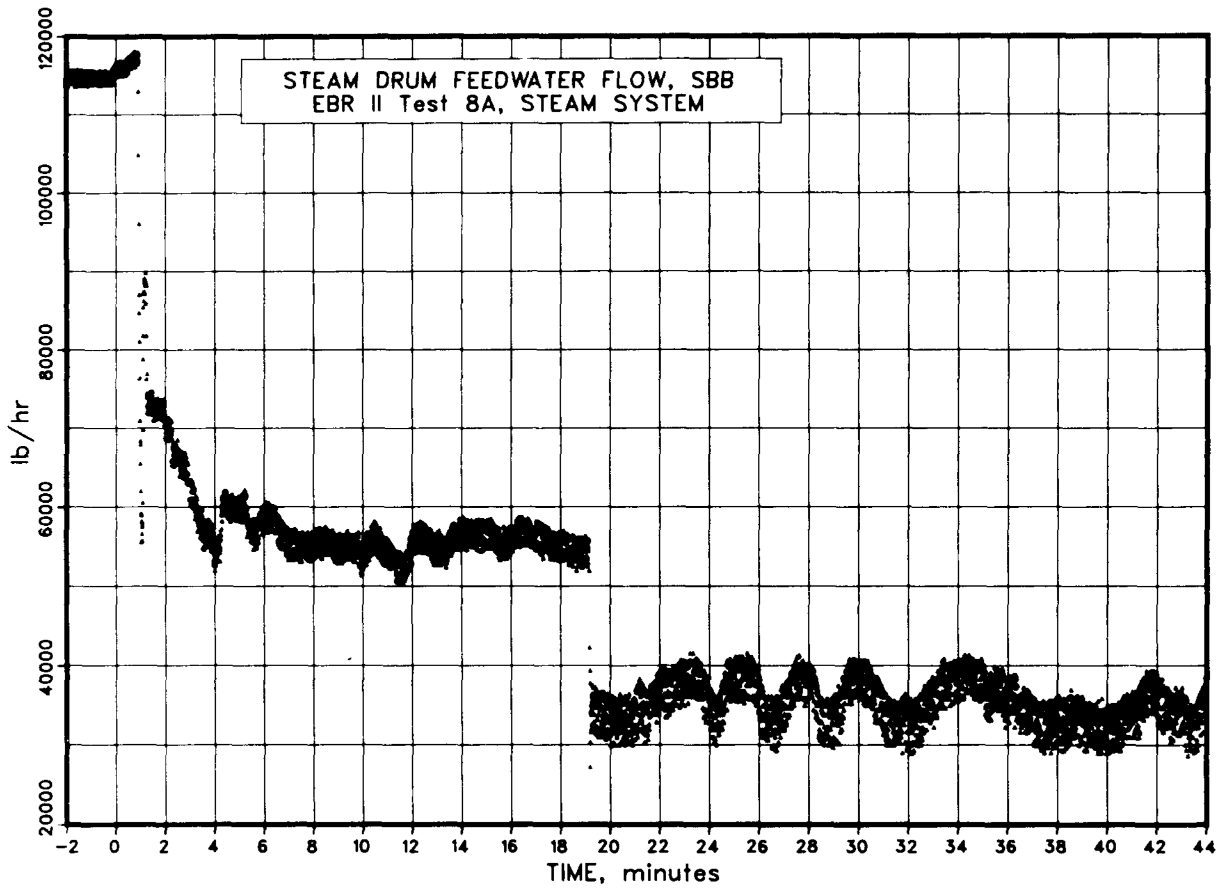

SECONDARY Na OUTLET TEMP, EVAPORATORS 2,4,6,8 HEADER
EBR II Test 8A, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

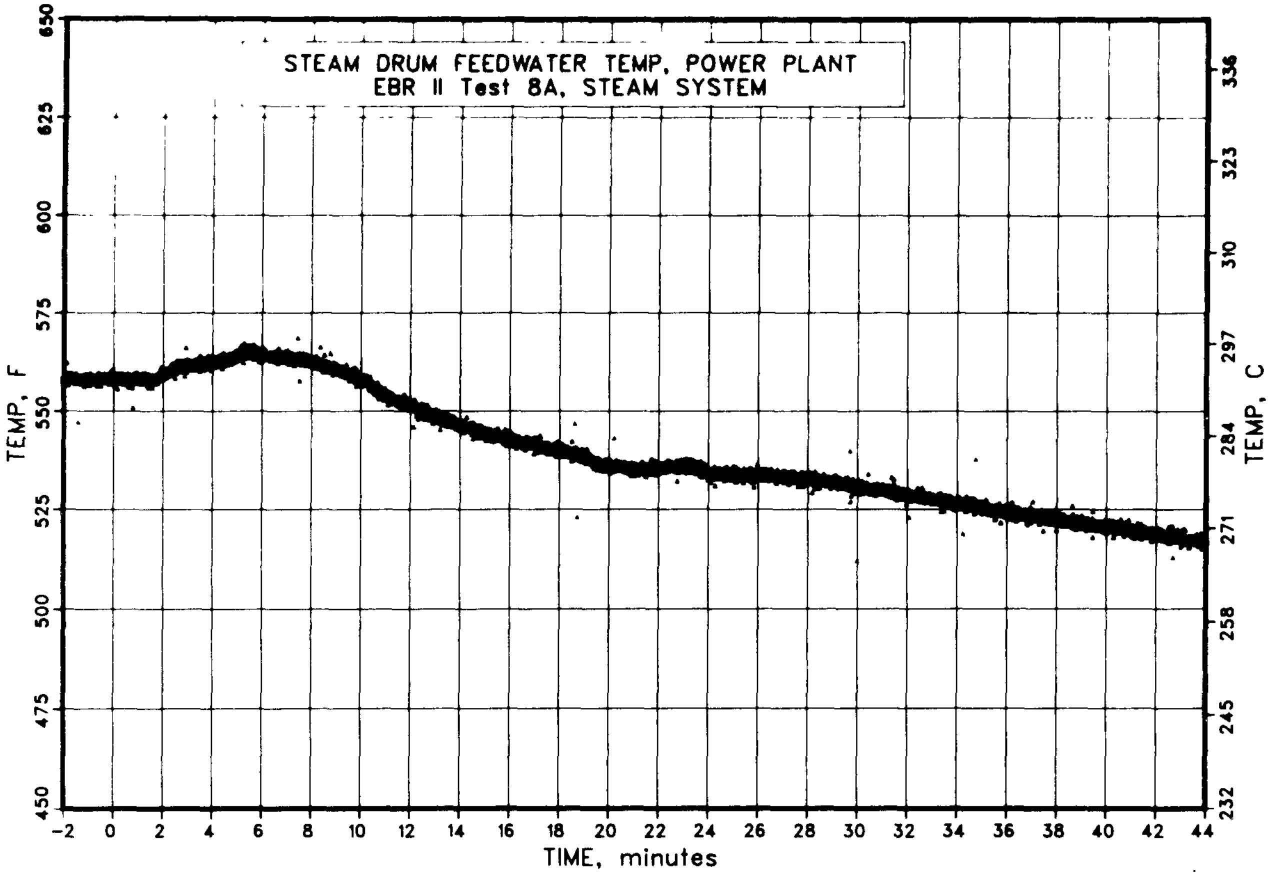

STEAM DRUM LEVEL
EBR II Test 8A, STEAM SYSTEM
in.
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes

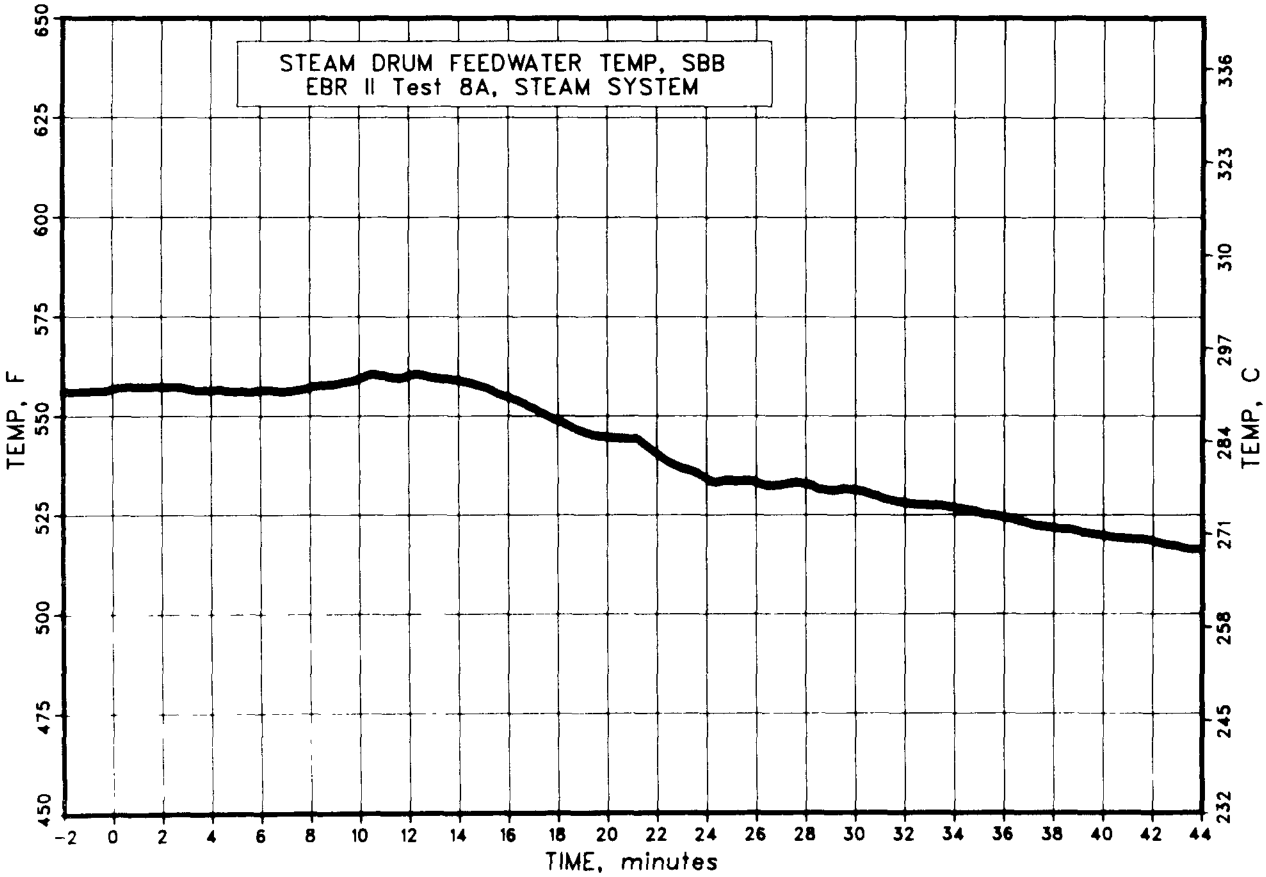

STEAM DRUM PRESSURE
EBR II Test 8A, STEAM SYSTEM
psig
1100
1150
1200
1250
1300
1350
1400
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes

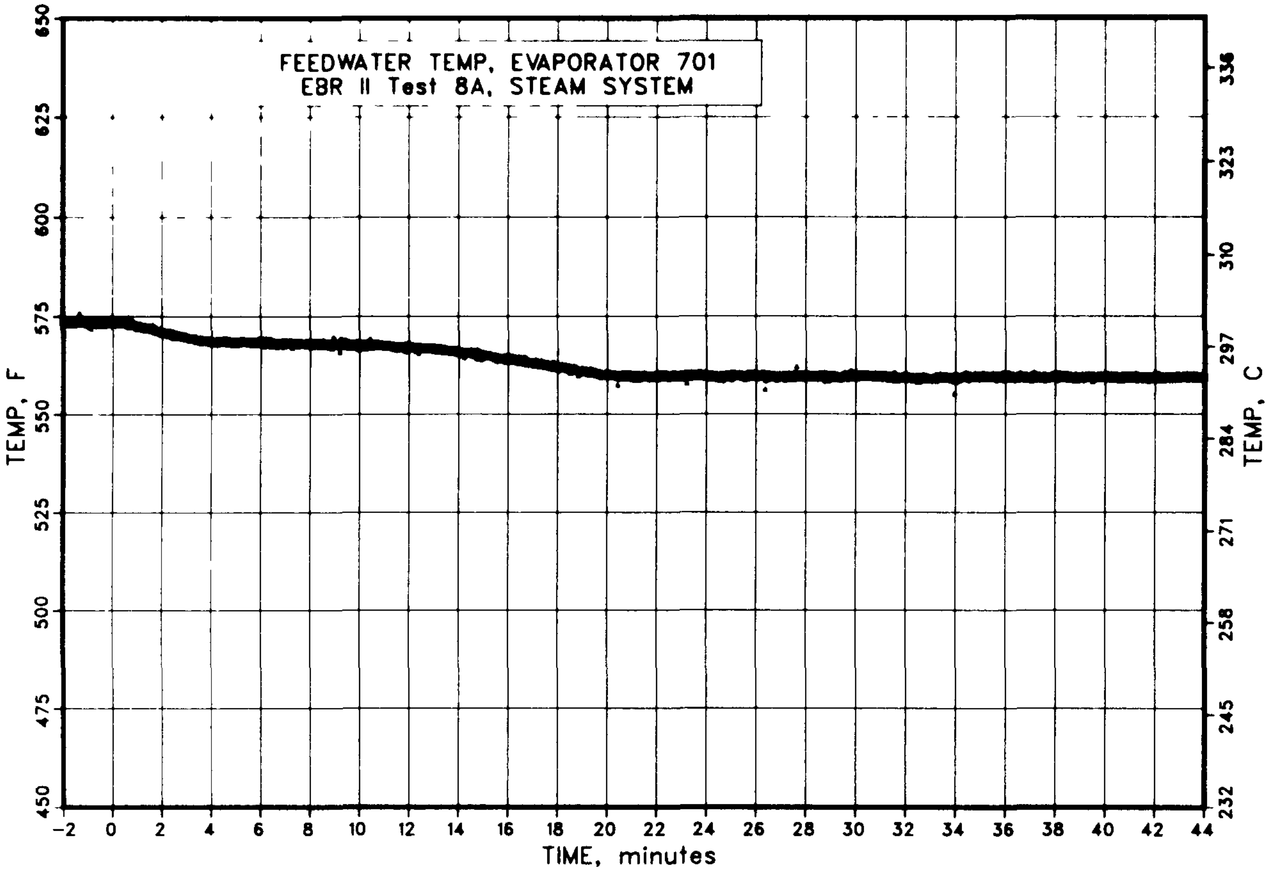

STEAM DRUM TEMP
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
700
675
650
625
600
575
550
525
500
363
350
337
324
311
298
285
272
259
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44

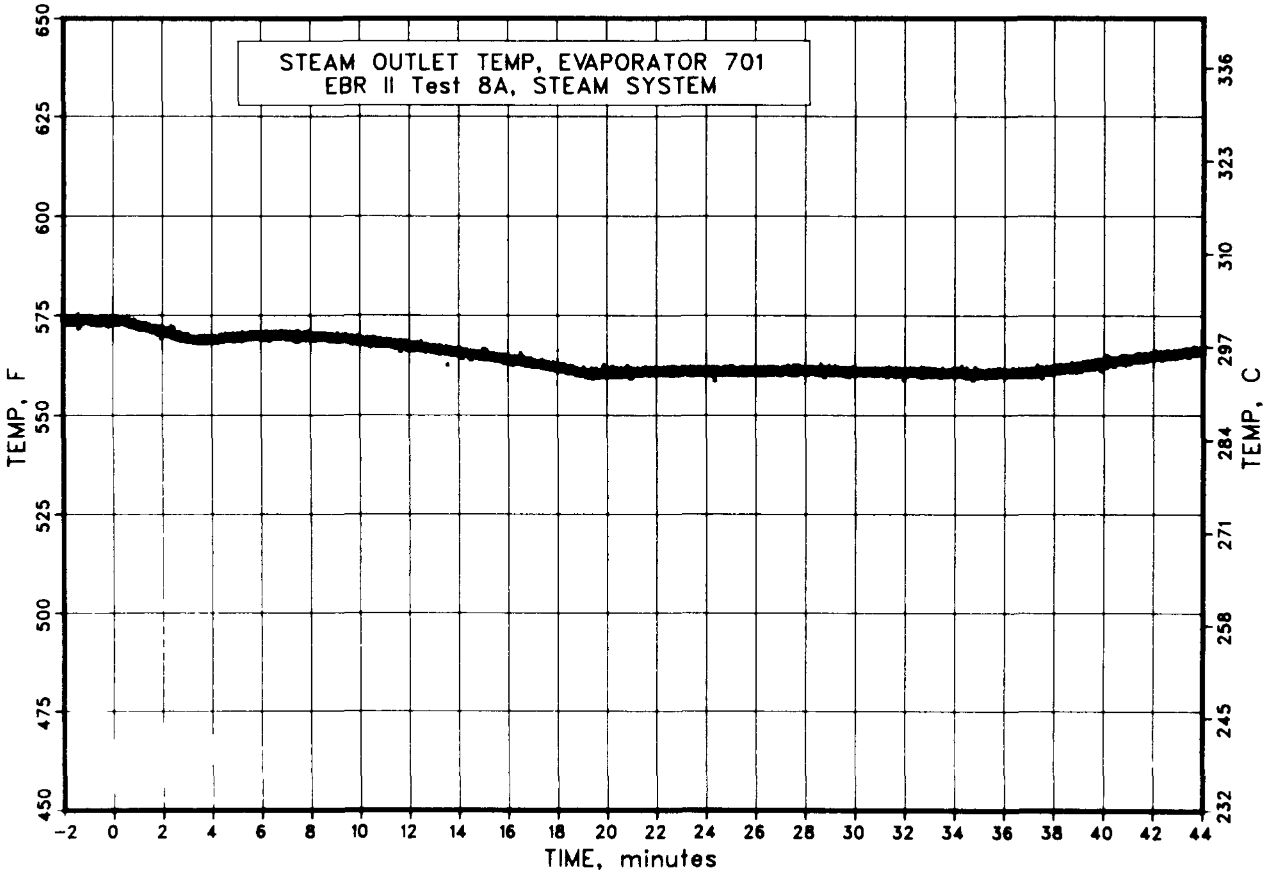

STEAM DRUM BLOWDOWN FLOW
EBR II Test 8A, STEAM SYSTEM
lb/hr
TIME, minutes
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44

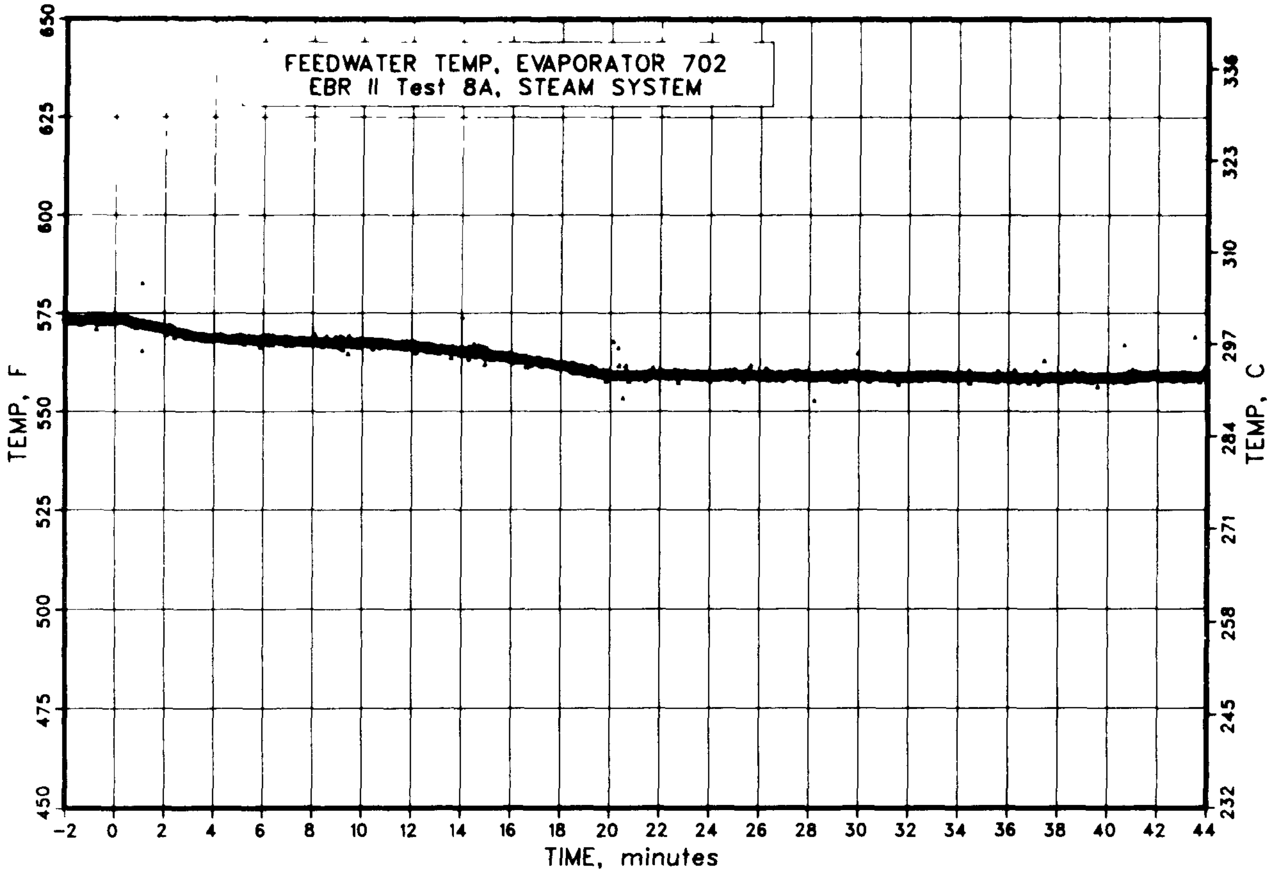

STEAM DRUM FEEDWATER FLOW, SBB
EBR II Test 8A, STEAM SYSTEM
lb/hr
120000
100000
80000
60000
40000
20000
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


STEAM DRUM FEEDWATER TEMP, POWER PLANT
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


STEAM DRUM FEEDWATER TEMP, SBB
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


FEEDWATER TEMP, EVAPORATOR 701
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


STEAM OUTLET TEMP, EVAPORATOR 701
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


FEEDWATER TEMP, EVAPORATOR 702
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
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12
14
16
18
20
22
24
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28
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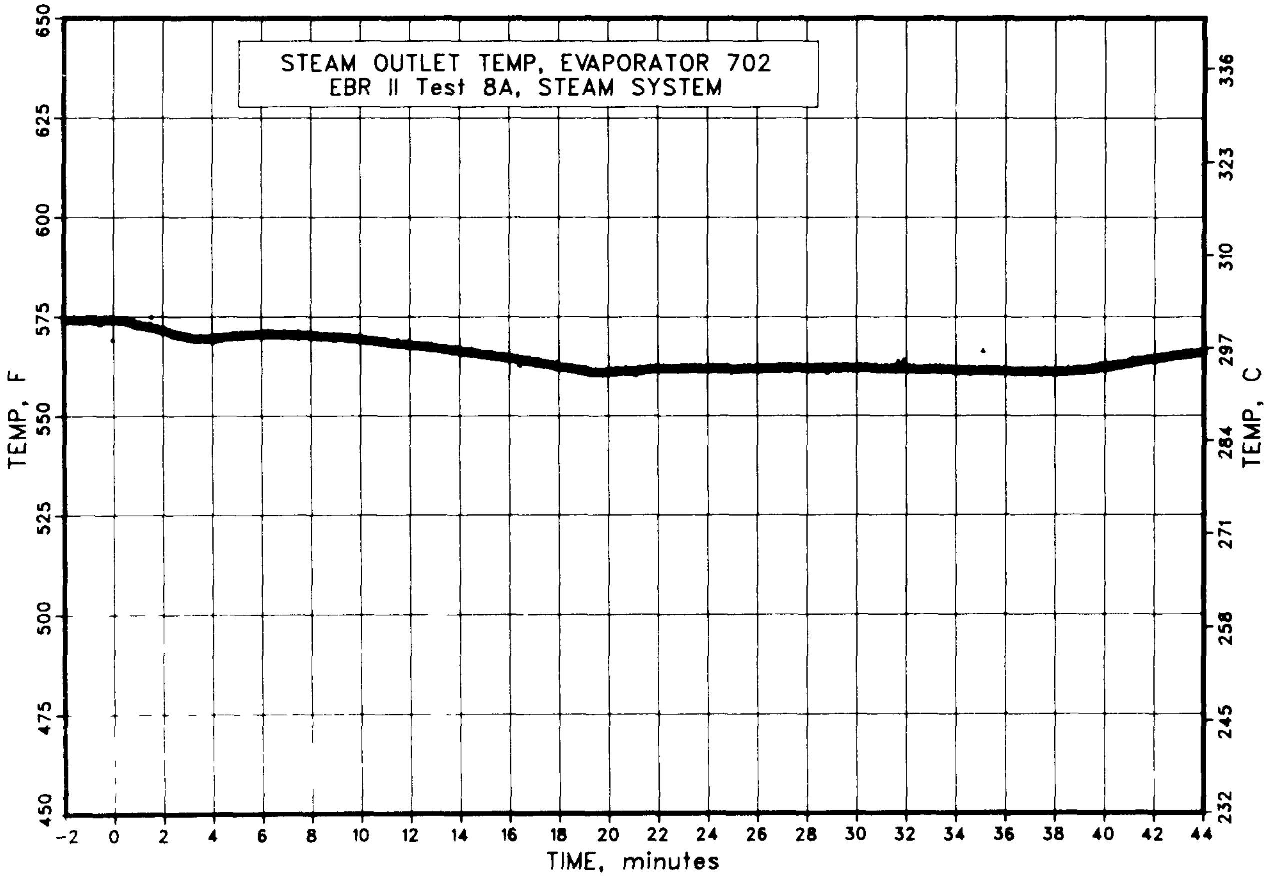
32
34
36
38
40
42
44


STEAM OUTLET TEMP, EVAPORATOR 702
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
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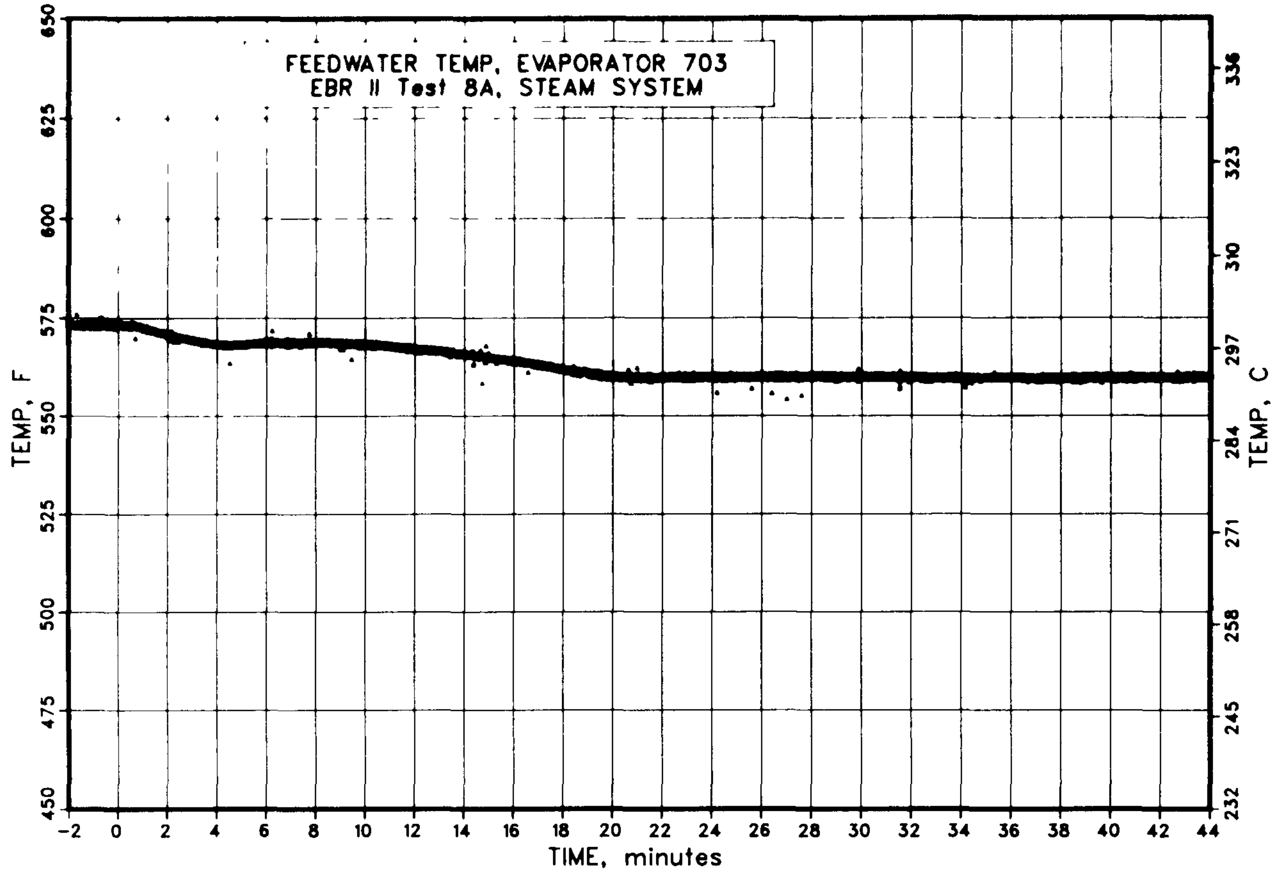
36
38
40
42
44


FEEDWATER TEMP, EVAPORATOR 703
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
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14
16
18
20
22
24
26
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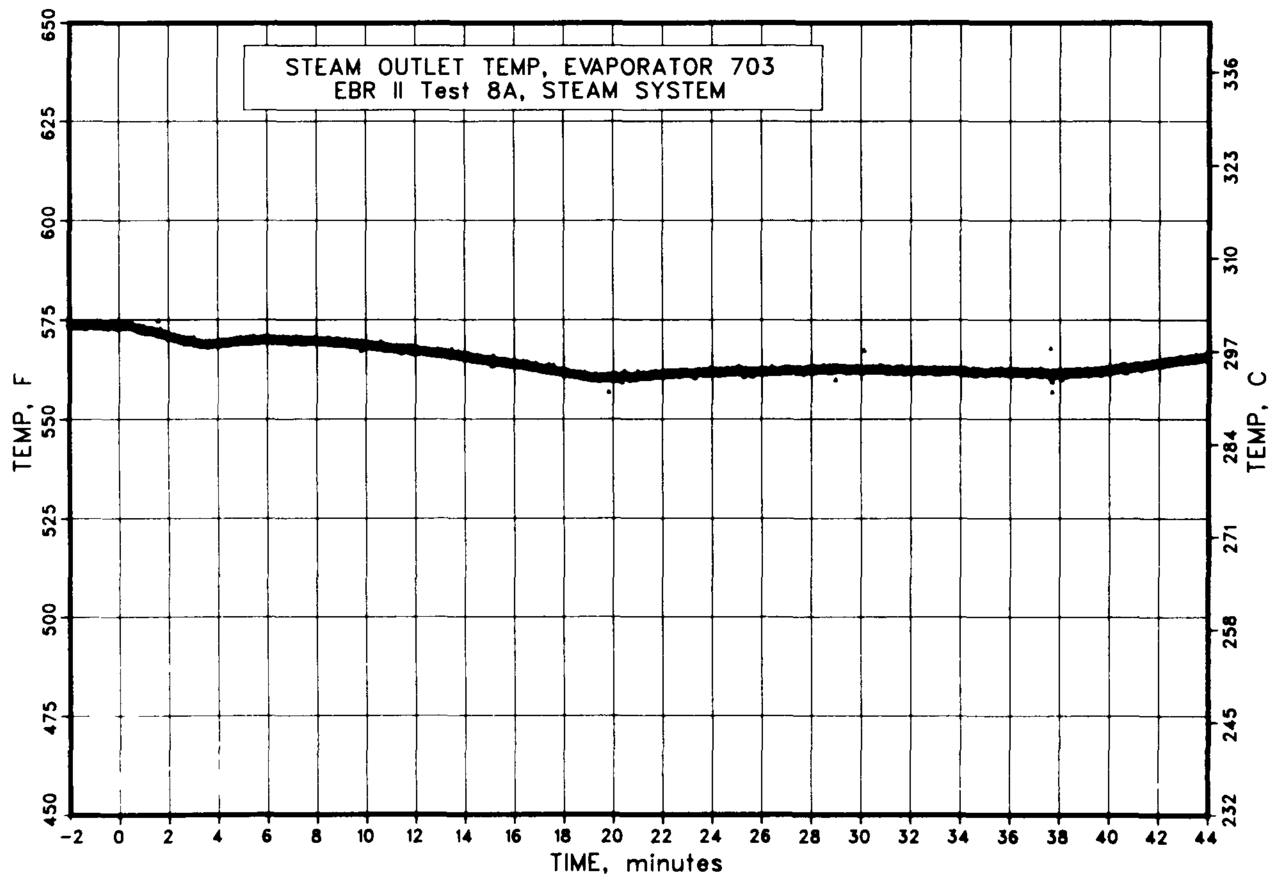
30
32
34
36
38
40
42
44


STEAM OUTLET TEMP, EVAPORATOR 703
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
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38
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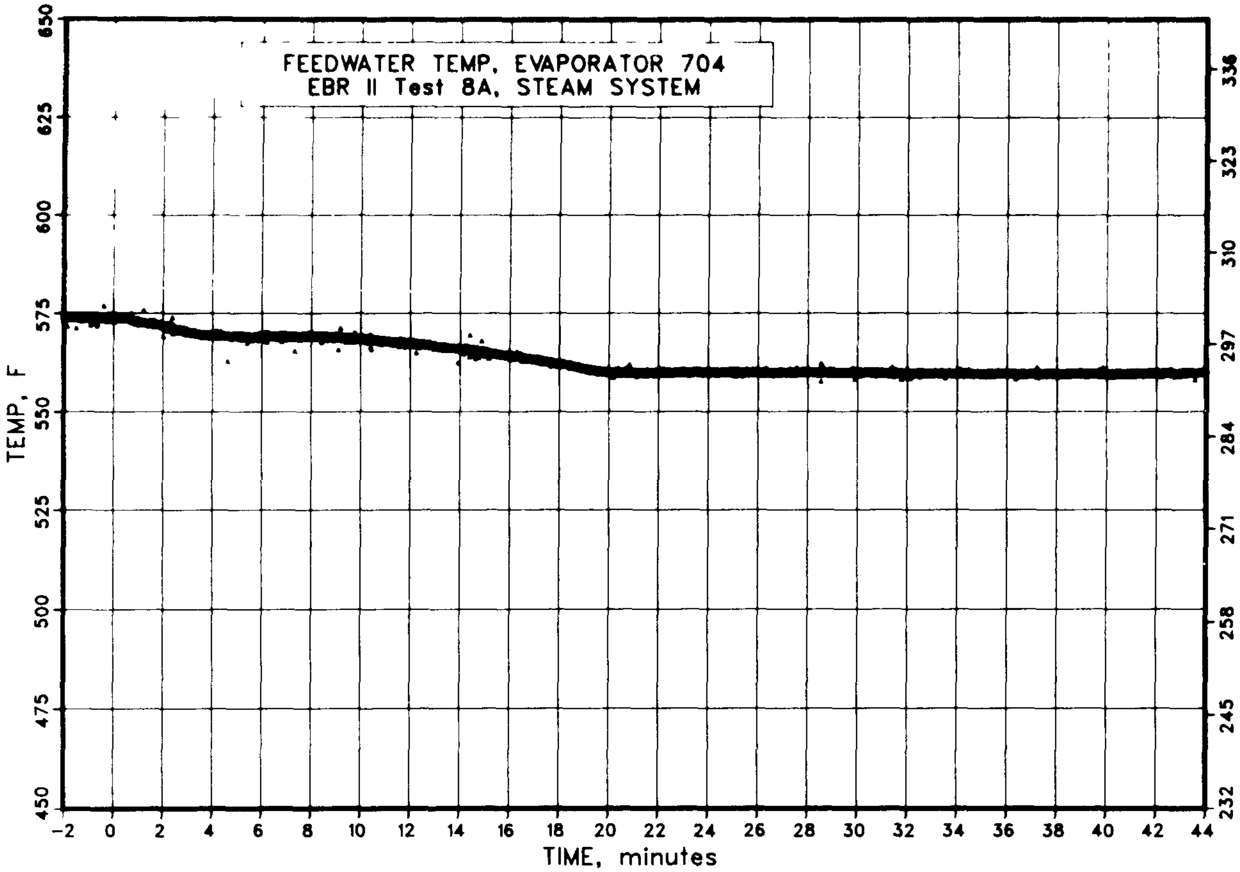
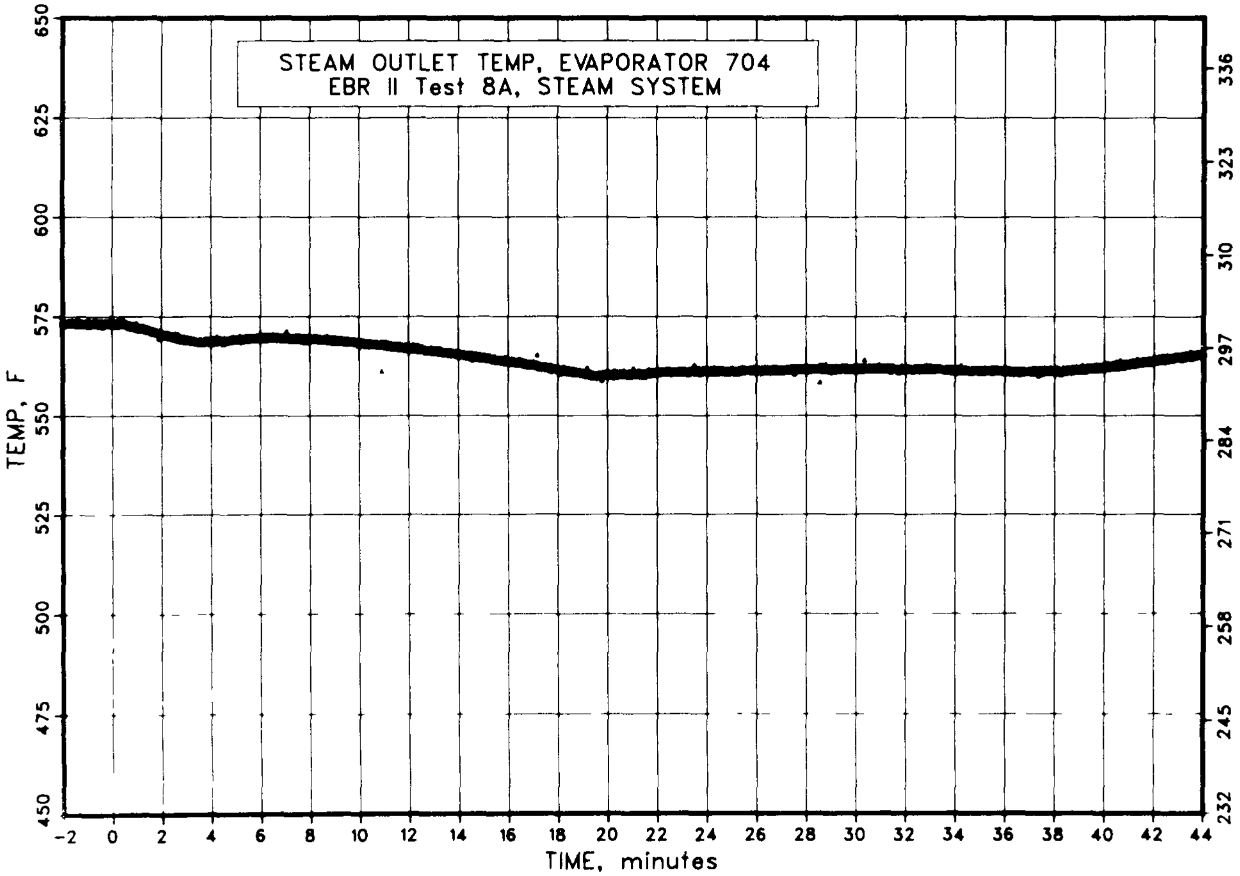
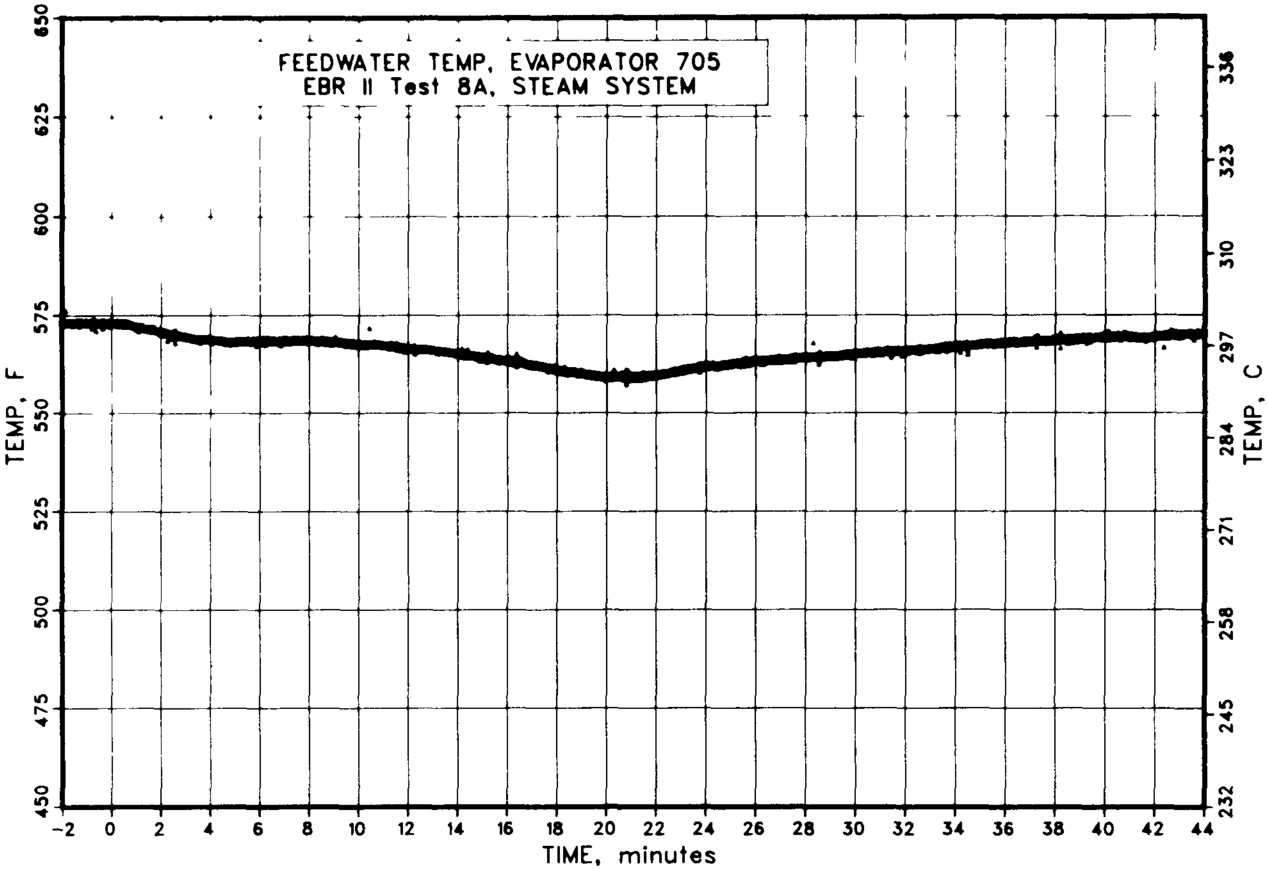
42
44


FEEDWATER TEMP, EVAPORATOR 704
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


STEAM OUTLET TEMP, EVAPORATOR 704
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44


FEEDWATER TEMP, EVAPORATOR 705
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
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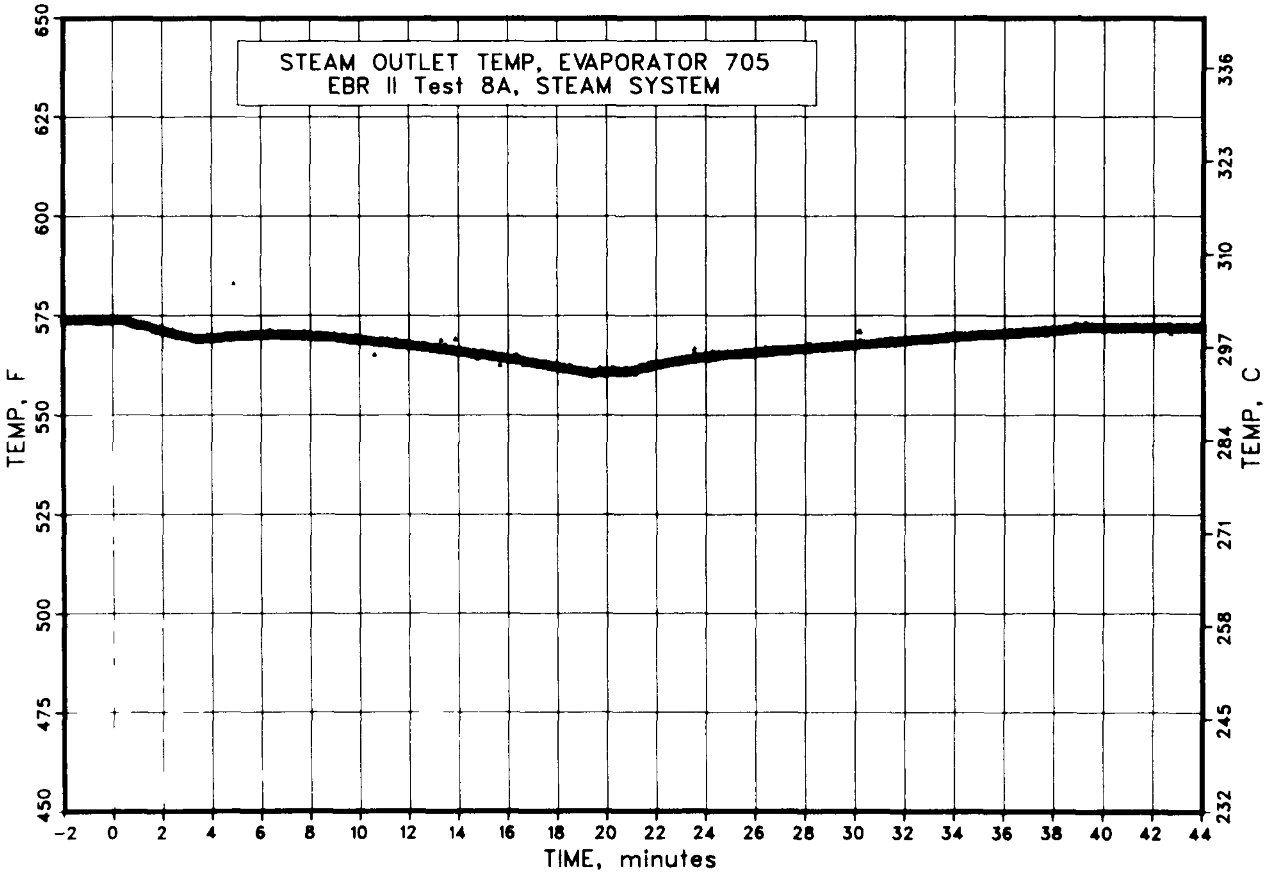
36
38
40
42
44


STEAM OUTLET TEMP, EVAPORATOR 705
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
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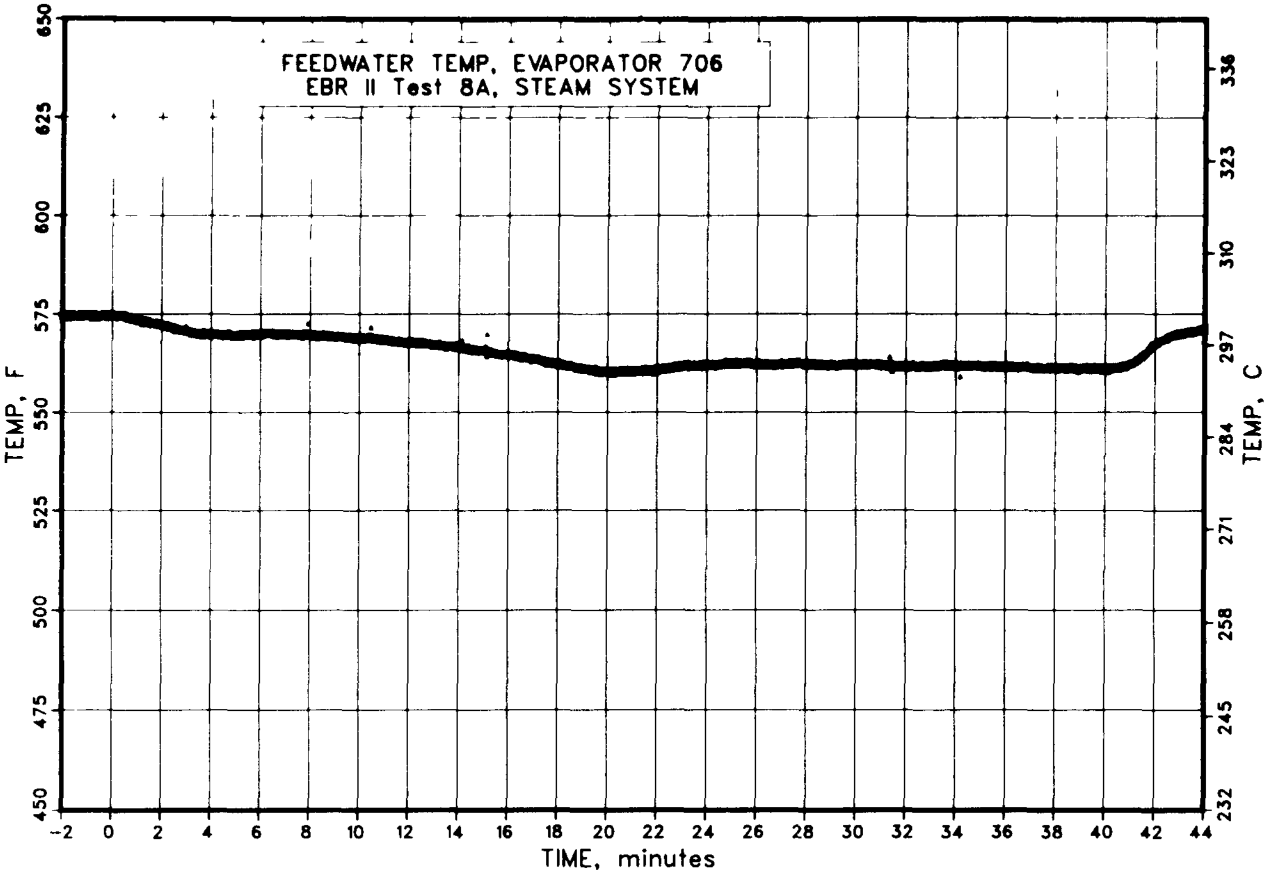
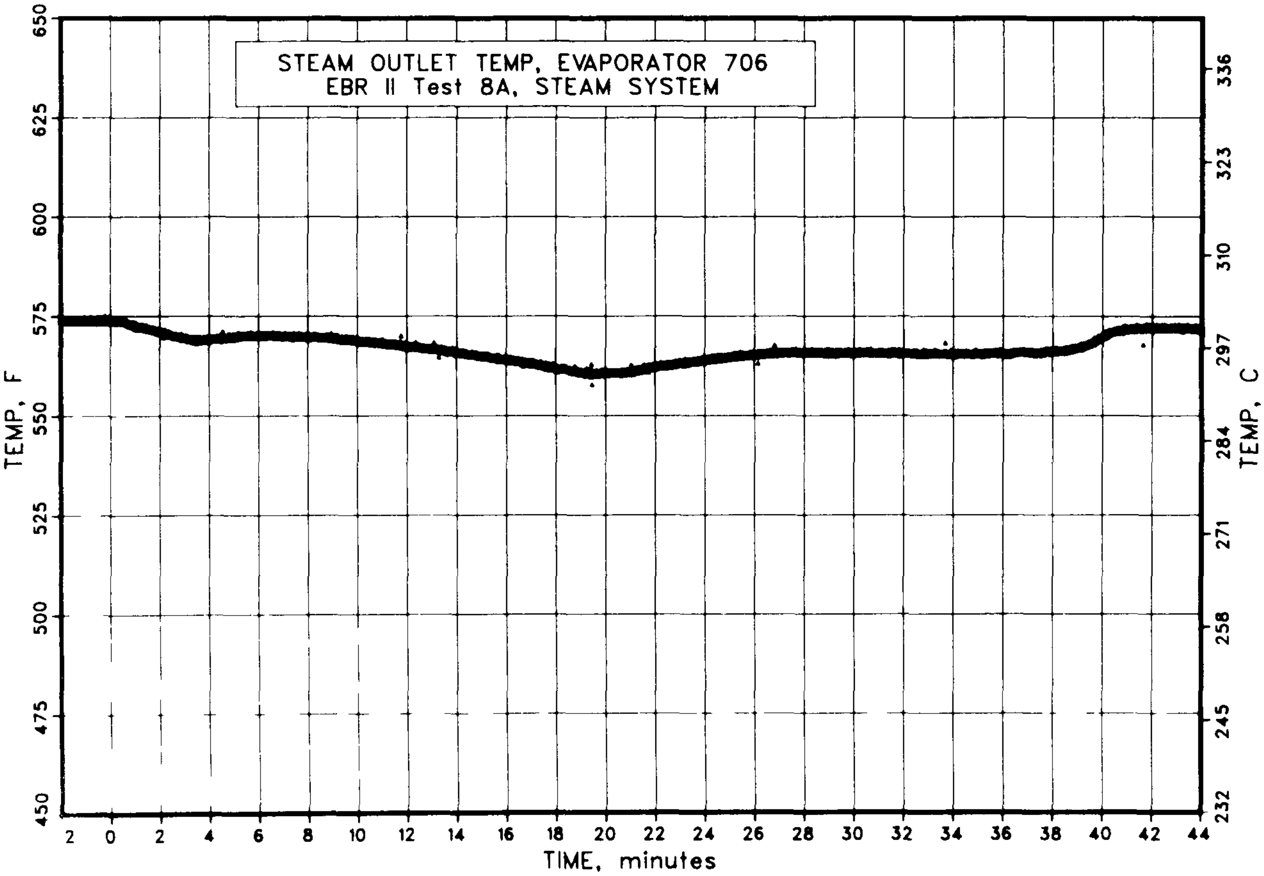
36
38
40
42
44


FEEDWATER TEMP, EVAPORATOR 706
EBR II Test 8A, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


STEAM OUTLET TEMP, EVAPORATOR 706
EBR II Test 8A, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
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284
271
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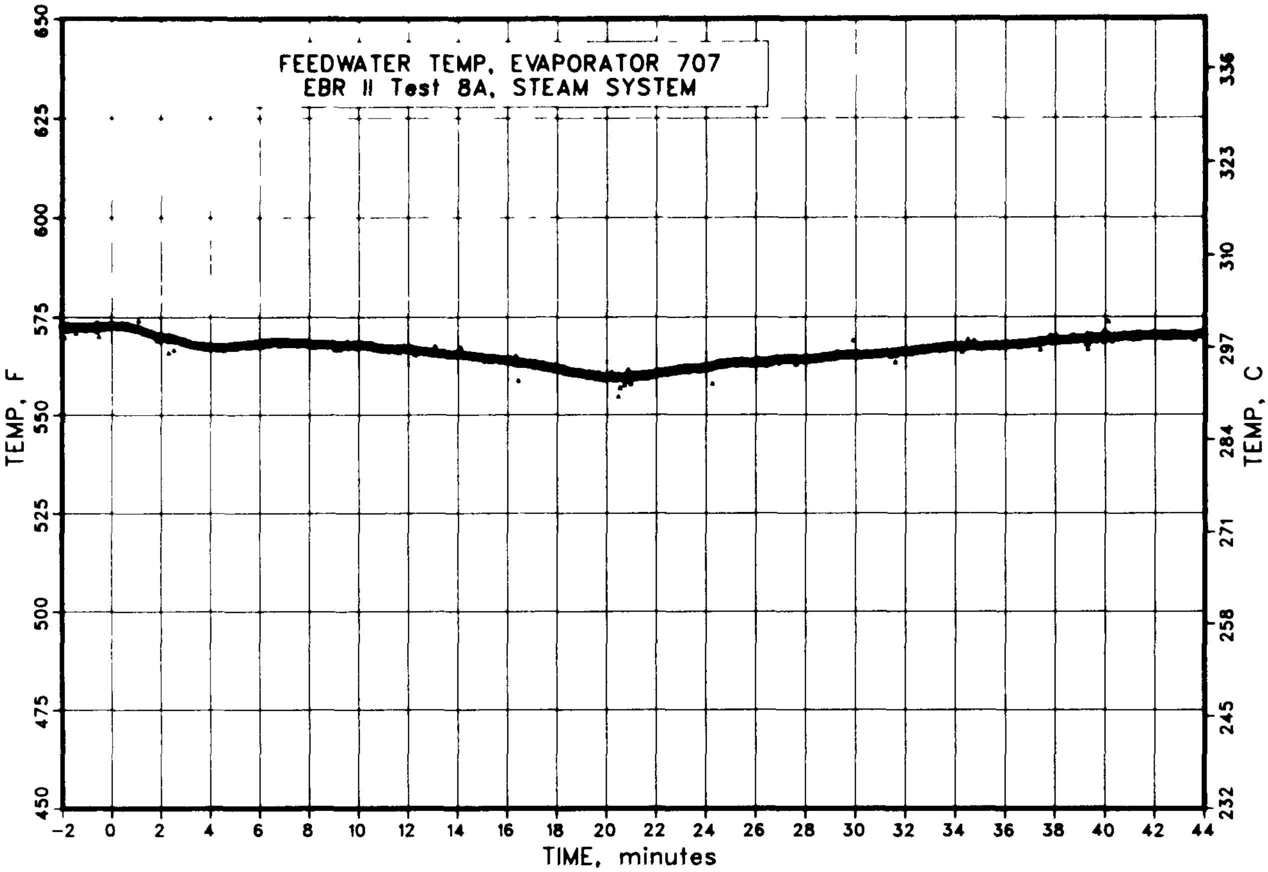
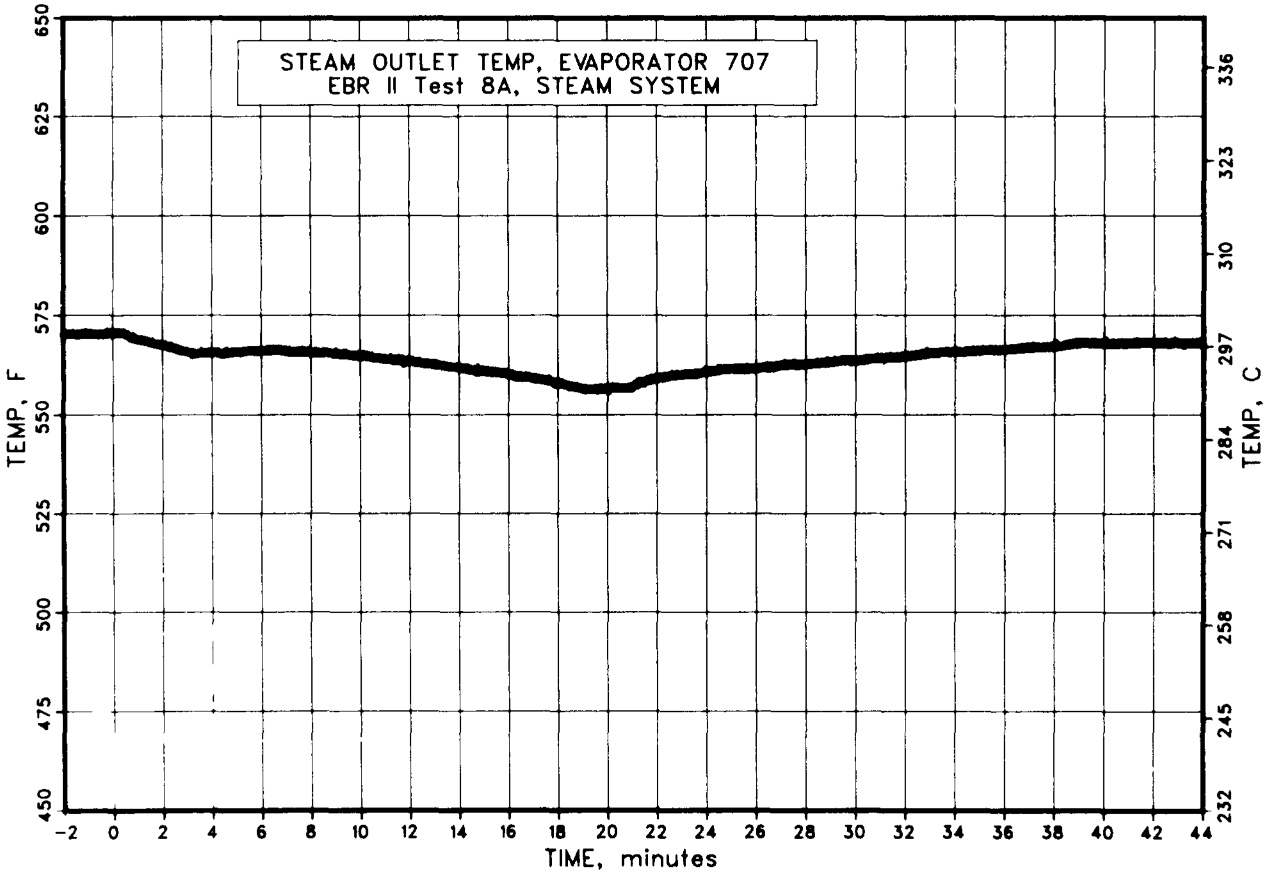
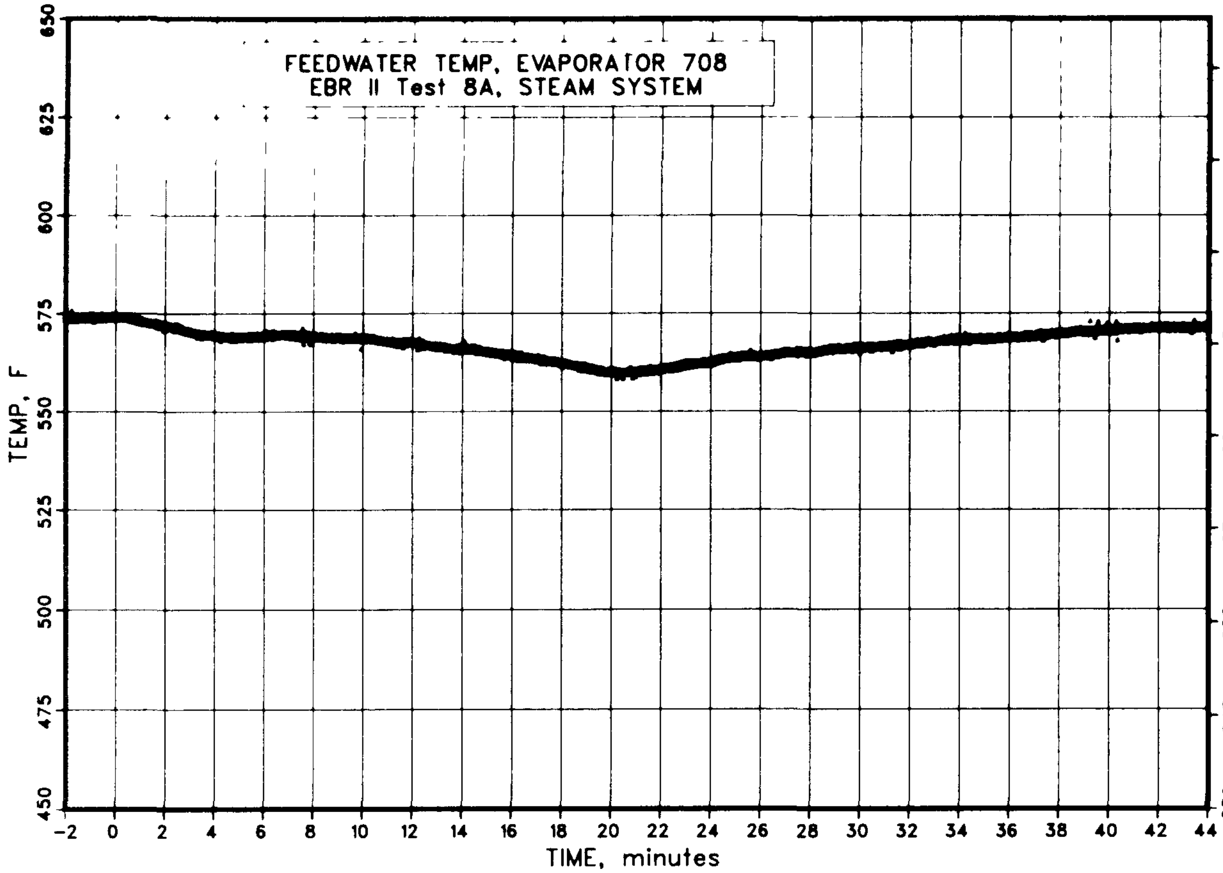
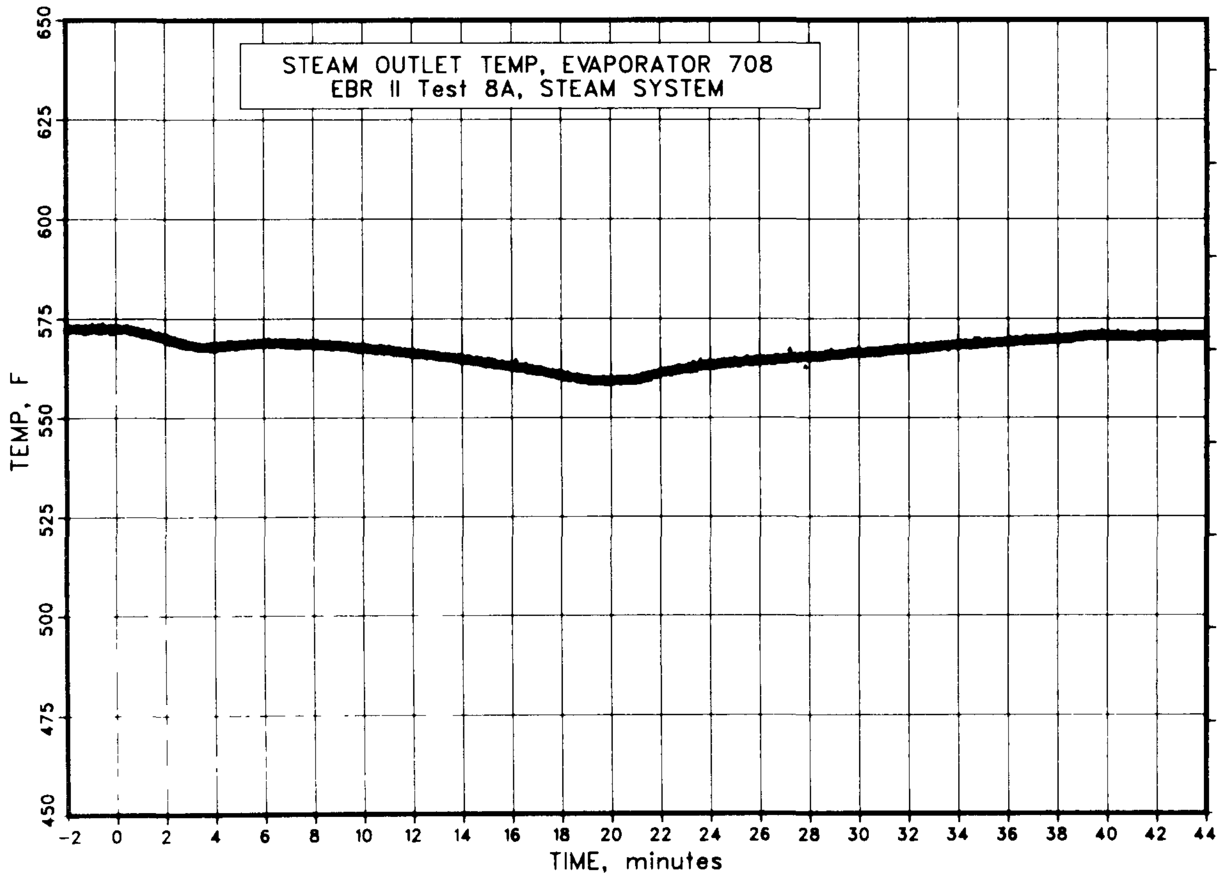
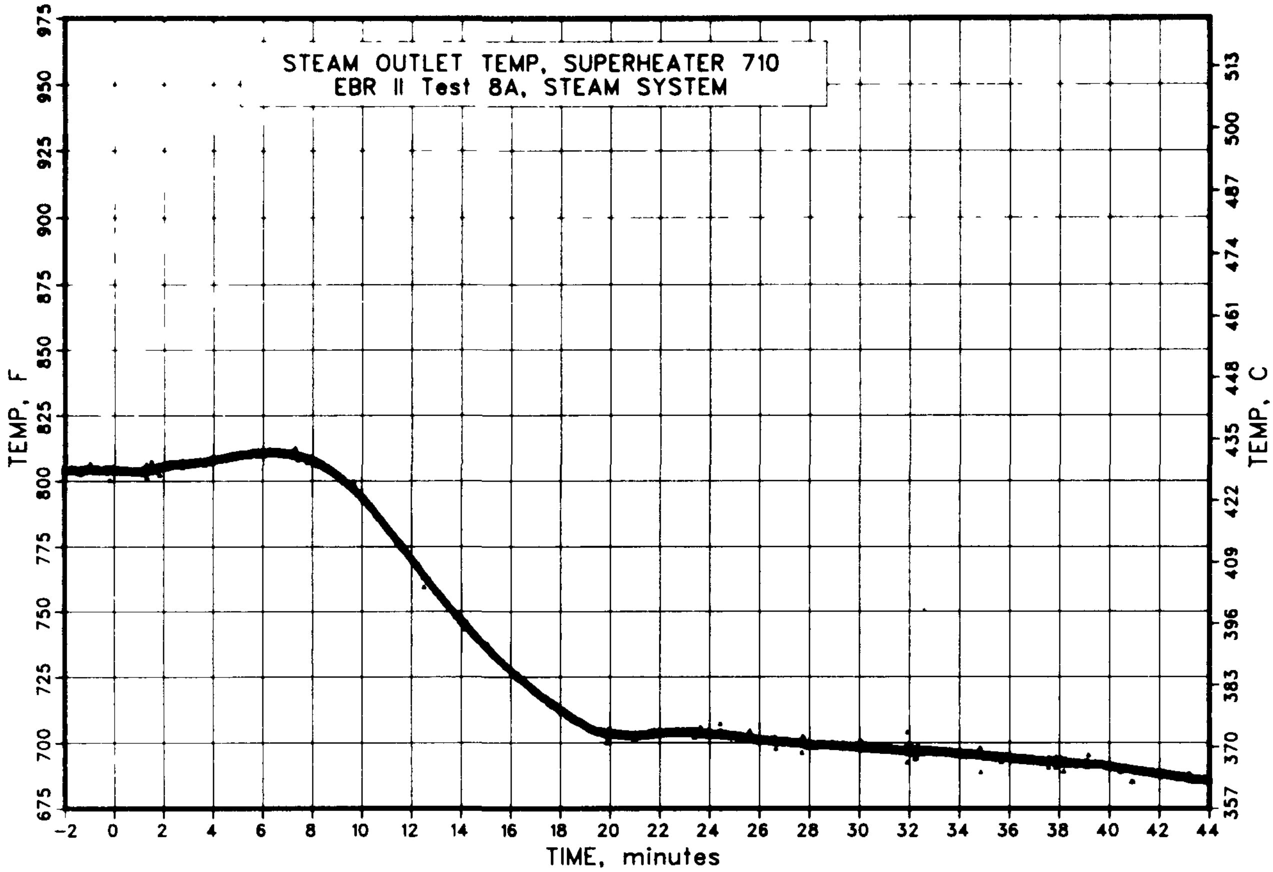
232
2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

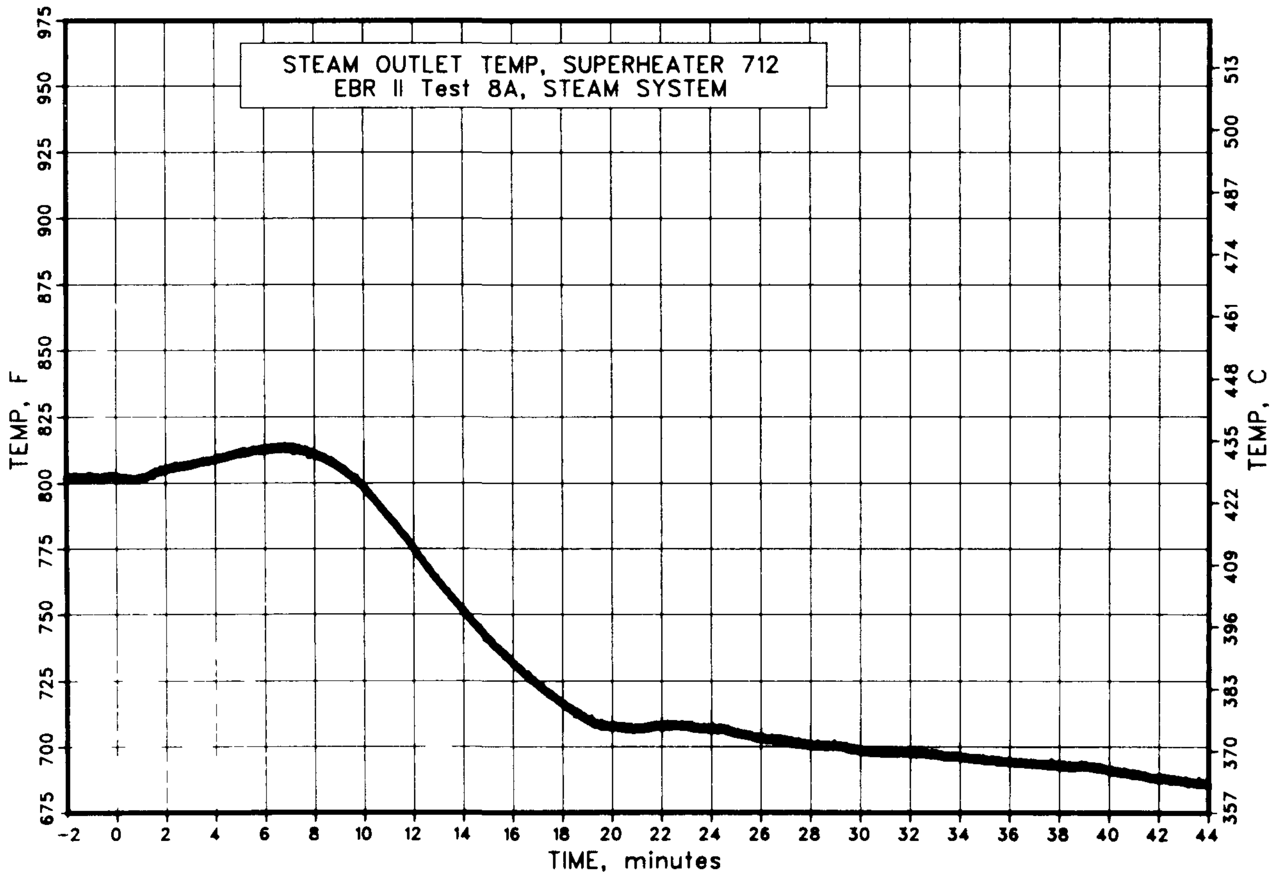

FEEDWATER TEMP, EVAPORATOR 707
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes

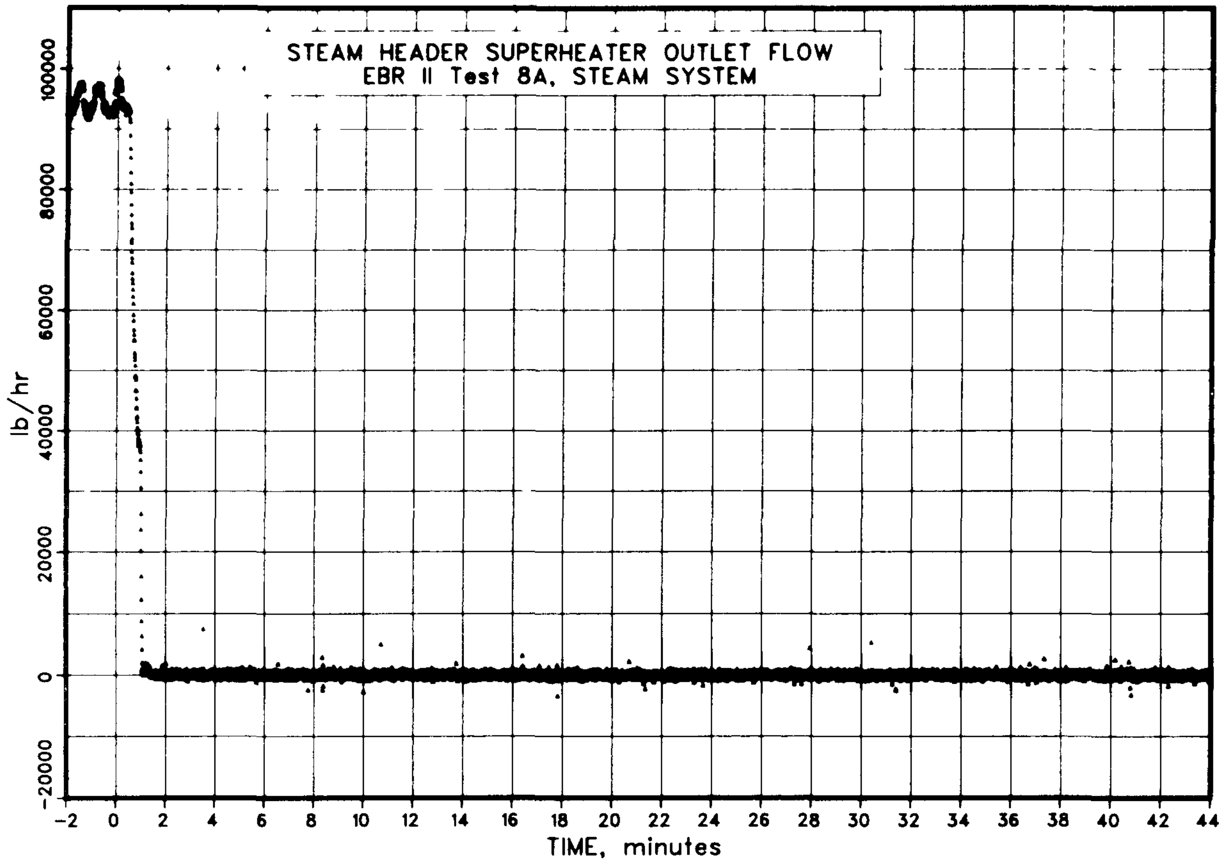

STEAM OUTLET TEMP, EVAPORATOR 707
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes

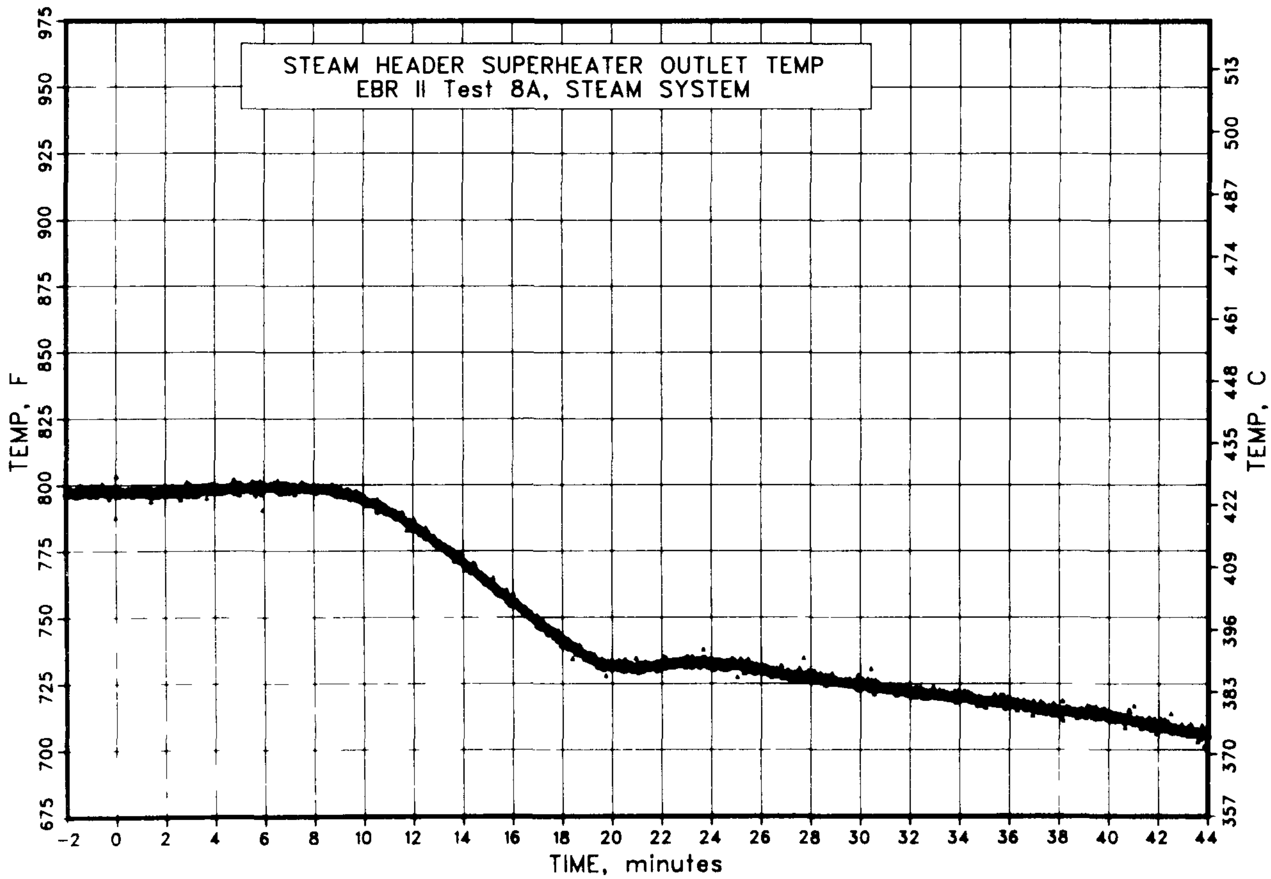

FEEDWATER TEMP, EVAPORATOR 708
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes

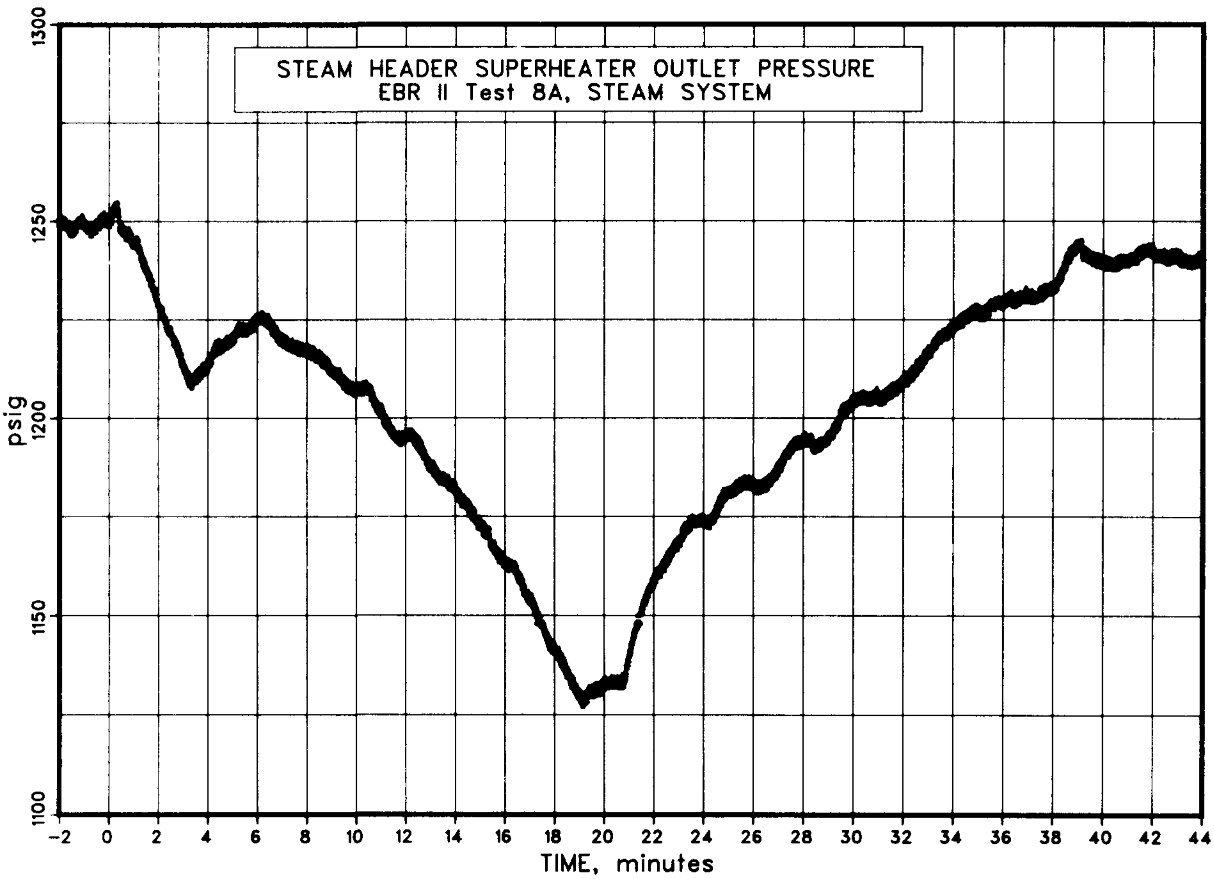

STEAM OUTLET TEMP, EVAPORATOR 708
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes

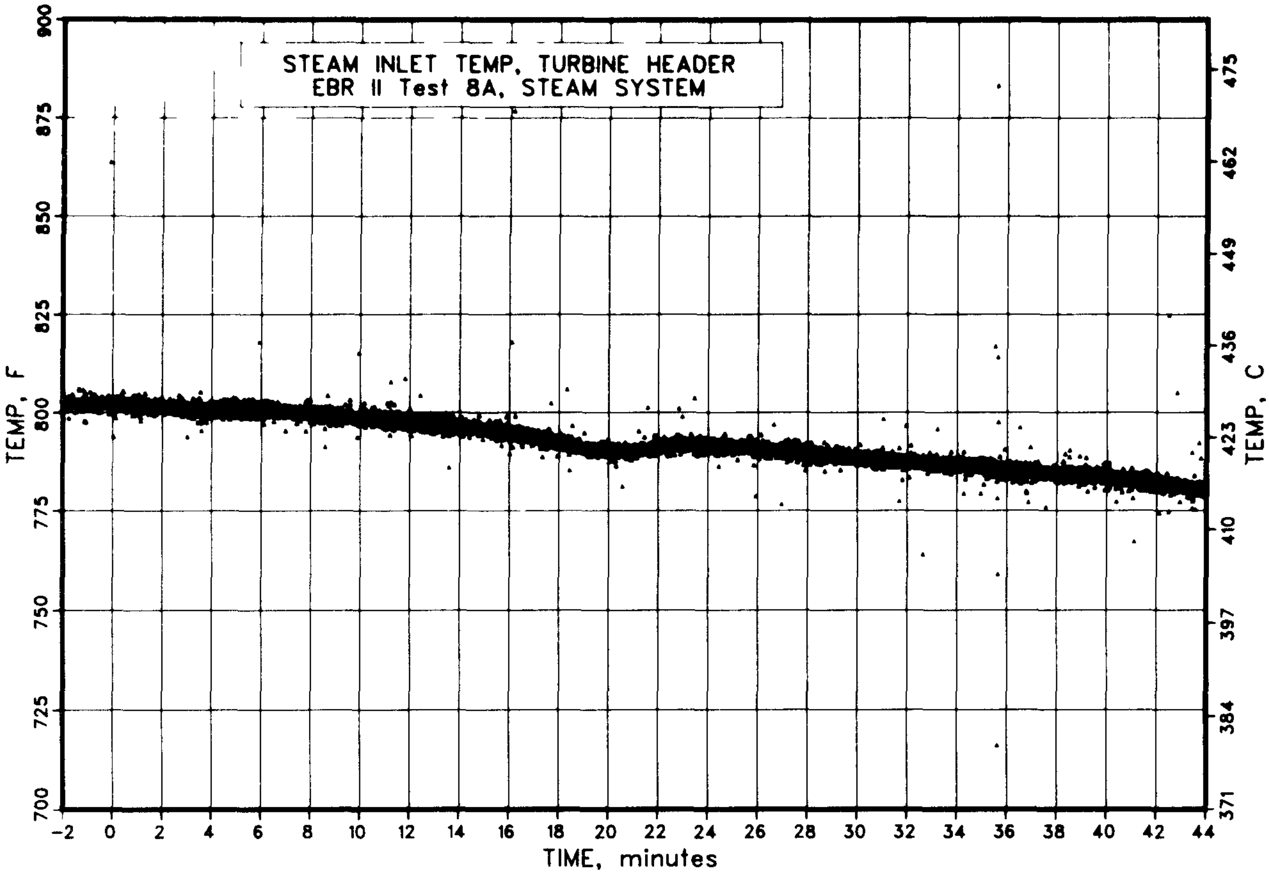

STEAM OUTLET TEMP, SUPERHEATER 710
EBR II Test 8A, STEAM SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

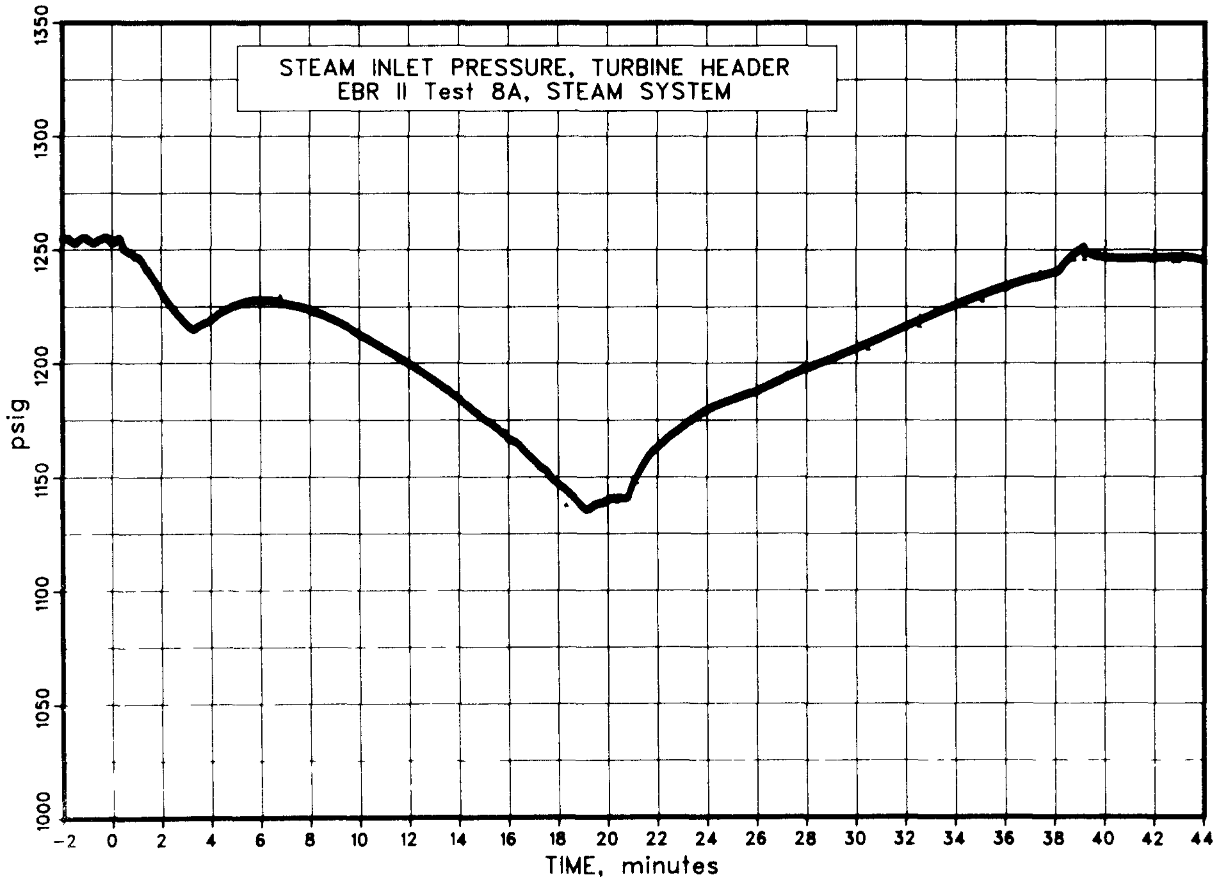

STEAM OUTLET TEMP, SUPERHEATER 712
EBR II Test 8A, STEAM SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

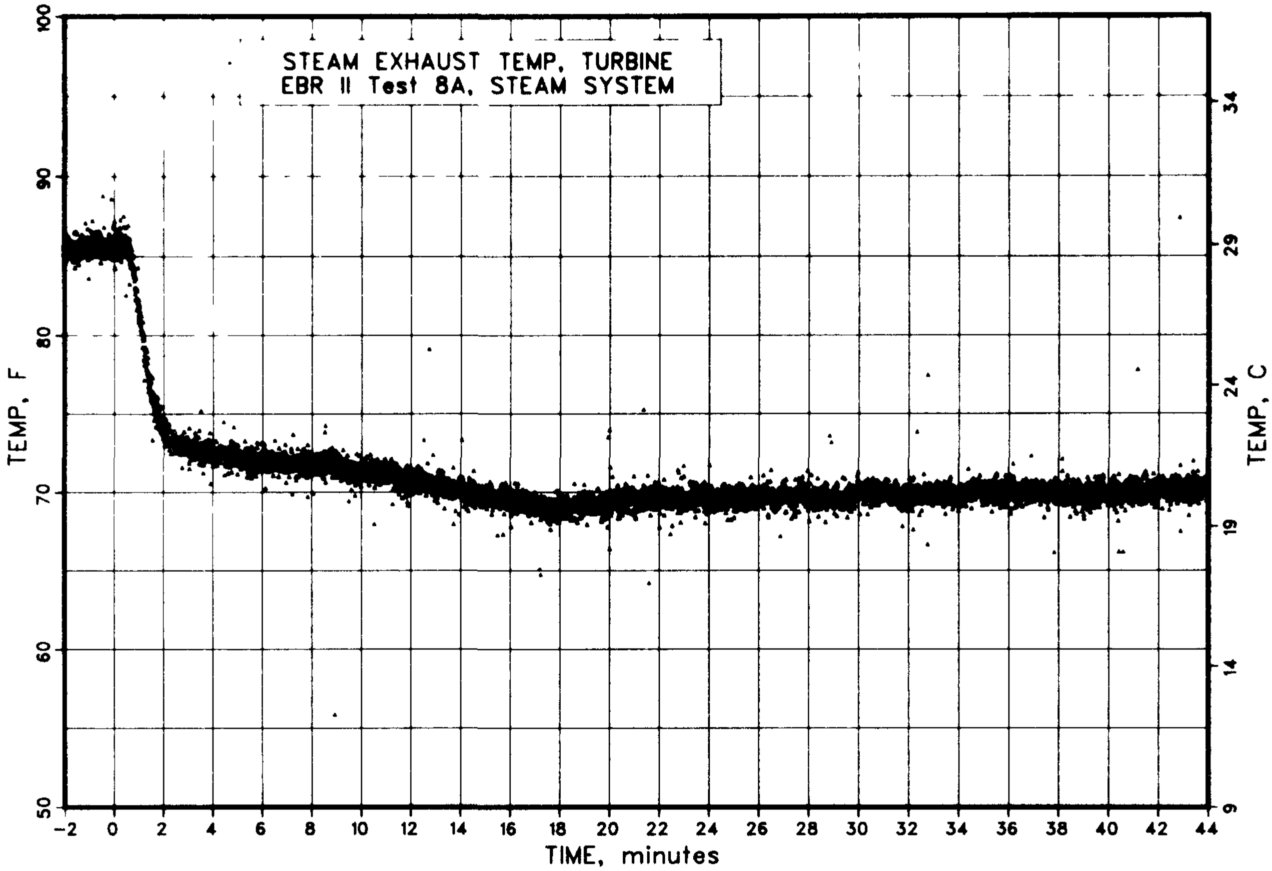

STEAM HEADER SUPERHEATER OUTLET FLOW
EBR II Test 8A, STEAM SYSTEM
lb/hr
100000
80000
60000
40000
20000
0
-20000
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

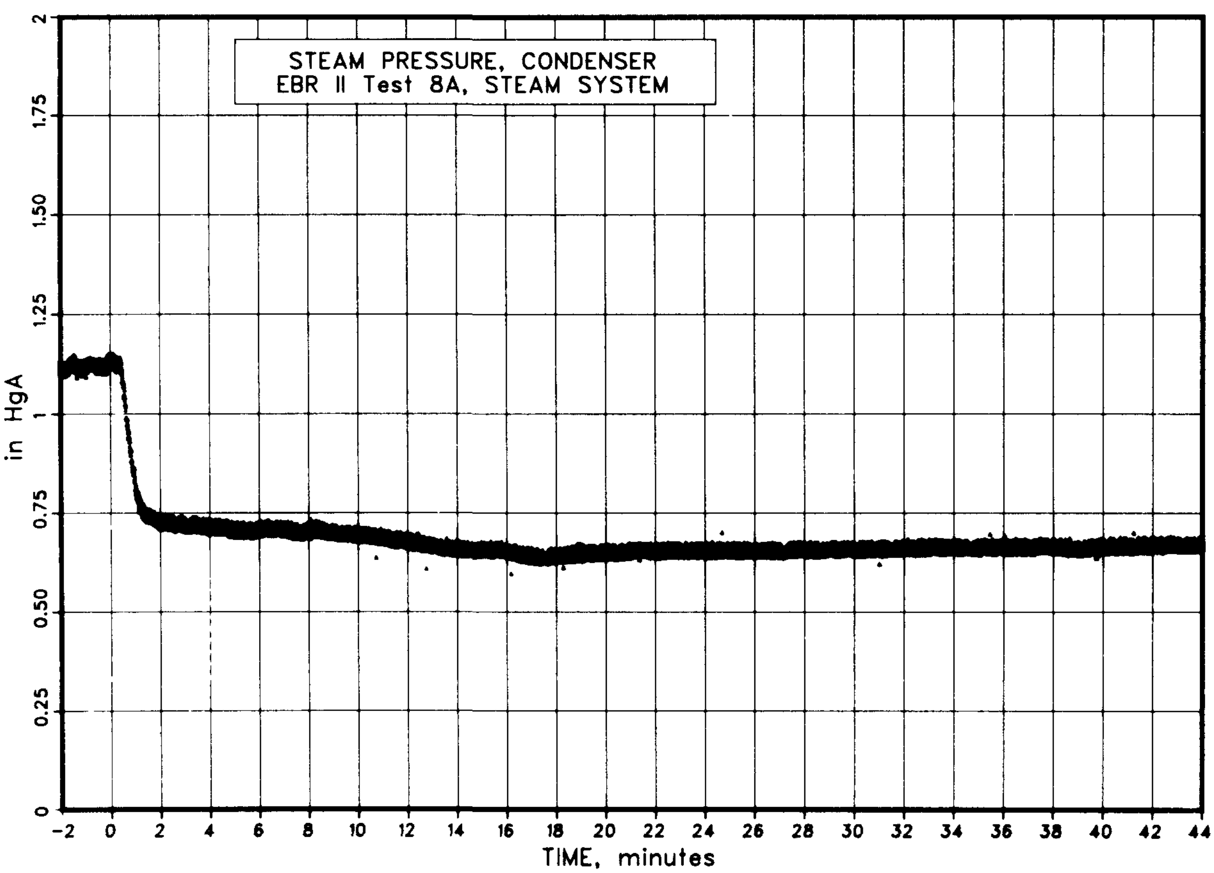

STEAM HEADER SUPERHEATER OUTLET TEMP
EBR II Test 8A, STEAM SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes

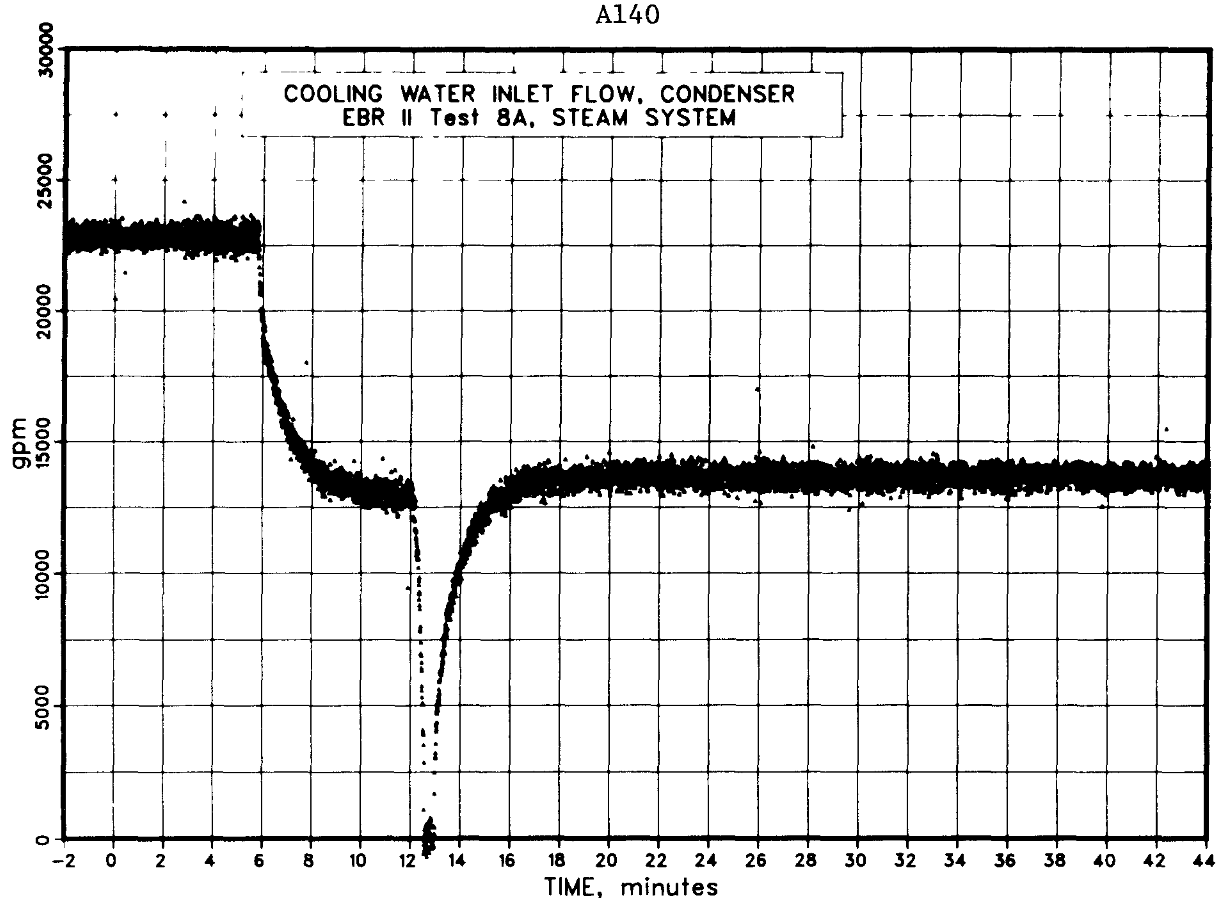

STEAM HEADER SUPERHEATER OUTLET PRESSURE
EBR II Test 8A, STEAM SYSTEM
psig
1100
1150
1200
1250
1300
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes

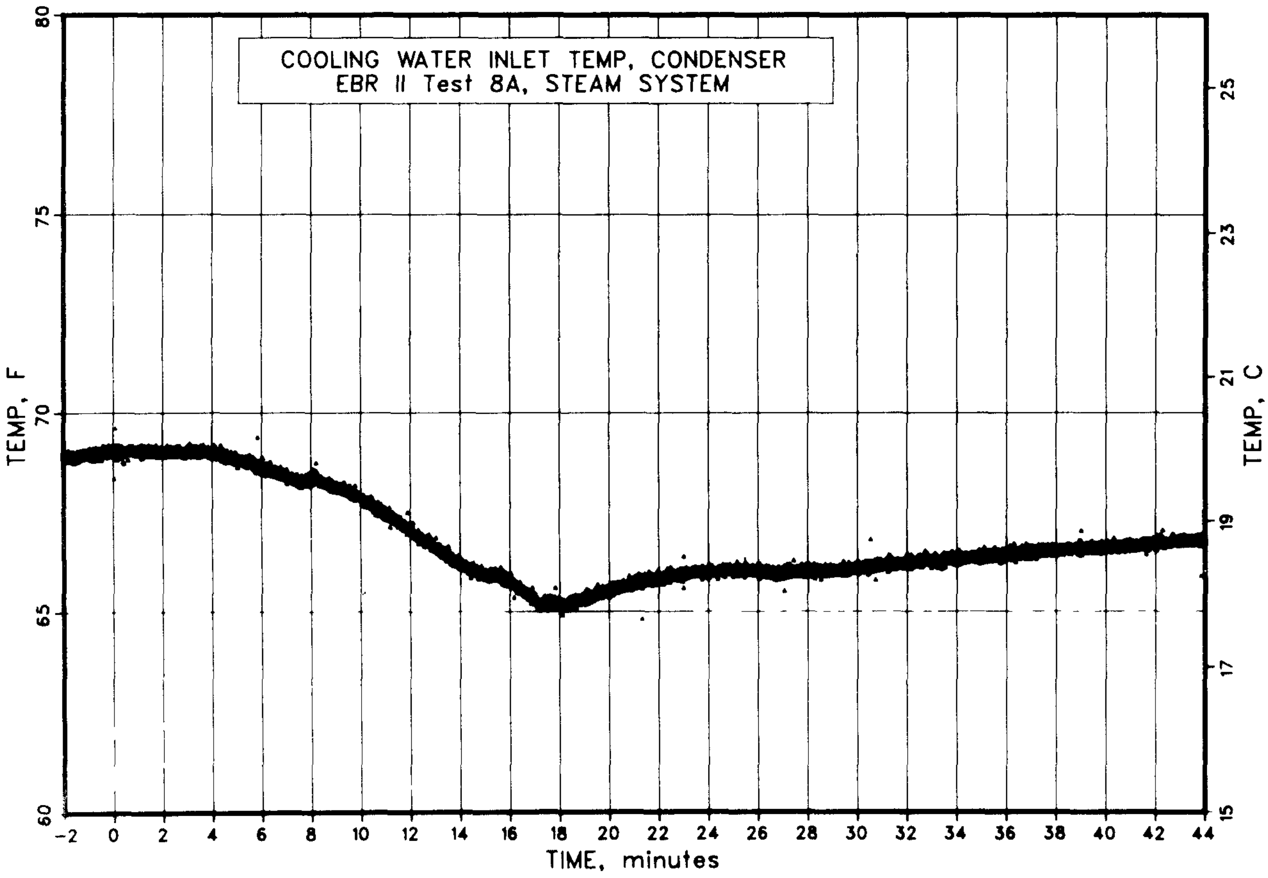

STEAM INLET TEMP, TURBINE HEADER
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
475
462
449
436
423
410
397
384
371
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44

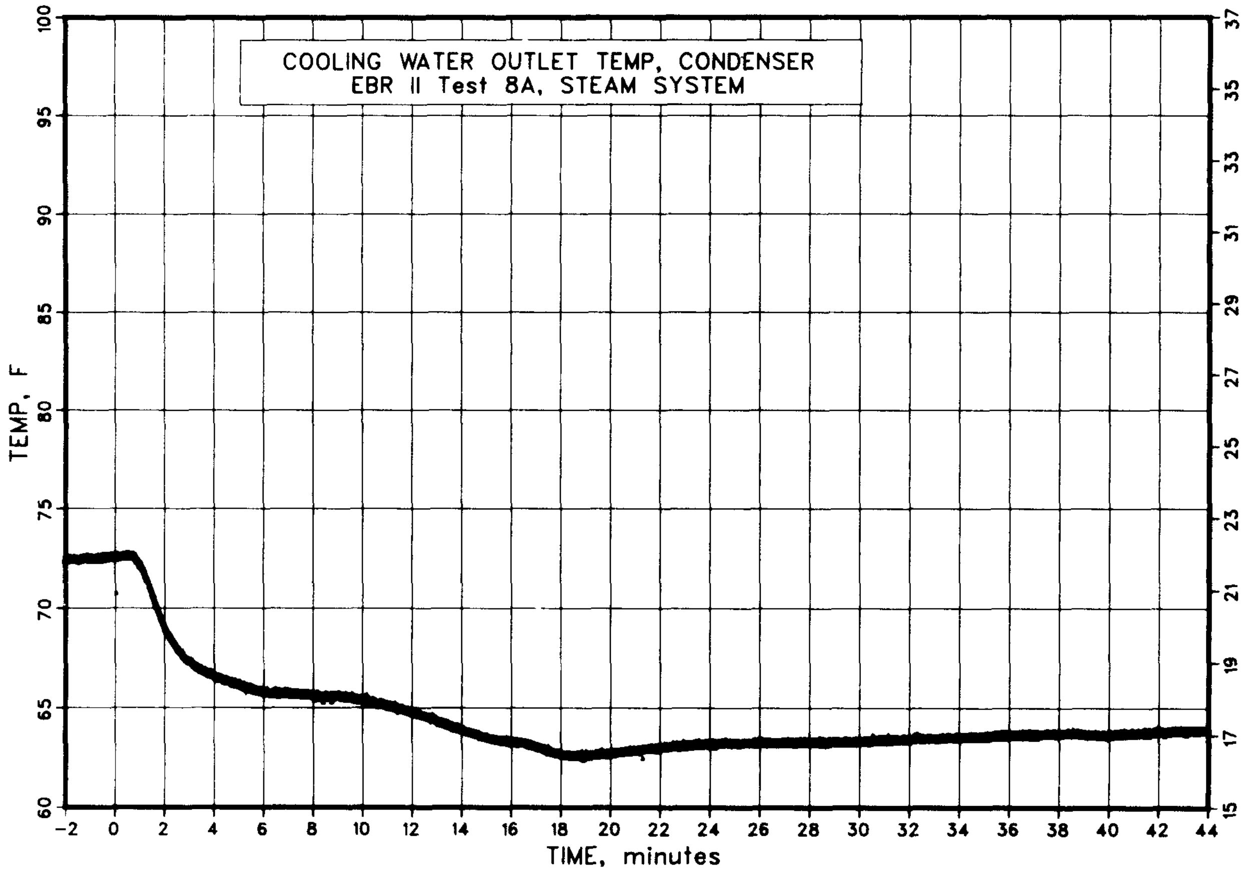

STEAM INLET PRESSURE, TURBINE HEADER
EBR II Test 8A, STEAM SYSTEM
psig
TIME, minutes
1350
1300
1250
1200
1150
1100
1050
1000
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44


STEAM EXHAUST TEMP, TURBINE
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
100
90
80
70
60
50
34
29
24
19
14
9
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


STEAM PRESSURE, CONDENSER
EBR II Test 8A, STEAM SYSTEM
in HgA
2
1.75
1.50
1.25
1
0.75
0.50
0.25
0
-2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
TIME, minutes


COOLING WATER INLET FLOW, CONDENSER
EBR II Test 8A, STEAM SYSTEM
gpm
0
5000
10000
15000
20000
25000
30000
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


COOLING WATER INLET TEMP, CONDENSER
EBR II Test 8A, STEAM SYSTEM
TEMP, F
60
65
70
75
80
TEMP, C
15
17
19
21
23
25
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
TIME, minutes


COOLING WATER OUTLET TEMP, CONDENSER
EBR II Test 8A, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
100
95
90
85
80
75
70
65
60
37
35
33
31
29
27
25
23
21
19
17
15
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44